David George Clare

Profession
Civil Engineer

Current Position
Director

Joined Arup
1988

Years of Experience

Nationality
British

Qualification
BSc Civil Engineering (First Class Hons)

MSc and DIC Soil Mechanics (Distinction)

Professional Associations
Member, Institution of Civil Engineers (ICE)

Committees
(1997-2002) Member of ISO /TC67/SC7/WG3 Panel 4and WG 4 committees preparing foundation sections of ISO codes for offshore structures: 19901 Pt 4 (Foundations Annex), 19902 (Fixed Steel structures), 19903- (Fixed Concrete Structures)

(2003- 2008) Foundations Technical Panel Leader and Country Representative for ISO/TC67/SC7/WG 8: Arctic Offshore Structures Standard

Publications
D.G.Clare, Z.A.Lubkowski, J.F.Bird (2002) Factors affecting liquefaction susceptibility of fine grained soils and the use of dewatering and suction to mitigate liquefaction risk. *12th European Conference in Earthquake Engineering, London, UK* Paper 562.

David is a Director of Arup.

He has experience of design and construction of piled and gravity base foundations for offshore structures, design of artificial islands and caissons subject to ice and wave loading.

David has also been responsible for the design of foundations for LNG tanks, process facilities, power stations, jetties and reclamations in seismic regions.

Formerly business leader for energy projects and group leader, London Geotechnics.

David has been responsible for the geotechnical aspects of many onshore, maritime, nearshore and offshore projects carried out by Arup in the UK and overseas.

Relevant Projects

Maritime Projects

Sempra Energy, Costal Azul, offshore Baja California, Mexico.

Review of foundation tender design for breakwater

BP, Shah Deniz, Zykh Yard, Baku, Azerbaijan

Review of all aspects of the platform fabrication yard upgrade

Dragon LNG, Milford Haven, Wales

Expert review of contractor claim over increased costs for construction of small and large diameter rock socket piles.

Cacouna Energy, Montreal, Canada

Expert review to identify areas for cost savings in the design of an LNG jetty subject to ice, wave and seismic actions in the St Lawrence River.

Immersed tube tunnel crossing the Bosporus, Turkey

Tender design of immersed tube tunnel crossing the Bosporus, Turkey

OKIOC, Islands Caspian Sea, Kazakhstan.

Tender design of artificial ice resistant islands.

Ampolex, Wandoo CGS, Australia.

Design review of CGS, and detailed design and construction

Clare, D.G. and Taylor, P.H. (1997) "Factors Affecting the Stability of Offshore Gravity Structures Subject to Ice and Wave Loading*", Procs. 3rd International Conference on Development of the Russian Arctic Offshore, RAO '97.*

Phillips, A.B., Clare, D.G. and Buys, H.G. (1996) "Geotechnical Design of a Casting Basin at Bunbury, Western Australia" *Proc. 7th Australia New Zealand Conference on Geomechanics, Adelaide.*

Ardus, D.A., Clare, D.G., Hill, A., Hobbs, R., Jardine, R.J. and Squire, J.M. Eds (1992) *Offshore Site Investigation and Foundation Behaviour - Volume 28", Kluwer.*

O'Riordan, N.J., and Clare, D.G. (1990) "Geotechnical Considerations for the Installation of Gravity Base Structures" *Proc. 22nd Offshore Technology Conf, Houston, OTC Paper 6381.*

Chipp, P.N., Clare, D.G., Henkel, D.G. and Pope, R.G. (1982) "Field Measurement of Suction in Colluvium Covered Slopes in Hong Kong", *Proc. 7th Southeast Asian Geotechnical Conference.*

supervision of the casting basin at Bunbury, WA

MWKL, Yemen LNG

Reviewer for foundation advice for LNG tanks and jetty on voided basalt.

Sual Power Station Intake Shaft, Philippines.

Design of temporary works dam for Sual Power Station intake shaft construction.

CEPA, Sual Power Station, Philippines

Detailed seismic hazard assessment and analysis of soil-structure interaction for several structures, including a coal unloading jetty and access bridge

Hopewell, Shajiao C, Power Station, China.

Foundation design of jetty and access bridge

Besix, South Hook LNG, Milford Haven, UK

Geo-seismic design input for the import LNG jetty.

CB&I, South Hook LNG, Milford Haven, UK

Seismic design basis for the import LNG terminal.

Qatargas, South Hook LNG, Milford Haven, UK

Seismic hazard assessment to define appropriate OBE and SSE seismic criteria according to EN 1473 and the review of the existing jetty under the SSE

Siemens AG, Santa Rita Power Station, Philippines.

Detailed seismic hazard assessment and preliminary design of foundations for a jetty and access bridge.

CLK Airport

Manager of £7M CPT site investigation marine mud survey for Chek Lap Kok airport reclamation, Hong Kong to determine dredge levels. Analysis of reclamation stability during fill construction.

NAB Load-Out

Verification of site preparation works for the load out of a steel jacket for the North Alwyn field. Works comprised reclamation, anchored sheet pile walls and construction of skidway embankments. Analyses included evaluation of equivalent skidway spring stiffnesses for structural load out analyses and verification of anchorages and mast foundations involved in the major bottle lifts.

Royal Docks

Geotechnical study of the Royal Group of Docks, London, entailing assessment of stability of some 10 miles of various types of dock walls with regard to present conditions and future

development.

Energy Projects

Offshore Projects

Husky WREP, Newfoundland, Canada

Concrete gravity structure (CGS) foundation detailed design reviewer. Construction dry dock Project Manager and designer. Dredged channel design routes for CGS tow out to site.

Shell FB Hybrid, NWS Australia

Concept studies for GBS/ steel tower hybrid in 250m WD

Woodside, Browse Docks, SE Asia

Studies of potential construction sites for 300mL x 150mW x 30mH rc caissons for LNG plant at Scott Reef

Apache, Reindeer, NWS Australia

Review of drilled and grouted pile design

Conoco Phillips, Compass Port LNG, GoM

Review of FEED foundation designs for offshore LNG storage tanks.

Sempra Energy, Costal Azul, offshore Baja California, Mexico.

Review of foundation tender design for breakwater

Maari Ace Platform, Cook Strait, New Zealand

Geotechnical reviewer for the foundation design of the self-installing gravity base structure.

Bassgas, Yolla Ace Platform, Bass Strait, Australia

Reviewer of the detailed design of this ACE self-installing gravity base structure gas production unit.

SEIC, Sakhalin Energy, Sakhalin II Project.

Project Director for FEED design of two platforms subject to severe seismic, ice and wave loading

Shell, Malampaya CGS, Philippines.

Project Director for detailed design of concrete gravity structure, and design and construction supervision of dry dock for construction of Malampaya CGS, Subic Bay, Philippines, Luzon

Immersed tube tunnel crossing the Bosporus, Turkey

Tender design of immersed tube tunnel crossing the Bosporus, Turkey

Conoco Indonesia Hang Tuah, W Natuna Sea, Indonesia

Reviewer of detailed design of foundation for self-installing

platform.

OKIOC, Islands Caspian Sea, Kazakhstan.

Tender design of artificial ice resistant islands.

Ampolex, Wandoo CGS, Australia.

Design review of CGS, and detailed design and construction supervision of the casting basin at Bunbury, WA

Hamilton Bros Prirazlomnoye Project, Pechora Sea, Russia Arctic

Prirazlomnoye offshore caisson FEED design and artificial island studies

CTMS, Gorgon CGS, Australia

Review of foundation design

Onshore Projects

SGSI, Persian LNG Upstream Onshore Project, Tombak, Iran

Project Director for the ground investigation and geotechnical interpretative reporting. Particular geotechnical issues related to the hot desert environment of the site are being investigated.

OKLNG, Nigeria

Project director for FEED stage ground investigation for a proposed LNG facility project in Olokola, Nigeria

BP, Shah Deniz, Zykh Yard, Baku, Azerbaijan

Review of all aspects of the platform fabrication yard upgrade

BP, In Amenas, Algerian Sahara

Site selection and foundation design for a gas plant.

MWKL, Yemen LNG

Reviewer for foundation advice for LNG tanks and jetty on voided basalt.

SGSI GTL Plant, Qatar

Specification of site investigation for voided carbonate soils, earthworks and pad loading trials.

Sual Power Station Intake Shaft, Philippines

Design of temporary works dam for Sual Power Station intake shaft construction

Hopewell, Shajiao C, Power Station, China

Foundation design of jetty and access bridge,

TSKJ, LNG Plant, Bonny Island, Nigeria

Providing advice on foundation design and site preparation works for a Shell Nigeria LNG plant to be built on a soft clay site.

Esso, Blast Wall, Antwerp

Design of piled foundations for blast wall surrounding ethylene tank, Esso Antwerp.

BP Venezuela, Access Roads to Remote Drill Sites

Studies for temporary access roads to remote drill sites.

Atlantic Gas LNG tanks, Point Fortin Trinidad

Seismic design of piled foundations for two large diameter LNG tanks.

Offshore Renewable Projects

OFTO, Various, UK

Geotechnical advice to Macquarie Bank on cable burial and anchor risks for cables sale

Centrica Metmast, Irish Sea

Detailed design of metmast foundations.

CLP Metmast, HK

Review of suction can foundation design

London Array Ltd, Windfarm Thames Estuary, UK

Scheme design of gravity base foundation

Shell Flats, UK

Scheme design of gravity base foundation types

Klasarden, Sweden

Concept design of gravity base foundation types

Scarweather Sands, United Utilities, Wales

Concept design of gravity base foundation types

Conoco Renewables Windfarm sites off UK Coast

Study of foundation types for potential windfarm sites off UK coast

Expert/ Due Diligence Commissions

OFTO Cable Transactions, UK

Transaction advice to Macquarie Bank on sale of windfarm export cables. Scope included: anchor and scour hazard risk assessment, trenching, rock dump cover etc.

Dragon LNG, Milford Haven, Wales

Expert review of contractor claim over increased costs for

construction of small and large diameter rock socket piles.

Cacouna Energy, Montreal, Canada

Expert review to identify areas for cost savings in the design of an LNG jetty subject to ice, wave and seismic actions in the St Lawrence River.

Client Confidential, Immersed Tube Tunnel Claim, Cork, Ireland

Expert review of potential claim for immersed tube tunnel

Deutsche Bank, Data Centre Basement Construction Review, Frankfurt, Germany

Due diligence review of a data centre basement and foundation design under construction.

Seismic Projects

Project Director for:

Besix, South Hook LNG, Milford Haven, UK

Geo-seismic design input for the import LNG jetty.

CB&I, South Hook LNG, Milford Haven, UK

Seismic design basis for the import LNG terminal.

Qatargas, South Hook LNG, Milford Haven, UK

Seismic hazard assessment to define appropriate OBE and SSE seismic criteria according to EN 1473 and the review of the existing jetty under the SSE

Persian LNG, Tombak, Iran

Seismic hazard assessment and faulting studies for this site adjacent to the highly active Zagros region.

Petroplus, Dragon LNG, Milford Haven, UK

Seismic hazard assessment to define appropriate OBE and SSE seismic criteria according to EN 1473 and investigation of local faulting issues.

Sempra, Costa Azul LNG, Baja California, Mexico

Review of the seismic hazard assessment and fault rupture study and the liquefaction assessment for the breakwater

Shell, SMDS Plants Worldwide

Seismic hazard assessments for proposed SMDS plants in South America, South East Asia and the Middle East.

M W Kellogg Ltd, Damietta LNG Plant, Egypt

Seismic design basis and managing the seismic design for the foundations for the Process and Refrigeration areas.

COGAP, Burlington Rivers Terminal, Barrow, UK

Geotechnical site investigation and seismic design implications and advice for this gas processing facility.

BP International, Bataan Polyetylene Plant, Philippines.

Review and assessment of seismic design of ethylene tank, including carrying out a non-linear soil-pile-structure interaction analysis.

Atlantic LNG, Point Fortin LNG Plant, Trinidad

Assessment of liquefaction and lateral spreading potential for the tank platform

Whessoe Projects Ltd, Point Fortin LNG Plant, Trinidad

Non-linear dynamic soil-structure interaction of two LNG tanks in a high seismic zone, taking into account probable soil liquefaction

Siemens AG, Santa Rita Power Station, Philippines

Detailed seismic hazard assessment and preliminary design of foundations for a jetty and access bridge.

CEPA, Sual Power Station, Philippines

Detailed seismic hazard assessment and analysis of soil-structure interaction for several structures, including a coal unloading jetty and access bridge

OGP, Kertih GPP 5 and 6, Malaysia

Detailed seismic hazard assessment and site response analysis for this gas processing plant

ESSO, Ethylene Tank Blast Wall, Antwerp, Belgium

Design of foundations for a reinforced concrete blast wall to an existing facility.

British Gas, North Morecombe Terminal, UK

Assessment of dynamic soil properties, site specific response studies, liquefaction potential and shallow foundations study.

British Petroleum, Polyethylene Plant, Indonesia

Dynamic soil-structure interaction studies of piled raft foundations for tank.

Arup - General

Senior Geotechnical Engineer and Associate

Leader of group providing geotechnical advice for projects on land and offshore with particular regard to oil and gas related developments. Projects included:

Design of deep basement and foundations, and effects of

construction on adjacent tunnels for No. 1 Poultry, London.

Lateral pile load test analyses and design for 40km BERTS elevated road and train system, Bangkok.

Manager of £7M CPT site investigation marine mud survey for Chek Lap Kok airport reclamation, Hong Kong to determine dredge levels. Analysis of reclamation stability during construction.

Foundation and basement scheme design for new Commerzbank Headquarters, Frankfurt.

Project Manager for site investigation, seismic hazard appraisal and foundation design for North Morecambe Onshore Terminal, Barrow-in-Furness.

Several concept and tender designs of concrete gravity base structures in the North Sea and Offshore Australia.

Shell UK Expro

12 month Secondment from Arup London.

Geotechnical Engineer responsible for all Shell's projects in the North Sea including:

Gannet 'A' jacket SI, pile group design and installation. Gannet subsea wells snag load design; Sole Pit Clipper and Barque pile design and installation; various jack-up spud can penetration assessments.

Fugro-McClelland Ltd. Hemel Hempstead

Project Engineer

Pile group foundation analyses for jacket in the QGPC North Field, offshore Qatar. Supervising engineer for site investigation and engineering analyses for jack up rig, offshore Qatar.

Project Manager for field investigation of alternative sites for gravity base and pile supported jacket structures in Ravenspurn North Field, North Sea, and pile foundation and conductor installation analyses.

Site formation and earthworks for bunds to support LPG tanks at BP Wytch Farm, Dorset.

McClelland Limited, London

Senior Geotechnical Engineer

Responsible for supervision and management of field and engineering projects.

Project Manager for site investigation for a gravity base structure and pile supported jackets in the Ravenspurn North Field, and associated pile foundation analyses.

State-of-the-Art site investigation and laboratory testing for an instrumented large diameter pile load test (LDPT) and associated

engineering predictions of pile behaviour under test.

Conductor foundation performance for subsea wellhead completion schemes in Andrew and Cyrus fields.

Design of grouted piles for template offshore India.

John Brown Offshore Structures Ltd, London

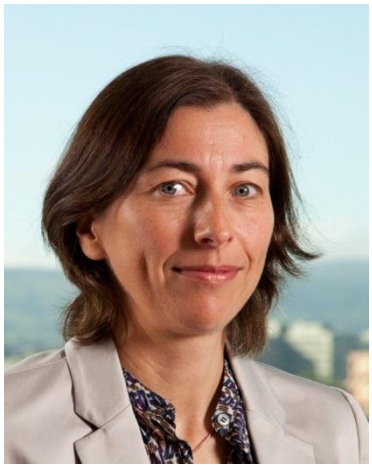
Foundation Engineer

Detailed foundation design for a jacket for the Eider field, North Sea. Evaluation of equivalent spring stiffness model of pile groups for use in the structural analyses, assessment of unpiled on-bottom stability of the jacket and associated installation studies. Lead engineer for the design of the template mudmat and piled foundation and jacket docking piles.

Verification of site preparation works for the loadout of a steel jacket for the North Alwyn field. Works comprised reclamation, anchored sheet pile walls and construction of skidway embankments. Analyses included evaluation of equivalent skidway spring stiffnesses for structural load out analyses and verification of anchorages and mast foundations involved in the major bottle lifts.

Lead engineer for design of piled foundations for jacket concept study for the Amethyst field. Engineer for the design of mat foundations for a wellhead protection frame in the Petronella field.

Julie Ascoop



Julie is a chartered Civil Engineer and has 18 years working experience as a maritime engineer, working with both consultants and contractors in Ireland, United Kingdom, the Netherlands and Germany. Julie has extensive experience in the project management of maritime projects, flooding and ocean energy projects. Recent projects include the construction of Greystones Harbour and Alexandra Quay East Container Terminal. She is currently involved in dredging plans for the Husky White Rose project, Arklow and Dunmore East harbour.

She graduated from Delft University of Technology in the Netherlands in 1994 with a Masters in Civil Engineering, specialising in Maritime Structures.

Profession
Civil Engineer

Current Position
Associate

Joined Arup
2006

Nationality
Dutch

Qualification
MSc, Civil Engineering, 1994, Delft University of Technology

CEng, Chartered Engineer, 2006

Professional Associations
Member of the Institute of Engineers Ireland (IEI)

Member of the Royal Dutch Institute of Engineers (KIVI)

Member of the World Association for Waterborne Transport Infrastructure (PIANC)

Languages
Dutch, English, German and basic French.

Safety Courses
Personal Track Safety, (Iarnród Éireann), Managing Safety in Construction (CIF), Safe Pass (HSA)

Julie has extensive experience in the project management, design coordination, public liaison and consenting process on maritime, ocean energy and dredging projects.

Selected Projects:

Belfast Cruise Ship Facility D & B tender

Julie is the Project Manager responsible for the tender design of the quay wall, dolphins, revetments, dredged berthing pocket, mooring points and paving for a new cruise ship facility in Belfast. The design will be submitted by BAM contractors as part of their tender.

Doolin Pier D & B tender

Julie was the Project Manager responsible for the Doolin Pier tender design, which was submitted by SIAC contractors to Clare County Council. The design consisted of a mass concrete pier, dredged approach channel and berthing pocket (in rock) and rock revetment, with concrete armour units.

Dublin Port High level study for the development of Alexandra basin West

Arup prepared a guidance report for Dublin Port outlining the steps to be taken for the development of Alexandra Basin West. The development involves the refurbishment of this area of the port to allow for a cruise terminal, a bulk terminal and several Ro-Ro ferry terminals. An important factor in the phasing of this project is the dredging and reclamation earthworks balance. Julie was a specialist port advisor on the team.

Due Diligence for the dredging of the port of Durres (Albania)

Julie Ascoop was the maritime engineer and dredging specialist

for the Due Diligence of the funding application for dredging works in the port of Durres. The client for this project was the European Banks for Reconstruction and Development (EBRD).

Julie was responsible for the review of the approach channel design and provided advice to the client on how to reduce the risk relating to dredge slopes, tolerances, siltation etc.

Consultancy Services for the Proposed Maintenance Dredging of Contaminated Sediment at Dunmore East Fishery Harbour Centre, Co. Waterford

Julie is project manager for this project which involves the dredging and disposal or reuse of some 17,000m^3 of sediment contaminated with high concentrations of contaminants such as TBT and heavy metals. Disposal of dredge spoil to sea is not environmentally viable and therefore the dredged material will need to be disposed of (or reused) on land.

Dublin Port Container terminal Alexandra Quay

Julie is currently the contract administrator for the refurbishment of Alexandra Quay East Container Terminal – a €10m Design and Build contract. Julie led a team of engineers who prepared the reference design, the specification, the Employers Requirements and tendered the project under a FIDIC contract.

The contract involves a new quay wall, STS crane rail beams, container stacking areas, a reefer gantry and RTG roadways and is currently under construction.

Arklow Harbour, Foreshore and Dredging Licence Application and Specification of Offshore Site Investigations

Julie is project manager on behalf of Wicklow County Council for the update of the dumping licence application (to the EPA), the new foreshore and dredging licence application (to the Department of Environment) and the specification of seismic investigations and offshore boreholes.

Under Julie's leadership, the team also provided the client with high level cost estimates to inform decisions about the disposal of the contaminated dredging spoil.

The main challenge of this project was to find a suitable location offshore, where a pit to contain the contaminated material could be dredged. The Arup team identified a suitable location and designed the size and slopes of the pit.

Dun Laoghaire Harbour, Cruise Terminal Business Case (2011)

Julie led the Arup Maritime Team in assisting economic (DKM) and shipping (STS) consultants with the preparation of a business case for a possible cruise terminal in Dun Laoghaire harbour.

This assignment involved a review of the high level cost estimate for the new cruise facilities and upgrade works required should

DL wish to establish berthing facilities for large cruise vessels.

Arup specified and attended the navigation studies that were carried out in the bridge simulation to establish the maximum size of vessels that can manoeuvre in and out of the harbour. Julie's team also carried out an Options Study comparing various possibilities for development of cruise moorings at the existing piers. In order to increase the confidence level of the cost estimate Arup also further detailed the jetty and dolphin pile design using site investigation data from previous projects and reviewed the dredging required and updated the dredging cost estimate. Julie led the Arup team of Engineers.

Expert Advisor on Coastal Flooding (2010)

Julie acted as expert advisor in the assessment of a coastal flooding report for the river Shannon as part of a due diligence process (Confidential Client).

She offered advice on the extreme flood levels in the area and the impacts of climate change on the development.

Dublin Port Container Terminal (2010-2012)

Julie is project manager for the redevelopment of the Alexandra Quay East container terminal in Dublin Port. The project involves the preparation of a reference design and FIDIC documents for a new quay wall, crane beam foundations container stacking areas, RTG runways, reefer gantry extension and hazardous waste slab. The design of the new quay wall was complicated by the presence of the existing caisson quay wall structure. Arup specified and managed the combined multibeam and drive survey to assess the condition of the caissons.

Julie and her team assisted Dublin Port Company with the procurement of the Design and Construct package for this project.

Bremore Port – EIS and Transport Design, Offshore Site Investigations (2010)

Julie is the maritime specialist assisting on both the environmental and transport teams within Arup working on the Bremore port development. Bremore port is a completely new Irish deep water port being developed by Drogheda Port Company. Phase I of the project is scheduled to cater for 10 million tonnes of freight in Lo-Lo, Ro-Ro and bulk cargoes.

Julie's maritime team assisted the client with the Master Planning for this large development and prepared the specification and tender documents for the offshore Site Investigation.

Julie has significant experience in the procurement of Offshore Site Investigations and acted as an advisor to the client in this regard. Julie was also responsible for the preparation of a high level construction cost estimate and a construction programme for

planning purposes.

Greystones Harbour and Marina Project PPP (2008 - 2011)

Project Manager for design of the marine side of this project covering the marina, harbour, dredging, reclamation and coastal defence. After 2 oral hearings, for which the Arup team provided all the engineering services, permission was granted for this project in August 2007. The design consisted of two large new breakwaters, constructed from large 21tn pre-cast concrete blocks. The sea-side is protected by the 3 - 6tn rock and 14tn Antifers. As part of the project Arup also designed a beach nourishment solution to manage the coastal erosion north of the harbour.

Construction of the harbour commenced in 2008 and was completed in 2011. The works were under a PPP contract and Arup provided services to the concessionaire SISPAR. Julie has been responsible for design management contract administration, (reviewing payment applications and certificates of completion) and the management of the QA process and site supervision by Arup Engineers. These services were all tailored to suit the PPP set up. Arup also provided engineering services for part 8 application by SISPAR.

As part of the land reclamation process dredged material was used, which required close cooperation and supervision from the Arup engineering team.

Rosslare Europort (2008)

Project manager for the development of a framework masterplan for Rosslare Europort. The project involved examining the existing layout of the port and investigating how best to re-arrange the port facilities in order to maximise efficiency. Arup also provided advice on how to integrate the proposed new motorway into the masterplan.

Greystones Harbour and Marina Project – Public Hearing (2007)

To answer the questions from the Planning Authority, Julie prepared a report which investigated the most sustainable method of transporting of shingle to the beach in Greystones.

Philip Dauncey

Profession
Civil Engineer

Current Position
Associate Director

Joined Arup
1977

Years of Experience
33

Nationality
British

Qualification
MA Civil Engineering

Professional Associations
Member, Institution of Civil Engineers

Member, British Geotechnical Society

Publications

Dauncey PC, Simpson B and Sturt R, 'Numerical modelling of an anchorage for the Metsovitikos suspension bridge, Greece', Fifth European Conference on Numerical Methods in Geotechnical Engineering, Paris, 2002

Hope S, Young S and Dauncey PC, 'Airport Railway Pile Tests' Proc. Hong Kong Institution of Engineers Geotechnical Division Annual Seminar - Foundations, 2000

O'Reilly MP, Simpson B and Dauncey PC, 'Ground movement at the toe of a high reinforced soil wall: a finite element study for the Stockley Park Arena Walls' Proc. of the International Conference on the Performance of Reinforced Soil Structures. BGS, Glasgow 1990

Dauncey PC, O'Riordan NJ and Higgins J, 'Controlled failure and back analysis of a trial embankment at Athlone' Proc. of the Ninth European Conf. on Soil Mechanics and Foundation Engineering, Dublin 1987

Philip has over 30 years experience in geotechnical engineering and has worked in Europe, North and West Africa, the Middle East, South East Asia and the USA on a variety of major projects.

He has wide experience of foundation design for buildings, bridges and industrial facilities involving both deep and shallow foundations, design of underground structures and design of slopes and earthworks.

Philip also has specialist experience of investigation, design and construction in soft clays and has been responsible for the design of ground improvement schemes, embankments, foundations and underground structures on weak, compressible ground.

He has recently been involved in several projects in arid regions and is a member of the Engineering Group of the Geological Society working party on hot deserts.

Philip has experience of leading the geotechnical engineering on infrastructure projects in many parts of the world

A4 motorway, Netherlands

Responsible for the tender design of foundations and earthworks for a 2km long 'land tunnel'. The tunnel is to be buried within an embankment on soft compressible clay and peat.

Izmit Bay Bridge, Turkey

Responsible for tender design of foundations for 1500m span suspension bridge in a high seismicity location. Involved 3D numerical modelling and assessment of dynamic soil structure interaction for main tower foundations in deep water.

In Salah Southern Fields Development, Algeria

Philip was lead geotechnical engineer for FEED stage ground investigations, trench excavatability studies, and unsealed road design for approximately 200km of pipeline and central processing facilities in the Sahara.

Forth Replacement Crossing, Scotland

Philip was responsible for the specimen foundation design for this multi span cable stayed bridge involving marine foundations in water depths of up to 20m. The design involved extensive use of 3D numerical analysis.

London Gateway Port, England

Responsible for tender design of new reclamation and ground improvement of reclamation fill and Thames alluvium for a container port with automatic stacking cranes.

Cole KW, Braithwaite PA, Dauncey PC and Seago KL, 'Removal of actual and apprehended dereliction caused by abandoned limestone mines in the West Midlands of England' Proc. of the Conf. on Building on Marginal and Derelict Land, ICE, Glasgow 1986

Dauncey PC and Woodland AR, 'Bored cast in situ piled foundations in Keuper Marl for the Birmingham International Arena' Proc. of the Conf. on Advances in Piling and Ground Treatment for Foundations, ICE, London, 1983

O'Riordan NJ, Davies JA and Dauncey PC, 'The interpretation of static cone penetrometer tests in soft clays of low plasticity', Proc. of the 2nd European Symposium on Penetration Testing, Amsterdam 1982

Davies JA and Dauncey PC, 'Construction of embankments on soft clays', Arup Journal Vol.17, No.1, 1982

Riverside South, London, England

Philip was responsible for the design of tied basement and river walls in a tidal section of the river Thames. The design involved extensive use of 2D numerical modelling.

Storage Retrievals Building, Sellafield, England

Philip was the independent assessor for foundation design of the storage retrievals building at the Sellafield nuclear power plant.

Gas Plant, Iran

Philip interpreted ground conditions and advised on site preparation and foundations at a site in a hot arid area.

LNG Plant, Yemen

Philip was geotechnical advisor to the EPC contractor for site preparation and marine works including the harbour and LNG jetty.

LNG Plant, Olukola, Nigeria

Lead geotechnical engineer for FEED design of site preparation and foundations for process plant and storage tanks.

Retail and office development, Istanbul, Turkey

Philip was lead geotechnical engineer for the design of a 35m deep basement and excavation support mostly in flysch and diorite rock.

LNG Terminal, Gulf of Mexico

Philip was part of the FFED stage design team for offshore LNG storage tanks and carried out analysis and design of the foundations comprising large diameter driven tubular piles.

In Amenas Gas Plant, Algeria

Philip was lead geotechnical engineer for the ground investigation and design of site preparation works and foundations for this gas plant in the Sahara.

Singapore Art Museum, Singapore

Philip assessed and reviewed the response of an historic masonry building to construction of the adjacent 35m deep Museum station.

Copenhagen Metro, Denmark

Philip assisted with a review of the feasibility of an alternative scheme for the East Amager line proposed by a residents group.

Damietta LNG Plant, Egypt

As lead geotechnical engineer, Philip was responsible for design of piled foundations for process plant and review of pile design and testing for tanks and a jetty in an area of moderate seismicity.

Metsovitikos Bridge, Greece

Philip was project geotechnical engineer responsible for design of ground investigations, anchorages and foundations for a proposed 550m span suspension bridge on the Egnatia Road, in an area of

high seismicity in the Pindos Mountains. The design of the foundations made use of 2D and 3D numerical modelling.

Hangzhou Bay Bridge, China

Philip provided advice on piled foundation solutions for a competition scheme for a 28km bridge.

Limerick Southern Ring Road, Ireland

Philip assisted with tender design of embankments over soft ground and cut and cover approaches to an immersed tube tunnel crossing of the river Shannon.

LNG Plant, Bonny Island, Nigeria

Project geotechnical engineer responsible for the design of preloading schemes, settlement analysis and review of monitoring for process plant, 60m diameter cryogenic storage tanks and floating roof steel storage tanks. Philip was also responsible for drivability and settlement studies for deep driven pile foundations for tanks and reviewed pile testing for jetties. Ground conditions comprised a complex sequence of deltaic interbedded sands and clays.

Lantau and Airport Railway, Hong Kong

Philip was the project geotechnical engineer for the design of Hong Kong Central Station and adjacent cut & cover tunnels which were constructed on a newly reclaimed site. The station substructure involved a phased excavation covering an area approximately 275m x 175m to depths varying between 16m and 29m, whilst the foundation design provided for overlying towers up to 50 storeys high. This project included four high capacity pile tests on rock socket piles and detailed assessments of ground movements around the excavations.

Channel Tunnel Rail Link, London, England

Philip was part of a task force for the route development studies for a section of CTRL in Essex and North Kent. He carried out feasibility studies for embankment and cut & cover tunnel approaches to the Thames tunnel through the Thames Marshes and feasibility studies for tunnels through landfills.

Replacement airport, Hong Kong

Philip was seconded to the Provisional Airport Authority for four months to review geotechnical aspects of the site preparation contract. This involved the levelling of Chek Lap Kok island and 900 hectares of marine reclamation using rock, completely decomposed granite and marine dredged sand fill and the construction of 14.5km of seawall.

Rutile Mine, Sierra Leone

Philip provided specialist advice on the stability of embankment dams under rapid drawdown conditions.

Taipei Metro, Taiwan

Philip led a geotechnical team from local JV partners and was responsible for the geotechnical design of 5km of metro including

three underground stations, bored tunnels, cut and cover tunnels and viaduct in a seismic area. The excavations were in soft clays with jet grouting to limit ground movements.

Axim-Elubo Road, Ghana

Philip carried out a specialist geotechnical investigation and design of strengthening works for embankments crossing soft clays and peat.

Athlone Relief Road, Ireland

Philip supervised the site investigation and carried out the geotechnical design for road and bridgeworks for 9km of highway on very soft clay. This project included stage constructed embankments with vertical drains and two instrumented trial embankments.

Enugu to Makurdi Railway, Nigeria

Philip was a member of the field team for the site investigation for 240km of railway underlain mostly by tropically weathered residual soils and was responsible for planning investigation, supervision of field work and managing a field soil testing laboratory. He subsequently undertook follow on geotechnical design and reporting.

Bukit Timah Expressway, Singapore

Philip was responsible for the design of earthworks and piled bridge foundations for 11km of expressway in alluvial and residual soils.

Eastern Relief Road, Dublin, Ireland

Philip was part of the team carrying out a feasibility study for this 10km urban expressway, partly in tunnel.

Channel Tunnel

Philip assessed the geotechnical aspects of the crossover cavern design and construction as part of a commission to undertake a risk analysis.

Stockley Park, Heathrow, England

Philip was responsible for foundation design for buildings, including the design of a large reinforced soil wall, on rehabilitated contaminated and derelict land.

Abandoned Limestone Workings, West Midlands, England

Philip was responsible for investigation and assessment of remedial measures for mines in the Metropolitan Borough of Dudley.

Dubai Dry Dock, United Arab Emirates

Numerical analysis of dock floor and gate sill structures and studies of the influence of gypsum layers on the dock performance.

Yannawa Waste Water Project, Bangkok, Thailand

Geotechnical reviewer for deep pump station excavations in soft

clay.

MRTA North Section, Bangkok, Thailand

Geotechnical reviewer for cut & cover stations and ground movement assessments.

Horsfall tunnel, England

Category III check of replacement railway tunnel through unstable hillside in the Pennines in northern England.

KCRC Westrail, Hong Kong

Philip carried out a review of the objectives, test programme, specifications and results from a major pile test programme involving load testing of 14 instrumented bored piles and barrettes in granitic, volcanic and metamorphic rocks.

Cheung Kong Center, Hong Kong

Geotechnical reviewer of ground movement and building response assessment for a deep basement adjacent to sensitive structures.

Second International Airport, Bangkok, Thailand

Reviewer for design of cut and cover tunnels in soft clay for rail link and automated people mover.

Foundation and basement design, England

Philip has been responsible for foundation and basement design for several major commercial developments including the National Exhibition Centre, Hall 7 in Birmingham and Broadgate, Leith House, South Quay Plaza, No. 1 America Square, 123 Buckingham Palace Road, and the British Library completion phase in London.

Site Investigations, various countries

Philip has been responsible for planning, specifying and in some cases supervising both land and nearshore site investigations including Khulafa Street Development, Baghdad, Iraq; Kessock Bridge, Inverness, Scotland; North Quay, Ayr Docks Scotland; Belfast Harbour Crossing, Northern Ireland; Merak Cracker Project, Indonesia; and Pearl GTL Project, Qatar.

Terence Leung

Profession
Maritime /Geotechnical Engineer

Current Position
Associate

Joined Arup
2008

Years of Experience
18

Nationality
British
Hong Kong SAR

Qualification
MSc in Civil & Structural Engineering
BEng (Hon) in Civil & Structural Engineering

Professional Associations
Chartered Engineer (CEng)
Member of the Institution of Civil Engineer (MICE)
Member of the Hong Kong Institution of Engineers (MHKIE)

Publications
Chow A, Chong B, Leung T, Trifunovics B, Turley J, Lee F and Ip R "Climate Change and its Implications on the Design of Coastal Structures in Hong Kong", The ICE Coasts, Marine Structures and Breakwater Conference 2013

Lee D, Yin K K and Leung T "Design Principles of New Seawall in Hong Kong", The HKIE Civil Division International Conference 2012

O'Kelly B, Hodgetts S and Leung T "Stabilisation of Stanton Lees Landslip using Piled Retaining Wall Solution", Proceedings of Bridge & Infrastructure Research in Ireland Symposium 2006

Terence is a civil engineer with specialised knowledge in maritime and geotechnics discipline. He has 18 years experience in design, construction and management of infrastructure projects in the UK, Abu Dhabi, Kuwait, the Philippines and HK.

He has played key roles in many public capital projects and private developments. He is currently working on The Brothers Marine Park, Tuen Mun-Chek Lap Kok Link, Tung Chung Reclamation, Central Kowloon Route and Lung Kwu Tan slurry pipe tray structure reinforcement work. Recently he has completed a study on climate change effects on coastal structures, and successfully led the innovative seawall design of the reclamation works of HZMB Hong Kong Boundary Crossing Facilities (HKBCF), and the independent checking for a reclamation at Das Island, Abu Dhabi, for integrated gas development. He had also worked on the design and construction of River Trade Terminal in Hong Kong, and was mainly responsible for the reclamation and quay wall design.

Other major infrastructure projects that Terence worked on included the immersed tube tunnel for New Tyne Crossing, London 2010 Olympic Park and widening of Motorway M1 between Junctions 10 and 13.

Terence has extensive knowledge in maritime/geotechnical design and construction. He has good experience in administration of construction contracts, and has experience in assessment of time and monetary claims.

Terence practices and promotes systematic risk management in design and construction of projects worldwide.

MTR Contract 1121 Shatin Central Link NSL Cross Harbour Tunnels
Arup is the Lead Designer for Dragages-Leader-Bouygues JV on the Tender Design for this Design and Build Contractor involving 1.4km immersed tube tunnel, temporary reclamations and breakwater/typhoon shelters. Terence is Arup's Immersed Tube Tunnel Lead for this tender, with support by IMT sub-consultant and IMT specialist contractor.

Agreement No. PW 8/2013 Review of Studies on Climate Change and its Implications on the Design of Coastal Structures – Feasibility Study
Project Coordinator for the review of CE46/2011 findings as a result of the recent release of the IPCC AR5 report.

Agreement No. CE26/2013 (GE) Territory-wide Study on

Underground Space Development in the Urban Areas of Hong Kong – Feasibility Study
Deputy Project Manager for this study to plan and assess the technical feasibility of potential underground space developments in Hong Kong.

Agreement No. CE 10/2013 (EP) Detailed Study of the Marine Park in the Brothers Islands – Design and Construction
Deputy Project Manager for this study to designate an 850-hectare park in the waters in the vicinity of the Brothers Islands, and to devise an operation and management plan.

Agreement No. CE 12/2012 (GE) Long-term Strategy for Cavern Development – Feasibility Study
Deputy Project Manager for this CEDD study aiming at formulating policy guidelines to facilitate to facilitate rock cavern development for both the public and private sectors, and reserving strategic areas for cavern development and selecting suitable Government facilities for systematic relocation to caverns.

Xincunsha Project Planning and Engineering Design, Qidong
Vessel mix study, navigation channel design, water lock conceptual design

Cyberport Development at Telegraph Bay- Independent Engineering Services for Ground Settlement
Project Manager for this project in independently reviewing the settlements monitored at this development, together with projecting future settlements and recommending engineering measures for the building structures and utilities on top of this reclamation site.

Agreement No. CE 46/2011 (CE) – Review of Studies on Climate Change and its Implications on the Design of Coastal Structures – Feasibility Study
Project Coordinator for this CEDD project investigating the effects of climate change on design of coastal structures, and updating the Port Works Design Manual. Liaison with specialist sub-consultants.

Brunei Temburonng Bridge Scoped maritime input, including hydrodynamic modelling, sedimentation and erosion modelling, wave modelling, marine traffic impact assessment, navigation aid specification, pier protection and coastal protection.

Agreement No. CE 43/2010 (HY) – Central Kowloon Route – Design and Construction
Maritime Team Leader for undertaking marine impact assessment (MIA) for the temporary reclamation and provisioning of public landing steps at Ma Kau Tok. This includes berthing study for naphtha tanker unloading naphtha for Town Gas.

Agreement No. CE 33/2011 (CE) – Planning and Engineering Study on Future Land Use at Ex-Lamma Quarry Area at Sok Kwu Wan, Lamma Island – Feasibility Study
Maritime/Geotechnics Team Leader coordinating the maritime, geotechnical and geological input in this proposal to house 4000-5000 people in this outlying island. Key tasks included ferry patronage vs. capacity analysis, seawall stability review, marine traffic impact assessment, submarine outfall construction, public landing steps planning, ferry pier and refuse transfer facility pier planning and design.

Agreement No. CE 32/2011 (CE) – Planning and Engineering Study on the Remaining Development in Tung Chung – Feasibility Study
Team Leader for review of marine traffic impact in relation to reclamation and re-location of heliport near the trafficking Urmston Road and marina design.

Contract No. HY/2012/08 Design and Construction of Tuen Mun Chek Kap Lok Link Northern Connection Sub-Sea Tunnel Section
Maritime Team Leader on designing temporary pontoon for government berths and modification of southern landfall seawall for tunnelling.

CLP Agreement No. 460004908 – Consultancy Services of Super Typhoon Study for Generation Business Group
Responsible for assessing the impacts from supertyhpoons on coastal structures at Castle Peak Power Stations and Blank Point Power Stations, and assessment of site vulnerability to flooding resulted from torrential rainfall, storm surge and overtopping as part of supertyphoon event.

CLP Slurry Pipe Tray Structure Reinforcement at Lung Kwu Wan
Team Leader / Supervision-in-Chief for tender and construction of both marine revetment works and on-shore promenade hard landscaping works, coordination with landscape and QS inputs to the project, part-time site supervision of revetment works.

Agreement No. CE 9/2011 (CE) - Increasing Land Supply by Reclamation and Rock Cavern Development cum Public Engagement – Feasibility Study
Reclamation Team Leader for identifying earmarked reclamations from previous studies undertaken since 1970s, and leading a team of engineers on constraints mapping towards a territory-wide site search for potential reclamation sites. Conduct workshop on eco-shoreline. Involved in government seniors presentation/meeting and public forum.

MTR Agreement No. C1108 Shatin to Central Link Hong Kong Section – Construction Scoping and Sequencing

Team Leader for undertaking marine impact assessment (MIA) for the provision of a barging point at Wan Chai Waterfront and design of seawall reprovisioning at Causeway Bay Typhoon Shelter.

EPD Contract No. EP/SP/68/12 Outlying Islands Transfer Facilities Follow-On Contract
Tender design for the modification works to provide a new landing at the existing seawall of Cheung Chau Transfer Facilities.

Alegre Beach Resort and Hotel, Cebu
Maritime Manager for preparing this total engineering-service proposal. Maritime elements included a boardwalk, an offshore deck accommodating a bar and marine study centre, and landing steps for berthing of small leisure vessels.

Hainan Theatre and Museum, Sanya, Hainan
Maritime and geotechnical manager to support Arup Tokyo Office on the design of perimeter seawall and piled foundations for a landmark offshore theatre and connecting links.

Integrated Gas Development Project, Das Island, Abu Dhabi
Project Coordinator and Lead Design Reviewer for independent checking and certification of maritime structures including quay walls, piled structure, revetments, shoreline protection and breakwater. Also leading a team of engineers on independent checking the foundations for over 60 nos. on-land plant and structures. One of the special issues was the effect of blasting on foundations.

Agreement No. CE 28/2009 (HY)
Hong Kong Zhuhai Macao Bridge - Hong Kong Boundary Crossing Facilities (HKBCF), Hong Kong
Design Team Leader for the design of steel cellular structure seawall, which is the first to be built in Hong Kong, for this fast-tracking project. Also completed a design review with Independent Reviewer (Professor John Burland of Imperial College) and secured his agreement on this noval design.

Agreement No. CE 36/2009(HY)
Hong Kong Zhuhai Macao Bridge - Hong Kong Link Road, Hong Kong
Senior engineer for providing maritime technical advice on non-dredged seawall scheme

Kwun Tong Line Extension / Shatin-Central Link Hung Hom Barging Point
Review of existing seawall stability for accommodating a new barging point at the existing Hung Hom finger pier.

EPD Contract No. EP/SP/58/08 Sludge Treatment Facilities at

Tuen Mun
The proposed STF comprises two incineration plants (Plants A & B), a series of buildings and a vast green landscaping across the site. The site is within the existing PFA lagoons filled by CLP, and this poses challenge to the site formation and foundation designs. Acted as Site Liaison Engineer performing periodic visits to the site to provide advice on trial compaction, site formation, excavation and driven H-pile foundation works.

London 2012 Olympic Park Infrastructure.
Design Sub-team Leader on a range of infrastructure elements across the South Park, and supervised engineers on design delivery. Particular responsibility for earthworks design and interface management for bridge F06, and oversaw designs for bridges F10b, F11, H07, H06, Channelsea retaining wall, Olympic Gardens retaining walls and drainage outfalls. Maritime input included assessment of vessel impact load on bridge pier and assessment of ship wave and flood scour on river banks.

Investment in Arup's Projects
Enhancement on Marine Traffic Impact Assessment in Hong Kong (IiAid 8494)
Project Manager for establishing a more systematic method of marine traffic impact assessment in Hong Kong.

Climate Change Projections using AR5 results (IiAid 8493)
Project Manager for making use of the state-of-the-art IPCC climate change AR5 results on giving predictions on climatic elements, including temperature, sea level rise, rainfall and wind speed.

Use of AIS Data for Quantitative Assessment of Marine Traffic Safety in Hong Kong Waters (IiAid 8299)
Project Manager for this Arup's R&D project to further establish the capability of marine impact assessment using AIS data.

Deep Cement Mixing (DCM) for Non-dredged Seawall Construction and Reclamation (IiAid 5421)
Lead Engineer for this Arup's R&D project to broaden the knowledge on the marine-based Deep Cement Mixing technique, and develop design and construction capability on using this method for seawall and reclamation construction

Evaluation of Non-dredging Techniques for Seawall Construction and Reclamation (IiAid 6708)
Lead Engineer to evaluate the effectiveness of various non-dredging methods for seawall and reclamation construction

<u>Projects prior to joining Arup</u>
High-Point Rendel, UK (2006 to 2007)
A19 DBFO New Tyne Crossing
Team Leader (Geotechnical/Maritime) for the detailed design of

the new tunnel across River Tyne. The new crossing comprises a 400m long immersed tube tunnel, cut-and-cover approach tunnels, highway approaches and associated maritime structures. Key responsibilities included management of in-house Geotechnical Design Team and sub-consultants and community liaison teams.

Medway Crossing and Peters Village Development.
Project Management team on behalf of the developer in this private housing development at a site along River Medway, Wouldham. Chiefly responsible for overseeing the design consultants (Halcrow and WSP), and operating a risk management strategy to identify, remove and manage project risks.

Lyme Regis Environment Improvements, Phase IV Preliminary Design
Deputy Assignment Manager for the consultancy services to West Dorset County Council on the management and scheme development of coastal protection and slope stabilisation works. Responsible for geotechnical appraisal, options assessment, design development, cost estimation and coordination with other disciplinary teams (ecologists, landscape architects, etc).

New Refinery Project, Al Zour, Kuwait
Marine Consultant team to manage the preliminary design and procurement of berthing facilities at Al Zour in southern Kuwait. Responsible for preliminary geotechnical interpretation of an offshore site investigation and pile design. One of the challenges in this project was the presence of "pockmarks" on the seabed, and a strategy was proposed to identify the associated risks, and to evaluate the engineering problems and solutions.

Scott Wilson, UK (2002 – 2006)
M1 Widening Junctions 10 – 13
Geotechnical Lead Designer of this £380M-worth Early-Contractor-Involvement (ECI) major motorway widening scheme. Managed a team of engineers in options assessment, advice on structure foundations, analysis of earthworks stability and assessment of earthworks acceptability. Coordinated with sub-contractors on earthworks and foundations. Provided advice towards the establishment of preferred route and initial target cost.

WCRM, Trent Valley Quadrupling
Team Leader for the geotechnical design and technical review of various retaining structures. Retaining structures included tied-back piled bridge abutment walls, a contiguous bored piled wall, king-post retaining walls and a cantilevered retaining wall on pile foundation.

A80 Auchenkilns Junction Improvement
Independent geotechnical review in the forensic study of this

design-and-build scheme. Key review on the design of slip road embankments, which were supported by driven precast concrete piles and basal geo-reinforcements on peat. Involved assessing the interaction amongst soil, pile structures and high strength basal geosynthetics.

Evergreen Phase 2
Team Leader for the preliminary and detailed design of a king-post retaining wall for track widening near Beaconsfield station. Designer/Checker of generic king-post retaining walls for accommodating signal posts, pad foundations and screwed pile foundations of signal posts and Location Case cabinets.

WCRM Lanark and Carstairs Junctions, Scotland
Team Leader for the preliminary design of the symmetrix pile foundations of Overhead Line Electrification (OLE) masts.

A6096 Ilkeston-Awsworth Link Road/ A6192 Staveley Northern Loop
Detailed design of earthworks and various ground treatment methods (including vertical band drains, surcharging, basal reinforcements) for these two schemes promoted by the Derbyshire County Council. Contract Documentation.

A30 Bodmin and Indian Queens
Technical checker (Geotechnical) of all bridges, underpass structures and strengthened earthworks along this 11.5km-long ECI highway scheme in Cornwall. One key feature in this scheme is a 20m high reinforced earth embankment.

A46 Newark to Widmerpool
Technical checker (Geotechnical) of bridge structures along this 28km-long Early Contractor Involvement (ECI) highway scheme.

Greengairs Landfill, Lankashire
Review of landfill capping design in support of an expert witness report.

Luanda Second Oil Service Centre Base Extension, Luanda
Preliminary design of driven open-ended steel tube piles supporting a jetty

Parkwood Landfill, Yorkshire
Design and review of side slope liner system, and foundations of leachate extraction chambers.

A63 Melton Grade Separated Junction
Geotechnical Engineer on the tender design (subsequently awarded) of this design-and-build scheme.

London Northwest Zone Earthworks, Network Rail
Designer/ Technical Checker of a wide spectrum of cutting/

embankment stabilisation schemes, ranging from earthworks, drainage to structure-related. Responsible for options assessment and quantities estimation to facilitate value engineering.
Major design and construction schemes included:
1) Stabilising piles in embankments;
2) Retaining structures, including anchored piled walls and contiguous bored piled walls;
3) Soil nailing in cuttings;
4) Drainage works in embankments.

Motorway M77: Fenwick to Malletsheugh, Scotland
Detailed design of earthworks along this 15km-long motorway, and geotechnical design of associated bridges and culverts. Review of construction method affecting the hydrology of moss and peat areas.

A6 Alvaston Bypass
Geotechnical Engineer of the Client's Representative for this 2.5km single carriageway over alluvial plains.

Scott Wilson, Hong Kong (1995 – 2002)
Lamma Island Power Station Extension, Hong Kong
Engineer for alternative design of ground treatment methods for the reclamation of this extension of the power station.

River Trade Terminal, Tuen Mun, Hong Kong
Engineer for design of ground treatment methods (installation of band drains, surcharging, pause periods and vibro-compaction) for the 65-ha reclamation. Design of foundations for derrick cranes. Structural design of substations and Administration building.

Slope Maintenance Term Consultancy, Hong Kong Housing Authority
Deputy Project Manager of this slope maintenance engineering consultancy for the public housing department. Responsible for managing the slope inspection teams and the site supervision team.

Landslip Preventive Measures, Hong Kong Government
Supervision-in-Chief of territory-wide slope stabilisation works contracts (values over £10 million equivalent). Liaison with clients and management of a 15-strong resident supervisory team overseeing works. Duties included valuation of variation orders, assessment of extension of time and monetary claims.

Pok Oi Flyover, Route 3 Country Park Section, Hong Kong
On secondment to Gammon Construction Ltd for site supervision of the construction of foundations and sub-structures of this twin three-span bridge over a trafficking roundabout.

Tseung Kwan O Stage I and II, Hong Kong

Tender design for after-use of these landfill sites.

Joanna O'Brien

Profession
Civil/Structural/Geotechnical Engineer

Current Position
Associate Director and Lead Geotechnical Engineer

Joined Arup
1988

Years of Experience
34

Nationality
Irish

Qualification
BE (1st Hons) University College Cork 1980
M Eng Sc (Geotechnical) 1990

Professional Associations
Chartered Member of Institution of Structural Engineers - 1991
Member of Engineers Ireland
Associate Member of BGA

Committees
Past secretary, chairperson and treasurer of the Southern Region of the Concrete Society of Ireland
Past committee member and secretary of the Engineers Ireland, Cork Region.

Joanna O'Brien has 34 years of geotechnical and civil engineering experience and has been responsible for all geotechnical activities on a number of major projects. Joanna is very experienced in the integration of the geotechnical aspect of projects within the overall project design and construction activities, so as to provide comprehensive and cost-effective design solutions to clients. She has excellent knowledge of the project management aspect of projects.

Her experience includes offshore and onshore energy projects, as well as major motorway and building projects. She has been retained to provide geotechnical advice relating to building failures and the provision of expert evidence in possible litigation.

While the majority of her experience has been in Ireland, her experience also includes three year's work in China and the Philippines, working from Arup's office in Hong Kong. Joanna is an Associate Director with Arup and she currently leads the geotechnical practice in the Cork office.

Joanna has extensive geotechnical experience with particular knowledge of optimising the geotechnical elements within the overall project design and construction requirements

Corrib Gas Terminal Reinstatement Works (2013-Present)

Following the construction of the Terminal, Arup has been commissioned to produce the construction packages for the reinstatement of areas of the Terminal site impacted by construction. Joanna's work, which is heavily reliant on historic information from previous involvement on the project, has been to pull construction drawings, work sequences and construction documentation together for a number of areas of the site. Construction records prepared by Arup on the previous work done have proved critical to progressing this work.

White Rose Extension Project , Newfoundland (2012-Present)

This project, for Husky Oil Operations Ltd, involves the installation of a concrete gravity structure (GGS) to drill for oil in the Grand Banks, Newfoundland. Joanna's involvement in the project to date is with the pre-FEED, FEED and detailed geotechnical design and costing of the casting basin (150m*150m *26m deep at dock floor level) for the CGS construction in Argentia, Newfoundland. Work included a desk study, scoping and sourcing the site investigation using rota sonic drilling and carrying out two 96 hour pump tests. Analyses included slope stability, cut-off wall extent, dewatering volumes (SEEP/W and MODFLOW analyses, bearing pressures, buildability, costing and

scheduling.

Additionally Joanna's work includes the optimisation of the excavation/ dredging of the sea bund in relation to costs and program, the scoping of the site investigation for the dredging works and the dredged slope stability design.

Munster Blackwater (Munster south and west) Drainage Relief Schemes, Mallow Town, Co. Cork (2009-2012)

This project, for the OPW, involved the extension of the flood relief schemes for Mallow town along the southern banks of the River Blackwater. Joanna was the geotechnical lead for the geotechnical elements of the project. These involved site investigation works, design works for piled retaining walls, anchors, seep analyses and flood embankments, writing of contract documentation and supervision of works on site. The main challenges were dealing with karst limestone whilst piling and ensuring good quality, timely construction in recessionary times.

Glenconway Wind Farm, County Derry, Northern Ireland

Carried out the geotechnical static design for 2.5MW wind turbine bases, liaising with the geotechnical dynamic design and the structural teams.

LNG Facilities Australia - Design Checking

Joanna leads the geotechnical checking of preliminary and detailed design of LNG projects for both the Perth and Brisbane offices. These include the Ichthy's LNG project, the Gladstone LNG project and the Queensland Curtis LNG project. The checking work includes review of ground models, geotechnical design parameters, pile driveability calculations and pile axial and lateral capacity calculations.

Kinsale Energy Ltd, Inch, Co Cork (2010)

Managed the geotechnical site assessment for the on-shore facility and the pipeline landfall for a sub-sea gas storage project. Activities included the scoping, procurement, supervision and interpretation of the preliminary site investigation for FEED work. Advised the Client on impacts on the project development. Ensured sufficient information was available so that all project participants were fully appraised of the geotechnical nature of the sites.

Hosetech, Little Island, Co Cork (2010 to Present)

Industrial ware house and office building that has experienced settlement since construction. Joanna is acting as geotechnical expert to determine the causes of settlement and the necessary remedial works required to save the building. Joanna is being retained by the Plaintiff for the provision of expert evidence in possible litigation.

Athea and Dromada Wind Farms – (2008-2010)

Joanna acted as geotechnical design manager for a 'Design & Build' contractor and worked to a very tight program to meet regulatory deadlines. Design and construction occurred

simultaneously which necessitated constant dialogue and very good, practical working relationships Work consisted of geotechnical design and risk assessment for the access roads, turbine bases and hard standings on a mountain top site that was covered in peat. The design included peat and environmental risk assessment and mitigation.

Doughcloyne, Cork (2010 to 2013)

Industrial ware house and office building that experienced very significant settlement since construction. Joanna acted as geotechnical expert to determine the causes of settlement and the necessary remedial works required to remediate the building. Joanna was retained by the Plaintiff for the provision of expert evidence in possible litigation. The case was successfully settled prior to going to court.

M20 Blarney to Limerick Motorway (2008 – Present)

Led the development of the geotechnical design of a major 40 km motorway from desk study through to tender design. Managed the geotechnical team and ensured that the geotechnical design integrated within the overall project design parameters. Currently the detailed Site Investigation fieldwork is being completed.

Corrib Gas Terminal (2003 to 2013)

Following a number of unsuccessful attempts to obtain planning permission for a major onshore terminal, Shell requested Arup to assist on the site development to obtain planning permission. The site, located in the remote north west of Mayo, in Ireland is covered in 2 to 8m deep blanket bog. Joanna was part of the Arup team which devised new solutions for the earthworks for the site. Despite the adverse publicity of two significant peat landslides in other locations in Ireland in late 2003, Arup was successful in obtaining planning permission to create a 12 hectare cut and fill platform with the removal of 450,000m^3 of peat off site. All geotechnical risks were highlighted with control and mitigating measure identified.

The work involved site investigation and design of earthworks for the creation of the level platform, the design of soft ground access to facilitate construction and drainage design to mitigate impacts on local very sensitive water courses. Subsequently Joanna was responsible for managing geotechnical hazard controls working closely with the onsite design and construction teams. Joanna leads the Arup team monitoring the earthworks construction and maintains the geotechnical risk register in compliance with regulatory requirements.

Shannon LNG (2006-2010)

This is a large LNG storage facility on the Shannon estuary in Ireland, comprising 4 no. 98m diameter, 50m high tanks with an off-shore jetty and ancillary process infrastructure and buildings. Joanna managed all geotechnical work involved the procurement and supervision of the preliminary site investigation to determine site suitability and geotechnical design parameters, in particular at proposed tank locations. The site investigation information was integrated with the plant design and the optimisation of the site

layout and the design for the tanks. Planning permission was achieved for the terminal, and more detailed design work is currently ongoing

Mayo to Galway Gas Pipeline (2000-2005)

Joanna led the site investigation work which comprised trial pits, probes and boreholes over the 124km pipeline route. The investigation was carried out whilst foot and mouth precautions were in place which required strict working protocols to be implemented. Ground conditions ranged from peat bogs of Mayo (up to 10m deep) to the karst limestone lowlands of Galway.

Blackpool, Cork (2005-2009)

This is an office development in a disused gravel quarry. It involved the design of temporary and permanent works to construct 2 levels of basement which resulted in a 25m high cut slopes to the boundaries of the site. Arup acted as engineers to the D&B contractor and Joanna was responsible for all geotechnical investigations and design work. Rock excavation and anchoring were necessary in temporary conditions. Slope stabilisation with reinforced earth and anchoring with surface protection was also used.

Altana and Carrigtohill IDA Park (1997 – 2006)

This involved an overall site investigation for geotechnical due diligence of the northern half of the park. Specific site investigation for Altana development. The site investigations were scoped and managed by Joanna. Rock depths greater than 25m were encountered and very variable groundwater conditions were present across the site from running sands to glacial tills to marine silts at depth.

Amgen Due Diligence Work (2005-2006)

This project involved a due diligence study of a site for Amgen Joanna was responsible for all geotechnical aspects of the due diligence work.

This involved investigation works to determine the ground conditions including a check for any contamination. The karst nature of the underlying limestone was identified as well as the low bearing capacities of the upper soils. Advised that a karst risk analysis be carried out for the site.

Stoneview, (2005-2007)

A large 2,500 housing development with associated infrastructure and town centre. Joanna was responsible for the site investigation work undertaken for the infrastructure. Feedback from ground conditions was required to minimise the environmental impacts of development on the surrounding environs.

Blarney Business Park, (2000-2007)

This is a large industrial park development. Joanna was responsible for the site investigations and foundation design for the various units constructed. Significant cut and fill activities were required to create level platforms for developments

requiring large plan areas.

Kinsale Road Roundabout & Sarsfield Road Roundabouts (1999-2001)

Joanna was responsible for the entire management of the site investigation works on a very busy sub-urban dual carriage way. It comprised trial pits, boreholes, coreholes and probing to determine ground conditions along the proposed routes of the interchanges at each of the roundabouts.

Very difficult ground conditions were encountered at both roundabouts. Development of foundation design for piled embankments and bridge supports.

Novartis Ringaskiddy Ltd., Cork(1989- present)

Site investigations and foundation design for the NIPBI building and for all production buildings. Joanna has been involved since construction started on site. The site is underlain by limestone bedrock so is prone to development of swallow holes. Foundation design was developed to ensure the long-term integrity of foundations. Risk analyses were undertaken of the impact of the karst limestone bedrock on foundation design, constructability, costs and program. Ongoing geotechnical consultancy services are supplied as and when required.

MRTA, Bangkok (1998)

This was a short-term problem solving secondment to the MRTA offices in Bangkok to assist with the design of the support columns during the top down construction for the station boxes. The upper ground in Bangkok comprises of very soft clays that move significantly on excavation. The boring of the north and south tunnels at stations 12 and 13 were causing double bending in the top-down columns. Joanna's structural experience coupled with geotechnical experienced enabled detailed soil/structure analyses to be carried out to determine construction tolerances for the columns.

Pfizer CEP Ringaskiddy – (1993 – 2004)

Site investigations and foundation design for both the OSP3 and OSP4 projects. OSP3 is founded on a 1250mm thick raft and OSP4 is founded on the limestone bedrock that was excavated up to 5m in depth on some locations. This was to minimise the height impact of the building on its surroundings. Foundation design and philosophy allowed for cavities in limestone bedrock. One, the size of a container, occurred just above foundation level so all bases were probed to depth to confirm the integrity of the limestone.

Johnson & Johnson (1997-1998)

This project involved site investigation, foundation design and site development. The site investigation indicated that the north of the site was underlain by shallow bedrock of highly weathered shale. Rock was in excess of 20m deep over the centre of the site while the limestone rock occurred at shallow depths to the south of the site. The foundation design allowed for the varying founding strata. A large level platform was required for the

production area so a significant cut and fill exercise was carried out on site. It was also possible to minimise the costs for the excavation work by taking full advantage of a local timely requirement for fill material. Foundation design philosophy to minimise differential settlement and maximise long-term integrity of foundations at reasonable costs.

Shearwater Kinsale, (1998)

Residential development in prime quay side site in Kinsale. Joanna had responsibility for the site investigation and foundation design on land historically reclaimed.

20m Cantilever retaining wall Hong Kong (1997)

Part of the side of a mountain was excavated for the development of a potable water treatment works. A massive cantilevered retaining wall was constructed to enable the excavation. The retaining wall consisted of a series of T barrettes built by diaphragm walling techniques. Each T measured 3m across the head of the T while the stem was 6m long. The thickness was 1m. This design work for the contractor was carried out between the Hong Kong office and Cork office. Geotechnical design work was carried out in Hong Kong and e-mailed to Cork(Joanna) at the end of the HK day for the structural design of the panels – thus facilitating a 20 hour working day which facilitated very rapid supply of construction information to site daily.

M/A Com (1996-1997)

Joanna was project engineer (geotechnical, structural and civil) and project manager for the design and construction of high tech industrial unit. Responsibilities ranged from site investigation, foundation design, structure design, design co-ordination, civil design and supervision of construction on site.

Sheet pile and diaphragm retaining walls for deep circular shafts in Hong Kong (1995-1996)

A deep tunnel, to house a sewage outfall pipe, was constructed as part of the strategic sewage disposal scheme in Hong Kong in 1995. Several shafts were required for access and exit points for the tunnel boring machines and for the removal of spoil. The shafts were constructed of sheet piling and diaphragm wall panels. Shaft diameters varied from 30m to 8m and in depth from 20m to 65m. The diaphragm walled shafts were taken to rock head and the shafts were continued in rock to the required depth. Joanna was responsible for the design of the diaphragm wall shafts. Arup were design engineers for Leighton Contractors.

Shajiao 'C' Power Station, China (1993-1995)

Arup were the design engineers for the civil contractor CEPA on a 3*660MW coal fired power station. Joanna was responsible for all geotechnical matters arising after joining the team part way through the construction phase. Over 60% of the site was reclaimed from the sea so the vast majority of buildings were founded on piles. Both driven piles and hand-dug caissons were used. Seawater was used for cooling so a large intake system

($28m^3$/second) was constructed some 1km into the sea. The cofferdam was required to join up the land based construction of the intake system with the marine section. Slope failures occurred on site as advice on dewatering excavations and slope parameters was not followed or construction was progressed too fast.

Tagaytay, Phillipines (1995)

Design of a condominium development. This development was located to the south of Manila on a ridge some 2000ft above the surrounding lands. The higher ground was as a result of volcano. The condominium was sited on the slope of a caldera – a collapsed volcano crater. This volcano was, and is, still active. The project involved site investigation work to determine the makeup of the slope and to determine the structural stability of the proposed building for various seismic events. The project required much down-sizing and re-shaping to give adequate factors of safety against collapse for 1in 50 and 1 in 100 year seismic events. Joanna was responsible for the foundation scheme design and the site investigations.

800m of Retaining Walls at Castle Mall Shopping Centre, Norwich (1989-1990)

Design of an 800m long contiguous piled retaining wall for a shopping centre built on a sloping site in the centre of Norwich city. The retaining wall was anchored in the temporary case until the construction of the floor plates, which acted as horizontal props for the retaining wall. Joanna acted as co-ordinator of structural and geotechnical interfaces as well geotechnical design engineer.

Embankment Place, London (1988 – 1989)

Arup Cork was involved in the checking of the structural steel drawings for the development – a structural arch without riggers and floor plates suspended from the arch. The project also involved some design work – one memorable member was a lattice strut designed to carry a horizontal compressive load of 12000kN. Joanna was seconded to the London office to design the strut.

South Deepwater Berth, Cork (1990)

Strengthening of existing quay wall, consisting of grouting behind the wall to increase wall mass, installation of piles below the wall to underpin the quay wall and installation of anchors to increase horizontal stability. Project designed by Dublin office with site liaison work carried out by Joanna from the Cork office.

Pre-Arup Work Experience

Langley Business Park, Slough, England (1986-1987)

Development of a high tech business park west of London with easy access to the M4 motorway. The project included the structural design of the buildings – structural steel frames with infill block work was the most common form of structure. A building for Rehau Plastics was a concrete framed building with post tensioned floor plates to maximise free space within the

building. The civil engineering of the business park was also included – road design, surface water and foul waste design. The local surface water system was limited in what loads it would accept so it was necessary to design soak aways and a hydrualic ram within the system. Joanna was the project design engineer and manager for all the above work.

Residential Development, West Norwood South London (1986)

Housing development on a clay slope. The slope was subject to minor, though significant, movement so the piles were designed with a coating to offer minimal resistance to ground movement and to avoid picking up excessive horizontal loads as a result. Houses were set out back to back, but stepped, to maximise development on site. This led to good economy in foundations whilst yielding two and three storey houses.

Narrow Street, Dockland, London (1987)

A 3 & 4 storey residential and office development in docklands in the late eighties. It was necessary to underpin surrounding structures as a basement was constructed to accommodate parking. Joanna managed the site investigation, underpinning design and the structural design of the building.

Guinness Brewery, Park Royal, London (1986)

Joanna managed the site investigation work comprising boreholes and trial pits on a busy brewery site. The site had been bombed during WWII and a detailed desk study was required to optimise location of the site investigation fieldwork.

Jasvinder Opkar

Profession
Civil Engineer

Current Position
Senior Maritime Engineer

Joined Arup
2010

Years of Experience
12

Nationality
Malaysian

Qualification
B. Eng (Civil) (Hons)
Chartered Professional Engineer Australia (CPEng) 3631211
National Professional Engineers Register Australia (NPER)
Registered Professional Engineer Queensland (RPEQ) 13250

Professional Associations
M. IEAust
M. ASCE
Grad. IEM
COPRI
PIANC

Publications

Jasvinder Opkar et. al, 2010 'Offshore Sand Extraction for Beach Nourishment Ameliorating Climate Change Sea Level Rise Impacts' Melbourne, Australia.

Jasvinder Opkar et. al, 2008 'Does Your Boat Harbour Rock?', Poster Paper - 17th NSW Coastal Conference, Wollongong, NSW Australia.

Noraieni Mokhtar, Jasvinder Opkar, 2004 'Sine-Slab Revetment System for Coastal Protection', International Conference on Marine Waste Water and Marine Environment, Italy.

Jasvinder Opkar is a Senior Maritime Engineer in Arup's Infrastructure Group with approximately 12 years professional experience. He is a chartered engineer affiliated with the Institution of Engineers Australia and a Registered Professional Engineer of Queensland.

Jasvinder specialises in Maritime and Coastal Engineering and has worked on a number of major port and coastal engineering projects in Australia and Asia with contractors and design firms. Jasvinder has worked on various types of ports including cruise terminals, container, bulk handling, general cargo, RORO, LNG and bulk liquid terminals.

Jasvinder's strength is in coastal engineering, coastal structures, dredging and port engineering. He undertakes both design and project management roles.

Puma Energy Petroleum Products Jetty EPC, Balikpapan, Indonesia

Project Manager for the EPC tender design support. Managed the overall delivery of design services for EPC contractor's tender. Undertook berthing analysis and metocean loads calculation. Assisted in design review and optimization for berthing dolphins, mooring dolphins, loading platform and access trestle.

Sydney Overseas Passenger Terminal, NSW, Australia

Assisted in the design of scour protection to resist currents from vessel propeller and bow thrusters.

Happy Jacks Spoil Dump Channel Protection Works, NSW, Australia

Assisted in channel protection design adopting A-Jacks concrete armour and rock rip-rap against high flows from the Happy Jacks dam discharge.

Singapore Sports Hub, Singapore

Undertook re-design of revetment protection incorporating recycled concrete material. Assisted in responding to site queries for construction of the revetment.

Webb Dock Redevelopment Maritime Works, Victoria, Australia

Prepared construction specifications for dredging and disposal of dredged material and rock protection. Provided technical assistance for the tender assessment, responsible for the dredging and disposal works section.

Jasvinder Opkar, Noraieni Mokhtar, 2003 'Design and Development of a Flexible Floating Breakwater System to Protect Ports and Harbours Against Wave Action, IHOCE, Kuala Lumpur, Malaysia.

Jasvinder Opkar et. al., 2002 'Design and Product Durability Improvement of Sine-Slab' Johor Bharu, Malaysia.

Jasvinder Opkar, 2001 'Design of Grout (40Mpa) for Structures Repair' University of Technology Malaysia.

Jurong Port C1 Cement Conveyor Structural Assessment, Singapore

Project Manager responsible for the independent assessment of the cement conveyor support structure. The assessment includes analysis of steel truss system to support the existing operations of cement unloading and conveyor system.

Cairns Shipping Development Environmental Impact Statement, Queensland, Australia

Team member for the maritime component. Provided technical advice on shipping channel design, navigation simulation and dredging & disposal methodology.

Walvis Bay North Port Pre-Feasibility Study, Namibia

Analysis of annual sedimentation rates in the proposed navigation channel and berthing basin.

Port of Leith Outer Harbour Expansion, Scotland

Provided technical advice on dredging for the expansion of Leith Port Outer Harbour for offshore renewable energy industry. The technical advice included dredging methodology, marine aggregate extraction, sequencing, high level cost estimates and interface with reclamation and wharf construction.

London Array Offshore Wind Farm Due Diligence, England

Undertook a study on the scour of the offshore high voltage substation foundations and cable crossings. Reviewed designs and as-built documentation related to scour protection.

Transaction of Port Botany and Port Kembla Technical Due Diligence, New South Wales, Australia

Provided due diligence advice on dredging and other port infrastructure assets to support the successful consortium’s bid of more than AUD$5billion. This advice included a risk assessment of dredging, disposal and future expansion.

Review of Studies on Climate Change and its Implications on the Design of Coastal Structures - Feasibility Study, Hong Kong

As part of a larger project scope, undertook a high level analysis of Benefit Cost Ratio (BCR) to determine the viability of incorporating the recommendations for climate change sea level rise into the Public Works Design Manual. Estimated flood damage cost for a typical Hong Kong urban area, utilising international guidance and GIS data.

Papua New Guinea Gulf Province LNG Plant, Papua New Guinea

Prepared high level port layout options comprising of nearshore harbour with breakwaters and offshore harbour with trestles and causeway. The port required a harbour suitable for 3 LNG berths.

Wave Break Island Development, Gold Coast, Queensland, Australia

Project Manager for the cruise terminal, marina, super yacht basin and trawler basin. Provided technical and engineering support for

the design of navigation channel, dredging and cruise terminal layout.

Abbot Point Multi Cargo Facility, Queensland, Australia

Deputy Design Manager, managing a design team consortium for a large scale dredging and reclamation project for a new green field port development. Involved in various stages going through EOI, Double ECI and being the preferred tenderer for Single ECI.

Lead Maritime Engineer, undertook design of reclamation bunds, revetments, breakwater and dredged slope protection. Port layout optimisation, design of berthing area and turning basin. Reviewed numerical modelling studies and assisted in physical modelling to assess wave overtopping, crest stability, concrete armour stability and toe / scour protection stability.

Malampaya Phase 3 Depletion Compression Platform, Philippines

Provided technical advice for scour protection for offshore concrete gravity structure. Assisted in preparing specifications for physical modelling to determine flow pattern, currents and scour around offshore concrete gravity structure.

Port Bonython Bulk Commodities Export Facility Environmental Impact Statement, South Australia, Australia

Provided technical advice and assistance on metocean and maritime engineering to the core management team and specialist sub-consultants for environmental impact assessment.

Kapernicks Bridge, Queensland, Australia

Site assessment, design of bridge abutment and riverbank rip-rap protection.

University of Queensland St Lucia Riverbank Stabilisation, Queensland, Australia

Lead maritime engineer for the delivery of construction phase services for riverbank stabilisation works.

Gold Coast Rapid Transit, Queensland, Australia

Review of scour assessment for bridge pile design for a number of waterway crossings in Gold Coast. Review of scour protection for shoreline embankment.

Cairns Cruise Shipping Development Strategy – Business Case, Queensland, Australia

Lead engineer for the design of navigation channel and turning basin for cruise vessels. Coordinated and involved in ship simulation studies. Provided technical advice on coastal engineering, environmental considerations, navigation aids, dredging quantities, and dredging & spoil disposal methodology. Assisted in dredging cost estimates.

Arrow Energy LNG Plant Project (Tunnel), Queensland, Australia

Technical advice on tidal and storm surge levels at Gladstone harbour including allowance for sea level rise.

Daru Port Development, Papua New Guinea

Assistant Project Manager, for the development of a greenfield copper concentrate bulk handling port.

Lead Maritime Engineer for the design of navigation channel, turning basin, berth pockets and berthing areas. Prepared specifications for dredging and reclamation. Undertook master planning of port layout, vessel berthing areas, tug berthing areas and barge unloading area. Managed the delivery of concept design for wharf structures, barge berth, access jetty, mooring and berthing structures.

Gladstone LNG Marine Jetty, Gladstone, Queensland, Australia

Lead maritime engineer for design of LNG loading jetty. Provided maritime engineering inputs for structural design including berthing analysis, mooring analysis and metocean loadings. Assisted in berth layout optimisation for LNG vessel mooring.

Darwin Marine Supply Base, Northern Territory, Australia

Provided technical advice during tender design on wharf layout master plan for rig tender / supply vessels, design of navigation channel and dredging methodology.

Cocos (Keeling) Island Shoreline Assessment, Australia

Undertook a high level assessment of shore protection structures, metocean conditions and sediment transport patterns around the island. Provided technical advice on shore protection options for cyclone conditions.

Christmas Island Storm Surge Assessment, Australia

Provided high level technical advice on storm surge levels for the development of cyclone shelter structures.

Shell Prelude Project – Darwin Onshore Supply Base, Northern Territory, Australia

Provided technical advice on tidal and storm surge levels at Darwin harbour including allowance for sea level rise.

Port Lincoln Cathodic Protection Design, South Australia, Australia

Project Manager for the delivery of cathodic protection design to Flinders Ports.

Eatons Crossing Road, Samford, Queensland, Australia

Undertook review of bridge abutment and embankment protection design.

BP Refinery Scour Study, Queensland, Australia

Project Manager for a scour study. Assessment of scour from fire fighting intake and outfall discharge. Design of scour protection.

Browse LNG Onshore FEED, Western Australia, Australia

Lead Maritime Engineer for the breakwater scope. Undertook design of rubble mound and precast concrete armour for

breakwaters and causeway. Provide technical advice on wave overtopping, scour protection and wave loading. Developed specifications for rock and concrete armours.

Queensland Curtis LNG, Gladstone, Queensland, Australia

Provide maritime engineering inputs for the tender design of LNG loading facilities including berthing and mooring forces, wave and current loads on piles.

Gladstone East Shores Development, Queensland, Australia

Project Manager for maritime components of the foreshore development master plan. Undertook inspection of seawall and revetments and proposed concept design for rehabilitation.

Gladstone LNG MOF, Gladstone, Queensland, Australia

Lead Maritime Engineer for the detailed design of Material Offloading Facility (MOF). Undertook detail design of barge berth and bulk aggregate berth causeway and armour rock protection, undertook review of berthing and wave forces analysis, provide advice for dredging and navigation aids. Prepared specifications for the construction of rock works.

Asia Pacific LNG, Gladstone, Queensland, Australia

Assessment of design wave climate for rock protection. Undertook tender design of rock causeway including rock armour and fill material specifications. Provided technical advice on protection of dredge slopes.

Port Headland Spoil Bank Marina, Port Headland, Western Australia, Australia

High level advice on marina design and development, staging and edge protection options.

Port of Darwin All Tides Access Study, Darwin, Northern Territory, Australia

Undertook marine climate study including wind data analysis, wave hindcasting, extreme wave and water level analysis. Performed hydrodynamic modelling and water quality modelling for plume modelling for dredging and offshore spoil disposal.

Provide advice on dredging design and dredging methodology (backhoe, cutter suction, trailing suction hopper dredger). Assist in evaluating environmentally friendly dredging option. Assessment and evaluation of spoil dumping options.

Kempsey Bypass, Kempsey, New South Wales, Australia

Provide technical advice on rip-rap rock design for levee protection and crest levels designs.

Port of Hastings Expansion, Hastings, Victoria, Australia

Performed hydrodynamic modelling and water quality modelling for sediment plume modelling for dredging, offshore disposal and reclamation works. Prepare specifications for site data collection program. Provide advice on dredging and spoil dumping impacts.

Sydney Sand Extraction Study, Sydney, New South Wales, Australia

Undertook concept design of beach nourishment. Assessment of potential sand sources and analysed dredging and sand placement methodology options. Provide advice on best dredging option, sand delivery option and sand placement option. Cost estimates for capital and maintenance works.

South Australia Marine Energy Study, South Australia, Australia

Identify potential tidal energy sites and analysis of potential wave and tidal power generation. Utilised hydrodynamic model to determine high current areas for power generation.

Stansbury Marina Development, Stansbury, South Australia, Australia

Wind data analysis, wave hindcasting and extreme wave analysis. Offshore wave modelling using SWAN and near shore wave modelling including wave penetration into marina using BOUSS2D. Undertook hydrodynamic modelling using RMA2 and water quality modelling using RMA11 to assess the impacts on adjacent oyster leases. Rubblemound breakwater and revetment design against wave action and propeller wash.

Lawrence Hargrave Drive, Coalcliff, New South Wales, Australia

Coastal engineering studies including wave data analysis and SBEACH modelling for storm erosion analysis. Liaise with subconsultant (Coffey) for slope movement monitoring and analysis. Concept design of rubblemound revetment for slope toe protection.

Port of Townsville Expansion Master Plan, Townsville, Queensland, Australia

Undertook wave modelling using BOUSS2D for wave transformation and penetration studies. The wave modelling works include port development staging. Review design criteria and provide advice on design risk. Preliminary design of rubblemound breakwater and revetment including overtopping analysis.

Taganito Wharf Expansion, Taganito, Philippines

Offshore wave modelling using CGWAVE and nearshore wave modelling using BOUSS2D. Provide technical advice on optimum wharf layout. Undertook assessment of wharf operational downtime.

Sual Coal Unloading Jetty, Sual, Philippines

Undertook wind data analysis and performed wave hindcasting using CEDAS software. Provided technical advice on wave conditions at the coal unloading jetty. Undertook a high level assessment of the failure of revetments.

Batam Island Container Terminal, Indonesia

Provided technical advice on dredging and reclamation for the development of a new container terminal. Scoping for site investigation and data collection works.

Port of Tanjung Pelepas Master Plan Review, Johor, Malaysia

Prepare specifications and supervise field data collection for the calibration and validation of hydrodynamic model. Undertook hydrodynamic modelling using SMS and RMA2 for proposed port expansion layouts. Analysed sedimentation rates for the proposed layouts. Provide technical advice on water quality and water circulation issues in the port basin areas.

Prepare dredging and reclamation plans which include best dredging option, dredging cycle time and program, cost estimates and spoil dumping area assessment. Provide technical support on the overall proposed master plan.

Similajau Port Development, Sarawak, Malaysia

Undertook design wave analysis and breakwater preliminary design. Provide technical advice on the proposed port layout against wave action.

Oakajee Port and Rail Project - Port Feasibility Study, Western Australia, Australia

Undertook independent review of proposed berm breakwater design. Review includes design criteria, armour design, overtopping, crest levels and construction methodology.

Port Botany Expansion, Sydney, New South Wales, Australia

Design team leader for the Tug Berths and Boat Ramp package. Undertook design of public boat ramp facility and tug berths. Assessment of tug and vessel propeller currents and scour protection design for wharf structure. Design of rubblemound groyne, breakwater, revetment, reclamation bund, beach nourishment and scour apron. Member of site management team reviewing contractor's design submissions, attend to site technical issues, undertake periodic inspections and respond to RFIs.

Port Kembla Expansion, New South Wales, Australia

Port Kembla Inner Harbour Dredging – Construction tender assessment and evaluation, full time for site supervision and contract management. Monitoring of dredging works (grab, backhoe and cutter suction dredgers). Supervised construction of grout mattress and rock revetment. Respond to RFIs and assist in the contract management.

Port Kembla Outer Harbour Development Master Plan and Environmental Impact Statement – Wave modelling using CGWAVE and BOUSS2D for wave penetration analysis, concept design of breakwater extension, management of vessel motion and mooring study.

Port Kembla Berth 103 – Construction tender assessment and evaluation, bulkhead wall geotechnical design, vessel scour assessment, rubblemound revetment design, steel pile supply delivery supervision.

Port Kembla Berth 107 – Vessel scour assessment and rubblemound revetment design.

NSW Maritime Authority Panel, New South Wales, Australia

Independent design review of pontoons, guide piles, revetments, seawalls, scour protection, jetties, sea-stairs, etc. Prepare approvals for construction and inspection of as builts.

Kuala Pahang River Mouth Improvement Works, Pahang, Malaysia

Concept design and master planning of river mouth improvement works. Concept design of breakwater options, revetment, navigation channel, beach nourishment and river diversion works. Detail design of navigation channel and management of dredging works. Assessment of proposed offshore spoil disposal ground and assist in preparation of Environmental Assessment.

Beach Rehabilitation Project, Tioman Island, Pahang, Malaysia

Concept design and master planning for beach rehabilitation works. Concept design of seawalls, groynes, geotubes and beach nourishment. Numerical modelling for wave transformation and deformation study, sediment transport, shoreline evolution and water quality. Assist in preparation of Environmental Impact Assessment. Construction management for dredging and beach nourishment works and undertook assessment to identify potential sand source areas.

River Rehabilitation, Drainage and Boating Facilities, Tioman Island, Pahang, Malaysia

River rehabilitation concept design and master planning. Conceptual design of navigation channel, berthing and boating facilities including ramp, gangway, finger piers, berths and guide piles. Preliminary design of retaining walls, revetments, seawall and mooring systems.

3X700MW Coal Fired Power Plant - Dredging Works for Cooling Water Intake, Pump Pit and Offshore Discharge Culvert, Tanjung Bin, Johor, Malaysia

Site Engineer - Overall planning, managing and monitoring of dredging works, assisted in managing interface with Port of Tanjung Pelepas shipping activities / pilotage for dredging and dumping activities. Supervision of hydrographic survey and data processing. Liaison with and reporting to main contractor, consultants and client on dredging works.

Dredging Works for Semblog Citranusa Jetty, Kabil, Batam Island, Indonesia

Site Manager - Preparation of dredging contract documents. Planning and monitoring of dredging works using grab dredgers. Supervision of hydrographic survey and data processing. Liaising with main contractor and client on the overall dredging works. Liaising with authorities for vessel permits and spoil dumping permits.

Dredging Works for Britoil Shipyard, Tanjung Riau, Batam Island, Indonesia

Site Manager - Planning and monitoring of dredging works using grab dredgers, liaising with consultant, client and authorities. Supervision of hydrographic survey and data processing.

Dredging of Sediment Mound Under Existing Berths 13 & 14 North Port, Selangor, Malaysia

Site Manager - Planning and monitoring of dredging works using grab dredger, managing interface with North Port shipping operations. Supervision of hydrographic survey and data processing.

Offshore Sand Mining Works, Port Kelang, Selangor, Malaysia

Site Manager - Undertook overall planning, managing and monitoring of sand mining works. Management of sand unloading, stockpile and delivery. Managing interface with local authorities and client.

Supervision of Vessel Repair and Maintenance at Dockyards in Malaysia, Singapore and Indonesia

Supervision of the maintenance and repair or self-propelled hopper barge Meisun BSP 2, tug boat Meisun T30, sand pump barge Meisun M90 and split hopper barges Meisun H10 & H12.

Beach Rehabilitation Works Using Beach Management System, Port Dickson, Negeri Sembilan, Malaysia

Site supervision of construction works including piling, concreting, pile cap, outlet sump, pipe laying, reclamation, pumping station and valve chamber, collector pipe and well, rubble wall and earthworks. Preparation of progress reports, method statements and construction program. Testing and commissioning of sea water pumping system.

Coastal Erosion Mitigation, Tanjung Piai and Perhentian Island, Malaysia

Provide technical advice to Department of Irrigation and Drainage (DID) Malaysia on the coastal processes and erosion mitigation options.

Reclamation and Coastal Erosion Mitigation, Pantai Sabak, Kelantan, Malaysia

Provide technical advice to Kelantan State Government on coastal erosion issues and possible mitigation measures.

Riverbank Stabilization Project at Housing Development Area at Lot 10, Bandar Kajang, Selangor, Malaysia

Tender design for riverbank stabilisation works using pre-cast concrete armour units. Assist contractor in cost estimation.

Shore Protection Works at PSC Naval Dockyard, Lumut, Perak, Malaysia

Provide technical advice and assist in tender design for reclamation protection using pre-cast concrete armour units.

Shore Protection Works at Lumut Power Plant, Lumut, Perak, Malaysia

Tender design for shore protection works. Provide technical and design advice on using rubblemound and pre-cast concrete armour units.

Bridge Abutment Rehabilitation for Westport, Port Kelang, Selangor, Malaysia

Tender design for bridge abutment rehabilitation works against wave and propeller wash. Provide technical and design advice on using rubblemound and pre-cast concrete armour units.

Development of a Floating Breakwater System with PETRONAS in Malaysia

Proposal for a research joint venture to develop a floating breakwater system to provide temporary protection during search and rescue operations, oil spill, ro-ro operations, etc. Proposal includes feasibility study, concept development, preliminary design, physical model testing and prototype testing.

Coastal Protection Works at Tanjung Kling, Malacca, Malaysia

Site supervision of coastal protection construction works which included revetment reclamation and seawalls. Conducted beach profile survey and condition assessment of concrete pre-cast armour units.

making sense of heritage

Staff profile

Paolo Croce

Archaeologist

Area of Expertise and Technical Skills

Coastal and Marine Archaeology
Aerial photograph analysis
Terrestrial and Underwater surveys

Career Details

2006 – 2011	Various archaeology units in Italy
2012 – 2013	Archaeological Prospection Service of Southampton
2013 - present	Wessex Archaeology

Qualifications

2006 BA Archaeology, University of Padua, Italy
2011 MA (distinction) Naval Archaeology, University of Bologna, Italy
2012 MSc Maritime Archaeology, University of Southampton
HSE III Commercial diver

Summary History

Paolo started his career as an archaeologist in a wide array of underwater and terrestrial sites dating from Palaeolithic to Late Medieval for universities (Padua, Siena, Ferrara) and commercial units (Coop Archaeosub Metamauco, P.E.T.R.A.) mainly based in north Italy.

In 2009 he qualified as Operatore Tecnico Subacqueo – HSE approved qualification for SSD Inland/Inshore Diving at Centro Formazione Offshore of Ravenna, Italy, and since then he developed his skills in archaeological excavations and surveys as well as commercial diving work on pipelines and in ports and harbours.

His experience ranges from excavating shipwrecks in the Venice Lagoon and Bronze Age lake dwelling on the Garda, to investigating the maritime heritage of the UK, geophysical surveys undertaken at coastal archaeological sites in United Arab Emirates and collaborations with coastal and underwater surveys in Oman and Montenegro.

At Wessex Archaeology he is part of the Dive Team and is one of our SCUBA Dive Supervisors. His main tasks comprise historical wreck investigation and assessment, intertidal and foreshore watching briefs and groundtruthing surveys. As a certified OTS technician he helps to keep the diving equipment in working conditions and supports our Dive Superintendent.

Recent projects include investigation of submarines off Falmouth beach, Heritage At Risk diving operations and project Samphire fieldworks, groundtruthing of geophysical anomalies in the Solent, watching briefs on dredging vessels as part of the London Gateway development, archaeological review of ROV video for seabed features, archaeological supervision of paddle steamer clearance in the Thames estuary.

Jason Manning

Profession
Engineering Geologist

Current Position
Senior Geologist

Joined Arup
1989

Years of Experience
25

Nationality
British

Qualification
BSc (Joint Honours), Geology and Geography

Professional Associations
Fellow, Geological Society of London

Committees
Chairman, Geological Remote Sensing Group (GRSG)

Publications
‘Engineering geological characterisation of the Barzaman Formation, with reference to coastal Dubai, UAE’
Macklin S, Ellison R, Manning J, Farrant A and Lorenti L,
Bulletin of Engineering Geology and the Environment, 71 (1) 1-19, 2012

‘Remote sensing for terrain analysis of linear infrastructure’ In ‘Mapping hazardous terrain using remote sensing’, Geol. Soc. Special Publication 283, 2007

‘Remote sensing for terrain evaluation and pipeline engineering’ Proc. Geopipe2004 conference, ICE, 2004

‘Civil engineering applications of wartime aerial photography and related material’. Photogrammetric Record Vol. 14: (80) 219-226, 1992

Jason is an experienced geologist in the field of engineering geology and geomorphology. He specialises in remote sensing, aerial photographic interpretation and GIS (including 3D modelling and visualisation). These skills are utilised together with desk studies in order to undertake site appraisal, site selection and geohazard studies including development of conceptual geological models.

He has wide experience in overseas fieldwork, including ground investigations, geohazard mapping and route alignment studies for pipelines, highways and railways.

Jason has extensive overseas field work experience and has worked in UK, Ireland, Russia, Kazakhstan, Kyrgyzstan, UAE, Egypt, Algeria, Tunisia, Morocco, Nigeria, Tanzania, Cape Verde, Estonia, Turkey, Philippines, Hong Kong and Caribbean.

Jason brings to the project a combination of specialist skills and worldwide experience in the fields of geology, geomorphology and remote sensing.

Emirates LNG, UAE
Jason was the lead engineering geomorphologist including assessment of tectonic geomorphology, remote sensing and geological ground model development for the seismic hazard assessment for the project.

Istanbul New Airport, Turkey
Geological and geomorphological site appraisal, procurement and appraisal of satellite imagery, development of geological ground model and provision of core-logging workshop training.

Earth Observation for Oil and Gas (EO4OG)
Project Manager for research project assessing oil and gas industry requirements in their use of earth observation applicable to different stages of the oil and gas project cycle.

Seychelles Strategic Plan
Geological appraisal through desk study, geomorphology, remote sensing and GIS analysis to assess geohazards, including slope instability, to provide input to planning strategy document.

Shah Deniz 2 Terminal Expansion Project, Sangachal, Azerbaijan
Jason was the lead engineering geomorphologist including assessment of tectonic geomorphology, remote sensing and GPS vector modelling for the seismic hazard assessment for the project.

Mansuriya Gas Project FEED, Iraq

Jason was the lead engineering geomorphologist including assessment of tectonic geomorphology, remote sensing for the seismic hazard assessment for the project.

Doha Metro, Qatar

Geomorphological assessment utilising historic aerial photographs, satellite imagery and GIS analysis for karst hazard assessment for proposed tunnel alignments and station boxes.

Sogamoso Dam, Colombia

Geomorphological assessment and aerial photographic interpretation for assessment of slope instability to highway and bridge infrastructure in a tropical mountain environment.

Biocity, Turkey

Geomorphological assessment utilising historic aerial photographs, satellite imagery, GIS analysis and site walkover to inform masterplanning of site constraints (including slope instability) and opportunities.

Sabiha Gokcen Airport, Turkey

Engineering-geological desk study, aerial photographic interpretation and satellite remote sensing assessment to inform site constraints and opportunities for airport expansion project.

Skolkovo Technopark, Moscow, Russia

Engineering geology assessment for major research centre in Moscow.

Isarene Development Project, Algeria

Lead Engineering Geomorphologist for pipeline routing and facilities location study (manifolds, CPF, BdV, airstrip, right-of-way etc) for exploration block in the east-central Sahara. Around 90km of interfield pipelines and 96km of export pipeline, traversing dune fields, interdune areas, depression and a 150m high falaise crossing. Development of geological model and hazard register, GIS and remote sensing analysis and dune mobility assessment study.

Husky White Rose Extension Project (WREP), Newfoundland, Canada

Desk study and aerial photographic interpretation for proposed casting basin dry dock on the Atlantic coast of eastern Canada in former glacial terrain.

Masterplanning project, Tanzania

Geological and geo-hazard desk study to identify risks and opportunities, to assist masterplanning of a proposed university campus development.

Masterplanning project, Kazakhstan & Kyrgyzstan

Geohazard study, field mapping and ground investigation (including geophysics) to investigate geo-hazards at proposed university campus sites.

Wylfa Nuclear Power Station, Anglesey, Wales

Lead geomorphologist for the capable faulting study being undertaken as part of the seismic hazard assessment consultancy services for the proposed new build nuclear power station at Wylfa, Anglesey in Wales. The study has included desk study, ground investigation planning, geological reconnaissance and mapping, development of a detailed 3D geological model for Wylfa area, detailed interpretation of the capability of faults in the region, and development of a regional seismo-tectonic model.

Jazan Refinery, Saudi Arabia

Desk study, geological assessment and satellite remote sensing assessment for input to seismic hazard assessment for proposed oil refinery on arid coastal belt on the Red Sea coast, close to active Red Sea tectonic rifting.

In Salah Gas - Northern Field : Teg Routing Study, Algeria

Desk study and satellite remote sensing assessment for route alignment planning of 10” gas pipeline from well pads to the CPF. Geo-hazards included wadis, dayas and variable rock excavatability.

King Abdullah Sports City (KASC), Jeddah, Saudi Arabia

Geological desk study for identification of possible ground related risks for proposed major sports development in alluvial fan and coastal plain of Red Sea. Geomorphological assessment for terrain and geological mapping and wadi assessment.

King Abdullah Petroleum Studies and Research Center (KAPSARC), Riyadh, Saudi Arabia

Geological desk study for identification of ground related risks for proposed research facility development. Including identification and assessment of karst hazards and flash flood hazards.

Newport Parrog outfall, UK

Geomorphological assessment of estuary and beach deposits for outfall structure.

In Salah Gas, Algeria

Lead Engineering Geomorphologist for desk study, GIS and remote sensing analysis for proposed gas pipeline and associated infrastructure in Sahara desert. Detailed quantitative assessment of wadi scour potential at proposed wadi crossings and recommendations for alternative crossings. Field work included geomorphological mapping and inspection for wadi crossings to assess and quantify potential scour to pipeline ROW.

Hassi Ba Hamou, Algeria

Desk study, data collection, GIS and remote sensing analysis for pipeline routing of proposed gas pipeline and associated infrastructure within Grand Erg occidental sand sea.

Lake Albert Concrete Barge, Uganda

Geological and GIS assessment for proposed dry dock construction site.

Oyster Wave Energy Project, Orkney, UK

Geomorphological and geological assessment including analysis of bathymetric data to assist design of proposed seabed wave energy machine.

Sveti Stefan, Montenegro

Desk study, geomorphological and geological assessment for proposed tourist development on Adriatic coast.

Sengkang LNG Terminal, Indonesia

Geological desk study for proposed terminal including 1km long jetty structure.

Tblisi, Georgia

Desk study, data collection and GIS 3D-visualisation for geological and geohazard assessment of proposed mixed-use development in Tblisi.

Baku City Masterplan, Azerbaijan

Desk study, data collection and GIS assessment for geological and geohazard assessment for proposed new town development. Satellite image and remote sensing interpretation.

Dock construction site study, Alaska & North Pacific Ocean

Desk study incorporating development of a GIS database to identify suitable sites for dry dock construction sites.

Maddinah to Mekkah Rail Link (MMRL), Saudi Arabia

Geohazard Desk Study to identify key constraints to proposed 450km high speed rail link. Incorporating GIS data and analysis.

Energy project, Egypt

Site selection for pipeline landfall and onshore pipeline routing, Mediterranean coast of Egypt. Geological desk study and site reconnaissance field work.

Arsenal Development, Tblisi, Georgia

Geological desk study, remote sensing and slope stability assessment for masterplanning.

Fontanka Masterplan, Odessa, Ukraine

Geological desk study, seismic appraisal, remote sensing, GIS for assessment of coastal site subjected to active slope instability.

UWCEA, Kenya

Geological desk study and satellite image interpretation for development site located on an escarpment of the East African Rift Valley.

Nuclear Facility Strategic Siting Study, Cumbria, UK

Geological and geomorphological assessment input for siting study report for a new build nuclear facility in West Cumbria in the UK. The study included seismic hazard assessment, a capable faulting study, tsunami hazard assessment, flood risk assessment, and storm surge and coastal processes studies for the proposed

site area.

Chimbulak Mountain resort, Kazakhstan

Geological desk study, remote sensing, GIS and field mapping for assessment of potential geohazards for proposed US$1 Billion resort development.

Ekat City, Ekaterinburg, Russia

Geological desk study.

Dock construction site study, Russian Far East

Desk study and site visits to identify suitable sites for dry dock construction sites. Incorporated development of a GIS database to enable comparison of constraints and opportunities between sites. Field work to Primorskiy Kray and Sakhalin island assessing potential dry dock sites and visits to quarries to assess potential aggregate sources.

Almaty, Kazakhstan

Geological desk study, seismic appraisal, remote sensing, GIS for assessment of seven development sites in vicinity of Almaty.

Highways Agency Research Project

Development of remote rapid assessment techniques. Research project assessing a wide range of terrestrial, airborne and satellite based remote sensing techniques for monitoring geotechnical assets (embankments and cuttings) for UK Highways Agency. Including application suitability for slope stability assessments.

Sambarabougou, Senegal

Hydrological and hydrogeological desk study for assessment of water supply options.

Tourist resort, Nevis, Caribbean

Geological desk study for proposed coastal tourist development in volcanic terrain.

Gautrain high speed railway, South Africa

Desk study assessment of karst hazard for proposed high speed rail link between Pretoria and Johannesburg.

Sikkim Airport, India

Geohazard desk study for Pre-masterplan study for proposed airport site in Himalayan mountains. Development of 3D models within GIS for visualisation.

Casting basin study, South-East Asia

Site selection study for proposed casting basins in south-east Asia, incorporating desk study, interpretation of satellite imagery together with development of GIS database.

Dublin-Belfast Interconnector pipeline, Northern Ireland & Republic of Ireland

Desk Study, aerial photographic interpretation and field survey for alignment route planning of 170km of proposed gas pipeline route, including assessment of alternate alignment options.

Antigua Airport, West Indies

Geological desk study and air photo interpretation assessment for proposed airport expansion.

Grand Museum of Egypt, Cairo

Geological and geomorphological appraisal of proposed museum site using high resolution satellite imagery and historic (1940's era) aerial photography.

Milford Haven-Aberdulais pipeline, Wales

Unexploded Ordnance (UXO) Hazard Desk Study for 120km gas pipeline.

Sulawesi LNG, Indonesia

Geological Desk Study for a petrochemical facility.

M1 widening, England

Contaminated land and hazard survey using stereo aerial photographs, for motorway widening works.

Komotini-Alexandroupoli pipeline, Greece

Geological appraisal and terrain analysis utilising aerial photographic interpretation and satellite imagery, part of 'Southern European Gas Ring'.

British Embassy, Algiers

Geological Desk Study including satellite image interpretation.

South Eastern University (SEUSL), Sri Lanka

Site appraisal including geo-hazard assessment of university site affected by December 2004 tsunami. Review of pre- and post-tsunami high resolution satellite imagery.

Donetsk Stadium, Ukraine

Use of high resolution satellite imagery within 3D GIS for visualisation and site appraisal for a proposed stadium.

University of Central Asia geo-hazard mapping project

Desk study, data collection, in-country meetings and field work to compile detailed geo-hazard maps for 3 campus sites in mountainous environments in Central Asia. Kazakhstan, Kyrgyzstan, Tajikistan.

Moscow City, Plot 9 Development, Russia

Ground investigation supervision and geological research for foundation design and assessment of karst risk.

Montana Tindaya, Canary Islands

Photogeological study for a detailed feasibility study of cavern design. Included 3D modelling and generation of fly-throughs within GIS environment.

Assaluyeh LNG plant site, Iran

Satellite image interpretation (ASTER and Landsat) and GIS analysis for seismic hazard appraisal. Geomorphological mapping and development of geological model.

Songdo, Korea

Remote sensing study of historical remote sensing imagery to determine detailed history of landfill reclamation associated with development on Songdo new town development, located on reclaimed land, west coast Korea.

Tombak LNG plant site, Iran

Satellite image interpretation (ASTER and Landsat) and GIS analysis for seismic hazard appraisal.

Casting Basin Study, Gulf of Mexico

Site selection studies for casting basin sites in the Gulf of Mexico region, US, Mexico and adjoining regions.

Otumara AGG, Nigeria

Pipeline route planning and site selection studies, using Ikonos and Landsat satellite data.

Casting basin study, Nigeria

Site selection studies for casting basin sites, including full length of Nigerian coastline, Niger delta and local region.

Novosibirsk, Russia

Image interpretation using 1960's declassified spy-satellite imagery for site appraisal.

British Earthquake Consortium for Turkey (BECT)

Hazard mapping study for earthquake reconstruction project following the 1999 Kocaeli earthquake. Mapping of landslides, geological and geomorphological mapping, including use of Ikonos high resolution satellite data.

Metsovitikos Bridge, Greece

Photo-geological mapping for proposed bridge and tunnel construction.

Baku, Azerbaijan

Appraisal of geotechnical site investigation reports (in Russian and Azeri) for sites in Baku.

Java, Indonesia

Geological appraisal of proposed coastal petrochemical site situated on varied geology of volcanic and marine deposits.

Cliff instability, Brighton, England

Desk study and geological mapping to identify cause and nature of cliff instability following landslide affecting a supermarket.

Development sites, England

Geotechnical Desk Study assessments of various contaminated land sites.

Paks nuclear power plant, Hungary

Satellite remote sensing for lineament identification of recent fault activity as part of a seismic hazard assessment.

Sual power station, Luzon, Philippines

Site investigation supervision.

Bord Gais, Republic of Ireland

Aerial photographic interpretation and field survey for 1,000km of proposed gas pipeline routes in Irish Republic and Northern Ireland.

Samarkand, Uzbekistan

Geological desk study.

Crossrail, London, England

Geological appraisal of tunnel alignment portions of proposed Crossrail project.

Landslide Preventative Measures project, Hong Kong

Air photo interpretation and site visits to assess stability of numerous natural, man-made slopes and retaining wall sites.

British Embassy, Moscow, Russia

Geotechnical Desk Study, site investigation planning and supervision, laboratory testing and reporting.

Hong Kong Country Park

Aerial photographic study and geomorphological assessment of a proposed country park in rugged granitic and volcanic terrain.

M25 widening J23-28, England

Air photo interpretation.

Water Treatment Plants, England

Aerial photographic study of 65 water treatment sites to assess geomorphology, history and contaminated land.

Tarif–Madinat Zayed–Liwa (TMZL) Highway, UAE

Aerial photographic interpretation, field survey, site investigation and route selection for a 110km highway in desert terrain of mobile sand dunes and Sabkha.

Trunk pipeline project, Middle East

Geological, geomorphological, seismic and topographical appraisal of 8,000km of proposed pipeline through seven Middle Eastern countries.

Caspian Sea, Kazakhstan

Geological study of seabed sediments.

Transco Pipelines, England

Photogeological and geomorphological mapping of five proposed gas pipeline routes totalling 104km in Essex, Northamptonshire, Cambridgeshire and Lancashire.

Matilda Kitou

Profession
Civil Engineer

Current Position
Senior Maritime Engineer

Joined Arup
2005

Years of Experience
19

Nationality
Greek

Qualifications
PhD, University of Liverpool, UK 1999

Diploma in Civil Engineering (Dipl Eng.), Aristotle Univ. Thessaloniki, Greece 1990

Professional Associations
Member Technical Chamber of Greece, 1991

Member International Navigation Association (PIANC), UK 2000

Member Institution of Civil Engineers (MICE), UK 2002

Chartered Engineer (CEng) 2002

European Engineer (EurIng) 2003

Construction Skills Certification Scheme (CSCS) Registered 2005

Member Technical Chamber of Greece, 1991

Member International Navigation Association (PIANC), UK 2000

Member Institution of Civil Engineers (MICE), UK 2002

Chartered Engineer (CEng) 2002

European Engineer (EurIng) 2003

Construction Skills Certification Scheme (CSCS) Registered 2005

Languages
Greek – Native speaker

English - Fluent

French - Advanced in Business Language Competence

Publications

Dr Kitou has over 19 years' experience in hydraulic modelling including both numerical and physical model studies. Eight years were spent in academic research and over 14 years in the design and consultancy industry.

Dr Kitou has been involved in the detailed design and management of various civil engineering projects with a specialisation in port and maritime works, shore protection and coastal management studies. She has experience in using computer models to simulate the wave climate in the nearshore zone and within protected ports. Dr Kitou has considerable experience in supervising, reviewing and managing numerical and physical model studies carried out by hydraulic modelling consultants.

Her PhD studies (funded by an EU Scholarship) involved research on random wave modelling and the development of a numerical model for wind wave transformation and wave-induced circulation in the nearshore zone. During the course of her Ph.D. studies, she carried out research in sediment transport and long term and short term morphodynamics as part of ther employment as a Research Assistant by the University of Liverpool, UK and University College Cork, Ireland in the mainframe of national and European research projects

Matilda's strengths lie in her experience in using numerical and physical models, and in her ability to apply the newest research in assessing coastal processes and the design of marine works.

Garden Bridge, London, UK

Management of the numerical modelling and site investigation studies for the Environmental Impact Assessment of a landmark pedestrian bridge on the Thames. Assessment of effects on coastal processes (scour, erosion and deposition) on the basis of numerical modelling results. 2013- 2014 (ongoing)

West of Duddon Offshore Wind Farm, UK

Scour and cable protection review for a Due Diligence assessment of the wind farm, this includes assessment of large scale sediment movement that may affect cable protection and estimation of ongoing maintenance costs, ongoing

Saldanha Ship Repair, Feasibility Study, South Africa

Metocean conditions assessment for a facility in Saldanha Bay as part of a prefeasibility study on behalf of South Africa port authority, including estimation of siltation rates and maintenance requirements for the shipyard, 2013-2014

Osprey Quay, Dorset, UK

Management of a Due Diligence study of Flood Protection structures in an extensive area behind Chesil Beach (Jurassic

Kitou M, Katopodi I and O'Connor BA 'Times scale of long-shore current development in the nearshore zone'. Proceedings XXX IAHR Congress 24-29 August 2003, Thessaloniki, Greece, Theme A, pp 307-314.

Kitou M. and Kitou N 'Effects of frequency and directional spreading on the long-shore mean current'. Proceedings of Waves 2001: The 4th International Symposium on Wave Measurement and Analysis, ASCE, 3-5 September 2001, USA

Kitou M 'Cross-shore modelling of short-crested wind wave transformation and wave-induced circulation in the near-shore zone', Ph.D. Thesis, University of Liverpool, 1999

Kitou M and O' Connor BA 'Evolution of a Directional Spectrum in Shoaling Water: The equivalence of two different approaches'. Internal Report CE/45/93, University of Liverpool, Department of Civil Engineering, 1993

Kitou M 'A depth-averaged model for wave-induced nearshore circulation'. Internal Report CE/29/90, University of Liverpool, Department of Civil Engineering 1990

Coast) in Dorset, including assessment of sediment processes that may affect the performance of the flood protection structures, 2013

Malampaya Compression Platform, Philippines

Management and Supervision of physical models testing, conducted at the Danish Hydraulics Institute, to evaluate design wave conditions for a (new) compression platform to be installed next to an existing platform, including evaluation of sediment transport and likely scour effects around the platform 2012

Margate, New RNLI Station, UK

Evaluation of wave conditions, coastal processes and flood risk assessment to help set the floor level of a new station to be used by the Royal National Lifeboat Institution. 2012

London Array Offshore Wind Farm, UK

Technical Review, evaluation and risk assessment of sediment transport processes scour protection around monopiles and cable protection for an offshore wind farm as part of due diligence exercise. The site is particularly challenging in terms of sediment transport processes since part of the cable is laid in an area of high mobility which includes offshore sandbanks, ongoing

Sherignham Offshore Wind Farm, UK

Technical Review, evaluation and review of Contractor's proposals for sediment transport processes, scour protection of monopile foundation, as part of a due diligence evaluation and estimation of risks to the Client, 2012

Walney Offshore Wind Farm, UK

Technical Review, evaluation and review of Contractor's proposals for scour protection of cable connecting wind farm to land station, as part of a due diligence evaluation and estimation of risks to the Client. This included evaluation of large scale sediment transport processes that may affect the integrity of the scour protection. 2012

Forth Replacement Crossing, UK

Technical Review of scour protection proposals by the Contractor for the bridge piers and towers supporting a major bridge Evaluation of proposals included understanding the effect of sediment transport processes in the Forth estuary and the effect the bridge may have on these. ongoing

Browse LNG, Australia

Management and supervision of Physical Modelling Studies in order to propose a scheme for the marine works. Marine infrastructure consisted of an offshore breakwater and a Tug harbour. 2011

Pendine, Wales, UK

Evaluation of coastal processes as part of a feasibility study to prepare management options for coastal defences on behalf of Carmarthenshire County Council and the Coastal Protection

Authority for Pendine Village. 2010

Parrog, Wales

Sediment transport assessment for the design of an outfall pipeline which will replace a damaged pipeline at Parrog in Newport. 2010

Scroby Sands Offshore Wind Farm, Norfolk, UK

Assessment and evaluation of the possible reasons for the cable failure from the maritime point of view, mainly sediment transport processes. 2007

Costa Azul LNG Terminal, Mexico

On this development of an LNG Terminal, undertook the planning, coordination and supervision of hydraulic physical model studies. Tested designs, considered structural stability and hydraulic performance of an offshore breakwater and a smaller tug harbour, sedimentation processes, navigation and vessel response. 2005-current

Greystones Harbour Development, Ireland

Harbour development including breakwaters and coastal protection works. Planning, coordination and supervision of hydraulic physical model studies. 2005-2006

Castlehaven Coast Protection Scheme, Isle of Wight

Team leader for the detailed design and preparation/issue of tender documents for all foreshore works in an area of cliff recession. Project manager and responsible for co-ordination, QA and financial management of the project. 2002-2004

Scarborough Strategic Coastal Monitoring, UK

Inspection and reporting engineer, solely responsible for visual inspection, recording and reporting on the existing coastal defence structures on the north east coast of England including Staithes, Whitby, Runswick Bay, Scarborough and Robin Hood's Bay. Part of a major coastal strategy scheme undertaken by High-Point Rendel on behalf of Scarborough Borough Council. 2002

Academic and Research Work Experience

Research assistant University College Cork, Ireland, for the EU-Training & Mobility of Researchers (TMR) project ‘coastal dynamics’.

Research assistant at the Department of Civil Engineering at University of Liverpool, for the SERC-funded project ‘modelling of fluid mud’.

Member of a research team carrying out an experiment at the Coastal Research Facility (CRF), Hydraulic Research Station, Wallingford, UK.

Test: Evolution of (uni-directional and multi-directional) random waves over two shoals.

Conferences & Workshops

Coasts, Marine Structures & Breakwaters, Edinburgh 2009.

Attendance of pre-conference short course

IAHR 2003: The International Association of Hydraulic Research Conference, Thessaloniki, Greece. Attendance and presentation of a technical paper.

WAVES 2001: The Fourth International Symposium on Wave Measurement and Analysis ASCE, San Francisco, USA. Attendance & presentation of a technical paper.

WAVES 2001: Short Course on Water Wave Modelling, ASCE, San Francisco, USA.

Coastal Engineering and Management, HR Wallingford, UK.

Wave-current Interaction workshop (WISE working group), Proudman Oceanographic Laboratory, Merseyside, UK.

Waves in Shallow Environments (WISE group) workshop, Porto Carras, Thessaloniki, Greece.

Modelling and Prediction of Physical Processes in Coastal Seas and Estuaries. Attendance and presentation of a research project titled ‘Formation of offshore sandbanks’.

Advanced course funded by EU-MAST program, Renesse, The Netherlands 23rd International Conference on Coastal Engineering, ASCE, Venice, Italy.

Lei Yang

Profession
Water Engineer

Current Position
Senior Engineer

Joined Arup
2006

Years of Experience
26
14 (UK)
12 (China)

Nationality
British

Qualifications
2005 - PhD in Hydroinformatics. Specialism: Numerical Modelling in Riverine and Coastal Waters. Cardiff University, UK.
1987 - MPhil in Environmental Engineering. Specialism: water treatment. Lanzhou Jiaotong University, China.
1983 - MEng in Civil Engineering. Specialism: Water and Wastewater Engineering. Lanzhou Jiaotong University, China.

C.WEM
CEng
MCIWEM
MIAHR

Dr Lei Yang is an experienced numerical modeller in water engineering.

She has specialist modelling experience covering sewer network, riverine, coastal and estuarine flow processes, with interests not only in the hydrodynamic aspects but also in sediment transport and water quality process modelling.

She has worked with a range of modelling tools including FEH, WinFAP, ReFH, InfoWorks CS, ICM, DIVAST (2D), FASTER (1D), MapInfo, CulvertMaster (1D), MIKE 11, Mike 21, Mike Flood, ISIS 1D, ISIS-Tuflow, and Estry-Tuflow.

Her recent years have been dealing with complicated urban flood modelling using ISIS 1D river model or integrated ISIS-Tuflow 1D-2D river and floodplain modelling. She has specialist knowledge on hydraulic model build of bridge, culvert or orifice structures to assess the local hydraulic performances alongside the river flows.

She worked as an academic staff in the research field of riverine and coastal modelling in Cardiff University from 1999 to 2006. Before that she worked as an associate professor/lecturer in Chinese universities in water engineering from 1983 to 1998.

> Lei has specialist experience covering hydraulic, hydrodynamic, water quality and sediment transport modelling.

Her years academic background gains her an in-depth understanding of all water-related engineering theory and principles. Her passion is to implement science and research in Arup engineering applications to promote innovation and sustainability.

In Cardiff University, Lei worked for an Environment Agency funded research project led by Professor Roger Falconer. As the principal modeller, she completed an integrated 1-D and 2-D model development of the project “Modelling the fate of the particles in Severn Estuary”. During the research project she established a new approach of modelling the bacterial contamination linked with sediment transport processes using advanced 1D-2D numerical schemes.

In Arup she led and completed a wide range of water modelling projects, including flood modelling from river and sea, dissolved oxygen modelling, estuarine sediment transport modelling and all types of sewer network modelling.

Publications

1. Co-Author. 'Flood Modelling due to Bridge Construction in Lower Ely River using ISIS-Tuflow', Tuflow Conference, Oct 2011.

2. Yang, L. 'Water Environment Modelling, UK Industry Applications in Assisting Engineering Design.' DHI Mike software conference, June 2011.

3. Yang, L., Lin, B. and Falconer, R.A. 2008. Modelling enteric bacteria level in coastal and estuarine waters. Journal of ICE. Proceedings of the Institution of Civil Engineers. Engineering and Computational Mechanics 161, Issue EM4, pp179-186.

4. Yang, L. 2008. Water Quality Modelling. Arup Research Review, 2008 Publication, pp20-23.

5. Co-author in the four volumes published in 2007 by Environment Agency (EA). See EA website for publications.

6. Co-author. 2005. Decay of intestinal enterococci concentrations in high energy estuarine and coastal waters: towards real-time T90 values for modelling faecal indicators in recreational waters. Water Research 39, pp655-667.

7. Yang, L., Lin, B., Kashefipour, S.M., Falconer, R.A. 2002. Integration of a 1-D model with object-oriented methodology. Journal of Env. Modelling and Software. Vol.17, pp693-701.

8. Author. 'Poole Model, Estuarine and coastal water quality modelling software, User's Manual, Version 2.00, Cardiff University, October 2001

9. Author. 'Flow and Solute Transport Model for Estuarine and Rivers. Users Manual. Cardiff University, 2000.'

New M4 Flood Risk Assessment, 2014

Client: Welsh Assembly Government

Lei proposed Tuflow to build a 1D-2D coastal flood model in assisting the flood risk assessment of the New M4.

The linked 1D-2D model was built using Lidar, featuring the geometry of the embankments of railway/motorway infrastructures and the many small ditches. The sea defences were added into the 2D domain using surveyed levels. WAG commissioned Arup to assess the flood risk from the extreme sea levels arising in both Seven Estuary and the tidal River Usk during the severe tidal flood events up to a 1 in 1000 year return period probability plus climate change and the 95% confidence intervals at upper bound of the extreme levels. Along the coastlines there were 28.5km open water boundaries built in the 2D domain. Therefore a temporal and special varying water level boundary was specified to receive a series of tidal hydrographs in a 2km spacing. Two models with and without the M4 construction were built and results were analysed.

The modelling revealed that there was severe flood risk to the study area under climate change conditions and the construction of the new M4 would cause increased flood depth in its seaward side.

Therefore mitigation measures were proposed and modelled. The mitigation modelling revealed that some sea defence improvement work at key locations would significantly reduce the flooding risk to the whole community and enable the new M4 and the existing M4 accessible during severe tidal flood events under climate change conditions. The challenge of this project is for Lei to organise a new model build to a large coastal area with limited survey data available.

Avonmouth/ Severnside Strategic Flood Risk Assessment, 2013

Client: Bristol City Council

Avonmouth SFRA model is an integrated 1D-2D Estry-Tuflow hydraulic model, aiming to predict extreme water level, flood extents and hazards caused from combined tidal, wave, storm surge and fluvial flood events for a large city area ruled by Bristol City Council. It was a highly completed model, i.e. including more than 400 boundaries regards to tides, wave, surge, and fluvial flow and pipeline inflows and was built on old Tuflow version.

Arup were commissioned by BCC to update the model to be compatible with the latest Tuflow Build and rerun the new model with 60 years climate change scenarios. Lei completed the model upgrade and built the climate change scenarios runs. The biggest challenge of this project is for Lei to master the not-working-status Estry/Tuflow model with limited available information and convert it into the latest Tuflow version within a limited programme time scale.

Risca Flood Risk Management Scheme, 2013 - 2014

Client: Natural Resources Wales

Risca town suffered historical flooding from its adjacent river EBBW. This scheme is based on an existing Risca hydraulic model, aiming to investigate different engineering options to mitigate the flood risk from the River Ebbw to the town.

There have been a number of hydraulic modelling studies undertaken in this study area in the past. Lei conducted a technical review of the past studies and audited the last version of Risca model, a linked 1D2D ISIS Tuflow model. Based on this, Lei prepared the modelling plan to gain agreement with EA's specialist team to update the model to suit for this project study.

In the option appraisal stage of this project, Lei led the preliminary design of the flood mitigation options and carried out the mitigation options model builds. This stage modelling study is the essential work for supporting Arup and NRW on the decision making of the preferred option.

In the detailed design stage, Lei completed baseline model update using detailed design surveys and then built the final defended model using detailed design drawings provided by the defence design engineer. In each stage Lei prepared technical modelling reports to compose the model delivery package.

The biggest challenge of this project is for Lei to lead the much complicated preliminary design options and planning and build the relevant hydraulic models accordingly.

Llanelli 2D Modelling, 2013

Client: Morgan Sindall for Dwr Cymru Welsh Water

As a team member of Llanelli green engineering project Lei built an InfoWorks ICM 2D model covering the town of Llanelli including the sewer network system using the ground topography from LiDAR and DCWW asset database. In the model the Llanelli 2D terrain was linked with much complicated 1D underground sewer system including storm, foul and combined sewer. The modelling dealt with surface run-off by applying direct rainfall. It predicted surface water flooding risks in urban area due to surcharged sewer during heavy rainfall.

Roath and Rhymney, Stage II 2013

Client: Environment Agency Wales

As a project team member, Lei led and completed Stage II Modelling of Roath and Rhymney. Stage II model is requested to develop and represent a proposed preferred flood defence along Roath Brook and River Rhymney, which is a part of the detailed design phase to provide the future water levels once the proposed defences are in place. It is a linked 1D-2D ISIS-Tuflow model with a fixed grid in 2m in size. In regarding to Stage I modelling components, some significant upgrades were made, such as, the previous1D bridge structures were constructed into both 1D and 2D domain and the previous 1D glasswalls were replaced in 2D

along the selected locations.

The challenge of this project is for Lei to check the model's strategy and improve the model to represent the reality of the preferred design.

YWS Hull Drainage Study, 2013

Client: Yorkshire Water Services

Review of Hull InfoWorks ICM Model. The InfoWorks ICM linked 1D-2D model was built by a sub-consultant. Lei, as a project team member, carried out a high level technical review throughout the Hull modelling package to audit the model build and the simulation results.

Plas Treoda External Flooding, 2012

Plas Treoda has historical external flooding on a number of occasions. The flooding issue is registered on the DCWW Definitive Flooding List. Working on behalf of DCWW, Arup conducted the investigation. Lei carried out a detailed InfoWorks CS hydraulic modelling study and found out that Plas Treoda flooding was mainly due to sewer capacity limitations. The hydraulic model was built to identify the quantity of surface water and explore the solutions hydraulically. The modelling study provided root causes and design options which underpinned the detailed design in next stage.

Cowbridge Road Ely Stage II, 2012

EAW commissioned Arup to carry out further damage assessment for an integrated scheme including The Mill and EA Defences. Hydraulic modelling was required to assist the damage/economic analysis. Lei led and completed the 1D-2D ISIS-Tuflow modelling study. New models were built to the protection standard up to 1in100 year return period fluvial flood plus climate change scenario.

The Mill, Private Client, 2012

Arup were requested by Ely Bridge Development Company to undertake a hydraulic modelling study to assess the flood risk for the development site - The Mill, as a part of a regeneration project to develop a new housing estate at the disused industry estate. The Mill which is adjacent to River Ely is exposed to flood risk from the river.

A dynamically linked 1D-2D ISIS-Tuflow hydraulic model is used to provide detailed flood route modelling and assess the flood risk due to the development scheme. Lei led and completed the modelling study which provided optimum development plan to protect the site and flood mitigations to surrounding areas.

Rogerstone, Private Client, 2012 - 2014

A hydraulic modelling study was carried out to assess the flooding risk from River Ebbw to Novelis Site, Rogerstone and its immediate upstream and downstream areas.

Lei managed the modelling project and built the 1D river and 2D terrain using ISIS-Tuflow modelling package. A baseline model was built to represent the existing site condition using Lidar and river cross-section survey. Several design option models were built to represent the proposed site development plans to test any potential increase or decreases in flooding for the site and its upstream and downstream areas. This new model build task as one of the key inputs has been passed the planning permit from EA Flood Risk Management department.

RAF Brize Borton, 2012

As part of the strategic development of Brize Norton airfield, Arup was appointed to advice on engineering services including the flood risk assessment regarding to the infrastructure planning.

Lei led and completed a Mike 21 2D flood modelling study to assist the Flood Risk Assessment. New model was built and the modelling has been prepared to optimum the planning scheme to gain proper flood compensation in support of the Planning Application to West Oxfordshire District Council.

Cowbridge Road Ely, (NEECA2) 2011

This project mitigates the flooding risk of the Cowbridge road area from River Ely, Wales. Historically this area has suffered flooding from river bank over-topping and the most recent flooding occurred in September 2008. A linked 1D-2D ISIS-Tuflow hydraulic model was built to predict the flood risk and reduce uncertainties for proposing the most cost-benefit flood mitigation scheme amongst a number of solution proposals. Lei led the linked 1D-2D ISIS-Tuflow modelling study and completed first phase – the baseline review modelling. The project is still on-going for options appraisal modelling.

Ystradygnlais Flood Alleviation, (NEECA2) 2011

Arup was commissioned by Environment Agency Wales to undertake a Project Appraisal Report (PAR) study for the community of Ystradgynlais, a town on the River Tawe in Powys, southwest Wales. The main objective was to identify the business case for flood risk management schemes. A hydraulic model was prepared to support the PAR study. This is a linked 1D-2D Estry-Tuflow hydraulic model to predict the channel flow and surface water profile and hence outline design of the flood risk management options. Lei led and completed the linked 1D-2D Estry-Tuflow flood modelling study.

Port Talbot PDR, West End Flooding, 2011

Arup was commissioned by Neath Port Talbot County Borough Council to provide design service for the proposed Peripheral Distributor Road (PDR). This system consists of culverts set within the proposed highway embankment. Environment Agency Wales have requested that a 2D model needed to be undertaken to assess the performance of the culvert in the West End area and to ensure that the highway embankment does not increase the flood risk in this area.

Lei developed a MIKE 21 2D flood model for the West End area

to assess the impact of the proposed PDR works on flood levels. The modelling exercise was undertaken to assess the existing and proposed flood levels, depths and velocities in the area of West End for various inflow scenarios. The most cost beneficial culvert settings were concluded from the 2D modelling results for subsequent detailed design.

Gowerton Model Build, 2010

Gowerton catchment covers both rural and urban areas. The existing catchment InfoWorks CS model included most part of the AIS sewer network but some parts were missed. Many modelled subcatment areas had some areas missed. Commissioned by DCWW Arup upgraded the existing model using the latest sewer AIS database, OS master map, HR Wallingford WRAP map etc. as a team member, Lei upgraded the subcatchment build and guided new modeller to complete the Gwoerton Model Build.

Llanrumney Park & Ride, 2010

This was a sewer diversion project. As a team member, Lei carried out the hydraulic modelling using InfoWorks CS to optimum the design options.

Cardiff City was to build a Park & Ride scheme near Llanrumney in Cardiff. Construction of the development involved significant changes in level of the flood plain of the River Rhymney. One area remained to undergo a proposed reduction in level to form flood compensation. DCWW had existing sewerage crossing this flood plain, and hence the sewerage was required diversion to accommodate the remaining proposed change in level. Arup commissioned by the council to provide the design services. The InfoWorks modelling was conducted to predict future hydraulic performance of the network in terms of the preliminary selected diversion routes.

Roath and Rummey, (NEECA2) 2010

As a team member, Lei completed the upper Roath hydraulic modelling to assess the attenuation capacity of Roath Lake using 1D ISIS software, which is a part of the Roath & Rummey 1D-2D modelling study while this PAR project for EAW tackles the flood risk assessment for the Roath area located in Cardiff city centre.

Mackworth Grange, 2010

A new development site was planned in Mackworth Grange in South Wales where the existing sewer capacity was at its upper limits. As a team member, Lei used InfoWorks CS to build a hydraulic model covering the sewer system in Mackworth Grange to assist the strategic sewer design for the development.

KASC, 2D lake modelling, 2010

As the principal modeller, Lei led a 2D numerical modelling study for strategically carrying out an optimum design for an artificial lake proposed in KASC masterplan project. This strategy was for designing an artificial waterway system including the lakes, lagoons and canals becoming a world-class rowing

centre with top water quality. A MIKE21 model was built to investigate the lake re-circulation, retention time, incoming and outgoing design flows and lake oxygen levels.

Mosaic Commune Water Quality Control Project, 2010.

Lei composed a tendering specification to tender Mosaic Commune water quality management scheme for Beijing office; the bid document emphases Arup full understands of the natural water behaviours and meet the client's requirements. Arup won the project. Lei led and completed the Phase-I feasibility study and preliminary design for the canal water quality control.

Qatar National Museum, 2009

As the principal modeller, using MIKE 21 FM HD and CulvertMaster to model a purpose-made tidal lagoon during the detailed design stage of Qatar National Museum Masterplan. It was a 2-D numerical modelling study, providing hydraulic and hydrodynamic constraints for the optimum design of a tidal lagoon and its inlet and outlet culverts to create an efficient and effective flushing pattern inside the lagoon whilst maintaining desired water quality. This hydrodynamic modelling was scoped to utilise the tides from the adjacent sea via the purpose-designed inlet /outlet culverts to refresh the tidal lagoon for at least once every two days.

Water Quality. 2009. Hydraulic assessment on CSO outfall discharges for Pontypridd Town Centre Enhancement scheme.

DCWW AMP4 water quality schemes, 2009. DCWW water quality schemes were targeted to solve unsatisfactory intermittent discharges from CSOs entering local watercourses during storm. Lei completed hydraulic modelling for Bond Demolition CSO, Risca Malvern Terrace CSO and Waurnfawr Park CSO schemes. The scheme driver was set by EA for Aesthetic control using screened CSO to remove solids and also for control of annual spill times to minimise the sewerage-caused water quality deterioration. For example, the Bond Demolition CSO hydraulic modelling was completed from new model build, verification to hydraulic performance analysis. The model with model build and verification report were audited by EA authorised auditor from Atkins and then applied to annual spilling analysis and detailed design.

Sewer Flooding, 2009. Analysis of a 14 months Long-term Depth Monitoring for flood risk assessment in Cardiff City Centre - Alexander St DG5.

Sewer Modelling, 2009. Hydraulic assessment on DCWW sewer diversion for Pentwyn P&R Site Development Proposal.

DCWW Surface Water Management Strategy – Bargoed Long-term Flow Monitoring, 2009

InfoWorks hydraulic modelling for Rhymney valley catchment from model build to model calibration / verification; as part of DCWW Surface Water Management Strategy. This catchment model was built to investigate the root-causes for some

longstanding pollution issues from the sewer network in the Rhymney valleys. As a team member, Lei completed the hydraulic modelling task for the pilot study. Sensitivity analysis of the hydraulic model against the long term flow monitoring data was carried out to investigate a series of catchment courses. During this task, Lei added values using InfoWorks hydraulic modelling by successfully employing Radar rainfall and sewer Hawkeye data to assess the sewer's hydraulic performance; provided a valuable modelling rule for our client on future asset management.

DCWW AMP4 DG5 schemes, 2008

As the water engineer, Lei has been responsible for a number of DCWW DG5 schemes in Pontypridd. A DG5 is a sewer flooding incident happened within a property. DG5 schemes were targeted to solve the internal flooding issues where they were listed on DCWW DG5 Flooding Register. DG5 flooding could be local or catchments-wide issues. Pontypridd DG5s had both causes at different properties and InfoWorks modelling was carried out to identify the roots and the problem assets linked with each property, whereby a catchment model with detailed sewer hydraulic modelling study was conducted.

Water Quality, 2008. CSOs hydraulic modelling for DCWW AMP4 water quality schemes – Bond Demolition CSO, Risca Malvern Terrace CSO and Waurnfawr Park CSO;

New M4 Project, Usk Modelling, 2007-2008

Lei led and completed an integrated 1-D and 2-D hydro-environmental modelling study, namely Usk Modelling. Usk Modelling included i) catchment hydrological modelling using FEH CDROM, WinFAP and REFH; ii) MIKE 11 and 21 hydrodynamic modelling to predict dynamic channel surface elevation and velocities; iii) Mike 21 sediment transport process modelling to assess suspended sediment concentrations and the bed layer changes; iv) MIKE 21 dissolved oxygen (DO) water quality modelling to predict the channel DO levers and v) modelling the contraction and local scour due from the new bridge crossing. This modelling task has successfully applied the concept of integrated modelling approaches to solve multidisciplinary engineering challenges.

DCWW Western Valleys DAP, 2007.

As a team member of DAPs (drainage area plans), Lei completed WV DAP for the area of Western Valleys (WV) in South Wales – a vital planning study during AMP4 for DCWW AMP5 and beyond. The WV DAPs encompassed site investigation, root-cause analysis, risk assessment and hydraulic modelling processes to identify the critical sewer issues and provide knowledge sounds solutions. The WV DAP implemented innovative and sustainable technologies with the application of SuDS to upgrade the 100 years old sewer facing defect, growth, water pollution and future challenges.

Cardiff Eastern District Pumping Station hydraulic calculation

to manage penstock control for Welsh Water (DCWW). **2007**.

Cogan Pumping Station hydraulic calculation to mitigate historical flooding for DCWW. **2007.**

Kilkenny Railway Culvert, 2007

Lei, as a modeller assisting on a highway project, carried out a combined hydrology and hydraulic analysis study of Kilkenny railway culvert, which was a highway rehabilitation service for Ireland Highway Agency. The Kilkenny Railway Culvert analysis was to predict the water surface profiles during 1in5, 1in10, 1in20, and 1in50 year return period flood events and assess the relevant flooding risks around the culvert under the railway bridge.

Yorkshire Bathing Water Quality Study. 2006.

Lei participated as a technical member of the bid team in Leads to provide modelling specialist inputs for Yorkshire Coastal Bathing Water Modelling.

PhD thesis, 2005.

Thesis Title: the development of the integrated 1-D and 2-D bacteriological modelling associated with sediment transport in coastal waters using FASTER and DIVAST. School of Engineering, Cardiff University. Dec 2005.

Michael Devriendt

Profession
Civil Engineer

Current Position
Associate

Joined Arup
1997

Years of Experience
15

Nationality
British

Qualification
MSc DIC Soil Mechanics
BEng (Hons) Civil Engineering
CSCS Professional Qualified Person (valid to August 2013)
LU LUCAS card (valid until Nov 2015)
Confined spaces training (Valid until Nov 2015)

Professional Associations
Member, Institution of Civil Engineers

Committees
Member of CIRIA Ground Engineering Steering Panel

Publications
Devriendt M. Trigger levels for displacement monitoring. Geotechnical Instrumentation News, March 2012.

Devriendt M. Principles of retaining wall design. Chapter F2, ICE Manual of Geotechnical Engineering. ICE Publishing, 2012.

Devriendt M & Willamson M, 'Validation of methods for assessing tunnelling induced settlements on piles', Ground Engineering, Mar 2011, pp. 25-30.

Devriendt M,'Risk analysis for tunnelling ground movement assessments', ICE Geotechnical

Mike has carried out many design management and technical lead roles for projects such as Crossrail, London 2012 Olympics, Qatar Bahrain Causeway and 2nd Avenue Subway in New York. The roles on these and other projects have involved managing teams of engineers and working alongside client organisations, understanding their needs and providing technical guidance in developing solutions. Mike's roles have included:

- Technical assessments and approvals relating to underground construction near to existing 3rd party assets.
- Managing teams of structural and geotechnical engineers responsible for carrying out design work, producing reports and ensuring that the works are carried out in accordance with the appropriate standards, safety regulations and codes of practice.
- Managing interfaces on complex multi-disciplinary projects with other design consultants and third parties.
- Carrying out design of shallow and deep foundations, basements and tunnels.

Mike has excellent communication skills for presenting complex design and technical information to clients and 3rd parties in a clear and concise understandable format.

Mike has extensive technical and managerial experience of leading large teams working on large infrastructure and commercial development commissions.

HS2, Euston C220 – Mar 2012 to present

Mike is the geotechnical lead for the Euston Station and station approach preliminary design for the hybrid bill. The role includes managing the design of all geotechnical structures and supporting the preparation of hybrid bill documentation. Michael is also an 'expert panel member' for an HS2 commissioned project for gathering UK tunnelling precedent together for settlement and ground borne vibration to support the hybrid bill.

Belgrove House, London, England - Jun 2011 to present

Mike is the Project Manager for the redevelopment of Belgrove House. The hotel development is opposite King's Cross Station and will incorporate the safeguarding requirements of Crossrail Line 2's King's Cross Ticket Hall. The proposed basement excavation will be formed around the existing London Underground westbound Piccadilly Line tunnel.

Engineering Journal, GE3, pp 109-118, 2010

Devriendt M, Doughty L, Morrison P and Pillai A, 'Displacement of tunnels from a basement excavation in London', ICE Geotechnical Engineering Journal, GE3, pp 131-145, 2010

Fuentes R, Pillai A, and Devriendt M. 'Short term three dimensional back-analysis of the One New Change basement in London', Proc numerical methods in geotechnical engineering conf, Trondheim 2010

Fuentes R and Devriendt M, 'Ground movements around corners of excavations - An empirical calculation method', J Geotech and Geoenvir Engrg, Volume 136, Issue 10, pp 1414-1424, 2010

Devriendt M, 'Geotechnical engineering collaboration between clients, consultants, contractors and universities: A European perspective', 1st Int Conf. on Education and Training in Geo-Engineering Sciences, 2008

Devriendt M, Banfield S and Lawrence A, 'A 'Transatlantic' comparison of building damage assessment methods', Proc of BGA Int Conf on Foundations, Dundee, 2008

Devriendt M, 'Alternatives to the Gaussian Curve Approximation - A comparison of empirical and analytical tunnelling induced ground movement analyses in fine grained soils', Underground Construction Conference Proceedings, 2005

Devriendt M, 'Ground movement and building damage assessments for the King's Cross Underground Station Redevelopment Project', Tunnels and Tunnelling International, pp 24-27, July 2003

Awards

ICE Fleming Award winner, 2009. One New Change ground source heat system – "Skanska's plumb job."

Thames Tideway Tunnel (TTT), Tunnelling impact assessment commissions, England – Jan 2011 to present

Mike is currently the technical co-ordinator across four assessment commissions that Arup-PBA are delivering for the TTT team assessing the impact of ground movements on tunnels, buildings, bridges and retaining walls. Mike has also acted as Project Manager for over £500k of these commissions. Mike has represented Thames Water as part of three separate commissions reviewing the interface between TTT works and the developments being proposed by 3rd party developers.

Crossrail MDC2 and C122 contracts, London, England – Oct 08 to present

Mike was technical lead as part of the C122 contract responsible for providing guidance and defining strategy for assessing the ground movement impact, mitigation and monitoring design for all of Crossrail works.

He was Interface Manager for the C122 design commission comprising bored tunnel design, assessment of settlement impact and permanent way design. He managed design interfaces from the team with approximately 20 other framework design consultants and 15 third parties.

Mike also wrote and acted as client contact for the monitoring and information management specifications for the Crossrail monitoring contract C701 and is currently working alongside the software company Quantum Black to improve interpretation of monitoring data across the project.

Infrastructure work, London 2012 Olympic and Paralympic Games, London, England – Oct 2006 to Dec 2009

Mike was the lead geotechnical engineer responsible for delivery of the design for bridges across the Olympic Park site. As part of this role he programmed resources for the geotechnical team and managed the liaison between Arup, the client, the Olympic Delivery Partner and other consultants. Mike also led teams carrying out category 3 checks on other consultant's work for assessing impact of construction works on the National Grid and EDF cable tunnels that are present beneath the site.

Aquatic Centre, London 2012 Olympic and Paralympic Games, London, England – Jan 2005 to Jun 2009

Mike was the lead geotechnical designer for the London Aquatic Centre. He carried out geotechnical design for all the sub-structure and managed teams of engineers carrying out complex analysis for the design of foundations above recently constructed National Grid and EDF tunnels and liaising with the 3rd Parties affected. Mike earlier managed the site investigation for upgrading of the river walls adjacent to the proposed new Aquatic Centre.

One New Change Development, London, England – Jun 2004 – Jun 2004 to Jun 2009

Mike was the lead geotechnical engineer for a 15m deep proposed basement for a retail and office development adjacent to St Paul's

Cathedral. He managed all geotechnical design for the structure and interfaces on approvals with organisations such as Metronet BCV and the Dean and Chapter of St Paul's Cathedral. He also procured two phases of site investigation and acted as lead Arup contact for queries relating to the piling and monitoring contracts.

King's Cross underground station redevelopment, England – Sep 2000 to 2008

Mike managed a team of five engineers carrying out settlement and building damage assessments. Following completion of the reports he managed the role of obtaining approvals from LUL, Network Rail, English Heritage, an independent category III checker and various other third parties for the proposed works.

Mike also provided guidance to the client and other third parties on the design and setting up of the phase I ground and structural monitoring contract. The role included writing the specification and providing technical guidance to the client during the installation and commissioning of the instruments.

He carried out permanent works design of tunnelling structures for the project and designed reinforced concrete and SGI tunnel structures to standard codes of practice. The design role comprised significant liaison with architects, M&E engineers and the tunnelling contractor.

Mike also provided guidance to the client on the acceptability of contractor designed temporary works affecting adjacent Grade I listed structures such as St Pancras Chambers and King's Cross Station.

He was involved in the scheme, preliminary and detailed design work comprising retaining wall and settlement analysis for the deep Northern Ticket Hall basement structure adjacent to King's Cross Mainline Railway Station.

As site liaison engineer for the piling works for construction of a deep basement, Mike provided technical guidance on piling issues to the client team. The piling works comprised construction of bored and cast in-situ piles to a depth of approximately 40m.

Due to significant changes to the Arup scope of works for the project, considerable time was spent revising design programmes and estimating staff resource requirements for additional work.

2nd Avenue Subway project team, New York, USA - Oct 03 to Mar 04

Mike was a geotechnical project engineer seconded to the DMJM Harris Arup joint venture, at the preliminary and detailed design stage of this major subway project. Activities included the derivation of soil parameters for complex finite element retaining wall analysis, interpretation of field data and consequent production of design notes for structural colleagues. He completed the assignment by writing the ground movement assessment report to be used as a contract document for a design and build section of the project.

Qatar Bahrain Causeway - May 08 to May 09

Mike was the lead geotechnical engineer acting as independent checking engineer for the design of a 40km road and rail causeway comprising both embankment and bridge structures. He managed a team of geotechnical engineers checking the design and liaised with the client organisation in Doha resolving design issues of contention.

Claridge's Hotel, London, England – Jun 05 to Mar 08

Mike developed construction sequences and prepared scheme design and a detailed feasibility report for the construction of a sub-basement beneath Claridge's Hotel in London. The feasibility report was used for planning submission to Westminster Council.

Whitecity Development, London, England – Jun 04 to Jun 05

As project manager Mike was responsible for client liaison, assessing the feasibility of construction sequences proposed by the contractor for the Whitecity shopping development in West London. He carried out analysis and wrote safe load assessments and approval in principle reports to obtain acceptance for the works to progress from Metronet BCV. He was also responsible for setting up of each individual commission with the client and issuing invoices and arranging payment.

Ana Ulanovsky

Ana Ulanovsky is a chartered engineer with over ten years' experience in the maritime sector. She has particular strengths in the design co-ordination and supervision of multidisciplinary maritime projects. She has managed ports, marinas and flood defence projects on behalf of both public and private clients.

She is passionate about cost-effective and creative designs for maritime infrastructure.

Ana is currently tender design lead for the maritime elements for the Thames Tideway Tunnel, including the assessment of dredging impact on existing quay walls, river walls, jetties and embankments. She has also been project manager and lead designer for the ground movement impact assessment of around 300 river walls on the Tidal Thames. She was design manager for Laing O'Rourke's QEC tender and therefore knows Portsmouth site well.

Ana is an experienced maritime civil engineer, with strong project and design management skills.

Profession
Maritime/Civil Engineer

Current Position
Senior Engineer

Joined Arup
2007

Years of Experience
12

Nationality
Spain

Qualification
Masters Module Business Economics
CEng MICE
MEng (Honours) 1st Class
PRINCE 2 PRACTITIONER

Professional Associations
Member Institution Civil Engineers UK
PIANC UK

Languages
English - Excellent
Spanish – Excellent
Italian - Good
French – Basic

H&S Qualifications:
Working Near Water
Breathing Apparatus
First Aider
Confined Spaces Awareness
Extensive CDM training
CCS Card

Publications
"Gorey Breakwater Pierhead, Investigations and Remediation" ICEBreakwater Conference Proceedings 2013

BMB Bid for Thames Tideway Tunnel

Ana is responsible for the tender design of all maritime permanent elements for this major project that will involve the strengthening of over 100 river walls in the Thames to be used as quay walls during construction of the Tideway Tunnel for the transport of all construction material and spoil from the Tunnel boaring. The design also entails the construction of temporary quay walls, new permanent flood defences, jetties and other maritime infrastructure and the assessment and mitigation of ship impact loads on the new infrastructure being built within the River's footprint.

London Gateway Port – Detailed Design Review Laing O'Rourke – DP World

Ana was project manager and design co-ordinator of the review of the detailed design of the London Gateway Port terminal including the review of the designs to meet the Employer Requirement's settlement criteria in a complex site with varied loading history, and the design of drainage, pavements, ducting, crane foundations and container beams.

Our role in the project has also included the design and supervision of the quay wall repairs including: the review of specifications and method statements and identified short falls, the review of construction practice, engineers on site 24 hrs per day during Dwall construction and undertaken field testing; assessment of the concrete records and identified defect mechanisms; carried out trial pit investigations of the wall to assess mattressing, anchorage and bond at laps; assessed the impact of defects on wall capacity and durability; review of spec for repairs and are making the record of defects.

Publications cont'd

"Stitching the Past – the use of needling technology in the restoration of historic piers in the Isle of Jersey"
ICE Proceedings Coastal Conference 2011

Liverpool 2 Container Terminal D&B Design Laing O'Rourke – Peel Ports

Ana was project manager and design co-ordinator for the tender design of a 1M TEU container terminal in Liverpool. Proposals included a modification of the existing layout to improve throughput and capacity of the terminal, provide a more reflective quay wall design to improve operations, and innovative value engineering options for a reduction in the size and length of ducting and drainage for the terminal.

Muelle Prat Container Terminal (Barcelona) – Hutchinson Port Holdings

Ana was design co-ordinator and client interface manager for the detail design of a 3.5M TEU container terminal including HV network, rail, drainage, piling and crane beams, and pavement. Ana also led the technical approval from the Port Authority for all detailed designs. There were difficult challenges to the design due to previous quay wall failure, reclamation quality, large space restrictions, operational requirements and temporary and legacy stages. The project also included the design of more than 15km of structural foundations for automatic stacking cranes and quay cranes in unconsolidated ground and the geotechnical supervision of the existing reclamation

Jetty Reconfiguration for Vessel Relocation, Portsmouth – Laing O'Rourke

Ana was project manager and design co-ordinator for the tender design of these new facilities for berthing of the two new aircraft carriers at Portsmouth.

Blackfriars Pier and Historic Vessel Relocations

Ana is project manager for the detailed design of a new 100m floating pontoon in the Tidal Thames and the design of new berthing and mooring facilities for two historic vessels. The project includes the detailed design of at least five linkspans with a maximum length of 70m and considers the impact of the floating pontoon dynamics on the linkspan elements, in particular fatigue considerations on the connection details and ship impact assessments. The design intent for the linkspan is innovative due to the Central London location of the new facilities, and the importance of the architectural drivers.

Berths 4 & 5 Reconfiguation, Jersey

Ana was project manager and design lead for the reconfiguration of these commercial and leisure berths in St Helier Marina in Jersey. The design entails the demolition of an existing bankseat and 60m linkspan and the construction of a new bankseat, two 50 and 30m access bridges, floating pontoons to different specifications for the berthing of leisure craft, a small Cruise vessel and an RNLI facility, and the design of pile and wall guide retention structures.

Ipswich RoRo

Ana was project manager and lead designer in the feasibility study of the extension of a RoRo linkspan to accommodate for longer and

wider vessels in the tidal River Orwell. The linkspan mechanism included hydraulic rams and floating ballast.

Durban Dig Out Pot – Transnet, South Africa

Responsible for the delivery of CAPEX and capacity comparisons for a number of development option scenarios including the expansion of the existing Durban port

Thames Tideway Tunnel, London - Thames Water

Ana led approximately £1m of technical assessment to determine the impact of settlement due to tunnelling and construction of shafts on the flood defences and other maritime infrastructure of the Thames. The team also producing mitigation proposals to counteract ground movement effects on river walls, locks and jetties.

Garden Bridge, TfL, London

Ana is part of the team looking at the buildability of this esciting bridge in the middle of London. The maritime scope includes assessing maritime constraints on its conceptual design including its impact on navigation and river flows and morphology.

Isle of Jersey, Repair Works Gorey Pier, St Aubins North Pier and St Aubins Fort Breakwater

Ana is leading the design of remediation measures to counteract the degradation mechanisms taking place in a number of cXVI piers in the Isle of Jersey (refer to articles published)

RFI Economic &Technical Feasibility Study for Container Terminal in the Middle East - Arup

Responsible for estimating traffic capacity-demand curves for ports and competition analysis and establishing technical feasibility of the project

Due Diligence for major Port Owner and Operator - Europe

Ana was responsible for the review of the CAPEX program of works for the company's 23 UK ports. She also contributed to the review of maintenance revenue expenditure and liaised with port directors on the management and operation of their assets.

Quay wall failure, confidential

Ana has produced the geotechnical and structural technical assessments to determine the failure mechanisms that led to a quay wall collapse in a port in the United Kingdom.

OFTO - Gwynt y Mor

Project manager for the technical review of the power transmission link for an offshore wind farm in the Irish Sea. Ana was responsible for the technical Due Diligence of the design and installation of the cables, onshore and offshore substations and related infrastructure.

Ipswich Ro-RO Link Span Extension

Ana produced a technical assessment to determine the possibilities of extending an existing Ro-Ro Linspan to accommodate for larger vessels.

London Games - ODA

Lead designer and manager for the production of scour protection, navigation studies and ship impact on the waterways of the London Games regeneration site including reuse of materials and steel structural design.

Gladstone LNG MOF

Ana reviewed the detailed design of end berth dolphins for this facility

Isle of Jersey, Crane rail replacement

D&B crane rail replacement design and specification for tight tolerance quay crane

Ipswich Tidal Barrier – Commercial Marina Piling Ltd

D&B design of ship impact protection for a temporary cofferdam

Liverpool Cruise Terminal - Giffords

Supporting expert witness advice

V&A Museum Dundee, KKAA Architects

Ana's role involved the definition of wave climate and currents, the calculation of wave loads on the structural elements , and an assessment of the risk involved with overtopping and flooding of this building-in-the-sea

Happisburg Slipway - RNLI

Design of slipway to be built in Suffolk (UK) eroding coastline

Costa Azul, Mexico LNG Terminal - Sempra

Project management, supervision and interpretation of physical modelling results for overtopping, scour protection, and loadings on breakwater designs for a tug harbour facility in the breaking zone of the Pacific Ocean

Sveti Marko Island, Montenegro

Concept and Scheme design for a hotel development including beaches, a marina, edge design and working with architects to develop acceptable threshold levels for hotels and other buildings

St Helier Marina, Jersey

Specification of piles and pontoons for a new marina

Liverpool Cruise Facility

Technical review of the failure of a linkspan in a cruise terminal facility

RNLI Slipway, Happisburgh, UK

Design of a timber slipway in an eroding coastline the North Sea coast of the UK

NEECA 2 - Loxford Frontages

Design of the replacement of a flood defence river wall in the River Roding

Riverwalk House, UK

Flood risk management assessment for a new development

Lots Road, UK

Design of flood defences for a a new development

Projects Pre-Arup

Thames Barrier Pier Cranes Replacement Project - £3M cc

NEC3 ECC PM and Client representative for the supply and construction of 7 fixed cranes on the piers of the Thames Barrier. Her role included securing funding from NRG for the project and the design of the crane foundations

Barking Barrier Corrosion Protection Works - £300k total cc

NEC3 ECC Supervisor with delegated powers from ECC PM. Her role included monitoring and reporting quality of the works, solving technical queries and reporting plant and labour to the client. She was also responsible for the acceptance of method statements and risk assessments on site.

Loxford Frontages River Roding Flood Defence Replacement - £1.7M cc

Production of tender documents and Pre-Construction Information, liaison with Network Rail, Client liaison, design and co-ordination of design activities

Tidal Thames Prefeasibility Programme - £500k cc

Project Manager and Client Sponsor – led inspection, categorisation and option analysis for over 150 flood defences

St Marko development, Montenegro - £50M maritime cc

Concept design and whole life costing for maritime structures: beaches, reclaimed land, quay edge structures, marina and jetties

Canary Wharf Riverside

Construction sequence for the installation of a river water cooling system in a constrained space. Design of a retaining wall on top of a listed retaining dock wall

Thames Barrier Performance Specifications

NEC PSC PM and Client Sponsor.

Thames Estuary Strategic Risk Reports

Thames Barrier Environmental Manager (inc. study of impact of closures on the River Thames)