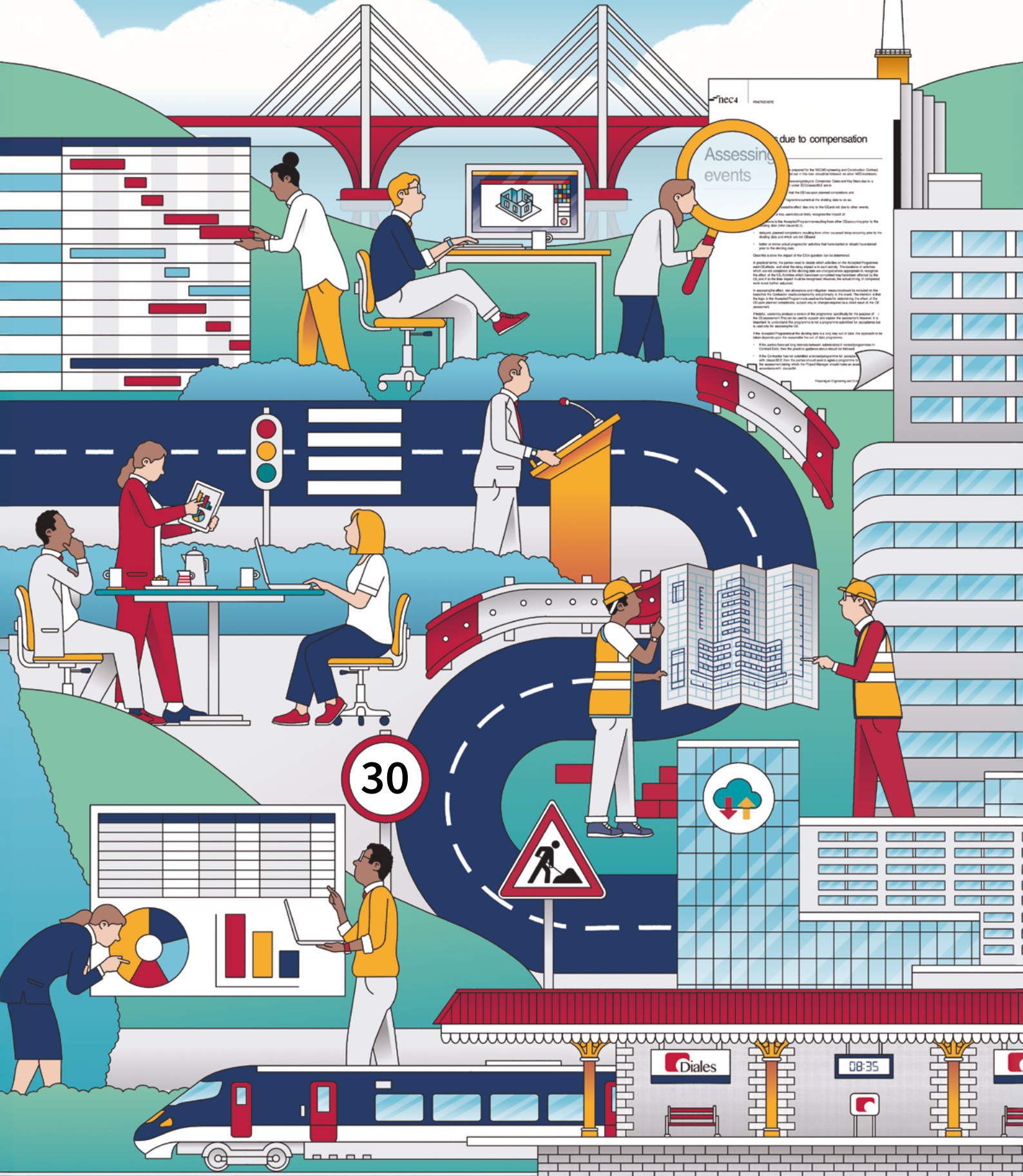
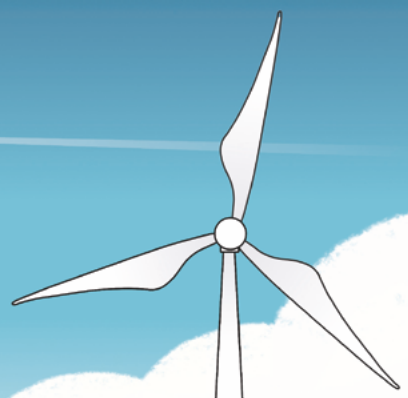




Issue 30 | April 2026

# DIGEST



# Welcome to the 30th edition of the Digest

In this edition, you will find articles that explore both technical depth and real world experience, starting with John Mullen and Peter Banathy examining an important and often debated issue in construction claims, which explores the circumstances in which production labour may legitimately be treated as time related and included within a prolongation claim.

Other insightful reads include an article by one of our technical directors in Germany, Dr Frank Holzweissig, and senior consultant Forough Mohammadi Delavari, and their discussion on schedule risk analysis which highlights how probabilistic modelling can help decision makers understand the true likelihood of meeting project deadlines and budgets.

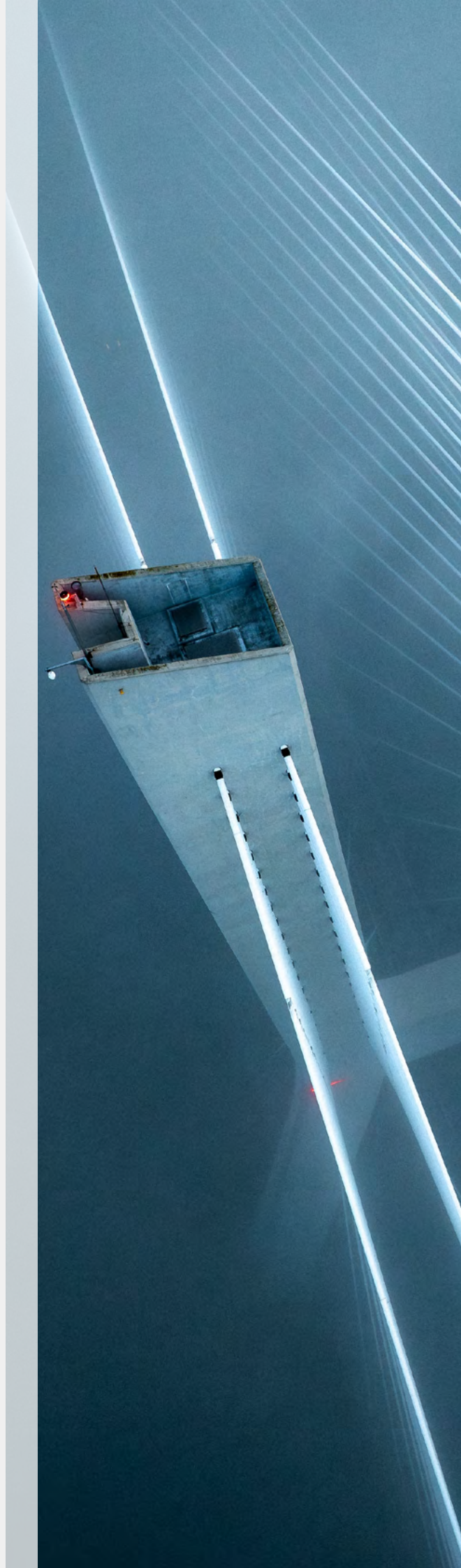
Contributions from Diales experts David Bunn and Mario Ledermann illustrate how their careers have developed through years of experience, learning, and professional growth within the industry.

We hope you enjoy this milestone 30th edition of the Digest, and that it continues to provide useful insight for your work and projects.

If you would like to join the discussions and are interested in contributing an article to a future edition, please contact our marketing team at [marketing@diales.com](mailto:marketing@diales.com).

## **Mark Wheeler**

CEO and Quantum and Technical Expert





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# 30 editions of the Digest

Reaching 30 is a significant milestone in life and often a moment for reflection. In that spirit, I am both surprised and delighted that we have now delivered 30 editions of our extremely popular Digest publication.

What gives me particular pride in the Digest, aside from the very positive feedback we receive from each edition, is that it reflects the same philosophy that has guided the growth of our business over the past 15 years. Throughout that time, we have continually strived to improve at every level. Our recruitment, training, service delivery and, most importantly, the outstanding people who make up our team, have all contributed to a business that becomes stronger year after year.

The Digest itself mirrors that journey. When it first came to us as part of the Trett acquisition in 2012, it was a modest publication, typically six to eight pages, printed in black and white and without imagery. From early on we set ourselves a simple rule: **every edition of the Digest should be better than the last.** Over time, it has evolved into the publication you are reading today, a full colour magazine, available both electronically and in hard copy, featuring high quality imagery and insightful articles that explore the construction and engineering dispute resolution field in which we operate.

The Digest provides a platform to showcase the expertise within Diales, while also welcoming contributions from clients and industry colleagues who share their own perspectives and experience. In many ways, its evolution reflects an organisation that continues to challenge itself to improve with every passing year. This special edition continues that tradition.

Reaching 30 editions would not have been possible without the contributions of our colleagues and the continued interest of our readers around the world. On behalf of everyone at Diales, thank you for your ongoing support.

Enjoy!





# All Site Labour in a Prolongation Claim?

Circumstances where production labour becomes as much of a prolongation cost as site overhead labour

John Mullen, Director, UK and  
Peter Banathy, Quantum Expert, UK

Claims for delay and disruption to construction and engineering projects traditionally address labour in two distinct ways, depending on whether that labour is regarded as work/task-related or time-related:

- a. Work/task-related labour will include tradespeople, artisans, labourers, helpers etc carrying out permanent construction work. Such “production labour” will usually be included in a disruption claim.
- b. Time-related labour will include cleaners, canteen workers, crane operators, security staff etc that facilitate the running of the site, and the construction of the Works, without actually carrying out permanent construction work. Such labour will usually be included in a prolongation claim along with other site overhead costs.

A further distinction between these two types of labour is that work-related labour will usually be priced in the measured works sections of any bills of quantities, whereas time-related labour will usually be priced in a preliminaries and general items section and hence may be referred to as “P&G labour”.

This traditional separation of production and P&G labour into two different categories means that the

reaction to a prolongation claim that includes both production and P&G labour is invariably that the former should be struck out pending quantification in the form of a disruption or loss of productivity claim. The disadvantage of this for the claimant (and advantage for the recipient) is that prolongation claims tend to be much easier to establish than disruption claims. As John Mullen wrote in *Evaluating Contract Claims*<sup>1</sup>:

“ **The quantification of losses resulting from disruption to the contractor's works is possibly the most difficult area for anyone engaged in quantifying additional payment that might be due as a result of the time consequences of change under a construction or engineering contract.** ”

1. *Evaluating Contract Claims* by J. P Mullen and R.P. Davison, published by Wiley Blackwell, third edition 2020



However, the danger with a slavish adherence to traditional approaches to such claims is a resulting failure to consider the underlying facts, which should dictate how they are quantified.

Some years ago, we worked together to provide quantum expert evidence on a new highway in the Middle East. Part of the factual background was that construction of some of the road wearing course was suspended because of questions regarding the appropriateness of the specified material and as a result of frequent access issues.

The contractor inevitably claimed for standing time of plant and associated drivers, and this was not contentious. However, it also included in its prolongation claim some road-laying operatives as being time-related. It made no claim for labour disruption or loss of productivity in the usual form and had submitted no contemporaneous downtime records.

The very experienced international arbitration tribunal, although stating that it is an unusual approach to treat such labour costs as time-related, was convinced that the facts were that it had become time-related and therefore was properly included in the prolongation claim.

Those facts included persuasive arguments from the contractor that because of the particular circumstances of the project and the nature of its works, it could not readily or economically re-deploy its labour or mobilise and re-mobilise it during periods of downtime for reasons that were the responsibility of the other party. The claim, therefore, quite properly, turned on its underlying facts. As John also wrote in *Evaluating Contract Claims*:

**“ The usual reaction to work-related labour within a prolongation claim is to exclude it, but this is not always correct depending on the factual circumstances of the delays and their effects.**

More recently, we have worked together in the Expert Advisor role in DAB proceedings on a very large energy related project. The DAB comprised two very



experienced construction professionals and a local Senior Counsel, all steeped in construction claims and disputes internationally. Our client was the contractor constructing over 80 individual buildings, each the subject of its own contractual Section, on a site covering some 3.7 km<sup>2</sup>.

The project had two important intrinsic features with implications for the contractor's flexibility on labour numbers. Firstly, the site was located far from the nearest urban area. This affected the contractor's ability to recruit and meant labour had to be locally housed in accommodation near the site. Secondly, a project-wide labour agreement included strict procedural requirements for both the mobilisation and demobilisation of labour.

The contractor's approved resourced programme planned a maximum of 700 operatives, in four groups rolling through the buildings in batches as they were progressively given access. In the event, access was granted consistently late, in a piecemeal manner, often on a partial basis and with little predictability. Repeatedly, the Engineer would reschedule promised access dates, only for them to be missed again. The longest delayed building access was over six years. The buildings were also subject of many other delay events.

The contractor's ability to manage its labour numbers in the face of these delay events was also greatly restricted by the behaviour of the Engineer. In denial as to the cause and effect of the delays, it regularly instructed the contractor to either increase its resources or to maintain numbers at the then current levels.

In the event, the Works overran by some 10 years overall, with Sectional completion delays totalling approximately 70,000 days. At the end of the DAB process, it ruled that the Employer was overwhelmingly liable for these delays.

The contractor framed its prolongation claims in the usual way, both for site-wide and Sectional time-related costs, including P&G labour. Its difficulty was what to do with its enormous production labour losses. Its actual peak labour level was more than triple that planned and its total labour hours were around eight times planned.

Early in our appointment we suggested looking at each individual building and the varying extent of

delay events and production labour loss on each and see if some correlations might give a basis for a measured mile or earned value approach. After much work by the contractor with its delay expert, this proved fruitless. We came to the suspicion that the labour losses were not dictated by disruption, but by delay. The contractor's factual witnesses agreed with this. Effectively, on this project the production labour was no less time-related than the P&G labour that the Contractor had included in its prolongation claim. As its quantum experts we supported this as both theoretically possible based on our experience elsewhere, and likely to have been the case here.

The reaction of the Employer and its quantum expert was predictably dismissive. They considered that a separate loss of productivity claim should be made, and that the claim was both global in nature and was simply for total costs incurred. The DAB had similar doubts at the start of our meetings on this claim. They queried whether production labour could have been allocated to other work, noted that production labour was priced in measured works items, asked what records the contractor had kept of its lost productivity and observed that no loss of productivity claim had been registered.

After extensive exchanges and meetings between the quantum experts and the DAB, it decided that we were correct. In this case, based upon the particular facts and circumstances as they were at the time, our client's production labour (including that of its key subcontractors) had indeed become time related. It was therefore correctly included in each of its Sectional prolongation claims.

Both of these cases illustrate that, in particular factual circumstances, and with the appropriate evidence, production labour can, despite conventional approaches, be as time-related as P&Gs labour and can be claimed accordingly.



# In conversation with Mario Lara Ledermann, Head of Building Safety and Fire Engineering



Mario Lara Ledermann, Technical Expert and Head of Building Safety and Fire Engineering, UK

**Mario Lara Ledermann is the head of our fast growing building safety and fire engineering department. In this conversation, Mario reflects on key industry challenges, lessons learned, and his perspective on delivering value in complex project environments.**

## **Q** What is your role at Diales?

I am an Operations Director at Diales, where I lead our newly established building safety and fire engineering team. My role involves managing a highly specialised team of experts and ensuring that this new service is fully integrated into the wider business. I work very closely with the technical side of the organisation, making sure our building safety offering complements and strengthens Diales' existing capabilities.

## **Q** Who has been the greatest influence on your career?

I would not point to one individual as a defining influence. Instead, my career has really been shaped by the evolution of fire engineering as a discipline. I moved from Chile to Australia in 2008, which was a pivotal moment, as Australia had a very mature and forward-thinking approach to fire engineering at the time. Interestingly, I fell into the profession by chance, starting work in a fire laboratory without any prior specialist background. What kept me there was the technical depth of the field and the constant opportunity

to learn and grow. That excitement around engineering and problem-solving has driven my career ever since.

## **Q** What has been the best moment of your career so far?

Rather than a single standout moment, there have been several milestones that have shaped my journey. Early in my career, I spent years working in a laboratory environment, carrying out full-scale fire tests where we built and burned real structural elements such as walls and floors. That hands-on experience was invaluable.

Later, in 2012, I worked for a major property developer in Australia, where we pushed the boundaries of modern methods of construction. One highlight from that period was contributing to the design and development of 25 King Street in Brisbane, a ten-storey commercial tower built almost entirely from timber.

More recently, my work has taken on a global dimension, leading to engagement with senior stakeholders including politicians and investors, and ultimately an invitation to speak at COP26 in Glasgow.

### **Q What makes you tick?**

At the core of it, I am motivated by the idea that my technical expertise can help create a better and safer industry, and by extension, a better society. It is important to me to work for a company that shares those values and supports that mission. I also have a strong belief in lifelong learning. No matter how experienced you become, staying curious and keeping up with new developments is essential. The moment you stop learning is the moment you start falling behind.

### **Q Tell us a little-known fact about you**

Outside of work, I am very active and play football two to three times a week. I also have a very international home life. I am Chilean, my wife is Australian, and we live in the UK. We also have a rescue dog called Leto, who came to the UK from a charity in Serbia. Despite having lived away from Spanish-speaking countries for almost 18 years, Spanish is still my first language.

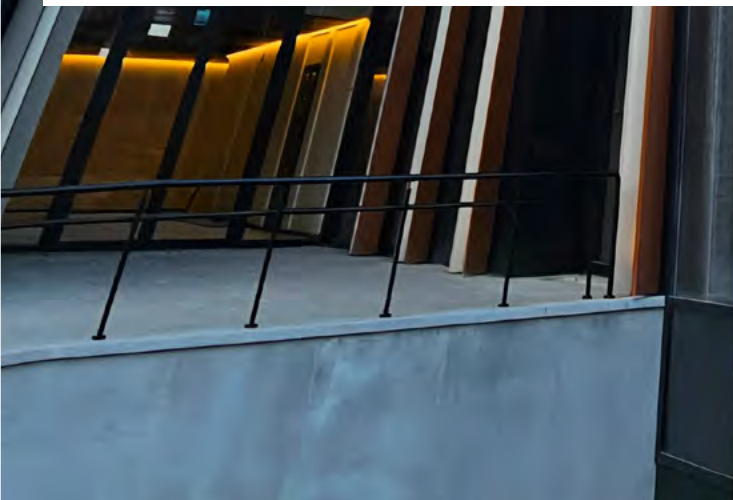
### **Q What are you most looking forward to in your role at Diales?**

I am excited about the future growth of our building safety and fire engineering service. One key ambition is to expand our proposition beyond traditional expert witness work and play a more proactive role in addressing emerging industry trends and challenges.

I am also looking forward to further developing the team, both technically and visually, particularly in how we present ourselves through the Diales website and to the wider market. As the service is still in its early stages, it will be rewarding to see how it finds its long-term fit within the business and continues to grow in capability and influence.

### **Diales welcomes Mario to the team!**

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# Erection Engineering in Major Bridges: Managing Risk and Dispute

Sameer Khan, Technical Expert, UK

## Introduction

Major bridges dominate landscapes and their scale, structural form, and aesthetic elegance often become enduring landmarks within both the built and the natural environments they inhabit.

The construction of such bridges follows logical sequences of activities spread over several stages across the construction period, during which the geometric and force profiles of the structure undergo a continuous evolution. These evolving geometries and forces often differ significantly from those that the bridge would experience in service. It is during these transitional stages that the bridge is most vulnerable to instability and failure, due to reduced stiffness, incomplete load paths, and reliance on temporary supports.

The specialist discipline that governs the safe navigation of these highly sensitive stages is known as erection engineering. It is both an art and a science – a considered blend of analytical rigour, and construction led thinking that enables bridges to be built safely, efficiently, and predictably.

Erection engineering of major bridges arguably presents the most complex and technically challenging aspects of their delivery. While it offers vast potentials for engineering intuition, added value and innovation, it also introduces a complex matrix of potential contention and dispute between project parties. Erection engineering therefore needs to carefully consider each current state of the construction project, to ensure that safety, compliance and achievement of the desired outcomes remain paramount through the entire course of project delivery.

## Brief description of erection methods

I have been fortunate to have had the opportunity to participate in various project leadership and expert

roles on some of the most high profile bridges in the world. Drawing on that experience, I would like to briefly outline some of the methods of bridge construction that I have come across in my work on international projects, and which are principally relevant to my discussions in this article:

- **Cable stayed bridge** construction features one or more towers [or pylons] from which inclined cables directly support the bridge deck. The cables are typically arranged in a fan or harp pattern, providing both structural efficiency and aesthetic appeal. This form of construction is used for spanning some of the most challenging natural and man-made obstacles.



- **Suspension bridge** bridges carry their stiffening deck from cables that hang in between tall towers. In their classical configuration, the main cables are suspended in a catenary and transfer loads to the towers and to the ground through anchorages at each end. This system allows very long spans to be achieved with a relatively lightweight superstructure.



- **Balanced cantilever** construction, mostly adopted for post-tensioned concrete bridges, is a method used for building bridges where segments are either cast in place, or precast, and extended symmetrically from a central pier.




- **Incrementally launched** bridges are constructed by progressively pushing [or pulling] sections of the bridge deck from one end across the piers using hydraulic jacks and sliding bearings. This method is efficient for building bridges over inaccessible terrain, minimising the need for temporary supports.



- **Span-by-span** bridges are constructed by placing and post-tensioning precast segments, one full span at a time,



typically using an overhead launching gantry. This method is efficient for repetitive spans and is suitable for long viaducts and elevated metro lines. Variants of this method can also feature fully precast spans and also cast in place spans.

- **Arch bridges** perhaps one of the oldest forms of bridge construction, employ a vertically curved structure to transfer loads primarily through compression along the curve, thus efficiently distributing weight to the supports at either end.
 

Major bridge projects, particularly those involving a signature crossing and extensive approach structures, often require a combination of construction methods. For example, on a large bridge project in Central America where I acted as an independent expert, the works included a segmental cable stayed bridge, alongside approach spans constructed using balanced cantilever and incremental launching techniques.

The technical and risk landscapes featuring the above bridge types evolve around complex interactions between the human workforce and various types of temporary works, mobile plant, equipment, heavy lifting devices, cranes, and highly specialised gantries and form travellers, as well as the environmental factors such as wind, earthquakes, temperature variations and geotechnical conditions.

### Evolving geometric and force profiles during erection

There are various issues that can be experienced when geometric and force profiles during erection can not only be different to those anticipated in-service but can even be opposite. For instance, bridges erected by incremental launching experience significant cantilevers and large stress variations during erection, even stress reversals, that would not occur in the operational life of the structure.

I recently led the Proof Engineering on a major project in Australia, which involved the construction of twin network arch bridges, each oriented on double skews. A novel technique was employed to incrementally launch the arches across a wide body of water, using a long space-truss launching nose. During the launching phase, the arches were engineered to accommodate cantilever behaviour. Following the completion of the launch, the structural system was gradually and systematically transitioned to a simply supported configuration for post-launch works and in-service conditions. The entire process was rigorously modelled using sophisticated computational techniques to analyse stress ranges, skew induced deflections, and the influence of onerous wind effects during launching.

Cable stayed bridges exhibit considerable complexity in the evolution of their geometric configurations and force profiles during erection. This complexity inherently arises from the significant disparities in the relative stiffnesses of the primary structural components. The situation becomes even more intricate when additional factors such as soil–structure interaction, dynamic vibrational behaviour [particularly wind-induced effects], thermal differentials, and various forms of age-related and geometric nonlinearities are also considered.

I led the Technical Design Audit of one of the biggest reinforced concrete cable stayed bridges in the world, located in Vietnam. The bridge posed a very interesting challenge in that only one set of mobile form travellers was used for constructing the superstructure. There was thus a time lag of more than one year between the constructions of the two halves of the reinforced concrete superstructure. The nonlinear age-related effects, such as creep and shrinkage, therefore had to be determined in considerable detail, using computerised modelling, to investigate geometric control for closing the record main span, and also long term effects on stress redistribution in the post-closure state.

Another iconic cable stayed bridge that I worked on as the technical project expert was for a metro project in Australia. The bridge featured a plan-curve superstructure, suspended by a centralised singular plane of cable stays. The bridge was constructed by a hybrid method, featuring precast balanced cantilever, as well as span by span erection, which I had proposed. The bridge went through distinct transitions of the statical system from construction stages to its final configuration. These transitory stages were modelled and monitored not only for geometric evolution, but also for force profiles.

In all the above instances, elaborate site surveys and monitoring was specified during the erection process. The analytical models were continuously benchmarked and appropriately updated in light of data received from the site.

### Geometric incompatibility

One of the most challenging aspects of design, erection engineering, and construction is understanding the various geometries a structure can experience throughout its lifecycle. For example, the geometry of a structural member in the fabrication or precasting yard is likely to differ from its geometry during lifting and installation, and yet again from its final geometry in service.

If these geometric transitions, especially in the context of tolerances, are not properly understood, analysed,

and accounted for during design and fabrication, or precasting, significant issues such as misalignment and lack of fit can arise. Corrective measures in such cases can be costly and time consuming, potentially leading to budget overruns and programme delays.

### The locked-in state

Almost inevitably, certain geometric deformations and stress states induced during the erection process become locked into the structure, even after temporary works, erection equipment, and construction loads have been re-positioned or even removed. These residual effects can have significant short term as well as long-term effects that must be accounted for in the engineering. Recognising, analytically predicting, and managing these locked in effects is therefore critical to reliable erection engineering.

I was appointed as an independent expert consultant for a major cable stayed bridge in the USA, on which the development of forces and deformations in the composite structure were investigated in detail across the erection stages. It was found that the torsional rotations experienced by the edge girders during erection could progressively build up and become locked-in, at least partially. Specialised means were therefore investigated to redress and achieve the desired 3D geometry control and fit-up.

It is essential in the erection engineering of major bridges that elaborate protocols and procedures are not only specified, but rigorously implemented to ensure that there is constant flow of real life data, collected through site monitoring and surveys, back to the design office for review and updating.

### Environmental loading

The investigation of integrity and stability of an 'under construction bridge' during the transient stages of evolving geometry and force profiles becomes significantly more complex when environmental loads are also considered. These include seismic, wind, temperature, differential temperature and differential temperature effects.

While seismic and wind design loads considered during erection are often lower in magnitude than those required for in-service conditions, their impact on a partially completed structure can be disproportionately severe. This is due to the reduced stiffness, incomplete load paths, and temporary support conditions. All of which make the unfinished structure more susceptible to large deflections, instability, and even collapse during erection.

Temperature and differential temperature effects also constitute a significant design consideration, sometimes more so for geometry control during

erection. In some cases, these thermal influences govern alignment, fit up, and cable force optimisation more than they do in the final service condition.

For instance, I recently led the design reviews on a cable stayed bridge project in the Middle East, where significant geometric deviations due to differential thermal effects during erection were indicated by computer models. The preliminary analytical investigation indicated significant potential deviations from the targeted alignments if differential thermal effects were not appropriately accounted for in the geometry control specifications.

Environmental loading therefore introduces another dimension of complexity to the erection engineering of major bridges, amplifying the need for careful prediction, site monitoring, management and control during all stages of construction.

### Computerised modelling and analyses

I have referred to computer models and analyses in the preceding sections. In modern practice, the use of computerised Finite Element Analysis [FEA] is fundamental to understanding and predicting the behaviour of major bridges across their entire lifecycle, including during erection. Advanced FEA has become one of the most powerful tools available to bridge engineers. Having used many of the high end proprietary platforms on the market, I have seen their analytical capabilities develop dramatically over the years. Contemporary software now provides sophisticated tools for staged construction analysis, a core requirement for assessing evolving geometry, force redistribution, and the temporary structural states that define erection engineering.

Many platforms offer integrated static and dynamic analysis, linear and nonlinear options, and the ability to model material nonlinearities with considerable precision. Several also include specialised modules for simulating key construction methods such as cable stayed, segmental balanced cantilever, span by span, and incremental launching. I have used these types of platforms not only for advanced analyses related with design and checking, but also for causative assessments in forensic work.

In addition, modern FEA systems incorporate code specific features for both force based and displacement based seismic analysis, nonlinear stability assessments, and studies of aerodynamic behaviour, ship impact, and cable loss scenarios.

Although the full potential of these integrations is still emerging, growing compatibility with BIM and parametric modelling environments, supported by rapid advances in automation and AI, is further enhancing the analytical landscape.



### **Concluding remarks - the significance of getting erection engineering right**

Erection engineering sits at the core of major bridge construction, defining how geometry, forces, and temporary states evolve from the drawing board to completion. Each current stage brings a unique configuration, often more vulnerable, and markedly different from the final in service structure. Managing these transitions demands precision in analysis, careful control of tolerances, and a continuous flow of real time information between site and design teams.

When erection engineering is executed well, it enables safe construction, predictable behaviour, and the timely achievement of critical milestones. When it is not, the consequences can be disruptive and severe. Getting erection engineering right is not simply a technical requirement, it is a fundamental contributor to project certainty, risk management, and the successful delivery of a major bridge.

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# Swiss Cheese Model

John Ford, Technical Expert, UK

**Professor James Reason's 1990 book, "Human Error" first put forward the Swiss Cheese Model in relation to accident and incident causation and it has since become a commonly used model in risk analysis and risk management.**

It compares human/machinery/management systems to multiple slices of Swiss Cheese, which has randomly placed and sized holes in each slice, stacked side by side, in which the risk of a threat becoming a reality is mitigated by the differing layers and types of defences which are "layered" behind each other, as illustrated in Figure 1. Therefore, in theory, lapses and weaknesses in one defence do not allow a risk to materialise (e.g. a hole in each slice in the stack aligning with holes in all other slices), since other defences (protections) also exist (e.g. other slices of cheese), to prevent a single point of failure.

The holes show the way in which the defences are not 100% reliable; some holes are due to latent conditions, some due to failures of the defences. Generally barriers are put in place in order to prevent overlapping of the holes to ensure that even if each defence is not 100% effective, the whole system is still safe. However under certain conditions, it may happen that the holes, i.e. the weaknesses of the defences, overlap causing the actual transformation of hazards into an accident.

Recently, I used the Swiss Cheese Model during an investigation of the electrocution of a construction site worker illustrated in Figure 2. During the course of his work, the worker was moving a metal framed portable lighting unit which had developed a "live" to "earth" fault during its transportation around the construction site. The worker was sadly electrocuted when he moved it for the final time.

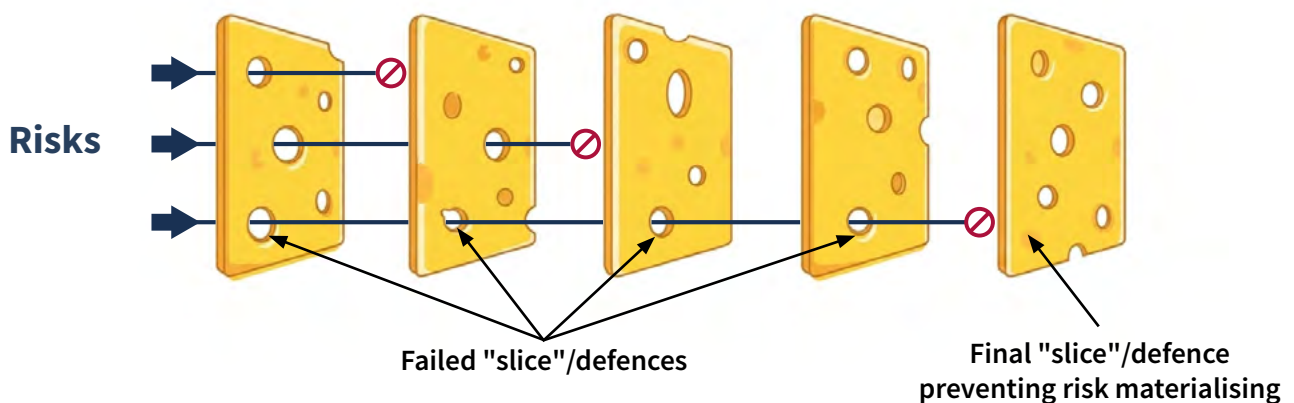


Figure 1: The Swiss Cheese Model (AI Generated)

The pictorial nature of the Swiss Cheese Model greatly assisted me, not only during my investigation, but also in explaining to the operators of the construction site, what “slices” (defences) they needed to introduce to prevent a reoccurrence of the fatal accident.

**My investigation revealed that:**

- a. The worker who was electrocuted was not wearing insulated gloves or insulated footwear. I am of the opinion that because he was not an electrician he should not necessarily have been and the site rules did not require him to do so. However, if he had have been it would have been a “slice” of defence.
- b. The protective earth conductor to the portable lighting unit was not complete between the portable generator and the portable lighting unit. The associated cabling consisted of three cables with the middle cable only being two core (i.e. “live” and “neutral” with no “earth” conductor). Without a complete protective earth conductor of the correct resistance from the supply point (portable generator) to the utilisation point (portable lighting unit), any fault current will tend to flow through anybody in contact with the faulty equipment back to the earthed star point of the secondary winding of the supply point’s transformer’s secondary winding.
- c. The electrical circuit supplying the portable lighting unit was only protected with a moulded case circuit breaker (MCB) which is an overcurrent protection device. This circuit should have incorporated a residual current protection device (RCD). There are many factors that determine if an alternating current (A.C.) electric shock results

in electrocution, but the worldwide accepted philosophy is to limit the current that the victim receives as well as the time that they receive it for. (It is well described in IEC 60479-1 - *Effects of current on human beings and livestock. General aspects.*) The probability is that if a person receives only a small electrical current for a short time period, they will survive. This is where earth leakage protection devices are used; sometimes referred to as residual current circuit breakers (RCCBs) or residual current breakers (RCBs) / residual current devices (RCDs). These are devices that measure the current on the live and neutral conductors. They use Kirchhoff’s first law (the algebraic sum of currents in a network flowing to and from a node is zero; what flows in, normally flows out). If the currents are not equal, it suggests there is electrical current leakage to earth. If there is an earth fault and some of the current is flowing in the earth conductor (from either the live or neutral conductor), the RCD will operate and trip out (cut off) the power. It is important to note that earth leakage protection devices do not prevent electric shocks; they prevent electric shocks propagating into electrocutions by limiting the earth fault current to a relatively safe level for a relatively short period of time.

Ultimately, the Swiss Cheese Model demonstrates that serious incidents rarely stem from a single failure, but rather from a chain of overlooked weaknesses, reinforcing the importance of robust, layered defences to prevent hazards aligning and resulting in harm.

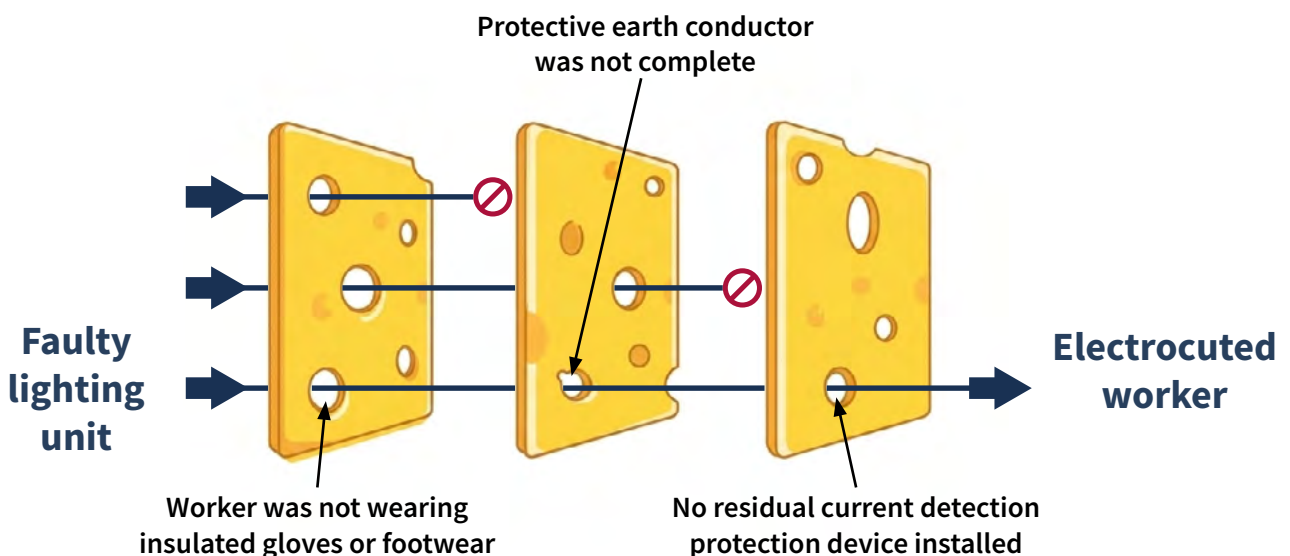


Figure 2: The three “slices” defences (AI Generated)



# My journey to becoming a Diales Expert

David Bunn  
Delay Expert, UK



## Before Diales

When I set about writing this article, it got me thinking, when did my journey to become a Delay Expert actually begin? It probably started back in 2000, at the outset of my career.

After leaving school I found myself working in the planning department for a main contractor, where I started to develop my understanding of construction processes. One of my earliest tasks was to assist a delay expert that had been appointed by my employer to work on an adjudication.

At a time when fax machines ruled the industry and businesses typically had one central email address, I was tasked with replicating the delay expert's hand drawn programmes within an early version of the Powerproject planning software. Even at the early stages of my career, the forensic nature of delay analysis intrigued me and from then on, I always had an eye on directing my career towards becoming a Delay Expert.

However, one thing I lacked at the tender age of 16, which is also a key ingredient to being considered an expert in any field, was experience! The term "expert" being anywhere between 10,000 hours of study in the West<sup>1</sup> or 60,000<sup>2</sup> of refining your skills in Japan.

1. <https://pmc.ncbi.nlm.nih.gov/articles/PMC4662388/>  
2. <https://www.lexus.co.uk/discover-lexus/craftsmanship/takumi-masters>

It was not until around 15 years later, after I had worked on many different projects, that my first significant opportunity to move towards becoming a Delay Expert presented itself.

At this point, I was working as a senior planner for a main contractor when an opportunity arose to work for Driver Project Services (a Diales Group company that provide a range of consultancy services to support the successful delivery of live projects).

## Diales Advisory

After almost three years' working for DPS, an opportunity arose to join the advisory part of the business. I became one of the first candidates to undertake the Minerva training programme which had been introduced by the business as an initiative to develop experienced construction professionals into senior consultants. The Minerva training programme included support through a Master's degree, a mentoring programme and in-house training with various experts in the business.

Of course, the transition from a planner to consultant is not an instant one, the roles and skill sets are very different, which initially meant starting from the bottom. In what felt like a step back to 2000, I soon found myself organising 1000s of progress photos in chronological order so that they fitted neatly into a PowerPoint presentation to summarise the 'as-built' story of a project. However, this was actually providing me with in-depth exposure to the information necessary to underpin a claim.

This new role also presented several new and exciting

**“ Even at the early stages of my career, the forensic nature of delay analysis intrigued me and from then on, I always had an eye on directing my career towards becoming a Delay Expert.**

(if daunting) challenges. Firstly, there was a significant increase in workload required to complete a Master's degree alongside a full-time job. This was further exacerbated by the incredible news on returning home from my first day at Diales that my wife was expecting our first child. In what seemed like a heartbeat, the roller coaster ride that was supporting my wife through her pregnancy was replaced by sleepless nights, early morning studying and then on to the day job. However, whilst you may be asking why I am discussing new parenthood in this article, the need to juggle, multitask and work flat out for demanding clients is all part of the Delay Expert role.

Very early I recognised that a central skill for a Delay Expert is report writing, which is not always natural for planners who are usually trained to develop short-form narratives for progress reports, emails and the like. One of the first training tasks that I was required to do was to peer review expert reports to familiarise myself with the structure and content of an expert report. It also provided a sobering look at the standard that would be required to succeed in my new undertaking.

However, under the excellent and above all else patient guidance of experts in the Teesside office, and across the company, I began to support the investigative and narrative works necessary to underpin an expert report. All under the strict instruction and keen eye of the expert who I was supporting.

My writing skills soon developed through writing shorter reports for claim preparation and avoidance commissions where the facts are reviewed to provide a preliminary position as to the strength of a client's position, allowing the client to make a reasoned decision on how to approach a particular issue.

Supported by senior Diales experts within the company, I progressed to writing my own detailed delay reports.

Another significant hurdle for me was the public speaking aspect of the role. The role of an expert may require in person expert witness evidence in a hearing, the pinnacle of which is to provide oral evidence for cross-examination at a court or arbitration hearing. Of course, such a role requires the expert to be capable of public speaking, which was at that stage my biggest

fear. Diales provided internal public speaking courses and supported me with piecemeal development, with small parts in our bi-annual seminars soon becoming near Oscar winning performances... Well not quite, but I certainly do not fear public speaking anymore, and fully understand the need to be able to put my opinions across in a calm and understandable manner.

### **Diales Expert Services**

Following the completion of the Minerva training programme and promotion to senior consultant, I continued to deliver delay reports for the purposes of negotiation and expert appointments which led to me being promoted to Associate Director.

Shortly after my promotion, I undertook another Diales training initiative, the 'Diales expert programme'.

The Diales expert programme is designed to develop senior consultants into fully fledged experts in line with numerous competencies which are all necessary for a testifying expert. For each competency the candidate must demonstrate 1) a high level of understanding, 2) that they have supported an expert in relation to that specific competency and 3) application of the competency. Importantly, the training focused on exposure to areas where I lacked experience or areas that are not my chosen field, including other disciplines such as quantum and technical, thus providing the platform to become a well-rounded expert who can work alone and also as part of a group of other discipline experts.

The Diales expert programme also included cross examination training, which proved to be plain sailing compared to my final series of interrogations by a senior expert within Diales, which were akin to the final battle with the ultimate boss in a 90s arcade game.

After emerging victorious, or at least still in one piece, from my final interrogations, I had finally realised my goal of becoming a Delay Expert, 25 years in the making, with my expert profile alongside some of the best in the business on the Diales website. By way of interest, 25 years, and an average of 47 weeks a year and 50 hours a week (and more as a hungry young planner) coincidentally puts me at around 60,000 hours in my specialist field.

Whilst I have invested a significant amount of time and focus into my career to find myself where I am today, I cannot imagine a better environment for development than Diales. Diales provides real opportunities for career development with support, training and lots of patience from the industry's finest, many of whom are genuinely willing to invest their time into the development of others.

# Payment Notices

Mark Blackmore, Quantum Expert, UK

**Payment notices are a crucial component in the construction industry, particularly in the context of the Construction Act 1996. They serve to formalise the payment process and ensure timely compensation for work completed.**

Payment notices are a crucial component in the construction industry, particularly in the context of the Construction Act 1996. They serve to formalise the payment process and ensure timely compensation for work completed.

The legal context for payment notices stems from the Housing Grants, Construction and Regeneration Act 1996, which was updated in 2009<sup>1</sup>, to protect the rights of parties involved in construction projects.

1. The amendments to the Construction Act came into force in respect of construction contracts entered into on or after 1 October 2011 in England and Wales and 1 November 2011 in Scotland.

One of the more significant changes relates to the abolition of the requirement that construction contracts need to be in writing. The Act now applies to all construction contracts, whether wholly in writing, partly in writing or completely oral.

Part II of the Construction Act requires that construction contracts must include:

- The right for a party to the contract to refer a dispute to adjudication (sections 108 and 108A).
- A mechanism for payments through the course of the contract (sections 109 to 113).

In the absence of the contract not containing the relevant provisions, 'the Scheme' (the Scheme for Construction Contracts (England and Wales) Regulations) provides a fall-back position.

The timetable for payments under the Scheme is demonstrated in the following graphic.

## Scheme timetable



Under an unamended JCT contract, for example a payment notice is required due under the contract and issued not later than five days after the payment due date. This is defined as 'the date provided for by the contract as the date on which payment is due'.

The payment notice must specify:

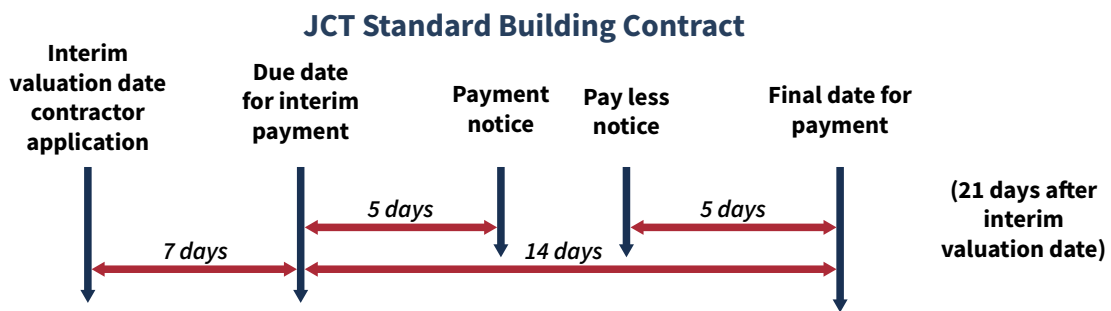
- The sum considered due, or to have been due at the payment due date (the notified sum); and
- The basis on which the sum is calculated.
- A payment notice must still be issued if the sum considered due is zero.

If a payment notice is not issued by the payer, the payee can issue a payment notice, known as a 'payee's notice

in default'. If the contract allows for an application for payment and that application is made, this automatically becomes the payee's notice in default. However, the paying party still has the opportunity to issue a 'notice of intention to pay less', or a 'pay less notice' before the final date for payment and must contain:

- The sum that the person giving the notice considers to be due on the date the notice is served; and
- The basis on which the sum is calculated.

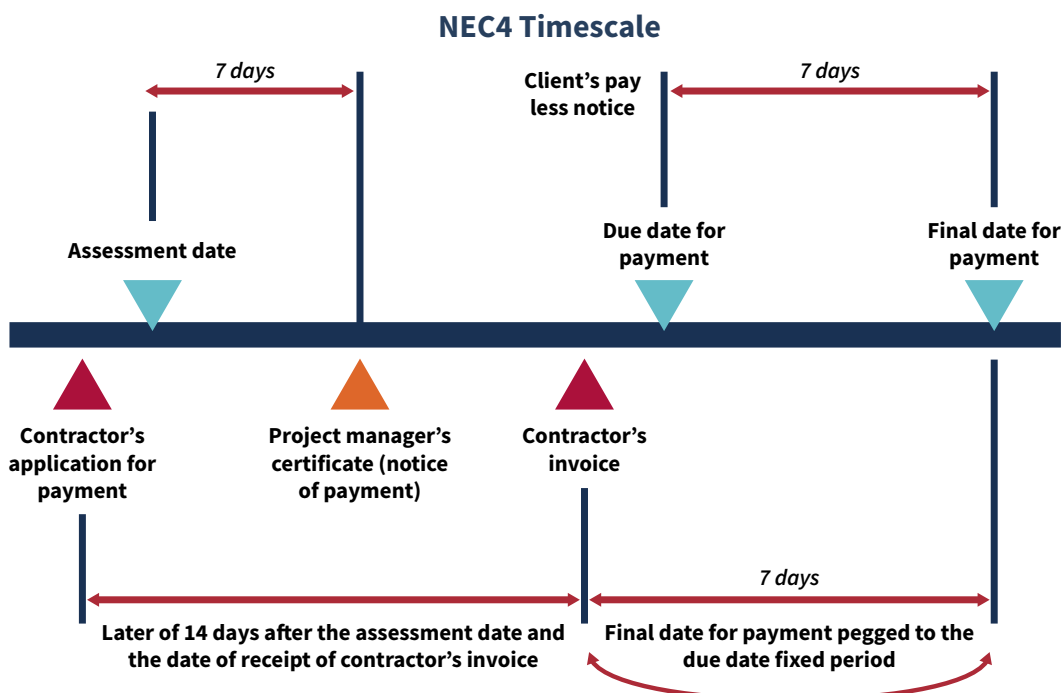
The following graphic demonstrates the typical timescales under a standard JCT contract.



Under NEC4, secondary option Y(UK)2 is a payment clause when the Act applies, and includes the following wording 'The final date for payment is fourteen days after the date on which payment becomes due or a different period for payment if stated in the Contract Data'.

Again, either party must notify the other if it intends to pay less than the notified sum. A party does not withhold payment of an amount due under the contract unless it has notified its intention to pay less than the notified sum as required by the contract.

The payment process under NEC4 is demonstrated within the following graphic.



Recent cases provide further guidance as to how payment notices are interpreted and enforced in the UK legal system.

### **Placefirst Construction Ltd v CAR Construction (North East) Ltd (2025)**

CAR secured a 'smash and grab' adjudication against Placefirst. Placefirst sought to challenge the enforcement of this decision. The key issues related to the payment and pay less notices, which have strict procedures to follow under the Construction Act.

**Court Ruling:** The court held that Placefirst's notifications within a single email, titled both as a 'pay less notice' and 'Valuation 30', contained the requirements for a valid payment notice. The judge emphasised that the interpretation should be objective, considering what a reasonable recipient would understand from the correspondence.

**Validity of Notices:** The judge noted that the payment notice does not need to explicitly state that the amount is what the issuer considers due at the payment due date, and negative sums are permissible. This ruling provides agents a bit more leeway in their notice designations and interpretations.

This case underscores the need for clear communication in contractual obligations and highlights the risks parties face when procedural guidelines are not diligently followed.

### **Vision Construction Ltd v Gypcraft Drylining Contractors Ltd (2025)**

VCL was the main contractor and Gypcraft was the boarding and drylining subcontractor on a residential development in Battersea.

Gypcraft issued its interim application for payment. VCL responded after the date the payment notice was due via an email entitled 'Payment Notice'. The email stated a lower value sum was due to Gypcraft. At no point was a pay less notice issued by VCL.

Gypcraft launched a smash and grab adjudication and was found to be entitled to the notified sum plus interest.

### **Lapp Industries Ltd v 1st Formations Ltd (2025)**

Lapp sought summary enforcement of an adjudicator's decision. Lapp had issued an application for interim payment for which no payment notice or payless notice was served.

1st Formations raised a jurisdictional challenge stating

there were numerous contracts between the parties rather than a single contract as alleged.

The judgment ruled that there was one contract and the application for interim payment was valid.

### **Kersfield Developments (Bridge Road) Ltd v Bray and Slaughter Ltd (2017)**

Bray and Slaughter issued an interim payment application that was neither paid by the deadline nor was a valid payment or pay less notice issued.

An adjudication was subsequently commenced. Kersfield refused to comply with the adjudicator's decision and launched Part 8 proceedings seeking a declaration that it was entitled to launch a second adjudication to independently value the works.

The judge confirmed that the interim payment application was valid and complied with the requirements of Clause 4.8 of the contract.

### **Conclusion**

Following the payment provisions set out in the Construction Contract, or in its absence the Scheme, is critical to ensure that you do everything possible to ensure compliance with the Construction Act.

The scheduling of calendar dates for all relevant contracts to ensure notices are issued in time is far easier than trying to defend a smash and grab adjudication for a simple administration error.



# Schedule Risk Analysis

## Dark Art or the High End of Project Scheduling?

Dr. Frank Holzweissig, Technical Director, Germany and  
Forough Mohammadi Delavari, Senior Consultant, Germany

### Between contractual certainty and probabilistic reality

Contractually agreed completion dates create an illusion of control. They are fixed, enforceable, and often backed by liquidated damages or incentive mechanisms, yet they ignore a fundamental reality: projects do not evolve deterministically. When the promised date is missed and statistically, it often is, the consequences are immediate and severe: claims, penalties, loss of revenue, and damaged stakeholder relationships. What is commonly interpreted as a failure of execution is, in many cases, a failure of forecasting. The gap between contractual certainty and probabilistic reality is where delays escalate into disputes and projects slide into crisis.

Projects today face more pressure to meet deadlines and budgets. Across construction, infrastructure, energy, and IT, schedule overruns and cost escalations remain among the most frequent sources of conflict and financial loss. Traditional deterministic scheduling methods typically produce a single completion date, implicitly suggesting certainty, yet they provide no insight into the likelihood of actually achieving that date.

Because future conditions and events cannot be predicted with certainty, initial project duration and cost estimates are regularly exceeded as uncertainties and risks materialise. The central questions decision-makers should therefore ask are not whether a project will finish on time and within budget, but:

- What is the probability of meeting the contractual completion date and approved budget?
- Within which range might project duration and cost realistically vary?
- How likely are specific outcomes within that range?

This is where Schedule Risk Analysis (SRA), and its extended form Integrated Cost and Schedule Risk Analysis (ICSRA), become essential. These methods translate uncertainty and risk into quantifiable inputs, explicitly reflect their impact on schedules and budgets, and provide a statistically sound basis for informed decision-making. Rather than replacing deterministic schedules, SRA and ICSRA expose their limitations and make their implicit assumptions transparent.

In an environment characterised by growing complexity, tighter contractual frameworks, and heightened financial exposure, the application of SRA and ICSRA is no longer optional. It requires experienced planners with a solid understanding of probabilistic modelling, statistical principles, and several years of practical project experience. Familiarity with established methodologies and professional tools such as Safran Risk or @Risk is indispensable, as is the ability to interpret results correctly and translate them into actionable management decisions.

## Risk versus uncertainty and the role of empirical data

It is essential to distinguish between the two concepts:

- **Uncertainty** describes the range of possible outcomes that arise from incomplete information.  
*Example:* An excavation usually takes 13 days, but may take only 10 under favourable conditions or up to 20 under poor ones. The duration is uncertain but not necessarily linked to a specific event.
- **Risk** refers to an identifiable event with a probability of less than 100% and a measurable impact.  
*Example:* "Rock layers are encountered during excavation" → Probability 15%, impact over 30 days and over €500,000.

Schedule Risk Analysis incorporates both perspectives: each activity or cost element is assessed for uncertainties in its estimates as well as potential risk events.

Uncertainties are modelled using three-point estimates (optimistic – most likely – pessimistic), while risks are defined by probability and impact parameters.

The quality of any analysis improves significantly when empirical data is incorporated alongside the expertise of the risk analyst:

- **Weather records:** Historical rainfall or frost days provide objective input for estimating weather-related delays.
- **Delivery and logistics data:** Past delivery times of key components yield realistic probability distributions.
- **Project databases:** Experience from comparable projects enables calibration of durations and risk events.
- **Market and price indices:** Variations in commodity prices or exchange rates are reflected in cost risk modelling.

This shows that risks and uncertainties are not a matter of intuition alone and they can be substantiated with data.

## Typical project risks in practice

Although the range of potential project risks is broad, recurring patterns are observed across most industries:

- **Technical risks:** unexpected ground conditions, design or specification errors, interface conflicts

- **Resource risks:** shortage of key personnel, delayed material deliveries, subcontractor dependency
- **External risks:** extreme weather, permit delays, political decisions, fluctuating raw material prices
- **Management risks:** delayed decisions, unclear responsibilities, frequent scope changes

In most projects, only a few factors cause the majority of the overall risk, the so-called "**Critical Few**".

## What is Schedule Risk Analysis? Including Monte Carlo and Criticality

SRA replaces fixed assumptions in the project schedule with probability distributions and simulates potential outcomes.

### Steps of an SRA

1. **Model definition:** A valid project schedule with tasks, dependencies, and
  - a. Milestones used as the foundation.
  - b. Random variables: Uncertainties are represented by probability distributions (typically three-point estimates). Risks are modelled as discrete events with probability and impact.
2. **Risk mapping:** Allocation of risks to activities or cost elements.
3. **Correlations:** Definition of relationships between risks, e.g. exchange rate and material cost may influence one another.
4. **Monte Carlo simulation:**
  - The computer randomly draws values from defined distributions.
  - For each draw, the critical path is recalculated and a completion date determined.
  - Thousands of iterations create a distribution of potential project durations.





Figure 1: Monte Carlo Simulation Distribution showing P50 and P80 completion probabilities

### Evaluation:

- P-dates (e.g. P50, P80) indicate the probability of achieving a certain completion date.
- Sensitivity analysis identifies which activities or risks have the greatest influence.
- Criticality Index (CI) measures how often an activity lies on the critical path across all simulations.

### The Value of Criticality

The Criticality Index directs attention to the truly decisive activities:

- High-CI tasks are the main drivers of schedule overrun.
- Mitigation can be targeted where it yields the greatest effect.
- Combined with sensitivity results, the Critical Few become clearly visible.
- Within ICSRA, tasks with high schedule and cost risk are identifiable.

In short, the Criticality Index transforms complex simulation results into **clear action priorities**.

### Integrated Cost Schedule Risk Analysis The next level

ICSRA links schedule and cost perspectives. Delays almost always lead to higher costs through site overheads, penalties, or lost revenue.

*Example:* A project section is delayed by three months, causing over €2 million in overheads and over €4 million in lost revenue. ICSRA visualises these relationships and enables realistic budget forecasts.

For investors, controllers, and project owners, the benefits are clear:

- Fewer cash-flow surprises
- Improved scenario comparability

- Informed decisions on whether preventive measures are economically justified

### Practical example: from model to decision

- At the planning stage, an infrastructure project was scheduled deterministically for a duration of 30 months. Based on this plan, the project team initially believed that the contractual completion date could be achieved with only limited schedule contingency.
- However, concerns were raised regarding weather exposure and the reliability of key material deliveries. To better understand these uncertainties, a Schedule Risk Analysis was conducted, incorporating historical weather records and delivery performance data. The simulation revealed a significantly different picture:
  - **P50** = completion at 34 months
  - **P80** = completion at 38 months, indicating a low likelihood of meeting the original target date.
- Further analysis showed that three work packages accounted for approximately 75% of the total schedule risk (time overrun), highlighting a small number of critical drivers rather than widespread uncertainty across the schedule.
- Based on these findings, the project team evaluated mitigation options, including revised sequencing and the allocation of additional resources to the

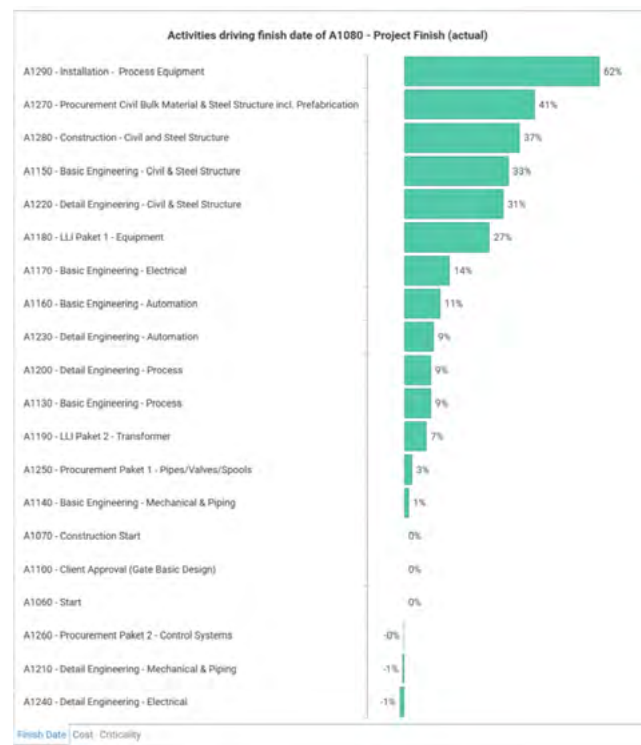


Figure 2: Tornado Chart showing risk driver drivers



Figure 3: Correlation chart showing link between schedule delay and cost impact]

identified high-criticality activities. These measures were then incorporated into the model and the SRA was re-run. The updated results showed a substantial improvement, with the P80 completion date reduced to 32 months, albeit with an additional cost of €1.5 million.

- An Integrated Cost Schedule Risk Analysis demonstrated that this increase in cost was economically justified, as it remained well below the potential penalties and indirect losses associated with missing the contractual deadline. As a result, management approved the mitigation measures.

This example illustrates two key outcomes:

- **Risk mitigation becomes quantifiable** - allowing decision-makers to clearly assess which measures deliver the greatest benefit relative to their cost.
- **Risk awareness increases naturally** - project managers, controllers, and investors gain a clear and shared understanding of the true drivers of schedule and cost risk, enabling more confident and transparent decisions.

## Conclusion and outlook

A qualified risk professional, working closely with the project team, identifies uncertainties and risks, quantifies them using appropriate methods, and integrates their effects into schedule and cost

estimates. With accurate and informed interpretation of simulation outputs, this process establishes a robust foundation for credible decision-making.

SRA and ICSRA are not “dark arts” but robust, data-driven methods that support professional project management. They enhance transparency, improve forecast accuracy, and enable proactive project control.

A major advantage lies in their direct link to mitigation planning: results translate into actionable options, allowing teams to make fact-based decisions. At the same time, the process strengthens risk awareness across the project team so uncertainties are no longer ignored but openly discussed and addressed.

By using empirical data, Monte Carlo simulations, and indicators such as the Criticality Index, the true drivers of schedule and cost risks become visible.

For project managers, controllers, and investors, this means:

- Fewer surprises
- Clearer priorities
- Better decisions

Looking ahead, real-time data and AI will further refine accuracy but even today, one thing holds true:

Those who quantify risk manage projects more successfully.



# Article Byte

## I'll be back: Turning a Termination into a Recoverable Claim

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Ashlea Read, Quantum Expert, Dubai and  
Oliver Pearson, Associate Director, Dubai

**Giga-projects in the Middle East are amongst the most ambitious and complex construction projects ever undertaken, attracting contractors from across the globe and generating contracts of extraordinary value and complexity. However, while these projects offer substantial opportunities, they also carry significant contractual risks. In recent months the industry has witnessed a notable rise in the termination of contracts across several high-profile developments.**

It is important to recognise that termination does not strip a contractor of its rights, remove its entitlement to payment for work executed, or relieve an employer of its contractual obligations. What it does do is create an environment in which those rights must be carefully identified, properly documented, and diligently pursued through the appropriate contractual and legal channels.

### Stakes are High

On giga-projects, the financial consequences of termination can be significant. By the time of termination, contractors will typically have mobilised substantial workforces, committed considerable investment in plant and equipment, procured large quantities of materials, and established extensive supply chain arrangements, all of which give rise to cost implications that do not simply cease upon termination.

The potential heads of claim available to a contractor in such circumstances are broad and may include the unpaid contractual works, materials on and off site, the costs of demobilisation, settlements due to subcontractors and suppliers, and prolongation and disruption costs incurred prior to the termination date.



Where the termination itself is found to be wrongful, the contractor may additionally seek to recover loss of profit and contribution to overheads on the uncompleted portion of the works.

The real challenge, however, is not in identifying what is recoverable in principle, but in proving it in practice. In formal dispute proceedings, whether through adjudication, arbitration, or litigation, the burden rests firmly on the contractor to demonstrate its entitlement with evidence that is robust, contemporaneous, and credible. It is at this stage that the real work begins, and where the line between recovery and loss is often determined.

### Importance of Records

At the point of termination, the most critical step a contractor can take is to ensure that the quantity and percentage completion of the works undertaken are accurately recorded and preserved. A joint site survey conducted with the employer or its representative is the ideal starting point, as it creates an agreed record of the physical status of the works at the date of termination. Where the employer is unwilling to participate, the contractor must act quickly, engaging (ideally) independent quantity surveyors and technical experts to measure, assess, and document both completed and partially completed works. In parallel, the contractor should work closely with suppliers to independently verify and record any off-site materials and equipment that have been paid for by the contractor but not yet reimbursed by the employer. This process is not merely procedural but fundamental to preserving evidentiary integrity, mitigating disputes over valuation, and strengthening the contractor's position in any subsequent negotiation or formal process.

Contemporaneous records form the foundation of any subsequent claim. Photographs and video evidence,

marked-up drawings, as-built records, delivery notes, and signed timesheets collectively build a picture that is difficult to dispute. Equally, contractual notices and documentation must be issued strictly within the timelines prescribed by the contract, as procedural failures at this stage can prejudice recovery significantly. In high-value disputes, the quality and completeness of contractor's records often prove determinative in deciding whether a claim succeeds or fails.

### Contract Landscape on Giga-projects in the Middle East

Giga-projects in the Middle East are typically governed by bespoke or heavily amended standard forms, often incorporating NEC, FIDIC, or entirely project-specific frameworks. Each brings its own termination provisions, payment mechanisms, and dispute resolution procedures, and the nuances between them are generally significant. Understanding how these provisions operate, particularly in circumstances where the employer asserts termination for default and the contractor disputes the grounds, requires a depth of contractual expertise that cannot be improvised under pressure.

Importantly, having a contractual right to terminate does not necessarily mean that the decision to do so has been exercised correctly or in accordance with the contract. Where termination is unlawful or procedurally flawed, a contractor may be entitled not only to recover its costs but to pursue damages for wrongful termination, which can be significantly more valuable. Identifying and pursuing these arguments requires early and informed specialist involvement.

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+1 403-830-9619

**Toronto**  
+1 403-830-9619

### EUROPE

#### FRANCE

+33 (0) 1 73 79 58 68

#### GERMANY

+49 (0) 89 5419 8931

#### SPAIN

+34 (91) 915 7351

#### THE NETHERLANDS

**Goes**  
+31 113 246 400

#### Rotterdam

+31 10 307 04 08

#### UNITED KINGDOM

**Blackburn**  
+44 (0)1706 223 999

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#### Teesside

+44 (0) 1740 665 466

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+27 11 234 8410

### ASIA PACIFIC

#### AUSTRALIA

**Perth**  
+61 8 6557 8690

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+61 (2) 8067 8684

#### SOUTH KOREA

+82 (0)10 9128 9592

#### SINGAPORE

+65 6226 4317

### MIDDLE EAST

#### KINGDOM OF SAUDI ARABIA

+966 11 834 3640

#### QATAR

+974 4 435 8663

#### UNITED ARAB EMIRATES

**Abu Dhabi**  
+971 2 4410 112

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