



UNIVERSITY OF
CAMBRIDGE

Construction Engineering Masters

Construction Engineering Masters Dissertation Conference

10 July 2026



www.construction.cam.ac.uk/education/cem



Construction Engineering Masters

The CEM programme was launched in 2011 with industry partner Laing O'Rourke to fulfil a shared vision of transforming the construction industry through innovation, education and technology.

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Welcome

A warm welcome to current students, lecturers, supervisors, colleagues, alumni and special guests to the 2026 Construction Engineering Masters (CEM) Dissertation Conference. Today is an important event in the CEM calendar. It provides the opportunity for us to share with you the insights emerging from the latest research conducted as part of the CEM over the past year. As you will see from today's schedule, a wide range of thought-provoking topics will be covered.

The CEM programme is in a unique position to support research that is highly relevant to industry. Our students—who are experienced practitioners—draw on their own knowledge and experience of professions connected to construction to shape a relevant topic for enquiry. We connect students with academic supervisors from a range of disciplines (including engineering, sociology, finance, law and management) to provide guidance. We very much encourage this mixing of disciplines; what results is an insightful blend of subject areas and findings, all of which can help improve the construction sector in a meaningful way.

Today you will be hearing from the 14th cohort of the CEM programme who are nearing the end of their research journey and are due to submit their dissertations at the end of July. This cohort have the opportunity today to present and test their findings with a wider audience as they enter the final stage of completing their research.

We have allocated some time for questions after each presentation and we encourage you to engage with the speakers to find out more about their research and its implications for the construction sector.

I hope that you enjoy the day and make the most of the opportunity to learn and network.

Thank you for joining us.

Prof Gavin Davies
CEM Course Director
June 2026

How the conference will work

In-person Participation

The conference is being held at the [Institute for Manufacturing](#), Alan Reece Building, 17 Charles Babbage Road, Cambridge, CB3 0FS, and also online. If you have requested parking, you will be sent details separately.

The venue opens at 08:30 for registration, and the conference will commence at 09:00. The day is split into four sessions – each session containing five to six presentation slots. Each presentation slot is 15 minutes (10 minutes for the student presentation, followed by 5 minutes of Q&A), with one minute for changeover between each speaker to allow time for AV set up.

21 students from the fourteenth cohort of the Construction Engineering Masters will deliver presentations on their dissertation research, which span a wide range of topics and themes. Questions from the audience are encouraged during the Q&A sessions.

Online Participation

If you are attending the conference via Zoom, please use the details below.

- To join <https://cam-ac-uk.zoom.us/j/84685632828?pwd=5KkbhFzp74Lf9ubT2btMBB1o2aGq7J.1>
- Meeting ID: 846 8563 2828
- Passcode: CEMDC2026

Procedure for Online Guests

- *WHEN TO JOIN*
Please consult the timetable provided to ensure that you **join the room during the allotted joining times** (during the start-of-day introduction and/or during the breaks between sessions) - attendees will not be admitted into a room once a session has started. Guests may leave during a session, but they will not be allowed to re-join until the start of the next session.
- *HOW TO JOIN*
Using the joining details above, you will enter a waiting room. Please set your Zoom name to **display your full name including your last name** so that you can be matched against the RSVP list and admitted into the conference room.
- *VIDEO AND MICROPHONE*
By default, all attendees will enter the conference rooms with their **video off and microphone muted**. Please keep your microphone muted for the duration of the conference.
- *ASKING A QUESTION*
During presentation slots you may use the chat function to submit your questions, privately, to the assigned marker (who will have 'host' after their name). Please ensure that you use the drop-down menu to change the recipient from 'everyone' to '...(host)'. Time permitting, the host will then read your question on your behalf.

Schedule – Morning sessions



Venue:
Institute for Manufacturing, Alan Reece Building,
17 Charles Babbage Road, Cambridge CB3 0FS

Zoom
[Meeting ID: 846 8563 2828](#)
[Passcode: CEMDC2026](#)

14th Annual Construction Engineering Masters Dissertation Conference

Friday, 10 July 2026 - In person and online

08:30 - 09:00 Registration (Atrium, Lower Ground Floor)/ Enter Zoom Room			Lecture Theatre 1		
09:00 - 09:09 Prof. Gavin Davies - CEM Course Director Welcome					
Session A1	09:10 - 09:25	Nik Tait - Senior Legal Counsel, Laing O'Rourke <i>Building Inclusion: A Case Study on the Impact of Line Managers in Shaping LGBT Experience in a UK Construction Organization</i> Turnover time for next student to prepare	Lecture Theatre 1		
	09:26 - 09:41	José María Guerrero Mata - Operations & Plant Manager, Arenko <i>From Concrete to Change: Experimenting with Working-Time Reduction in a Mexican Precast</i> Turnover time for next student to prepare			
	09:42 - 09:57	Anna Wild - Project Engineer, Laing O'Rourke <i>Understanding Job Satisfaction among UK Steel Fixers: The Influence of Job Design and Purpose</i> Turnover time for next student to prepare			
	09:58 - 10:13	David Jennings - Project Leader, Laing O'Rourke <i>A Qualitative Study of the Performance Review Process for Worksite-Based Operatives and Supervisors in the UK Construction Industry</i> Turnover time for next student to prepare			
	10:14 - 10:29	Yutong Li - Sub Agent, JN Bentley <i>Exploring Risk Factors and Awareness of Mental Health among UK Construction Workers</i> Turnover time for next student to prepare			
	10:30 - 10:45	Hayley Jackson - Pre-Construction Manager, Coffey <i>Pathways to Progress: Structural and Strategic Influences on Women’s Career Progression in Contracting</i>			
	10:45 - 11:00 COFFEE & TEA BREAK (Atrium, Lower Ground Floor)/ Enter Zoom Room				
	Session A2	11:00 - 11:15		Gin Ng - Senior Design Manager, Wates Residential <i>Unlocking Scope 3 Carbon Reduction Opportunities in the UK: Understanding Early-Stage Design Processes</i> Turnover time for next student to prepare	Lecture Theatre 1
		11:16 - 11:31		Maninder Sandher - Chief Financial Officer, Kilnbridge <i>Commercial Pressure, Leadership Attention, and Long-Term Capability Investment in UK Infrastructure Construction</i> Turnover time for next student to prepare	
		11:32 - 11:47		Sophie McPhillips - Associate Director, AtkinsRéalis <i>Perceived Control of Time and Associated Wellbeing for Engineers: An Intervention Study</i> Turnover time for next student to prepare	
11:48 - 12:03		Shannon Henry - Senior Project Manager, Laing O'Rourke <i>Menstrual Health in Construction: Productivity, Perceptions, and Policy</i> Turnover time for next student to prepare			
12:04 - 12:19		Andrew Miles - Technical Leader – Systems Engineering & Assurance, Laing O'Rourke <i>Development of an effective competence-based interview framework for assessing Building Regulations Principal Contractor Designated Individuals</i> Turnover time for next student to prepare			
12:20 - 12:35		Dinorah Sánchez - Director of Product Management, Trimble, Inc. <i>Handing off the Model: Project Handoff, Technology, and the Value at the Intersection of Construction and Asset Management</i>			
12:35 - 13:30 LUNCH (Common Room, First Floor)/ Enter Zoom Room					

Schedule – Afternoon sessions



Venue:
Institute for Manufacturing, Alan Reece Building,
17 Charles Babbage Road, Cambridge CB3 0FS

Zoom
[Meeting ID: 846 8563 2828](#)
[Passcode: CEMDC2026](#)

14th Annual Construction Engineering Masters Dissertation Conference

Friday, 10 July 2026 - In person and online

	12:35 - 13:30	LUNCH (Common Room, First Floor)/ Enter Zoom Room	
Session A3	13:30 - 13:45	Hugh Lo - Lead Planning Engineer, Skanska <i>What happened, When and Why? Contextualising Tunnelling Productivity with Natural Language Processing</i>	Lecture Theatre 1
		Turnover time for next student to prepare	
	13:46 - 14:01	Susanna Taylor - Project Manager, Severn Trent <i>Plant-Based Coagulants for Wastewater Treatment: the Challenges of Introducing Innovation to the Water Industry in England</i>	
		Turnover time for next student to prepare	
	14:02 - 14:17	Lewis Vick - Future of Work Manager, Laing O'Rourke <i>Attitudes Towards Workforce Empowerment amongst Management within the Construction Industry and Impact on Trade Job Attractiveness</i>	
		Turnover time for next student to prepare	
	14:18 - 14:33	Adaeze Onuigbo-Nwadigo - Managing Director, Jona Infrastructure Advisory <i>Organisational and Behavioural Barriers Influencing AI Implementation in Mega Construction Projects</i>	
		Turnover time for next student to prepare	
	14:34 - 14:49	Kason Chan - Assistant Project Manager, Blue Stone <i>Implementation of Smart Safety Management System (SMS) in the Hong Kong construction industry: Overcoming barriers and creating opportunities</i>	
	14:50 - 15:05	COFFEE & TEA BREAK (Atrium, Lower Ground Floor)/ Enter Zoom Room	
Session A4	15:05 - 15:20	Jake Shorrock - Project Leader, Laing O'Rourke <i>Advancing Operative Deployment through 4D Method Statements and Digital Simulation: A Case Study in Hyperscale Data Centre Construction</i>	Lecture Theatre 1
		Turnover time for next student to prepare	
	15:21 - 15:36	Doyinsola Kazeem - Lawyer, Clifford Chance <i>Balancing Intellectual Property Rights and Open Innovation in the Construction Industry: Challenges and Opportunities</i>	
		Turnover time for next student to prepare	
	15:37 - 15:52	Rachael Cunningham - Bid and Preconstruction Leader, Laing O'Rourke <i>From Chains to Networks: Bilateral Contracts and Structural Dysfunction in the UK Construction Industry</i>	
		Turnover time for next student to prepare	
	15:53 - 16:08	Aisling Timbs - Project Manager, Laing O'Rourke <i>Evaluating the Impact of Outreach Interventions on Students' Perceptions of Careers in</i>	
		Turnover time for Course Director	
	16:09 - 16:20	Prof. Gavin Davies - CEM Course Director Closing address	
	16:20 - 17:15	DRINKS RECEPTION AND NETWORKING (Common Room, First Floor)	

Dissertation Research Abstracts in Presentation Order

This section presents the abstracts of the dissertation presentations featured in this year's conference, presented in presentation order. These dissertation abstracts can also be found at <https://www.construction.cam.ac.uk/dissertation-conference-2026> in alphabetical order.

Building Inclusion: A Case Study on the Impact of Line Managers in Shaping LGBT Experience in a UK Construction Organization



Nik Tait

Senior Legal Counsel
Laing O'Rourke

The challenge of improving diversity and inclusion remains one of the greatest facing the construction industry. Among those most adversely affected by exclusionary workplace cultures are lesbian, gay, bisexual and transgender ('LGBT') workers. Beyond the significant commercial, legal, and ethical consequences of the industry's historically heteronormative and hypermasculine norms, this exclusion risks constraining the sector's ability to

attract and retain talent during a skills shortage.

The industry has not been deaf to calls for change. Organisational equality policies and inclusion frameworks are increasingly prevalent. Why, then, does evidence of LGBT exclusion persist? One explanation may be that the challenge lies not in organisational intent, but in its implementation. Research suggests that, as the primary interface between policy and everyday practice, line managers are instrumental in translating companies' inclusion ambitions into workplace experience.

Accordingly, the aim of this dissertation was to advance understanding of the extent to which line managers shape LGBT workers' experiences of inclusion and exclusion within UK construction. Research in this area is limited by a lack of up to date and in-depth data both in respect of contemporary LGBT experience itself and the role of line managers in shaping that experience. To address this, the study adopted a qualitative approach using semi-structured interviews with LGBT workers and line managers across a case study UK Tier 1 construction organisation. It explored LGBT workers' experiences of inclusion and exclusion, their perceptions of line manager influence on those experiences, and line managers' own understandings of their impact.

Initial findings suggested that LGBT workers experienced relatively high levels of inclusion, appearing to challenge prevailing accounts of exclusion within the literature. Closer analysis, however, revealed this to be contingent and often sustained through LGBT workers' own strategies of adaptation. Whilst both participant groups identified line managers as central to inclusion, neither could readily identify specific actions that produced this effect. Instead, line manager influence derived less from what they did, and more from what they did not do: it manifested in the surrounding behaviours they tolerated or failed to challenge. This was particularly significant given participants' tendency to view immediate working environments, rather than formal policies, as the primary determinant of experience. Taken together, this suggest that line managers represent a critical but underutilised mechanism for producing inclusion. Improving workplace culture may therefore depend less on developing organisational policies and more on enabling line managers to recognise and respond to forms of exclusion. In a fragmented and decentralised industry such as construction, the implications of these findings may extend beyond LGBT inclusion alone.

From Concrete to Change: Experimenting with Working-Time Reduction in a Mexican Precast Plant



José María Guerrero Mata

Operations & Plant Manager
Arenko

While debates on reduced working hours and four-day workweek models have expanded internationally, evidence remains concentrated in high-income countries and service-based sectors. Limited research has examined how working-time reduction operates in physically demanding industrial environments, particularly in Latin America, where long working hours and productivity concerns continue to shape organisational practices. This dissertation examines the technical and social feasibility of gradual working-time reduction in a Mexican industrial setting through a real-world intervention in a precast concrete manufacturing plant in Monterrey. The study addresses this gap through a mixed-methods intervention implemented over three consecutive phases, gradually reducing the working week from 51 to 42 hours while maintaining operational continuity. Quantitative analysis combined operational indicators, including productivity, absenteeism and production costs, with repeated employee wellbeing surveys measuring stress, fatigue, recovery, sleep quality and work–life balance. Qualitative interviews further contextualised employees' experiences.

Findings suggest that gradual working-time reduction can be implemented without harming operational performance. Despite substantial reductions in working hours, labour productivity per hour increased across the intervention phases, while absenteeism and production costs remained stable or improved. Employees also reported better wellbeing, sleep quality and work–life balance, without corresponding increases in perceived workload pressure. Rather than supporting the assumption that productivity depends primarily on longer working hours, the intervention suggests that performance may also be linked to enhanced recovery, greater motivation and more sustainable work organisation.

By examining these dynamics in a Mexican blue-collar industrial context, the study contributes empirical evidence to a debate largely shaped by service-sector experiences and regulatory discussions. Nevertheless, the findings should be interpreted in light of the absence of a control group, the short intervention period and the single-case design. Overall, this dissertation suggests that improving employees' quality of life does not have to compromise operational performance. More broadly, it indicates that even within rigid industrial environments, alternative forms of work organisation may be viable and meaningful in emerging economies facing debates around time, productivity and wellbeing.

Understanding Job Satisfaction among UK Steel Fixers: The Influence of Job Design and Purpose



Anna Wild

Project Engineer
Laing O'Rourke

Job satisfaction remains a significant challenge within the UK construction industry, amid growing concerns over mental health and skills shortages. Existing research offers competing explanations for what shapes job satisfaction, with some emphasising job design and others highlighting perceived sense of purpose and meaning. However, little is known about how these factors interact within specific construction occupations, or whether one consistently outweighs the other. This study addresses this gap by examining how job design and perceived sense of purpose shape job satisfaction among steel fixers working in prefabrication factories and in-situ construction sites. Although steel fixers perform the same core occupation in both settings, the contrasting work environments provide an opportunity to explore how workplace context could influence employee experiences.

A qualitative approach was adopted, using semi-structured interviews with ten steel fixers from prefabrication and site-based settings, analysed through thematic analysis to explore similarities and differences between the two work environments.

The findings suggest that job satisfaction could be influenced by the interaction of job design, perceived purpose and social context. However, the most notable finding was the extent of variation between individuals. Despite sharing the same occupation, participants differed considerably in the aspects of work they valued most, suggesting that established job satisfaction theories may not fully capture the diversity of worker preferences and experiences. For example, some thrived on task variety and challenge, whereas others preferred repetition and routine. Participants frequently described autonomy and task complexity as positive aspects of their work, while workload, rework, poor communication and physical demands were often identified as sources of dissatisfaction. Some participants also reported deriving meaning and pride from contributing to completed projects.

The study concludes that the relative importance of job design and perceived purpose in shaping job satisfaction appears to vary between individuals. Rather than identifying a universal formula for improving satisfaction, the findings highlight the importance of understanding workers as individuals whose motivations, preferences and sources of meaning differ. Efforts to improve job satisfaction may therefore be most effective when they move beyond a one-size-fits-all approach and instead recognise the diversity of ways in which workers experience and value their work.

A Qualitative Study of the Performance Review Process for Worksite-Based Operatives and Supervisors in the UK Construction Industry



David Jennings

Project Leader

Laing O'Rourke

The UK construction industry faces persistent workforce challenges, including skills shortages, an ageing workforce, and difficulties in retaining experienced site-based employees. Whilst performance management practices have been widely studied within professional and office-based occupations, little research has explored their application among site-based workers and supervisors. This gap is significant, as effective performance reviews may support employee development, engagement, and retention within a pressured labour market.

To address this gap, this study explores the perceptions of site-based workers and supervisors towards formal performance reviews, examining the perceived benefits and challenges of their introduction. A pragmatic research philosophy and inductive qualitative approach were adopted. Data was collected through fifteen semi-structured interviews conducted across three live construction projects within a UK tier-one contractor and analysed using Braun and Clarke's thematic analysis framework.

Five key themes were identified. Performance management currently occurs primarily through informal, day-to-day interactions and the delivery of operational outputs, with the absence of formal reviews widely accepted and culturally normalised. Participants viewed performance reviews as potential mechanisms for recognition, communication, and career development rather than tools of control. However, their effectiveness was considered highly dependent on trust, fairness, and managerial competence. Participants also highlighted risks associated with formalisation, including bias, favouritism, surveillance, and the exclusion of workers with limited language or digital skills.

The findings suggest that site-based workers do not reject formal performance reviews but have become accustomed to their absence. This study provides new insight into how performance review systems may be adapted for site-based contexts. It concludes that carefully designed, development-focused performance reviews could offer a credible mechanism to improve engagement, support career progression, strengthen organisational belonging, and contribute to workforce retention within the UK construction industry.

Exploring Risk Factors and Awareness of Mental Health among UK Construction Workers



Yutong Li

Sub Agent
JN Bentley

The UK construction industry is facing a significant mental health challenge. The nature of the construction industry, considered by tight deadlines, long working hours, and job insecurity which can create stresses and link to poor mental health outcomes.

This research aims to explore the key factors affecting mental health within the UK construction industry and how managerial awareness to support affected employees. Survey data are collected to identify the main risk factors associated with poor mental health, while interviews with senior leaders explored their perspectives, level of awareness, and views on potential improvements. By combining these methods, the study developed practical recommendations to support better mental health outcomes across the industry.

The findings identify several risk factors consistent with those reported in the literature, including long working hours, tight deadlines, and high workload demands. The survey also highlights a few potential improvements, such as promoting a better work-life balance, creating a positive workplace culture, and increasing support from senior leadership. One notable finding was that almost one-third of respondents did not feel comfortable discussing their wellbeing with colleagues or managers. This suggests that creating an environment in which employees feel safe and confident to speak openly about mental health remains a significant challenge. The interview findings indicate that organisations should adopt a more proactive approach to supporting employee wellbeing, rather than relying solely on individuals to seek help when they are struggling. Like fitness-for-work assessments, regular wellbeing check-ins could help identify concerns at an earlier stage and provide suitable support. The findings also suggest that not all employees feel comfortable approaching Mental Health First Aiders, while Mental Health First Aiders may not always have the specialist knowledge required to deal with complex issues. Therefore, organisations should consider providing access to qualified mental health professionals where appropriate.

The study further highlights the importance of organisational culture in promoting positive mental health. Developing a supportive and caring workplace environment is important, as employees who feel valued and genuinely cared for are more likely to discuss their wellbeing and seek help when needed.

Pathways to Progress: Structural and Strategic Influences on Women's Career Progression in Contracting



Hayley Jackson

Pre-Construction Manager
Coffey Construction

The contracting sector continues to experience a significant gender imbalance, particularly within technical, engineering and site-based roles, with this disparity becoming more apparent at senior levels. Whilst the barriers contributing to the underrepresentation of women in construction are well documented, less is understood about the structural and strategic aspects of contractors and the influencing factors affecting progression opportunities. Addressing gender imbalance in the contracting sector is important not only from an equality perspective, but also due to its implications for long-term workforce sustainability, organisational performance and industry resilience. This research identifies structural and strategic similarities and differences of four contractors, all with considerable UK operations, in relation to the following five themes: recruitment and selection; retention; equality, diversity and inclusion (including flexible working, maternity and paternity leave and gender pay gap); career development, promotion and training and development and networks, mentoring and support structures. This has been used to inform a framework to support more diverse recruitment and career progression opportunities for women into leadership roles across contractors.

This study employs a mixed-method approach, combining a review of organisational policies and strategies with semi-structured interviews of current senior leaders from the respective companies to understand their personal perceptions and experiences across each of the five themes, comparing to published policy. The current diversity of senior leadership across the organisations is then analysed from published data on the individual company websites.

The outcomes of this research highlight a systemic disconnect between organisational strategy and practice, with key decision-making occurring in departmental and divisional silos, which undermine consistent, long-term approaches to gender progression and equal opportunities. A lack of transparency, objectivity and structured pathways for gaining experience limits opportunities for equitable advancement, with women's networks and support structures constrained by a lack of formal embedment across organisations. Substantial short-term resource pressures industry wide, further challenged with internal business divisional priorities, consistently dominate any strategy for equality, reinforcing reactive decision-making rather than considering the need for long-term proactive requirements.

Unlocking Scope 3 Carbon Reduction Opportunities in the UK: Understanding Early-Stage Design Processes



Gin Ng

Senior Design Manager
Wates Residential

Scope 3 emissions constitute the largest and most consistently under reported component of organisational greenhouse gas footprints in the UK, typically accounting for 80–95% of total value chain emissions. The UK Green Building Council (UKGBC) suggests the use of Life Cycle Assessment (LCA) as a method for improving the accuracy of Scope 3 Category 1 reporting. This study examines the challenges of early stage embodied carbon assessment, captured in LCA reporting, at an organisational level and explores continuous improvement practices that could strengthen carbon reduction strategies.

The significance of this study aligns with the Public Procurement Note (PPN) 06/21 which raises the bar for carbon accountability in government contracting. As Environmental, Social and Governance (ESG) disclosure becomes central to investment and risk decisions, contractors and key suppliers are expected to strengthen carbon reporting to stay competitive, meet stakeholder expectations, and support clearer, more reliable climate data.

The methodology adopted a qualitative, workshop-led design to examine carbon-related decision-making within selected construction projects. Three UK projects were chosen through purposive snowball sampling, and the resulting themes were subsequently presented and discussed in a validation workshop.

The findings suggest a lack of consistent carbon ownership across project teams, with responsibility fragmented by unclear deliverables, limited standardisation in material data collection, siloed working practices, and entrenched procurement patterns that result in technical expertise being appointed too late.

Overall, this research suggests that clearer carbon ownership and the integration of carbon reporting into project deliverables are necessary to improve accountability. Furthermore, organisations should improve the collection of project-specific data and apply process improvement theories to ensure that technical expertise is introduced at the appropriate stage to enhance reporting quality, transparency, and ultimately carbon reduction.

Commercial Pressure, Leadership Attention, and Long-Term Capability Investment in UK Infrastructure Construction



Maninder Sandher

Chief Financial Officer
Kilnbridge

UK construction presents a striking paradox: the sector operates against a declared national infrastructure pipeline of £750 billion, yet records the highest number of corporate insolvencies of any domestic industry and underinvestment in new technologies, product standardisation, and digital platforms is commonplace. Existing explanations focus on strategic intent or policy gaps.

This dissertation investigates a different mechanism: whether the contractual and financial architecture within industry leaders structurally constrains their capacity to sustain long-term capability investment. Senior financial leaders are the focal point of this study, as they simultaneously bear responsibility for short-term commercial reporting and longer-term capital allocation, making them uniquely positioned to identify where those two obligations conflict.

Methodology: A qualitative, interpretivist design combining a financial scoping analysis of major UK contractors with semi-structured interviews with senior financial leaders. Interview data were analysed using a theoretically-driven thematic analysis.

Three interconnected findings emerge. Horizon compression operates through contractual governance rather than shareholder return expectations; this study terms this contractual short-termism. Profit and cash-flow volatility trigger attentional capture, systematically consuming leadership bandwidth and crowding out the longer-term thinking that investment requires. Together, these factors suppress dynamic capability development, the sustained investment through which firms build long-term competitive advantage and financial stability, thereby trapping firms in the very conditions that prevent investment.

These findings are synthesised through the Investability Conditions Model, developed by this study, which identifies three conditions a firm must satisfy simultaneously to escape this trap: holding both short and long-term performance in view at once; treating capability investment as a driver of future margin rather than an outlay against current margin; and sustaining a credible multi-year value narrative. Predefined investment triggers, ring-fenced project capital, and programme-level procurement commitments of sufficient durability are identified as levers for practitioners and policymakers.

Perceived Control of Time and Associated Wellbeing for Engineers: An Intervention Study



Sophie McPhillips

Associate Director
AtkinsRéalis

The construction and engineering industry has a challenge of poor wellbeing of its workforce, with many employees experiencing stress and a lack of work-life balance. Time management behaviour has been identified in previous research as a coping mechanism for stress and is linked to improved individual wellbeing, particularly through improving 'perceived control of time' – how one feels about the demands on their time and the extent to which they are in control. There has been little research, however, exploring this in the context of knowledge workers, including engineers. This study addresses this gap by investigating the relationship between time management behaviours, perceived control of time, and wellbeing among engineers in a large engineering consultancy.

The research used a quasi-experimental design for an intervention study, using a pre- and post-survey approach with a sample of 104 engineers. Participants attended a two-hour structured training session on time management, completing a survey prior to the training and then at the end of a three-week trial period, during which they implemented the techniques from the training. The training focused on setting goals for different time horizons, daily prioritisation, and distraction management. The survey collected data on participants' perceived workplace wellbeing, stress, and time management behaviours, using validated survey scales including the Time Management Behaviour Scale (TMBS) and Perceived Stress Questionnaire (PSQ). Workload, based on utilisation and billable time, was used as the control variable. Statistical analysis was conducted using Stata software to assess changes in time management behaviours, perceived control of time, stress, and wellbeing before and after the training intervention.

The findings suggest that there were statistically significant improvements in several variables at the end of the trial period, with participants demonstrating improved workplace wellbeing, decreased stress, and improved perceived control of time. No significant change in objective workload was observed, suggesting that improvements in wellbeing and stress can be attributed to changes in behaviours and perceptions rather than to changes in workload and demands.

The study has demonstrated that individual workplace wellbeing and stress can be improved through changes in time management behaviours, without reducing workload, and that these behavioural changes can be encouraged through relatively short, low-cost interventions. The study contributes new evidence in a previously unexplored context for time management research and highlights several opportunities for wider implementation within organisations, as well as proposing further research areas that may deliver workforce wellbeing benefits in the industry.

Menstrual Health in Construction: Productivity, Perceptions, and Policy



Shannon Henry

Senior Project Manager

Laing O'Rourke

Although there has been increased attention to women's health in recent years, particularly in relation to the gender data gap and its implications for workplace wellbeing, the subject of menstrual health (MH), including physical, psychological, and social aspects, remains under-researched in many occupational health contexts. This lack of research is especially prominent in the construction industry, a male-dominated and physically

demanding sector.

While women's employment in UK construction has increased by approximately 25% over the past decade, they represent only around 15% of the workforce. Improving gender diversity is a key industry priority, with organisations seeking to attract and retain more women to meet growing labour demands and leverage the benefits of diverse teams. However, limited research has examined how MH experiences impact productivity or how construction workplace support can be effectively implemented in this context. Not only is this significant given that MH is a fundamental and constant experience for most women of a working age, but there are also broader recognised impacts of MH on workplace productivity. In addition, there are structural and cultural constraints present in construction, which may limit symptom management and the practical use of workplace policies.

To investigate this issue, this research aims to (1) explore women's lived experiences of MH and its impact on productivity, and (2) explore employee perceptions of both MH and the practicality of implementing supportive policies. These aims were addressed using a sequential explanatory mixed-methods approach, focused on participants employed by a single UK-based main contractor. Quantitative survey data were analysed using descriptive and inferential techniques to identify key patterns, which informed the development of qualitative interview questions. Qualitative data were subsequently analysed using thematic analysis, supported by a critical feminist theoretical perspective, with elements of social constructivist thinking, to integrate the data sets and enable deeper insight into lived experiences, perspectives, and workplace dynamics.

One of the key findings identified in this study is that MH issues are not absent from construction workplaces, but are often concealed and managed by employees. Productivity is frequently maintained through a "get on with it" culture, underpinned by presenteeism and self-coping strategies, masking physical and psychological impacts on work. This behaviour is reinforced by non-disclosure which is shaped by perceived stigma, discomfort, legitimacy concerns, and distrust. Crucially, structural constraints (including limited flexibility for on-site roles) and cultural norms further limit the management of symptoms and the potential use of workplace support. Furthermore, the diversity of MH experiences and

absence of a clear benchmark further complicate understanding, creating barriers to both disclosure and support.

This study contributes new insights about the experiences of MH in construction, demonstrating that MH-related impacts may be hidden, and that productivity can be maintained, but at a cost. It highlights that the effectiveness of workplace support depends not only on policy provision, but on addressing the underlying cultural and perceptual dynamics that shape behaviour. While results suggest that adoption of MH policies may demonstrate organisational commitment and are associated with better attraction and retention of women in construction, their practical effectiveness is dependent on addressing these underlying factors. Future research should build upon these findings by testing the effectiveness of MH-related policies within construction workplaces.

This study carefully considers the delicate balance between gender equality and differentiation. As MH is often considered a sensitive topic, the author has committed to approaching this research with care and ensuring it does not promote ideas of inequality.

Development of an Effective Competence-Based Interview Framework for Assessing Building Regulations Principal Contractor Designated Individuals



Andrew Miles

Technical Leader – Systems Engineering & Assurance
Laing O'Rourke

Following the Grenfell tragedy, the Building Safety Act 2022 and the subsequent amendments to The Building Regulations introduced dutyholder roles requiring demonstrable competence, defined as a combination of skills, knowledge, experience and behaviours (SKEB). However, limited guidance exists on how behavioural competence should be assessed in practice, leaving organisations exposed to subjectivity and disproportionate assessment burden.

This study develops and evaluates an effective and proportionate competence-based interview framework for assessing a key dutyholder, the Building Regulations Principal Contractor Designated Individual. Adopting a pragmatist worldview and drawing on literature spanning competence, assessment, safety theory, leadership and workplace climate, the research derives a set of behavioural competencies, three Behavioural Event Interview scenarios mapped directly to the statutory behavioural requirements, and a five-level anchored rubric. The framework was evaluated through ten pilot interviews within a tier-one contractor, informing a planned competence assessment programme.

Central to the framework is a General Competence Model developed within this study, positioning behaviour as the universal mediator through which skills, knowledge and experience are deployed. This operationalises the “flat” SKEB definition of competence and supports the separation of behavioural assessment (interview) from a knowledge assessment (written).

The framework effectively differentiated candidates and proved proportionate in its delivery whilst maintaining sufficient rigour to support assessment. Participants recognised the value of assessing lived experience rather than rehearsed responses and reported the process as fair and proportionate. Successful implementation, however, depends on organisational preparation, with assessment also driving awareness and compliance with the regulations. The framework offers organisations a practical means of operationalising the behavioural requirements of the regulations and provides a foundation for wider industry adoption, supporting more consistent competence assurance across the built environment sector.

Handing off the Model: Project Handoff, Technology, and the Value at the Intersection of Construction and Asset Management



Dinorah Sánchez

Director of Product Management
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This dissertation aims to explore how U.S. municipalities manage construction-to-operations project handoff and how digital technologies support or constrain the transfer of asset information and lifecycle value. The research is situated within the wider sustainability agenda, particularly three United Nations' Sustainable Development Goals relating to sustainable cities and communities, clean water and sanitation, and

industry, innovation, and infrastructure. The intersection of those goals highlights the need for a sustainable built environment that considers the whole lifecycle value across stakeholders. The adoption of digital models, including 3D modelling and digital twins, remains uneven, with differences persisting between European and American practice. In the United States of America, natural disasters and aging infrastructure place an additional pressure on asset owners who lack asset information from earlier lifecycle phases. Meanwhile, project and asset data captured in the design and build stages is lost prior to maintenance and operations, making project handover a key event in an asset's lifecycle. The academic literature spans assets, industry, and geography, but a gap exists in relation to U.S. municipalities and utilities.

The study has four core objectives that examine current project handoff practices, the role of digital technologies, key barriers and opportunities, and the potential contribution of systems thinking to improve the handover process. A qualitative methodology was adopted to explore and capture insights from participants, their organizations, and external influences on their practices. The initial literature review informed the questionnaire used to conduct semi-structured interviews with engineers, IT professionals, and asset owners in U.S. municipalities and utilities. The transcribed interviews were evaluated through thematic analysis by reviewing the data, coding, and deriving themes.

The findings highlight the lack of local or national policy, fragmentation across organizational departments, and the hesitation among asset owners and industry actors to require or provide the digital thread. A preliminary, conceptual framework, based on empirical findings, was developed to provide guidance to U.S. professionals seeking to improve handover and reduce data loss between the construction and operations and maintenance phases.

What happened, When and Why? Contextualising Tunnelling Productivity with Natural Language Processing



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Tunnelling productivity is readily measured but explaining performance variation remains a labour-intensive task. Diagnosis relies on manual interpretation of unstructured narratives, a process that is both inconsistent and poorly scalable, leaving much of the contextual information underutilised. This challenge is compounded by advances in digitisation and data capture technologies, which have increased data availability without a corresponding improvement in the capacity to extract meaningful insights. To date, few studies have directly linked measured productivity outcomes to narrative records. This study investigates whether contextual information contained within routine tunnelling reports can be systematically analysed using Natural Language Processing (NLP), Large Language Models (LLMs), and knowledge graphs.

An end-to-end NLP framework was developed to extract and interpret productivity context from 116,567 diary entries collected across two tunnelling projects. By converting diary text into numerical representations, recurring themes were first identified using unsupervised clustering algorithms. These themes were then statistically associated with daily production output and interpreted using LLMs. Three algorithms were compared to determine which technique most effectively captured productivity-related patterns. Themes identified by the best-performing algorithm were subsequently incorporated into a cluster-augmented classifier to evaluate their usefulness in classifying productivity outcomes. To improve accessibility, a knowledge-based approach was adopted to organise productivity evidence into an interpretable network linking productivity outcomes, chronology, and contextual narratives.

All clustering algorithms identified themes that were statistically significant when associated with production outcomes, with Gaussian Mixture Models (GMMs) producing the strongest overall association ($\eta^2 = 54\%$). Themes such as cutterhead interventions, grouting equipment maintenance, and thrust force exceedances were consistently associated with reduced tunnel advance rates. The GMM-based classifier improved the accuracy of productivity classification from 71% to 86%, compared with the keyword-frequency baseline. The knowledge-based approach enabled natural language querying of project records, providing both verbatim evidence and contextual explanations.

This study demonstrates that routine project records can serve as a valuable source of productivity insights when analysed with domain-specific NLP techniques. The proposed framework offers a scalable and transparent approach to transforming routine records into productivity evidence. While demonstrated using tunnelling data, this framework has the potential to reduce reliance on manual review and support more comprehensive productivity assessment across construction projects.

Plant-Based Coagulants for Wastewater Treatment: the Challenges of Introducing Innovation to the Water Industry in England



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Efficient wastewater treatment is increasingly vital as the Earth experiences growing water scarcity. Tighter environmental pressures, stricter discharge permits, and ageing infrastructure exacerbate the challenges faced by the wastewater industry in England. This research investigates the use of plant-based coagulants as a possible alternative to traditional metal-based chemicals in wastewater treatment and explores the difficulties associated with introducing new technologies into an operational water company.

The study uses a mixed-methods approach involving a literature review, a pilot chemical dosing trial at a wastewater treatment works in England, and interviews with water industry professionals. The pilot trial assessed whether plant-based coagulants could improve effluent quality and reduce the need for additional treatment assets. Interviews were also used to understand how innovation is managed within the industry and to identify barriers to implementation.

The findings suggest that plant-based coagulants have the potential to support tighter environmental permits while reducing operational and capital demands. However, the research also identified several challenges that limit innovation, including regulatory processes, the availability of funding, operational concerns, supply reliability, and resistance to change from stakeholders involved in treatment operations. The study concludes that although plant-based coagulants may offer technical and environmental benefits, successful implementation depends on more than treatment performance alone. Greater collaboration between regulators, project teams, and operational end users is needed to improve confidence in emerging technologies and encourage wider adoption across the water industry.

Attitudes Towards Workforce Empowerment amongst Management within the Construction Industry and Impact on Trade Job Attractiveness



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This dissertation seeks to align management attitude toward workforce empowerment with trade experience modelled to Maslow's Hierarchy of Needs, followed by proposals to industry for enhancing trade experience through management practices. A heavy emphasis on contrasting outcomes for trade roles in Modern Methods of Construction with Traditional Methods was maintained throughout, to attain a directional view of the industry for workforce occupational experience. A parallel convergent, mixed methods approach was adopted. Primary research was conducted through semi-structured interviews, to obtain qualitative data on the nuances of management attitude and perception, as well as workforce attributing causal factors to trade model scores and providing preferred resolutions. Secondary data was used for the quantitative portion of the study, to ensure reliable and truly reflective models on trade experience. An abductive research approach was taken, grounding the research in content from the CIPD Good Work Index, to frame and align the research with construction workforce to an accepted UK Government standard in the assessment of good work across industries; this was felt a necessary imperative, to ensure that this research serves as a prognosis of job standard across industries, providing data that helps drive competitiveness. Subsequently, data was funnelled into categories in accordance with the renowned motivational model, Maslow's Hierarchy of Needs. The primary function of disseminating data this way was to present an easily interpreted model of trade and operative roles in their current, experienced state. Whilst Modern Methods display decidedly better results amongst higher order motivators, they perform marginally worse in lower order motivators. Across motivators, love and belonging showed the most significant difference between the two groups, with traditional trades considerably underperforming against their modern method counterparts.

Organisational and Behavioural Barriers Influencing AI Implementation in Mega Construction Projects



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The construction industry has long faced criticism for inefficiency, recurring issues of project delays, low productivity, unsafe practices, and poor cost control. These challenges intensify in mega construction projects due to their scale, duration, numerous stakeholders, high uncertainty, and major impact, complicating safety management throughout the project lifecycle.

Deploying artificial intelligence-based tools and technologies offers potential to enhance safety performance in major project environments, yet adoption remains slow. This study examines the organizational and behavioural obstacles to the adoption of artificial intelligence in mega projects.

This research advances the literature on mega construction projects by examining the effects of artificial intelligence-based innovation and the organizational and behavioural barriers it presents. The study is timely, as the construction sector continues to experience high accident rates, inefficiencies, and resistance to digital innovation even as AI-based safety technologies proliferate. Solving these persistent issues has significant societal and industry value: more robust AI adoption can improve safety, lower incident rates, support better decision-making, and drive productivity in complex, high-risk construction settings.

This study used a qualitative methodology, conducting semi-structured interviews with professionals involved in a multi-billion-pound rail mega project. Interviewees included innovation managers, engineers, Heads of IT delivery, safety experts, project managers, and senior decision-makers. Interview questions were guided by three technology acceptance models: the Diffusion of Innovations (DOI), the Unified Theory of Acceptance and Use of Technology (UTUAT), and Trust in Automation. These frameworks provide a theoretical perspective for analysing organizational and behavioural factors in mega projects. Thematic analysis revealed the following key themes: leadership and strategic direction; organizational barriers; implementation context; usability and skills; trust and reliability; and adoption behaviour and acceptance.

The study found that AI adoption within mega construction projects is shaped by leadership, organizational, and behavioural factors. Strong leadership engagement and an innovative culture emerged as key drivers for AI uptake. However, participants noted that leadership commitment often faces constraints from budget pressures, risk aversion, and competing project demands.

Several organizational barriers surfaced, including fragmented project structures, isolated work practices, regulatory constraints, and contractual liability concerns. These issues discourage organizations from investing in or deploying new technologies. The findings indicate that successful implementation demands

clear messaging about AI tools' purpose, benefits, and expected results, reinforced by robust governance.

From a behavioural standpoint, usability, training, and data literacy emerged as pivotal in influencing adoption. Trust proved vital, especially in safety-critical environments where users demand assurance in AI systems' reliability, accuracy, and sustainability. Participants noted that technology acceptance varies from person to person, influenced by experience, confidence, and familiarity with digital tools.

Overall, the study finds that successful AI integration in mega construction projects requires organizations to foster innovation, build user trust, and supply the skills, governance, and leadership essential for adoption, rather than relying solely on technology.

Implementation of Smart Safety Management System (SMS) in the Hong Kong construction industry: Overcoming Barriers and Creating Opportunities with Application of Technology Acceptance Model (TAM) – Technology Organization Environment (TOE) Framework



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The construction industry is considered as one of the most hazardous industries in Hong Kong, contributed by its high accident and fatality rates. In 1999, a mandatory implementation of a Safety Management System (SMS) was enforced for all organizations within the Hong Kong construction industry as an attempt to tackle the industry's challenges in relation to health and safety. While the initial SMS implementation has seen promises with significant improvement in industrial accident and fatality rate during its early adoption in the 2000s, there have been signs of diminishing in recent years. Various technological advancements have been introduced to the construction industry, one of which is the digitalization of the construction safety system – Smart Safety Management System (SSMS). A SSMS is an IoT-driven SMS designed to utilise a network of interconnected technologies to digitalise, automate, and enhance the existing systematic process of safety management process in workplaces. Existing research has demonstrated the potential benefits of SSMS in improving safety performances in the construction industry; however, current literature has been conducted in Western countries, where its implications shall not be applied to the construction industry in Hong Kong.

To explore the potential implementation of SSMS in the Hong Kong construction industry, this dissertation, therefore, evaluates the current status of the SSMS adoption in Hong Kong. An extended Technology Acceptance Model (TAM) is utilised and integrated with the Technology Organization Environment (TOE) framework. Based on the extended TAM-TOE model, an online questionnaire survey is distributed to individuals working in the Hong Kong construction industry to explore their perceptions towards the acceptance of SSMS. Thereafter, data are collected and assessed using descriptive analysis. Based on the findings, it is suggested that a reduction in accident and fatality rates is the most prominent benefit of SSMS as perceived by the construction individuals in Hong Kong. In terms of barriers, the author highlights the lack of financial and regulatory support from the HKGOV as well as inadequate practical trials of SSMS in construction projects, as the most critical barriers for SSMS to be implemented in the mainstream of the construction industry in Hong Kong. This dissertation forms a baseline for research on this subject matter and can be used by SSMS developers and safety practitioners to improve ways of deploying SSMS in construction projects, as well as legislative officials and policy makers in the HKGOV to make appropriate regulations regarding SSMS implementation in the construction industry.

Advancing Operative Deployment through 4D Method Statements and Digital Simulation: A Case Study in Hyperscale Data Centre Construction



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The construction industry continues to rely heavily upon written Risk Assessments, Method Statements (RAMS) and verbal briefings to deploy operatives at the workplace. However, the rapid growth of hyperscale data centre construction, increasing adoption of modular and offsite manufacturing techniques, and the prevalence of linguistically diverse workforces present new challenges for traditional communication methods.

In London, where a significant proportion of the construction workforce operates with English as a second language, the effective transfer of complex task information has become an increasingly important consideration for project performance and safety. Despite advances in digital construction technologies, comparatively little research has examined how such tools influence operative comprehension at the point of work.

Drawing upon concepts from cognitive psychology, pedagogy, and construction communication research, this study investigates the extent to which enhanced comprehension of physical construction tasks can influence safety and productivity outcomes within a live project environment. The research builds upon a growing body of literature examining digital learning interventions within construction, including virtual reality, augmented reality, and visualisation technologies, whilst addressing a gap concerning their practical application to frontline task communication and execution.

The study was conducted on a hyperscale data centre project in the United Kingdom, characterised by repetitive installation activities, modular construction methodologies, and a diverse workforce. Adopting a pragmatic mixed-methods approach, the research combined workforce engagement forums, surveys, structured site observations, productivity monitoring, and semi-structured interviews. An iterative process was used to develop a series of 4D method statement animations that visually represented task sequencing, workplace conditions, safety controls, and installation methodology. Performance outcomes observed during a baseline phase using conventional briefing methods were subsequently compared with outcomes recorded during an enhanced communication phase incorporating the 4D visual intervention. The findings indicate that communication format and delivery, not solely informational content, play a significant role in operative comprehension.

Consistent with principles established within cognitive psychology and multimedia learning theory, participants reported improved understanding of task sequencing, safety requirements, and workplace expectations when information was communicated through visual and time-sequenced formats. Operatives frequently described the intervention as providing greater clarity and confidence than traditional briefing methods, whilst observational data suggested improvements in task execution

efficiency and reductions in behavioural uncertainty during installation activities. The research contributes to both construction management and learning theory by demonstrating that visual, experiential communication methods may be better aligned with the cognitive demands of complex, sequence-sensitive construction tasks than conventional text-based approaches. As construction continues to pursue greater industrialisation, standardisation, and workforce integration, the findings suggest that 4D visual communication can enhance not only project planning functions, but also frontline operative understanding, safety communication, and workforce performance.

Balancing Intellectual Property Rights and Open Innovation in the Construction Industry: Challenges and Opportunities



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The construction industry is increasingly shaped by digitalisation and open-innovation approaches to project delivery. A critical yet often overlooked element of this operational shift is data sharing, which frequently involves information tied to organisational intellectual property rights (IPR). While open innovation promotes knowledge exchange and co-creation, it also introduces legal challenges around ownership, protection, and attribution of proprietary information from jointly developed outputs.

Drawing on case law, legislative frameworks with a qualitative research methodology, combining survey data from five participants this study employs thematic analysis to examine how organisations negotiate ownership, access, and control of knowledge in collaborative construction projects in UK and Nigeria. This combination enables a multi-layered examination of both practitioner experiences and the broader regulatory context shaping IP governance in construction. The comparative legal analysis highlights significant differences in institutional capacity and IP literacy between the two jurisdictions, revealing how these disparities influence organisational willingness to engage in open-innovation practices.

Findings indicate that job role strongly predicts IP literacy, and participants often rely on trust, long-term relationships, and informal norms rather than formal IP clauses when deciding what to share. Despite generally low perceived tension between openness and IP protection, respondents highlighted the need for greater awareness of IP risks. Participants also noted that adopting open-innovation practices demands a cultural shift in how organisations understand and manage intellectual property throughout the project lifecycle. Given the sector's fragmented supply chains and reliance on complex contractual arrangements, respondents noted that robust, transparent IP governance frameworks are essential to mitigate risks associated with shared data, jointly developed design outputs, and collaborative environments.

The study highlights that while collaborative approaches can accelerate innovation, they also intensify concerns around ownership, control, and potential IP loss. Overall, the findings reveal both opportunities and tensions in cross-organisational collaboration, suggesting that successful adoption depends on governance models that balance knowledge sharing with the need to safeguard IPR in construction settings.

From Chains to Networks: Bilateral Contracts and Structural Dysfunction in the UK Construction Industry



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For over 30 years the UK construction industry has commissioned reports into its own dysfunction - Latham (1994), Egan (1998), Farmer (2016) - and for 30 years those reports have reached substantially the same diagnosis and prescribed substantially the same cure: collaborate better, integrate earlier, trust more. The industry has agreed enthusiastically and then collapsed again, most expensively at Carillion (2018) and ISG (2024). The UK

now proposes to deliver an infrastructure pipeline of £725 billion (NISTA, 2025) through largely the same contractual mechanisms, against a productivity opportunity that the Construction Leadership Council values at £45 billion annually (CLC, 2023). This dissertation argues that the recurrence is structural rather than behavioural. NEC4, JCT D&B and FAC-1 remain bilateral instruments and a project is not a bilateral undertaking. Contracts govern vertically, projects coordinate horizontally, and dysfunction occupies the space between.

This research represents projects as dual hypergraphs (H), where a hypergraph is a network in which a single connection may join more than two parties at once, as used and popularised by social media platforms. $H_{contract}$ shows the set of relationships the contracts can see, and $H_{reality}$ shows the coordination the project actually requires. This approach renders the gap between the contract reality and project reality definable. The methodology combines doctrinal analysis of the three standard forms with nine semi-structured interviews of UK legal practitioners. The formalisation of the gap as the Structural Dysfunction Index (SDI) provides an ex ante diagnostic, assessing whether a contractual architecture can see the coordination its project needs before anything is signed.

Practitioner accounts converged on structural patterns: seven of nine exhibited the behavioural-structural paradox, blaming behaviour while describing structure; eight described collaborative provisions neutralised in practice; four described early warnings working against relationships they depend on. Illustrative calibration using authoritative public audit sources places Carillion (NAO, 2018) and New Zealand's SCIRT alliance (OAG, 2013) at opposite extremes of structural exposure. Where behaviour determines the severity of any given failure and contract structure determines the frequency with which failures recur, the result is a frequency problem that severity-focused reform cannot resolve.

Evaluating the Impact of Outreach Interventions on Students' Perceptions of Careers in Construction



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The construction industry, face persistent workforce challenges including an aging workforce, skills shortages, and low public prestige. Despite substantial economic and employment significance, construction careers remain characterised by negative public perceptions, limited awareness of career diversity, and severe gender imbalance. Outreach interventions have demonstrated effectiveness in improving student engagement with STEM pathways; however, limited evidence exists regarding how construction-specific, employer-led outreach influences young people's perceptions, particularly regarding which intervention components trigger meaningful change.

This study evaluates the impact of an employer-led construction and engineering outreach programme on Year 9 students' perceptions of careers in the sector. Specifically, it examines: (1) whether participation produces measurable changes in career knowledge, interest, and stereotypes; and (2) which intervention elements students perceive as most influential in shaping their career perceptions.

A mixed-methods, quasi-experimental design was employed with pre- and post-intervention surveys conducted with participants before and after a two-session workshop intervention. Of 70 enrolled students, 34 completed both surveys (25 male, 9 female) and formed the paired-analysis group. The intervention featured industry professionals delivering career pathway information, interactive activities and exposure to female role models at all career stages. Wilcoxon signed-rank tests ($\alpha = .05$, two-tailed) evaluated changes in knowledge, career interest, and stereotype endorsement measured on 5-point Likert scales.

The intervention produced significant improvements in career knowledge. The composite Knowledge Index increased significantly with 94% of participants improving. Individual knowledge components such as job types of knowledge, pathway knowledge and subject knowledge showed consistent gains with female students achieved substantially larger knowledge gains than their male peers. Despite learning substantially more, female students' career aspirations were not significantly shifted while male students showed significant gains. Stereotype measures showed no statistically significant change overall, though item-level analysis revealed that students significantly rejected the stereotype that construction is exclusively trade-based. Female students reported positive engagement with role models and activity-based learning; however, this appreciation did not translate to increased personal encouragement or self-efficacy (self-confidence).

While the intervention effectively broadened students' understanding of construction career diversity,

short-term exposure proves insufficient to shift career aspirations, particularly for female students. Knowledge gains alone do not guarantee interest or encouragement. Future interventions would need to extend beyond activity-based learning and role model exposure to include explicit encouragement frameworks, sustained family engagement, and gender-responsive career guidance to translate positive experiences into durable shifts in self-efficacy and career intention.