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Early Warning Notice Contract Procedure: Improving its use on large Infrastructure Projects

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Abstract

The 'New Engineering Contract' (NEC) form of contract launched in 1993 and was a revelation in the construction contracting world, using plain language and built-in processes to stimulate good project management. A key NEC contractual tool is the Early Warning Notice (EWN) procedure which facilitates collaborative risk management between the contractor and the employer's project management (PM) team using proactive mitigation rather than a reactive damage limitation philosophy.

Whilst the EWN procedure has been welcomed by the construction sector and is a positive step forward, its use on large, complex infrastructure programmes can lead to problems of creating an administrative burden due to notices being required for a broad range of 'matters'. This is compounded by contractual sanctions for failure to use the EWN procedure which can result in the intent of the procedure being transformed from risk management to commercial protection. These issues can lead to negative behaviours which tarnish the collaborative ethos of the contract and the EWN procedure. This dissertation uses research data from the Crossrail programme, which uses the NEC3 contracts, to provide recommendations to industry for improving the EWN procedure and contractual provisions.

The literature review identified a number of themes associated with the problems encountered when applying the EWN procedure on construction contracts. However these reported problems were based on qualitative rather quantitative data.

The research used primary and secondary data from the Crossrail programme to obtain a greater understanding of the problem and provide recommendations through interviews of practitioners with many years experience of managing the EWN procedure. The findings of the research demonstrate that there is a link between a project's anticipated final cost (AFC) and the quantity of EWNs. Projects above £100m have more that 1 EWN submitted per day. The research also identified that on average 82% of EWNs are submitted by the Contractor team. The research provides practical ways to improve the management of EWNs via a simple structure template and also provides alternative contractual provisions to reduce the negative effects of the standard punitive sanction clauses.

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Glossary

AFC	Anticipated Final Cost
CE	Compensation Event
ECC	Engineering and Construction Contract
EWN	Early Warning Notice
ICE	Institution of Civil Engineers
JCT	Joint Contracts Tribunal
MSc	Master of Science
NEC	New Engineering Contract
PM	Project Manager
RICS	Royal Institution of the Chartered Surveyors
RRM	Risk Reduction Meeting

Preface

I have been working in the Rail infrastructure sector for the past 16 years and for nearly a decade on large infrastructure programmes using the NEC and the EWN procedure to facilitate collaborative and proactive management of risk. More recently I have been a commercial manager on two different Crossrail projects which use the NEC3 Engineering and Construction Contract (ECC) Option C, Target contract.

I am extremely interested in finding more practical, effective and efficient ways of working. Throughout my career in the construction industry I have encountered situations where process is followed without full consideration of the 'waste' or non-value add elements of the process or how things can be changed for the better. From first-hand experience I have encountered such problems with the EWN procedure. As such I am particularly interested in how the NEC3 form of contract can be improved, specifically in relation to the EWN procedure.

It is important to note that I am an advocate of the NEC3 when compared to other forms of contract I have worked on, namely ICE, IMechE and Model Form (MF1). I feel the NEC's concise and easy to understand language and contractual terms together with the built-in project management processes greatly improve the delivery of construction work. I agree with the EWN procedure's intent however in practice, there is ample room for improvement.

The EWN provisions of the NEC3 ECC are geared towards projects with a single main contractor with limited interfacing with other main contractors/projects. When the provisions are applied to large complex infrastructure programmes of work, such as Crossrail, it leads to the EWN process becoming unmanageable and time consuming, with the focus being placed on protecting commercial positions rather than the intent of the process which is proactive collaborative risk management. I felt this 'one size fits all' approach to the implementation of the EWN procedure required further investigation and challenge.

The topic of improving the EWN procedure on large infrastructure programmes is both a current issue and also important for the future. Flagship infrastructure programmes which

currently use the NEC3 suite of contracts include Thames Tideway, High Speed 2 and Crossrail. With the NEC being endorsed by the Government's Construction Clients' Board, the only form of contract to receive such recommendation (Hughes, 2013), the EWN procedure is here to stay. Therefore research of this topic is important and relevant from both a personal and industry perspective.

This dissertation forms part of my Construction Commercial Management Master of Science (MSc) degree at the University of Westminster, London. I would like to express my gratitude to all those who have helped me throughout my studies and for this dissertation, in particular:

- The support of my fiancée Ana,
- The guidance and support from my supervisor,
- The support of my Employer, Crossrail Limited,
- The people who gave up their time to partake in research interviews.

Declaration

I hereby certify that all material in this work-related project which is not my own work has been identified through the proper use of citations and references. I also confirm that I have fully acknowledged by name all of those individuals and organisations that have contributed to the research for this work-related project.

I further declare that this work-related project has not been accepted in part or in full for any other degree, nor is it being submitted currently for any other degree. The work-related project contains 16,346 words, exclusive of illustrations, tables, reference and bibliography section and appendices.

I confirm that a digital copy of this work-related project may be made available to future students of the University of Westminster.

Student's name: Terry Smith

Student's signature.....  .....

Date of declaration: 24nd August 2018

Chapter 1: Research Rationale

Large infrastructure programmes are complex by their very nature, requiring interfaces between multiple projects and thus have inherent risk. The 'New Engineering Contract' (NEC) form of contract launched in 1993 and was a revelation in the construction contracting world, using plain language and built-in processes to stimulate good project management to address these inherent risks. Most importantly the contract acknowledged the fact that problems will occur and mandated a collaborative approach to solving problems that could impact time, cost and quality via the Early Warning Notice (EWN) procedure (Meng, 2014).

However the EWN procedure is not without its problems being seen as overly administrative and unmanageable on some projects which have excessive quantities of EWN's (Broome, 1998).

Pellegrinelli (2011) highlights the issue of texts, processes and procedures advocated by professional bodies not being applied as intended by professional competent and experienced practitioners because they are not fit for purpose in practice. This suggests that the underlying theory and assumptions upon which the 'best practice' is based needs to be revisited. This has been the author's experience of the EWN procedure, the theory of the procedure, its benefits and intent are not fully realised as practitioners become disengaged with the procedure and use it for commercial protection rather than as a risk management tool.

This work-related research project will focus on the topic of improving the EWN risk management procedure and contractual provisions of the NEC3 Engineering and Construction Contracts (ECC) Option C 'target cost' contract which is used on large infrastructure programmes. Including the Crossrail programme for delivery of key design and construction work packages with tier 1 contractors.

Whilst the benefits of collaborative proactive project management facilitated by the EWN procedure, is acknowledged by the majority of literature reviewed. There is a need to better understand the problems associated with the procedure, where the author has identified a

lack of research (specifically quantitative) and a lack of recommendations to overcome such problems.

This research will cover this knowledge gap and facilitate the development of recommendations and improvements. This research is particularly important for large complex infrastructure programmes which by their very nature will have more risk than simple small scale projects and therefore more EWN's (Davies and Mackenzie, 2014).

Infrastructure and construction projects make up over half the value of the Government Major Projects Portfolio at £222 billion whole life cost and will continue to be a focus for the Government over the coming years (Infrastructure and Investment Authority, 2017a). This is in line with Government's commitment to infrastructure investment and is set to continue with a projected investment in public and private infrastructure projects of circa £600 billion over the next ten years (Infrastructure and Investment Authority, 2017b).

The NEC is the only contract recommended by the Government's Construction Clients' Board (Hughes, 2013) with demonstrable success, helping to deliver the London Olympic Games on programme and to budget (Dickson, 2013). Combined with other flagship infrastructure programmes procured using NEC3 such as Thames Tideway, High Speed 2 and Crossrail. The implementation of the EWN procedure on large infrastructure is set to continue.

The Infrastructure and Projects Authority (2017a) state the authority is an advocate of continuous improvement and developing useful tools for successful project delivery. Furthermore Crossrail 2 is currently being developed as the follow on project to Crossrail. As such this research can be used as a learning legacy for use on Crossrail 2 and other large infrastructure projects as a means of improving the implementation of the EWN procedure.

In light of above, the business case for improving the EWN procedure on large infrastructure programmes is compelling and the research topic is both current and important for the future. Improving the EWN procedure has the potential to have a significant positive impact due to the high value and large quantity of infrastructure programmes which could find this research beneficial.

Chapter 2: Research Goals

Aim

Develop an improved contractual and management approach for the implementation of the NEC3 ECC EWN procedure on large complex infrastructure programmes.

Objectives

The following objectives support the aim of the research:

1. Investigate the problems encountered when implementing the EWN procedure on large infrastructure programmes.

2. Establish the extent of the EWN procedure's problems on the Crossrail programme using analysis of primary and secondary data to better understand the key issues.

3. Investigate the causes of the problems encountered when implementing the EWN procedure on the Crossrail programme.

4. Design and recommend improvements to the EWN procedure, contractual provisions and its implementation on large infrastructure programmes.

Key questions

Using best practice, as recommended by Naoum (2013), the following key questions correspond to the objectives as shown in the summarised table, Figure 1:

1. What are the problems associated with the current EWN procedure on large infrastructure programmes?

2. What is the scale of the problems associated with the use of the EWN procedure on the Crossrail programme?

3. What are the causes of the problems associated the use of the EWN procedure on the Crossrail programme?

4. How can the EWN procedure, contractual provisions and its use on large infrastructure programmes be improved?

Objectives:	Key Questions:
1. Investigate the problem.	1. What is the problem?
2. Establish the extent of the problem on Crossrail.	2. What is the scale of the problem on Crossrail?
3. Investigate the causes of the problem on Crossrail?	3. What are the causes of the problem on Crossrail?
4. Improve the EWN procedure.	4. How can the EWN procedure be improved?

Figure 1 – Objectives and corresponding key questions

Scope of Research

The scope of the research will be limited to NEC ECC Option C Target contracts between the employer and contractor on the Crossrail programme. Due to the author working for the employer and therefore having direct access to the EWN data of the main contracts it was deemed the most appropriate and suitable area of research.

Expanding the research could give rise to ethical and disclosure issues due to the sensitive nature of the data recorded during the EWN procedure. Therefore it was considered inappropriate to research the EWN procedure between the contractor and its supply chain. Furthermore obtaining access and consent to use this information for research would be difficult.

Researching other non-Crossrail projects would also be difficult in terms of gaining access and consent to use the information for research purposes. As such this was also excluded.

This research strategy will also ensure that the research remains focused and specific to large infrastructure programmes and means the research data is readily available to the author.

Chapter 3: Literature Review

The following chapter will provide an overview of the topic, commence with an introduction to the NEC, followed by an overview of the Crossrail Programme, construction risk management principles and the EWN contractual provisions and procedure.

New Engineering Contract (NEC) Introduction

The inception of the NEC stems from 1985, when the Council of the Institution of Civil Engineers (ICE) approved a recommendation 'to lead a fundamental review of alternative contract strategies for civil engineering design and construction with the objective of identifying the needs for good practice'. The key drivers for this change, as highlighted by Hughes (2013) were:

1. concern that sector specific contracts using limited procurement routes were out-dated.
2. the culture of prolonged claims negotiation and protracted agreement of final accounts after completion of the works, were not delivering value for money.

The NEC form of contract was developed by the Institution of Civil Engineers (ICE) and was first published in 1993, during this time of deep recession in the early 1990's the construction industry was forced to rethink its approach in order to survive and improve. The collaborative style and promotion of good project management via contract clauses helped the NEC to quickly grow in popularity. It was a departure from the traditional adversarial contracting approach of reactive management with uncertainty of cost, time and quality. (Trebes and Mitchell, 2005a)

A further catalyst for the success of the contract was its endorsement by Sir Michael Latham's Constructing the Team, published in 1994 and later Sir John Egan's Rethinking Construction, published in 1998. The status of the NEC was reinforced by endorsement from the Office of Government Commerce for use on public sector construction procurement; this has helped the NEC become the most frequently used form of contract for civils, transportation infrastructure and utilities works (Trebes and Mitchell, 2005a). Hughes

(2013) notes that the NEC3 is the only contract to have received a Government recommendation to date.

The success of the NEC is reinforced further by Hughes (2013), who states that there have been several flagship national and international projects and tens of thousands of other projects successfully delivered using the NEC, with the majority of Employers praising the contract for helping to control time, cost and quality whilst fostering improved relationships between the contracting parties.

The contract was renamed the Engineering and Construction Contract (ECC) in 1995 so that it was clear the contract could be used for engineering and construction work, however the suite of contract is still called the NEC, with the edition that this dissertation is based on, NEC3 being issued in 2005. The most recent version NEC4 was issued in June 2017, with subtle changes to the EWN process which will be discussed later. See Figure 2 for a summary of the editions.

NEC Edition	Edition Name	Date of first publication
1st edition	NEC	1993
2nd edition	NEC2	1995
3rd edition	NEC3	2005
4th edition	NEC4	2017

Figure 2 – Summary of NEC edition publications. Source: www.neccontract.com

The NEC was intentionally developed to be different from the ICE conditions of contract and other traditional standard forms. The contract did not build upon the foundations of existing forms of contract and was developed with the intent of being used on a day-to-day basis as part of the management of the project (Eggleston 2006).

Rowlinson (2011, p1) concurs and sees the contract as a 'Project Management Procedures Manual' and notes that this is because the contract was drafted by project managers rather than by lawyers. The processes and procedures are generally mandatory as per clause 10.1 of the conditions of contract:

> *"The Employer, the Contractor, the Project Manager and the Supervisor **shall act as stated in this contract** and in the spirit of mutual trust and co-operation."*

Objectives of the NEC

The core objectives of the NEC suite of contracts are (New Engineering Contract, 2013):

1. Flexibility - contract can be used:
    a. for engineering and construction/building works.
    b. full, partial or no design liability
    c. different pricing options such as lump sum, re-measured or target cost
    d. in the United Kingdom and other countries
    e. optional clauses to allocated risk between the parties

2. Clarity and simplicity – the contract uses:
    a. clauses written in ordinary language
    b. short sentences
    c. bullet points
    d. clear division of responsibilities
    e. no cross-referencing between clauses which would create complex interaction

3. Stimulus to good management using in-built project management processes that promote foresighted collaborative management such as provisions for the:
    a. early warning notice procedure
    b. programming time management
    c. progressive management of change within set timescales

Hughes (2013) notes that some critics have said that the 'simple language' used in the contract can lead to more disputes as certain clauses lack definition and recognised wording found in established contracts. However Hughes (2013) states that anecdotal evidence, as adjudication proceedings are private, suggests this is unfounded as the level of adjudications is not greater than any other contract.

With regards to the contract being flexible, previously separate forms of contract had been used for different construction disciplines, such as ICE for civil engineering contracts, JCT for building contracts, IChemE for process contracts (Hughes, 2013). Whereas the NEC3 suite can be used across these disciplines.

NEC - Spirit of mutual trust and cooperation

The contract is based on the parties acting in the spirit of mutual trust and cooperation as per the first clause of the contract, clause 10.1. This approach is supported by the procedures included in the contract and by its very nature, cooperation and trust is achieved through the parties to the contract implementing the required actions of the procedure within the timeframe stipulated in the contract. That is to be reliable and consistent (Trebes and Mitchell, 2005a).

This is echoed by Hughes (2013) who states that it is the early warning notice, change and programme management procedures that help foster trust and collaborative working rather than clause 10.1.

Compensation Events

Under the NEC3 the term ‘claim’ or ‘variation’ is not used, instead ‘compensation events’ are used as a means of compensating the contractor for delays and cost increases which are at the risk of the employer and not the contractors fault.

The list of compensation events are covered in section 6 of the contract. If these events occur they will entitle the contractor to compensation if it can be demonstrated the event has caused the contractor to incur additional cost or the event has delayed their planned completion.

Key roles in the ECC

The ECC has the following key roles identified in the contract (New Engineering Contract, 2013):

- **Project Manager** – the project manager (PM) administers the contract on behalf of the employer, looking after their interests in a fair and unbiased manner.

- **Supervisor** – the supervisor monitors and inspects the works to ensure they are provided to the standard and performance required. If not the Supervisor raises Defect notices.
- **Employer** – the Employer pays the contractor for the works and also appoints the project manager and the supervisor.
- **Contractor** – The contractor is obliged to provide the works in accordance with the scope of the contract (called the Works Information) by the completion date.

Main Option Clauses

There are various procurement and pricing options available for the NEC3 form of contract as noted below. These options provide different ways to pay the contractor depending on the required procurement strategy and financial risk allocation (see Figure 3) of the project (Hughes 2013).

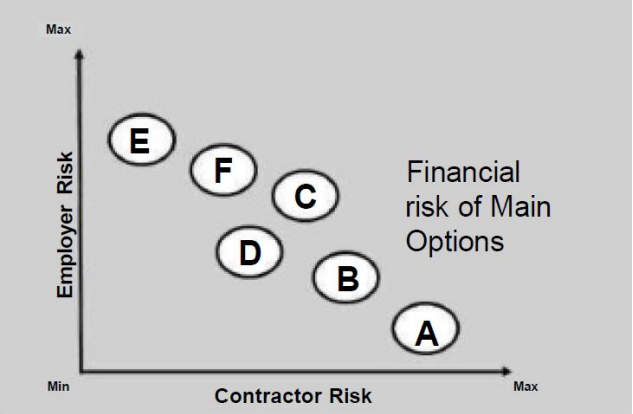


Figure 3 - Financial Risk of Main Options A-F. Source: Hughes 2013, p 9.

- Option A – Priced contract with activity schedule
- Option B – Priced contract with bill of quantities
- Option C – Target contract with activity schedule
- Option D – Target contract with bill of quantities
- Option E – Cost reimbursable contract
- Option F – Management contract

Main Option C – Target contract with Activity Schedule

Option C target contracts are a variation of a cost reimbursable contract where the lump sum tendered price becomes the 'target' with underspend and overspend risk being apportioned between the parties as appropriate and as stipulated within the contract. The contractor is paid based on the cost incurred not on the progress of the works achieved.

This dissertation will focus on Option C, as this is the option that is most frequently used on large infrastructure programmes. The reason being that the commercial risk of the project

can be shared between both parties. This helps avoid the contractor including excessive risk allowances in their tender, furthermore it helps drive a culture of cost saving as the contractor shares in the savings achieved. Hughes (2013) details the results of a survey, conducted by the RICS, of 106 NEC3 contracts and found that Option C was the most popular being the main option selected for 55% of the contracts.

The difference between project and programme

At this point it is important to consider the difference between a project and programme of works. Projects have a specific start date, end date time, cost and quality constraints which when met signify completion. Programmes consist of many related projects which when managed and coordinated together deliver greater benefits than managing the projects individually (Pellegrinelli, 2011). Crossrail has many different projects which when combined have the key objective of delivering a new passenger train service. Therefore Crossrail is a programme and not a project.

The Crossrail Programme

This research will use data from the Crossrail programme. Crossrail is a new railway through the centre of London, with an investment budget of £14.8 billion, it is one of the largest civil engineering projects in Europe. Crossrail's 'central section' running through central London is due to complete at the end of 2018 and once the full line is complete will deliver a high frequency, high capacity service linking Shenfield and Abbey Wood in the east and Reading and Heathrow in the west via 38 new stations and 21km of twin bored tunnels under central London. Figure 4 shows a route map for the new railway.

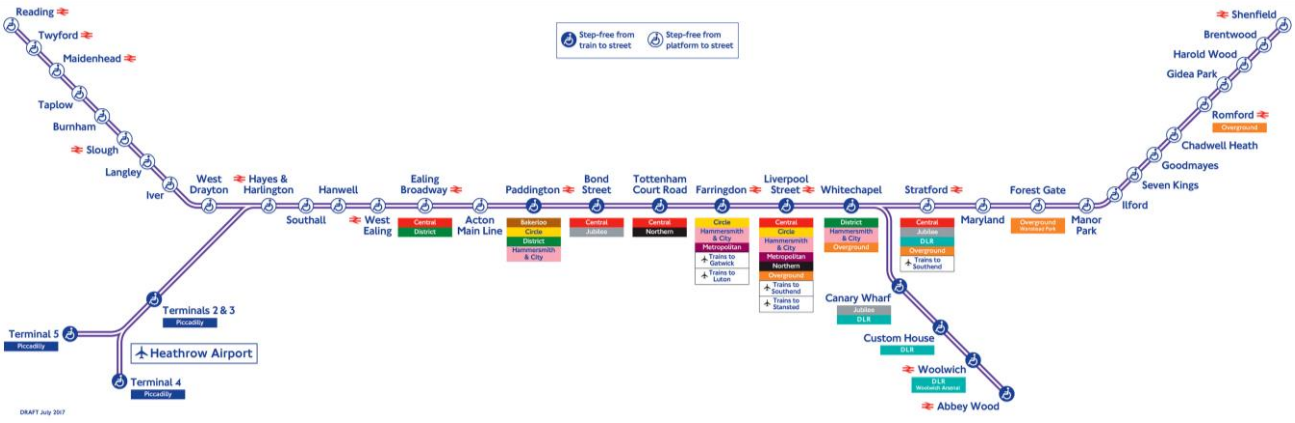


Figure 4 - Crossrail Route Map. Source: www.crossrail.co.uk

Principles of risk management

Chapman (2012) defines "project risk management" as the management of risk exposure in the pursuit of achieving predefined goals. BSI (2009) uses the following definitions:

> ***Risk*** *potential events which could adversely affect a company's objectives.*
>
> ***Risk Management*** *coordinated activities to direct and control an organization with regard to risk.*

Risk is an inherent part of the construction process, it brings together skilled workers to construct a unique design in uncertain weather conditions on a site rather than under factory conditions. Therefore it can be virtually impossible for a project to have a design, tender estimate and programme that does not change during the project (Hughes 2013).

It is interesting to note that whilst the NEC3 mandates use of a risk register, the stipulated components are limited to the description of the risk and the mitigation actions as per clause 11.2 (14) of the conditions of contract. This falls short of the general best practice of the risk register being used to rank risks based on their likelihood and impact. Rowlinson (2011, p. 41) seems to share this point of view stating "the Risk Register requires only two pieces of information". Rowlinson (2011) notes that in practice users consider this to be insufficient information and the Risk Register should be developed to include other information such as what the cost and time impacts of the risk might be.

The Risk Register under the NEC does not allocate risk, the conditions of contract determine who carries a risk, rather the risk register records risks and the proposed mitigation to avoid or reduce its impact (Hughes 2013).

This is reinforced by Trebes and Mitchell (2005a) who state risks which arise during the execution of the works are allocated both contractually and financial via the NEC conditions of contract.

However there could be perceived transfer of liability by the contractor if the Project Manager endorses/agrees risk mitigation and this is formally recorded via the Risk Register.

It should be noted that the Crossrail Programme uses a contract amendment to protect the PM in this respect by modifying clause 14.1 of the conditions of contract.

Whilst clause 16.4 states that risks that have passed are removed from the Risk Register, it is recommended that the information is kept on the register but hidden or shaded using software packages so that the full list of risk is maintained for future lessons learnt exercises (Rowlinson 2011).

EWN Procedure Contractual Clauses

The NEC3 ECC contract has the following core EWN contract clauses:

> **Clause 16.1** The Contractor and the Project Manager give an early warning by notifying the other as soon as either becomes aware of any matter which could
>
> - increase the total of the Prices
> - delay Completion
> - delay meeting a Key Date or
> - impair the performance of the works in use.
>
> Either the Project Manager or the Contractor may give an early warning by notifying the other of any other matter which could increase the total cost. The Project Manager enters early warning matters in the Risk Register. Early warning of a matter for which a compensation event has previously been notified is not required.
>
> **Clause 16.2** Either the Project Manager or the Contractor may instruct the other to attend a risk reduction meeting. Each may instruct other people to attend if the other agrees.
>
> **Clause 16.3** At a risk reduction meeting, those who attend co-operate in

- making and considering proposals for how the effect of the registered risks can be avoided or reduced, seeking solutions that will bring advantage to all those who will be affected,
- deciding on the actions which will be taken and who, in accordance with this contract, will take them and

- deciding which risks have now been avoided or have passed and can be removed from the Risk Register.

Clause 16.4 The Project Manager revises the Risk Register to record the decisions made at each risk reduction meeting and issues the revised Risk Register to the Contractor. If a decision needs a change to the Works Information, the Project Manager instructs the change at the same time as he issues the revised Risk Register.

These clauses will be discussed further in the below sections.

EWN Procedure Overview

Change is considered to be almost inevitable in construction contracts, the EWN provisions of the contract embrace this by using the EWN provisions in clause 16 of the NEC, to mandate a pro-active forward looking management style from both the employer and the contractor. Both parties have an obligation to raise EWN's immediately when the parties become aware of matters which could occur and have negative consequences on cost, time and quality. (Trebes and Mitchell, 2005a, p14). Hughes (2013) notes that few contracts have express provisions for providing similar 'early warning' notices and the EWN procedure is one of the most important and valuable parts of the contract.

Notice must be given in a written form and verbal communication such as a telephone call will not suffice as per clause 13.1 of the conditions of contract. Furthermore, in accordance with clause 13.7 of the conditions of contract, the notice must be given separately from other communications, so that it can't be 'hidden' within minutes of a meeting covering a host of issues.

The EWN concept is simple, prevention is better than cure and it is more efficient to try and mitigate a risk rather than deal with the consequences of that risk after the event. NEC3 focuses on efficient and contemporaneous resolution of matters that could impact time, cost and quality and the EWN provision is vital in achieving this outcome (Forward, 2011).

These matters are then logged on to a risk register and risk reduction meetings (RRM) are held in order to agree mitigation measures that aim to reduce or avoid the risk and agree who is best placed, in accordance with the contract, to action the mitigation measure.

It should be noted that a RRMs are not mandatory for every EWN, if the matter is not urgent then the EWN matter can be discussed at the next scheduled progress meeting or alternative meeting that brings the parties together. However if the matter is urgent then either party can and should instruct the other party to attend a RRM as part of the EWN procedure (Trebes and Mitchell, 2005a, p17). Eggleston (2006) notes that the consequences of either party failing to attend a RRM once instructed are not addressed by the conditions of contract.

This approach can facilitate increased communication about issues reducing the likelihood of such issues becoming disputes. The EWN contract provisions were developed to stimulate collaborative risk management using foresight in order to reduce disputes. “Joint consideration of the problem should lead to joint agreement as to the best solution” (Trebes and Mitchell, 2005b, p71). The EWN provisions are the first tier of formal dispute management under NEC3 (Forward 2011).

The EWN process is not just a means of notifying the other party of their faults, it also requires confession of the parties’ own faults. However the contractual wording does not prescribe how rigidly the obligation to raise EWN’s should be operated as such the parties should use common sense to avoid trivial matters being raised as EWN’s. (Eggleston 2006).

However this approach is in conflict with contractor’s business need to protect their commercial position due to the contractual sanctions which will be discussed in the next section.

Furthermore the author is aware from experience managing NEC contracts that contractors can be less inclined to issue EWN’s that relate to issues that are their own fault as they believe it may in fact increase their risk of disallowed cost not reduce it.

Eggleston (2006) highlights that there are mandatory obligations to raise EWN’s but also discretionary EWN’s by the contractor for matters which could increase his total cost. This discretionary nature is used to avoid the impractical position of the contractor issuing an

EWN for every price increase, which on large scale projects would lead to a significant administration burden.

However, Rowlinson (2011), highlights that for cost reimbursable contracts (Main Options C, D and E) any increase in the contractor's cost will result in additional payment by the employer, therefore it is beneficial for the contractor to issue EWN's for such matters so that the parties can work together to mitigate such cost increases.

Therefore there is scope for the EWN procedure to become unmanageable due to the quantity of EWN's on Option C contracts.

From analysis of the wording of clause 16, Hughes (2013) highlights the following:

- 'As soon as' – means immediately, both parties are obliged to give an EWN as soon as they become aware of a matter.
- 'Could' – means that the matter is to be notified even if there is no evidence that it will certainly happen. If it is felt the matter could happen it is to be notified.

Whilst Hughes (2013), highlights the above, it is not practical for an EWN to be issued immediately and it would be sensible for the urgency of submission to be based on the imminence of the risk.

Also the number of risks that 'could' happen on a large infrastructure contract will be immense. Therefore adopting this approach would soon become unworkable and a more pragmatic approach to assessing the probability of the risk is required to prevent unrealistic improbably risks being notified as EWN's.

Sanctions for failure to submit EWNs by the contractor (clause 61.5 and 63.5)

The NEC ECC has the following sanctions if the contractor fails to submit EWNs in accordance with the contract.

> **Clause 61.5** If the Project Manager decides that the Contractor did not give an early warning of the event which an experienced contractor could have given, he notifies this decision to the Contractor when he instructs him to submit quotations.

> **Clause 63.5** If the Project Manager has notified the Contractor of his decision that the Contractor did not give an early warning of a compensation event which an experienced contract could have given, the event is assessed as if the Contractor had given early warning.

If the contractor fails to meet their obligations with regards to the EWN procedure then this can have negative repercussions with the amount a contractor is compensated for a risk held by the employer. The PM can assess the time and cost impacts as if the contractor had issued an EWN and the effects of the risk could have been mitigated. (Trebes and Mitchell, 2005a, p4).

The test is would an experienced contractor have been aware of the early warning matter and whilst this is subjective, documentation and observation will generally show that the contractor did have knowledge of the matter. However it may simply be a case that an experienced contractor should have had the knowledge and therefore given an early warning at a particular time. (Trebes and Mitchell, 2005a, p4).

Target Contract Option C EWN Sanction (clause 11.2 [25])

A further remedy under option C contracts is shown below:

> **Clause 11.2 (25)** Disallowed Cost is cost which the Project Manager decides
>
> - was incurred only because the Contractor did not
> - give an early warning which this contract required him to give.

Under this provision, cost which the project manager decides was incurred only because the contractor did not give an early warning, which the contractor is obliged to give, is disallowed cost in accordance with clause 11.2(25), bullet point 5 (Hughes 2013).

The practical implications of the above remedies are that the contractor, being a commercial entity, is incentivised to be overly cautious in order to reduce the risk of reduced payment from the Employer. Consequently the EWN process becomes overwhelmed with insignificant or improbable notices issued by the contractor protecting their commercial position.

Rowlinson (2011, p40) highlights that failure by the PM to raise an EWN will lead to a lost opportunity to mitigate the impact of an event. Furthermore it would also constitute a breach of contract by the employer for not ensuring the PM carried out their duties (clause 60.1 (18). As such the contractor would be entitled to a compensation event.

Issues associated with the EWN procedure

It is worth noting that Loosemore (2006, p12) argues that "Risk management should be as much about maximising opportunities for gain as it is about minimising the risks of failure." However it is interesting that the literature specific to the NEC does not highlight this as an issue with the EWN procedure i.e. it is focused on minimising risk rather than maximising opportunities.

Bridgewater and Hemsley (2006) highlights practical issues with the EWN procedure in that neither party to the contract is able to deal with the quantity of EWN's, leading to the procedure being abandoned as the parties focus on delivering the project.

Parties use the process to apportion blame or liability, it is seen as a precursor to entitlement to a compensation event (CE), however a CE does not need to have an EWN. This adversarial approach could be seen as breach of 10.1 and the EWN process should focus on risk mitigation.

The above issue is reiterated by Hughes (2013), who notes that often it is believed that EWNs are the first step towards compensation events. When the purpose of the EWN is to avoid a compensation event occurring or if it does to lessen its impact.

Hughes (2013) highlights that the parties are not required to notify past matters that have already occurred as this has no value. The risk event can no longer be directly mitigated. The requirement is solely for future risks. However the author is aware from experience that contractors can still be inclined to issue EWNs for matters in the past as they believe they need to record such issues via the EWN procedure, a better late than never logic.

Rowlinson (2011) notes that the EWN and Risk Register process does not need to record every minor risk, as every time someone has a discussion about how they are going to do something on a project they are in effect managing risk. However the system needs to

capture risks which may become a problem and those that require monitoring and consideration by the project team. Rowlinson (2011) does not state how this can be achieved in practice, however he does recommend that at the RRM the Accepted Programme is reviewed at the same time so that the philosophy of foresighted project management is achieved.

However Rowlinson (2011) does highlight what should not be included in the risk register and suggests two extremes which should be excluded, these are business risk such as the viability of the project. This is something for the employer to manage separately. Together with the day-to-day working risk the contractor has to manage such as a site operative transportation van breaking down. The Risk Register should focus on the time, cost and quality issues that will impact the success of the project.

Rowlinson (2011) also comments that the volume of early warnings can be an issue, however his view is that it is better for the PM to be notified than not notified. He also notes that the reason contractors issue EWNs is to protect them from sanctions as noted above.

The author would challenge this position as this can lead to the EWN procedure being swamped with insignificant issues detracting from efficient management of risk.

Wright and Fergusson (2009), acknowledge that the NEC requires more day-to-day management effort which suggests higher costs to operate. However notes that the additional cost is arguably offset by proactive management of issues as soon as they arise via the EWN procedure, helping to avoid additional cost.

Broome's (1998) research found that some Project Managers felt they had been 'flooded' with EWNs by over enthusiastic contractors. Another felt that the EWN was issued too late and only once the impact of the risk was sufficiently developed. However, whilst it was difficult to prove, the research found that the EWN procedure was viewed as being positive in respect of increasing the likelihood of meeting the project objectives. Another comment from an interviewee was that the contractor was unwilling to raise EWNs that were their fault.

Broome (1998, p80) had the impression following the interviews "that early warning notifications were often a daily and sometimes hourly occurrence", although unfortunately he does not have any data to support this assertion.

McInnis (2000) states that during the early use of the NEC by the construction industry, EWN's were invoked unnecessarily, however this has improved with EWN's being used to manage time, cost and quality matters. Although McInnis (2000) does not provide any reference or empirical data to support this statement.

Meng (2014) provides interesting ideas and highlights the importance of the EWN procedure in delivering a collaborative solution focused culture rather than blame culture which can lead to adversarial relationships to the detriment of the project objectives. The EWN procedure provides a means of addressing problems in timely manner before they grow into significant issues which are then difficult to solve. The research found that EWN systems were being used in 87 out of 97 projects c. 90% and concluded that using a EWN system has a positive effect on project performance. However in the author's opinion the research missed an opportunity in understanding the problems and issues associated with implementing an EWN system as it did not comment on any negative issues.

Trebes and Mitchell (2005a p14), acknowledges that the EWN process may "become burdensome to the Project Manager, even though a specific answer is not required from the Project Manager, he would still be obliged to review each notice as part of his project management duties."

Hughes (2013) explains that a view held by many Project Managers is that the EWN process is only something a contractor would give as an early notice of a 'claim' but goes on to explain that this approach is incorrect as either party can raise EWN's and they should not be used to compensate the contractor. They should be used to share knowledge and resolve potential issues regardless of who is at fault.

NEC4 Changes to the EWN Procedure

The NEC4 suite of contracts was launched on 22 June 2017. Garratt (no date) details the following contractual changes which impact the EWN procedure:

1. The Risk Register has been renamed the Early Warning Register to better reflect the fact it is to be used as a risk management tool and not a means of allocating risk between the parties of the contract.
2. The Risk Reduction Meeting has been renamed the Early Warning Meeting to be consistent with the above change.
3. The Project Manger is expressly required to issue an Early Warning Register within 1 week of the starting date of the contract and 1 week after each early warning meeting.
4. The contract now expressly requires the early warning meeting is held within 2 weeks of the starting date and then at intervals no longer than as stated in the contract data until Completion. This ensures that such meetings are held continuously throughout the contract rather than on an ad-hoc basis when either party instructs the meetings as per NEC3.
5. Subcontractors are now expressly required to attend an Early Warning Meeting if they can assist in deciding the actions to be taken. Rather than being optional as per NEC3.
6. In cost based contracts (Option C, D and E) a new clause has been added with respect to time bounding the risk of Disallowed Cost. Within a period of 13 weeks the PM must either accept the Defined Cost or notify errors. If the PM does not adhere to the timescales the Defined Cost is deemed accepted.

The above clauses will help ensure that the EWN procedure uses Risk Reduction (Early Warning) Meetings on a regular basis rather than being optional unless instructed as was the case for NEC3. Furthermore the changes recognise the importance of including subcontractors in the decision making process. This is a welcome addition in that EWNs will be actively discussed by the relevant parties of the supply chain on an on-going basis rather than EWNs being used just as a form of written communication.

The approach for progressive assessment of Disallowed Cost is another positive addition and something which Crossrail is already implementing. It has assisted with managing the anxiety associated with the risk of Disallowed Cost being applied towards the end of a project. This will allow the contractor to have a firm position on their profit margin within a reasonable timescale.

Literature Review Summary

The advantages associated with the EWN procedure are well documented, the issues to a lesser extent. There is also limited quantitative research that has been conducted with regards to such issues and a shortage of practical recommendations for how they can be overcome.

The key issues of the EWN procedure identified include:

- Limited information mandated in the Risk Register
- Additional cost to implement the procedure.
- Becomes a resource and administrative burden.
- Being used to protect a contractor's commercial position due to sanctions.
- Being used for insignificant matters.
- Lack of focus on opportunities.
- Being used to apportion blame.
- Being used to support entitlement to compensation events.

The NEC4 improvements assist with reinforcing the RRM part of the procedure and help reduce anxiety of Disallowed Cost long after an event. The changes are commended by the author however they do not address the other issues noted above.

The literature review has raised some interesting questions which will be further explored as part of the research methodology and analysis of primary and secondary data as detailed in the next chapter. Some specific areas and ideas which require further research are noted below:

- Are PM's using sanctions if contractors do not raise EWN's in accordance with the contract?
- Are sanctions contained in the contract driving the wrong behaviours?
- Is the use of only a 'carrot' better than using a combination of a 'carrot' and 'stick' for Option C? If sanctions are removed, the contractor will still be incentivised to manage risk as the cost benefit will be shared as part of the target contract mechanism.
- Would a more subtle approach be better, clause 63.7 of the conditions of contract would allow the PM to assess a compensation event on the basis that a contractor reacted "competently and promptly" and that cost is "reasonably incurred". So if the sanctions for failure to issue an EWN were removed, the PM would still have the facility to assess compensation events on this basis. This would focus the contractor's attention on action rather than the paperwork associated with EWNs.

Chapter 4: Research Methodology

Research is a systematic enquiry or critical investigation using existing or new data to expand knowledge, however good research will have a specific aim and focus on an aspect of a topic (Naoum, 2013).

Biggam (2015) states that the research methodology must be designed in a way which is suitable to the aims and objectives of the research. Rather than selecting a strategy and trying to backfill the research aims and objectives into the research methodology.

Primary data is data collected explicitly for the research. Secondary data is information generated by others and not specifically for the purpose of the dissertation research (Laycock et al., 2016).

This dissertation will use a combination of primary and secondary research data in order to achieve the aims and objectives of the research. The literature review highlighted a lack of quantitative data surrounding the use of the EWN procedure, which will be addressed in this research.

The following section will provide an outline of the research methodology used in this dissertation.

Biggam (2015) advises that practical considerations are valid justifications for a specific research methodology, for example whilst conducting 50 interviews may provide the basis of an excellent empirical study. Bearing in mind the time and resource constraints of a master's dissertation report, this approach may be over ambitious. Therefore in designing the research methodology, the author considered:

- the issue of Crossrail works drawing to a close in 2018 with a significant number of projects being completed and staff leaving the project throughout 2018.
- the lack of quantitative data on the use of the EWN procedure identified in the literature review.
- the literature review has identified that there are mixed feelings about the EWN procedure predominantly from qualitative research.

- the literature review identified a lack of recommendations for how the EWN procedure could be improved.

Figure 5 shows an overview of the outline research methodology, the following sections will describe each stage in further detail.

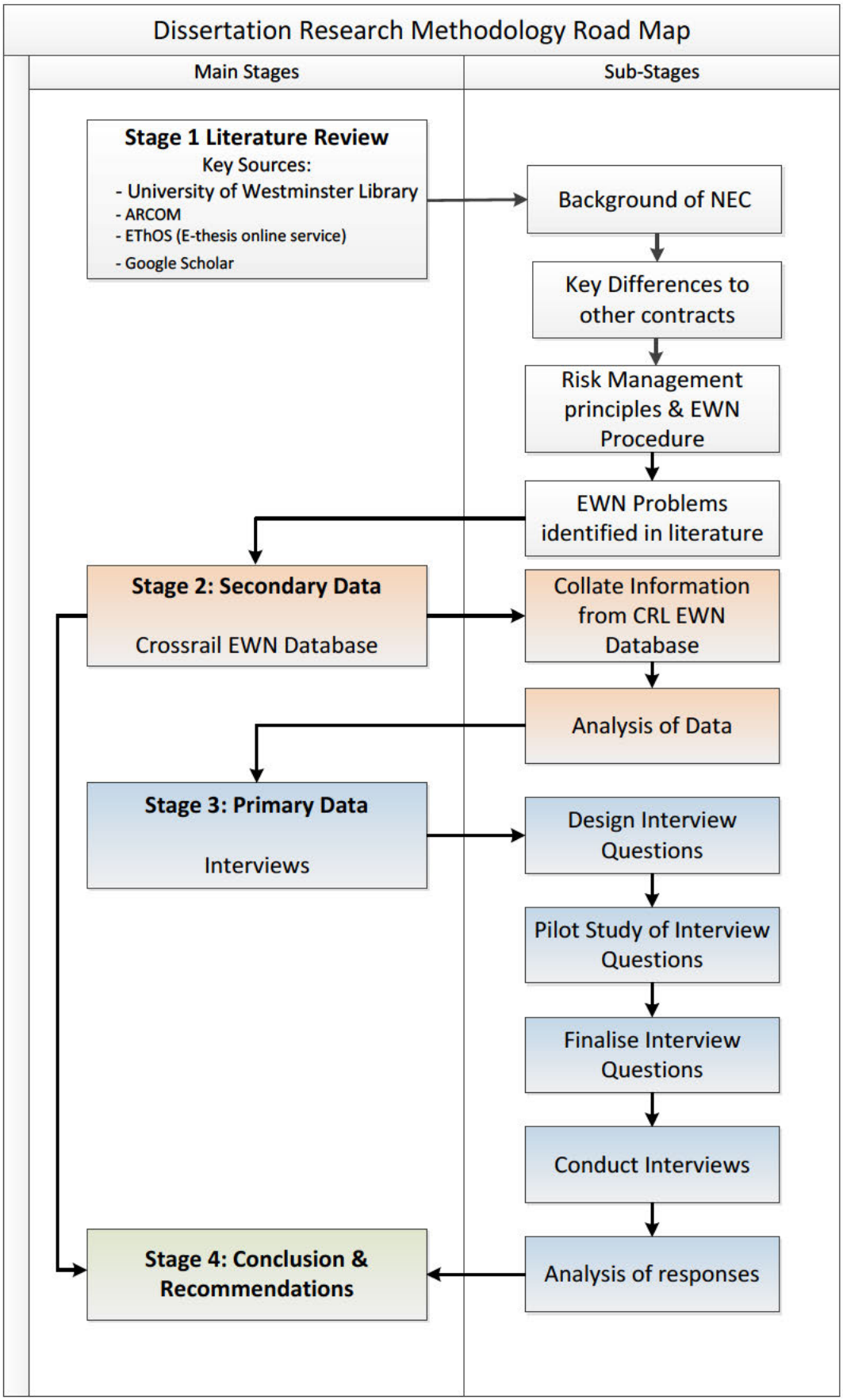


Figure 5 - Research Methodology Road Map. Source: Adapted from Naoum (2013, p 15).

Stage 1: Literature Review

The first step was to investigate and evaluate existing literature related to the NEC form of contract in order to obtain a deeper understand of the topic and issues in question from the existing body of knowledge.

Laycock et al (2016), recommended the following resources for sourcing literature, this was combined with the University of Westminster On-line Library Search to provide a robust collection of relevant literature and to understand what research has been carried out with regards to the EWN procedure.

- ARCOM (Association of Researchers in Construction Management) website
- British Library's EThOS (E-thesis online service) database
- Google Scholar

The subject of the NEC form of contract of contract was searched using key words in order to find relevant literature including books, peer reviewed journals, Government reports, theses and dissertations.

The literature review was initially conducted as an annotated bibliography which summarised the key findings from the research of the relevant literature as recommended by Naoum (2013). This was then developed into a literature review organising the annotated bibliography into a logical flow, addressing understanding and critiquing the existing body of knowledge.

Stage 2: Secondary Data - quantitative data specific to the topic

Existing secondary data was sourced from the Crossrail programme's EWN database and Contract Administration software. This information allowed the observed issues as identified from the literature review to be put into context and facilitated an understanding of the scale of issues using quantitative data, including a greater understanding of:

- The quantity of EWNs being issued on contracts.
- The relationship between the size of the contract in terms of Anticipated Final Cost (AFC) and the volume of EWNs.
- Which party raised the EWNs and to what proportion.
- Was the PM using the EWN sanction clauses in the contract and if so, to what degree.

The findings of the secondary research were then explored further by use of structured interviews.

Relationship between quantity of EWNs and AFC

The hypothesis for this research is that as the forecast cost of a contract increases so does the quantity of EWNs submitted. This is on the basis that as the volume of work increases so does the volume of matters which can impact time, cost or quality. A simple chart comparison will be used to graphically represent this relationship. A Pearson's r (correlation coefficient) will be used to further test this correlation (Laycock et al., 2016). In order to ensure that commercially sensitive data is not disclosed the specific AFC values will not be detailed within this dissertation.

Which party raised the EWNs

The EWN register was also analysed in terms of understanding which party to the contract was raising the most EWNs and whether this was disproportionate between the parties. The interview questions could then be used to understand what may be driving the observed behaviour.

The hypothesis for this data was that as a consequence of the sanction clauses the contractor will issue a greater number of EWNs compared to the PM team.

EWN sanctions

The implementation of the sanctions available to the PM for failure by the contractor to raise EWNs were investigated using the communication registers for the whole of Crossrail. This helped to understand if the sanctions were directly contributing to the problem or whether it was the risk of their use by the PM that was the issue. This topic was then further explored using structured interviews.

The Crossrail EWN register database includes the following key data for each contract and EWN:

- Description of the EWN risk / matter
- Date EWN was raised
- Who raised the EWN (PM or Contractor)
- Date the EWN was closed

Whilst the register details how long an EWN remains open until it is closed on the system, it was decided not to analyse this data. This is because it may give rise to inaccurate conclusions as the EWN is generally not closed until the actions are complete which may be many months in the future or the matter/risk may be re-occurring over a number of months and as such remain open even though the EWN is being actively mitigated.

The investigation was limited to the largest contracts by value on the Crossrail programme. These contracts all use NEC3 ECC Option C Target Contracts.

Stage 3: Primary Data - Structured interview

The analysis from the literature review and secondary data obtained from the Crossrail EWN database and Contract Administration software, was then used to formulate a set of interview questions. The following sections detail the considerations applied whilst designing the primary data collection.

Postal Questionnaire or Interview

A postal or electronic questionnaire was discounted as on balance the disadvantages, led to the choice of personal interviews. Naoum (2013) states the following limitations for postal questionnaires:

- the questionnaire must contain simple questions in order to achieve a good response rate
- industry fatigue, leading to a low response rate due to businesses having greater priorities than responding to a steady stream of student questionnaires. This was particularly evident for the Crossrail programme with the need for teams to focus on achieving the contract completion in the summer of 2018.

- inflexibility as the process does not allow 'probing' or further ad-hoc questioning.

Format of Interview (Unstructured, Semi-Structured or Structured)

A structured interview was chosen as this allowed easier analysis of the results compared to an unstructured or semi-structured interview.

The structured personal interview was deemed most appropriate when compared to an unstructured or semi-structured interview due to the following advantages highlighted by Naoum (2013):

- structured interviews will generally have a higher response rate compared to a postal or email questionnaire as the interviewees are contacted directly.
- interviewees can be 'probed' in order to understand why a certain answer was given.
- questions will be issued to interviewees prior to the interview so that background information can be gathered if necessary, rather than the interviewee being unaware of the questions and not being able to answer on the 'spot'.
- complex questions can be asked and explained and qualified during the interview if the respondent is unsure of the question, leading to more accurate answers.
- The interviewees were known by the author to allow focus on important research specific questions.

The other key consideration to the type of interview format was the time and effort required to analyse unstructured or semi-structured interviews. This would have been much greater as the responses would not be in a consistent format or relate to the same questions.

Interview Sampling

The broad sampling technique was conducted by requesting interviews with practitioners who had the following characteristics:

- At least 18 months experience working on the Crossrail programme.
    - **Justification:** Experience of large scale infrastructure programmes was required for the research.
- Experience of implementing the EWN procedure on the Crossrail programme.

  - **Justification:** The research aims to improve the EWN procedure so it is vital that the interviewees have experience of implementing the EWN procedure on a large infrastructure programme.
- Contract Administration NEC3 ECC option C experience and training.
  - **Justification:** In order to help solve the issues a deep understanding of what impact the conditions of contract had on the EWN procedure was required.

This approach allowed the characteristics of the sample to be the same as its population and act as representative of the population as a whole (Naoum, 2013).

Because the research related to interpreting and forming opinions of the EWN related conditions of contract it was decided to discount random sampling of the project team and instead use selected sampling from the commercial / quantity surveying teams so that it was certain that the interviewees would have the required knowledge and experience in order to answer the questions from an informed point of view. The risk of using a random sample is that the responses may be ambiguous to the subject under investigation (Naoum, 2013).

The next important consideration was that there are two distinct groups with different characteristics predominantly due to which organisation employed the interviewee, that is either the Contractor or Project Manager team. Therefore in order to have balanced results the sample used equal numbers from each organisation, the results would then be analysed together and separately.

Farrell (2011) notes that eight interviews are an acceptable minimum number of interviews when conducting qualitative research. Taking into consideration the time constraints of the dissertation, a sample size of 10 was chosen. The author considered that as each interview would last approximately 1 hour, this sample size provided a balance between ample sample size and the time and effort of the author and of the interviewees.

It is acknowledged that in order to conduct a chi-square test to analyse the relationship between the results from the PM team and the Contractor team a sample of at least 20 interviewees would be required (Naoum 2013). Further Laycock et al. (2016) advises that the greater the number of categories for a question, the greater the amount of data

required to conduct a chi-square test. As the amount of categories for the closed questions were relatively high this was further justification that a chi-square test would not be appropriate when 10 nr interviews were carried out.

Ethics Statement

During research it is vital to consider ethical issues. The use or misuse of research results can be unethical if the results are released to the public without knowledge/consent of the participants or if the knowledge is used to hurt people (Rennie and Smyth, 2016).

To ensure an ethical approach for the personal interviews, the following was implemented:

- interview requests were polite and respectful and potential interviewees were not put under pressure to conduct the interview.
- agreement from interviewees was formalised using a consent form, with relevant details of how the interviews were to be conducted and how the results were to be used.
- each participant remained anonymous and their name was not disclosed.
- interviewees were put at ease and it was made clear that the interviewee had the ability to skip any questions if they did not feel comfortable answering.
- interviewees were given the questions in advance to reduce any anxiety and allow time to consider their response.
- interviews were conducted at a date and time that suited the interviewee.
- the interviews were designed so that they would not take longer than 1 hour to complete.
- The relevant clauses from the contract were extracted and sent to the interviewees via email for ease of reference.

The final dissertation was also issued to Crossrail senior management so that the Crossrail data used was approved for publication.

Questionnaire Construction

To assist with linking the interview questions to the research, the questionnaire was split into a series of themes that reflected the research objectives, topics and issues identified from the literature review.

The questions were designed to use a combination of closed and open questions. The closed questions used an ordinal rating scale in order to gauge the interviewees' opinion to the themes and issues identified from the literature review and secondary data analysis. An example of the ordinal scale used is shown in Figure 6. This form of rating data is typically used when you ask attitude questions (Naoum, 2013).

	Vastly insufficient	Insufficient	Mildly insufficient	Reasonable	Mildly Excessive	Excessive	Vastly Excessive	Undecided
	1	2	3	4	5	6	7	8
Answer:					X			

Figure 6 - Example of a ordinal scale question

The general approach was to use a follow-on question after the ordinal scale questions with regards to why the interviewee had that particular opinion and then in discussion what had caused this opinion. This in-depth part of the questioning would be valuable in ascertaining potential improvements and recommendations for the EWN procedure where common themes were encountered in the research results.

A further follow-on open question for each key topic area was then used to understand the interviewees' ideas of possible EWN procedure improvements.

The interview questions did not directly ask whether Risk Reduction Meetings were being held. This is because the meetings are now expressly stated within NEC4 as being required on a period basis as per the interval stated in the Contract Data rather than only being held if instructed as per NEC3.

The issue identified in the literature review regarding EWNs being used as a pre-cursor to a CE was consciously not directly asked. This is because it may be seen as being biased against the contractor. Therefore a question around protecting a commercial position was used so that the question was neutral and could apply to both the PM team and the Contractor team.

Pilot Study

As recommended by Naoum, (2013), the questions for the interview were designed to better understand the gaps in knowledge identified from the literature review and analysis of the secondary data. The views and opinions of the people who use the EWN procedure

day-to-day together with discussion were used to understand what the interviewees ideas were with regards to improvements to the EWN procedure. This would assist in achieving the aim of the research. A list of 'first thought' questions was developed, and as recommended by Naoum (2013), the first draft of the interview questions was conducted as a pilot study to test the suitability of the questions as originally drafted (Appendix A), the outcome of the pilot study was used to refine and improve the interview questions into the final version as shown in Appendix B. The final version was then used to gather the primary data.

Outcome of interview questionnaire pilot

Following feedback from the pilot interview, the interview questions (as per Appendix A) were adapted to form the final interview questions (as per Appendix B).

The feedback generally centred around the questions being leading questions, for example the below question (Figure 7) may be seen to influence the interviewee's answer to agree rather than disagree. Therefore the question was changed as per Figure 7 in order to be unbiased and non-influencing. This approach is recommended by Naoum (2013) so that the results of the research are not influenced or biased towards the researcher's own opinions.

Where possible this approach was adopted for all questions. Other changes included revising the language in order to remove ambiguity and provide greater impartiality. For example the word 'sanction' was changed to 'provision' in order to remove any negative connotations.

Pilot

4a Do you feel that the volume of EWNs issued are excessive on the project?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

Final

What is your opinion of the volume of EWN's issued on your contract?

	Vastly insufficient	Insufficient	Mildly insufficient	Reasonable	Mildly Excessive	Excessive	Vastly Excessive	Undecided
	1	2	3	4	5	6	7	8
Answer:								

Figure 7 - Example of question change following the pilot interview

Recording the interview data

The interviews were transcribed so that there was a record of the key points of the interview. This was carried out whilst the interview was being conducted on a large screen which both the interviewer and interviewee could see. This allowed for the collected data to be validated 'live' and the wording was agreed by the interviewee after each question was completed. A draft copy was also emailed to the interviewee so that they could review the recorded information at their own leisure and confirm it was an accurate and fair reflection of the interview.

Research Validity

Validity of research is associated with the how empirical data is gathered and analysed. Valid research consists of using an appropriate research methodology which is suited to the research question (Biggam, 2015). In other words the research method is fit-for-purpose. This research is considered valid as the research has the aim of providing a practical improvement to the current EWN procedure when implemented on large infrastructure programmes. The chosen research methodology addresses this aim by using both secondary and primary data which is specific to this aim.

The secondary data provides quantitative information relating to the EWN procedure used on a large infrastructure programme, namely Crossrail. The primary research uses a selected sample of practitioners who use the EWN procedure on a day-to-day basis and therefore have the insight to be able to assist in achieving the aim of improving the EWN procedure. The method of obtaining this data is considered to be fit-for-purpose as the questions use a combination of the ordinal scale in order to gauge opinions followed by open questions in order to understand why the interviewee has such opinions.

Research Reliability

It is important to ensure that research is reliable (trustworthy), to achieve this, evidence and records of the research should be kept, demonstrating it was conducted in a fair and objective way (Biggam, 2015). In order to address this issue the author has used the following appendices which provide a robust record of the research:

- Appendix A – Pilot Study Interview Questionnaire
- Appendix B – Final Interview Questionnaire (Completed Example)
- Appendix C – Research Participation Information Form
- Appendix D – Interview Research Consent Form (blank to maintain anonymity)
- Appendix E – Secondary Data – Quantity of EWNs (Cost information redacted)
- Appendix F – Schedule of interview and dates held (names redacted)
- Appendix G – Primary Data – Dissertation Quantitative Questionnaire Findings Summary
- Appendix H – Primary Data – Dissertation Qualitative Questionnaire Findings Summary

Questionnaire Findings Analysis

The questionnaire data was analysed in order to discover trends and formulate recommendations for the improved implementation of the EWN procedure on large complex infrastructure programmes.

Whilst Naoum (2013), recommends that coding of qualitative data is the first step of analysis, due to the relative small number of interviews and the qualitative open questions were supported by quantitative closed questions, it was decided that the time and effort required to conduct this form of analysis would not deliver any significant benefits in

identifying themes which could then be used to provide recommendations for the improvement of the EWN procedure. Instead the transcribed results of each interview were reviewed and the key themes from the open questions were noted in the findings and analysis chapter.

Bar charts were used in order to identify trends and differences in the data results to assist with analysis. This approach is known as 'category frequency' and allows large volumes of data to be distributed into categories to determine the quantity each category occurs (Naoum, 2013). The preference of bar charts over tabulation is that the results will be presented into a graphical format and it will be easier to understand and interpret trends and differences.

Stage 4: Conclusion and Recommendations

A combination of the analysis of primary and secondary data findings was used in order to formulate conclusions and develop recommendations to meet the aim of improving the implementation of the EWN procedure on large complex infrastructure programmes.

This section will also summarise recommendations for further research.

Link between the research goals and research methodology

The below table (Figure 8) puts the research methodology into context of the research aim, objectives and key questions. It provides a link between each part of the research.

Aim: Develop an improved contractual and management approach for the implementation of the NEC3 ECC EWN procedure on large complex infrastructure programmes.		
Objectives:	**Key Questions:**	**Research Methodology:**
1. Investigate the problem.	1. What is the problem?	1. Literature Review & analysis of primary and secondary data.
2. Establish the extent of the problem on Crossrail.	2. What is the scale of the problem on Crossrail?	2. Predominantly analysis of Crossrail secondary quantitative data.
3. Investigate the causes of the problem on Crossrail.	3. What are the causes of the problem on Crossrail?	3. Predominantly analysis of primary qualitative data.
4. Improve the EWN procedure.	4. How can the EWN procedure be improved?	4. Analysis of primary and secondary data including cross validation & recommendations.

Figure 8 – Link between research goals and research methodology

Chapter 5: Findings & Analysis

The following will detail the findings and analysis of the secondary and primary data using charts and summaries of the data together with analysis commentary.

Secondary Data

The secondary data was obtained from the Crossrail Contract Administration software which kept databases and registers of EWNs on each contract.

In order to understand the volume of EWNs on the Crossrail programme, the top 10 nr contracts by value (Anticipated Final Cost - AFC) were selected where there was key spend over the financial years 15/16, 16/17 and 17/18. This timeframe was chosen so that the data was recent and the responses to the questions would be based on a similar timeframe. The contracts used as part of the secondary research are detailed in the below Figure 9. Each contract on the Crossrail programme was given a 'C' reference number which is detailed below. All of the contracts were NEC3 Option C Target contracts.

Contract Ref.	Name	Description of works
C360	Intermediate Shafts & Portals	Design and build of shafts and portals
C405	Paddington Station	Station design and build
C412	Bond Street Station	Station design and build
C422	Tottenham Court Road Station	Station design and build
C502	Liverpool Street Station	Station design and build
C530	Woolwich box & portal fit-out	Structure fit-out works
C610	Systemwide Main Works	System design and build (Track, OHLE, etc.)
C620	Signalling System	System design and build
C660	Control and Communication System	System design and build

Figure 9 - List of Contracts used for EWN secondary data analysis

Quantity of EWNs

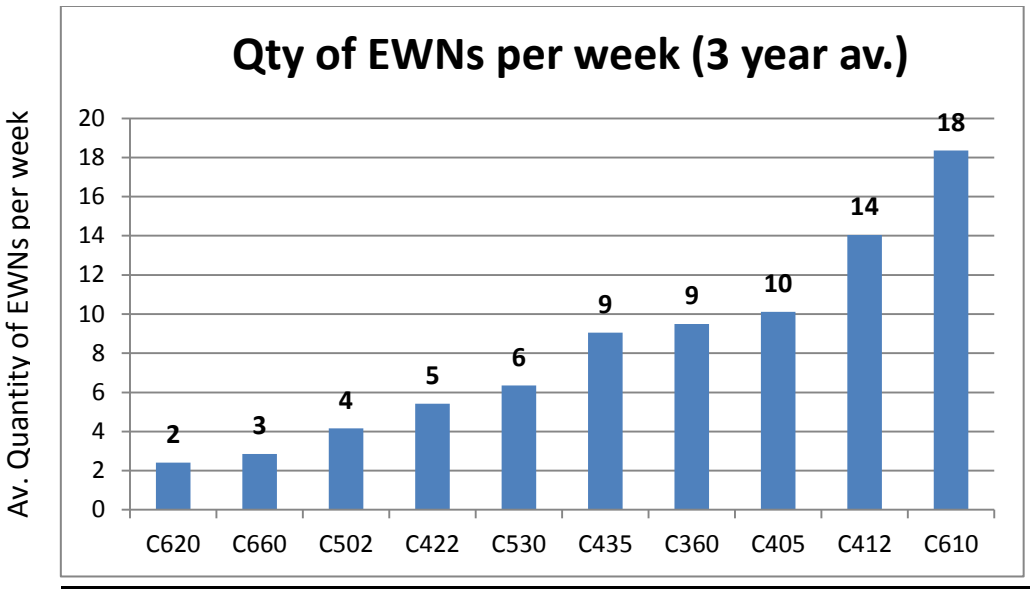


Figure 10 - Quantity of EWNs issued per week

The contracts were organised in ascending order based on the average quantity of EWNs issued per week over a 3 year period (financial years FY2015/16, FY2016/17 and FY2017/18). These years were chosen as they were the most up-to-date data. The results of this data are shown in Figure 10.

Whilst it is a subjective assessment, the author's view of an excessive quantity of EWNs would be a project with 5 or more EWN's issued per week. At a 2-3 hour weekly risk reduction meeting, personal experience has shown that the meeting may be able to adequately cover 4 nr new EWNs along with updating old open EWNs. However above this number the open EWNs starts to grow and become difficult to manage. Maintaining open EWNs at a low number becomes a challenge. The risk reduction meeting becomes more about closing passed risk events and mitigated EWNs rather than agreeing future mitigation actions.

Quantity of EWNs vs Anticipated Final Cost

The quantity of EWNs were then compared to the AFC in order to understand if there was correlation between the AFC and volume of EWNs issued on a project. This is shown in Figure 11.

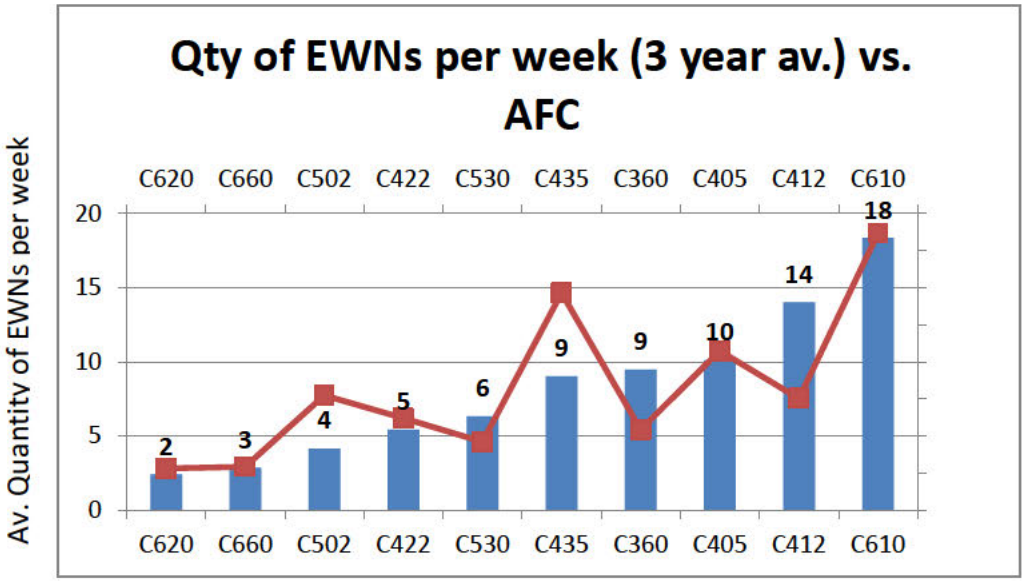


Figure 11 - Qty of EWNs issued per week vs. forecast Anticipate Final Cost Chart

It is evident that there is a positive correlation between a contract's AFC and the quantity of EWNs issued.

Using a Pearson's r (correlation coefficient) test within Excel on the observed secondary data provided further evidence of correlation. Higher quantity of EWNs were correlated with higher AFC values, r=0.77 which is considered to be a large effect.

In statistics it is generally accepted that the following scale can be used to estimate the effect size (Laycock et al., 2016). If r =

- +/- 0.5 = large
- +/- 0.3 = medium
- +/- 0.1 = small

Therefore the hypothesis has been proven to be correct.

Analysis of findings

The average quantity of EWNs issued per week for the lower value contracts did not appear to be unreasonable considering the scale and complexity of Crossrail. However as the value of the contract increases there is a correlation between the AFC of the contract and the quantity of EWNs issued.

There are 2 nr key exceptions to this correlation namely the C502 and C435 contracts. It is recommended that further research is conducted to better understand what may have been the drivers for a relative lower volume of EWNs being issued.

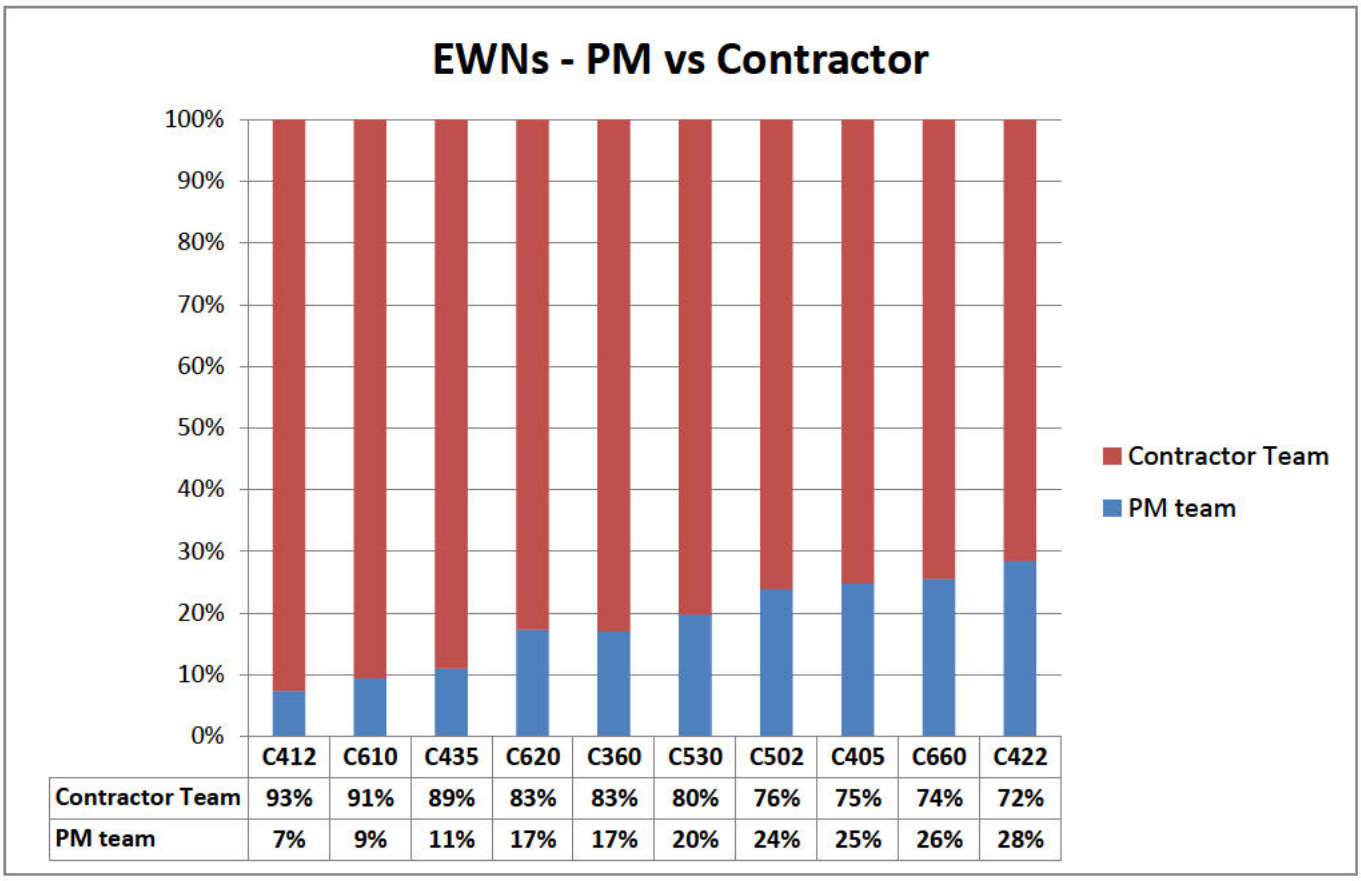
The specific AFC values for each contract have been removed in order to maintain commercial confidentiality. Using the above noted subjective assessment of excessive quantity of EWN's. The standard NEC3 EWN procedure is effective for lower value complex infrastructure contracts but once the AFC exceeds £100m, the quantity of EWNs can be expected to be more than 4 per week and begins to become unmanageable.

EWNs Issued – PM vs Contractor

The same sample of contracts was used to analyse how the quantity of EWNs issued are split between those submitted by the PM team and the Contractor team.

Each contract's EWN register as of 08 June 2018 was used to quantify the number of EWNs issued by both parties.

From the literature review it was apparent that the contractual sanctions within the contract would incentivise the contractor to issue a greater number of EWNs compared to the PM team. This hypothesis was proven to be correct, on average 82% of EWNs were issued by the contractor team compared to 18% by the PM team. The results for each contract are shown on Figure 12.



	C412	C610	C435	C620	C360	C530	C502	C405	C660	C422
Contractor Team	93%	91%	89%	83%	83%	80%	76%	75%	74%	72%
PM team	7%	9%	11%	17%	17%	20%	24%	25%	26%	28%

Figure 12 - EWNs Project Manager vs. Contractor Chart

Use of EWN Disallowed Cost Sanctions (Clause 11.2 [24])

Crossrail's contract administration database was used to analyse if the PM has applied Disallowed Cost on any of the Crossrail contracts as a consequence of the contractor not raising an EWN in accordance with the contract.

The database was searched for reference to '11.2 (24)', '11.2(24)', 11.2[24], etc. to see if the clause and its possible written variations had been applied on any Crossrail contract.

The Crossrail contract administration database had 151 nr project manager communications that had reference to clause 11.2 (24). Of this 6 nr communications had reference to either the words 'early warning' and 'disallow'. This suggests that this sanction is rarely used on the Crossrail programme.

Whilst it is acknowledged this search may not be 100% accurate. Based on the time and resources available it is deemed an appropriate method to gauge the use of Disallowed Cost due to the contractor's failure to issue EWNs in accordance with the contract.

The results of this research would suggest that either the contractor is submitting EWNs in accordance with the contract or alternatively the PM does not deem it appropriate to apply the clause and disallow cost.

Use of EWN Reduced Target Sanctions (Clause 61.5)

Crossrail's contract administration database was used to analyse the quantity of compensation events which had been accepted on the basis that the assessment of quantum would take into consideration failure to submit a EWN at the time a competent contractor should have become aware of the matter.

Out of a total of 27,421 CEs captured on the Crossrail contract administration database only 57 nr have clause 61.5 applied, equivalent to 0.21%.

Furthermore 46 nr (81%) were implemented at below £50k and 16 nr (28%) were implemented using a Project Manager's Assessment as they could not be mutually agreed which would suggest that the clause was generally applied to lower value compensation events which were not contentious.

These finding suggests that this clause is either not applicable as the contractor raises EWNs in accordance with the contract or that generally the PM does not enforce the clause due to its punitive nature.

Primary Data

The below tables detail a summary of the findings:

Question 1 - How many year's experience do you have working on projects which use the NEC form of contract?

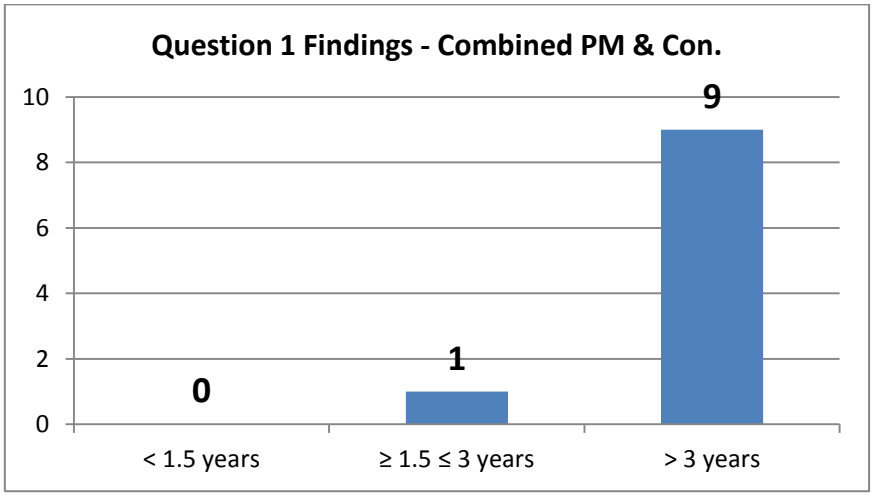


Figure 13 - Question 1 Findings Chart – Combined PM & Contractor data

In total 10 nr interviews were conducted. The interviewees were all experienced in using the NEC form of contract with all the interviewees having at least 1.5 years experience. The results are shown in Figure 13.

Question 2 - Do you work on the Project Manager's team or the Contractor's team?

In order to get a balanced view, as per the research methodology an equal number of PM team and Contractor team interviews were undertaken, 5 nr for each team.

Question 3a - What is your role on the project?

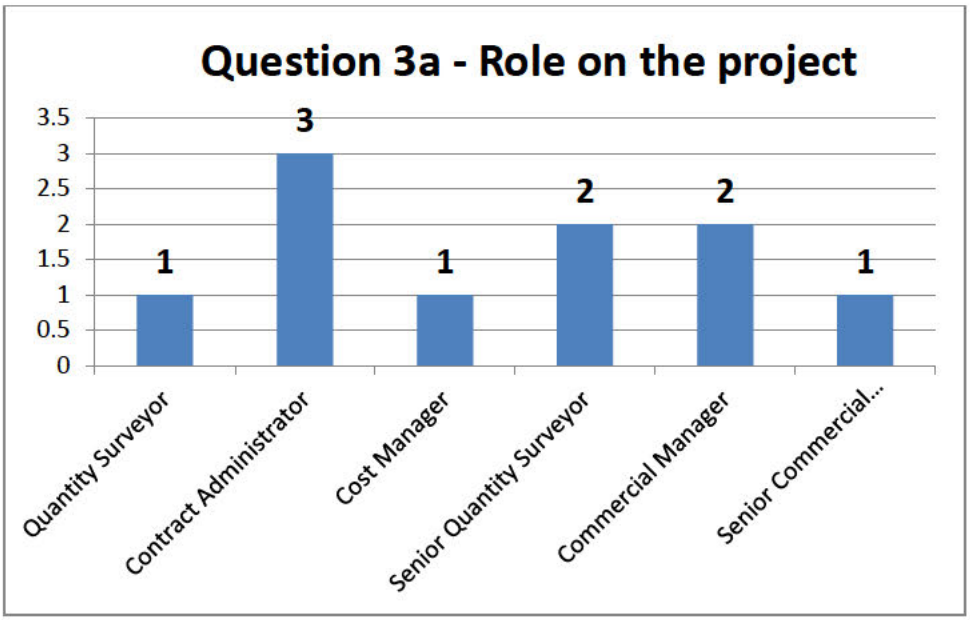


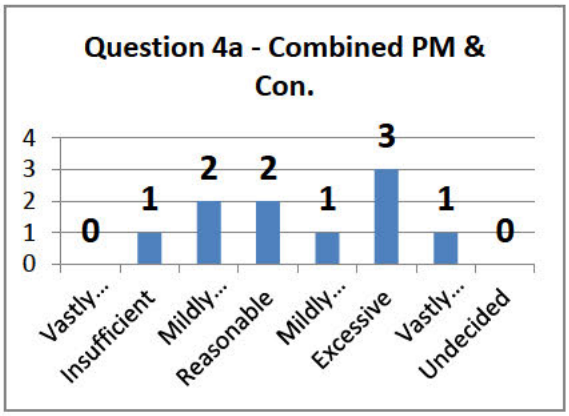
Figure 14 - Question 3a Findings Chart – Role on the Project

The sample consisted of the roles as detailed in Figure 14. Along with the year's experience, the range of roles provided a broad perspective of opinions of the EWN procedure.

Question 3b - Do you work on a Crossrail NEC3 Engineering and Construction Contract Option C?

All of the interviewees were working on a NEC3 ECC Option C contract at the time of the interview.

Question 4 - What is your opinion of the volume of EWN's issued on your contract?



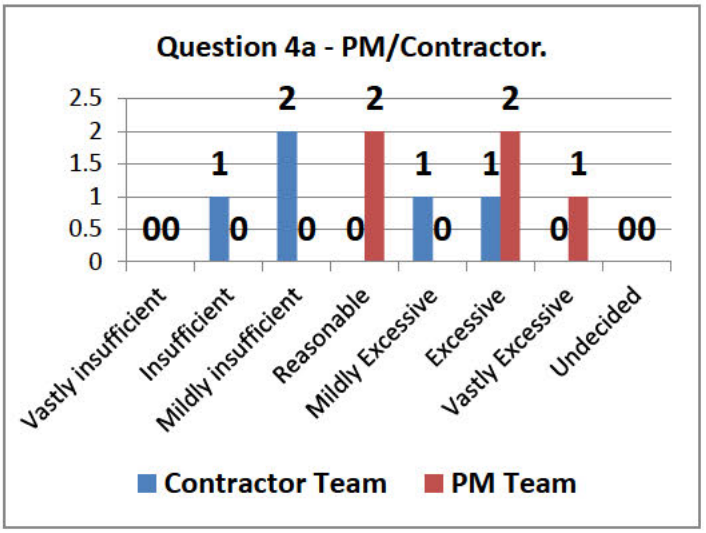


Figure 15 - Question 4a Findings Chart

The results of this question as shown in Figure 15 were quite broad on the spectrum of being insufficient to excessive. The interviewees that had carried out their own quantitative research into the actual number of EWNs issued per month considered this to be reasonable or insufficient stating that the size and complexity of Crossrail could in fact have led to more EWNs.

It is worth noting the interviewees that stated the quantity of EWNs were reasonable worked on a contract where the average number of EWNs was 5 nr or less per week.

Those interviewees that believed the quantity of EWNs was on the insufficient range, generally chose this opinion based on the size and complexity of their Crossrail contract and believed that with the amount of interfacing requirements there would be more EWNs which were about managing risk rather than recording history or a commercial position.

It is also noted that generally the PM team responded with the quantity being on the excessive end of the scale whereas the Contractor team tended to consider that the quantity of EWNs was on the insufficient scale. This is because the PM team has to administer the Risk Register and also because the contractor issues a lot more EWNs compared to the PM team.

Where the interviewees opinion was that the volume of EWNs were excessive the justification given was generally that the EWNs submitted were not correct EWNs as they related to historic matters which could not be mitigated.

The response to this question suggested that a significant volume of EWNs were related to interface issues between different contracts which form part of the Crossrail programme. Generally such issues are not resolved by the interfacing contracts as each party is commercially incentivised to prioritise their own works in order to reduce cost and improve gain share. This tends to give rise to disagreement or decisions which are not in the best interest of the wider programme which subsequently require direct intervention by the PM teams. It is recommended that further research is carried out with regards to either reducing the amount of interfacing between contracts as part of the procurement process or alternatively altering the conditions of contract in order to incentivise collaboration not

only between the PM and contractor team but also between contractor teams from different contracts.

Question 5 - What is your opinion on the amount of time spent by the project administering the EWN procedure?

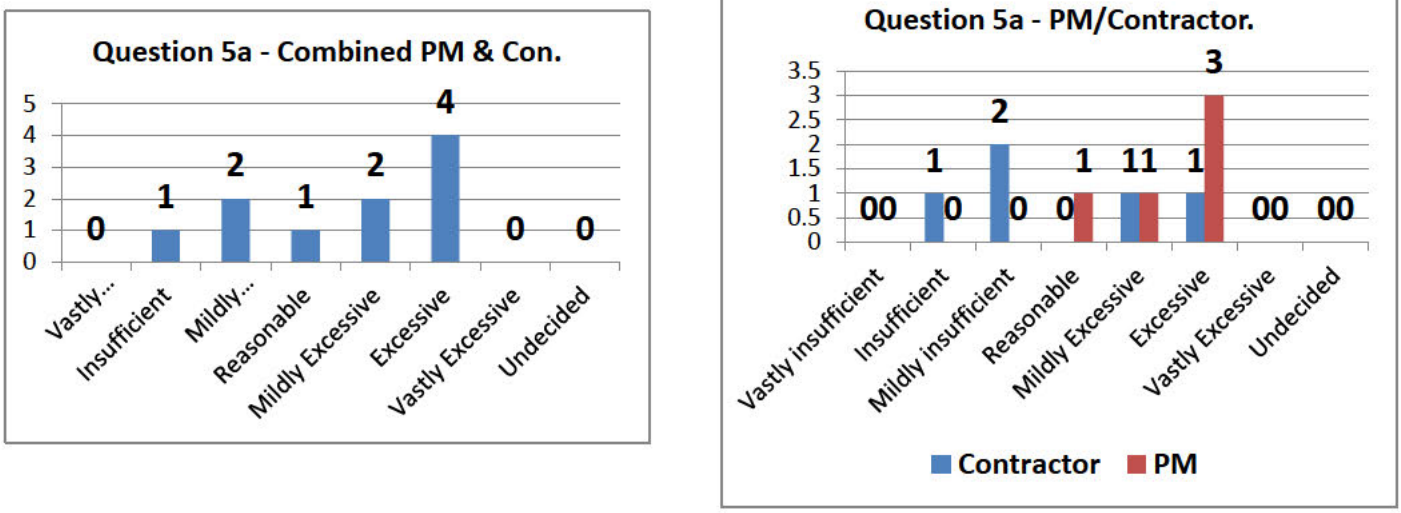


Figure 16 - Question 5a Findings Chart

Again the results of this question as shown in Figure 16 spanned the spectrum of insufficient to excessive, with the PM team tending to view the time spent as excessive and the Contractor team as insignificant.

Where the opinion was noted as being insufficient this is due to the process not being used as intended and risks were viewed as being managed more informally outside the EWN procedure or it was noted that the procedure was viewed as a contract administration mechanism rather than a risk management tool as intended.

Where the opinion was that the time spent was excessive the justification was generally that too much time was spent administering the procedure, closing out risks that had passed and as such did not adding value, rather than actually managing and mitigating risk.

Question 6 - Do you feel that the EWN process is sometimes used for insignificant issues which would be better dealt with using more informal means?

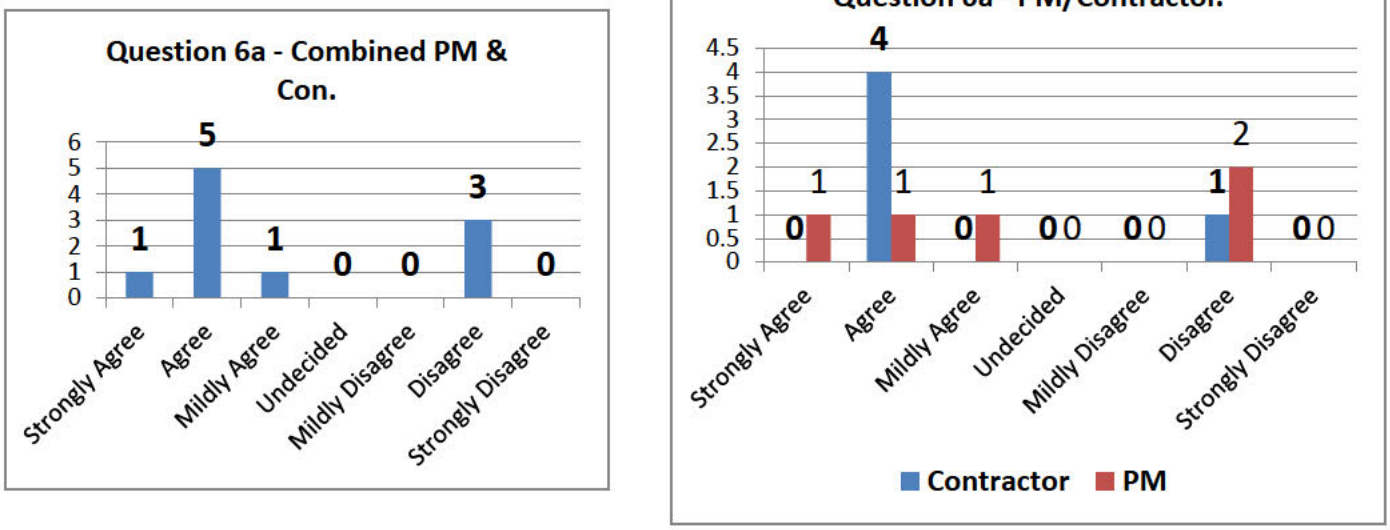


Figure 17 - Question 6a Findings Chart

The general consensus for this question (70% of interviewees) as shown in Figure 17 was that EWNs are used for insignificant issues. Interestingly this opinion was more prevalent within the Contractor team.

One disagree response noted that the contract does not provide for a subjective assessment of whether the matter is significant or not. Another interviewee noted that generally insignificant issues were being dealt with through an informal approach rather than using the formal contractual process.

Recommendation: The contract should allow a subjective assessment to be carried out in order to avoid low cost impact matters being formalised through the EWN process without the risk of this leading to Disallowed Cost or reduced target assessment. Such matters could be managed informally.

Question 7 - Do you feel that EWNs are used as a means of protecting the other party's commercial position rather than managing risk?

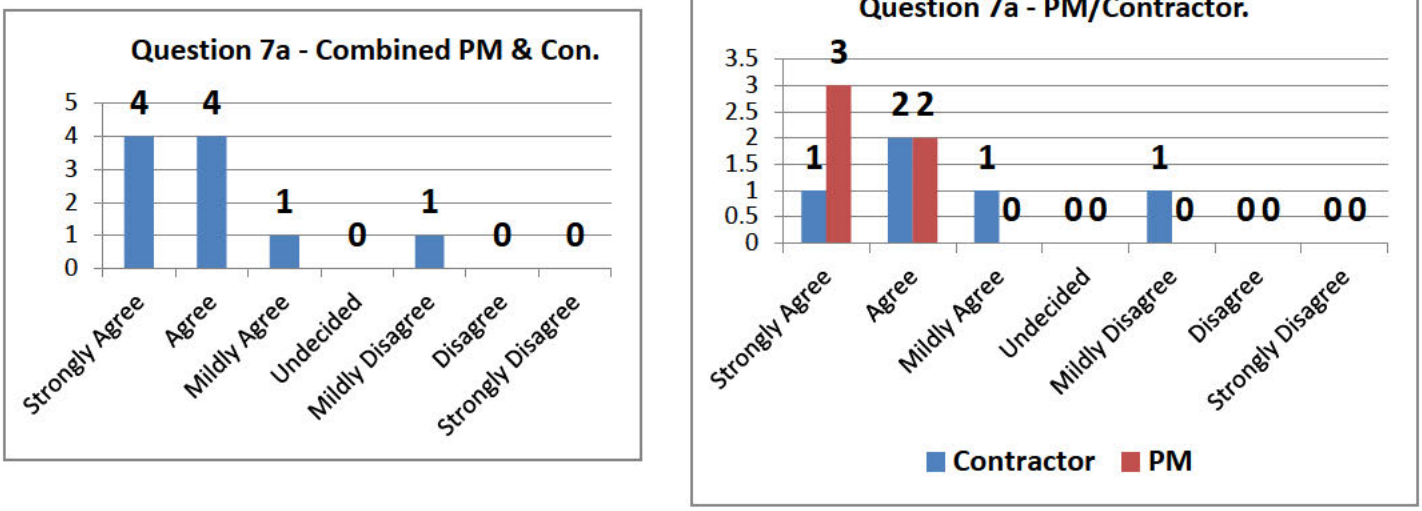


Figure 18 - Question 7a Findings Chart

The general consensus of this question (90% of interviewees) as shown in Figure 18 was that the EWN procedure was used in order to protect the other party's commercial position. The justification given was that events that had already occurred were recorded using EWNs in order to protect the other party from blame or that EWNs were used to help protect against Disallowed Cost.

Another interesting point that was made is that generally the process is managed by the commercial team and therefore the approach adopted is inherently biased towards commercial management rather than the focus being on the management of risk.

The interviewee that mildly disagreed did acknowledge that they had experience of the RRM being used to apportion liability rather than managing and resolving the risk.

Recommendation: Utilise non-commercial members of the team for example, a risk, delivery or engineering practitioner so that the focus is on managing risk rather than commercial protection.

Question 8 - Do you feel that EWNs received are sometimes used for matters that have already occurred and cant be mitigated?

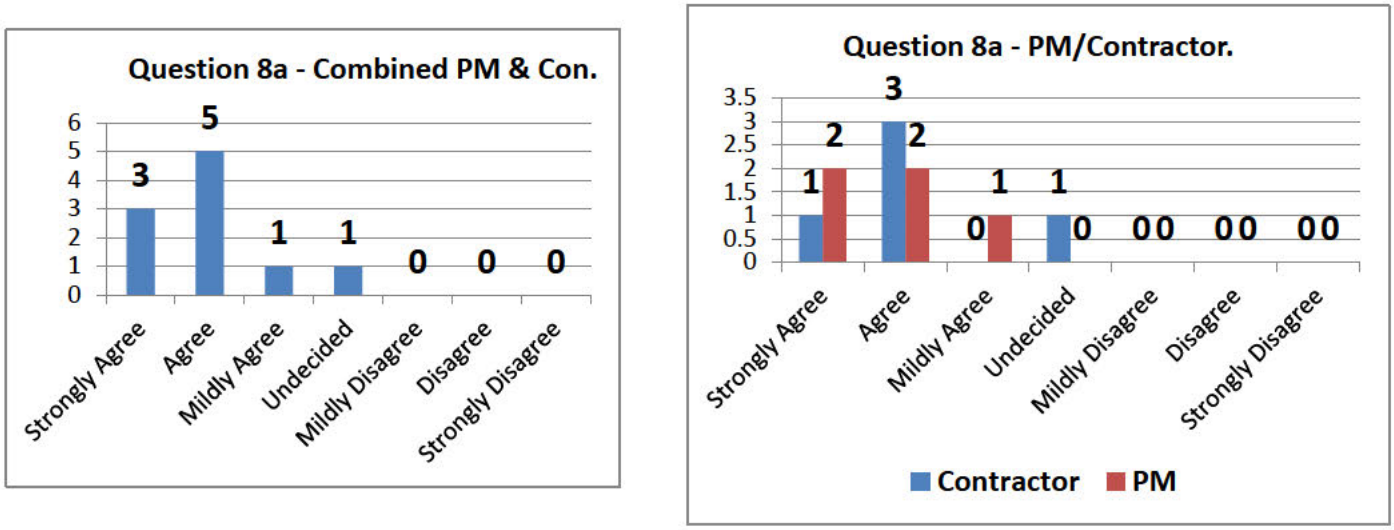


Figure 19 - Question 8a Findings Chart

The general consensus for this question (90% of interviewees) as shown in Figure 19 was to either strongly agree or to agree with the question. Again the justification given was with regards to recording a position as a form of protection or recording how money has been spent rather than as a means to manage risk.

Another reason highlighted that on a fast moving project whilst the EWN may be created before the event, by the time it is created, reviewed and submitted, the event may have already occurred.

The other reasons which were noted were to do with training and people not fully understanding how the EWN provisions of the contract should be administered.

The interviewee that was undecided agreed with the above position and noted that whilst the EWN may be formally submitted after the event, the risk is informally being mitigated before the event.

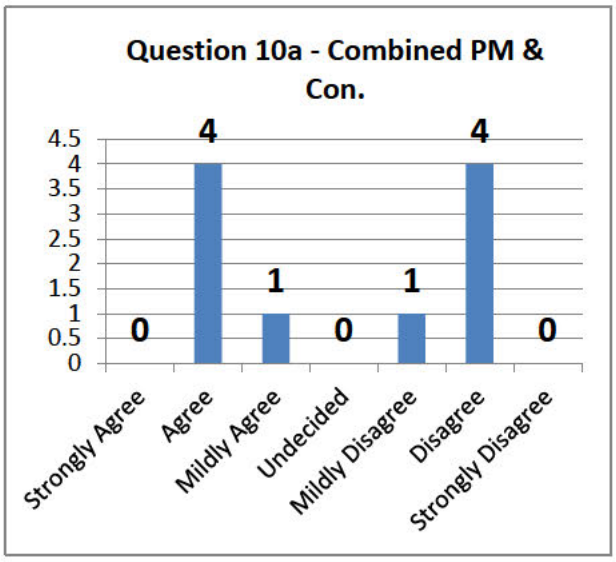
Recommendation: Improve training and make it explicit within the contract wording that EWNs are only for matters which are in the future.

Question 9 - What do you feel could be done to improve the contract / EWN process with respect to the above?

The following lists the other key improvements noted during the interview process:

- Use a robust and rapid site based approach similar to confirmation of verbal instruction' records which were used in the past. This will allow risks to be managed more efficiently and expedite the implementation of mitigation measures.
- Focus on time and quality rather than cost. On large infrastructure projects the largest cost driver is generally delay to the programme.
- Make the person who originates the EWN responsible for its management and closure. This should lead to a reduction in EWNs and a focus on the key issues.
- Empowering the Project Manager via a contract clause to remove / discount an EWN which does not meet the criteria of notifying the other party of an event which could impact time, cost or quality.
- The system used for administering EWNs electronically should have a check list so that EWNs can't be submitted if the risk/event has occurred in the past. Instead the communication will be sent as a project manager or contractor communication.

Question 10 - Do you feel that the EWN process could be improved by including the management of opportunities rather than the focus being on negative matters such as delay and increased cost?



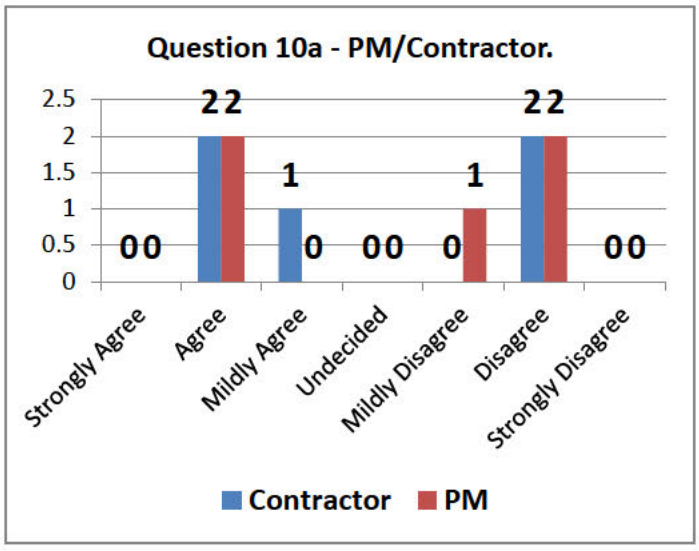


Figure 20 - Question 10a Findings Chart

The responses to this question as shown in Figure 20 were equally split between the range of agree and disagree. Where the interviewees disagreed, this was not because they did not believe there were benefits to the management of opportunities, it was generally because they felt that there should be a separate standalone contract procedure rather than merging the management of opportunities and risk together.

However another important point recorded was with regards to when the EWN procedure is used as intended it inherently finds opportunities and positive outcomes for identified risks anyway.

Others felt that the Option C form of contract with the pain/gain share mechanism already gave ample incentive for the management of opportunities and that a formal process could act as a barrier to the implementation of initiatives.

In light of the above findings the recommended changes to the EWN contract provisions will not include management of opportunities.

Question 11 - What do you feel could be done to improve the contract / EWN process with respect to the above?

The following lists out the key improvement noted in the interviews:

- Include a formalised contractual mechanism for management of opportunities which is distinct and separate from the EWN procedure.
- The EWN process should change focus to time rather than money because generally if you finish on time it will cost less and you will find opportunities to make it happen.

Question 12 - Are you aware of provisions as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract, being used on Crossrail or any other NEC project?

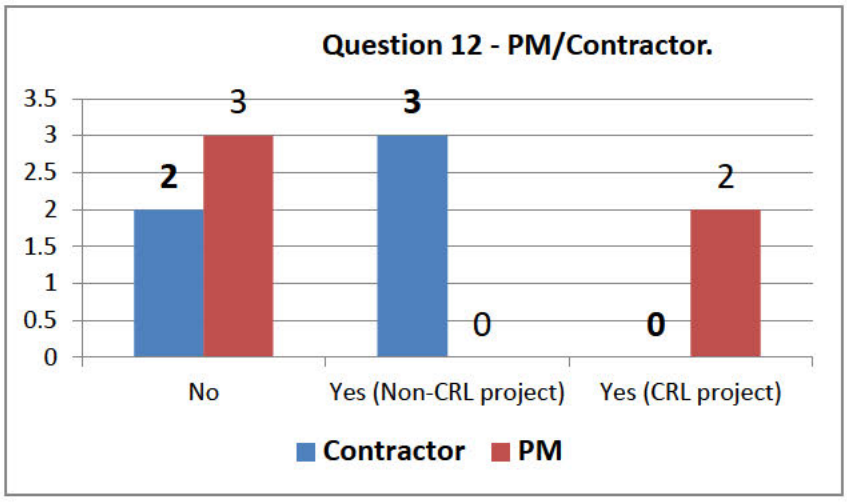
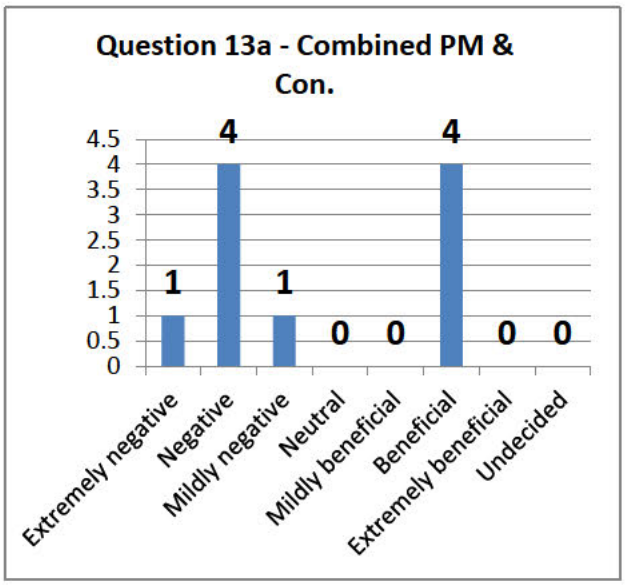


Figure 21 - Question 12 Findings Chart

The response to this question as shown in Figure 21 supported the secondary research that was conducted in that the majority of interviewees had not experienced the use of the EWN contractual sanctions. Those that did have experience did not consider the use of the provisions to be significant in terms of cost or target reductions.

Question 13 - What is your opinion of the impact of the contract provisions for failure to use EWN's as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract?



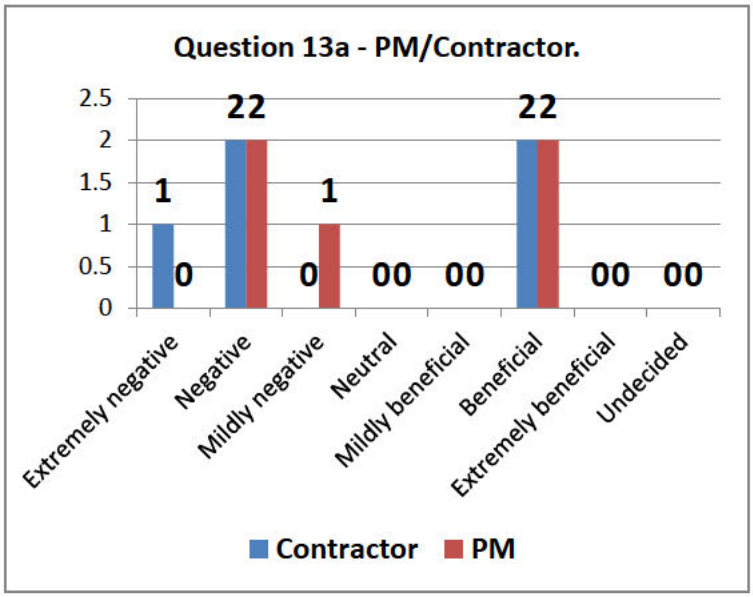


Figure 22 - Question 13a Findings Chart

The general consensus (60% of interviewees) as shown if figure 22 was that the sanctions associated with the contractor not issuing EWNs in accordance with the contract had a negative impact. The justification provided for this was that the sanctions were not in the spirit of the contract in terms of mutual trust and could lead to negative behaviours and excessive EWNs in order to reduce the risk of the PM applying the sanctions.

Another point raised was that the clauses may mean that EWNs are raised in a hurry in order to be a marker and as such are poor quality and lack the required information.

The other concern raised was with regards to the level of subjectivity required in terms of assessing when a contractor should have issued an EWN.

Where the interviewee's opinion was that the sanctions were beneficial this was due to the view that the clauses had a positive impact on the behaviour of the contractor in terms of providing an incentive, albeit via the risk of a penalty, for the contractor to record risks formally and as such ensure risks were identified and managed.

Question 14 - What is your opinion with regards to the impact of removing the contract provisions for failure to issue EWN's as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract?

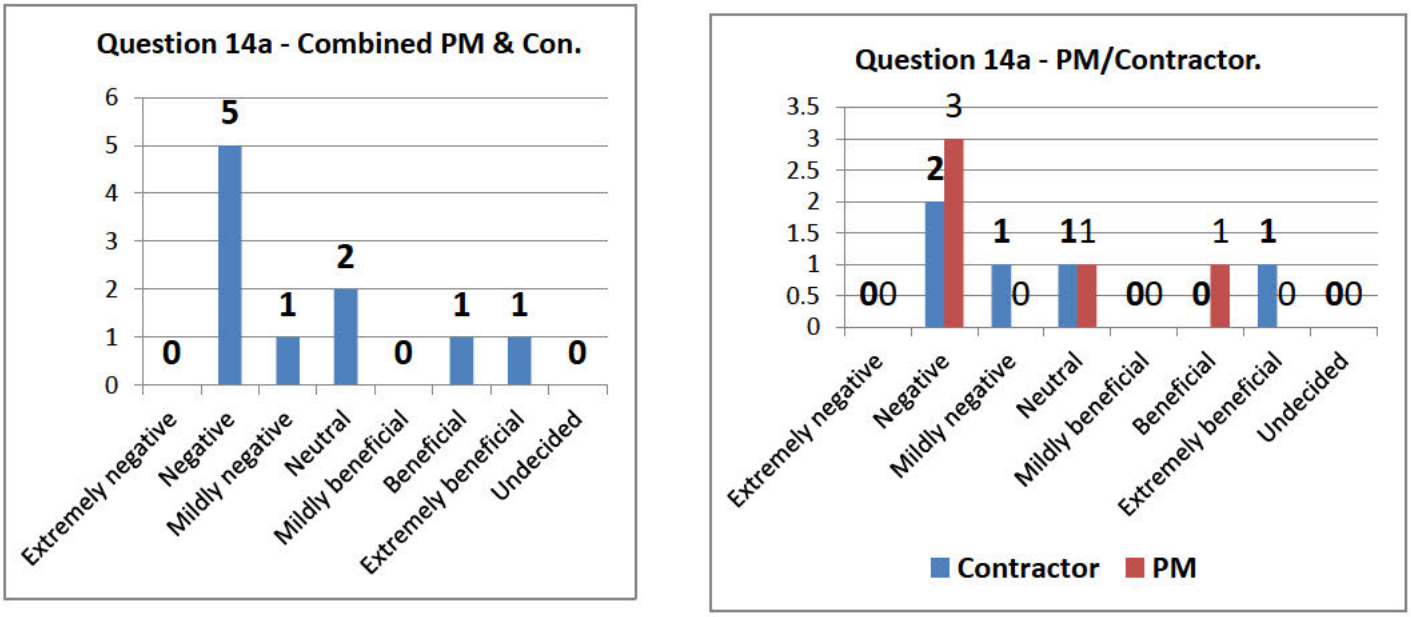


Figure 23 - Question 14a Findings Chart

The response for this question as shown in Figure 23 was that the removal of the EWN sanction clauses would be negative by 50% of interviewees. This was interesting as although some interviewees believed that the sanctions had a negative impact on the project, they believed that simply removing the sanctions would be negative without having something else in place to incentivise submission of EWNs. It was accepted that a contractual mechanism was required in order to make sure the EWN procedure was followed however the current sanction approach was not deemed appropriate where the project is trying to foster mutual trust and a collaborative environment.

Question 15 - What are the negative consequences of the above provisions?

The below summarises the responses to this question:

- The mutual benefit of the EWN procedure is diluted as the contractor focuses on managing the submission of EWNs rather than managing risk.
- Leads to adversarial behaviour as the PM is contractually obliged to Disallow Cost even though the contractor may be performing well.
- EWNs are more concerned about recording a commercial position rather than managing risk.
- Clause are punitive and can lead to negative behaviours.
- The sanction clauses are too subjective and can lead to disputes.
- Clauses 11.2 (25) gives rise to anxiety as the contractor is concerned about the risk of Disallowed Cost and there is no time bar.
- Trust is reduced as a contractor may make a decision in good faith but because an EWN has not been raised there is a risk of Disallowed Cost.
- The reduction in the contractor's recovery of cost can lead to trying to recover any deductions from the supply chain.

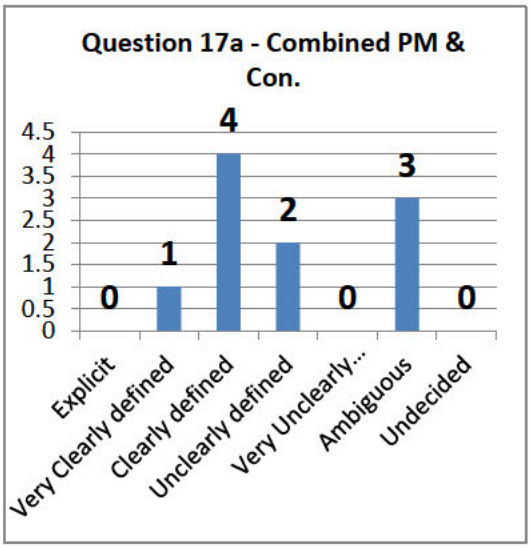
Question 16 - What do you feel could be done to improve the contract / EWN process with respect to the above?

The following lists the key improvements noted in the interviews with respect to the EWN sanctions:

- Rather than have commercial teams administering the procedure use engineering or delivery so that the focus is on risk management not commercial management.

- The penalty clauses should be time limited so that the contractor is aware of any Disallowed Cost in timely manner.
- The contract needs to recognise that infrastructure projects are inherently risky and increasing this risk by potentially disallowing a contractor's margin via Disallowed Cost should be avoided.
- The carrot rather than stick approach should be used in order to incentivise the contractor to issue and manage EWNs.

Question 17 - What is your opinion as to how the conditions of contract prescribe what matters qualify as an EWN?



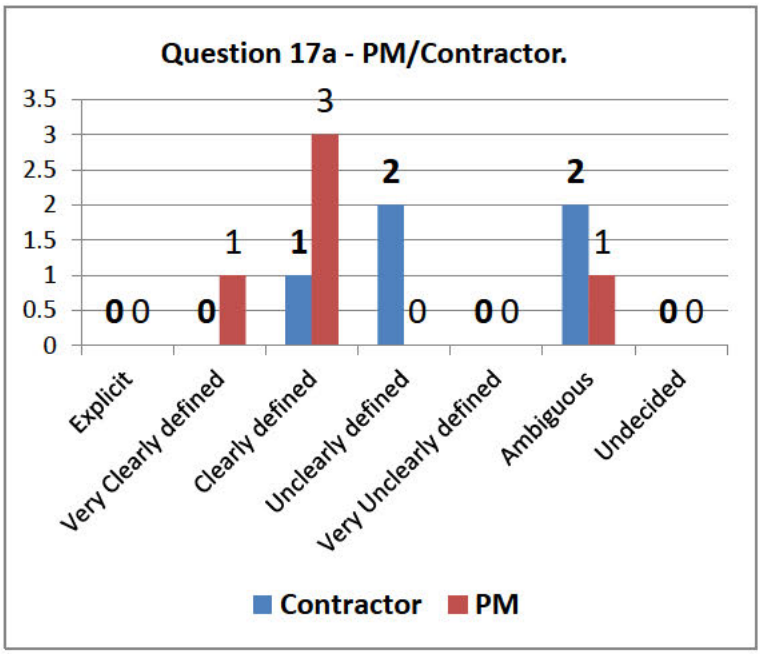


Figure 24 - Question 17a Findings Chart

The response to question as shown in figure 24 was equally split between clearly defined and unclearly defined/ambiguous.

Where the response was associated with being clearly defined, the justification was that the contract clearly defines what gives rise to an EWN. However it was noted that because the definition is broad and wide ranging this can lead to spurious EWNs.

Where the response was associated with the definition being unclearly defined or ambiguous, this was generally because the wording was not clear on how to deal with

matters that had already occurred but the time, cost or quality impact will materialise in the future.

Recommendation: Amend the EWN clause so that it is explicit that EWNs are only required for future matters.

Question 18 - What is your opinion as to how the conditions of contract prescribe the structure and content of an EWN?

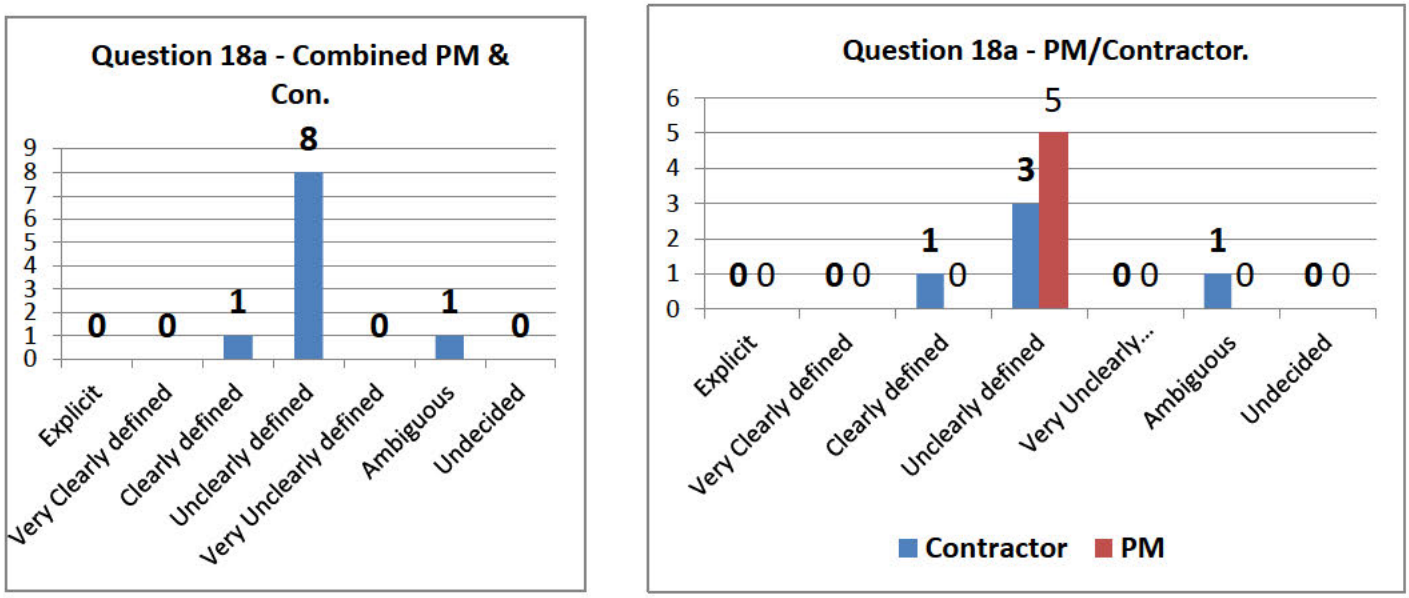


Figure 25 - Question 18a Findings Chart

The response to this question as shown in Figure 25 was generally that the contract unclearly defines the structure and content of an EWN (80% of interviewees). With only 1 nr interviewee believing that the definition was clearly defined as they felt the clause tells you what to do in the event of an EWN, i.e. hold a risk reduction meeting with the aim of mitigating the impact of the matter in question.

The interviewees which believed the contract was unclearly defined felt that the reduced clarity lead to the following issues:

- Two extremes for quantity of content either 2 line EWNs or excessive paragraphs of text.
- EWNs tend to focus on describing the matter rather than focusing on how it can be managed.
- Inconsistency and uncertainty as to how to produce an EWN

An interesting point was given in that the approach adopted by the contract allows maximum flexibility and the Works Information should be used as the means of specifying the structure and content of EWNs rather than the conditions of contract.

Question 19 - What do you feel could be done to further improve the contract / EWN procedure?

It was noted that an improvement to the EWN procedure would be to use an EWN template and process guidance within the Works Information in order to ensure that EWNs were submitted using a consistent structure and provide adequate information on the matter/risk, how it can be mitigated together with its probability, imminence and the potential impact if the risk is not managed in terms of time and cost. This approach will allow EWNs to be prioritised accordingly.

Figure 26 provides the suggested template for use on contracts in order to improve the quality and consistency of EWN submissions and is developed from a template the author devised for use on Crossrail contracts. The template also aims to facilitate discussion prior to formal submission and the necessary data to allow informed prioritisation. It recommended that this approach is implemented at the outset of a contract and forms part of the Works Information. Ideally implemented using EWN software so that the fields are mandatory and answers are required before the EWN can be formally submitted through the system and added to the Risk Register. This will also allow the EWN data to be automatically collected in the Risk Register (EWN register) allowing easy sorting for high priority/risk/imminence EWNs.

Early Warning Notice Process (EWN) Process & Template

EWN Process

1. If a member of the project team identifies a risk which could have an effect on health and safety, time, cost, quality and requires input from others / Project Manager, then the below form shall be completed and issued to the Project Risk Manager and Project Manager.
EWNs are not required for risk / matters that are in the past but will have future impacts. The future impacts will be managed via planning and cost control procuedures.

2. Where possible, whoever raises the Early Warning Notice (EWN) shall discuss the issue/risk with their relevant prior to formal issue record key points from the discussion and include on the issued EWN.

3. The written format shall use bullet points wherever possible, be concise and specific, lengthy prose is to be avoided. The Risk Review Meeting (RRM) discussion can bring out the detail if required.

4. The Risk Manager / Project Manager will organise a meeting invite to the next risk review meeting and log the event on the risk register where appropriate.

5. The meeting will focus on the technical solution / risk mitigation and agree actions to avoid or reduce the risk and who will take them and when the actions need to be closed.

EWN Template (see red text for guidance on how to populate the data)

EWN Title:		
Insert title summary of the risk.		
Discipline:		
E.g. Track, OHLE, Tunnel Ventilation System, Cable Management System, etc.		
Originator/Contributors:		
Insert name of person who identified the risk.		
Contact:		
Insert name of person who should be contacted to discuss the risk.		
Description of the FUTURE risk / matter:		
High level description of the risk, including root cause and effect.		
Root cause of risk event:		
High level description of root cause of the risk event.		
Name of PM team / Contractor team counterpart pre-EWN discussion conducted with:		
Person who the matter was discussed with prior to formal drafting of the EWN		
Effect of risk if unmitigated:		
High level description of effect of risk if unmitigated.		
Proposed actions which are to be taken to avoid or reduce the risk and who will take them:		
Proposed actions	**Action Owner**	**Target Completion Date**
1		
2		
3		
4		
5		
IMMINENCE - When will the risk event occur: Low / Medium / High (subjective assessment only)		
This section it is just to rank as Low, Medium or High rather than attribute an actual value. This is used to prioritise EWN's and is developed during the risk review meeting (Low = < 1 week / Medium = > 1 week < 1 month / High = > 1 month or Delay Completion Date or Key Date).		
TIME - Potential programme impact if risk is not mitigated: Low / Medium / High (subjective assessment only)		
This section it is just to rank as Low, Medium or High rather than attribute an actual value. This is used to prioritise EWN's and is developed during the risk review meeting (Low= ≤ 1 week / Medium = > 1 week / High = Delay Completion or Project Milestone).		
COST - Potential cost impact if risk is not mitigated: Low / Medium / High (subjective assessment only)		
This section it is just to rank as Low, Medium or High rather than attribute an actual value. This is used to prioritise EWN's and is developed during the risk review meeting (Low = <£50k / Medium = >£50k-£250k / High = >£250k).		
PROBABILITY - Probability risk will occur: Low / Medium / High (subjective assessment only)		
This section it is just to rank the likelihood of the risk event occurring as Low, Medium or High rather than attribute an actual value. This is used to prioritise EWN's and is developed during the risk review meeting (Low = ≤ 25% / Medium = > 25% ≤ 75% / High = >75%).		
RISK REDUCTION MEETING - Representatives		
PM team:		
Contractor Team:		

Figure 26 - EWN Procedure Guidance & Template

Question 20 - What do you feel could be done to further improve the contract / EWN process not mentioned or covered in your responses above?

The following lists out the other key improvement noted during the interview:

- Improved training to the wider team on how EWNs should be administered and managed. This will help avoid EWNs being used for risk events that have already occurred in the past.

Recommended Improvements to Contractual Clauses

Prior to implementation of the below contractual amendments it is recommended that the revised wording is reviewed by an appropriately qualified solicitor.

Early Warning Clause 16.x

Based on the findings of the literature review and analysis of the secondary and primary research it recommended that clause 16 is amended as per the following red text. Supporting notes are given for the purposes of explaining the changes.

> **Clause 16.1** The Contractor and the Project Manager give an early warning by notifying the other **when** ~~**as soon as**~~[1] either becomes aware of any **future**[2] matter which could:
>
> [Note 1: mandating that EWNs are issued immediately is unreasonable and impractical and may lead to EWNs being rushed as noted in the literature review and interview questionnaire findings. It also means that discussion is less likely to be held before the EWN is submitted]
>
> [Note 2: provides clarity that an EWN is not required for a matter that has already occurred]
>
> - increase the total of the Prices **by more than an order of magnitude of £x's if not mitigated**[3]
>
> [Note 3: Allows low value matters to be dealt with outside the formal EWN procedure. Use of order of magnitude confirms it should be a subjective assessment]

- delay Completion
- delay meeting a Key Date or
- impair the performance of the works in use.

Either the Project Manager or the Contractor may give an early warning by notifying the other of any other matter which could increase the total cost **by more than an order of magnitude of £x's if not mitigated**[3]. The Project Manager enters early warning matters in the Risk Register. Early warning of a matter for which a compensation event has previously been notified is not required.

Clause 16.11 The Contractor or Project Manager use and complete the early warning notice template contained within the Works Information for all early warnings[4]

[Note 4: This will ensure the required information is including within the EWN]**.**

Clause 16.2 – No Change

Clause 16.3 – No change

Clause 16.31 – Where the PM considers that an early warning notified by the Contractor is not given in accordance with this contract, it does not need to be recorded on the Risk Register[5]**.**

[Note 5: This will allow the PM to close EWNs without seeking agreement from the contractor].

Clause 16.4 The Project Manager **revises the Risk Register for EWNs which the Project Manager submits and the Contractor revises the Risk Register for EWNs which the Contractor issues**[6]. **The Risk Register is revised** to record:

[Note 6: This will provide greater accountability for the management of an EWN]

- **The information contained in the completed EWN template included in the Works Information**[7]**,**

  [Note 7: Increases the usefulness of the Risk Register and allows the requirements to be defined by the Works Information template]

- the decisions made at each risk reduction meeting,

and issues the revised Risk Register to the Contractor **or Project Manager**[8]. If a decision needs a change to the Works Information, the Project Manager instructs the change at the same time as he issues the revised Risk Register.

[Note 8: Provides a shared responsibility for issuing the Risk Register]

It is also recommended that the NEC4 changes to the EWN procedure as noted in the literature are applied to the NEC3 contract.

Recommended changes to the sanction clauses

Clause 11.2 (25) Disallowed Cost is cost which the Project Manager decides

- was incurred only because the Contractor did not
- give an early warning which this contract required him to give. **The maximum amount of Disallowed Cost for not giving an early warning per matter is £x's**[9]**.**

  [Note 9: This change provides a maximum further explained below]

Clause 61.5 – No change.

Clause 63.5 If the Project Manager has notified the Contractor of his decision that the Contractor did not give an early warning of a compensation event which an experienced contract could have given, the event is assessed as if the Contractor had given early warning. **The maximum reduction in terms of effect on Defined Cost per compensation event is £x's**[10]**.**

[Note 10: This reduction maximum only applies to cost not time]

The above changes take into account the findings of the interviews which generally agreed that a form of penalty was required to assist with implementation of the EWN procedure. Once combined with the above amendment which states that EWNs are only required for matters which are more than £x's means that the exposure level of the sanction clauses is defined and easier to quantify. It allows the employer to tailor the EWN clause based on the contract value. For example a contract with an AFC of £600m and limited budget for

management staff may state that matters with impacts on cost of less than £20k are managed via informal means without the contractual requirement for involving or notifying the PM team. Ultimately any cost overspends will already be apportioned as per the pain/gain percentage split noted in the Contract Data as such the contractor will still be incentivised to manage cost. This approach delivers a reduced punitive approach and should assist in reducing the quantity of EWNs which are for low value matters or purely issued to protect a commercial position. Whereas by still allowing the time impact of compensation events to be reduced in accordance with clause 63.5 it allows a Completion Date which is not changed due to the default of the contractor with respect to failure to issue an EWN.

Chapter 6: Conclusions and Recommendations

This chapter provides a conclusion and recommendations for further research. The EWN procedure is a positive initiative in theory which provides contractual provisions for the collaborative proactive management of matters that may impact time, cost and quality. The EWN procedure is a positive influence in getting the parties of a contract to discuss and agree ways to mitigate risk and when first launched was an innovative approach compared to the reactive project management associated with traditional contracts.

In practice the EWN procedure does succeed in providing a formal means of proactively identifying and managing risk but at the cost of wasted effort administering matters which have already occurred or are issued in order to protect a commercial position.

On large complex infrastructure programmes such as Crossrail, the EWN procedure can become overly commercial and an administrative burden due to the quantity of EWNs that are submitted. The research method delivered a quantitative validation of the anecdotal and qualitative evidence of this issue as observed from the literature review.

The targeted primary research consisting of interviews with practitioners with many years experience of the EWN procedure, allowed a deeper understanding of these issues. A contributory reason identified was the broad contractual wording which does not differentiate between those matters with a small impact and those with a significant impact. This in isolation would not be overly disruptive as generally common sense will prevail with EWNs being used for critical matters where the time spent drafting, administering and mitigating the risk provides ample benefits. But due to the punitive nature of the EWN contractual sanctions (potential Disallowed Cost or a reduction in target assessment) the contractor may revert to a tick box mentally which increases the volume of EWNs submitted as protection from such sanctions. This was supported by the number of EWNs issued by the Contractor team being significantly more than their PM team counterparts consistently across the Crossrail contracts researched. In conjunction with 90% of interviewees believing that EWNs were used as a means of protecting a commercial position and for matters that had already occurred and couldn’t be mitigated.

Even though the Crossrail programme had limited evidence of such sanctions being used by the PM, the threat of their use is enough to change behaviours and reduce the benefits of the EWN procedure.

This issue is further compounded by the procedure being administered and managed by commercial teams who by their very nature will seek to reduce commercial risks.

It is clear that a one size fits all approach for the EWN procedure needs to change. The way the procedure is administered should reflect the scale and complexity of the works.

It is recommended that the administrative improvements contained within this dissertation are implemented on all future infrastructure contracts and the contractual improvement implemented where the AFC exceeds £100m. This will allow the cost vs. benefit attributes of the EWN procedure to be re-balanced in favour of the benefits and drive a true collaborative risk management culture with a greatly reduced negative commercial influence. The author's key improvement recommendations are as follows:

Administration

- Train and develop the project team with regards to the management and administration of the EWN procedure including risk, engineering and delivery practitioners.
- Change the EWN administrator – Consider using administrators which are from an alternative function, that is non-commercial focused.
- Change accountability - The party who identifies and drafts the EWN should be responsible for ensuring the risk/matter identified is mitigated and subsequently closed on the Risk Register.
- Use the EWN process guidance and template as in is shown in Figure 26 so that there is a consistent and robust level of information for each EWN.

Contractual

The EWN sanction clauses do not drive the correct behaviour and lead to EWNs becoming a protection mechanism rather than a collaborative risk management tool as intended. A summary of the key recommended contractual amendments are as follows:

- Provide the PM the ability to unilaterally decide to close a EWN if it does not meet the criteria of the contract e.g. the risk event is in the past.
- Amend clause 16.1 to explicitly state that EWNs are only required for matters which occur in the future.
- Include provisions to limit and define the exposure of the contractor to Disallowed Cost and reduced target assessment as a consequence of failure to submit an EWN in accordance with the contract.
- Include provisions which state that EWNs are only required for matters which if not mitigated will have an impact on cost greater than a defined sum. This will avoid EWNs being used for low cost matters.

The below Figure 27 provides a summary of the conclusion in context with the aim, key questions, research methodology, findings and conclusions.

Aim: Develop an improved contractual and management approach for the implementation of the NEC3 ECC EWN procedure on large complex infrastructure projects.			
Objectives:	**Key Questions:**	**Research Methodology:**	**Findings & Conclusion**
1. Investigate the problem.	1. What is the problem?	1. Literature Review & analysis of primary and secondary data.	The key problem with the EWN procedure were identified as follows: • Quantity of EWNs submitted • EWN sanctions driving negative behaviours • Being used to protect / record a commercial position • Being used for insignificant matters. • Lack of focus on opportunities. • Being used to apportion blame. • Being used to support entitlement to compensation events.
2. Establish the extent of the problem on Crossrail.	2. What is the scale of the problem on Crossrail?	2. Predominantly analysis of Crossrail secondary quantitative data.	• The volume of EWNs on the Crossrail project were found to be excessive for contracts with an AFC in excess of £100m as the average would be greater than 4 nr EWNs issued per week. • The secondary data suggested that the EWN sanctions were generally not applied on Crossrail projects.
3. Investigate the causes of the problem on Crossrail.	3. What are the causes of the problem on Crossrail?	3. Predominantly analysis of primary qualitative data.	The interviewees supported the literature review with regards to: • EWNs being used to protect commercial positions (90% of interviewees) • EWNs being used for insignificant matters (70% of interviewees) • EWN sanctions having a negative impact (60% of interviewees) The interviewees also felt that the EWN structure and content being unclearly defined (70% of interviewees)
4. Improve the EWN procedure.	4. How can the EWN procedure be improved?	4. Analysis of primary and secondary data including cross validation & recommendations.	The key improvements identified during the interviews were: • EWN procedure guidance and template • EWN training for the whole project team • Greater ownership, the EWN procedure being managed by the individual who identifies the risk. • Reducing the punitive nature of the EWN sanctions

Figure 27 - Conclusion Summary

Further Research

The further areas of research identified are as follows:

EWN Sanctions modification or removal

Would a 'carrot' rather than 'stick' approach be an improved method of facilitating use of the EWN procedure? Whilst the questionnaire results covered this topic and generally the responses were that the punitive nature of the EWN sanctions were driving negative behaviours. Further research such a pilot project where the sanctions were replaced with reward incentives, would be beneficial for the industry in order to understand if such an approach leads to greater collaboration and trust between the PM and contractor teams. If successful the initiative could be implemented on all large infrastructure projects potentially helping to realise significant time and cost savings via risk mitigation.

Quantity of EWNs low compared to contract AFC

The analysis of the secondary data with respect to the volume of EWNs compared to the contract's AFC highlighted 2 nr contracts where the volume of EWNs was low compared to other projects. It would be interesting to adopt a lessons learnt exercise and conduct further research to understand what was done differently on these projects.

Implementation of the proposed improvements

Further research is required in order to understand the impact of the recommendations provided in this dissertation. Would they assist in improving the collaborative management of risk on large infrastructure programmes? Again it is suggested that pilot contracts are used to test the initiatives and understand their impact on the behaviours of the project team and subsequent achievement of project objectives.

Programme Collaboration not just Contract Collaboration

The NEC3 Option C form of contract does not necessarily cater for collaborative working between different contracts. Generally contractors, as business' who are seeking to increase their profits, work in silos and make decisions based on how to achieve this goal rather than what's best for the wider programme. It is recommended that further research is conducted in this area to understand what can be done to improve the collaboration between organisations of different contracts so that decisions are made in the interest of the programme and not the individual contract.

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APPENDIX A - PILOT INTERVIEW QUESTIONNAIRE

EXPERIENCE & ROLE ON THE PROJECT

1 How many year's experience do you have working on projects which use the NEC form of contract?

Less than 1.5 year	1.5-3 years	More than 3 years

2 Do you work on the Project Manager's team or the Contractor's team?

PM team **Contractor Team**

3 What is your role on the project?

EWN PROCESS - VOLUME OF EWNs

4a Do you feel that the volume of EWNs issued are excessive on the project?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

4b Please explains your choice above?

5a Do you feel the EWN procedure creates too much administration and meetings?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

5b Please explains your choice above?

6a Do you feel that the EWN process is used for insignificant issues which would be better dealt with using more informal means?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

6b Please explains your choice above?

PROTECT COMMERCIAL POSITION?

7a Do you feel that EWNs are used as a means of protecting the parties commercial position rather than managing risk?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

7b Please explains your choice above?

8a Do you feel that EWNs are used for matters that have already occurred and cant be mitigated?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

8b Please explains your choice above?

9 What do you feel could be done to improve the contract / EWN process with respect to the above?

OPPORTUNITIES MANAGEMENT

10a Do you feel that the EWN process is too focused on risk management rather than managing opportunities?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree

1	2	3	4	5	6	7

What do you feel are the causes of the above?

10b

What do you feel could be done to improve the contract / EWN process with respect to the above?

11

SANCTIONS

12 Are you aware of sanctions as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract, being used on Crossrail or any other NEC project?

Yes **No**

13a Do you feel that sanctions for failure as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract are successful at driving the correct behaviours?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

13b Please explains your choice above?

14a Do you feel that if the sanctions for failure to issue EWN's as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract were removed, the EWN process would be improved?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

14b Please explains your choice above?

What are the negative consequences of the above sanctions?

15

What do you feel could be done to improve the contract / EWN process with respect to the above?

16

EWN Structure & Format

17a Do you feel that the standard contract conditions should be more prescriptive as to what qualifies as an EWN?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

17b Please explains your choice above?

18a Do you feel that the standard contract conditions should be more prescriptive as to the structure and content of an EWN?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

18b Please explains your choice above?

What do you feel could be done to further improve the contract / EWN process?

19

EWN Other Improvements

What do you feel could be done to further improve the contract / EWN process?

20

APPENDIX B - FINAL INTERVIEW QUESTIONNAIRE (COMPLETED EXAMPLE)

QUESTION CONTEXT

These questions should be answered on the basis of a NEC3 Engineering and Construction Contract (Option C - target cost) between the Employer and the Contractor

EXPERIENCE & ROLE ON THE PROJECT

1 How many year's experience do you have working on projects which use the NEC form of contract?

Less than 1.5 year	1.5-3 years	More than 3 years
		✓

2 Do you work on the Project Manager's team or the Contractor's team?

PM team **Contractor Team**

3a What is your role on the project?

Contract Administrator

3b Do you work on a CRL NEC3 Engineering and Construction Contract Option C?

Yes **No**

EWN PROCESS - VOLUME OF EWNs

4a What is your opinion of the volume of EWN's issued on your contract?

Vastly insufficient	Insufficient	Mildly insufficient	Reasonable	Mildly Excessive	Excessive	Vastly Excessive	Undecided
1	2	3	4	5	6	7	8

4b Please explains your choice above?

As at the 18/07/18, there are currently 656 EWNs. The contract has been running for almost 4.5 years . This equates to approximately 1 EWN every 2 days. Given the value and complexity of the project, I consider the volume to be reasonable.

5a What is your opinion on the amount of time spent by the project administering the EWN procedure?

Vastly insufficient	Insufficient	Mildly insufficient	Reasonable	Mildly Excessive	Excessive	Vastly Excessive	Undecided
1	2	3	4	5	6	7	8

5b Please explains your choice above?

Based on the fact that as at 18/07/18, there were 21 open EWNs on C660 going back as far as 3 months, suggests to me that a reasonable amount of time and effort has been put into administering and resolving EWNs.

6a Do you feel that the EWN process is sometimes used for insignificant issues which would be better dealt with using more informal means?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

6b Please explains your choice above?

Arguably, there is no such thing as an insignificant issue, it is either an issue or is not. So then for me the question becomes is the EWN process used for non-issues . Generally, my experience has been that this is not the case. Clearly you will always have exceptions, but in my view these are few and far between.

PROTECT COMMERCIAL POSITION?

7a Do you feel that EWNs are used as a means of protecting the other party's commercial position rather than managing risk?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

7b Please explains your choice above?

Absolutely, this in my experience has been incorrectly used a tool by the Contractor to act as an memoire to trigger compensation events rather than concentrating on how to resolve the risk.

8a Do you feel that EWNs received are sometimes used for matters that have already occurred and cant be mitigated?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

8b Please explains your choice above?

This situation often occurs when either the participants are new to the contract or are themselves inexperienced. If a matter cannot be mitigated, it is not technically a risk. Therefore only two choices exist, either instruct a change to the works information that will result in a compensation event that increases cost and prices . Or the scope is reduced so that the problem is avoided (this is not mitigation as the problem is not resolved).

What do you feel could be done to improve the contract / EWN process with respect to the above?

9 Improve staff training to recognise matters where mitigation is unlikely, so that no time is wasted on producing EWNs. Then focus on design /scope change.

OPPORTUNITIES MANAGEMENT

10a Do you feel that the EWN process could be improved by including the management of opportunities rather than the focus being on negative matters such as delay and increased cost?

Strongly Agree	Agree	Mildly Agree	Undecided	Mildly Disagree	Disagree	Strongly Disagree
1	2	3	4	5	6	7

What do you feel are the causes of the above?

10b The cause is largely due to the focus of clause 16.1 being only on risks.

What do you feel could be done to improve the contract / EWN process with respect to the above?

11 Early warnings should be about any matter that a could affect the cost and or the prices either positively or negatively. An incentivisation process could be embedded in the contract as sub-process of the Early warning procedure, an early recommendation (for want of a better term) .

EWN Contract Provisions

12 Are you aware of provisions as per clause 11.2 (24), 61.5 and 63.5 of the conditions of contract, being used on Crossrail or any other NEC project?

Yes **No**

12b Please explains your choice above?

It was on CRL but it was insignificant issues relating to the target adjustment.

13a What is your opinion of the impact of the contract provisions for failure to use EWN's as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract?

Extremely negative	Negative	Mildly negative	Neutral	Mildly beneficial	Beneficial	Extremely beneficial	Undecided
1	2	3	4	5	6	7	8

13b Please explains your choice above?

These clauses are designed to encourage the Contractor to be pro-active and not just sit back and let things happen or not happen as the case may be.

14a What is your opinion with regards to the impact of removing the contract provisions for failure to issue EWN's as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract?

Extremely negative	Negative	Mildly negative	Neutral	Mildly beneficial	Beneficial	Extremely beneficial	Undecided
1	2	3	4	5	6	7	8

14b Please explains your choice above?

The removal of these Contract provisions does not help in driving the right behaviours for the Contractor.

What are the negative consequences of the above sanctions?

15 From a contractor's perspective it might be negative if it leads to Disallowed Cost or reduced target.

What do you feel could be done to improve the contract / EWN process with respect to the above?

16 I think the provisions are fine just the way they are. However, further training and awareness of these provisions could be given to the Contractor so that the clauses are properly understood so that early warning are raised appropriately.

EWN Structure & Format

17a What is your opinion as to how the conditions of contract prescribe what matters qualify as an EWN?

Explicit	Very Clearly defined	Clearly defined	Unclearly defined	Very Unclearly defined	Ambiguous	Undecided
1	2	3	4	5	6	7

17b Please explains your choice above?

Each of the six bullet points contained in clause 16.1 are clearly defined. It is possible for it to be clearer, even explicit, but this is not necessary, as this would make the process too prescriptive in my view.

18a What is your opinion as to how the conditions of contract prescribe the structure and content of an EWN?

Explicit	Very Clearly defined	Clearly defined	Unclearly defined	Very Unclearly defined	Ambiguous	Undecided
1	2	3	4	5	6	7

18b Please explains your choice above?

The structure and content is not clearly defined, which I think is a good thing. This allows each contract to tailor the structure to best suit the way the contract is being administered. The content in terms of the types of matters to be described is clear but the structure should be left to the individual contracts.

What do you feel could be done to further improve the contract / EWN process?

19 The early warning process should formally recognise the opportunities management process in the way described in the answer to Q.11

EWN Other Improvements

What do you feel could be done to further improve the contract / EWN process not mentioned or covered in your responses above?

20 More attention needs to be given to closing early warnings in contemporary timeframe especially when there are a lot of EWNs to deal with. EWNs are often left open until they are actually dealt with or actioned or the issue somehow passes. Whilst this may seem like a logical way to proceed. My experience has shown that this approach tends to lead to having too many EWNs open and meetings can become inefficient as the participants are not focusing on the current issues. This is because either no one has checked to confirm that the action has taken place or the right person is not in the meeting to confirm. This can often result in wasted time checking and reviewing items that are already closed . I think it is far better to close the EWN with an agreed planned date which be could be included on a clause 32 programme as appropriate. Therefore, I am an advocate of closing the early warning as soon as an action plan has been agreed and dated, it forces the parties to not just consider resolution , but also how and when that resolution will be implemented. If an action is closed with a planned date , but it does not get carried out then risk may need to be raised again. Whilst it might seem like more work, I consider it is the right thing to do as the risk profile may have changed due to it not being actioned at the agreed time and a further assessment may be required.

APPENDIX C - RESEARCH PARTICIPATION INFORMATION FORM

Study Title: Early Warning Notice Contract Procedure: Improving its use on large Infrastructure Projects

Researcher Name: Terry Smith

Before deciding to take part in this research please read this information carefully. If you agree to participate you will be asked to sign the attached consent form.

What is the research for?

This research is required for partial fulfilment of the Construction Commercial Management Masters award at the University of Westminster.

What is the research about?

The research aims to understand people's attitude and opinions of the use and potential improvement of the Early Warning Notice provisions of the NEC form of contract on large infrastructure projects. There is little primary data on the topic and participation in this research will help to fill a research gap that has been identified from a literature review.

Why have I been chosen?

This research aims to gather valid data from subject matter experts and you have been selected to form part of a sample due to your experience and knowledge of the Early Warning Notice procedure and NEC3 ECC option C terms and conditions.

What will happen if I take part?

1. A proposed interview meeting invite will be sent for your acceptance or request for a different date/time. The meeting will not last any longer than 1 hour.
2. At the interview you will be asked questions on the topic of Early Warning Notice procedure and you will be required, where possible to answer those questions to the best of your ability.
3. Where the researcher requires clarification, you may be asked follow up questions in order to obtain a deeper understanding of your answers.
4. The researcher will be making a record of your answers during the interview. You will have the ability to review this record and confirm that it represents a true and accurate record of the interview and also to confirm your acceptance to the information gathered being used anonymously as part of the research.

Is there a requirement to reveal sensitive Crossrail information?

No, you will not be obliged to disclose any information which you are not comfortable with sharing for the purposes of this research.

Are there any consequences for not taking part?

No. There are no consequences for not taking part in this research, it is totally at your discretion to take part or not.

Are there any benefits in my taking part in the research?

You will have the option of receiving a copy of the research and will also be given refreshments during the interview.

Are there any risks involved?

No, the final dissertation will be reviewed by Crossrail management before being submitted and your participation will be anonymous. The interview will be conducted professionally and it will be like any other day at the office.

Will my participation be confidential?

Yes. The dissertation will not identify participants by their names.
The interviews will be conducted in privacy, inside Crossrail meeting rooms.
The data will be stored on a password protected computer at all times.

Data will be collected, stored, processed and disclosed in accordance with the 1998 Data Protection Act which came into force on 01 March 2000. This Act aims to protect the rights of individuals who are the original sources of data.

What happens if I change my mind?

If at any time before, during or after the interview but before draft publication of the dissertation on 15 August 2018, you change your mind and decide against continued participation or publication of your data, then you have the right to do so without any consequences.

What happens if anything goes wrong?

If you happen to have a complaint or concern about this study, please feel free to discuss this with my line manager Clive Thomas (Systemwide Business Manager), his contact details can be found on the Crossrail database.

Where can I get more information?

If you have got any further questions after reading this information sheet, please feel free to contract me on 0203 229 9469 (x2469) or at terrysmith@crossrail.co.uk.

Source/Reference: Adapted from the University of Southampton: Participant Information Sheet Rev 1 (12 March 2017)

APPENDIX D - INTERVIEW RESEARCH CONSENT FORM (blank to maintain anonymity)

Study Title: Early Warning Notice Contract Procedure: Improving its use on large Infrastructure Projects

Researcher Name: Terry Smith

Name of participant:

Please tick the below boxes if you agree with the statements:

Pre-Interview Consent:
I have read and understood the Interview Participation Information Form and have had the opportunity to ask questions about the research?

I agree to take part in this research project and agree for my data to be used for the purpose of the research.

I understand that my participation is voluntary and I may withdraw at any time without any consequences.

Data Protection
I understand that information collected about me during my participation in this study will be stored on a password protected computer and that this information will only be used for the purposes of this research. All files containing any personal data will be made anonymous.

Signature of participant:

Date:

Post-Interview Consent:
I have reviewed and agree that my interview record sheet is an accurate representation of my thoughts and feelings on the questions asked during the interview.

Signature of participant:

Date:

APPENDIX E - SECONDARY DATA - QUANTITY OF EWNS (Cost information redacted)

				Contract ref.									
Financial Year	**Period Nr**	**Start Date**	**End Date**	C620	C660	C502	C422	C530	C435	C360	C405	C412	C610
FY2014/15	1	01/04/2014	26/04/2014	2	3	20	5	0	48	19	36	13	4
	2	27/04/2014	24/05/2014	5	7	5	15	0	37	30	22	31	5
	3	25/05/2014	21/06/2014	2	9	16	13	0	41	23	32	26	6
	4	22/06/2014	19/07/2014	4	6	21	14	0	57	17	19	35	6
	5	20/07/2014	16/08/2014	0	8	46	9	0	39	25	46	36	6
	6	17/08/2014	13/09/2014	0	7	16	19	0	27	36	34	63	12
	7	14/09/2014	11/10/2014	4	4	13	18	1	27	31	23	35	12
	8	12/10/2014	08/11/2014	3	13	20	17	10	28	30	21	30	8
	9	09/11/2014	06/12/2014	1	6	17	15	10	43	28	33	50	20
	10	07/12/2014	03/01/2015	5	6	18	2	15	17	13	18	28	26
	11	04/01/2015	31/01/2015	7	5	31	4	17	34	27	23	44	75
	12	01/02/2015	28/02/2015	7	16	32	9	21	32	26	39	46	50
	13	01/03/2015	28/03/2015	0	2	35	11	35	46	19	40	45	30
FY2015/16	1	01/04/2015	02/05/2015	10	2	33	13	34	62	25	50	55	61
	2	03/05/2015	30/05/2015	11	23	24	13	12	50	24	72	53	55
	3	31/05/2015	27/06/2015	8	18	25	9	10	42	22	40	52	67
	4	28/06/2015	25/07/2015	7	12	35	16	11	45	19	39	38	67
	5	26/07/2015	22/08/2015	6	9	23	10	29	41	37	48	67	59
	6	23/08/2015	19/09/2015	5	10	12	18	14	53	39	25	62	70
	7	20/09/2015	17/10/2015	3	11	26	27	31	78	36	40	73	51
	8	18/10/2015	14/11/2015	2	20	17	24	37	57	21	63	42	58
	9	15/11/2015	12/12/2015	11	15	21	26	31	50	44	45	62	58
	10	13/12/2015	09/01/2016	5	18	14	19	20	26	14	26	36	48
	11	10/01/2016	06/02/2016	6	28	6	22	42	41	32	29	66	53
	12	07/02/2016	05/03/2016	22	7	10	28	47	41	56	31	58	78
	13	06/03/2016	02/04/2016	6	14	10	16	34	32	40	25	53	75
FY2016/17	1	01/04/2016	30/04/2016	3	10	12	21	22	44	37	25	47	73
	2	01/05/2016	28/05/2016	11	13	10	32	23	27	45	25	45	97
	3	29/05/2016	25/06/2016	18	13	12	25	27	31	44	21	40	68
	4	26/06/2016	23/07/2016	9	12	24	28	9	30	51	21	55	64
	5	24/07/2016	20/08/2016	4	30	13	26	24	42	41	34	49	94
	6	21/08/2016	17/09/2016	12	10	12	22	21	32	31	30	53	75
	7	18/09/2016	15/10/2016	1	10	15	35	33	49	52	36	61	104
	8	16/10/2016	12/11/2016	10	27	11	18	60	30	38	35	53	104
	9	13/11/2016	10/12/2016	12	10	17	28	16	33	53	54	46	116
	10	11/12/2016	07/01/2017	9	8	13	12	23	15	25	41	44	72
	11	08/01/2017	04/02/2017	10	2	16	32	20	22	61	59	57	123
	12	05/02/2017	04/03/2017	15	4	15	47	26	22	50	60	71	118
	13	05/03/2017	01/04/2017	16	7	16	31	23	36	52	45	50	100
FY2017/18	1	01/04/2017	29/04/2017	8	8	22	21	23	25	32	33	55	73
	2	30/04/2017	27/05/2017	8	10	12	10	18	43	53	51	71	67
	3	28/05/2017	24/06/2017	13	1	15	18	13	39	45	33	86	67
	4	25/06/2017	22/07/2017	12	3	14	18	25	28	47	31	83	78
	5	23/07/2017	19/08/2017	7	6	17	18	20	34	35	62	61	86
	6	20/08/2017	16/09/2017	8	1	6	14	14	33	62	54	68	71
	7	17/09/2017	14/10/2017	26	4	14	16	31	35	30	42	59	67
	8	15/10/2017	11/11/2017	11	4	12	31	37	42	42	32	54	57
	9	12/11/2017	09/12/2017	11	3	10	18	23	25	36	52	71	70
	10	10/12/2017	06/01/2018	5	6	14	13	7	19	15	14	25	46
	11	07/01/2018	03/02/2018	21	12	33	21	51	23	30	52	49	49
	12	04/02/2018	03/03/2018	11	16	19	30	26	17	40	46	60	62
	13	04/03/2018	31/03/2018	3	29	19	20	23	17	25	58	59	62
FY2018/19	1	01/04/2018	28/04/2018	8	9	33	15	30	26	22	41	44	17
	2	29/04/2018	26/05/2018	10	8	17	18	17	14	18	67	54	24
	3	27/05/2018	23/06/2018	11	24	19	12	29	6	31	39	53	37
	4	24/06/2018	21/07/2018	10	2	21	16	36	9	25	33	56	80

FY2015/16 Weekly Average	2	4	5	5	7	12	8	10	14	15
FY2016/17 Weekly Average	3	3	4	7	6	8	11	9	13	23
FY2017/18 Weekly Average	3	2	4	5	6	7	9	11	15	16
Three year average	**2**	**3**	**4**	**5**	**6**	**9**	**9**	**10**	**14**	**18**
AFC as at the end of FY 17/18										

Total Qty of EWNs - PM team	84	156	362	336	241	290	408	696	243	316
Total Qty of EWNs - Contractor Team	400	454	1,152	845	978	2,325	1,989	2,110	3,024	3,028
Total Qty of EWNs	484	610	1,514	1,181	1,219	2,615	2,397	2,806	3,267	3,344
Total Qty of EWNs - PM team (%)	17%	26%	24%	28%	20%	11%	17%	25%	7%	9%
Total Qty of EWNs - Contractor Team (%)	83%	74%	76%	72%	80%	89%	83%	75%	93%	91%

APPENDIX F - SCHEDULE OF INTERVIEWS (names redacted)

Interview Location: Crossrail Systemwide Office, One Westferry Circus, 6th Floor

Item	**Name**	**Date**	**Time**	**Notes**
1	[redacted]	16/07/2018	15:30	**Pilot**
2		19/07/2018	09:00	
3		20/07/2018	09:30	
4		20/07/2018	15:00	
5		20/07/2018	11:00	
6		23/07/2018	13:00	
7		23/07/2018	14:00	
8		24/07/2018	13:00	
9		25/07/2018	09:00	
10		26/07/2018	12:00	
11		26/07/2018	15:30	

APPENDIX G - PRIMARY DATA - DISSERTATION QUANTIITATIVE QUESTIONNAIRE FINDINGS SUMMARY

	Name										
How many year's experience do you have working on projects which use the NEC form of contract?	1	3	3	3	3	3	3	3	2	3	3
Do you work on the Project Manager's team or the Contractor's team?	2	Contractor	Contractor	Contractor	Contractor	Contractor	PM team	PM team	PM team	PM team	PM Team
What is your role on the project?	3a	Senior Quantity Surveyor	Quantity Surveyor	Commercial Manager	Senior Commercial	Senior Quantity Surveyor	Contract Administrator	Contract Administrator	Contract Administrator	Cost Engineer	Commercial Manager
Do you work on a CRL NEC3 Engineering and Construction Contract Option C?	3b	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
What is your opinion of the volume of EWN's issued on your contract?	4a	2	3	3	6	5	7	4	6	4	6
Please explains your choice above?	4b										
What is your opinion on the amount of time spent by the project administering the EWN procedure?	5a	2	3	3	5	6	6	4	5	6	6
Please explains your choice above?	5b										
Do you feel that the EWN process is sometimes used for insignificant issues which would be better dealt with using more informal means?	6a	6	2	2	2	2	3	6	1	2	6
Please explains your choice above?	6b										
Do you feel that EWNs are used as a means of protecting the other party's commercial position rather than managing risk?	7a	1	2	2	5	3	1	1	1	2	2
Please explains your choice above?	7b										
Do you feel that EWNs received are sometimes used for matters that have already occurred and cant be mitigated?	8a	1	2	2	4	2	1	3	1	2	2
Please explains your choice above?	8b										
What do you feel could be done to improve the contract / EWN process with respect to the above?	9										
Do you feel that the EWN process could be improved by including the management of opportunities rather than the focus being on negative matters such as delay and increased cost?	10a	6	2	2	6	3	2	2	5	6	6
What do you feel are the causes of the above?	10b										
What do you feel could be done to improve the contract / EWN process with respect to the above?	11										
Are you aware of provisions as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract, being used on Crossrail or any other NEC project?	12	Yes	Yes	No	No	Yes	No	Yes	No	No	Yes
Please explains your choice above?	12b										
What is your opinion of the impact of the contract provisions for failure to use EWN's as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract?	13a	1	6	6	2	2	2	6	3	2	6
Please explains your choice above?	13b										
What is your opinion with regards to the impact of removing the contract provisions for failure to issue EWN's as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract?	14a	7	2	2	3	4	4	2	2	6	2
Please explains your choice above?	14b										
What are the negative consequences of the above provisions?	15										
What do you feel could be done to improve the contract / EWN process with respect to the above?	16										
What is your opinion as to how the conditions of contract prescribe what matters qualify as an EWN?	17a	6	4	4	3	6	6	3	3	3	2
Please explains your choice above?	17b										
What is your opinion as to how the conditions of contract prescribe the structure and content of an EWN?	18a	3	4	4	4	6	4	4	4	4	4
Please explains your choice above?	18b										
What do you feel could be done to further improve the contract / EWN process?	19										
What do you feel could be done to further improve the contract / EWN process not mentioned or covered in your responses above?	20										

APPENDIX H - PRIMARY DATA - DISSERTATION QUALITATIVE QUESTIONNAIRE FINDINGS SUMMARY

EWN PROCESS - VOLUME OF EWNs

Q. 4a What is your opinion of the volume of EWN's issued on your contract?

Q. 4b Please explains your choice above?

1	Because the amount of EWN's that I have personally issued are limited on the subcontract I manage.
2	There's a lot of EWN's that are insignificant / not relevant / historic. So there should be more EWNs that would allow management of risk.
3	Large contract with lots of disciplines and the nature of the project and the scope of works together with interfacing parties, I felt there would be a lot more.
4	The nature of the project and the complexity, including the interfaces with the other tier 1 contract and Others has led to a lot of EWNs. In turn there is a lot of nervousness and concern that we don t prejudice the way that the Employer views the success or performance of the project.
5	Excessive however the parties are following the contract and the interfaces are a key driver. As RRMs are not held and the benefit is not harnessed by reducing the risk.
6	EWNs issued are generally post mitigation stage and are issued as a commercial position.
7	Sometimes EWNs are issued to get attention, instead of a normal communication/ CCM. So, in such instances Contractor will be raising unnecessary EWNs. Similarly, some EWNs are repetitive, again to get attention, Contractor will raise a second or third EWN on the same subject, to try and highlight the urgency of the issue. Most EWNs are issued after the event, and seem to be mainly because Contractor wants to get certain issues "on the record" rather than to mitigate a risk/ seek technical solution. For example, Contractor has issued an increasing number of EWNs regarding frustrated access issues (approx. 15 a month over last 3-4 months)
8	Based on YTD data, we are averaging 10nr EWN's / period which based on a project of this size and complexity the quantum seems 'reasonable'.
9	In my opinion, EWNs are sometimes raised unnecessarily when either an event has already happened, and is raised merely notify the other party of the event, or for an event that is an identified risk and where no mitigation to avoid delay / additional cost is possible.
10	As at the 18/07/18, there are currently 656 EWNs. The contract has been running for almost 4.5 years . This equates to approximately 1 EWN every 2 days. Given the value and complexity of the project, I consider the volume to be reasonable.

Q. 5a What is your opinion on the amount of time spent by the project administering the EWN procedure?

Q. 5b Please explains your choice above?

1	People may see the process as admin rather than a tool in order to make informed decisions. People tend to discuss issues informally rather than recording through the contract.
2	Time is spent fixing the issues rather that using the formal process to record EWNs and RRM actions.
3	EWN not used as intended hence why its inefficient. Used more as a contract mechanism rather than as a risk management tool.
4	Although there is a large volume of EWNs the process implemented on C610 has been honed and fined tuned so that the amount of time spent administering the EWNs is measured and appropriate to the volume. The template used has helped to administer the EWNs efficiently and faster and make submissions more consistent.
5	Amount of time and RRMs probably could be spent more efficiently.
6	There is a lot of time spent drafting EWNs and then holding RRMs
7	Since the EWNs/ RRMs are facilitated by the commercial team instead of the team/function that raises the EWN, RRMs often do not take priority over other commercial tasks. Hence are not always as regular. However, when RRMs are held, a lot of time is taken to write up/ issue actions or meeting notes, follow up on the actions and then ultimately close the EWNs in eB. The teams actually raising the EWN have often already discussed the EWN in other meetings, so sometimes, the RRM is just used to record the details of another meeting (duplicating efforts). It would almost be easier (and more time efficient) if the EWN initiator would arrange his/her RRM and update the actions in eB.
8	It appears to me that a lot of time and resource can be expended with administering 'closing out' of historic / superseded EWN's.
9	In my opinion, the NEC form of contract Option C imposes a heavy administrative burden on both parties, particularly where the scope is undefined or open to interpretation, or there are interfacing parties that can affect the Contractor's ability to Provide the Works, such on large infrastructure projects such as Crossrail. The unnecessary raising of EWNs as described in 4b above, adds to the burden.
10	People may see the process as admin rather than a tool in order to make informed decisions. People tend to discuss issues informally rather than recording through the contract.

Q. 6a Do you feel that the EWN process is sometimes used for insignificant issues which would be better dealt with using more informal means?

Q. 6b Please explains your choice above?

1	My experience is that people use informal means rather than EWN as it is less time consuming and does not have the risk of being formally recorded.
2	The process is used to record history rather than future events.
3	Some are housekeeping issues which could be dealt with on-site through collaborative working. However it depends on the behaviours of each party. E.g. Its too formal for some issues on site which require a decision there and then rather than being recorded through the contract and needing a RRM.
4	However the contract dictates that both parties follow the process regardless of the scale of the matter in question.
5	The wording of the EWN is vast and covers a lot. Therefore its difficult to predict how an EWN could potential become significant in the future.
6	There have been occasions where EWNs are used for insignificant matters.

7	As explained above, Contractor often raises EWNs to record certain issues, and since majority of these are issued after the event - it is no longer an EWN, and should therefore be dealt with through CCMs. All, Contractor has sometimes issued an EWN to record that we have not yet responded to a previous EWN - such communication could be issued as reminder via CCM. In fact, where Contractor recently issued almost 20-30 frustrated access EWNs, in order to try and reduce the amount of EWNs being raised, I arranged a RRM so we could review all the EWNs and agreed a separate process between construction teams to review the FAR on a weekly basis and record these in a spreadsheet, which would then be issued via CCM/PMC weekly. This would still ensure that both parties are aware of the issues, and that the frustrated access is recorded. However, as Contractor was still keen to raise EWNs on this issue - we agreed that they would issue 1 EWN a month on frustrated access referring to the previous CCMs/ PMCs issued.
8	Some EWN's do not contain events which could affect time, cost or quality and should therefore for dealt with outside of the EWN process by another means (e.g. project progress meeting). I have experienced requests for information coming thorough as EWNs rather than Requests for Information (RFIs).
9	The NEC form of contract is explicit in when early warnings should be raised, it does not provide subjective assessment of what is "insignificant"
10	Arguably, there is no such thing as an insignificant issue, it is either an issue or is not. So then for me the question becomes is the EWN process used for non-issues . Generally, my experience has been that this is not the case. Clearly you will always have exceptions, but in my view these are few and far between.

PROTECT COMMERCIAL POSITION?

Q. 7a Do you feel that EWNs are used as a means of protecting the other party's commercial position rather than managing risk?

Q. 7b Please explains your choice above?

1	Yes my experience is that the above is true. Something has gone wrong and the EWN is used to try and protect the party from blame of an event that has already happened.
2	Yes however this could be due to the fact that the process is managed by the commercial team. It would be better if engineers managed the process in order to manage their risks.
3	Contract requirement, means of protecting disallowed cost.
4	My experience is that the process is used to manage risk, however I also do have experience where it has been used to protect commercial positions. E.g. situations where liability is discussed rather than the party best placed to resolve and determine risk.
5	Because of the wording of the EWN clauses the contractor has to issue EWNs. The issues involved on a large infrastructure project will generally always lead to an impact on time, cost and quality.
6	There are excessive amounts of EWNs issued in batches which makes it difficult to close out in a timely manner.
7	Yes, see earlier response to 4b. Where majority of the EWNs are issued not as EWNs but after the event, it seems clear that Contractor is issuing the EWNs for other reasons. I think the Contractor feels that this method of recording issues formally, is more effective than CCM.
8	The main premises of the EWN process is to raise an early warning with the other party when there is an issue that could affect the project. However, there are situations where the content of EWN's lays blame and accusation with others for a potential event in order to commercially protect their own position.
9	Yes, see comment 4b above. This is usual done to ensure that no subsequent costs are disallowed.
10	Absolutely, this in my experience has been incorrectly used a tool by the Contractor to act as an memoire to trigger compensation events rather than concentrating on how to resolve the risk.

Q. 8a Do you feel that EWNs received are sometimes used for matters that have already occurred and cant be mitigated?

Q. 8b Please explains your choice above?

1	Yes this has been my experience. They are also used for things which are hard to solve and perhaps a consequence of the design or procurement decision which then has an impact on delivery.
2	As noted above and as an example EWNs are issued for frustrated access events which are in the past.
3	Large projects can suffer delay in turnaround so that once the EWN is reviewed, digested and issued the matter can have occurred. Can be used as a catch-up to record previous agreements.
4	I am not aware of any particular EWN that is one or the other. They tend to be more obvious and in the progress of being mitigated and the EWN paperwork follows.
5	Sometime EWNs can be used to record historic issues. The EWN is a narrative as to how defined costs is spent in order to protect from Disallowed Cost and the contract doesn t allow for this to be captured elsewhere. There are shift reports but these are not generated by people with contractual knowledge who understand Disallowed Cost.
6	A lot of EWNs are issued where the matter has already passed or resolved on-site.
7	Yes, see previous answers
8	EWN's are sometimes raised subsequent to an event which has impacted time cost or quality occurring in order to avoid potential Disallowed Costs.
9	Yes, see comment 4b above.
10	This situation often occurs when either the participants are new to the contract or are themselves inexperienced. If a matter cannot be mitigated, it is not technically a risk. Therefore only two choices exist, either instruct a change to the works information that will result in a compensation event that increases cost and prices . Or the scope is reduced so that the problem is avoided (this is not mitigation as the problem is not resolved).

Q. 9 What do you feel could be done to improve the contract / EWN process with respect to the above?

1	- There needs to be trust and a removal of fear of what's discussed in the EWN / RRM being used against the other party. - How the contract defines and treats EWNs. It says we want you to collaborate and then tells you - Seems biased towards the PM, what happens if the PM doesn't share info that could be used to mitigate risk.
2	How its administered on projects could be changed so that its not seen as a commercial tool but a risk management tool.
3	Use an Confirmation of verbal instructions which both parties sign on-site for day to day issues rather than use EWNs. RRM for potential issues / matters that have not yet been raised as EWNs. Remove the administration of the process from commercial otherwise the RRMs can be too commercially focused rather than trying to solve the problem. Good example was where the PM had a weekly meeting to deal with EWNs and resolve issues in a timely manner and the EWN process was not managed by commercial it was by deputy PM.
4	You could separate cost from programme. If you can focus on finishing on time this is most important to the reputation of the contractor. In other words remove cost and just use EWNs for programme matters. Cost issues could be dealt with through a 3rd party to improve agreement of the mitigation between the parties.
5	Alternative means of capturing issues that is not n EWN on a fast moving project the decision making process should be captured somewhere else rather than EWN.
6	Madate RRMs and it cant be for historic events. It needs to be for events in the future.
7	- Educate the team to understand what an EWN is and when it should be raised - If the separate teams were responsible for managing and closing their own EWNs, they might reduce the number of unnecessary EWNs, as the onus would be on them to administer and resolve them.
8	Empowering the Project Manager to remove / discount an EWN which does not meet the criteria of notifying the other party of an event which could impact time, cost or quality.

9	I consider that the principles behind the early warning provisions within the NEC form of contract are appropriate and align with the collaborative spirit of the NEC. However, I believe that the EWN provisions are not always fully understood, and can be inappropriately used as described above.
10	Improve staff training to recognise matters where mitigation is unlikely, so that no time is wasted on producing EWNs. Then focus on design /scope change.

OPPORTUNITIES MANAGEMENT

Q. 10a Do you feel that the EWN process could be improved by including the management of opportunities rather than the focus being on negative matters such as delay and increased cost?

Q. 10b What do you feel are the causes of the above?

1	The way the contract is written means that EWN is used for risks rather than opportunities. The contract is not structured to deal with opportunities. The word warning gives connotations of authority and negativity, asking to find potential failure.
2	Clauses already cover opportunities via the obligation to mitigate any potential NCE. Having formal process could be a barrier to implementing an opportunity. It would be useful if it required cooperation or collaboration with CRL or another Tier 1 contractor.
3	Agreed the clauses could cover opportunities too.
4	The EWN process is not a suitable forum, the contractor already has a opportunity management process. If its on a smaller project then using EWNs for risk and opportunities may be beneficial.
5	Good be a good option to have a contract clause to formalise discussion of opportunities. However this should happen anyway. The PM should be aware of the contractors methodology or proposed changes.
6	Mandate RRMs and it cant be for historic events. It needs to be for events in the future.
7	No, I think management of opps is something that should be dealt with separately, and should not be combined with EWNs. The EWN mechanism if used correctly serves an important purpose.
8	I feel a project could benefit from having more focus on opportunities within the contract, however, I don't think that this should be managed through the EWN process but have a process in its own right. It could cause confusion if you try and merge it with risk management process. It should be standalone process.
9	In the CRL Main Option C forms typically used for the Tier 1 contracts, the incentivisation model, i.e. to reduce costs and early completion, and specific value engineering provisions should provide adequate provision to the Contractor to promote positive management of opportunities.
10	The cause is largely due to the focus of clause 16.1 being only on risks.

Q. 11 What do you feel could be done to improve the contract / EWN process with respect to the above?

1	The best job I worked on was on the Olympics as a nation you could not be late, there was a set opening ceremony date and it would be embarrassing if the UK was late. This drove good behaviour for managing opportunities. Everybody looked for a way to get it done and fix problems. Greater clarity over what you are buying. What is the most important thing? Is it time. The EWN process should change focus to time rather than money because generally if you finish on time it will cost less and you will find opportunities to make it happen.
2	No change required. Opportunities should just be a discussion point in interface meetings and the like.
3	It should be clear that anybody should feel free to raise an EWN, improved training for the project so that the team are aware what is expected, what we are going to manage and the expected outcomes.
4	You need to have a formalised =(written into the contract) opportunity management process which allows the PM and contractor team to assess and agree initiatives to improve the project outcome. This would help to satisfy clause 10.1 with regards to collaborative working. It will help improve communication between the parties.
5	Adding a opportunities review process contractually would it discourage opportunities management. To improve the process you could formally keep an opportunities register to gether with a risk register.
6	Have a dedicated Risk and Opportunities to manager EWNs and opportunities.
7	See response to 9. The EWN process if administered correctly would involve finding opportunities within an identified risk. However because its generally used to record history the opportunity to mitigate the matter is lost.
8	An 'Opportunities' process should be incorporated within future NEC contracts.
9	As noted above.
10	Early warnings should be about any matter that a could affect the cost and or the prices either positively or negatively. An incentivisation process could be embedded in the contract as sub-process of the Early warning procedure, an early recommendation (for want of a better term) .

EWN Contract Provisions

Q. 12 Are you aware of provisions as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract, being used on Crossrail or any other NEC project?

Q. 12b Please explains your choice above?

1	Not on CRL but another NEC project.
2	Yes but non-CRL works.
3	N/A
4	No experience of the PM applying these clauses.
5	Not on CRL. But I have experience of Disallowed Cost and reduced target.
6	N/A
7	N/A
8	N/A
9	Yes. It was the Disallowed and reduced target assessment provisions.
10	It was on CRL but it was insignificant issues relating to the target adjustment.

Q. 13a What is your opinion of the impact of the contract provisions for failure to use EWN's as per clause 11.2 (24), 61.5 and 63.5 of the conditions of contract?

Q. 13b Please explains your choice above?

1	It drives the wrong behaviours because it causes people to make decisions not in the best interest of the project. The way its drafted makes it one way. Very subjective criteria as when a Contractor should know of an EWN. Should be redrafted as a joint onus. That everybody helps project succeed and focus on outputs you really want.
2	It tends to get peoples backs up and it becomes a tick box exercise to make sure the EWN is issued and the above clauses are applied by the PM. This can mean the EWN is issued in a hurry and does not include full details.
3	The contract enables the Contractor to track the events and keep the client informed of issues on site.
4	The clauses are one sided in that the contractor is penalised. It goes against the spirit of mutual trust and cooperation. This results in a negative impact on relationships and subsequently the project performance.
5	The clauses drive the volume of EWN's as the contractor is concerned over potential penalties as noted above.
6	This promotes contractor behaviour in terms of protecting a commercial position rather than the focus being on managing risk.
7	Contractor will raise EWN for any events (before or after), to try and protect their position.
8	It tends to leads to the wrong behaviours in terms of the Contractor issuing EWN's in order to protect their commercial position.
9	On the whole these provisions incentivize the Contractor to provide early warn notices

10	These clauses are designed to encourage the Contractor to be pro-active and not just sit back and let things happen or not happen as the case may be.

Q. 14a What is your opinion with regards to the impact of removing the contract provisions for failure to issue EWN's as per clause 11.2 (25), 61.5 and 63.5 of the conditions of contract?

Q. 14b Please explains your choice above?

1	It drives the wrong behaviours. It will not have a negative impact, it cant be any worse as the EWN process is not used as intended e.g. protecting positions / events in the past.
2	Its removed and replaced with an alternative carrot process then this would be beneficial however simply removing the stick may mean that EWNs are missed.
3	Its about sharing information and the clause are an incentive for doing this.
4	It would be negative as you would still need some form of replacement arrangement in order to incentivise use of the EWN procedure.
5	I don t think it s a case of just the clauses out it should be more balanced. You would get less admin but then not as much communication/collaboration between the parties.
6	It will help remove the commercial positioning but then EWNs may not be issued.
7	Contractor will no longer be driven to raise EWNs as there is no risk to contractor in terms of DC or CEs
8	Hopefully assist with reducing the volume of unnecessary EWN's and their administration as well as drive better behaviours between the parties.
9	Removal of the provisions of these clauses would remove the incentive for the Contractor to engage with the Project Manager to identify and mitigate cost and time impacts.
10	The removal of these Contract provisions does not help in driving the right behaviours for the Contractor.

Q. 15 What are the negative consequences of the above provisions?

1	The clauses are a punishment if you get it wrong. They are judgemental and it rests with the PM which is not collaborative. People are nervous about disallowed cost so they raise EWNs when not required or by the time the RRM is held its too late to mitigate the issue.
2	Collaboration can be impacted negatively due to risk of Disallowed Cost. You tend to get more EWNs that cant be mitigated as they are in the past.
3	Trust the contractor is not fully empowered as there is a risk that a decision which is made in good faith at the time could then lead to Disallowed Cost if the EWN is not raised. Takes focus away from delivering the works and more on managing the process.
4	Drive bad or negative behaviour from the contractor as he attempts to off-set any possibly of such clauses being imposed by the PM and as a consequence the contractor exaggerates the content or consequences of the EWN. From a PM perspective the clauses can drive adversarial behaviour in terms of penalising a contractor even though they may be performing well.
5	Volume of EWNs that are raised which on infrastructure projects of this size dilutes the intention of the EWN process to collaboratively reduce risk.
6	The contractor uses EWNs to protect their commercial stance.
7	Contractor will raise an EWN for events that may not be an EWN, for their own security.
8	The mutual benefit of the EWN process can be over showered by commercial positioning which was never the intent behind the process.
9	As noted in 4b above, a consequence of these provisions can lead to EWNs being unnecessarily raised.
10	From a contractor's perspective it might be negative if it leads to Disallowed Cost or reduced target.

Q. 16 What do you feel could be done to improve the contract / EWN process with respect to the above?

1	Its too personal doesn t encourage you to focus on the problem. If you don t do it you will not get your money. IT doesn t not recognise that issues are not simple or binary as the contract expects they are complex and non-binary.
2	Keep the clauses it provides a good stick to enable the process to be significant and duly managed. However it should be administered better. Perhaps it should be run by a different party. If you get commercial to manage. Focus will be on cost and contract issues. If you get a planner it will be focused on time.
3	The penalty clauses can drive the wrong behaviours as if the main contractor loses recovery via the clauses then this may impact the supply chain as the impact is flowed down. The penalty clauses should be time bared so that the Contractor' s knows where they stand and does not have the risk of Disallowed Cost open.
4	Disputes are not allowed to be escalated if an EWN has not been issued. Disallowed Cost and reduced recovery of target can mean a contractor loses his margin or a significant proportion over night. Furthermore the bar is set too high as works are complex and are not under factory conditions. If you could have a contract where the contractor's margin is not at risk e.g. if performance metrics are met then the Disallowed Cost. Under construction conditions (not in a factory) its a risky business and using such clauses increases risk however if the contractor includes this in their tender then they would be unlikely to succeed in winning the project.
5	There needs to be something in place to encourage the contractor to raise EWNs. The EWN clause needs to be less wide ranging.
6	The contractor uses EWNs to protect their commercial stance.
7	As noted above if better training was provided then the EWN's that are issued would allow the parties to collaborate in mitigating impacts through finding opportunities.
8	Run a project workshop at the commencement of a project to instil the EWN process and its mutual benefits for both parties.
9	As noted above.
10	I think the provisions are fine just the way they are. However, further training and awareness of these provisions could be given to the Contractor so that the clauses are properly understood so that early warning are raised appropriately.

EWN Structure & Format

Q. 17a What is your opinion as to how the conditions of contract prescribe what matters qualify as an EWN?

Q. 17b Please explains your choice above?

1	People generally focus on money rather than time. The punishment doesn t even mention time. Where do you draw the line of the disallowed?
2	The 4 bullet points. There is a grey area in terms of if an event has been notified by NCE do you need a EWN to mitigate risk (Final paragraph 16.1)? The key reason you get EWNs that are not EWNs is not because of the contract wording on an EWN but because of the penalty clauses noted above.
3	The EWN might not have happened but in the real world it could already have happened or it will be soon. The impact could be in the future but the event has occurred or some issues are re-occurring. The clause wording does not make it clear how such issues should be dealt with.
4	The way the clauses are worded is OK.
5	At the time of raising an EWN you don t necessarily know what the impact will so you are likely to raise EWNs to make sure you don t get penalised.
6	It would help if it was more clear that the matter needs to be in the future and can be mitigated. To help prevent historic matters that have already occurred being issued as EWNs.
7	I think most events could fall into one of the prescribed categories
8	In my opinion, clause 16.1 clearly defines what matters give rise to a notification of an early warning.
9	Clause 16.1 defines what matters qualify matters qualify for EWNs.
10	Each of the six bullet points contained in clause 16.1 are clearly defined. It is possible for it to be clearer, even explicit, but this is not necessary, as this would make the process too prescriptive in my view.

Q. 18a What is your opinion as to how the conditions of contract prescribe the structure and content of an EWN?

Q. 18b Please explains your choice above?

1	By the time you get to the point of raising an EWN it tells you what to do.

2	The contract is very unclear and you end up getting two extremes either 2 liners or lots of paragraphs. People tend not to appreciate what the EWN is for and just focus on recording what the event is rather than how the event can be mitigated.
3	Its unclear however this is a good thing as it does not create any barriers for people raising the EWN in a language or style of their choke. However the contract should specify what content is to be included so that there is some guidance which is simple and quick to complete.
4	A basic template of requirements in order to qualify as a formal EWN would be useful so that there is consistency and familiarity with the EWN process..
5	It does talk about the actions to be taken at a RRM but its not prescriptive as to the content of the EWN meeting.
6	There is no set template in the contract. It should stipulate what key points the EWN should include so there is consistency and set information included.
7	Its easy to write paragraphs explaining the issue how what when but not addressing the key points etc.
8	I'm not aware that the contract prescribes the structure / contract of an EWN.
9	The conditions of contract do not define the structure or content of EWNs, these are defined in the Works Information and eB templates
10	The structure and content is not clearly defined, which I think is a good thing. This allows each contract to tailor the structure to best suit the way the contract is being administered. The content in terms of the types of matters to be described is clear but the structure should be left to the individual contracts.

Q. 19 What do you feel could be done to further improve the contract / EWN process?

1	You may need a Z clause which tells you what sort of OOM on impact where you need to raise an EWN. If it s a day or £1000 issue don t bother go and speak to someone not spend time raising EWN. Graduated EWN is different scales focus on big issues. Cover trends not just one off events. Infrastructure projects are long so important to cover trends. One size fits all approach of the process doesn't work on major projects of long durations with multiple interfaces.
2	Focus should be on how the risk is mitigated. People should be better educated on the EWN process to ensure it is managed how its intended.
3	As noted above do not have commercial staff administering the staff. There should be a critical issues EWN meeting to go through important or high risk/value issues. Followed a more general meeting to go through the day-today issues.
4	As noted above separate time and cost and use a template. Link the EWN as a prerequisite to dispute escalation. You would have different levels of disputes e.g. level 3 is you have not done enough e.g. raised an EWN and had an RRM on the dispute then you don't get the opportunity to take the other party to court and litigate.
5	The EWN content should include a requirement to communicate the proposed mitigation.
6	New risk manager use a EWN template.
7	EWN template set out to clearly address the issue/ event, effect, actions etc. There should be a EWN checklist / flow chart and if any of the questions mean that the EWN has already occurred and cant be mitigated then the flow chart will say the matter is to be recorded via a CCM instead. Alternatively the software should be changed so that you have a mandatory list of questions which need to be answered for example when is the event expected to occur and if this is in the past then the EWN cant be issued. Another improvement would to have the EWNs peer reviewed by a EWN specialist so that they could cancel any EWN that were not true EWNs in accordance with the contract.
8	Further definition / example of content of EWN could be provided in contract / guidance note. You could have an example of best practice EWN and also an example of what does not constitute as an EWN with justification.
9	The Works Information and templates for EWNs could be improved to provide better clarity of what information, particularly in respect of cost and time impacts of the events or matters, should be provided in the EWN. Provision of guidance within the Works Information about the information to be provided, would be beneficial.
10	The early warning process should formally recognise the opportunities management process in the way described in the answer to Q.11

EWN Other Improvements

Q. 20 What do you feel could be done to further improve the contract / EWN process not mentioned or covered in your responses above?

1	It needs to form part of the procurement strategy, the EWN process can be an afterthought. The EWN should be adapted taking into consideration the scale and complexity of the project. If you want a behaviour you should incentivise rather that use the stick. Disallowed cost if not just margin its real money. Disallowed cost is very risky for a contractor. Very subjective by one person the PM and it should be collaborative.
2	Key points are improve education and also the implementation of the process.
3	Nothing more to add.
4	Force the Employer to accept training costs on the key scope and provisions of the contract for both the PM and contractor team in operations and delivery. This would help people communicate in that they are all talking the same language.
5	The contract could more clearly define what the end purpose of the EWN is. That might prevent the volume EWNs being excessive. The EWN clauses should state that if the party does not consider there to be benefit obtained from a RRM its not a EWN in order to remove insignificant.
6	Covered above.
7	- Team initiating EWN manages the process or one single EWN administrator to focus on the process. There should be greater ownership for the originator of the EWN being accountable for managing the RRM process and closure of the EWN.
8	Educating parties of the key mutual benefits of the EWN process is key to the effective implementation of this system.
9	N/A
10	More attention needs to be given to closing early warnings in contemporary timeframe especially when there are a lot of EWNs to deal with. EWNs are often left open until they are actually dealt with or actioned or the issue somehow passes. Whilst this may seem like a logical way to proceed. My experience has shown that this approach tends to lead to having too many EWNs open and meetings can become inefficient as the participants are not focusing on the current issues. This is because either no one has checked to confirm that the action has taken place or the right person is not in the meeting to confirm. This can often result in wasted time checking and reviewing items that are already closed . I think it is far better to close the EWN with an agreed planned date which be could be included on a clause 32 programme as appropriate. Therefore, I am an advocate of closing the early warning as soon as an action plan has been agreed and dated, it forces the parties to not just consider resolution , but also how and when that resolution will be implemented. If an action is closed with a planned date , but it does not get carried out then risk may need to be raised again. Whilst it might seem like more work, I consider it is the right thing to do as the risk profile may have changed due to it not being actioned at the agreed time and a further assessment may be required.