DLT Engineering

Technology for Modular Construction

Bridges

Buildings

Erection Gantries

Power & Industrial

Offshore

Oil & Gas

Jacking Systems

Skidding Systems

Specialist Equipment


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CAPACITY

DLT Engineering

Technology for Modular Construction

Introduction

Welcome to DLT Engineering

DLT Engineering was founded in 2000 but can trace its links to historical companies formed in the 19th century. As such, the Company has a long and distinguished history in the construction of landmark structures around the world, particularly iconic bridge works and building structures.

Today, we develop, manufacture and operate the specialist technology needed for the modular construction of bridges, buildings, dams, refineries, power stations, offshore structures and manufacturing plants. We also offer construction engineering and site services to help our clients get the best value from our engineering expertise and the equipment we supply.

Our role on most projects is to develop solutions to construction problems, fully engineer these solutions and then to work with our customers to carry out the operations on site. We are happy to offer any combination of construction engineering, including temporary works design, equipment supply/rental and site support services to suit the needs of each project.

Please see pages 6-22 of this brochure for brief details of the many projects that we have been involved with. Further details are also available on our website: www.dlteng.com

Company Management Systems

All our projects are carried out in accordance with our company management systems for quality, environmental and occupational health and safety which are accredited by Lloyd's Register Quality Assurance Ltd to ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007 standards. These management systems have been developed and written in-house by our own staff to ensure total relevance to our business and the quality of services to our clients.

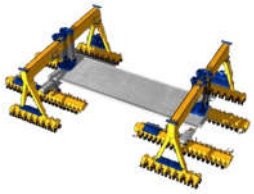
Products

Our product range includes bridge construction equipment, offshore construction equipment, jacking tower systems, strand jacks, hydraulic gantries, skidding systems and synchronised jacking and weighing systems.

We specialise in hydraulic powered equipment and integrated systems. Our standard products are designed in-house, generally to the requirements of the relevant European standards. However, bespoke items, including bespoke versions of our standard products, can be developed and designed to suit the needs of the project and the customer's specific requirements.

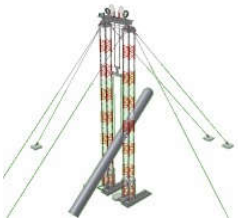
Our full range of products include the following:

Bridge Deck Erection Gantries



Straddle Carriers

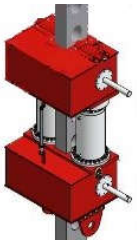
Self-Propelled Transporters



Jacking Tower Systems

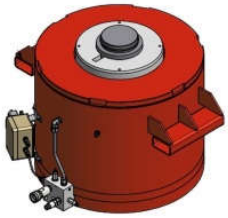
Strand Jack Systems

Skidding Systems

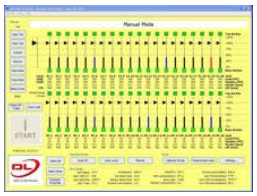


Pinned Climbing Jacks

Chain Jacks

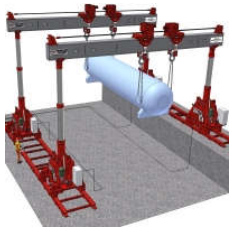


Synchronous Jacking & Weighing Systems

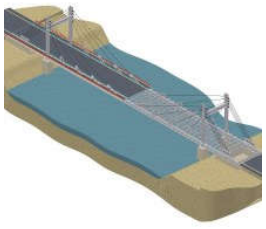


Heavy Lift & Skid Control Systems

Hydraulic Power Units

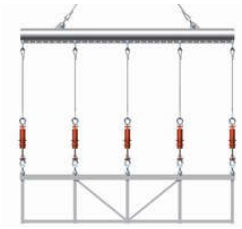


Hydraulic Gantries



Modular Bridges

Hydraulic & Electric Winches



Hydraulic Sling Length Adjustment Systems

Viscous Dampers / Lock-Up Devices

Further Information and details are available at our website: www.dlteng.com

We maintain a small stock of strand jacks and hydraulic power units for rental or quick delivery. This enables us to respond rapidly where there is a need, to suit the customer's requirements.

Construction Engineering Services

We offer a range of construction engineering consultancy services for the design and construction of many types of structure, including bridges, buildings, heavy process plant, petrochemical vessels and offshore structures. We have particular expertise in the erection of long span suspension and cable stayed bridges, and in the engineering of specialist modular construction involving heavy lifting, lowering and horizontal skidding operations.

Our engineers draw on first-hand experience of site operations to provide practical schemes supported by clear and concise documentation. We can develop schemes from initial concept through to detailed design including stage by stage analysis of the permanent works if required.

Our services include the engineering and design needed for the following:

- Heavy lifting operations
- Skidding operations
- Mechanised temporary works
- Bridge deck erection gantries
- Bridge deck launching and sliding
- Power station heavy plant installation
- Erection of large roof structures
- Long span bridge erection engineering, including cable stayed and suspension bridges
- Modular steel bridges

We also offer 3rd party independent checking services for construction methods and temporary works designs for projects on a global basis. For example, in the UK we have experience in certifying projects for clients Network Rail and the Highways England (formally the Highways Agency).

Site Support Services

Site Support for our equipment is provided by our Site Technicians, who have many years of experience in carrying out heavy lifting and moving operations. They are usually seconded into a client's team to assist with the first few operations until the client's own staff feel confident to safely operate the equipment themselves. As part of this service we provide a formal training and certification programme to approve client's staff as competent to operate and maintain the equipment. Our Site Technicians become a valued member of the site team and are often requested to return to assist with future operations.

Our Site Technicians are also available to carry out periodic inspection, maintenance and load testing of the equipment with manufacturer's certification of the work carried out.

Reference Projects

Launching Gantry – Temburong Bridge, Brunei

DLT were responsible for designing and supplying a bespoke launching gantry that was used for the simultaneous erection of two 870-tonne, 50m long box girder precast concrete bridge deck beams. It was used to erect all bridge deck beams (four per span) along the 13.35km marine viaduct, crossing Brunei Bay and connecting Mengkubau & Sungai Besar to Labu Estate. This bridge is the first road bridge in the country to link the mainland of Brunei to the Temburong enclave, bypassing the Malaysian district of Limbang and its associated border controls.

Rising Factory – East Village Plots 8 & 9, Stratford, London

DLT supplied a pinned climbing jack system and engineering support for the construction of two multi-storey residential towers. The 'rising factory' concept was developed by MACE Limited and was used to create a weatherproof factory environment for the construction of each floor. The scheme used a temporary steel framed factory building erected over the top of each tower during construction. Each factory included two 15-tonne capacity overhead gantry cranes for materials handling and various levels of platforms for welfare facilities and materials storage.

Construction of each tower progressed generally at a rate of one floor per week. When in operation, the weight of the factory was supported on four 230mm diameter, hydraulically operated pins supplied by DLT. After each floor had been constructed, the pins were withdrawn, the rising factory was lifted about 3.3m using four DL-CP250 pinned climbing jacks and the pins reinserted ready for the next floor to be built. The total weight of each rising factory during lifting was approximately 900 tonnes and each lift was completed in a little over two hours.

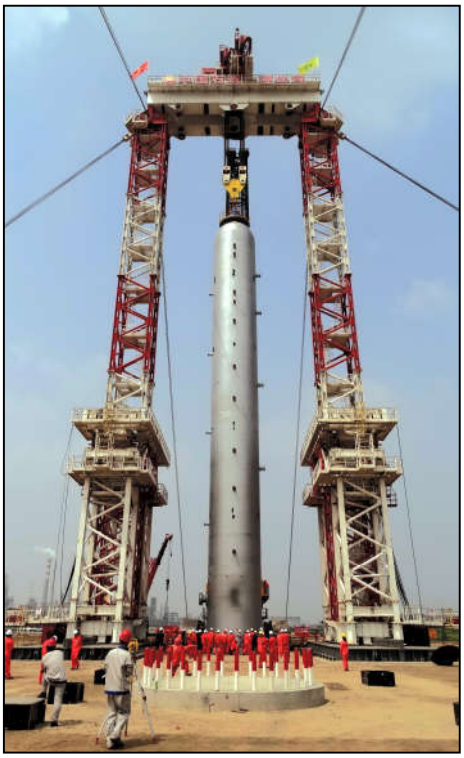
Erection Gantries – Humen II Suspension Bridge, China

The Humen II Suspension Bridge in China is an asymmetrical suspension bridge with a main span of 1,688m and a suspended side span of 658m. The reinforced concrete towers are 257m tall and the main cable spacing is 42.1m. The deck is an aerofoil shaped orthotropic steel box 49.7m wide and 4m deep.

DLT were responsible for the concept, detailed design and equipment supply for three 500-tonne SWL deck erection gantries and also one saddle erection gantry which was used for the installation of main cable saddles at the top of both towers and the splay pillars.

The deck erection gantries were successfully overload tested to 125% of safe working load and function tested off site on a specially designed test frame. The 175 deck segments were lifted into position in just 10 weeks. The Client reported that the gantries were easy to operate, each completing a 70m lifting cycle in 4 hours and relocation in 30min, the latter thanks to an innovative movement system specifically developed for this gantry.

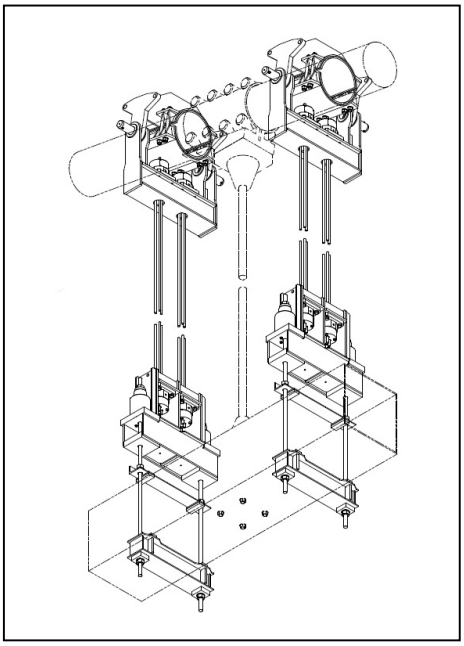
Reference Projects



MYQ5000 Jacking Tower System for Refinery Construction – China

DLT designed and supplied a 5,000-tonne lifting capacity jacking tower system to China Petroleum First Construction Corporation for use in the erection of heavy petrochemical vessels. The MYQ5000 jacking tower system is able to self-erect and self-dismantle and is also able to move with the vessel after lifting. The MYQ5000 was successfully function tested to 110% capacity (5,500 tonnes) and static load tested to 125% capacity (6,250 tonnes).

The tower system is designed to erect petrochemical vessels weighing up to 5,000 tonnes and 100m high. The system is also designed to lift smaller loads up to a maximum tower height of 160m. Vessels can be moved both longitudinally and horizontally and rotated after lifting. Four DL-S1394 strand jacks (1,394-tonne capacity per jack) are used for lifting and four DL-CP400 pinned climbing jacks (400-tonne capacity per jack) are used for longitudinal and transverse movements. Central monitoring and synchronised control of all jacking systems is provided using a customized, wireless version of our proven DL-P40 computer control system. High accuracy GPS stations are located at the top of each tower for monitoring the tower verticality. The GPS data is integrated into the DL-P40 computer control system.



Temporary Hanger System – Tamar Suspension Bridge, UK

The Tamar Bridge is a suspension bridge that connects the counties of Devon and Cornwall over the River Tamar in southwest England.

Maintenance works were needed to the cable clamps and hangars that support the deck from the main suspension cables. DLT developed and supplied a temporary hanger system that was used to relieve the load from each permanent hanger and to support the bridge deck whilst the maintenance works were carried out.

DLT also provided certified training in the use of the system to the Client's team so that they could safely install and operate the equipment themselves.

MOSE Flood Protection System – Venice, Italy

DLT were subcontracted by the Mantovani Group to aid in the construction of a jack-up crane barge used for lifting and transporting the flood gates at the entrance to the Venetian lagoon. This included supplying a computer-controlled strand jack system and providing on-site technical support.

Reference Projects

Tunnel Gantry/Crane – Crossrail, Liverpool St. Station, London

DLT were sub-contracted by Laing O'Rourke Construction Ltd to design and supply heavy-lifting equipment to aid them in transferring precast concrete train platform components through the newly constructed Crossrail tunnels. This meant designing bespoke gantries and cranes suited to the exact requirements of the tunnel system to allow for the easiest possible movement of components.

These large pieces of equipment also had to be lowered safely into the tunnels piece by piece, and consequently the designs had to take into consideration ease of assembly in an underground setting with limited space.

Casting Yard Transporter – New Champlain Bridge, Montreal

DLT were responsible for supplying a 1,000-tonne capacity transporter to allow for the safe and efficient movement of concrete pile caps, footings and pier sections from the enclosed casting yard to the required site locations, for distances of up to 475m. The 40-wheeled, diesel-powered transporter could travel at speeds of 1km/hr loaded, and 3km/hr unloaded, and had to operate in Montreal's severe weather conditions, including snow.

DLT also supplied the jack-up system (consisting of four 300-tonne capacity, 2.5m stroke hydraulic cylinders and a diesel-engine operated power unit) required to lift the concrete blocks so they could be loaded safely onto the transporter.

Erection Gantries – Queensferry Crossing, Scotland

DLT were appointed by the main contractor, Forth Crossing Bridge Constructors, as construction engineers for the launching of the North Approach Viaduct and for the design of the deck erection gantries for the cable stayed spans.

The North Approach Viaduct launch section was 221m long, weighed 4,200 tonnes, and was launched a distance of 233m. DLT provided the detailed design for the six deck erection gantries, used to erect a total of 109 steel/concrete deck sections, weighing up to 729 tonnes, at an erection rate of 1 section per gantry per week. At opening, Queensferry Crossing is the world's longest triple-tower cable-stayed bridge.

Bridge Deck Lifting Gantries – TM to CLK Link, Hong Kong

DLT were subcontracted by Gammon Construction Ltd to provide bespoke equipment to aid their construction of the 1.6km long, southern connection viaduct section of the Tuen Mun to Chek Lap Kok Link in Hong Kong.

DLT designed and supplied equipment for a number of different types of gantries. This including strand jacks, secondary rams, hydraulic power units and computer control systems that were used throughout the project. The scope also included assistance with the conceptual design of the gantries and site support and training in the use of the equipment.

Reference Projects

Erection Gantries, Transporters & Skidding System – Riyadh Metro Project, Saudi Arabia

DLT were sub-contractors to FAST Consortium for the design and supply of two DL-SE500/35 bridge span erection gantries, two DL-TLC500 transporters and two DL-SC260/21.2/25 straddle carriers for the transport and final erection of 500 tonne, 35m long precast concrete bridge deck beams on the 16.7km long elevated section of Line 4 of the Riyadh Metro project. The equipment was designed to deliver and erect the bridge beams at an average rate of 1 per day, to erect bridge beams on a plan radius of 1200m and to pass through cast in-situ sections with a plan radius of 100m.

DLT were also responsible for a multi-span sideways skidding system for side shifting deck beams on a wider section of the viaduct which required 2, 3 or 4 precast deck beams side by side. This system consisted of skid units, with strand jacks for pulling, at each end of each span, supported on a temporary frame which was supported on the permanent pier pile cap.

Olmsted Locks & Dams Project – Illinois, USA

The Olmsted Locks and Dams project consists of twin 110-foot wide by 1,200-foot long lock chambers on the Ohio River at Olmsted, Illinois. The project as a whole was the largest and most expensive inland waterway project undertaken in US history. The lock chambers are constructed from heavy precast concrete units, that were cast in a yard on shore and then handled on land using a purpose made gantry crane and in the water using a purpose made heavy lift catamaran barge.

DLT were awarded the contract to design, supply and operate two 12,000-tonne capacity computer controlled strand jack systems for use as the main lifting systems on both the gantry crane and the catamaran barge.

Synchronised Jacking System – Calvary Church Convention Centre, Malaysia

DLT were contracted by Victor Buyck (Malaysia) to supply a 4xDL-S185 strand jack system for erection of two 200-tonne mega trusses, and also for design and supply of a synchronised jacking system to open and close two 270-tonne ‘angel’ wings located on the roof. The angel wings open to allow fresh air to enter the main hall and also serve as an architectural feature. Each wing is supported by eight hydraulic rams with strokes of up to 3.8m and all rams are monitored and controlled centrally using a specially developed control system.

3,600-tonne Capacity Weighing System – Vietnam

DLT supplied a 3,600-tonne capacity computer-controlled weighing system to a client in Vietnam. The system consisted of four 600-tonne and four 300-tonne capacity weighing jacks, all synchronised, controlled and operated by a single operator using the DL-P40 computer control system.

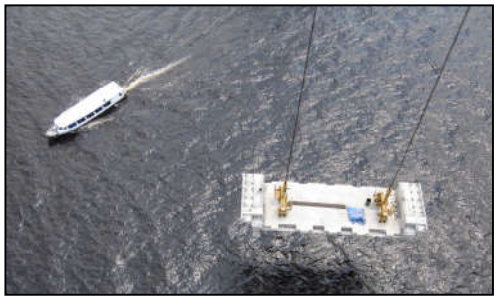
The jacks were provided with load cells and the overall accuracy of the system was within 0.5%. DLT also trained the client's personnel in operation and maintenance of the system, to enable them use the equipment themselves.

Erection Gantry, Transporter & Straddle Carriers – Sheikh Jaber Al Ahmed Al Sabah Causeway Project, Doha Link, Kuwait

DLT were responsible for the detailed design of a bridge-deck erection gantry, a transporter, and a pair of straddle carriers for the Sheikh Jaber Al-Ahmed Al-Sabah Causeway Project (Doha Link) in Kuwait. The Doha Link is a 12.43km sea crossing with twin parallel decks and is constructed from precast concrete deck beams supported on cast in-situ piers. The straddle carriers, transporter and gantry were all designed to handle precast concrete bridge deck beams weighing up to 1,700 tonnes, with a span range of 30m to 60m.

Deck Erection Gantries – Rio Negro Cable-Stayed Bridge, Brazil

The Ponte Rio Negro is a 3,595m long crossing of the Rio Negro, linking Manaus with Iranduba over the River Negro. DLT were awarded the contract to design, supply and operate two 320-tonne capacity deck erection gantries to lift and position the 52 precast concrete deck sections of the cable stayed spans. Each gantry uses two DL-S185 strand jacks for lifting the deck sections, and other hydraulic rams to adjust the plan position and slope for accurate alignment with the previous section.



Stadium Roof Lift – Mané Garrincha, Brasilia, Brazil

As part of preparations for the FIFA 2014 Football World Cup, DLT worked with Protende to provide lifting equipment, advice and supervision for the lifting of the new roof at the reconstructed Éstadio Nacional Mané Garrincha. This included providing fifty modified S98 Strand Jacks (incorporating Protende cylinders) to be mounted at even spacings around the circumference of the existing stadium roof. The fifty strand jacks were synchronised to lift the new roof canopy support cables into positon, suspended above the pitch and stands.

Following the reconstruction, the increased capacity of the stadium made it the second-largest stadium in Brazil, and one of the largest stadiums in South America as a whole.

Reference Projects

DL-TS3600/DL-TS7200 Jacking Tower Systems for the Erection of Petrochemical Vessels – China

The DL-TS3600 is a jacking tower system designed and supplied by DLT to Sinopec Tenth Construction Company in China. The tower system has a gross lifting capacity of 3,600 tonnes in two tower configuration and 7,200 tonnes in four tower configuration. DL-CP600 pinned climbing jacks (600-tonne capacity per jack) are used and each tower can be fitted with two or three of these jacks. The vessel can be moved longitudinally & transversally and can be rotated 360 degrees with an optional swivel after lifting. A self-erection and dismantle option is available, and the tower system uses our proven DL-P40 computer control system.

Transfer Deck Launch – Reading Railway Station, UK

DLT designed all temporary steelwork required for the launch of the 30m-wide and 135m-long transfer deck for the redevelopment of Reading Station. The deck was assembled in three sections adjacent to the station, before being slid into place using our S62 strand jacks. The station redevelopment took place as part of the preparations for the 2012 Olympic Games, as the station would be a key element of the transport infrastructure during the games.

2x1,000-tonne Jacket Load Out & Offshore Pushing System – Japan

DLT designed and supplied a 2x1000-tonne capacity (push/pull) jacking system to Nippon Steel in Japan for use on their offshore jacket installation barge. The jacking system comprised two DL-GP1000 skidding jacks and was designed to 'walk' along a bespoke skid track with anchorage slots at 1.25m centres. It is used for load-out of jackets onto an installation barge and for pushing the jackets off the barge at the installation site. It has a hydraulic load balancing system to ensure equal distribution of the anchor force to four slotted holes, reducing the cost of the skid track.

DL-SE1000/35 Span Erector – Honam High Speed Rail, South Korea

DLT were sub-contractors to Samsung C&T for design and supply of a DL-SE1000/35 span erection gantry for erecting the full length of section 4-1 on the Honam High Speed Railway project. The DL-SE1000/35 can erect precast spans weighing up to 1,000 tonnes and up to 35m long at a rate of up to 2 spans per day and is self-launching into the next span.

Platform Installation – BARD Wind Farm, North Sea

DLT were responsible for the design, supply and operation of two 4,704-tonne capacity systems for installation of the transformer platform to the BARD wind farm. The platform was designed to float out and self-install. A total of sixteen DL-S588 strand jacks were supplied, with eight jacks being used for lowering the jacket onto the sea bed and eight jacks for lifting the top side up the jacket into final position.

Reference Projects

DL-GA540 Generator Installation Gantry – India

DLT supplied a 540-tonne capacity modular gantry for installation of generators to Lift and Shift India. The gantry is modular to accommodate the geometry of each site and incorporates folding strand jacks to allow the generator and strand jack carriage to move together into the turbine hall without the need to remove a section of the overhead crane rail to provide extra headroom. The gantry is able to lift, rotate and move the generator into final position and incorporates both transverse and longitudinal movement systems to allow the generator to be set accurately onto its foundations.

Bridge Launching – Ponte Verde Steel Arch Bridge, Italy

The 1,000-tonne superstructure of the Ponte Verde steel arch bridge in Padua, Italy, was launched into place by Edimo Metallo S.p.A using DLT Engineering DL-S185 strand jacks and with the assistance of our construction engineering and site supervision services. The complete arch bridge was fully assembled on site and then launched over the 90m span into final position, crossing ten railway lines that remained open throughout. Within the 90m span there were two temporary supports for launching, located between the railway lines. Two DL-S185 strand jacks were used for pulling and a further two DL-S185 strand jacks restrained the bridge from running away down the small slope and allowed the launch to be reversed in an emergency.

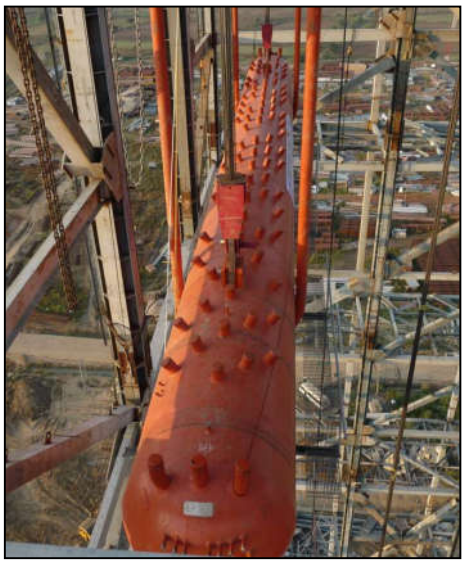
4x5,000 tonne & 4x3,750 tonne Float Over Jacking Systems – Arabian Sea

DLT undertook the design and supply of two synchronised hydraulic jacking systems for use in the float-over installation of a 13,400-tonne process platform and an 8,000-tonne living quarter platform for ONGC's B193 oil/gas process complex in the Arabian Sea, located 75km offshore of Mumbai in a water depth of 70m. With multiple rams in use at each support point to provide redundancy, the systems allowed for ease of transport and handling, resulting in maximum safety and flexibility for future use. Each system uses four hydraulic power units and has a central computer control system for accurate synchronisation and full data logging of the operations. The systems operate at a lifting speed of 70mm/min and a lowering speed of 1000mm/min.

324-tonne Chimney Flue Lifting Systems – India

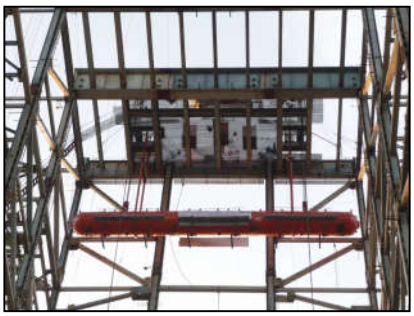
DLT supplied three sets of 3x108-tonne capacity strand jack lifting systems to Gammon India Limited. Gammon has used these systems throughout India for the erection of flue segments in RCC Chimney. Each system of three DL-S108 strand jacks is powered by one DL-L15/4/300/E electrically powered hydraulic power unit and uses the proven DL-P40 computer control system for monitoring, accurate synchronisation and control. The flue segments are erected in parts weighing up to 300 tonnes. The segment is delivered and positioned directly under final position at ground level through a wheeled trolley over rails, then lifted vertically with strand jacks and transferred from the strand jacks to the permanent beams. The strand jacks are then lowered to lift another segment until the total erection of the flue segments is completed up to a height of around 275m.

Reference Projects



BHEL 370-tonne Capacity Strand Jack System – India

DLT supplied a 370-tonne capacity strand jack lifting system to BHEL Western and Northern divisions in India for use in the construction of power stations. The system comprises two DL-S185 strand jacks powered by two electrically powered hydraulic power units for a lifting speed of 20m/hr and is controlled using our DL-M2 pendant control system. The steam drum is delivered and positioned at ground level directly under final position, lifted vertically to final height and then transferred from the strand jacks to permanent hangers. BHEL Western division has erected around ten steam drums using this equipment.



Strand Jack Systems For Replacement Of Thrusters

DLT have supplied and operated many strand jack systems for the installation and replacement of thruster units weighing up to 50 tonnes on drilling ships and floating platforms. Strand jacks provide a compact and cost effective solution for handling heavy thruster units and we have also developed a system of modular power units and jacks that can be taken through bulkhead doors into the thruster room.

Roof Erection – HAECO Hangar 3A, Hong Kong Intl. Airport

DLT were sub-contractors to China State – Leighton JV for the lifting of the 3,520-tonne pre-assembled steel roof. The roof was lifted 30m using eight DL-S418 strand jacks mounted on four 40m high DL-TS3000 free standing towers and six DL-S185 strand jacks mounted on the permanent concrete columns. The hangar itself is a world-class 16,000m^2 aircraft maintenance facility that can accommodate two jumbo jets and one nose-in aircraft at Hong Kong International Airport.

DL-TS3000 Jacking Tower System – Gunsan, South Korea

The DL-TS3000 jacking tower system can lift vessels up to 3,000 tonnes and 150m high. It is able to self-erect and dismantle and, with the optional 1500-tonne capacity tailing frame, is able to operate without a tailing crane. It can operate unguyed up to 70m high in storm winds of up to 40m/sec. All components are transported in standard shipping containers for economic relocation between sites.

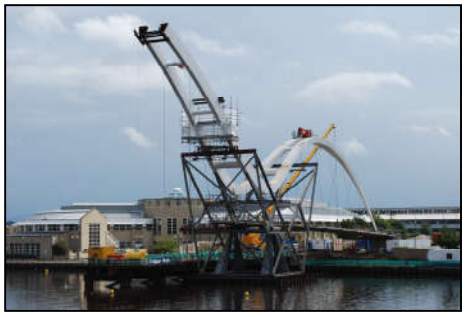
Reference Projects

14,000-tonne Topsides Load Out – Malaysia

Working with local partner JWS Engineered Transport Sdn Bhd, DLT were responsible for the supply and operation of a 2,352-tonne capacity strand jack system for load out of the Tallisman Topsides onto the delivery vessel. We used four DL-S588 strand jacks, powered by two DL-L120/2/300/D diesel-powered hydraulic power units. JWS have since carried out numerous lifting and skidding operations using DLT strand jacks.

Sea Drill Pontoon Launch – Jurong Shipyard, Singapore

DLT were sub-contracted to side-shift and launch two 3,600-tonne pontoon units at the Jurong Shipyard, Singapore, in 2007 for the Sea Drill floating platform #8. The pontoons were supported on inflated air bags for these operations and moved using two DL-S185 strand jacks and two DL-L30F/1/350/120/E hydraulic power units for a launching speed of 17m/hour, controlled using the DL-P40 computer control system.



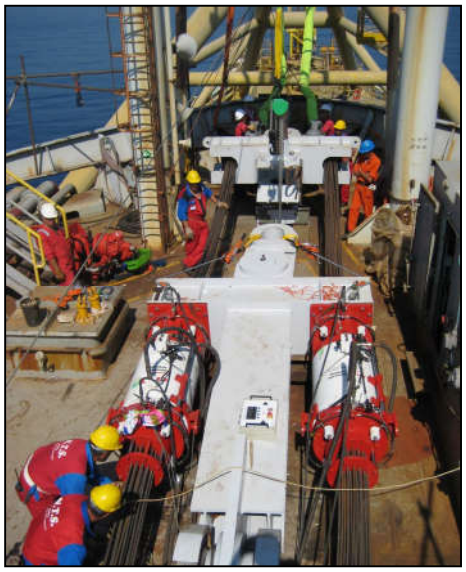
Erection Engineering – Infinity Footbridge, Stockton, UK

The award-winning Infinity Footbridge is a 2-span tied arch crossing the River Tees in Stockton, England. The main span of the bridge is 120m, while the side span is 60m. The arches are steel box sections and the deck is made from precast concrete segments that are post-tensioned together to form the arch ties. DLT provided expert advice to the designers on erection methods, and details for fabrication and buildability. DLT also contributed full erection engineering to the contractor, including stage by stage analysis, aerodynamic response analysis and detailed design of all temporary works. A strand jack system was also provided for use during erection of the bridge.

FPSO Mooring Pendulum Installation – Singapore

DLT were responsible for installation of two 120-tonne mooring pendulums for SMOE in Singapore, using strand jacks to achieve a positional alignment of +/- 0.2mm for installation of 5-tonne pitch pins.

Reference Projects



Recovery of Mooring Yoke to Release FSO from Buoy – Mediterranean Sea

DLT were sub-contracted to provide a strand jacking system to raise a mooring yoke, in order to release a Floating Storage & Offloading (FSO) vessel from its mooring buoy, where it had been located for 20 years. The original 1,000-tonne capacity long-stroke ram used to install the yoke was unserviceable. DLT engineered a system using two DL-S418 strand jacks mounted on a T-frame, attached to the FSO using the existing long-stroke ram mounting point. The jacks were powered by a DL-L114/4/D diesel engine operated hydraulic power unit.

Jacket Erection – Maari Field Wellhead Platform, Malaysia

DLT were sub-contracted to design, supply and operate a skidding and jacking system to incrementally erect a 26m x 22m x 140m high 2,800-tonne jacket structure. The sections were lifted using our DL-TS3000 Mk1 jacking tower system, in four-tower configuration and using eight DL-C450 climbing jacks. The lifting operations took place in 2007.

Steam Generator Replacement – California, USA

Rigging International requested DLTs aid in replacing a steam generator in the SONGS nuclear power plant in California. DLT provided a lifting system comprised of two DL-S418 strand jacks powered by one DL-L60/4/300/D diesel powered hydraulic power unit for a lifting speed of 14m/hr and controlled using our DL-P40 computer control system. The operation took place adjacent to a live nuclear reactor in an environment with very high electrical magnetic interference. Our DL-P40 computer control system was approved for use in this environment following a successful 24-hour continuous running test on the site.

Reference Projects

Mooring Line Tensioning – Corocoro FSO, Venezuela

DLT were sub-contracted to assist in the installation of a FPSO mooring line system 32km offshore in the Corocoro Oil Field, Venezuela. DLT designed and supplied the strand jack tensioning system to pull pairs of mooring lines toward one another to achieve a 700-tonne bedding tension.

Roof Erection – Venetian Theatre, Macao

DLT were sub-contractors for the erection of the 940-tonne steel roof structure for the new two-thousand seat theatre as part of 'The Venetian' Development in Macao. Our scope included erection engineering, equipment rental and site operation. The roof trusses were assembled on site at ground level and then lifted into position using a climbing jack system. The roof trusses were erected in three separate lifts, each weighing up to 400 tonnes.

Pinalito Hydroelectric Plant, Dominican Republic

DLT were employed by Odebrecht to supply equipment and site supervision to install a water distribution pipe which was required to pass over one of the Dominican Republic's many mountains. DLT's equipment and supervisors assisted in the installation of the pipe, pulling a total of seventy eight sections, from ten different locations using DLT strand jacks. The maximum pull was 132 tonnes, and the longest pull in terms of distance was 157m.

Deck Erection Gantries – Sutong Cable-Stayed Bridge, China

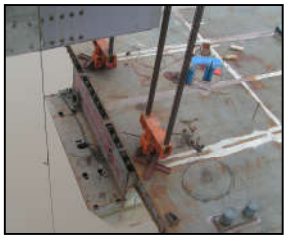
With a main span of 1,088m, the Sutong cable-stayed bridge was the longest span cable-stayed bridge in the world between the years 2008-2012, and won the 2010 Outstanding Civil Engineering Achievement award from the American Society of Civil Engineers. DLT were sub-contractors to 2nd Navigation Engineering Bureau for the design and supply of eight deck erection gantries that were used to erect the eighty-four steel orthotropic deck segments, each weighing up to 450 tonnes.

Reference Projects

Deck Lifting – Shibanpo Yangtze River Bridge, China

During construction of the Shibanpo Yangtze River Bridge in China, DLT were responsible for using strand jacks to lift the primary structural elements, including concrete box girders and a central steel box, into place from barges on the river below. Once constructed, the bridge itself achieved a world record for the longest concrete box girder bridge span, at 330m long. The bridge is 1,103.5m in total length and 19m wide.



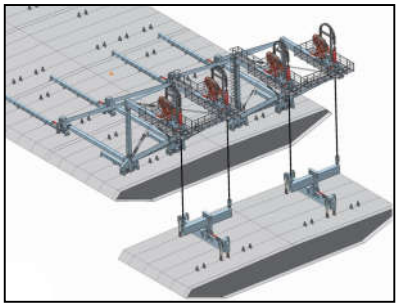



Blast Furnace Re-Lining – Taiwan

DLT were sub-contractors for the installation of a new 40.75m high, 3,115-tonne furnace line in Taiwan. Our scope included full engineering of all temporary works required, together with supply of jacking equipment and site labour to carry out the work. The blast furnace was delivered to the site in eight segments, weighing up to 477 tonnes each, which were lifted and skidded into the furnace house before being jacked vertically and aligned for welding. These operations were carried out using a mix of strand jacks and climbing jacks.


Deck Erection Gantries – E-Dong Yangtze Cable-Stayed Bridge, China

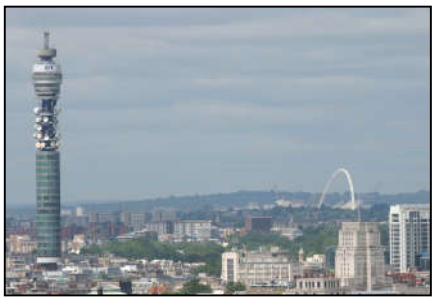
The E-Dong Yangtze Cable-Stayed Bridge is located in Huanggang City, Hubei Province, China, and crosses the Changjiang (Yangtze) River. It has a main span of 926m and side spans of 275m, making it one of the longest cable-stayed bridges in the world. DLT were awarded the sub-contract by Second Highway Engineering Bureau to design a pair of 280-tonne capacity deck erection gantries to erect steel orthotropic deck segments, weighing up to 369 tonnes each on one half of the main span.

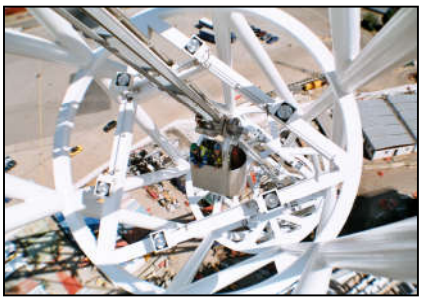



Reference Projects

Detailed Erection Engineering – New Wembley National Stadium, London

DLT were responsible for the detailed erection engineering for the 26,000 tonnes of structural steel involved in this project, including the stands, cable suspended roof and main arch structures. The 1,490-tonne main arch was assembled flat and rolled up into position using strand jacks. DLT were also responsible for engineering and supervising this operation.





Detailed Erection Engineering – Heathrow Airport, New Terminal 5, London

DLT were responsible for the detailed erection engineering for the 18,500-tonne steel roof structure of the new main terminal building, and for a 1,100-tonne air traffic control tower. Both were fabricated off-site and erected on-site using strand jack lifting systems. The roof box girders, purlins and cladding to the terminal building roof were erected in six 2,000-tonne lifts. The control tower was pre-assembled off-site into seven modules and assembled on-site using a unique vertical jacking technique.

Second Orinoco River Crossing (Orinoquia Bridge), Venezuela

At over 3km long and with two cable-stay spans of 310m, this project provided many engineering challenges. The steel box girder deck for the 60m approach spans was launched in pre-assembled units of up to 2,413 tonnes. The steel box girder deck of the two cable-stay main spans was erected by balanced cantilever in 250-tonne segments. DLT were responsible for the supply and operation of the strand jack systems for launching the approach spans and for lifting and skidding the main span deck units.

Bishop's Bridge Replacement, Paddington Station, London

The existing three-span masonry bridge and steel truss span, which passed over fifteen rail lines at the entrance to London's Paddington Station, was replaced in 2006 with a new six lane composite bridge. The masonry spans were demolished and the 941-tonne truss bridge was lifted 9.8m to allow assembly and incremental launching of the new 2,500-tonne bridge deck below. DLT were responsible for the conceptual and detailed design of all construction methods, and supply and operation of all jacking systems for the lifting and launching operations, all of which took place within limited railway possessions.

Reference Projects

‘Walking’ Deck Erection Gantries – Runyang Bridge, China

DLT were responsible for the design, supply and commissioning of four 370-tonne capacity deck erection gantries for this 1,490m main span suspension bridge. These gantries ‘walk’ the main cables and work in pairs to erect steel deck units weighing up to 470 tonnes each. The gantries can be self-erected onto the main cables and are easily adapted for future projects with different cable centres and diameters.

Alfred Zampa Mem. (Carquinez) Suspension Bridge, California

DLT were responsible for all aspects of construction engineering for the bridge deck, main cables and hangers for this 728m-span suspension bridge. We also undertook the sub-contract to erect the twenty-four 700-tonne steel deck units. Using our strand jacks, the deck units could be jacked into position directly from the ships that had carried them from their manufacturer in Japan. The bridge was constructed in the Carquinez Straits, an active shipping lane under U.S. Coast Guard jurisdiction, at a site that was subject to strong currents, winds and dense fog.

Incremental Deck Launching – Mary McAleese Boyne Valley Cable-Stayed Bridge, Ireland

DLT were responsible for the design of the superstructure (as an alternative to the client’s design), detailed design of the erection methods for all elements of the deck, and for supply and operation of the strand jacking systems used to launch the deck into final position. The construction site was located in an environmentally sensitive area, and close to a site of historical importance at which the Battle of the Boyne took place in the year 1690. As a result of these limitations, the bridge was the first cable-stayed bridge in the world to be constructed using the incremental launching method. Precise calculation of the deck geometry and strand jack forces at all stages was required to enable site operations to be adequately controlled.

Jiangyin Suspension Bridge, China

DLT were responsible for the detailed erection engineering, heavy lifting equipment supply, and site supervision for deck erection on this 1,385m main span suspension bridge. The Jiangyin Bridge went on to win the Eugene C. Figg Medal for Signature Bridges at the International Bridge Conference Awards in 2002 as an “outstanding achievement in bridge engineering that, through vision and innovation, provides an icon to the community for which it was designed.”

Sheikh Khalifa Bin Salman Causeway Bridge, Bahrain

DLT were responsible for erection engineering of the steel arch superstructure, involving offsite assembly of the 3,000-tonne main span, transport to site and lifting in one piece into final position using eight 500-tonne capacity strand jacks. The bridge spanned 404m as part of a causeway linking Hidd to Manama, carrying 3-lane carriageways in each direction.

Tuti Suspension Bridge, Khartoum

DLT were responsible for the permanent-works design and erection engineering for this landmark structure in the centre of Khartoum. The bridge has a main span of 210m and had been designed for construction by local labour. The Tuti Bridge was one of the first suspension bridges to be constructed in both Sudan and wider Africa. The bridge provided ease of access to the island of Tuti, which had previously only been accessible by ferry.

Reference Projects

Connection Design & Erection Engineering – HQ1 Building, London

DLT were responsible for detailed connection design and erection engineering of the 6,600-tonne steel frame of this sixteen-storey office block. This included heavy lifting of a 650-tonne module, which was built on a lower floor and then raised 30m to the sixteenth floor. DLT were also responsible for the supply and operation of the strand jack system to carry out this lift, using four DL-S185 strand jacks.

Load-Out of FPSO Pontoon – South Korea

DLT were responsible for the design, supply and operation of a strand jack system to load out a 14,500-tonne FPSO pontoon onto a delivery ship, for main contractor Hyundai. The deck was moved 125m using four 580-tonne capacity strand jacks.

Tsing Ma Suspension Bridge – Hong Kong

Our engineers were responsible for detailed erection engineering, heavy lifting equipment supply and site supervision for deck erection on this 1,377m main span suspension bridge. When constructed, the Tsing Ma Bridge was the eleventh longest suspension bridge in the world and is the longest that can accommodate both rail and road traffic. In the case of a severe typhoon, the two road lanes and two railway lines enclosed on the lower deck can still be used to transfer passengers to and from the airport.

Dismantling of the Brent Spar Oil Storage Platform – North Sea

DLT were responsible for the design of a 2,300-tonne capacity lifting gantry for handling cut sections of the Brent Spar as it was decommissioned in a Norwegian fjord in 1999. The gantry used four 580-tonne capacity strand jacks for lifting and a gripper jack system for longitudinal movement over the decommissioning barge. The legs and cross beams of the gantry structure were made from a proprietary tower system which were connected and braced using purpose designed steelwork.

Convention & Exhibition Centre – Hong Kong

DLT were responsible for erection engineering, heavy-lifting equipment supply, and operation for the erection of an 8,000-tonne prefabricated roof structure and a 5,500-tonne link bridge. The roof structure was fabricated and assembled in the Philippines into modules weighing up to 460 tonnes each, which were then shipped to the site for lifting and skidding into their final positions. The link bridge was erected ‘piece small’ by a stiff-leg derrick mounted on a purpose-built skid track.

Roof Erection – Virgin Atlantic Hangar, Heathrow Airport, UK

DLT were responsible for the detailed erection engineering for the lifting by strand jacks of an 800-tonne roof truss for this aircraft maintenance hangar at Heathrow Airport. The roof structure was assembled at ground level and then lifted using strand jacks mounted on the top of the permanent columns, which were stabilised by rented proprietary towers that were anchored down to the permanent foundations.

Reference Projects

Roof Erection – Cairns Convention Centre Phase II, Australia

The roof to this convention centre is constructed from a complex series of curved 'V' shaped steel trusses, working with a plan tie system in the finished state to provide a rigid and stable structure. To reduce the roof erection cost and programme, the roof was assembled in fully clad panels adjacent to site and erected onto temporary supports within the building. DLT were responsible for the detailed erection engineering of the roof, including all temporary supports and stability bracing, which was required to withstand cyclone wind loads at any erection stage.

Roof Erection – HAECO Hangar 1, Hong Kong Intl. Airport

DLT were responsible for the design, supply and operation of a strand jack lifting system together with associated erection engineering to lift two pre-assembled roof sections, each weighing over 1,000 tonnes. Each section of roof was lifted with nine DL-S185 strand jacks. Temporary works for the lift comprised three 300-tonne capacity jacking towers, plan bracing to stabilise the roof and a guide track against the concrete core structure.

Link Bridges – Hong Kong

DLT were responsible for the design, supply and operation of a strand jack heavy-lifting and horizontal skidding system for the erection of two 1,100-tonne pre-assembled link bridges in Hong Kong for main contractor, Gammon-Skanska.

Jacking Tower System – Formosa Plastics Plant, Taiwan

DLT were responsible for the design, supply and operation of a 100m high modular jacking tower system for the erection of thirty-six petrochemical vessels, ranging from 1,120-tonne at 30m high through to 1,450-tonne at 115m high.

Reference Projects

2,500-tonne Strand Jack Tower System – China

DLT were responsible for the conceptual and detailed design of this 2,500-tonne lifting capacity modular strand jack tower system, specifically designed for the Chinese refinery construction market. The tower system is owned and operated by the No. 4 Construction Company of SINOPEC and has many new features including self-erection and luffing under full load.

Lal-Pir Power Station – Pakistan

DLT were responsible for the design, supply and operation of a system to lift, skid, rotate and lower into final position of a 350-tonne generator. The generator was delivered outside the building and was lifted from the transporter using four DL-S105 strand jacks mounted on a purpose-built transportation frame, which sat on a skid track running into the building. Once in the building, the generator was rotated 90-degrees on a purpose made turntable and skidded a further 10m before being lowered into final position.

Our engineering team have also been responsible for the detailed connection design and erection engineering of a number of tower blocks in London, including:

Canary Wharf Tower, London (pictured left)

A 25,700-tonne steelwork frame for a fifty storey tower block.

HSBC Bank, London (pictured right)

A 12,000-tonne steelwork frame for a forty-three storey tower block.

Bank of America Building, London (pictured left)

A 6,400-tonne steelwork frame for a sixteen storey office block.

Clifford Chance Building, London (pictured right)

A 12,300-tonne steelwork frame for a thirty-four storey tower block.

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