

Personal Details

Nationality	British
Year of Birth	1963
Profession	Civil Engineer
Specialisation	Design and Construction of Tunnels and Underground Space



Capabilities Statement:

Professor Colin Eddie is an expert in the Design and Construction of tunnels and underground space. He has 39 years' experience in the tunnelling industry and has an intimate working knowledge of current best practice in both the design and construction of tunnels. This includes a detailed knowledge of all forms of temporary and permanent construction methodologies in use today.

He manages an active research and development programme and has been personally responsible for the introduction of many innovations which have been credited with improving the safety, efficiency and quality of many recent major projects. In 2011, he successfully led (on behalf of the British Tunnelling Society) the launch of the MSc in Tunnelling and Underground Space at Warwick University and he actively supports the course as a member of the Industrial Advisory Panel and champion of the Construction Methods module of the course.

In 2005, he was invited to become a Fellow of the Royal Academy of Engineering. In 2015 he was selected to be Royal Academy Visiting Professor of Innovation and Tunnelling at the University of Warwick and in 2018 the University appointed him Professor of Practice (Civil Engineering). In 2014 The UK Institution of Civil Engineers awarded him the John Mitchell Gold Medal in recognition of his significant contribution to tunnelling.

Key Achievements:

Until May 2017 Colin Eddie was Engineering Director of one of the UK's largest tunnelling firms (Morgan Sindall PLC) and Managing Director of the in-house design consultancy business; UnPS Ltd. In June 2017, he formed his own consultancy business (Colin Eddie Consulting Limited). He has been responsible for the management of a specialist underground engineering department (85 strong) which has undertaken the detailed design of some of the largest underground projects in the UK. In the last twenty years, most of his tunnelling projects have been of a design and build nature and he has managed the implementation of over £2.5bn of tunnelling work in this time.

An Engineer with 39 years' experience, he has managed the design and construction of many prestigious projects including the UK's largest tunnel (The North Downs Tunnel for the Channel Tunnel Rail Link). The first nine years of Colin's career were spent on site on a variety of soft ground and rock tunnelling projects. Since 1988 he has been responsible for the underground engineering activities and formed the consultancy (UnPS) in 2002. To promote a seamless interface between design and construction, he encourages regular contact between the design teams and the worksite and, where appropriate co-locate on site.

In addition to the management of permanent and temporary works design, Colin was responsible for the introduction of formal risk management procedures within Morgan Sindall. He is passionate about the integration of design with construction and has led a "Safe by Design" culture to improve safety and to promote efficiency through world-class engineering.

He has been credited with the development of many innovations within the tunnelling industry including:

- The first use of steel fibre reinforced tunnel linings (now an industry standard)
- CombiShell™ method of tunnelling (together with BeMo Tunnelling)
- LaserShell™ method of tunnelling (together with BeMo Tunnelling)
- UltraShell™ method of tunnelling (together with BeMo Tunnelling)
- Quadracurve™ Precast Lining System
- One-pass segmental lining system for hydraulic tunnels
- SlipStress™ and SmartShell™ novel lining system for water retaining shaft and tunnel structures
- USC™ a self-healing sprayed concrete

In conjunction with Herrenknecht GmbH and Putzmeister GmbH, he and colleagues from Morgan Sindall, developed the MultiMode Tunnel Boring Machine (TBM) concept. Utilising compressed air face control and a pressurised Bentonite annulus, the MultiMode TBM successfully completed the challenging Heathrow Airside Road Tunnel. The 9m-diameter machine, operating with cover as little as 4.5m, controlled surface settlement to less than 10mm, resulting in no operational impact on the airport activities. In addition to excellent settlement control capabilities, the TBM worked with nominal soil conditioning (foam and polymer addition), thus ensuring minimal environmental impact and ease of reuse of the tunnel spoil on site.

In support of the company's R&D activities, Colin has promoted working relationships with the UK's Building Research Establishment and with many academic centres of excellence. In recent years, he has conducted collaborative research with a number of Universities:

- **Imperial (UK)**
 - Effect of tunnel settlement on existing underground facilities
- **Innsbruck (Austria)**
 - Development of a highly ductile tunnel lining formed from Engineered Cement Composite
 - Long-term durability of sprayed concrete
- **Cambridge (UK)**
 - Centrifuge model investigation into a segmental tunnel collapse
- **Bochum (Germany)**
 - Engineering properties of frozen soils
- **Oxford (UK)**
 - Sprayed concrete tunnel liners and used of foams and polymers in tunnelling
- **Surrey (UK)**
 - Characterisation of High-Performance Fibre Reinforced Cementitious Composites
- **Warwick (UK)**
 - Composite Tunnel Linings / Hydraulic Performance of Tunnels

In association with the Building Research Establishment and other independent laboratories, he has managed full-scale testing programmes to support innovative design concepts:

- SlipStress™ Shaft Lining Methodology
- SmartShell™ Tunnel Lining System
- Sprayable waterproof membranes
- Engineered Cement Composite Tunnel Linings
- Steel fibre reinforced segmental tunnel linings (full-scale bearing and bursting tests)
- Steel fibre reinforced sprayed concrete

- Fire testing of precast and sprayed concrete tunnel linings incorporating polypropylene fibres to prevent explosive spalling
- Strength testing of specialist fastening systems for segmental tunnel linings
- Self-healing sprayed concrete
- Contactless Excavation and Contactless Demolition Concept

In 2001, he managed the formation of Morgan Sindall's Research and Development department, test facility and laboratory. This was established to enable trials and testing to be performed on an industrial scale on a variety of tunnelling related topics. This facility was first utilised to develop an ultra-high-quality sprayed concrete for use in the permanent works of the prestigious Heathrow Terminal 5 Project.

Also, in 2001, Colin fulfilled the role of Planning Supervisor and Design Manager for the development of Morgan Sindall's tunnel lining manufacturing facility at Ridham Dock in Kent. The twin carousel factory is one of the most advanced in Europe and capable of manufacturing up to 700 tonnes of precast concrete tunnel linings in one day.

He is an active member of the Institution of Civil Engineers and the British Tunnelling Society (BTS) and has presented papers on a variety of topics, including:

- Design and Construction of Heathrow Baggage Tunnel
- Use of steel fibre reinforcement in tunnelling
- Design and Construction of the North Downs Tunnel
- The use of permanent sprayed concrete linings
- Use of Polymers and Foams in tunnelling
- Use of Compressed Air to control settlement
- Design and construction of the Hastings and Bexhill Tunnel
- Ground freezing for the recovery of a collapsed tunnel at Hull
- Development of King's Cross Station – Phase II Tunnels
- Sustainable Sprayed Concrete Tunnel Linings
- SCL Tunnelling
- The past, present and future of tunnelling and underground space

In addition to the above presentations which were predominately of a technical nature, he has also spoken on the procurement and management challenges associated with major infrastructure projects in the UK:

- NCE Tunnelling Conference 2013
- NCE Tunnelling Conference 2015
- London Engineering Group Annual Conference 2016
- CICES Commercial Management Conference 2018

In 2006 he became the youngest engineer to present the prestigious Harding Memorial Lecture at the Institution of Civil Engineers (ICE). He chose as his theme "Tunnelling into the Future" and presented the case for emerging technologies to support the effective development and utilisation of underground space.

He contributes to the annual BTS Design and Construction Course and has lectured on tunnelling at a number of UK universities. He has also presented papers on tunnelling related topics to members of the Institution of Mechanical Engineers, the Concrete Society, The Geological Society and at tunnelling seminars arranged by the UK Health and Safety Executive.

Colin is a former committee member of the BTS and past chair of the training and education sub-committee, and member of the technical committee. He was also chair of the BTS committee tasked with preparing guidance on TBM operational protocols. He has peer-reviewed a number of publications on behalf of the BTS; including:

- “Occupational exposure to nitrogen monoxide in a tunnel environment”
- Insurance Joint Code of Practice (JCOP) “Procurement, Design and Construction of Tunnels and Associated Underground Structures”

He sat on the Steering Committee for the Tunnelling and Underground Construction Academy (TUCA) in London for over five years and is committed to initiatives to encourage young people into engineering.

He is a former member of the Institution of Civil Engineers R&D Committee which controls the R&D and Knowledge Management activities of the ICE.

He has acted as a member of the Expert Panel to the (£16bn) CrossRail Project; (£3bn) Thames Tideway Projects and most recently the (£1bn) Silvertown Road Crossing at Greenwich. He is currently acting in an Expert Advisor (Tunnels) role for the Lower Thames Crossing Project (£6bn). He has provided support to International Clients on a variety of underground engineering projects in all sectors including transportation, Public health, nuclear, power and energy.

Professor Eddie has also acted as an Independent Expert Witness for disputes on a number of international tunnelling projects.

The achievement however which Professor Eddie believes to be the most significant so far is the development of the LaserShell™ method of tunnelling (in conjunction with Christian Neumann Beton-und Moneirbau). This method significantly improves safety at the tunnel face and enables Sprayed Concrete Lined (SCL) tunnels to be constructed to a superior quality and more efficiently than would be possible with traditional methods. The method was developed following a serious accident on his North Downs Tunnel (CTRL 410) project and has since been successfully used on major tunnelling works on the Heathrow Terminal 5 project, King’s Cross Station Redevelopment and Crossrail C510 Project (Liverpool Street and Whitechapel Stations). The method is currently in use on the Tideway West project (in conjunction with the USC™ - self-healing sprayed concrete).

Education

Colin entered the tunnelling industry at the age of sixteen. In the following four years, whilst working as a site engineer on several tunnelling projects in the UK and one (non-tunnelling project) in Qatar, he studied on a day release basis to obtain ONC and HNC qualifications in Civil Engineering and was awarded the Civil Engineering prize from the Coventry Technical College in 1981. His HNC dissertation was entitled “Rock Tunnelling”.

In 1984, he was sponsored by his company as a mature student to read Civil Engineering at Newcastle University. During this period, he maintained close links with his employer and worked on a variety of projects during vacation periods. He graduated with an honours degree in Civil Engineering in 1987. His specialist subject was Geotechnical Engineering and his final year dissertation was entitled “Geotechnical Aspects of Small Bore Tunnels in Soft Ground”.

Professional Status

- 2018 Professor of Practice (Civil Engineering)
- 2015 Royal Academy Visiting Professor of Innovation and Tunnelling
- 2005 Fellow of the Royal Academy of Engineering
- 2004 Fellow of the Institution of Civil Engineers

1992 Member of the Institution of Civil Engineers

Employment Record

1979~May 2017- Morgan Sindall PLC (formally Miller Buckley, Miller Civil Engineering and Morgan Est)

1979~1981	Junior Site Engineer
1981~1986	Site Engineer
1986~1987	Site Agent
1987~1988	Senior Site Engineer
1988~1994	Tunnel Design Engineer
1994~2003	Chief Tunnelling Engineer
2003~May 2017	Engineering Director Morgan Sindall (Tunnelling) and Managing Director UnPS Ltd.

May 2017~Present - Colin Eddie Consulting Limited

May 2017~ Managing Director

Key Projects

- Thames Tideway West
- Crossrail C510
- Lee Tunnel
- King's Cross Station Redevelopment
- Heathrow Terminal 5 – Tunnels
- Heathrow Baggage Transfer Tunnel
- Ridham Dock Tunnel Lining Manufacturing Facility
- CTRL 350/410, North Downs Tunnel and Medway Bridge
- Hull UWWTD

Publications

Grose, B., & Eddie, C. (1996). Geotechnical aspects of the construction of the Heathrow Transfer Baggage System tunnel. Geotechnical Aspects of Underground Construction in Soft Ground.

Watson, P. C., & Warren, C., & Hurt, J. C., & Eddie, C. (2002). The design of the North Downs Tunnel. BTS Conference.

Tindall, S., & Chamley, P., & Grose, B., & Eddie, C. (2002). Using hindsight at Hull. Tunnels and Tunnelling.

Eddie, C. (2002). Spayed concrete on frozen ground. Tunnels and Tunnelling.

Eddie, C. M. (2002). Settlement Control using compressed air. UK, Second International Conference on Engineering and Health in Compressed Air Work.

Eddie, C. M., & Neumann, C. (2004). Development of the LaserShell Method of Tunnelling. USA, North American Tunnelling Conference 2004.

Eddie, C. M., & Neumann, C., & Cruickshank, A. (2005). Sprayed advances – LaserShell update. Tunnels and Tunnelling.

Eddie, C. (2006). Tunnel vision. Tunnels and Tunnelling.

Eddie, C., & Neumann, C., & Jäger, Dr J. (2009). Innovative Permanent Shotcrete Tunnel Linings in London Clay. Austria, Spritzbeton-Tagung 2009.

Eddie, C., & Psomas, S., & Harper, M. (2010). Sustainable tunnel linings: Asset protection that will not cost the earth. Tunnels and Tunnelling.

Boughanem, S., & Jesson, D. A., & Mulheron, M. J., & Smith, P. A., & Eddie, C., & Psomas, S., & Rimes, M. (2011). Engineered Cement Composites Properties for Civil Engineering Applications. South Korea, 18th International Conference on Composite Materials (ICCM 18).

Eddie, C. M., & Allen, C. (2012). Design and Construction of a novel lining system for a large water retaining shaft on the Lee Tunnel Project. International Conference on Shaft Design and Construction.

Boughanem, S., & Jesson, D. A., & Mulheron, M. J., & Smith, P. A., & Eddie, C., & Psomas, S., & Rimes, M. (2013). HPFRCC Characterisation for Tunnelling Applications. Istanbul, International Conference on Civil, Structural and Earthquake Engineering.

Mar, Dr A., & Eddie, C. M. (2013). Modelling the Influence of Compensation Grouting and multiple tunnel construction using Advanced Finite Element Analysis. NAFEMS World Congress.

Psomas, S., & Eddie, C., & Sutherden, R., & Matta, C. (2014). SFRC for cast-in-place (CIP) Permanent Linings: Thames Tideway Lee Tunnel Project in East London, UK. Athens, 2nd Eastern European Tunnelling Conference.

Boughanem, S., & Jesson, D. A., & Mulheron, M. J., & Smith, P. A., Eddie, C., & Psomas, S., & Rimes, M. (2015). Tensile characterisation of thick sections of Engineered Cement Composite (ECC) materials. Journal of Materials Science 50(2)

Hover, Dr E., & Psomas, S. (2015). Short, Mid and Long-Term Tunneling-Induced Settlements at Whitechapel Station. Ground Engineering.

Johnson, R. P., & Psomas, S., Eddie, C. M. (2017). Design of steel fibre reinforced concrete tunnel linings. ICE Proceedings.

Hover, E., & Psomas, S., & Eddie, C. (2017). Estimating crack widths in steel fibre-reinforced concrete. ICE Proceedings.

Eddie, C., & Psomas, S. (Awaiting Publication). High Performance Fibre Reinforced Cement Composites (HPFRCC) for Tunnelling.