Issue 27 | September 2024

DIGEST

Welcome to issue 27 of the Digest

I am delighted to be introducing this latest version of the Digest, the first since our business fully changed its branding to Diales, moving away from the Driver Trett branding we have used in various locations around the globe for many years.

In line with our aspirations to take our business to new levels of quality and delivery under Diales, this edition is filled with some excellent technical content. The use of data and AI is an ever-growing topic, which Ibrahim Elsisi covers, highlighting the dangers of Chat GPT.

Global economic headwinds have caused price escalation in many regions and the recovery of these costs is explained by Robbie Beattie, as he combines his experience from various approaches. Time, its management and calculation, are discussed by guest contributors Jessica Tresham and Mike Stewart, who provide an insight into time bars, while the notoriously difficult calculation of disruption is covered by Mark Murphy, of the Singapore office.

Our Dubai experts Ashlea Read and Khalid Yousri provide an informative Q&A on the differences between arbitration and expert determination. We are also introduced to our latest forensic architect expert, Euan Geddes, on page 28.

All of this complex technology means more data centres, and my colleague Vincent Fogarty, a published author on the topic, rounds off this issue with a Digest Byte.

Our staff around the globe are justifiably very proud of the Digest, and it continues to go from strength to strength. If you would like to contribute, or request we cover a topic, please get in touch.

Mark Wheeler
Chief Executive Officer

ADR IN CONSTRUCTION

NAVIGATING THE INTERSECTION OF TRADITION AND TECHNOLOGICAL INNOVATION

Balancing established methods with emerging technologies in Alternative Dispute Resolution.

Robert Dean, Associate Director, Abu Dhabi, UAE.

The construction industry, with its extensive array of intricate projects and multifaceted stakeholder interests, relies heavily on Alternative Dispute Resolution (ADR) as an essential tool. ADR is a term that encompasses techniques for resolving disputes outside of litigation. This includes arbitration, adjudication, expert determination and mediation. It is designed to resolve disputes with greater efficiency and flexibility and at a lower cost than the courtroom, while also potentially preserving professional relationships.

While arbitration can be confrontational and may not always be fast-paced or lower cost than litigation, adjudication, on the other hand, is often quicker and less confrontational. This makes adjudication an approach that can adapt to the dynamic, fast-paced nature of construction projects and the varying needs of the parties involved.

Adjudication is a method often favoured for its speed and efficiency, aimed at providing a temporary resolution to allow work to continue. Indeed, the process was introduced as a method of dealing with disputes as and when they arose on live projects quickly and cheaply to allow the works to remain unaffected and the parties to continue working together. However, the speed of adjudication, combined with the jurisdiction of the adjudicator and the conduct of the parties, means that the outcome of an adjudication may not be as foreseeable or reasoned as an arbitral award or court judgement.

Traditional ADR methods each differently address the unique challenges of construction disputes. My role often involves assisting expert witnesses, particularly in the context of arbitration, where I have observed its unique blend of judicial formality with the flexibility crucial in construction contexts.

Expert determination, focuses on decisive, expert-led judgments. Mediation, meanwhile, relies on collaboration, promoting mutually beneficial solutions and maintaining business relationships.

Each method contributes distinctively to dispute resolution. While the ideal outcome is to preserve project integrity and encourage collaborative relationships, the reality in the construction industry can be complex, with varied results. The effectiveness of each approach largely depends on the specific context, complexity, size, scope and dynamics of the dispute at hand.

> ***As we contemplate the future role of technologies like blockchain in ADR, it is interesting to note the rise of hybrid ADR approaches, such as Med-Arb, in certain sectors and regions.***

While we continue to value the established methods of ADR in the construction sector, it is also important to recognise the emerging innovations that are beginning to influence industry practice. Emerging technologies like blockchain are entering the scene. Blockchain is a decentralised, digital ledger that records transactions across multiple computers and ensures that the recorded transactions cannot be altered retroactively. This technology, while not yet mainstream in construction dispute resolution, suggests a future where digital, decentralised decision-making could enhance transparency, efficiency, and global applicability.

The use of smart contracts, which are computer protocols designed to facilitate, verify, and enforce the performance of a contract, could significantly impact construction dispute resolution processes. These contracts can reduce the scope for disputes by providing smoother, objective contract administration and automated payment processes. The source of many construction disputes can be traced back to parties' basic misunderstanding of the contract they have entered into, compounded by a range of contract administration failures or errors. Smart contracts have the capability to function as unbiased, trustworthy, and consistent contract administrators, resulting in a reduced margin for error and increased transparency.

Information within the smart contract will be captured and registered on a distributed ledger between the relevant parties, producing a robust and reliable audit trail of past events that will reduce scope for disagreement if a dispute does arise. Such contracts would further avoid many of the current snags and disagreements that result from contract non-compliance and misinterpretation throughout the life-cycle of the project. However, developing the smart construction contract in the first place will be no small undertaking – standard construction contracts need to provide for risk allocation and administration of a wide range of physical, economic, and legal issues.

As we contemplate the future role of technologies like blockchain in ADR, it is interesting to note the rise of hybrid ADR approaches, such as Med-Arb, in certain sectors and regions. This may result in a change to standard dispute resolution practices. Med-Arb merges mediation's focus on collaborative resolution with the decisive nature of arbitration. The process starts with mediation and, if unresolved, transitions to arbitration for a binding decision. This approach, offering a blend of collaboration and decisiveness, presents an innovative option for complex construction disputes.

Alongside these developments in ADR methods, the role of Artificial Intelligence (AI) is becoming increasingly significant. The integration of AI into ADR suggests a future where technology not only supports, but enhances dispute resolution.

In the construction industry, known for its complexity and multilayered challenges, AI can revolutionise how disputes are managed. By leveraging data analysis, predictive modelling, and algorithmic decision-making, AI can offer deeper insights, predict potential conflicts, and even suggest resolutions. This could streamline the dispute resolution processes, making them more efficient and effective, particularly regarding intricate construction projects with numerous variables and vast data sets.

However, the integration of technologies like blockchain and AI in ADR is not without its challenges. Practical issues such as scalability, data security and the need for industry-specific customisation pose significant hurdles. The construction industry requires tailored solutions that these technologies are still adapting to. Moreover, the legal and regulatory frameworks surrounding blockchain and AI are evolving, necessitating cautious navigation. Understanding and overcoming these challenges is crucial for the effective implementation of these technologies in construction dispute resolution.

While embracing these technological advancements, it is crucial to recognise the enduring relevance of traditional ADR methods such as arbitration, adjudication, expert determination, and mediation in the construction industry. These time-tested practices, deeply rooted in legal and contractual expertise, continue to be the backbone of dispute resolution internationally. The integration of technologies like blockchain and AI should be viewed as complementary tools, enhancing rather than replacing the established

practices of these ADR methods. Maintaining the balance between tradition and innovation is key to addressing the diverse and complex nature of construction disputes, ensuring that the solutions remain grounded in practical, industry-specific realities.

In conclusion, the ADR landscape in construction is poised for significant evolution. Traditional methods like arbitration, adjudication, expert determination, and mediation form the foundation but are now on the cusp of being augmented by technologies like blockchain and AI. While these innovations promise to bring greater efficiency, transparency, and adaptability, their integration is still in the early stages.

As we stand now, the construction industry has the opportunity to leverage these tools, shaping a future where dispute resolution is transformed to meet the complexities of modern construction challenges. It is pertinent to mention, in the spirit of embracing innovation, that the drafting of this very article was assisted by artificial intelligence.

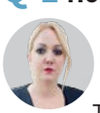
This approach not only highlights the use of new technologies in our field but also underscores how they complement our established practices. By investing in understanding the potential and limitations of these tools, construction parties can navigate the transformation effectively, ensuring that they are well-equipped to harness the benefits of these advancements while mitigating potential risks. The future of construction dispute resolution lies in the successful integration of tradition and innovation, and the industry must be prepared to embrace this change.

AN EXPERT IN ARBITRATION *vs* AN EXPERT IN EXPERT DETERMINATION

A conversation between Ashlea Read, Director and Quantum Expert, and Khalid Yousri, Regional Operations Director, Dubai, UAE.

Ashlea Read will answer the questions relating to an Expert in Arbitration, whilst Khalid Yousri will answer the questions relating to an Expert in Expert Determination. What are the differences between the two roles?

Q-1 How does the process start?



Expert in Arbitration:

The parties will have generally agreed a dispute process within a clause of the contractual agreement. In the example of arbitration, the process usually starts with one party giving notice to the other of its intention to arbitrate a dispute. The clause will generally set out the seat of the arbitration which will determine the procedural rules. There are usually two ways for an expert in arbitration to be appointed, either by party appointment or via an arbitral institute.

Generally, under common law jurisdictions, party appointed experts are more common, whereas under civil law jurisdictions it is more common to have an expert appointed by the tribunal or an arbitral institute.

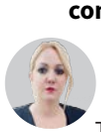
Expert in Expert Determination:

It is generally dictated by the terms set out in the contractual agreement which may incorporate an expert's term of reference, or from a separate ad-hoc agreement that the parties enter into later, which can be tailored to suit their needs.

However, unlike other forms of alternative dispute resolution, for example arbitration, there are no statutory rules governing the expert determination procedure.

In the Middle East, the trend of inclusion of expert determination prior to progressing to a formal dispute resolution is becoming more popular in construction contracts.

Q-2 How long does the process take from commencement to decision?



Expert in Arbitration:

The duration of an arbitration will be dependent upon various factors and as such the length of arbitration can vary greatly. There is no one answer as to how long an arbitration may take. The various factors may include the availability of the arbitrator(s) and the legal counsel, the number and complexity of the issues, and the number of witnesses required, both expert and factual.

Expert in Expert Determination:

The expert determination process is usually quicker than arbitration or litigation. The period will be dependent upon the number of issues and the complexity of the issues that the expert is required to determine. For a sizable dispute, it is normal for this to take between two to four months.

Q-3 What is the Expert Role and duty?

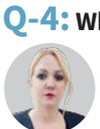
Expert in Arbitration:

To provide a professional opinion on the matter in dispute based on their field of experience and knowledge. The purpose of the expert is to provide an independent and unbiased opinion to assist the tribunal in reaching its decisions regardless of who pays its fees. Experts enable the tribunal to understand issues that are outside of its area of knowledge. The expert should not advocate a party's case.

Expert in Expert Determination:

The role of the expert is to act impartially and to allow each party the opportunity to be heard by the other party. The expert determiner would reach a decision by considering the presented evidence and applying their expertise. It is important to establish that the appointed expert is not an expert witness or an arbitrator.

Q-4: What does the process usually involve?



Expert in Arbitration:

This usually involves producing several independent reports as per the instructions provided by the appointed counsel and pursuant to the tribunal's requirements. This may also involve a joint report with the opposing expert to try to narrow down the number of issues in dispute, again to assist the tribunal.

The expert may then be required to provide oral testimony in a hearing, which is a chance for the parties to present their evidence to the tribunal and to test that of the other party.

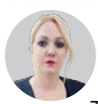
Expert in Expert Determination:

The process is usually agreed between the parties. However, generally, the process includes submissions by the parties, the number of which are usually stipulated within the agreement.

The expert determiner then proceeds with reviewing the documents and may issue requests for information or have meetings with the parties in case of further clarifications.

Thereafter, normally the expert determiner would proceed with its final determination; however, and depending upon the nature of the agreement, the determiner may issue an interim determination to allow the parties to comment prior to proceeding with its final determination.

Q-5: How does the Expert deal with the issues outside its area of Experience, and/or, Expertise?



Expert in Arbitration:

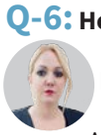
The simple answer is, it should not... Generally, the expert's CV will be appended to its reports, allowing the tribunal to understand the expert's evidence and level of expertise on the subject matter.

If an expert has provided evidence outside of its area of expertise, not only will the expert be made to feel particularly uncomfortable in cross examination but, and more importantly, the tribunal may choose to disregard part or all of the expert's testimony.

Expert in Expert Determination:

Subject to the terms of the ad-hoc agreement, the expert determiner may delegate issues outside of its area of expertise to other experts. Any involvement of other experts should be communicated to the parties and the proposed experts should be approved.

Q-6: How does the decision get enforced?



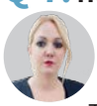
Expert in Arbitration:

An arbitration award is determined by a tribunal based on the merits presented by each party. Following the issuance of the award, enforcement can only come through the court system. However, it is important to note that the rules governing the arbitration and the applicable law may affect the recognition and enforcement of an award.

Expert in Expert Determination:

Enforcement usually depends upon what is agreed between the parties in the terms of reference. Generally, most expert determinations I have been involved in have been non-binding. In instances where it is agreed by the parties that the award is binding then it can usually be enforced through court proceedings.

Q-7: How does the decision get challenged?



Expert in Arbitration:

There are several ways to challenge an arbitration award and most countries in the world allow arbitration awards to be challenged, although circumstances are usually limited. The two most common grounds for challenge are that the tribunal did not have jurisdiction to make the award or irregularity on the part of the tribunal.

Expert in Expert Determination:

The ability to challenge depends mainly on the nature of the determination as per the agreement. If the determination is non final, and non-binding, then there is nothing to challenge, assuming that such a determination is not admissible later in formal dispute proceedings. However, if the decision is final and binding, there is usually a timeline for how and when the decision can be challenged. This usually starts by issuing a notice of dissatisfaction and then proceeds to the dispute resolution process contained within the contract agreement.

Q-8: What are the main pros of the process?

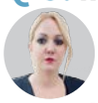
Expert in Arbitration:

1. Party appointed experts are usually selected for their area of expertise to assist the tribunal.
2. A strong report together with solid oral evidence can make a significant impact on a party's position (may improve it).
3. Tribunal appointed experts may appear to possess a greater capacity to remain impartial in their opinions.
4. The expert can provide a simple understandable approach and explain complex information and data to assist the tribunal.

Expert in Expert Determination:

1. It is quicker than other forms of dispute resolution.
2. An expert determination can be used whilst a project is still ongoing (in a shorter period than arbitration) which allows the parties to focus on completion of the project.
3. It can provide an indication as to the likely outcome for the parties prior to a formal dispute.
4. It may facilitate an early commercial settlement.
5. It is usually more cost effective than a formal dispute process.
6. It can be a flexible process, tailored to suit the nature of the dispute(s).

Q-9: What are the main cons of the process?



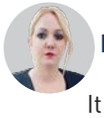
Expert in Arbitration:

1. Party appointed experts may sometimes be considered as advocates for the party who appointed them.
2. Lack of coordination between the party appointed experts.
3. Differing instructions provided to each expert within the same discipline.
4. Tribunal appointed experts are not always trusted by the parties.
5. An early appointed tribunal expert may not have appropriate expertise given that the tribunal may not be aware of all the issues in detail.

Expert in Expert Determination:

1. The parties may opt for a non-binding determination which could be seen as a waste of time and money.
2. Lack of substantive submission by either party can cause the expert determination to identify weaknesses in the party's position, which may assist the opposing party if the dispute is referred to alternative dispute resolution later.
3. The expert determination may lack the analysis of the legal aspects of the dispute leading to incomplete decisions.
4. The process is generally not reinforced by statute.
5. Not suitable if there is significant disagreement over the interpretation of legal matters assuming the expert determiner has no legal background.

Q-10: Any final words?



Expert in Arbitration:

It is important to involve an expert from an early stage to help develop the most effective independent opinion and to allow sufficient time for the expert to undertake appropriate research, as well as ensure that information and data is collated by the parties early for adequate analysis.

Expert in Expert Determination:

Often, expert determination is used to narrow the disputes between the parties and is an effective process for the parties to understand their position as set out by an independent third-party. This allows the parties to make a more considered decision before proceeding to formal dispute. Given that the process is confidential, it also safeguards commercially sensitive data and can assist in maintaining good commercial relationships.

RECORDS: CONTEMPORANEOUS PROGRAMMES

Adrian Stan, Associate Director, London, UK

No matter how much one stresses the importance of records, claims fail because of a lack of available records or substantiation. In this article, I discuss the issue and importance of contemporaneous programme records from the delay analyst's point of view.

As a starting point, I have looked at the definition of the words "contemporaneous" and "records", in order to better understand their role and importance in the context of a construction project.

WHAT IS A RECORD AND WHAT DOES CONTEMPORANEOUS MEAN?

There are several definitions given by the Oxford English Dictionary for the word "record"[1], of which two in particular catch my attention, those being:

- '**1.** A piece of evidence about the past, especially a written or other permanent account.'; and
- '**2.** A person or thing's previous conduct or performance ...'.

The Oxford English Dictionary defines "contemporaneous"[2] as:

- 'existing at or occurring in the same period of time'.

In essence, contemporaneous records refer to all documents which have been prepared and issued by the parties to a contract (and others) throughout the project duration. These documents are not limited to a single document type or format.

Whilst there isn't an exhaustive list of records to be kept on a construction project, all forms of contract contain references to particular records that have to be produced and issued – these should therefore form what I consider to be the minimum level of records to be retained by a party to that contract, with those documents being supplemented by many other forms of records on a daily basis. Taken together, project records might include: programmes, progress reports, site diaries, minutes of meetings, emails, drawings, instructions, payment applications and certificates, invoices, timesheets etc. The list is seemingly endless! But the gulf between what should be recorded and what is recorded is often substantial, and this is where the difficulties begin.

1. Concise Oxford English Dictionary, ed. by Angus Stevenson and Maurice Waite, Twelfth ed. (New York: Oxford University Press Inc., 2011), s.v. "record"
2. Concise Oxford English Dictionary, ed. by Angus Stevenson and Maurice Waite, Twelfth ed. (New York: Oxford University Press Inc., 2011), s.v. "contemporaneous"

> ***Every party to a project is required to (and will have made allowance to) prepare records. So, prepare and submit them at the required time.***

CONTEMPORANEOUS PROGRAMME RECORDS

In general terms, programmes can be categorised as baseline (or master) programmes, revised baseline programmes, and updated (or progress) programmes, albeit the specific wording used to define these programmes can vary depending on the form of contract chosen and the location of the project.

A baseline programme, or master programme, represents the initial programme approved and agreed between either the Employer/ Project Manager/ Contract Administrator/ Engineer and the Contractor, or the Contractor and its Subcontractor. The first programme is often referred to as the baseline programme, as it represents the scope of the works and the contractor's planned intent at the start of the works. This serves as a comparison upon which changes to the scope of works, variations and the effects of events can be measured. Ideally, a revised baseline programme should be updated at regular intervals to show the effects of progress and changes to the scope of the works, and the revised baseline programme approved as a realistic programme for the delivery of the remaining works with the Employer, the Employer's Agent, or the Contract Administrator/ Engineer.

A revised or updated baseline programme is needed when, for example, there is a change to the original scope of works. In these types of circumstances, the parties to a contract should take a proactive attitude and acknowledge that good contract administration and project management practice requires this matter to be formally addressed within the revised baseline programme - this should set out the realistic plan for completion of the remaining works, and thereby avoid potential time related disputes. Adopting a "wait and see" approach does not serve any party (or the project more widely), as ignoring the change, or leaving it too long to prepare a revised baseline programme to reflect that change, only makes it riskier to progress and manage the project, and more difficult to deal with any issues, claims and/or disputes which might arise. A myriad of issues can unfold just because the conduct of the parties was not in line with the requirements of the contract, or good project management practice more generally.

Updated or revised baseline programmes must reflect progress and the as-built information at regular intervals throughout the lifetime of a project. The revised baseline programme can then be compared to the baseline programme so that the variance between the contractor's original planned intent and the current intent can be measured. These intervals are often monthly and reflect the point in time the contractor formally assesses the progress of the works. The date of these intervals is sometimes referred to by project planners or schedulers as data dates or cut-off dates. The date that the baseline programme is updated is usually a critical point, for example the end of a month, or another contractually required date, when the contractor (or the subcontractor) is required to record and report the progress achieved at site.

The NEC form of contract does not use the wording of updated programmes, but revised programmes. Unlike other forms of contract, e.g. JCT or FIDIC, the NEC sets out specific instructions as to what is required to be shown on each revised programme and how often a revised programme has to be submitted to the Project Manager for acceptance – all set out under clause 32 'Revising the programme'.

In the JCT 2016 (Standard Building Contract with Quantities) and FIDIC, there is no definition as to how often an amended or revised programme has to be prepared. However, given that any notice of delay has to be given to the Architect/ Contract Administrator and must include details as to the cause and extent of such delay, it is common sense that such programmes should be prepared at monthly intervals as a minimum.

These updated or revised programmes are prepared by the contractor, and are checked (and approved, if appropriate) by the Employer or Employer's Agent (JCT), Project Manager (NEC), or the Contract Administrator (JCT). Based on my experience, depending on the project location and project team, implementing and following a regularised process of submitting updated/ revised programmes and their approval can vary greatly, with some teams following the process diligently, and others not at all. These programme updates, prepared throughout the lifetime of a project, are of valuable importance when carrying out delay analysis. As these programmes were prepared at various (and hopefully regular) points in time, they will form part of the weekly or monthly progress reports and as such become contemporaneous programmes which can be relied upon. The key point being that the critical path is being reported at the time, and as such the critical and near-critical works can be identified by the parties. Any extension of time (with or without prolongation costs) and/ or the liability for liquidated damages is determined following a critical path analysis. The onus is on the contractor and/ or subcontractor to demonstrate and substantiate said entitlement; properly updated and accurate contemporaneous programmes are crucial for achieving this.

Without doubt, every project across the world, to some extent or other, will have to deal with claims and/ or disputes that must be resolved.

For this reason, the ability to reference and rely on up to date programmes which reflect the prevailing scope of works (including both baseline/master and updated programmes) is of utmost importance. This is both for the assessment of the impact of delay events upon completion, and to determine the most appropriate method of analysis to use in identifying the impact of delay events upon overall completion. The more frequently the programme is updated to reflect the current status of the works and the effects of change on the project, the more accurate the results of the analysis are likely to be.

This, ultimately, aids the parties in reaching agreement on the causes of delay when negotiating the final account at the end of the project.

The regular updating of the programme to reflect the progress of the works during the duration of the project results in greater accuracy when identifying the causation and effect of delay events and changes, the correct allocation of responsibility for the delay and the risks held between the parties.

CONCLUSION

In my opinion, the key points to consider, are:

1. Know and understand your contract and ask your relevant departments to familiarise themselves with this. The contract is the 'holy book' of any project.

2. Every party to a project is required to (and will have made allowance to) prepare records. So, prepare and submit them at the required time, and keep them in a readily accessible and organised format.

3. Substantiation – there is a requirement to demonstrate or to determine entitlement (time or cost, or time and cost) which falls back on the availability and quality of records kept.

4. Show consistency and clarity in the information which goes into the records.

London, UK

FORMULAIC APPROACHES TO THE QUANTIFICATION OF PRICE ESCALATION

Robbie Beattie, Associate Director, Teesside, UK

INTRODUCTION

Having spent the last eight years in the Middle East, I have recently returned back to my roots in beloved Newcastle. Whilst I left the UK with no children, I have somehow managed to return home with my better half and two kids (a three-year-old and a five-year-old!).

Making sure the family home is fit for purpose has been a high priority, resulting in frequent visits to the local builders' merchant and Greggs for a quick pasty lunch. These experiences tell me something has significantly changed, especially when it comes to paying for goods and services.

The construction industry has often been faced with unique challenges, but price escalation has become a particular concern due to recent global factors. Formulae based approaches can offer a relatively straight-forward way to calculate price escalation, but only if a mechanism is included in the contract agreement. The reality is that most construction contracts do not include an agreed formulae to deal with price escalation. Accordingly, my article explores the use of formulae when a contracting party is looking for potential solutions to significant price escalation challenges the industry has faced in recent years. I have decided not to discuss the thorny issue of force majeure and will stick to my role of being a QS.

1. https://www.ship-technology.com/features/global-shipping-container-shortage-the-story-so-far
2. https://www.iea.org/commentaries/what-is-behind-soaring-energy-prices-and-what-happens-next
3. https://www.iss.europa.eu/content/europes-energy-crisis-conundrum

BACKGROUND TO GLOBAL FACTORS

The COVID-19 pandemic led to sharp price increases due to changes in supply and demand from services to goods[1]. This significantly impacted the construction and engineering industries on a global scale. This was compounded by unplanned maintenance works and shutdowns at global energy producing plants[2]. Further, increased demand and unfavourable weather conditions led to a decrease in energy production and volatile increases in energy prices[3]. Most recently, the Russia-Ukraine War has resulted in unprecedented increases in materials and energy prices as sanctions have been imposed[4].

ABNORMAL PRICE ESCALATION

Published statistical data shows that recent sharp price increases do not reflect typical price increases that were experienced in prior years. For example, the Construction Producer Price Index (CPPI) and Construction Cost Indicator (CCI) published by Eurostat[5] show that abnormal price escalation related to construction activities has been observed during the last three years as follows[6]:

4. https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/739366/EPRS_BRI(2023)739366_EN.pdf
5. https://ec.europa.eu/eurostat/statistics-explained/SEPDF/cache/51867.pdf
6. The CPPI is a European Union (EU) business cycle indicator that measures the prices of construction activities (new residential buildings). The CCI shows the trend in materials, labour, equipment and energy costs of new residential buildings in the EU.

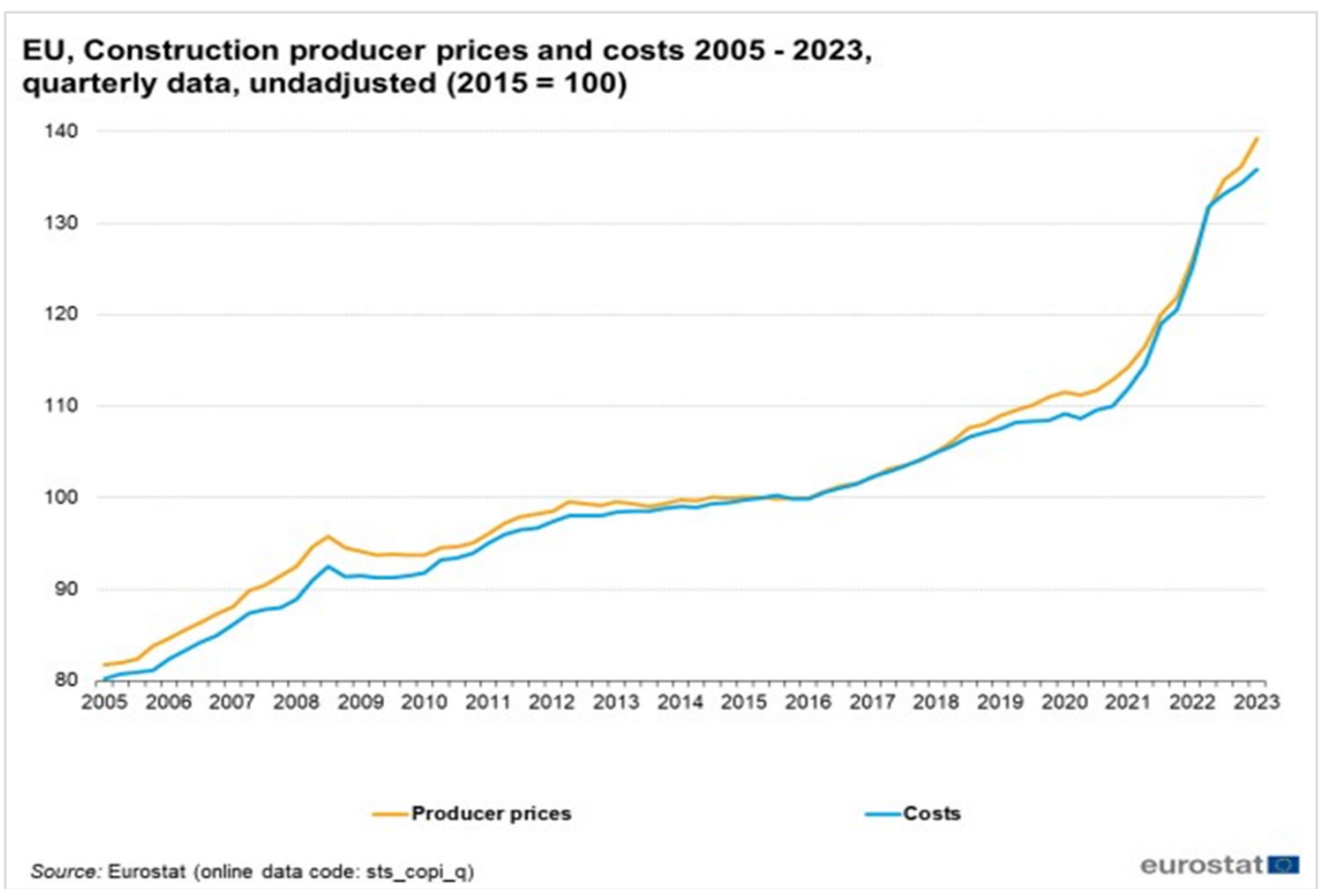


Figure 1 – Eurostat Construction Producer Price Index

Statistical data collated by Eurostat also reveals that purchasing prices for typical commodities used in construction abnormally increased by between 23% and 60% from September 2020 to September 2023, compared to the previous three years[7]. This is set out as follows:

7. https://ec.europa.eu/eurostat/databrowser/view/sts_inppd_m$defaultview/default/table?lang=en

S. No.	Commodities	Period 1 (2017-08 to 2020-08)	Period 2 (2020-09 to 2023-09)	Abnormal Increase
1	Mineral Wool	6.71%	35.19%	28.47%
2	Concrete	8.20%	31.30%	23.09%
3	Steel	-6.61%	53.33%	59.94%
4	Gypsum	8.20%	31.30%	23.09%
5	Bricks & Tiles	5.82%	44.39%	38.57%
6	Wood	1.09%	29.15%	28.06%
7	Copper	-0.38%	40.05%	40.43%
8	Glass	3.41%	38.98%	35.57%

Table 1 - Price Escalation for Sampled Commodities

Accordingly, the quantification of price escalation, whether for cost and value monitoring or for the purpose of seeking relief under a contract or governing law, has become increasingly important for contracting parties in recent years.

CONTRACTUAL RISK OF PRICE ESCALATION

The default position for many construction contracts is that the risk of price escalation is borne by the contractor, rather than the employer. Construction contracts often state that adjustments for changes in cost do not apply or more simply, that the contract price is fixed for the duration of the works. Unfortunately, contractors are sometimes burdened with heavy losses as a result of incurring more cost than originally budgeted for.
In the absence of explicit contractual clauses that permit adjustments in cost, then contractors may only be able to construct a case whereby the reason that the contractor has suffered losses is the result of an employer risk event under the contract that entitles the contractor to recover its losses.

For example, where the contractor has suffered delay as a result of an employer risk event, and that risk event entitles the contractor to recover cost, then the contractor may be entitled to recover the associated damage or the additional cost incurred for the specific employer risk event. In such cases, the recovery of damages or additional cost incurred is unlikely to be demonstrated through the use of formulae.

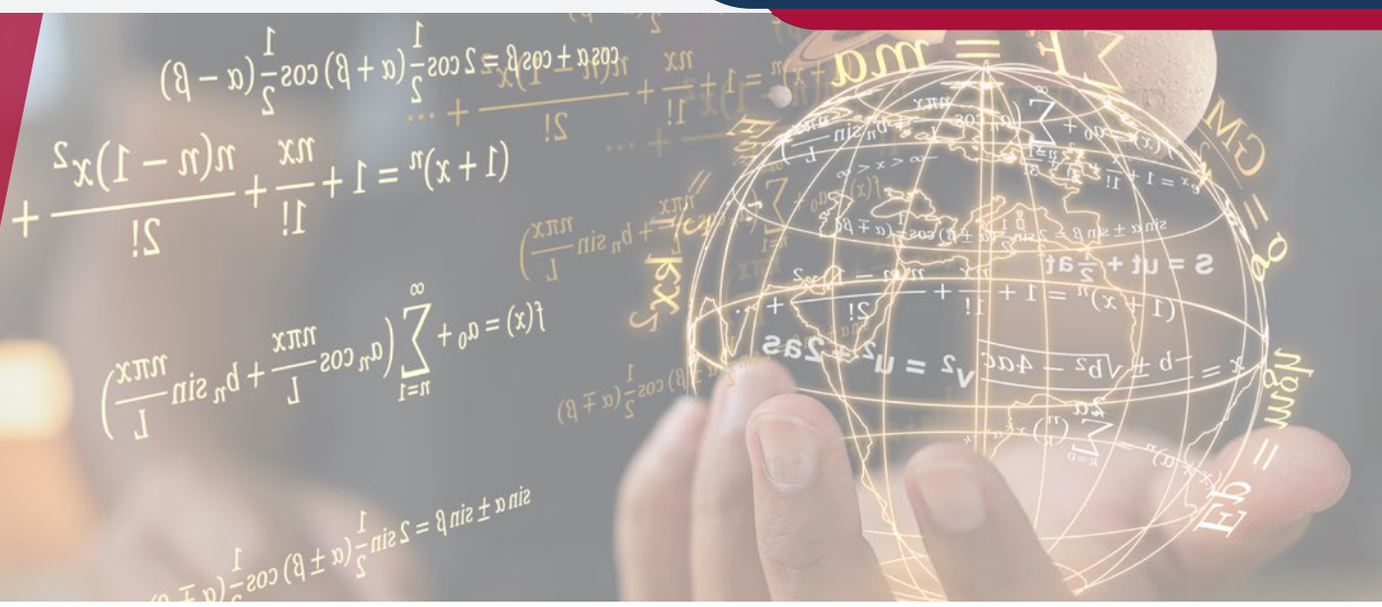
PRICE ESCALATION FORMULAE

Some construction contracts do include clauses whereby the quantification of price escalation using formulae is accepted. For example, Sub-Clause 13.8 [Adjustments for Changes in Cost] of the FIDIC Red Book 1999 and secondary option X1 for the NEC4 contracts (Options A, B, C and D) offer formulae to calculate price escalation. These formulae often contain two main variables that require careful consideration by contracting parties before agreeing on formulae in construction contracts.

(1) Proportions of the Contract Price Subject to Price Escalation

Price adjustment formulae often set out the proportions of the Contract Price that can be adjusted and the proportions that cannot be adjusted due to price escalation. This information is normally included on a percentage basis in a table of data in the appendix to the contract. For example, a table of data may show that the adjustable proportions of the contract price are labour, materials and equipment on a 20%, 50% and 15% basis respectively, and the non-adjustable proportions that are not subject to price escalation are 15%. Some of these proportions may be broken down further, such as steel for reinforcement and concrete for foundations.

The proportions described in the table of data should therefore reasonably reflect the proportions included in the contractor's priced estimate of the works. For example, if the contractor's estimate of the works for a mechanical and electrical project included 20% for steel pipes and 30% for cables and wires that are subject to adjustments, then this data should be accurately reflected in the table of data for the agreed formulae.



(2) Reference Price Indices

Consideration should also be given to the reference price indices used in the quantification of price escalation. These indices should be applicable in terms of relevance, reliability and geography i.e., the locations where the goods were purchased from. For example, for a construction project located in Europe, it may be advisable to adopt indices that collate specific data in European countries, such as Eurostat, rather than from the Federal Reserve Economic Data which may contain data more relevant to the United States of America.

Further, if an aggregated price index is used, then the data collected by the statistical body should be relevant to the works being undertaken by the contractor[8]. For example, an aggregated index for residential house building in the UK, may not be appropriate for a structural steel frame project or a roads and infrastructure project located in Norway.

SUMMARY

Recent global events have put a spotlight on the impact that price escalation can have on construction projects. Price adjustment formulae offer a pragmatic way to calculate rises and falls in prices without the burden of establishing actual losses incurred, but only if an agreed mechanism is included in the agreement.

Careful consideration must be given before contracting parties enter into a construction contract so that an appropriate formula is included.

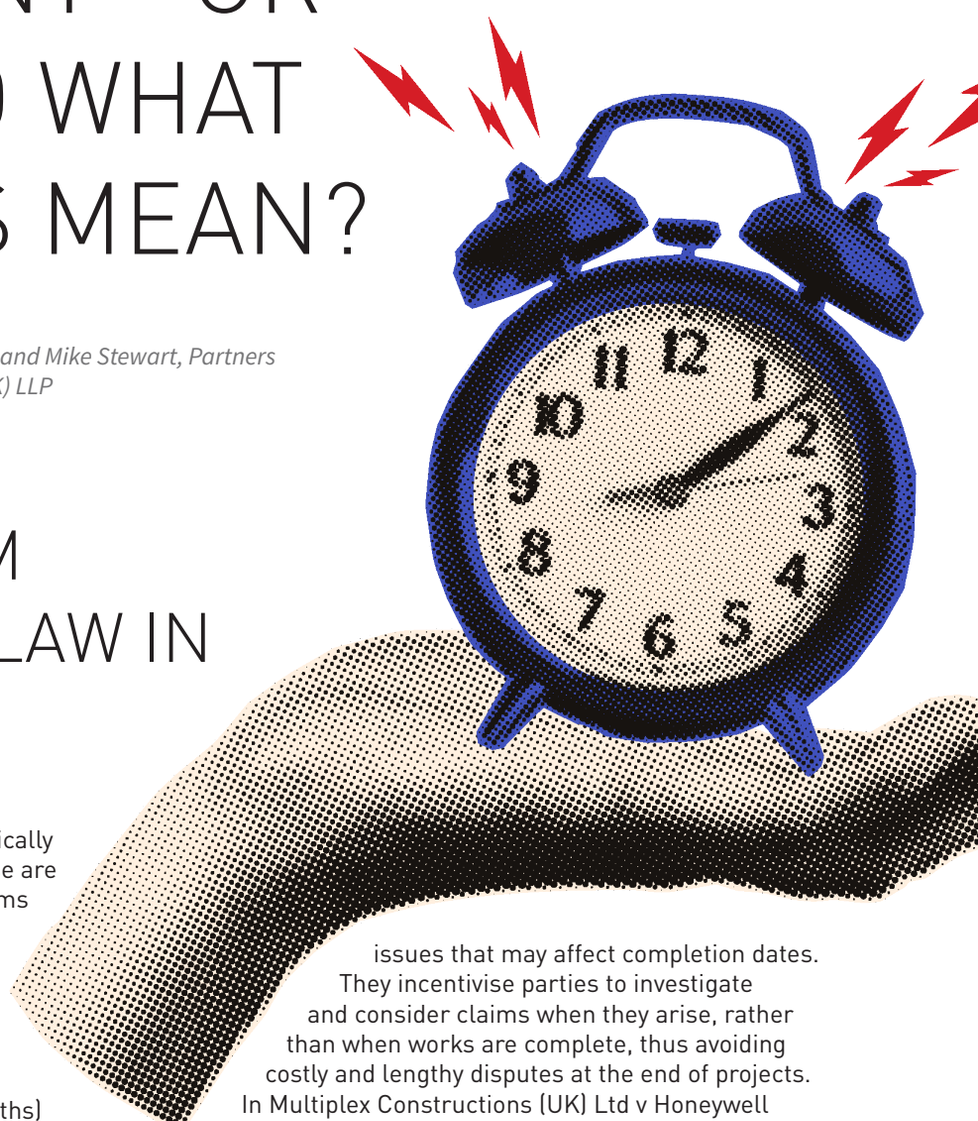
When contracting parties have not included a price escalation mechanism in their contract, then it will be necessary to substantiate the actual damage or additional cost incurred as a result of an employer risk event. This would normally require extra effort than simply relying on an unagreed formula, as an accurate quantification of actual losses incurred will be needed. The general rule that the asserting party must prove an actual loss has been incurred as a consequence of a breach of contract will apply. In the absence of a contractually agreed formula, a third-party dispute resolver will apply the conventional approach of understanding the duties of each party under the contract, decide whether a given party has committed a breach of contract, and then ascertain the damages flowing from the breach. Unagreed formulae and indices may assist with settlement negotiations, but they will not be sufficient in front of a third-party tribunal.

Practitioners should therefore obtain expert advice on the suitability of a formulaic approach for the quantification of price escalation when agreeing construction contracts. Likewise, if you are experiencing a significantly delayed project caused by another party to the contract, but do not have the benefit of an escalation provision, there may be other avenues to explore that could mitigate the effect of price escalation. Ultimately, success always depends on what your contract says and the specific facts of your project.

8. Aggregation means the process of combining or adding different sets of statistical data to obtain a higher level of statistical data.

TIME BARS:
ARE THEY CONDITIONS PRECEDENT - OR NOT - AND WHAT DOES THIS MEAN?


Jessica Tresham and Mike Stewart, Partners
Gowling WLG (UK) LLP



LESSONS FROM RECENT CASE LAW IN ENGLAND

Construction and engineering contracts typically contain clauses known as "time bars". These are clauses which set a time limit by which claims must be notified.

Time bars historically applied to claims by contractors for extensions of time or additional payment, requiring them to give notice of a claim within a set time period (usually measured in days, rather than months) after they become aware, or should have become aware, of the event or occurrence giving rise to the claim. Time bars have more recently been applied in respect of claims by employers – Clause 20 in the FIDIC Red / Yellow Book 2017, for example, contains a time bar which applies to both contractor and employer claims.

WHY USE TIME BARS?

Time bars facilitate efficient contract and claims management by ensuring that early warning is given of issues that may affect completion dates. They incentivise parties to investigate and consider claims when they arise, rather than when works are complete, thus avoiding costly and lengthy disputes at the end of projects. In Multiplex Constructions (UK) Ltd v Honeywell Control Systems Ltd,[1] Jackson J (as he then was) summarised the proposition as follows:

"Contractual terms requiring a contractor to give prompt notice of delay serve a valuable purpose; such notice enables matters to be investigated while they are still current. Furthermore, such notice sometimes gives the employer the opportunity to withdraw instructions when the financial consequences become apparent."

1. Multiplex Constructions (UK) Ltd v Honeywell Control Systems Ltd [2007] EWHC 447 (TCC)

TIME BARS: CONDITION PRECEDENT (OR NOT)?

A question which often arises is whether a time bar amounts to a "condition precedent". If it is, it will exclude entitlement if a claim is not notified within the relevant timeframe, irrespective of the merits of that claim.

The effect of a failure to comply with a time bar – if it constitutes a condition precedent – may prove significant and result in otherwise valid claims being barred. It is therefore vital to be aware of their effects and how to operate them properly.

CONDITIONS PRECEDENT UNDER ENGLISH LAW – A RECENT REMINDER

The English Technology and Construction Court (TCC) has issued a recent reminder of the rigorous standards that will be applied under English law to conditions precedent in Tata Consultancy Services Ltd v Disclosure and Barring Service [2024] [2].

The dispute arose out of an IT modernisation project which DBS engaged TCS to complete in 2012. The project was beset by delays from an early stage. TCS claimed around £110 million in delay damages, and DBS counterclaimed for delay as well as claims arising out of the quality of the software.

One of the issues addressed in the wide-ranging judgment was responsibility for delay. TCS contended that the main causes of critical delay were the lack of availability of technical infrastructure, and mismanagement of DBS' IT hosting provider. DBS argued that the cause of delay was TCS' delayed development and testing of the software.

THE RELEVANT DELAY / NOTICE PROVISIONS

The contract entitled TCS to relief from delay damages (and to recover its own losses) where delay was due to an "Authority Cause", provided it served:

- a notification of delay "as soon as reasonably practicable" if it became aware that it would not (or was unlikely to) achieve a milestone date.
- an "Exception Report" within 5 working days of its delay notification.

DBS argued that that this constituted a condition precedent, and failure to comply meant that TCS would not be entitled to compensation for delays attributable to an "Authority Cause".

Conversely, where delay to a milestone was due to "Contractor default", TCS became liable to pay delay liquidated damages. In such a scenario, the Authority was required to "promptly" issue a Non-conformance Report. The clause provided that the Authority "will then have" the option to claim delay liquidated damages.

TCS argued that this meant that DBS' entitlement to recover liquidated damages was also conditional upon compliance with this clause.

TCC DECISION

Constable J comprehensively reviewed the English authorities on conditions precedent, helpfully distilling the authorities into the following key points:

- The overriding principle remains that every contract must be construed according to its own particular terms.[3]
- There is nothing as a matter of principle to prevent parties freely agreeing to a condition precedent, but parties will not be taken to have agreed that the exercise of a particular right to payment or relief is subject to a condition precedent absent clear wording to that effect.
- English law will uphold conditions precedent provided that they (a) specify a precise time limit for serving notice; and (b) expressly provide that the right to claim will be lost if the notice is not served within that time limit.[4]
- The use of language of obligation (e.g. "shall") is necessary, but will not on its own be sufficient to render a provision a condition precedent.
- The absence of the words "condition precedent", is not "determinative against construing the regime as one of condition precedent".
- The absence of any language expressing a clear intention that the particular right is conditional upon compliance with a particular requirement is, however, likely to be a "powerful indicator" that the parties did not intend the clause to operate as a condition precedent.

2. https://www.bailii.org/ew/cases/EWHC/TCC/2024/1185.html#_Toc165305378

3. Scottish Power UK PLC v BP Exploration Operating Company Ltd [2016] All ER 536

4. Bremer Handelsgesellschaft mbH v Vanden-Avenne Izegem PVBA [1978] 2 Lloyd's Rep 109

- The "requisite 'conditionality' may be achieved in a number of different ways using different words and phrases when construed in their ordinary and natural meaning".

- The clearer the wording of the requirement to be complied with (in terms of substance and / or timing), the more consistent it will be with the conclusion that the clause forms part of a condition precedent regime.

In this case, the "plain language" of the relevant clause made compliance with the notice regime a condition precedent to TCS's entitlement to compensation for delays which were due in whole or in part to an "Authority Cause". However, the condition precedent applied only to the contractor's entitlement to compensation for such delays. Failure to comply with the condition precedent regime did not impact upon its entitlement to other forms of "relief" including an extension of time and relief from liability for both general and delay damages.

In relation to DBS's entitlement to claim delay liquidated damages, Constable J also found that the claim was barred by reason of DBS's failure to serve Non-conformance reports. The wording of the relevant clause was "very clear...DBS is required ('shall') to 'promptly issue a Non-conformance Report'." It concluded that: "The AUTHORITY will then have the options set out in Clause 6.2". The entitlement was found to be "clearly linked" to the service of a Non-conformance report, through the conditional phrasing of 'If....then....'".

On the facts of this case, DBS was still able to advance a claim for unliquidated or general delay damages for the delays exceeding 6 months. However, this turned on the wording of the applicable delay provisions – in different circumstances, all entitlement might have been lost.

KEY TAKEAWAYS AND APPLICATION OF TIME BARS INTERNATIONALLY

Time bars are typically found within international construction and engineering contracts. Irrespective of the governing law of those contracts, the guidance contained in the TCS v DBS decision will be highly relevant to the practical application of those clauses, although the "good faith" provisions of some Civil Code jurisdictions may dilute the otherwise strict effect of conditions precedent.


The Royal Courts of Justice

NAVIGATING OPERATIONAL AND MAINTENANCE RESPONSIBILITIES IN PETROCHEMICAL EPC CONTRACTS

Unravelling the complexities and avoiding disputes in the completion phases

Sergey Pleshakov, Associate Director, Dubai, UAE

SETTING THE STAGE: AN OVERVIEW OF PETROCHEMICAL EPC CONTRACTS

The fundamental principle of an Engineering, Procurement, and Construction (EPC) Contract for the delivery of an oil, gas, or petrochemical facility is that a contractor is obligated to deliver a fully operational facility to an owner. This facility must perform to the specified guaranteed levels, and all costs associated with delivering such a facility are included in a lump-sum turnkey contract price. The completion process of a petrochemical facility (a plant) necessitates the commencement of production to conduct operational and performance testing. Achieving the performance guarantees stipulated in the contract during the normal and steady operation of a plant can be time-consuming. The fine-tuning of an already-producing plant can also be a complex and prolonged task. The discovery of defects or deficiencies during commissioning and testing can extend the completion phase from several months to several years.

> ***A typical EPC contract contains several clauses or separate articles to govern completion phases […] upon the completion of each phase, and satisfying all all prerequisite requirements, a completion certificate is issued by the owner for each milestone.***

DECODING THE PHASES: A DEEP DIVE INTO A TYPICAL PETROCHEMICAL EPC CONTRACT

A typical petrochemical EPC contract is structured around the following main phases: engineering, construction, mechanical completion, pre-commissioning, commissioning, Ready-For-Start-Up (RFSU), introduction of hydrocarbons and/or catalysts, performance tests, and initial (or provisional) acceptance of a plant. Initial acceptance occurs upon the successful achievement of minimum and/or guaranteed performance levels.

The final acceptance of a plant usually occurs after the completion of a defect liability period and releases the contractor from most of its obligations under the contract. Typically, initial or provisional acceptance is a major milestone that must be achieved within the contractually prescribed time for completion.

Achieving initial acceptance relieves the contractor from its obligation to complete the project within the agreed time and pay liquidated damages in case of delays and/or failure to achieve performance levels. The final acceptance usually takes place after the expiration of a defects liability period and might require conducting other tests such as licensor or lenders' tests, but it is not linked to liquidated damages either for delays or achievement of performance guarantees. The performance tests might also include lenders' tests and can form so-called completion tests, which are the prerequisite requirement for initial acceptance.

A typical EPC contract contains several clauses or separate articles to govern completion phases such as mechanical completion, commissioning, RFSU, performance testing, and initial acceptance. Upon the completion of each phase and satisfying all prerequisite requirements, a completion certificate is issued by the owner for each milestone.

THE FINAL HURDLE: CHALLENGES AT THE COMPLETION STAGE OF PETROCHEMICAL PROJECTS

The completion milestones of a petrochemical project, such as commissioning, RFSU, and performance testing, are the most complex and problematic processes. The planned process of Ready-For-Start-Up, and then starting up all systems and sub-systems of a plant, can be delayed by the non-performance of some equipment, which can force the plant's completion to a prolonged halt. In reality, after introducing hydrocarbons and chemicals into the process equipment, which enables operational testing of various systems and sub-systems, a petrochemical facility commences producing its intended product, for example, polymers, ammonia, or refined oil products. Upon starting up and beginning production, it is not always possible to easily shut down the facility without incurring significant losses. All systems should be filled with feedstock and chemicals when producing or be preserved with specific substances such as nitrogen. An owner is usually eager to commence the much-anticipated stage of commercial production. The cyclical nature of the process means that the commercially ready product would be accumulated in storage. After a gradual start-up, a facility would need to run for several weeks to achieve conditions for conducting performance testing. The product export lines and loading facilities can only be fully tested after the plant commences production of commercially graded product. This means that commissioning and testing of a plant coincides with the commencement of commercial operation and logistics. The project lenders are normally pushing for the facility to start producing as they need to see returns on their investment. The commencement of commercial operation provides much-anticipated relief for the owner and project lenders, especially if the project was delayed.

UNRESOLVED ISSUES: IDENTIFYING AND ADDRESSING PROBLEMS IN PETROCHEMICAL EPC CONTRACTS

Complex petrochemical projects are prone to delays. Upon reaching the Ready-For-Start-Up milestone and introducing hydrocarbons into the systems, a facility practically commences production. The bespoke EPC contracts do not always expressly provide for parties' operation and maintenance responsibilities upon achieving completion milestones. At the same time, contractors are keen to reduce costs and demobilise staff, as at the completion stages the main focus for a contractor is to complete and leave the construction site as soon as possible. The typical EPC contract structure described above envisages achieving several completion milestones in a timely fashion. During this achievement of the final completion milestones, a facility commences

production. The owner stores a product and begins to sell the product before the facility achieves initial acceptance. Normally, the EPC contracts contain a statement that the owner is entitled to retain any revenue obtained from the operation of the plant, whether before or after initial acceptance. It is quite common that a petrochemical facility can be around 99% complete but still lack all the requirements for initial acceptance. In the case of defects, such a prolonged completion stage can easily span for 2-3 years.

During this time, the multiple systems comprising the facility must be maintained and/or preserved. The owner's team de facto operates the plant upon completing the required training during the Ready-For-Start-Up commissioning. However, the contractor's responsibility for care and custody stretches up to initial or provisional acceptance. The contractor would have to keep its operating and maintenance resources (or pay vendors and subcontractors) until the initial acceptance certificate is issued. Upon achieving RFSU and gradually ramping up production, the contractor would be looking to demobilise most of its resources.

In the case of prolonged delays to initial acceptance certification, the contractor might refuse to maintain equipment and/or refuse to provide its resources for fixing any operational issues.

The contractual care and custody responsibility does not include operational maintenance or repairs of something that was caused by operating the plant. At some point, the contractor might argue that it is more economical to shut down the plant and put it into preservation rather than continue incurring maintenance costs. An agreement is normally reached on a common understanding that the owner is producing and selling a product and therefore should take over and fully operate and maintain the plant.

Contractually, this means that the contractor's care and custody responsibility ceases before the initial acceptance certification. Common sense prevails upon contractual provisions, but both parties might still be looking to claim its costs should other matters delaying initial acceptance crystallise as a formal dispute.

TOWARDS BETTER CONTRACTS: ENHANCING CLARITY AND EFFICIENCY IN EPC CONTRACT DRAFTING

As discussed above, a petrochemical EPC contract is typically structured around achieving certain milestones where initial or provisional acceptance serves as a major completion milestone manifesting time for completion under the contract. During the negotiation stages, it appears that the contract drafting envisages that all major milestones are achieved smoothly from one to another without delays or problems. However, in many petrochemical projects, this is not the case. Ordinarily, there is no separate contract provision that guides the respective responsibility of the parties in relation to operating and maintaining the facility/plant during each completion phase leading up to initial acceptance. The operation and maintenance of a plant are supposed to be covered by 'care and custody' and 'loss and damage' to the works provisions. But what happens if the facility has been producing for some time, but the owner is unable to issue the initial acceptance certificate to the contractor and such a period is prolonged for a year or two? When drafting contractual clauses that guide completion phases, parties should expressly provide criteria for accepting custody and care as well as transferring operational and maintenance responsibility.

The draftsmen should carefully follow the technical side of things and prepare for any eventuality in the complex process of completing the petrochemical facility. Delays to achieving initial acceptance inevitably increase costs for both parties, and parties seek to limit their exposure to potential maintenance costs. Once the facility reaches 100% of the guaranteed production levels, the operation and maintenance obligations should be transferred to the owner.

A contract should be clear on the parties' risk and responsibilities distribution related to the operation and maintenance of the plant prior to, during, and after achieving all major completion milestones. Specific attention should be given to the completion phase when the facility has commenced production. It is advisable to include a separate article or clause guiding the contractor's care of the works and the process of transferring the responsibility for care to the owner, and a separate clause for the transfer of operational and maintenance responsibilities.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MEET THE EXPERT

EUAN GEDDES

Euan recently joined the Technical team at Diales, and he is based in our London office.

A Chartered Architect with over 30 years' experience, Euan is accredited by both RIBA and RIAS as an expert witness, and has testified in the High Court (TCC).

We caught up with Euan in this Q&A, to get to know more about his background and how he got to his current position.

Q-1 What is your role at Diales?

I am a Technical Director in the architectural team at Diales, and I am an Expert Witness.

Q-2 Who has been the greatest influence on your career?

I have been lucky to work with a number of influential people during my career. In particular, I had the privilege of working with Christopher Miers for a few years prior to his untimely passing in early 2023.

Chris was recognised for his expertise in construction dispute resolution, particularly acting as an expert witness in construction-related legal matters. He founded the specialist architectural and engineering firm of Probyn Miers in 1998 and established it as a leading firm for forensic analysis, dispute avoidance, and dispute resolution. Chris's reputation in dispute resolution was well-deserved and his contribution was immense. I found him to be one of the most complete experts I have ever met. He was meticulous in his work and always ensured that his opinions were objective and balanced. He was generous with his time and happy to share his skills and expertise. Moreover, he was unfailingly charming, interesting, and good company. I cannot think of a better role model.

Q-3 What has been the best moment of your career?

As a job running architect, I was lucky to work on a host of rewarding projects with some extremely talented people. This included a wide variety of projects - from residential and retail developments to one of the most sophisticated energy-from-waste projects in the UK.

However, a personal career highlight was making the leap from traditional architectural practice to expert witness work as it involved me having to learn a host of new skills at a mature age!

Q-4 What makes you tick?

At work: the challenge of disentangling complex and difficult cases to reach opinions which I consider to be fair, balanced, and robust. I often find that cases unfold and develop while working through them, sometimes with surprising results. I also get satisfaction from giving clients or instructing solicitors the information that they need to know, even if it not necessarily what they were hoping for.

At home: most types of music, ... apart from jazz!

Q-5 Tell us a little-known fact about you.

I completed the World Marathon Majors series of races (Berlin, Boston, Chicago, London, New York, and Tokyo) in 2018, running each marathon in under 3 hours. At the time, fewer people had completed the race series than had climbed Mount Everest.

Q-6 What are you looking forward to in your new role at Diales?

I am excited to have joined an established team of respected architectural experts. As well as contributing to the work of the team, I want to play my part in attracting new clients and developing new work streams. I would also like to continue to grow and develop as an architectural expert, including involvement in international arbitrations.

METHODS OF CALCULATING DISRUPTION

Mark Murphy, Director, Singapore

Due to numerous events in the last 5 years[1], multiple opinions have been published by various construction and legal professionals regarding the calculation and recovery of time and/or costs for disruption.

This article will identify some of the more common methodologies for calculating disruption on construction projects.

CALCULATION METHODOLOGIES

Production output is a measure of what is actually produced. Whereas productivity loss (e.g. disruption) is experienced when the planned rate of production is not achieved using the planned resources allocated to a particular task.

This means, the contractor will likely need to expend more resources to achieve the same unit of output as initially intended, thus causing the contractor to incur additional costs.

Example one

If a contractor achieved 100% of its production target but utilised twice the resources than planned, then while the contractor would achieve the target production, such an achievement would be made by utilising resources at a 50% efficiency rate.

1. For example, the COVID-19 pandemic, USA / China trade-war, the Russia / Ukraine war, the Israel / Gaza war and the Red Sea attacks

Example two

If the contractor did not increase the quantity of its resources, then it would likely take twice the planned duration to complete such works, and cost twice as much as originally anticipated.

While the contractor will be forced to incur the same level of increased costs in the examples above, in Example two, the contractor does not appear to have mitigated the durational effects of the event that reduced its rate of production by 50%.

Should the contractor intend to recover the costs associated with the event that resulted in the 50% reduction of the production rate, example no. one, then a prudent contractor would seek to utilise a calculation methodology that is widely recognised within the construction industry and/or internationally to evaluate the extent of such an event, before calculating the quantum of said event(s).

In the International Recommended Practice No. 25R-03 ("IRP No. 25R-03"), the Association for the Advancement of Cost Engineering ("AACE") consider:

… there is no uniform agreement within the construction industry as to a preferred methodology of calculating lost productivity. There are, in fact, numerous ways to calculate lost productivity. …

In section C.1 of the IRP No. 25R-03, the AACE provide a list of different methodologies it considers are appropriate for calculating lost productivity, as brought about by a disruption event:

Project Specific Studies

- Measured Mile Study
- Earned Value Analysis
- Work Sampling Method
- Craftsmen Questionnaire Sampling Method

Project Comparison Studies

- Comparable Work Study
- Comparable Project Study

Speciality Industry Studies

- Acceleration
- Changes, Cumulative Impact and Rework
- Learning Curve
- Overtime and Shift Work
- Project Characteristics
- Project Management
- Weather

General Industry Studies

- U.S. Army Corps of Engineers Modification Impact Evaluation Guide
- Mechanical Contractor's Association of America
- National Electrical Contractor's Association
- Estimating Guides

Cost Basis

- Total Unit Cost Method
- Modified Total Labor Cost Method
- Total Labor Cost Method

Productivity Impact on Schedule

- Schedule Impact Analysis

In paragraph 18.13 (Guidance Part B) of the Society of Construction Law ("SCL") Delay and Disruption Protocol 2017 ("Protocol 2nd edition"), the SCL provides different methodologies it considers are appropriate for calculating lost productivity, as brought about by a disruption event:

Productivity-based methods

1. Project-specific studies
   (a). Measured mile analysis
   (b). Earned value analysis
   (c). Programme analysis
   (d). Work or trade sampling
   (e). System dynamics modelling
2. Project-comparison studies
3. Industry studies

Cost-based methods

1. Estimated vs incurred labour
2. Estimated vs used cost

In the absence of any uniform agreement within the construction industry regarding a preferred methodology of calculating lost productivity, this article has blended the methods set out in IRP No. 25R-03 and the SCL Protocol 2nd edition, to explain the methodologies commonly implemented to calculate disruption on construction projects.

PRODUCTIVITY BASED METHODS

1. Project-specific studies
Measured mile analysis

A commonly used method of calculating the effects of lost productivity, as brought about by a disruption event. This method of analysis compares the production output of identical activities during two different periods of time: a period when the disruption event did not occur (non-affected period); and a period when the disruption event did occur (affected period).

This method considers the effect of production loss during the affected period, compared with actual production typically achievable during non-impacted periods. Normal productivity fluctuations caused by, amongst other things, the contractor's own inefficiencies and non-claimable risk, such as inclement weather, are not usually addressed in this form of analysis.

Earned value analysis

This calculation methodology involves the comparison and analysis of the following cost concepts:

- Planned value (i.e., budgeted cost for the schedule/ programme works);
- Earned value (percent completed x budget cost of a unit of work); and
- Actual cost (how much was spent producing a unit of work).

These factors can be analysed to study project performance in terms of production, schedule / programme budget, and cost, typically via the following industry accepted formulas/indices[2]:

- Cost performance index = Earned value ÷ Actual Cost;
- Schedule performance index = Earned value ÷ Planned Value;
- Schedule variance (earned working hours or cost – budgeted working hours or cost); and
- Cost variance (earned working hours or cost – actual working hours or cost).

Calculated schedule and/or cost variances can be analysed to determine if any production/cost inefficiencies might be demonstrated to be related to the loss of production. For example, if planned and actual man-hours are used, and there is a 17.5% production loss, then where the contractor planned to expend 100,000 man-hours, the works would have taken 117,500 man-hours to complete.

An "Earned Value Analysis" greatly depends on the quality of the contractor's records, and its demonstration requires a feasible resource loaded baseline master schedule/programme, with planned and marked-up production progress, matched to the budget.

Fully detailed records of production, and man-hours utilised along the baseline schedule/programme of each work activity being studied, would need to be analysed in detail. Success in the use of this method will depend on full and detailed project production records being available.

Work/trade sampling method

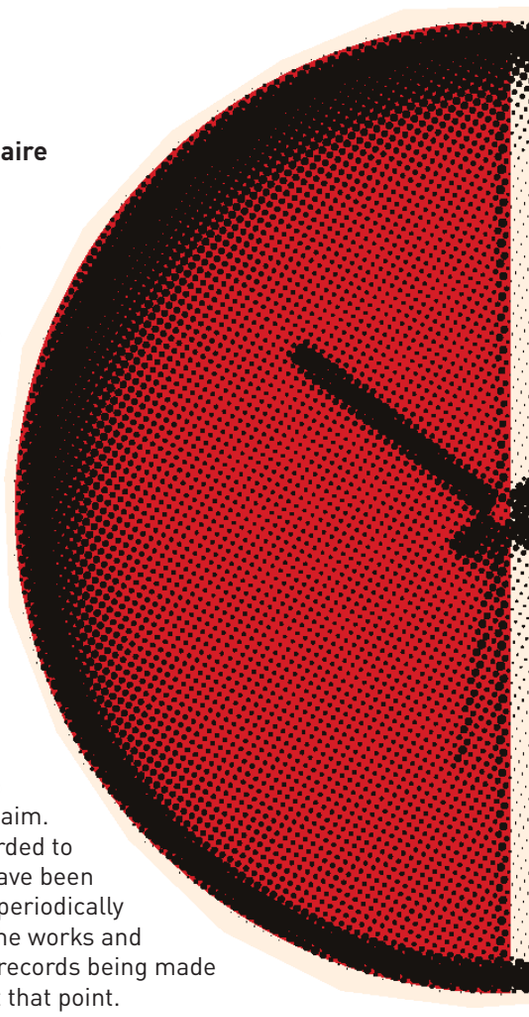
Typically, this method requires transparent studies, or a series of production tests, that record a normal or reasonable rate of production for a controlled portion of the works. The study typically breaks the activity down into its detailed components and the time normally taken for each component.

This test-controlled rate of production, if determined to be reasonable, will be a comparison of the average production rate that can be achieved during a normal period of construction, and the production rates during disrupted periods.

Craftsman questionnaire sampling method

This method examines productivity noted by tradesmen or supervisors during the disrupted period, that explains the specific reasons for the loss of production.

The method is heavily reliant on diligent records taken during construction, such as daily diaries/ production charts. While not entirely accurate or scientific, the contemporary records can be used to support a disruption claim. More credibility is afforded to these records if they have been exchanged regularly / periodically by the parties during the works and any corrections to the records being made jointly by the parties at that point.



Project-comparison studies

While the other party rarely agrees that the comparisons in these methods are realistic, they can be useful to support productivity loss estimations using other methods.

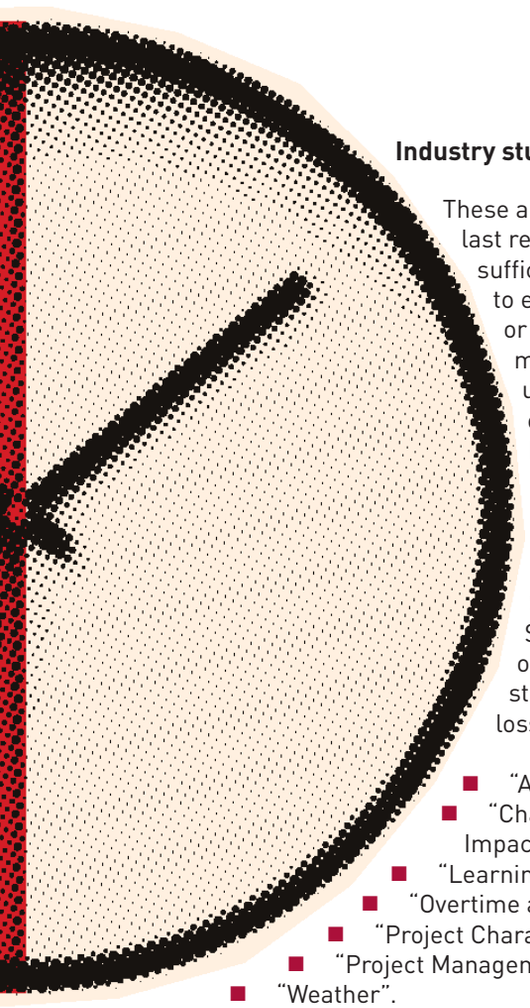
Comparable Work Study

This method involves an estimation of productivity loss on the disrupted work activity, and then comparing this to similar work activities on the same project that were known to be unimpacted (i.e. completed without disruption).

Comparable Project Study

This method resembles the "Comparable Work Study" but involves the comparison with a similar unimpacted work activity on the same project but done by another contractor.

2. https://www.pmi.org/learning/library/practical-calculation-schedule-variance-7028



Industry studies

These are often used as a last resort in the absence of sufficient project records to enable project specific or project comparison methods, or to back up other methods of evaluation, that have been employed.

Speciality Industry Studies

Speciality Industry Studies makes use of specific industry studies on productivity loss, such as:

- "Acceleration";
- "Changes, Cumulative Impact and Rework";
- "Learning Curve";
- "Overtime and Shift Work";
- "Project Characteristics";
- "Project Management"; and
- "Weather".

General Industry Studies

This calculation makes use of industry-wide publications and manuals, such as:

- U.S. Army Corps of Engineers Modification Impact Evaluation Guide;
- Mechanical Contractor's Association of America;
- National Electrical Contractor's Association; and
- Estimating Guides.

COST BASED METHODS

In the absence of any other method of evaluating productivity loss, there are options to use the following alternative methods, to examine the actual man-hours associated with direct labour and costs.

Total Labour Cost Method

The estimated cost of labour, less the actual cost of labour, the difference being the production overrun cost.

Total Unit Cost Method

The difference between the labour cost per unit of work of an impacted period, less the labour cost per unit of work of a non-impacted period.

Modified Labour Cost Method

Same as the "Total Labour Cost Method" less allowances for known amounts such as excessive bid prices and inefficiencies not related to the disruption. This approach attempts to exclude unrelated inefficiency and is therefore the most preferred cost-based method.

CONCLUSION

Recollecting the common saying that 'no two construction projects are the same', it is similarly true for the effects of two disruption events. However, given the similarities between construction projects and disruption events, the means of understanding and calculating the extent to which a disruption event has affected a construction project, can be adjusted and replicated across projects.

Being that each project, its records, and disruption events are fundamentally different, it is practically impossible to recommend or prescribe the use of one specific calculation methodology over another. However, when attempting to calculate how much disruption has occurred, it is always advisable to use contemporaneous records to substantiate the calculation; thereby providing the most robust calculation possible, as that should in theory, improve the likelihood of the claim being accepted.

Should your project have experienced an event that you consider disrupted the works, and you require assistance in evaluating the extent of such disruption, Diales has experienced professionals worldwide, who are both able and willing to help.

THE ESSENTIAL GUIDE TO PUNCHING SHEAR

Rob Gray, Operations Director, London, UK

Avoiding punching shear is essential to the safety and stability of a concrete slab structure. This article delves into the basics of punching shear to demystify the concept.

WHAT IS PUNCHING SHEAR?

Punching shear occurs in reinforced concrete structures, particularly in slabs or flat plates. When loads, such as the weight of a building and its occupants, act on a slab, it results in a concentrated force which at certain points can result in a unique type of stress known as punching shear, usually around a column. Imagine a pen beneath a sheet of paper. When the paper is pushed down the pen causes a build-up of stress in the paper around the point of contact. It is possible for this pressure to build up to the point that the pen punches through the paper, in the same way as a column might punch through a slab.

THE SCIENCE BEHIND PUNCHING SHEAR

Reinforced concrete comprises a combination of concrete and steel reinforcement bars (known as rebars). The concrete provides the compressive strength, while the rebars enhance tensile strength. Together, they create a robust composite material.

In a concrete slab, columns or supporting elements transfer loads to the slab. However, at the connection between the slab and these supporting elements, there is a vulnerability to punching shear. The concentrated force at these points can exceed the slab's capacity to withstand the load, leading to failure. The failure is usually 'brittle' in nature, in that it can be sudden and without warning. Brittle failure is to be avoided, as the impending failure is not obvious and therefore capable of fatal consequences.

Punching is one of the least understood forms of structural action in concrete design, and as a result, understanding has been built-up through testing. Code of practice (COP) recommendations have essentially been developed on an empirical basis.

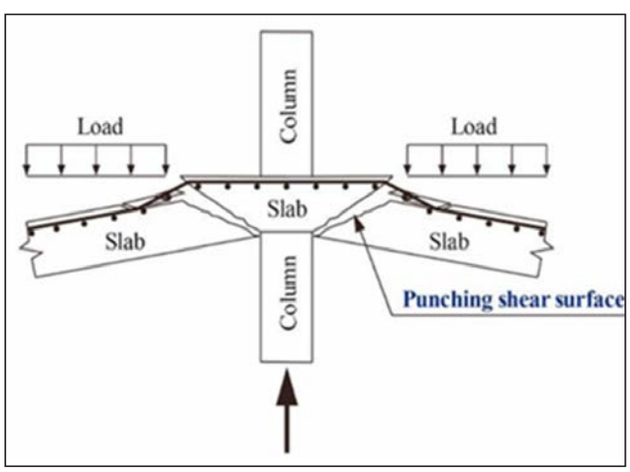


Figure 1. Schematic diagram showing the loads and a potential punching shear failure plane.

All COP guidelines deal with punching shear resistance in the same way, namely determining the stress at a control perimeter around the loaded area (commonly the connection point between the column and slab). The distance from the perimeter to the loaded area varies by COP.

KEY FACTORS INFLUENCING PUNCHING SHEAR

Several factors influence the occurrence of punching shear in a concrete slab. The first is the design of the slab itself – its thickness and the arrangement of reinforcement bars play a pivotal role. Thicker slabs generally have a higher capacity to resist punching shear, while well-placed reinforcement bars can distribute the load more effectively.

The layout of columns and the distance between them also influence punching shear. If columns are too closely spaced, the load on the slab is concentrated in smaller areas, increasing the risk of punching shear. On the other hand, wider column spacing allows for a more even distribution of loads, reducing the likelihood of failure.

PREVENTING PUNCHING SHEAR

Engineers employ various design and construction techniques to prevent or mitigate punching shear in concrete structures. One common approach is the inclusion of shear reinforcement, often in the form of stirrups or inclined bars. These reinforcements act as a safety net, distributing the load across a broader area and preventing the concentrated forces that lead to punching shear.

Figure 2 – This image shows the steel reinforcement for a slab around a column prior to the pouring of concrete.[1] *The triangular-shaped bars improve the slab's resistance to punching shear locally around the column.*

Additionally, selecting an appropriate slab thickness based on the intended use of the structure is crucial. Thicker slabs can handle more significant loads, providing a buffer against the risk of punching shear. In some cases drop panels may be appropriate, where the slab is locally thickened around the column.

Engineers also consider factors such as the type of concrete mix and the curing process to enhance the overall strength and durability of the structure.

REAL-WORLD EXAMPLES

Punching shear failure of flat slabs has caused serious accidents in the past. In 1997, Pipers Row car park in Wolverhampton collapsed due to a punching shear failure, exacerbated by deterioration of the concrete slab around the columns. The resulting loss of strength in the concrete made the slabs vulnerable to punching shear.

A more deadly failure occurred in Seoul in 1995, when the Sampoong Department Store collapsed, killing over 500 people. A series of design changes, including removal of columns, construction of smaller columns than the design envisaged, and increased plant loads on the roof, meant the floor slabs became more susceptible to a punching shear failure. Significant reforms to South Korea's building codes were enacted following the collapse.

More recently, the 2021 Champlain Towers South collapse, in Surfside Florida, also appears to have been partially caused by punching shear failure. Whilst the official investigation into the causes of failure has yet to be completed, poor maintenance, coupled with changes to the loading pattern of a pool deck and limited robustness of the structure have been postulated as potential antecedents to increased vulnerability of the structure to punching shear.

The three examples above have a common theme; the design and construction were (or has been alleged to be) insufficient, through inadequate COPs, design errors or unverified changes to the design. The structural frame was therefore vulnerable to punching shear failure and changes to the building over time, such as deterioration of the structure, in conjunction with inadequate maintenance or changes to loading patterns. This increased its vulnerability, and may have ultimately been behind the collapse.

CONCLUSION

In essence, punching shear is a phenomenon that demands careful consideration in the design and construction of concrete structures. It is an invisible force that engineers strive to overcome through thoughtful planning and innovative solutions. As we navigate the urban landscape, surrounded by buildings that stand tall, it is worth appreciating the science behind their stability, with the mitigation of punching shear being a key aspect in ensuring they withstand the test of time.

1. "File:Durchstanzbewehrung-Stahlbeton.jpg" by Get the picture is licensed under CC BY-SA 4.0. To view a copy of this license, visit https://creativecommons.org/licenses/by-sa/4.0/?ref=openverse

THE OPPORTUNITIES FOR AI AND DATA SCIENCE IN THE ANALYSIS OF CONSTRUCTION PROJECT DATA

Ibrahim Elsisi, Associate Director, Brisbane, Australia

AI (Artificial Intelligence) and more generally data science (which combines AI, machine learning, advanced analytics, maths, and statistics) are rapidly developing technologies that are becoming increasingly accessible. Most of us carry a Siri or Alexa around with us on our devices, and in late November 2022 OpenAI made its 'AI language tool' ChatGPT freely available to the mainstream. A study for the Swiss Bank UBS reported ChatGPT to be the fastest growing app in history[1], reaching 100 million monthly active users just two months after its launch. For comparison TikTok took nine months to hit that uptake; Instagram, two and a half years.

In response to the prompt 'what are the three biggest strengths of AI?' ChatGPT tells us:

"**1.** AI excels at processing and analysing vast amounts of data quickly and efficiently, enabling it to identify patterns, make predictions, and uncover insights that humans may not easily detect.

2. AI has the ability to automate repetitive and mundane tasks, freeing up human resources and allowing them to focus on more complex and creative endeavours.

3. AI can assist in solving complex problems by considering numerous variables simultaneously, providing optimized solutions and recommendations that can enhance decision-making processes. (sic)"

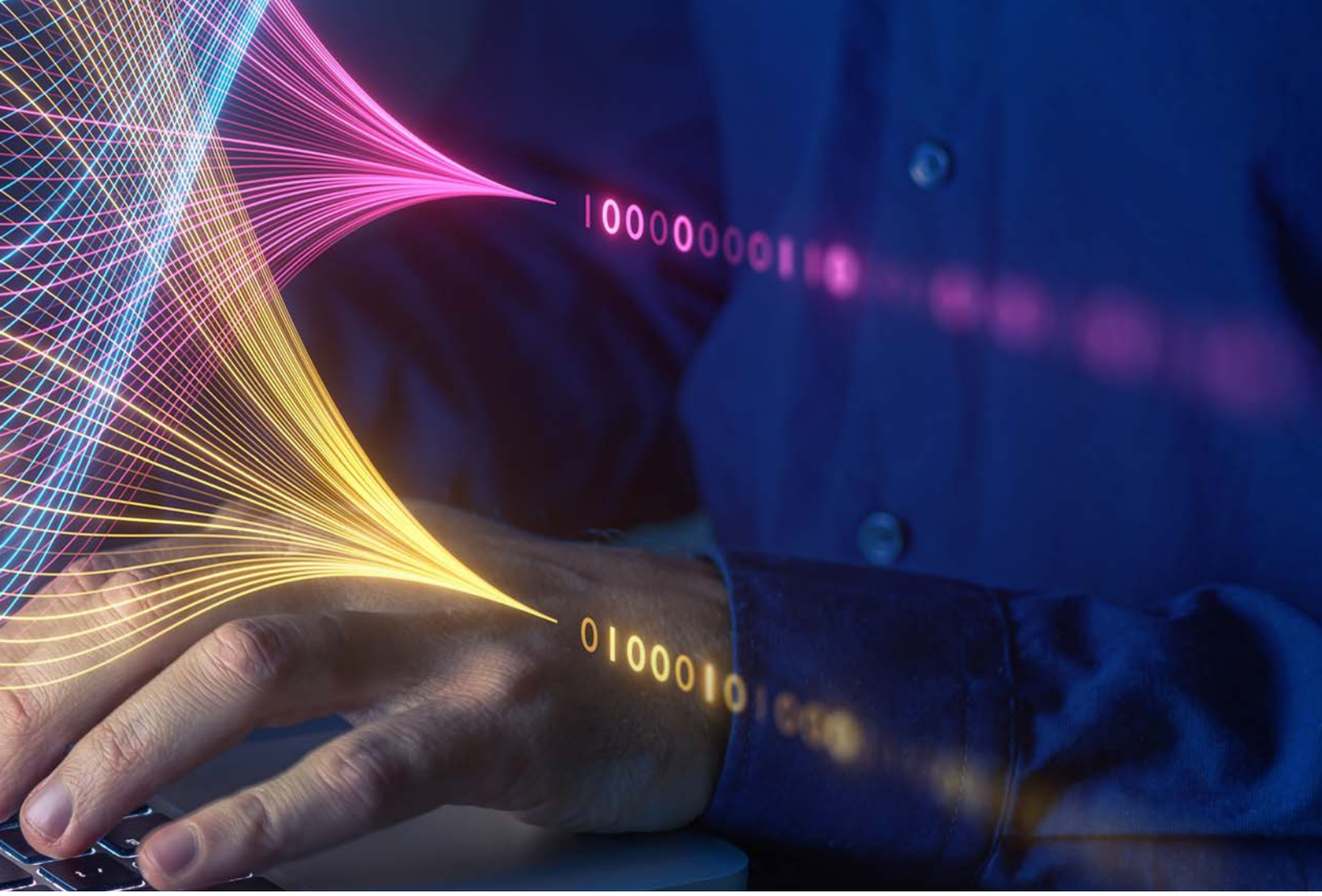
These strengths mean that AI and data science technologies offer immense potential to construction professionals. The construction industry is renowned for its complexity and scale, as are the disputes. Construction professionals face a dual challenge; the need for complex analysis on extensive documents and technical data, balanced with the requirement to present the results in a way that can be understood and practically applied. That is why construction professionals are turning to data science and, in more recent times, AI. Its strengths offer the potential to enhance efficiency and accuracy.

AUTOMATED DOCUMENT ANALYSIS: STREAMLINING INFORMATION EXTRACTION

Construction projects generate extensive quantities of data and documents. This includes contracts, correspondence, technical details and performance records. Traditional manual analysis of this data can be a laborious and error-prone task which is limited by cost driven predefined criteria.

AI-powered document analysis, Natural Language Processing (NLP) techniques and training AI models on

1 'ChatGPT sets record for fastest-growing user base'; February 2, 2023 - https://www.reuters.com/technology/chatgpt-sets-record-fastest-growing-user-base-analyst-note-2023-02-01/



large datasets of construction-related documents can automate this process, based on much larger predefined criteria or keywords given the overall lower costs when compared to manual analysis. For example, AI can be trained to automatically extract information related to specific project delays or variations. This automation saves time and equivalent costs, while freeing professionals to focus on thought-orientated tasks such as analysing and explaining the extracted information. Similarly, AI techniques can be applied to quickly identify discrepancies or inconsistencies between different documents (such as numerous revisions of a particular general arrangement drawing), identifying areas for deeper investigation.

PRODUCTIVITY TREND IDENTIFICATION: ANALYSING PAST PERFORMANCE AND FORECASTING FUTURE PERFORMANCE

Data science techniques provide construction professionals with insights into performance on a construction project and productivity trends. Regression analysis and machine learning algorithms can be applied to analyse the relationship between known project variables such as duration, resource allocation, cost, and productivity. Machine learning models trained on historical data can also provide predictions and forecasts for future performance, allowing professionals to anticipate risks and opportunities.

Techniques such as decision trees, random forests, and neural networks can quickly analyse various project factors and their impact on performance. These techniques help identify both short and longer term patterns and correlations, enabling professionals to make informed decisions and provide data-supported conclusions.

SCENARIO-BASED DELAY ANALYSIS: OBJECTIVE EVALUATION IN COMPLEX DISPUTES

Experience dictates that disputes arise from differences of opinion which are not necessarily based on fact. Data science and AI can play a crucial role in providing objective evaluations. For instance, by training AI models on historical project data and applying machine learning algorithms, professionals can simulate and evaluate different analysis methods based on the available data. A common application is the analysis of delays. AI models can analyze project schedules, performance data and other available details to assess the effect of disruptive events. By automating these analyses, professionals can reduce manual effort whilst providing evidence-based insights. The ability to run multiple scenarios offers a more objective analysis by reducing human bias and subjective preferences for certain approaches.

SIMPLIFYING TECHNICAL FINDINGS: EFFECTIVE COMMUNICATION FOR NON-TECHNICAL PARTIES

AI tools, when used appropriately, simplify complex technical information, aiding effective understanding and communication between stakeholders with varying technical skills. Decision tree algorithms provide step-by-step guidance through complex decision-making processes. Additionally, AI language tools such as ChatGPT can be prompted to generate plain language explanations and summaries. For example, ChatGPT's one-sentence summary of this paragraph is: "AI tools simplify complex technical information, guide decision-making, and generate clear explanations for effective communication." By simplifying complex technical language, AI tools enhance understanding, transparency, and inclusivity for all parties involved.

CAUTIONARY CONSIDERATIONS: LIMITATIONS AND HUMAN EXPERTISE

While data science and AI offer significant advantages in construction data analysis, it is important to be aware of their limitations and exercise caution in their use. AI's creative language limitations have been famously highlighted by Nick Cave[2] among others, and reliance on ChatGPT for legal research has recently landed a US lawyer in difficulty[3]. AI models can be influenced by biases in the training data, potentially leading to inaccuracies. Complex or ambiguous language may challenge AI's document analysis capabilities, risking misapplication of the nuances and context of construction-related documents. A leading criticism of nascent AI is that if it makes an error it often remains committed to that error, continuing to believe that it is right. Human professional expertise and judgment remain essential in verifying results and ensuring appropriate application.

The key to the successful use of data science and AI is the availability of relevant, reliable and consistent data. There is an old adage of "garbage in – garbage out" and the professionals need to be clear on the data being used to support the ensuing results.

CONCLUSION

Data science and AI integration have the potential to revolutionize the analysis of construction project data, particularly for dispute resolution. Automated document analysis streamlines information extraction, while productivity trend identification enables data-supported decision-making. Multiple scenario testing, objective evaluations, and simplification of technical findings promotes effective communication and informed, inclusive decision-making. Balancing AI's evolving capabilities with human professional expertise ensures effective data-supported outcomes, ultimately benefiting collaboration, reducing costs, and improving the construction industry.

Finally, the reliance on data science and AI has similarities to the reliance on a complex time schedule. If the output is 99% correct, the 1% that is incorrect can undermine confidence in the entire results.

Going back to the difficulties of the US lawyer, the BBC reported that the ChatGPT prepared filing referred to an example case that did not exist. It is likely that this was a very difficult position from which to recover in the eyes of the judge.

2. 'Nick Cave Slams AI Attempts at Nick Cave Songs'; January 16, 2023 - https://www.rollingstone.com/music/music-news/ai-chatbot-chatgpt-writes-song-nick-cave-style-1234661842/
3. 'ChatGPT: US lawyer admits using AI for case research'; 27 May 2023; A New York lawyer is facing a court hearing of his own after his firm used AI tool ChatGPT for legal research - https://www.bbc.com/news/world-us-canada-65735769

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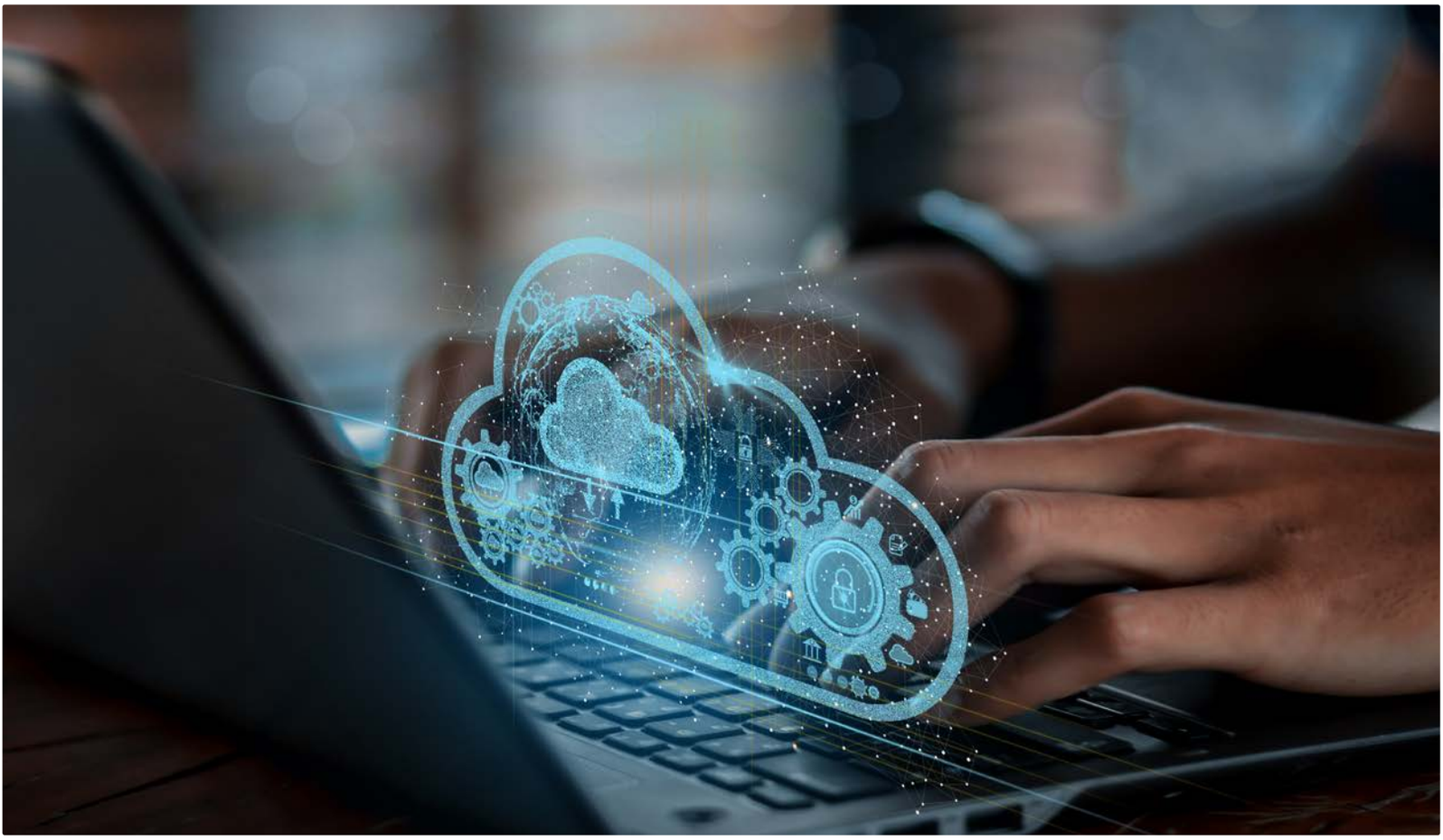

ARTICLE BYTE

The competing axis around which data centre size continually evolves.

Vincent Fogarty, Managing Director of Diales Technical, Quantum and Technical Expert London, UK

Data centres are also a fundamental part of the business enterprise, designed to support applications and provide services such as data storage, access management, backup, and recovery. Data centres also provide productivity applications, such as online meeting portals, e-commerce transactions and provisioning for online gaming communities. Recently big data, machine learning and artificial intelligence have prompted the growth of data centres.

Cloud computing is a primary driver of data centre growth. The cloud relies upon the pooling of data stored and then processed within the capabilities provided by the likes of Apple, Microsoft, Amazon, and Google. Users connect via Internet devices, and through the network's tentacles, data centres allow users access to the data they need. The data is in all formats, from audio files, photographs, and compute software. Data centres are the internet's core, and the cloud is only made possible by high-speed, resilient, and reliable networks. These cloud networks may be public, private, or commercial.

Following the rise of the Internet of Things (IoT) and Industry 4.0, manufacturers depend on big data analytics to enhance their operations' output efficiency and cost-effectiveness. The IoT usually refers to the instrumented world where IP[1] addresses are embedded in objects in the environment[2]. These "Things" are devices operated in their home or carried by people. Modern-built assets tend to have intelligent doors, lighting, and controls that all interface with IP addresses. All types of Bluetooth, RFID[3], GPS[4], vehicles and many more "Things" are connected by the network's tentacles.

1. An Internet Protocol address is a numerical label such as 192.5.2.1 that is connected to a computer network that uses the Internet Protocol for communication.
2. Greengard, S. (2015). The internet of things. Cambridge, Massachusetts: Mit Press.
3. AB&R (2019). What is RFID and How Does RFID Work? - AB&R®. [online] AB&R. Available at: https://www.abr.com/what-is-rfid-how-does-rfid-work/
4. www.merriam-webster.com. (n.d.). Definition of GPS. [online] Available at: https://www.merriam-webster.com/dictionary/GPS

The potential of a digital twin[5] that augments the creation of virtual reality offers the possibility to simulate all types of asset design and function scenarios, create extensive data, and compute demand.

Many IoT missions may require several locations for IoT data analysis and storage, including endpoint devices with integrated computing and storage; nearby devices that perform local computation; intelligent gateway devices; and on-premises data centres, managed to host sites, colocation facilities, and network providers' point-of-presence locations. The diversity of edge computing locations reflects the diversity of markets for IoT.

Several IoT deployments may end up storing, integrating and moving data across a combination of public cloud and other commercial facilities, including colocation sites, with both distributed micro-modular edge data centres and enormous centralised core data centres, including those of public cloud providers playing a role. Even within similar IoT applications, network architectures and data centre types may have various interfaces and data exchange paths, as shown in Figure 1.

However, more IoT devices have further generated data through Internet connections. The processing of mega quantities of data prompts the need for the internet via cloud computing because stand-alone technology does not have the capacity. The pivotal engine of this physical cloud computing infrastructure is data centres.

In this age of data, reports[6] indicate that there were 36 billion IoT devices installed worldwide by 2021 and a forecast of 76 billion by 2025. The generation of large masses of data affects the transactions also being captured, transmitted, stored, evaluated, and retrieved. Data centres house these treasuries of this internet age.

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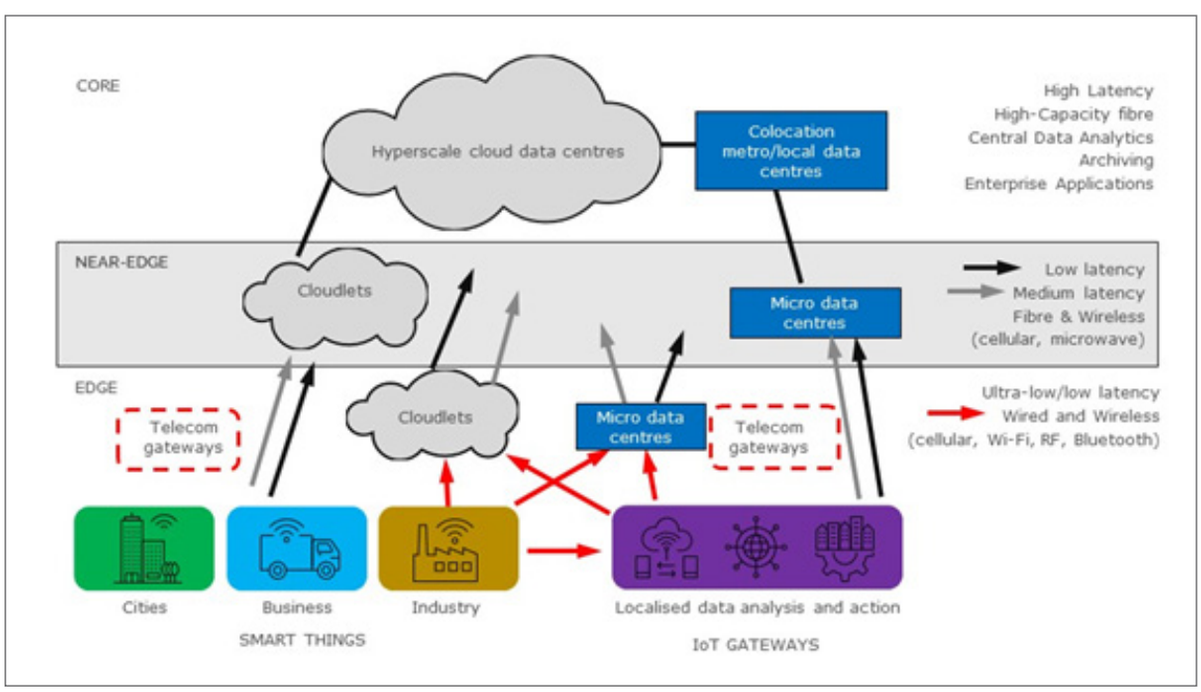

Figure 1 – Data Centre Interfaces with the Internet of Things (IoT)

The internet has primarily fuelled this sustained growth of data creation. The smartphone has been a big part of this growth.

5. Nath, S.V., Schalkwyk, P. van and Isaacs, D. (2021). Building Industrial Digital Twins Design, Develop, and Deploy Digital Twin Solutions for Real-World Industries Using Azure Digital Twins. Birmingham: Packt Publishing, Limited.

6. Statista (2012). IoT: number of connected devices worldwide 2012-2025 | Statista. [online] Statista. Available at: https://www.statista.com/statistics/471264/iot-number-of-connected-devices-worldwide/.

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