

CIVIL & STRUCTURAL ENGINEERING SERVICES



Arthian



Our Engineering Team specialise in providing safe design solutions for high risk projects and industries. Our staff provide sustainable and cost effective engineering solutions to our clients. Our portfolio of services includes:

- Civil & Structural Engineering
- Civil Infrastructure
- Design & Assessment Fire, Blast & Toxic Resistant Buildings
- Occupied Building Assessment
- Pipelines Assurance & Integrity
- Process Infrastructure Assessment
- Tankage & Storage Assessment
- Bridges & Culvert Design & Assessments
- Roads & Drainage
- Explosion Analysis
- Demolition & Temporary Works
- Terrorist Security & Threat Assessments
- Secondary & Tertiary Containment
- Pipe racks & Gantry Design & Assessments
- Temporary & Enabling Works
- Structural Monitoring & Assessments
- Pipeline Assessments
- CAD Resourcing

Arthian offer a range of general Civil & Structural design and assessment services to our clients. These range from the design of new civil & structural assets to the assessment of existing assets. Typical works that we undertake within this service offering include:

- **Design of new plant support structures and foundations.** This includes pump / filter bases, process plant / vessels, bullet tanks, access/egress.
- **Assessment and strengthening of existing structures.** Arthian have supported clients with the overhaul and refurbishment of aging plant and life extension projects extensively over our 25 years in business. This includes inspection, modelling, assessment, design and supervision of structural strengthening measures.
- **Design of new foundations for plant infrastructure** such as piping & E&I supports.
- **Design of access structures.** Including walkways, stepovers, stairs, & towers.
- **Design & assessment of retaining walls.** Reinforced concrete, gabions, masonry, mass retaining walls and reinforced earth retaining structures.
- **Assessment of plant structural modifications.** Including steel and concrete support structures and foundations, pipe supports and attached structures
- **Structural Repairs.** Including investigations, assessment and remediation recommendations.

Arthian specialise in delivering the above services within Chemical, Energy and high-hazard brownfield environments. Managing and effectively communicating risk to our clients is integral to the way we work.



SECONDARY & TERTIARY CONTAINMENT DESIGN & ASSESSMENTS

Arthian has extensive experience in the design, assessment, inspection and upgrade of secondary containment systems.

We are active members of the [Energy Institute Containment Working Group](#). We provide input into the development of new guidance and advise on gaps within industry knowledge.

In addition to having extensive experience within regeneration, upgrades and life extension projects, Arthian also offer a range of additional services:

- **Inspection of bunds and containment systems.** This includes inspection and reporting in accordance with industry good practice guidance (CIRIA C736).
- **Compliance assessment of existing facilities.** This includes assessing the existing performance vs the COMAH Competent Authority requirements.
- **New build secondary containment.** This includes concrete bunds, lined earth bunds, leak detection, transfer systems, drainage and remote storage solutions.
- **Upgrade/remediation of existing containment systems.** We have extensive experience supporting clients in upgrading their containment systems to meet regulatory requirements. This typically includes increasing height, repairing bund penetrations, specification of appropriate sealants and joints, repairing burrowing and other bund defects.
- **Tertiary containment modelling.** Modelling of spills and design of upgrade mitigation measures to contain over-topping. This includes overland flow modelling using specialist software.
- **Volumetric modelling.** This includes 3D surveying (or scanning) to identify ground profiles. This is then imported into our 3D ground modelling software package to allow us to calculate bund volumes for compliance checks.

TANK FOUNDATION DESIGN & ASSESSMENTS

Our experienced team of civil, structural, and geotechnical engineers provides a full suite of integrated engineering services to deliver compliant, safe, and value-added solutions to our clients. Typical services we provide within a tank storage environment are:

- **Reinforced concrete raft foundations**
- **Granular tank foundations**
- **Piled tank foundations**
- **Concrete ring beams and granular foundations**
- **Tank holding down anchors**
- **Integral leak detection systems**
- **Below tank liners**
- **Berm finishes**
- **Assess platforms/steps**
- **Tank Overhaul Support**
- **Jack Foundations & Retrofit Floors**



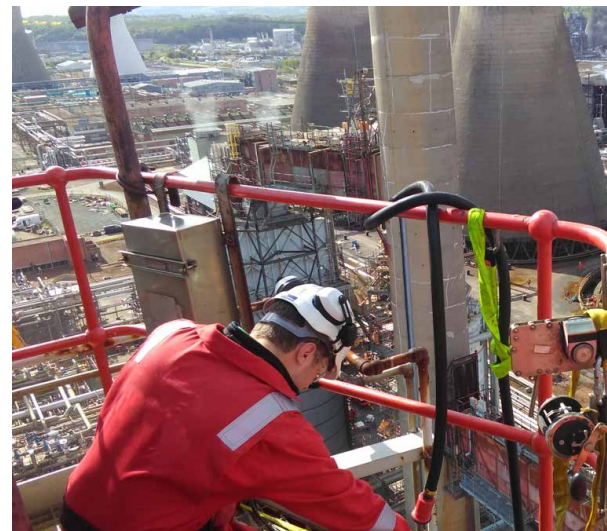
TANK INFRASTRUCTURE DESIGN & ASSESSMENTS

- **Pipe supports**
- **Electrical control stations supports and shelters**
- **Pipe racks and gantries**
- **Cable ducts and culverts**
- **Filter foundations and platforms**
- **Pump foundations**
- **Fire fighting foam tank foundations and bunding**
- **Bund drainage design**
- **Bund access walkways & gates**



Arthian's experience in the inspection of civil and structural assets in an industrial and chemical environment means we've implemented innovative ways of capturing, sharing and analysing information. The use of intrinsically safe tablets, programmable inspection software, inspection poles, 3D cameras and high zoom cameras allow us to carry out inspection works in a safe and controlled manner. Typical inspections include:

- Process plant & infrastructure
- Risk Based Inspections
- Pipe racks & gantries
- Bridges & culverts
- Access platforms, stairs
- Ducts & covers
- Hard standings/floor slabs
- Identification and categorisation of defects/location plans
- Indicative repair measures & timeframes



DEMOLITION STRATEGIES

- Supporting our clients in developing a demolition scope of works to allow effective procurement of a demolition contractor.
- Supporting in Tender evaluations
- Development of safe demolition strategies and risk registers.
- Design of temporary works to facilitate safe demolition of a structure / vessel i.e. temporary propping, bracing, etc.
- Design or performance specification of crash decks.
- Design and assessment of access routes, haul roads, & crane mats associated with the works.



ROADS & DRAINAGE

Arthian have significant experience of drainage systems and roads within industrial assets including:

- New roads and carparks
- Vehicle swept path assessment
- Re-surfacing works including creating appropriate drainage falls
- Specifying white lining, signage and barriers
- Impermeable area surveys
- New drainage system design
- Installing new surface water catchment systems
- Tie-ins to existing private and public roads.
- Pipe track drainage improvement schemes and strategies.



PIPE RACKS & GANTRIES

Arthian are experienced in the design, assessment and inspection of pipe racks and gantry's, supporting clients in the complexities of designing and managing the risk of installing new infrastructure near/over existing live chemical lines.

Services Include:

- Designing single, multi-level, & multi-span pipe racks
- Assessing existing pipe racks for existing and spare capacity.
- Reviewing reduced capacity due to modifications made insitu
- Reviewing excessive section loss or missing structural members.



BRIDGES

Arthian has extensive experience in the design and assessment of bridge structures within ageing assets. We have carried out a number of bridge replacement projects in recent years which included the design of new abutments and wing walls with a new prefabricated steel bridge deck.

We have undertaken structural inspections & assessments to identify the load capacity of all bridges in site wide remediation programmes that involved calculating axle load capacities, advising of risk ratings and colour coding based on condition.

CULVERTS

Arthian has extensive experience in the design and assessment of culverts for crossing new or existing services. These are often reinforced concrete with removable deck units to facilitate inspection works.

We are highly experienced in the efficient design of these systems and have successfully supported clients with programmes to re-route/culvert directly buried process pipes.



BUILDING DESIGN

Arthian has decades of experience in the design of building structures for both commercial and industrial sectors. We have carried out the design of numerous buildings for uses such as:

- Control rooms
- Forward operating buildings
- Amenities buildings
- Workshops
- Substation Design
- Stores
- TAR/Contractor Villages
- Stacked Cabin Designs

Arthian are SER certifiers for building works or alterations requiring building

BLAST RESISTANT

The Arthian specialist structures team has extensive experience in the design of new build blast resistant buildings and modular blast resistant buildings. We can provide a full suite of Architectural, Mechanical, Electrical & Plumbing and Human Factors design through our network of strategic partners.

We have experience in the assessment and upgrade of existing buildings for fire/blast events. We can inspect, measure, model and report existing building performance against a range of scenarios. We can also recommend and design upgrades to mitigate the risk to the building's occupants.

PROCESS ENGINEERING & DESIGN

We are specialists in process engineering to reduce your environmental and safety risks. Drawing on the core skills of our experienced in-house process engineering team, we support our client's process engineering needs, from single day mini-projects to major capital intensive investments.

Our team of recognised chemical and process engineers has many years of experience assisting industry in the following ways:

- design of new or modified manufacturing process plant and equipment;
- delivery of innovative solutions to unique processing challenges;
- identifying and implementing measurable efficiency benefits;
- process modification to reduce environmental impact and enhance employee health and safety; and
- working to reduce costs and improve profitability.

PROCESS SAFETY ENGINEERING

Regardless of your business size or speciality, our experienced and approachable team will assist you in identifying and better understanding your site-specific hazards, and evaluating risk, as well as advising on legal responsibilities and best practice control measures to ensure your operational risks are minimised.

Regulatory Compliance

- COMAH Report
- ATEX & DSEAR
- CDOIF/ ERA

Functional Safety

- Hazard Identification
- Functional Safety Training
- Human Factors

Risk Assessments

- HAZOP
- HAZID
- LOPA
- Fire Risk Assessments
- DSEAR
- Toxic Gas Modelling

- Quantitative Risk Assessments
- ALARP
- Occupied Building Risk Assessments
- PADHI

OCCUPIED BUILDING RISK ASSESSMENTS OBRA ASSESSMENT STRATEGIES

Arthian undertake Occupied Building Risk Assessments and have worked very closely with a number of blue-chip clients to develop their own Occupied Building Risk Assessment Strategies, both for permanently occupied buildings and temporary occupied buildings.

Our teams have worked extensively in this field, both developing site-wide strategies and also undertaking Cost-Benefit Analysis to decide how best clients can address both individual and societal risk aspects for a wide range of buildings.

Our job when undertaking an OBRA is to utilise readily available industry data and identify the likelihood and significance of potential event outcomes, the presence of layers of protection and defence methodologies and identifying what risk reduction measures may already be in place.

HIGHLIGHTS

- Reconciliation of Site Safety Case with HSE view of risk on site
- Vapour Cloud Explosion Analysis
- Expert Witness
- PADHI
- Toxic Gas Modelling
- Flammable Liquid Gas Clouds
- Flash Fire/Jet Fire Risk Assessments



TEMPORARY & ENABLING WORKS **DESIGN & ASSESSMENTS**

Arthian undertake the design of a wide range of temporary works systems to support our clients in both new build works or with ongoing maintenance operations. Our experience in supporting industrial and chemical clients leads to benefits in understanding any temporary works requirements, restrictions, and consequently, time and cost savings.

- **Propping and temporary strengthening of existing bridges/structures/buildings.** This is common within ageing assets where conditions can be poor and also where emergency access is required over a weak bridge. This allows structures to remain in operation (safely), thus, preventing any cost implications of plant downtime.
- **Design of excavation temporary works.** Including design of open cut excavation, sheet pile solutions and specification of proprietary products.
- **Temporary bund breaches.** Including cut profile, temporary retention systems and temporary bund wall arrangements to maintain containment.
- **Pipeline and cable protection.** Including protection systems for crossing or loading of buried services.
- **Mobile crane access & crane pad designs.** Including assessment of ground conditions and advising on ground improvements for safe crane operations. Arthian has previously developed site-wide ground loading guidance for crane operations for many industrial clients.
- **Temporary access structures.** These include ramps and bridges over pipes and services

- **Destruct/Demolition Specification**
- **Geotechnical Desk Studies**
- **Design, Procurement & Supervision of Ground Investigations**
- **Laydown Areas**
- **Haul Roads & Route Assessments**
- **Piling Platforms**

GEOTECHNICAL SUPPORT

Our geotechnical engineering expertise underpins projects in construction, oil & gas and petrochemicals. Our team can help prevent project delays and overspends by providing pragmatic solutions and technical advice. Our work helps to form the foundations of planning, design, construction and maintenance choices from the outset.



Engineering design. The interpretation of data and the production of ground models for input into preliminary and detailed engineering designs. The geotechnical engineering design includes bearing capacity, stress and settlement calculations.

Crane pad design and assessments. Design of crane pads and mats/piling platforms.

Temporary works design and certification. Arthian carry out both temporary works design and category 3 checks of designs undertaken by others. For example, the design check of rigid inclusions for crane mats.

Investigation Supervisor. Arthian design, procure, manage and supervise ground investigations. Our team prepare the contract documents, tender where required, and can supervise the ground investigation contractor. We undertake the role of investigation Supervisor to ensure the quality of the ground investigation. Arthian can provide Ground Investigation Report (GIR) and Geotechnical Design Report (GDR).

Tank settlement analysis. Arthian interpret the results of geotechnical site investigations to determine ground parameters. The ground parameters are used to predict the settlement of the tank over its lifespan and the project is completed by designing a suitable and cost-effective tank foundation.

Riverbank erosion assessment and remediation. Assessment of riverbank failures adjacent to site infrastructure and loading facilities.



Our survey team work in high hazard environments and are trained risk assessors. We offer a wide range of industrial surveying solutions.

- Topographic surveys with area, volume and section details
- Structural settlement and movement monitoring
- Verticality surveys to BS4076 – Chimney monitoring, Flarestack verticalities
- Site layout surveying and updating
- As-built surveys
- Precise levelling surveys
- Remote object laser measurement
- Boundary surveys
- Storage tank surveys in accordance with EEMUA
- Surveys for thermal expansion and contraction
- Laser scanning
- Tank ovality surveys
- Tank floor surveys
- Tank calibration surveys
- Floating roof surveys
- Plant modelling

A diverse team of environmental scientists, environmental compliance managers, hydrogeologists, geotechnical engineers, and ecologists allows Arthian to assist our clients with a wide variety of needs.

Our extensive experience of COMAH compliance includes carrying out Environmental Risk Assessments (ERAs) and cost-benefit assessments in line with the CDOIF guidelines. Our teams also assist in Safety Case renewals/updates as part of preconstruction Safety Case submissions.

Contaminated Land. Our team can provide specialist groundwater monitoring and waste management advice. Other services include sampling, site investigations, assessments, spill response, GIS Database

Environmental Management & Compliance. Typical services include Licensing & Consents, PPC Compliance, Bund Integrity Assessments and Stability, Secondary & Tertiary Containment, Environmental Management Plans, Noise & Vibration Monitoring, and Environmental Impact Assessments (EIAs).

Environmental Risk Assessments (ERAs) & COMAH Compliance. In support of the CDOIF process, we have designed and led numerous detailed quantitative assessments.



Advisory Services

- Masterplanning
- Feasibility Studies
- Environmental Impact Assessments
- Environmental Management
- Flood Risk Management
- Air Quality
- Noise & Acoustics
- Contaminated Land Risk Assessment
- Consenting & Permitting
- Process Engineering
- Process Safety
- Pre-FEED, FEED & Detailed Engineering Design
- Project & Programme Management
- Occupational Hygiene
- Risk Management
- Due Diligence
- Site Auditing
- Owner's Engineer Services

