

Exponent®
Engineering & Scientific Consulting

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Professional Profile

Matthew Doré, Ph.D., CEng, FWeldI, AMICE, AIMMM, is a senior managing engineer in Exponent's Metallurgical & Corrosion Engineering practice with over 25 years of experience in structural integrity, fatigue and fracture mechanics, and failure investigation. He advises legal teams, insurers, infrastructure owners, and energy operators on complex structural failures and fitness-for-service assessments, with particular specialty in the fatigue of welded structures and components.

Structural Integrity & Fitness-for-Service Assessments

Dr. Doré helps clients perform structural integrity and fitness-for-service (FFS) assessments for structures and components. Such analyses aid parties in deciding whether the structure should remain in service, requires repair, or must be retired. He applies fracture mechanics principles, design assessments, and experimental stress analysis to evaluate the remaining life of structures operating in demanding environments, including offshore platforms, bridges, pipelines, and pressure vessels. His assessments are grounded in internationally recognised standards, including BS 7608, BS 7910, API 579, IIW, and the Eurocodes, and his work is routinely used to support regulatory submissions, insurance claims, and dispute resolution.

Failure Investigation & Root-Cause Analysis

Dr. Doré conducts failure investigations and root-cause analysis for clients who need to understand why a structure or component failed. His investigations address fatigue cracking, fracture, stress corrosion cracking, weld defects, and overload failures across the construction, energy, transport, and defence sectors. He integrates metallurgical examination, residual stress measurement, mechanical testing, non-destructive evaluation (NDE), and finite element analysis (FEA) to establish root cause with the rigour required for legal proceedings, insurance disputes, and regulatory inquiries. Dr. Doré has served as an expert witness in structural integrity and failure analysis matters, including international arbitration and litigation outside the United States.

Fatigue of Welded Structures

Dr. Doré is one of the UK's foremost specialists in the fatigue behaviour of welded joints, the phenomenon by which repeated loading causes cracks to initiate and grow at weld toes, roots, and discontinuities, potentially leading to structural failure. He advises clients on fatigue design, fracture, fatigue life extension, and post-weld improvement techniques such as high-frequency mechanical impact (HFMI) treatment. His work spans welded steel and aluminium structures in offshore, civil, and transport applications, and he has conducted large-scale fatigue testing programmes to characterise crack growth behaviour under variable amplitude loading conditions representative of real service environments.

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Expert Witness & Legal Support

Dr. Doré provides expert witness and technical advisory services to law firms, insurers, and government bodies involved in disputes concerning structural failures and construction defects. His experience encompasses international arbitration, construction litigation, contract and business disputes, and litigation outside the United States. He prepares technically rigorous, clearly communicated expert reports and is experienced in presenting complex engineering evidence to non-specialist audiences, including legal counsel, arbitration panels, and regulatory bodies.

Standards Development & Training

Dr. Doré holds leadership positions in the international standards bodies that govern fatigue and fracture assessment of welded structures and components. He currently serves as Chair of BS 7608 (fatigue design of welded steel structures) and Chair of the fatigue subcommittee for BS 7910 (fitness-for-service assessment of structures containing flaws), and as the UK National Delegate to IIW Commission XIII on fatigue. He also serves as a UK Expert on Eurocode fatigue and fracture committees for bridges and structures (B/525/10, CB/203). This standards leadership gives clients direct access to an engineer closely involved in the development and interpretation of the standards, bringing valuable insight to disputes, design reviews, and regulatory engagements where their application or interpretation is contested. Dr. Doré delivers training on fatigue design and fitness for service and engineering design in accordance with the relevant standards, and he has been recognised by ASME for this work.

Areas of Expertise

Structural Integrity & Fitness-for-Service

- Fatigue crack growth analysis
- Fatigue design guidance for welded structures
- Fracture mechanics
- Fatigue life improvement techniques

Structures & Materials

- Welded steel structures
- Welded aluminium structures
- Additive manufacturing integrity

Industry Sectors

- Offshore structures
- Bridges and viaducts
- Pipelines
- Hydrogen energy transition
- Shipping

Learn about Dr. Doré's training programmes

Fatigue of Welded Structures

Practical Application of BS 7910

Academic Credentials & Professional Honors

Ph.D., Materials Engineering, The Open University, United Kingdom, 2015

B.Eng. (Hons), Mechanical Engineering, Anglia Ruskin University, 2007

Mechanical Engineering, Anglia Ruskin University, 2005

ASME – Fatigue Design Assessment of Weldments, 2017

TWI Commendation Award, 2014

Prior Experience

Technology Fellow, Structural Integrity, TWI Ltd, Cambridge, 2024–2026

Section Manager, Fatigue & Fracture, TWI Ltd, Cambridge, 2017–2024

Centre Director, Professor in Enterprise and Innovation (Fatigue & Fracture), Advanced Structural Integrity Innovation Centre, Coventry University, 2021–2023

Team Manager, TWI Ltd, Cambridge, 2016–2017

Principal Project Engineer, TWI Ltd, Cambridge, 2014–2016

Senior Project Engineer, TWI Ltd, Cambridge, 2011–2014

Project Engineer, TWI Ltd, Cambridge, 2007–2011

Professional Affiliations

BSI WEE/37: Committee Member

WEE/37/3 BS 7910 (Chair – Fatigue)

WEE/37/9 BS 7608 (Chair)

B/525/10, CB/203: Committee member & UK Expert

IIW Commission XIII: UK National Delegate

Publications

Andrew Cosham, Matthew Doré, Fokion Oikonomidis, Menno Hoekstra, Xing Sun, Max Koronka, Nancy Thompson and Gemma Simpson. “Characterisation of the Effects of Hydrogen on Three Line Pipe Steels in the Local Transmission System”, 4th AMPP Conference & Expo 2026.

Doré, M. "The Status of Research on Structural Integrity of Additive Manufacturing in Steels and Aluminium Alloys," White Paper, TWI Ltd, 2025.

Bakir, A., R. Reed, X. Zhang, A. Syed, P. Reed, P. McNutt, and M. Doré. "Fatigue performance of cold spray repaired aluminium alloy 7075," International Journal of Fatigue, vol. 198, 2025, p. 109036.

Shahriarifar, M., M. Doré, M. Dodge, K. Khan, and X. Zhang. "Investigation on the fatigue behaviour of stainless steel 316L produced by laser powder bed fusion process," Fatigue 2024 Conference Proceedings, 2024.

Bakir, A. A., X. Zhang, M. Doré, and P. McNutt. "Structural integrity of cold spray repaired aluminium alloy 7075 specimens," Fatigue 2024 Conference Proceedings, 2024.

Bakir, Ali Alpren, Xiang Zhang, Matthew Doré, and Kashif Khan. "Structural integrity assessment of cold spray repaired high-strength aluminium alloy 7075 specimens," MS&T23, 2023.

Akgun, Emre, Xiang Zhang, Tristan Lowe, Yanhui Zhang, and Matthew Doré. "Fatigue of laser powder-bed fusion additive manufactured Ti-6Al-4V in presence of process-induced porosity defects," Engineering Fracture Mechanics, vol. 259, 2022, p. 108140.

Akgun, Emre, Xiang Zhang, Romali Biswal, Yanhui Zhang, and Matthew Doré. "Fatigue of wire+arc additive manufactured Ti-6Al-4V in presence of process-induced porosity defects," International Journal of Fatigue, vol. 150, 2021, p. 106315.

Johnston, C. and M. Doré. "Comparison of the Fatigue Performance of Galvanised M72 Bolts With Design Standard Recommendations," Materials Technology, vol. 3, 2021.

Zhang, Yanhui and Matthew Doré. "Comparison of Fatigue Crack Growth Rates of Different Specimen Geometries," OMAE2021-62388, 2021.

Boruah, Dibakor, Xiang Zhang, and Matthew Doré. "Experimental evaluation of interfacial adhesion strength of cold sprayed Ti-6Al-4V thick coatings using an adhesive-free test method," Surface & Coatings Technology, 2020.

Zhang, Yan-hui, Matthew Doré, and Jazeel R. Chukkan. "Evaluation of the solutions for calculating misalignment-induced stress concentration factor at girth welds in pipelines," OMAE2020-18288, 2020.

Sun, Xing and Matthew Doré. "Improved bending correction factor for fatigue assessment of welded joints," Proceedings of the Thirtieth International Ocean and Polar Conference, ISOPE, 2020.

Akgun, Emre, Romali Biswal, Matthew Doré, and Xiang Zhang. "Failure causes of an additive manufactured TI-6AL-4V and implications on fatigue design," Engineering Integrity Society, Fatigue 2020, 2020.

Boruah, Dibakor, Xiang Zhang, and Matthew Doré. "Theoretical prediction of residual stresses induced by cold spray with experimental validation," Multidiscipline Modelling in Materials & Structures, 2019.

Boruah, Dibakor, Xiang Zhang, and Matthew Doré. "Evaluation of residual stresses induced by cold spraying of Ti-6Al-4V on Ti-6Al-4V substrates," Surface & Coatings Technology, 2019.

Boruah, Dibakor, Xiang Zhang, and Matthew Doré. "An analytical method for predicting residual stress distribution in selective laser melted/sintered alloys," Materials Research Forum LLC, 2018.

Zhang, Yan-hui and Matthew Doré. "Fatigue crack growth assessment using BS 7910:2013 - Background and recommended developments," International Journal of Pressure Vessels and Piping, vol. 168, 2018, pp. 79-86.

Mikkola, E., M. Doré, G. Marquis, and M. Khurshid. "Fatigue assessment of high-frequency mechanical impact (HFMI) - treated welded joints subjected to high mean stresses and spectrum loading," Fatigue & Fracture of Engineering Materials & Structures, vol. 38, no. 10, 2015, pp. 1167-1180.

Doré, Matthew J. and Stephen J. Maddox. "Investigation of Fatigue Crack Acceleration under Variable

Amplitude Loading for a Structural Steel and Aluminium Alloy," Advanced Materials Research, vol. 891-892, 2014, pp. 581-587.

Mikkola, Eeva, Matthew Doré, and Mansoor Khurshid. "Fatigue strength of HFMI treated structures under high R-ratio and variable amplitude loading," Procedia Engineering, vol. 66, 2013, pp. 161-170.

Gerritsen, Christoph, Sofie Vanrostenberghea, and Matthew Doré. "Diode laser weld toe re-melting as a means of fatigue strength improvement in high strength steels," Procedia Engineering, vol. 66, 2013, pp. 171-180.

Doré, Matthew J. and Stephen J. Maddox. "Accelerated Fatigue Crack Growth in 6082 T651 Aluminium Alloy Subjected to Periodic Underloads," Procedia Engineering, vol. 66, 2013, pp. 313-322.

Maddox, S. J., M. J. Doré, and S. Smith. "A case study of the use of ultrasonic peening for upgrading a welded steel structure," Welding in the World, vol. 5, no. 9-10, 2011, pp. 56-67.

Freeman, R., C. Kong, M. Doré, and L. Zhang. "Optimisation of Laser Direct Metal Deposition for Additive Manufacture and Repair of Alloy 718," Aeromat 20 Conference and Exposition American Society for Metals, 2010.

Maddox, S. J., M. J. Doré, and S. Smith. "Investigation of ultrasonic peening for upgrading a welded structure," IIW doc. XIII-2326-10, 2010.

Thomas, W., D. Staines, P. Tubby, M. Doré, and M. Gittos. "Friction Skew-stir welding - Fatigue performance." INALCO 2004, 2004.

Project Experience

Structural Integrity & Fitness-for-Service Assessments

Dr. Doré has led structural integrity and fitness-for-service assessments for critical infrastructure across the UK and internationally, including high-profile bridge investigations, pipeline integrity studies, and energy sector evaluations. His work consistently combines advanced fracture mechanics analysis with physical testing to produce defensible, standards-compliant conclusions.

- Conducted advanced fatigue crack growth assessments and fitness-for-service evaluations for the Boston Manor and Gade Valley Viaducts, examining the condition of electroslag welds and lively bottom flanges to assesses “remain in service” options. The 2.4-km-long Boston Manor Viaduct, to the west of London carrying the M4 motorway, was nationally and politically important at that time due to the impending Olympic Games.
- Led hydrogen compatibility and structural integrity studies on the repurposing of existing natural gas pipelines for gaseous hydrogen transportation, addressing the distinct crack growth and embrittlement behaviour of hydrogen relative to natural gas under BS 7910 and related standards. Project was nationally important for aiding the blueprint of such works in the UK.
- Conducted a structural integrity assessment for a high-profile investigation of the Forth Bridge, applying fracture mechanics and fatigue analysis to evaluate the condition of a nationally significant heritage structure.
- Undertook a full-life assessment on a large oil platform jacket structure operating in the Gulf of Mexico, to ascertain the requirements needed for an additional 15 years’ service. Through materials testing and calculation, the extension was deemed acceptable, leading to further assessments across the fleet with increased revenue of the operators.

Failure Investigation & Root-Cause Analysis

Dr. Doré has investigated failures in offshore, subsea, civil, and industrial structures, applying a systematic root-cause methodology that integrates materials characterisation, stress analysis, and standards review to produce findings that withstand legal and regulatory scrutiny.

- Investigated sour corrosion behaviour (sulphide stress cracking and hydrogen-induced cracking) in carbon-manganese steel riser welds for subsea applications, identifying the mechanisms driving degradation in hydrogen-sulphide-containing environments and informing fitness-for-service decisions for the operator. Part of a programme of qualification testing and assessment before operational use.
- Supervised the weld repair and inspection of a cracked half-joint on a critical railway bridge, overseeing the technical assessment of repair options and the inspection programme required to confirm structural adequacy before the structure was returned to service. The work was successfully undertaken and reduced significant costs through unplanned traffic management.
- Led investigations into the sudden fracture of steel holding down bolts for a significant UK bridge, identifying the governing mechanism responsible, as well as developing systems for future inspection and preventative maintenance strategies.
- Investigated the occurrence of cracking in escalator steps, providing identification of the mechanisms at play. Required metallographic examination, materials testing, and fatigue analysis, to develop recommendations which were subsequently undertaken to improve the structural performance and reduce subsequent down-time.

Fatigue of Welded Structures

Dr. Doré has led and contributed to major research and consulting programmes focused on the fatigue performance of welded joints in steel and aluminium structures, including large-scale testing, variable amplitude loading studies, and post-weld improvement technique evaluation.

- Managed a long-term Joint Industry Project (JIP) focused on the characterisation of materials retrieved from decommissioned offshore structures, generating fatigue and fracture data to support life extension decisions and decommissioning planning for offshore operators. The work was backed by both the Health and Safety Executive and the Petroleum Safety Authority and led to an easing on the conservatism for such assessments.
- Optimised post-weld improvement techniques, including high-frequency mechanical impact (HFMI) treatment for high-strength steel welded structures as part of an EU Commission initiative, producing validated guidance for extending the fatigue life of in-service welded connections. The work was subsequently used in support of developing the IIW’s HFMI guidelines, now used internationally.
- Managed a European collaborative project involving fatigue testing programmes across four companies in three countries, coordinating multi-site experimental work to characterise fatigue crack growth behaviour under representative service loading spectra. The work allowed an off-highway vehicle manufacturer involved to make significant financial savings across their range of excavators and trucks.
- Developed and managed multiple programmes of fatigue testing on representative large-scale welded steel specimens, under constant and variable amplitude loading, to establish the fatigue strength of safety critical joints for strategic defence vessels.
- Developed a methodology for qualification testing of steel garden trampoline frames. Required full-scale instrumentation and dynamic testing of trampolines to establish test requirements for

local joints. The qualification test improved the level of safety for those products and became a requirement by a large UK retailer to enable manufacturers to feature in their stores.

- Following the discovery of significant cracking to a European automated pick/pack track system in a refrigeration storage facility, developed and led a programme of full-scale testing to investigate the performance of a proposed restoration design to meet the demands of static and cyclic loading at reduced temperatures. Successful demonstration led to the implementation of the design at the storage facility, resulting in reduced down-time and financial savings.
- Led a programme of work on military aluminium bridge structures (a design utilised globally) to establish the fatigue performance of critical welded joints and develop guidelines for the implementation of HFMI to improve fatigue life.
- Investigated the performance of ultrasonic impact testing applied to welded joints to develop guidelines for its application to real world structures. The work saw its implementation on UK rail networks and became the initial guidance used in the development of the IIW's HFMI guidelines.

Expert Witness & Legal Support

Dr. Doré has provided technical support in legal and insurance matters involving structural failures, construction disputes, and engineering practice, preparing expert reports and analysis that meet the standards required for arbitration and litigation proceedings.

- Technical Dispute Resolution – Expert determination of root cause of a bicycle wheel failure, evaluating whether the incident stemmed from material fatigue. (Europe)
- Expert Witness Support – Construction & Engineering. Investigating the mechanisms responsible for weld failure of a jacket structure, Arbitration proceedings, ~2018. (UK)
- Expert Witness Support – Construction & Engineering. Investigating the mechanisms responsible for weld failure of a jacket structure. Arbitration proceedings, ~2014. (UK)
- Technical Dispute Resolution – Industrial Health & Safety. Failure of a heavy industrial stator mounting pads, ~2014. (UK)
- Arbitration and Legal Preparedness – Nuclear infrastructure failure. Leak rate determination for insurance loss adjuster, ~2010. (UK)

Standards Development & Training

Dr. Doré's standards leadership has directly informed consulting engagements where the correct interpretation and application of BS 7608, BS 7910, IIW fatigue guidance, and the Eurocodes is central to the outcome.

- Applied BS 7910 fatigue crack growth assessment methodology, including background knowledge of its development and recommended developments, to pipeline and structural integrity evaluations, ensuring that assessments reflect current best practice and are defensible.
- Applied BS 7608 S-N fatigue assessments, including background knowledge of its development, to multiple industry sectors, ensuring recommendations made are defensible.
- Undertaken review assessments on the use of Eurocodes to ensure correct practice being undertaken according to the relevant code and its National Annex. Delivered training on fatigue design assessment of weldments, recognised by ASME, equipping engineering teams with the skills to apply BS 7608, BS 7910, and IIW fatigue design guidance correctly in practice.
- Developed a training course on fatigue of welded structures, currently marketed through Exponent, to develop the understanding and implications of fatigue design.

- Developed a training course on the practical application of BS 7910, currently marketed through Exponent, to develop fitness-for-service knowledge to support engineering critical assessment.

Research

Professor in Enterprise and Innovation (Fatigue & Fracture) at Coventry University, 2021-2023. Supervised numerous Ph.D. candidates, providing technical guidance and support to completion of their studies on topics of structural integrity of additively manufactured components, effect of hydrogen diffusion, fatigue life improvement, and fatigue design. Dr Doré has published over 30 peer-reviewed papers in technical journals and conference proceedings.

Personal research projects have included areas such as:

- Re-analysis of fatigue S-N classification curves and inclusion of new datasets in BS 7608. An ongoing study to review and increase existing database of S-N data for weld classification details. Will be included in the forthcoming revision to BS 7608.
- Re-analysis of fatigue crack growth rate guidance and inclusion of new datasets. This involved the significant addition of new data, enabling a comparison between old and modern steels. Included in the current revision to BS 7910.
- Review of guidance on vibratory stress relief for welded steel structures. Work provided insight into the effectiveness of the technique.
- Status of research on structural integrity of additive manufacturing. This state-of-art-review explored areas for future development and provided an overview of Ph.D. work in that area completed at TWI.
- An investigation of fatigue crack growth acceleration. Identified mechanisms associated with accelerated crack growth under variable amplitude loading. Work performed on both structural steel and aluminium alloy to support recommendations in the forthcoming revision to BS 7608.
- The effect of ground groove geometry following weld toe machining. Investigation into the performance of groove geometry to material thickness.