

Compaction of reclaimed land

- Vibro compaction, onshore and offshore
- Vibro replacement, onshore and offshore
- Pile foundations
- Deep soil mixing
- Rigid inclusions

Keller Group plc - Who we are

Every day, people around the world live, work and play on ground prepared by Keller, the world's largest geotechnical specialist contractor.



North America

Bencor
Case Foundation
Hayward Baker
HJ Foundation
Keller Canada
McKinney Drilling
Moretrench Industrial
Suncoast



EMEA

Central Europe
North-East Europe
North-West Europe
South-East Europe
Brazil
Franki Africa
Middle East
Iberia and Latin America
French Speaking Countries



Asia-Pacific

ASEAN
India
Keller Australia
Waterway Constructions
Austral Construction

Solutions specialist

Used individually or in combination, our technologies solve a wide range of challenges across the entire construction sector – from industrial, commercial and housing projects to infrastructure construction.

Global strength and local focus

Global strength and local focus are what makes us unique. With an extensive branch network across more than 200 cities worldwide, Keller is uniquely placed in combining local knowledge of markets and customers with global expertise and experience. Strong, long-lasting client relationships, a knowledge base of the brightest

minds in the industry (bolstered by our global product team experts), and our commitment to using proven, best practice methods ensure we are always able to offer the optimum solution. With 10,000 employees and operations in more than 40 countries, we have the people, expertise, experience and financial stability to respond quickly, get the job done and see it through safely.

By connecting global resources and local knowledge, we can tackle some of the largest and most demanding projects around the world but the everyday work we do is just as important and, in total, we handle an unrivalled 7,000 projects every year.



Keller at a glance



1860
established



10k
employees



40
countries



7k
projects pa

**We are
the world's largest
geotechnical
specialist
contractor**

Helping create infrastructure
that improves the world's
communities



Ground improvement



Grouting



Deep foundations



Earth retention



Instrumentation and monitoring



Challenges we can solve

Our extensive geotechnical expertise accumulated over the years enables us to provide cost-efficient solutions and respond flexibly to a variety of challenging situations and conditions.

We use advanced technologies that allow the execution of highly complex works, such as stone columns, wet and dry soil mixing, rigid inclusions, various types of piles, barrettes, diaphragm walls, nails, anchors and sophisticated types of grouting to strengthen and/or seal the ground and to protect rail infrastructure from subsidence and loss of service.

We take special care to keep disruption to a minimum, selecting technology and equipment to ensure operations can continue during the works.

Reclaimed land

Land reclamation is done all over the world, but it's particularly important in the Middle East and Far East where cities are short of available land to build on.

Reclaimed land usually requires ground improvement as the dumped or dredged fill material is generally not dense enough to provide adequate bearing capacity, acceptable settlement or resistance to seismic events. Keller offers a wide range of solutions to deal with the various properties and characteristics of the soil used for any reclamation project.

Health and safety

Health and safety is a priority for Keller and we have a proven track record of one of the lowest accident frequency rates in our industry. The commitment of leaders and employees to our Think Safe programme has earned us awards and recognition from industry bodies as well as our clients.

We believe no one should be harmed as a result of any work we do and our ultimate goal is zero incidents.

Dubai Harbour

Dubai, United Arab Emirates

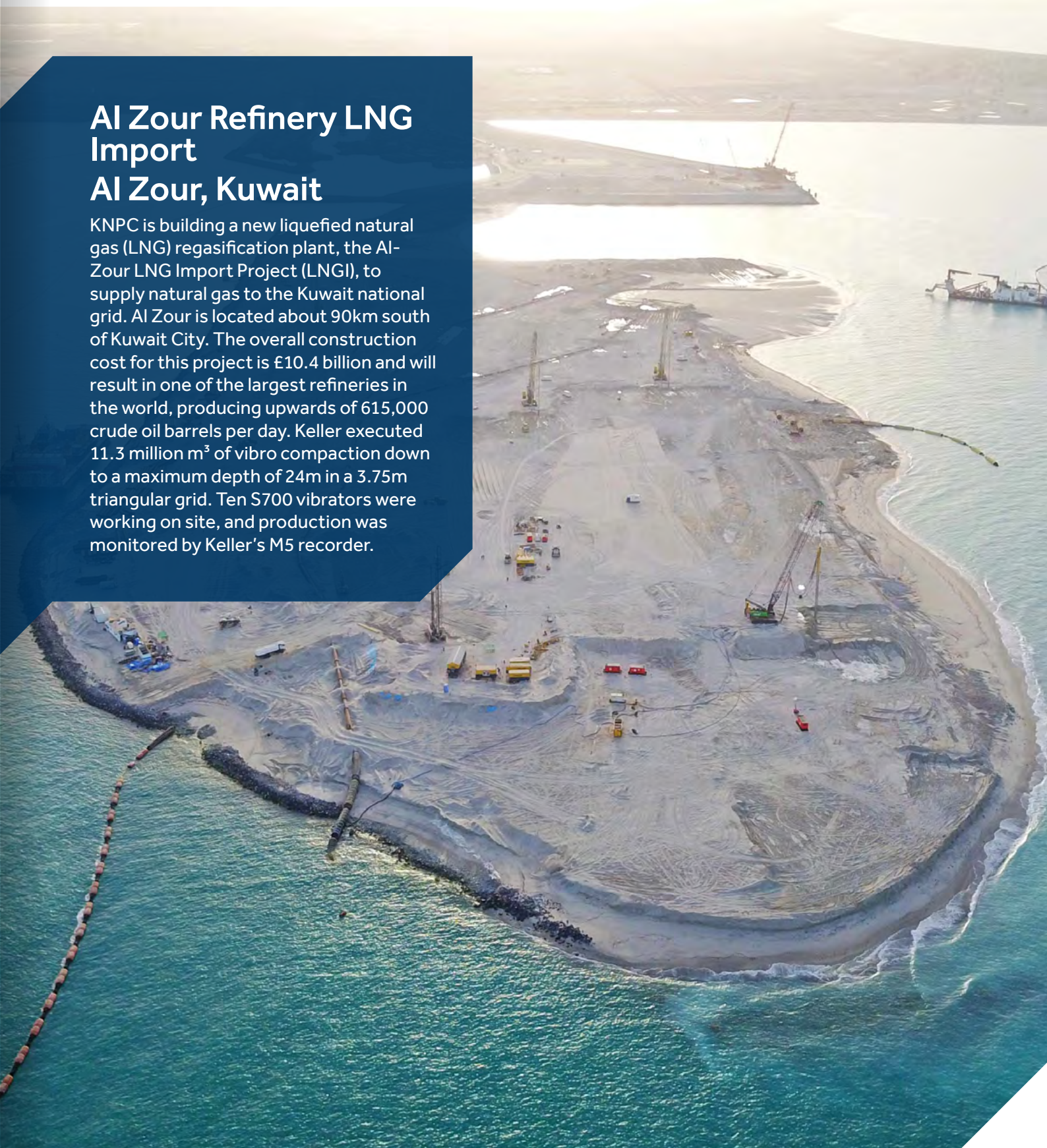
The new 20 million ft² Dubai Harbour, adjacent to the famous Palm Jumeirah, will feature the region's largest marina, as well as a cruise ship terminal, a 135m-tall lighthouse featuring a luxury hotel, and various retail and entertainment spaces. Led by developer Meraas, the project is the cornerstone of the Emirate's vision to attract 20 million tourists a year by 2020. Keller's substantial ground improvement task was to compact a 380,000m² new peninsula, whilst supporting Van Oord's idea of reusing reclaimed land source material instead of dredging it from an area at sea.



Project examples

Al Zour Refinery LNG Import Al Zour, Kuwait

KNPC is building a new liquefied natural gas (LNG) regasification plant, the Al-Zour LNG Import Project (LNGI), to supply natural gas to the Kuwait national grid. Al Zour is located about 90km south of Kuwait City. The overall construction cost for this project is £10.4 billion and will result in one of the largest refineries in the world, producing upwards of 615,000 crude oil barrels per day. Keller executed 11.3 million m³ of vibro compaction down to a maximum depth of 24m in a 3.75m triangular grid. Ten S700 vibrators were working on site, and production was monitored by Keller's M5 recorder.



Palm Deira Dubai, United Arab Emirates

Palm Deira, in the shape of a palm tree, is the third and largest of a series of man-made islands in Dubai covering an area of around 50 million m². It required one billion m³ sand for land reclamation which was dredged from the sea off Dubai. The calcareous sand quality varied with high shell content in the range of 60% to 90%. Keller used vibro compaction to compact a total of 32 million m³ of reclaimed land reaching a maximum depth of 25m, using eight S700 vibrators.



Project examples

Palm Jumeirah Dubai, United Arab Emirates

Palm Jumeirah was the first of the three palm islands in Dubai to be constructed. It has a number of hotels, resorts, residences, a mall and a water park, and by 2007 had become the world's largest artificial island. Keller executed a total of 636,000m² of vibro compaction on numerous projects on the island such as the monorail, hotel resorts and apartment residences.

Burgan Cape Terminals Cape Town, South Africa

Burgan Cape Terminals is a large fuel storage facility at the port of Cape Town to receive, store and distribute the energy safely. Franki, a Keller company, was awarded the contract to design and execute the foundations for 13 large tanks with diameters from 12 to 31m and heights from 17 to 19m. A total of 15,100m² of dynamic compaction was undertaken on reclaimed land. As the foundations of tanks nearby were unknown, another Keller company Getec, provided monitoring services to record settlement and vibrations during the work.



Project examples



Upper Zakum Islands Abu Dhabi, United Arab Emirates

Our client was dredging and reclaiming four islands 80km off the coast of Abu Dhabi to enhance oil productivity. To create these islands, 23.5 million m³ of calcareous sand was dredged from nearby. Keller densified a total of 27 million m³ of calcareous sand by vibro compaction over a period of four years, reaching maximum depths of 21m. This was primarily using S700 vibrators, although S300 vibrators were used for secondary compaction on some islands.



Al Raha Beach Abu Dhabi, United Arab Emirates

Al Raha Beach is a vibrant mix of premium residential, commercial, cultural, entertainment and public amenities across eight precincts. A total of three million m² of reclaimed beachfront was needed for three precincts. Keller executed 42 million m³ of vibro compaction and 207,000m of vibro replacement – both onshore and offshore. Depths for compaction were between five and 17m and for stone columns depth varied between four and 11m.

Project examples



Changi International Airport, Terminal 5 Changi, Singapore

Changi Airport is a major airport in Singapore and one of the largest transportation hubs in Asia. Terminal 5, built on 1,080 hectares of reclaimed land, will enable an additional 50 million passengers annually making it one of the largest terminals in the world. Keller executed a total of 33 million m² of vibro compaction, and in height-restricted areas, used a telescopic Vibrocat rig.



Project examples

Muharraq Sewage Treatment Plant Hidd, Bahrain

The Government of Bahrain is developing a new sewage treatment plant on Muharraq Island. The 15.9km-deep sewer will be made up of micro-tunnels and a 4.2km network connected to the existing grid. Keller's scope of work included the construction of eight shafts and an intermediate lifting station. Keller constructed the shafts by installing 900mm-diameter secant bored piles down to a depth of 22.5m below ground level.

Tanger Med II Tanger, Morocco

Once expanded, Tanger Med will be the largest port in Africa, handling an estimated nine million containers a year. The port's expansion involves the construction of two new terminals, for which a new 1.6km quay had to be built. Keller deepened the berths from 16 to 18m along the 450m quay with a retaining wall made of tube piles. Keller installed a total of 411, 101cm-diameter piles to a depth of 15m. The strength of the tubes installed into the bedrock will guarantee the design to last a 100 years, as per the client's request.



Project examples



Durrat Al Bahrain Manama, Bahrain

Durrat Al Bahrain is the third largest man-made island in Bahrain and lies 40.5km south of the capital. The \$6bn, 21km² master development has been created across a cluster of 15 islands, hosting beachfront villas, luxury apartments, hotels, resorts, parks and retail malls. Keller's scope of work included the construction of 408 bored piles (1200mm diameter, 30m deep) for 13 bridges.

CFP Ruwais Refinery Abu Dhabi, United Arab Emirates

ADNOC is to expanding its Ruwais refinery to allow it to process up to 420,000 barrels per day of Upper Zakum crude oil. Keller was chosen to perform ground improvement measures under the units, but some were very sensitive to vibration. As a result, Keller proposed deep soil mixing for which 1,177 columns (each 1m diameter) were installed down to depths of 13 to 14m. Keller also installed 12,955 stone columns by vibro replacement (dry method) 15m deep in the ground and 1,029 of bored piles up to 21m deep.



Project examples

Shipyard Development Tuas, Singapore

Jurong Shipyard is developing a new yard on recently-reclaimed land. The development includes the construction of dry docks, a hull block assembly workshop and other structures. Keller designed and executed 126,400m² of vibro compaction at depths from 15 to 28m, as well as 30,400m² of prefabricated vertical drains (PVD) installed to depths between 25 and 40m. In certain areas where layers of sandy clay and marine clay were found, a 5.6m- high surcharge was used for the PVD installation.

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