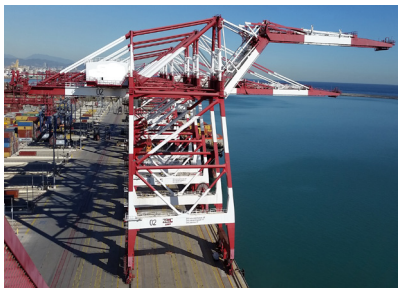
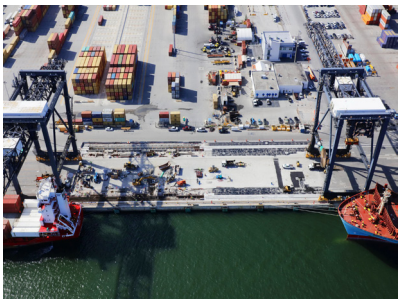
INFRASTRUCTURE SERVICES



Liftech Consultants Inc.



Liftech

LIFTECH CONSULTANTS INC.

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COMPANY OVERVIEW
INFRASTRUCTURE SERVICES

Liftech Consultants Inc. is a consulting engineering firm, founded in 1964, with special expertise in the design and procurement of dockside container handling cranes and other complex structures. Our experience includes design for wharves and wharf structures, heavy lift structures, buildings, container yard structures, and container handling equipment. We provide structural, mechanical, and electrical engineering services. Our national and international clients include owners, engineers, operators, manufacturers, and riggers.

We have developed innovative crane designs that have become industry standards including the first modern container crane, first trapezoidal girder to support the trolley on container cranes, first wire rope damper to reduce wind induced vibration on cranes, firsts RTG crane, first low profile crane, first articulated boom crane, first structural maintenance program, and fatigue tolerant detailing.

Liftech continues to provide innovative solutions to meet industry needs. We recognize that every port has unique challenges and goals, ranging from site-specific loading requirements to owner-specific needs for integration. We work with ports, advising the current trends and technical options. Liftech has tremendous experience having worked on a variety of challenging crane and wharf projects worldwide. Our experienced staff members are the resources for developing efficient solutions for crane and infrastructure projects.

Design Philosophy

Liftech is at the forefront of marine terminal technology and strives to develop new technology that improves terminal productivity and safety. We design functional, environmentally sound structures for the most economical investment. We believe in converting natural resources and labor into usable facilities that are a blend of aesthetic and functional considerations. We work well with owners, engineers, contractors, and architects.

COMPREHENSIVE INFRASTRUCTURE SERVICES

As a small, specialized firm with a good international reputation, Liftech provides comprehensive structural, mechanical, and electrical engineering services for marine facilities from the water to the fence line, including container and bulk handling equipment, wharves, RTG/RMG runways, high mast lighting footings, truck scale foundations, gate structures, building structures, overhead cranes, and crane-wharf interface. Very few companies have such combined expertise, and this is our strength.

Crane Configuration Development Support

Liftech leads the effort to define the crane geometry, load parameters, and design criteria that meet operation requirements. We review owner crane specifications, if available. Otherwise, we use Liftech's specifications for crane stability criteria and loads and load combinations. We select a crane model from Liftech's crane database that matches closest to the proposed crane geometry. We modify the crane model as necessary to meet the geometry and operation requirements.

Crane Load Analysis for a Specified Crane Configuration

Once the crane configuration and parameters are defined, we perform detailed crane load analysis based on an assumed crane model defined above to comply with site-specific design criteria. We analyze the crane models for the established load criteria. We check crane stability in accordance with the crane criteria and estimate ballast requirements for operational conditions, if required.

We check the member stresses to verify the assumed crane model will meet the criteria and provide a reasonable crane weight estimate.

We calculate the crane loads including vertical and horizontal wheel loads, corner uplift loads, stowage pin socket loads, and crane stop loads. We use storm wind criteria and load factors specified in ASCE 7-16, and provide loads for the specified operating, overload, and stowed conditions.

We recommend design crane loads that will include contingencies to account for the uncertainties. The recommended crane loads will be presented in factored and unfactored load formats suitable for the wharf designer to use in designing crane girders and piles.

Crane Load Consultation

We respond to questions from the wharf designer about the application of the crane loads for the wharf girder and hardware designs. We will assist with the location of stow pins and tie-downs.

Crane Wharf Hardware Design Review

We review the calculations and drawings for the crane-wharf hardware design for compliance with the crane load and crane operation tolerance requirements.

Wharf and Pier Structures

We provide design and analysis services for wharf and pier structures. Our experience includes the design of wharf and pier structures for large earthquake loads, including cast-in-place and precast concrete systems, as well as steel systems. Projects include a 426-foot wharf in Redwood City, a 550-foot wharf at the Port of West Sacramento that supports a cement unloader, over 5,000 feet of wharves at the Port of Oakland that support container cranes, and a MOTEMS-compliant wharf. The MOTEMS wharf permits continued operations during construction by fabricating most of the structures off-site and installing prefabricated components between vessel calls. We evaluated all of the wharves at the Ports of Oakland and Virginia to determine the crane rail capacities to aid the ports in their equipment decisions. We have performed evaluation studies and have justified increased crane girder capacities for over a dozen girder systems. We have performed wharf evaluations for heavy temporary loadings, e.g., moving container cranes over the wharf.

Float Design and Analysis

We provide design and analysis services for float structures, including cranes mounted on barges and ships and floats for ferry terminals. Projects include design of the local barge support structure for the Left Coast Lifter, a 1,700-t capacity barge supported shear leg derrick, a post-tensioned concrete float for the WETA South San Francisco Ferry Terminal, two steel floats for the WETA Pier 9 layover berths, and a steel float for the WETA Clay Street Ferry Terminal in Oakland. We designed a pile supported pier, gangway, concrete service float with maintenance shed and crane, and system of pile-moored concrete floats with an array of fendering and mooring systems for berthing up to 12 ferry vessels for the WETA Central Bay Operations & Maintenance Facility in Alameda, and the piling, two new steel floats with associated super structures and mooring berthing systems, three new gangways, and refurbishment modifications to the existing float to allow for greater compatibility with other WETA floats and vessels for the WETA Downtown San Francisco Ferry Terminal.

Crane Design

We design cranes for most of the world's container crane manufacturers. For Paceco, we developed the original standard A-frame, modified A-frame, low profile quay cranes, and RTG and RMG frame structures that have become the industry standard. For Mitsubishi, we provided structural design for the

first machinery-on-trolley cranes to meet the strict stiffness criteria of the Port of Singapore Authority. For Paceco, Italimpianti, and Samsung, we designed the then largest low profile cranes and provided designs of articulated boom cranes worldwide. Most recently, we helped design the largest quay crane for ZPMC with a 100-ton capacity and reviewed many of the manufactured DHT40 (dual-hoist- tandem-40) cranes.

Crane Procurement

We provide crane procurement assistance to numerous port authorities, shipping lines, and terminal operators. Our services range from preparing specifications to complete assistance, including bid evaluation, design review, quality assurance audits, and fabrication inspection. We have written specifications to assist in the procurement of hundreds of container cranes, most of which are super post-Panamax.

Crane Modification & Repair

We design modifications to increase the lift height, extend the outreach, increase the capacity, and change the rail gage for numerous cranes. For use in raising cranes, we designed jacking frames that dramatically decrease the out-of-service time for the crane. We are often called upon for consultations on damaged cranes. Our repair services include condition review, repair assessment, design of temporary securing, design of repairs, and oversight of the repair work. The repairs may involve replacing members, strengthening local areas, or heat straightening.

Crane Assessment

We help clients with crane equipment assessment and recommendations for purchase, modification, or repair. Our services include useful life assessment, reliability studies, condition surveys, and inspection programs. We are occasionally retained as an expert witness to assess crane accidents, evaluate repair estimates, and help resolve disputes.

Crane Transfer Systems

We designed many systems for transferring container cranes between non-linear berths including above ground shuttles, below ground shuttles, turntables, and curved rails with and without switches. We developed a computer program that calculates the near optimal curved rail geometry that typically avoids the need for a side shift mechanism between the crane and its gantry system.

Heavy Lift Design and Review

Liftech has provided structural design and review of heavy lift and crane structures for nuclear power plants, offshore platforms, and other special structures since the 1970s. Our expertise also includes structural design and review of floating cranes of capacity up to 12,000 t and a 1,700-t floating crane that was used to erect the major components of the San Francisco-Oakland Bay Bridge self-anchored suspension span. The barge mounted 1,700-t floating crane was built by ZPMC in China and is suitable for handling large bridge components.

Equipment Transportation

We provide engineering for the transportation of cranes, oil processing modules, offshore oil structure components, and miscellaneous equipment on barges and ships. Our services include checking the structures and the vessels for voyage forces, designing any required reinforcing for the structure and/or vessel, and designing the attachments to the vessel.

Building Design

Our building design experience ranges from one-story and two-story tilt-up concrete buildings with steel or wood framing to multi-story braced frame steel buildings. The buildings are generally for port, office, commercial, and industrial uses. In addition to traditional building structures, we also design miscellaneous structures in port terminals including canopies, light poles, guard booths, and truck wash facilities. During the design process, we review our designs with owners and contractors to ensure the most cost-effective design.

Seismic Design

Our experience with seismic design includes evaluation and design of buildings, container cranes, unloaders, and wharf structures. After the Loma Prieta earthquake, we provided structural evaluation of several buildings. After the Guam and Kobe earthquakes, we evaluated crane and wharf structures and helped owners determine the future of their structures. We provided the design reconstruction of a portion of the wharf at Guam. For new cranes, buildings, and other structures, we provide innovative and economical earthquake-sound designs using the latest technology. We have performed seismic studies using finite element time history analysis to evaluate the performance of several container crane and unloader structures.

Crane Analysis Software

We developed a proprietary program for the design and analysis of quay cranes and other container handling equipment. The program is capable of designing or analyzing cranes for the various international standards. We have licensed the software to select crane manufacturers.

More Information

For more information, please visit the Liftech website: www.Liftech.net

CONTACT INFORMATION

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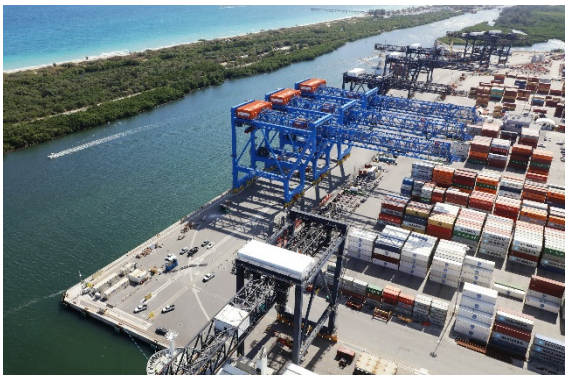
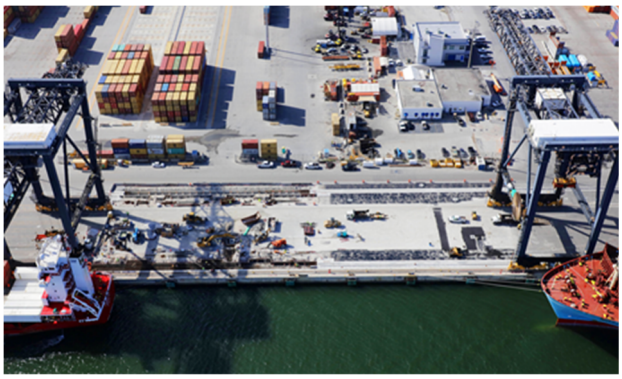


New cranes in blue operating with existing cranes



Cranes operating and new girder construction

Crane Procurement, Crane Modification, and Wharf Expansion
Port Everglades Department of Broward County, Fort Lauderdale, FL

Port Everglades operates seven 1990s, 46.5-LT capacity low profile STS cranes at their Southport terminal for servicing vessels up to 16 containers across. The port is also serving vessels up to 22 containers across with up to 8 high on deck and purchased new 65-LT capacity cranes.

Liftech made studies to determine parameters for the new cranes and identify required upgrades to the landside infrastructure. Liftech provided crane procurement specifications, design review, and fabrication review services for the new cranes fabricated in China.

Liftech designed upgrades for the existing cranes including lift capacity increase from 46.5 to 65 LT and crane structure upgrades to comply with current wind design loads. The upgrade required replacing the existing DC main hoist drive. To simplify maintenance, the main hoist, trolley, boom hoist, and gantry DC drives on the existing cranes were replaced with new AC drives.

Liftech designed 5,000 feet of new crane girders, about 3,500 feet for the new cranes at Berths 30–32, and an additional 1,500 feet for the existing cranes at Berth 30. The new girders were offset from the existing girders, permitting continued operations of the existing cranes during construction, and to suit a larger rail span. The crane girder systems include cable trenches, power vaults, crane stowage locations, rail frogs, and compact crane stops.

Other infrastructure work included a two-story building to house switchgear for a 13.2 kV power supply.

Client:
Port Everglades Department
of Broward County
Fort Lauderdale, Florida, USA

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Berths 57-59 Wharf
Port of Oakland, California

Liftech designed a new 3,600-foot container wharf for the Port of Oakland at Berths 57-59. This $90 million construction project gives the port a state-of-the-art facility designed to resist the highest probable earthquakes with minimum damage. The wharf serves six new container cranes for which Liftech provided design and fabrication review.

The innovative wharf design used 48-inch diameter cylinder piles and standard 24-inch prestressed piles in combination with cement deep soil mixing (CDSM). Liftech also developed a new ductile shear key design for use between wharf sections that is economical and easily repairable.

The project involved excavation of 2.1 million cubic yards of soil; stockpiling, testing, and treating 400,000 cubic yards of material; installation of CDSM walls, large diameter piling, and storm drains; and construction of an embankment dike and fill that was incorporated into Middle Harbor Shoreline Park.

Reference:
Port of Oakland
Oakland, California, USA

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Wharf and Crane Study
Port of Oakland, California

Liftech conducted an extensive wharf and crane study to help the Port of Oakland in their overall planning. Liftech calculated the ultimate wheel load capacity of all crane rail girders, waterside and landside, at all dockside container wharves for current and future channel depths. Liftech also calculated the wheel loads of all the dockside container cranes at the port. The port can use the calculated capacities to determine which cranes can be relocated from one wharf to another.

Reference:
Port of Oakland
Oakland, California, USA

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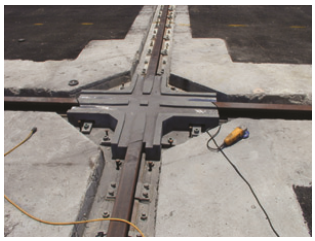


Crane Transfer System Design, Berth 30
Port Everglades, Florida

Many wharves have nonlinear berths that meet at a corner. It is often economical to share cranes between these berths. To share, cranes must transfer between them. Transfer methods range from shuttle systems that move the cranes between the berths to curved rails that the cranes gantry on. Recently, the most popular method has been the curved rail. This seemingly simple method is actually complicated to design and has many options for the owner. Larger curve radii use up valuable yard space. Smaller radii may require a side shift mechanism in the gantry system to accommodate gage change. Extending straight rails to the corner requires switches and a power transfer method.

Liftech assisted with the wharf design for a 900-foot berth extension. As subconsultant to Sverdrup, Liftech designed the curved rail, switches, and frogs to enable crane transfer between adjacent perpendicular wharves.

Reference:
Sverdrup Civil, Inc.
Edison, New Jersey, USA

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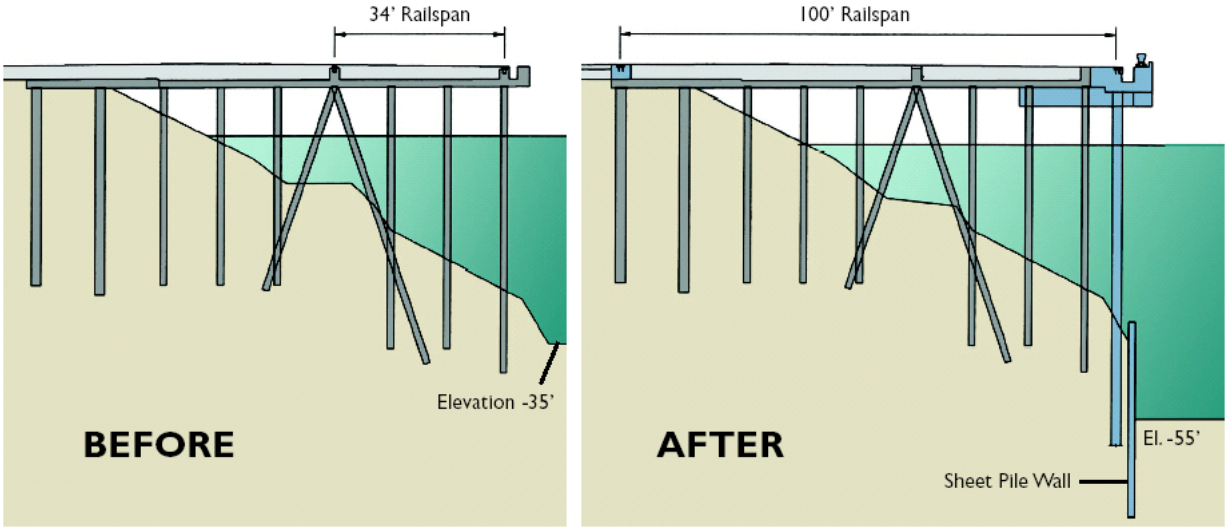

Port of Oakland Berths 32 & 33 Rehabilitation
Oakland, California

Liftech designed a remodel to a 1,500-foot container wharf for the Port of Oakland at Berths 32 & 33 and a new 250-foot wharf extension to Berth 30. This $20 million construction project allows 100-foot rail span container cranes to travel from the Berth 30 wharf to the Berths 32 & 33 wharf. In addition, sheet piling was installed at the toe of the embankment to allow the berth to be dredged to elevation -55 feet. Without the remodel, Berths 32 & 33 could only accommodate 34-foot rail span cranes, and the cranes could not travel between Berths 32 & 33 and Berth 30.

Reference:
Port of Oakland
Oakland, California, USA

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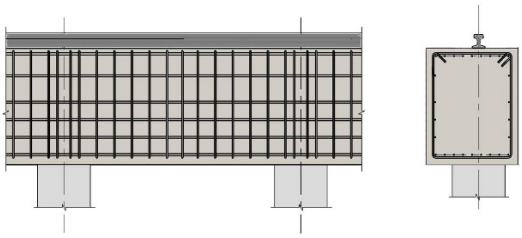
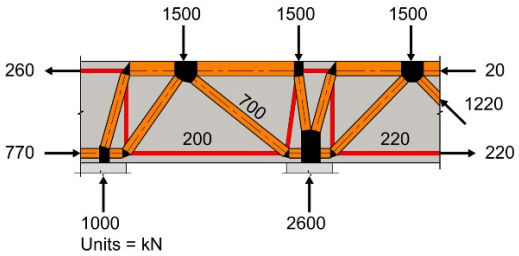


Crane Girder Structure



Strut-and-Tie Model

Wharf Evaluation and Modification
Portsmouth, Virginia

The rated capacity of existing wharf structures was increased up to 35% after Liftech evaluated the strength of the structures at Portsmouth Marine Terminal.

Increasing the rated load eliminated the need to strengthen the wharves or limit the operations of the larger, newly purchased cranes. Liftech's assessment included state-of-the-art methods such as strut and tie.

Liftech also designed improved stowage hardware for both the newly purchased cranes and existing cranes. The design facilitated installation and integration with the existing wharf structures.

Reference:
Virginia Port Authority
Norfolk, Virginia, USA

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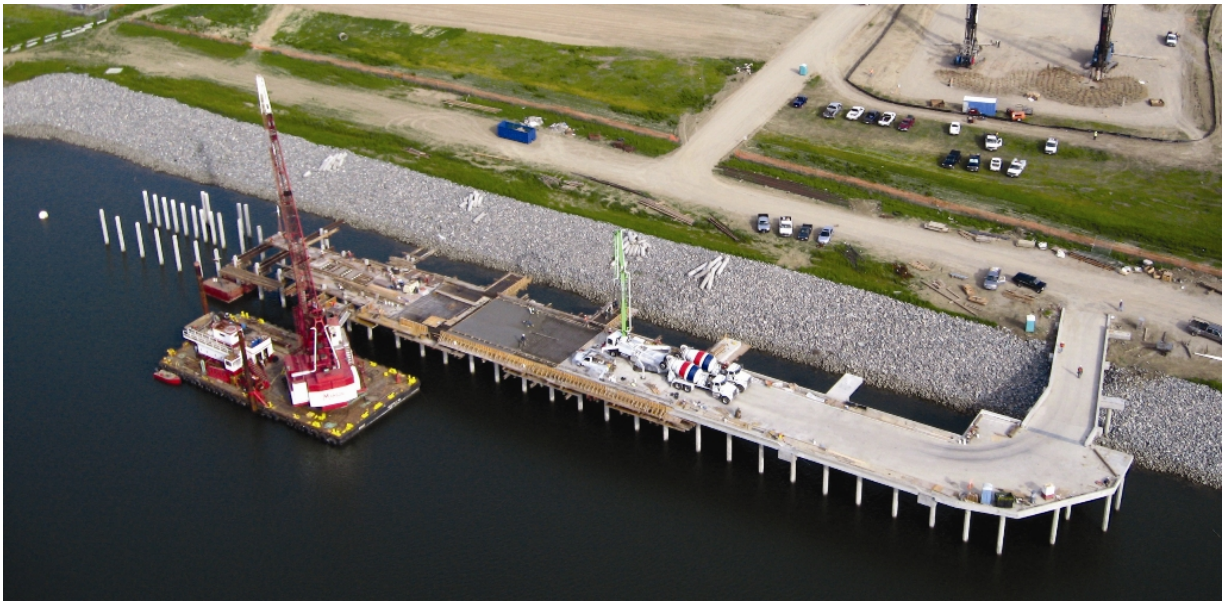

Cemex West Sacramento Wharf Project
Sacramento, California

Liftech worked with Manson Construction as part of their design-build team to design the wharf, access bridge, and mooring platform structures for a cement unloading facility for Cemex Inc. The 550-foot wharf supports a cement unloader and screw conveyor system to transfer cement from the vessel to storage structures on land. The moment frame design for the wharf structure limits seismic forces on the unloader and conveyor structures.

Liftech also made a dynamic analysis of the combined wharf and unloader structure for seismic forces.

Reference:
Manson Construction Company
Richmond, California, USA

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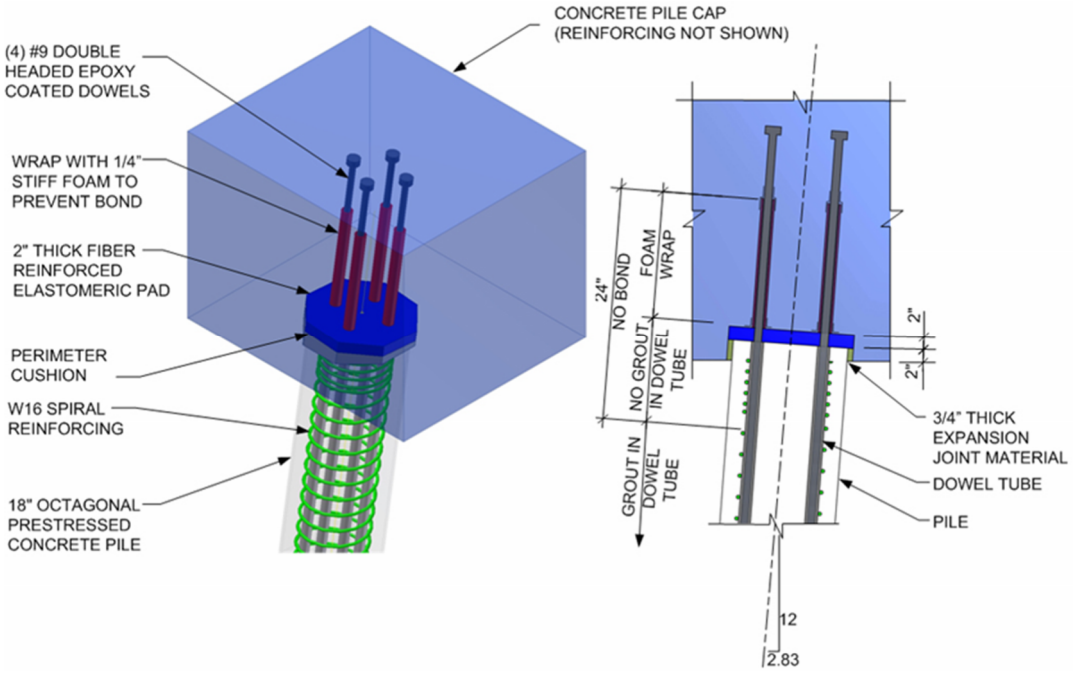

McNears Beach Pier Repair and Seismic Upgrade
Marin County, California

During a storm, a 100’ by 400’ barge broke its mooring and collided with the pier at McNears Beach Park, damaging about half of the pier structure.

The original pier structure consisted of a precast concrete superstructure supported by slightly battered 18” octagonal precast, prestressed piles.

Liftech designed a replacement pier structure with details to provide significantly better seismic performance. These details included pile-to-pile cap connections designed using a fiber reinforced bearing pad, isolating the sides of the embedded pile, and unbonding the dowels for 24” of length. This flexible connection results in considerable elastic rotation.

Testing by the University of Washington has shown that similar connections perform significantly better during seismic loading than a classical pile connection.

Client:
Manson/Dutra JV
Richmond, California, USA

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Port of New Orleans Wharf Analysis
Port of New Orleans, Louisiana

Global Rigging & Transport unloaded two Doosan cranes at the Port of New Orleans using a dolly system.

Liftech reviewed the wharf structure to determine its adequacy to support the dolly loads and helped select the offload location.

Reference:
Global Rigging & Transport, LLC
Virginia Beach, Virginia, USA

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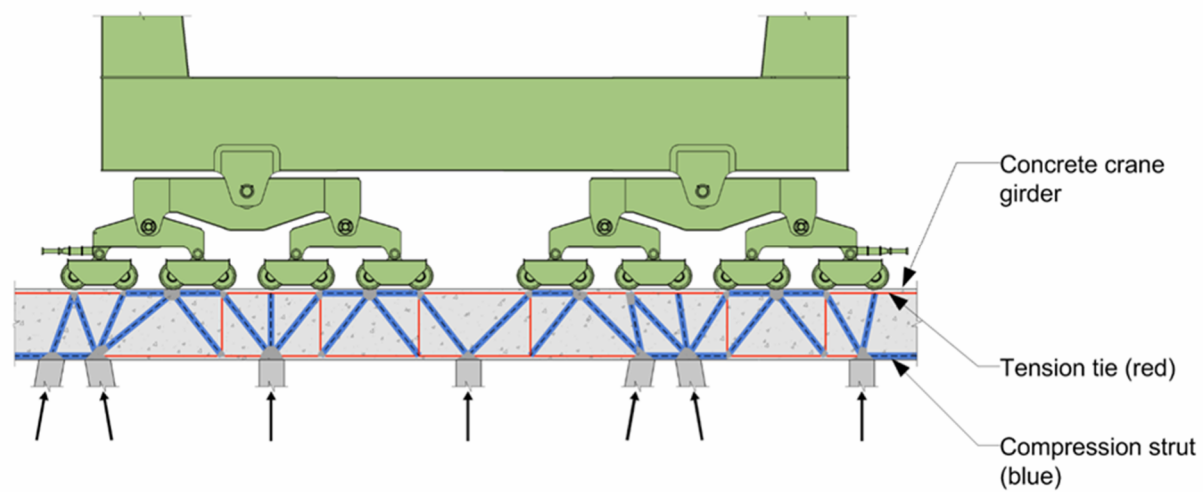

Wharf Crane Girder Capacity Study
Halifax, Nova Scotia, Canada

A Halifax Port Authority tenant purchased new ship-to-shore container cranes. The wharf was extended several times between 1969 and 2010. The new crane wheel loads exceeded the allowable wheel loads on the existing girders. The port authority was faced with the possibility of reinforcing the majority of the girders.

Liftech analyzed the girders and estimated the girder capacity for shear, flexure, concrete bearing, and pile bearing. The capacities of a significant portion of the girders were governed by shear, as calculated with conventional analysis.

Liftech further analyzed these girders using strut-and-tie model analysis as permitted by the concrete design code, and justified up to 70% higher shear capacity. With the advanced analysis, girder reinforcing was limited to only a short span, resulting in significant cost savings for our client.

The figure above shows the concrete girder as a strut-and-tie model.

Reference:
Halifax Port Authority
Halifax, Nova Scotia, Canada

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Water Emergency Transportation Authority (WETA)
South San Francisco Ferry Terminal
Float and Gangway
Oyster Point Marina
South San Francisco, California

As part of a Manson Construction Company design-build team, Liftech designed a 103-foot-long steel truss gangway, a 45-foot-wide by 115-foot-long post-tensioned concrete float, and mooring dolphins. The float is used to berth ferry boats.

The design includes gangway supports that permit large lateral displacements between the pier and float during seismic events.

The ferry terminal is designed to be operational after a large earthquake.

Reference:
Manson Construction Company
Richmond, California, USA

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Port of Redwood City Wharf Design
Redwood City, California

Liftech worked with Manson Construction Company as part of their design-build team to design a 426-foot-long wharf, two access bridges, a 955-foot-long sheet pile seawall, mooring platforms, walkways, and a longshoreman building. The moment frame and thin deck of the wharf structure limit the seismic forces and number of piles required.

References:

Manson Construction Company
Richmond, California, USA

Port of Redwood City
Redwood City, California, USA

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Marine Oil Terminal, Wharf Replacement
International-Matex Tank Terminals, Richmond, CA

International-Matex Tank Terminals (IMTT) replaced portions of an existing wood wharf structure at their Richmond, California, facility to meet Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS).

Liftech worked with Manson Construction Company to develop the replacement design. The design allowed IMTT to limit time on-site and maintain operations during construction. The design consists of individual steel-framed platforms supported on steel pipe piles and connected walkways. The structure includes two platforms for piping operations and eleven dolphins for mooring and berthing.

Liftech worked closely with California State Lands Commission and other agencies to help obtain necessary permits. This retrofit was the first major project designed and built to meet the MOTEMS code requirements.

Reference:
International-Matex Tank Terminals
Richmond, California, USA

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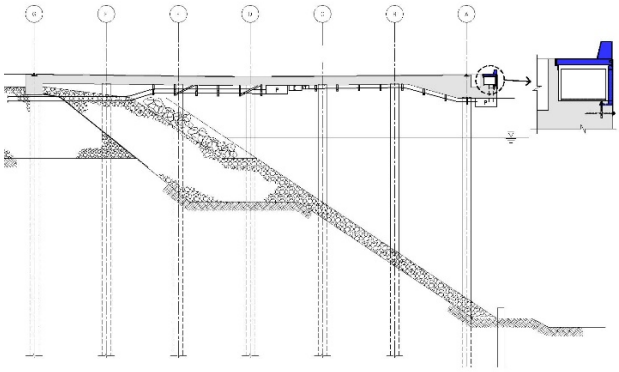

Port of Oakland Shore Power
Oakland, California

Liftech provided structural engineering services for wharf structure modifications to accommodate shore power vaults at Port of Oakland Berths 25, 30, 32, 35, 37, 55–59, 67, and 68.

We developed various solutions for different wharf configurations. For wharf configurations with limited space between the crane power trench and wharf edge, we developed a steel frame vault concept that fits within the limited wharf space. We also identified the wharf area where the vault can be located to avoid additional wharf strengthening.

Reference:
Moffatt & Nichol
Oakland, California, USA

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Bigge Heavy Lift Cranes

Bigge Power Constructors built large capacity derrick cranes intended for large scale modular construction of nuclear power plants.

Each crane rolls on a circular track. This particular application required a capacity of 4,000 short tons at a radius of 240 feet from the center of rotation, 836 short tons at 640 feet, and 500 short tons at 790 feet. This layout allows the crane to reach multiple locations within a plant, eliminating the need to relocate the crane during the project's construction.

Liftech assisted Bigge's engineering team with the design of the boom, mast, and carriage assemblies of the new cranes, and structural analysis of part of the crane assembly. Liftech also provided peer review and engineering support for some other aspects of the project.

Reference:
Bigge Power Constructors
San Leandro, California, USA

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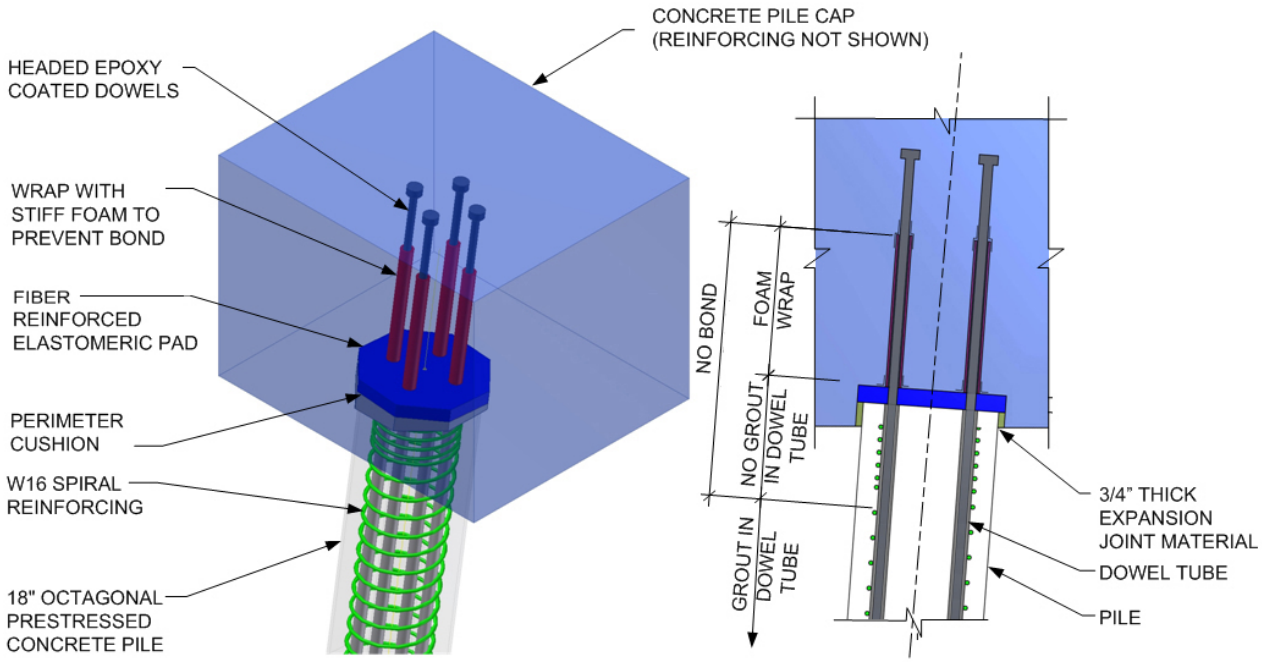
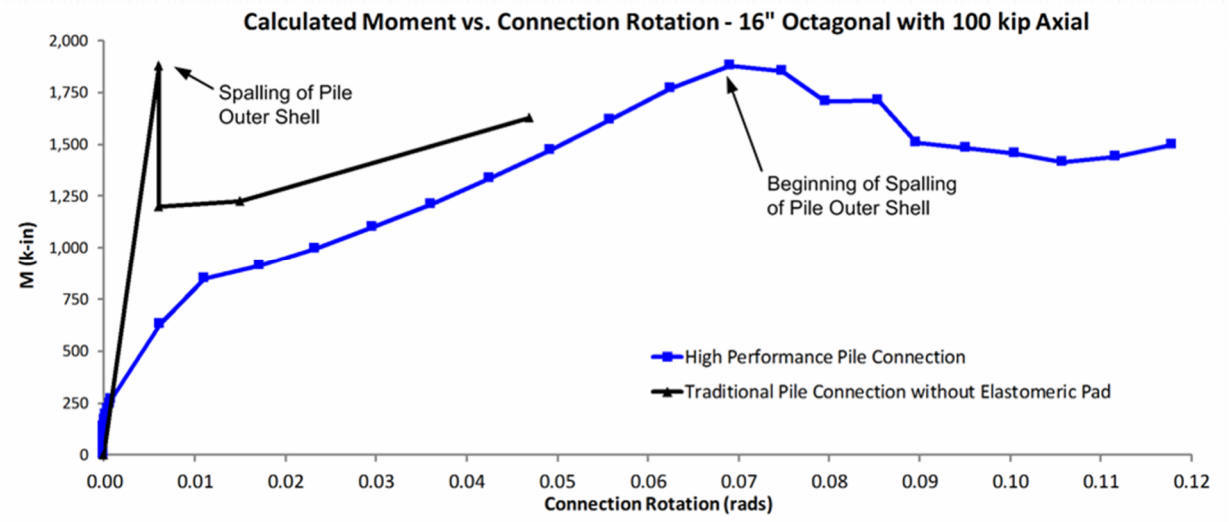


High Performance Pile Connection

Liftech designed a high performance pile connection to permit significant rotation between the pile and pile cap without damage. The increased flexibility, rotation, and damping will reduce earthquake forces that develop in the structure, and reduce or avoid damage during minor earthquakes.

The fiber reinforced elastomeric pad between the end of the precast pile and pile cap increases connection flexibility, better distributes bearing forces, and provides damping. Fiber reinforced elastomeric pads are commonly used to limit impact forces and control vibration, and are commonly used as exposed bridge bearings. The unbonded length of dowel increases the length over which the dowel stretches, increasing the connection flexibility. The perimeter cushion of expansion joint material allows for relative movements between the pile and cap and is sealed with silicone caulk.



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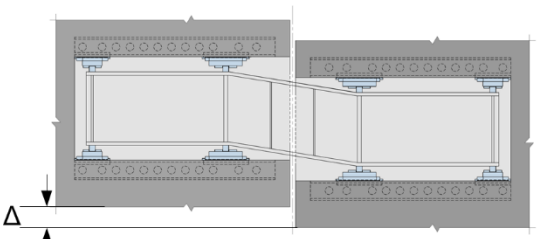
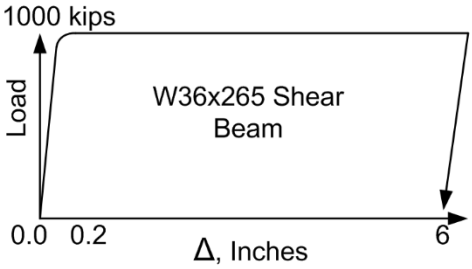
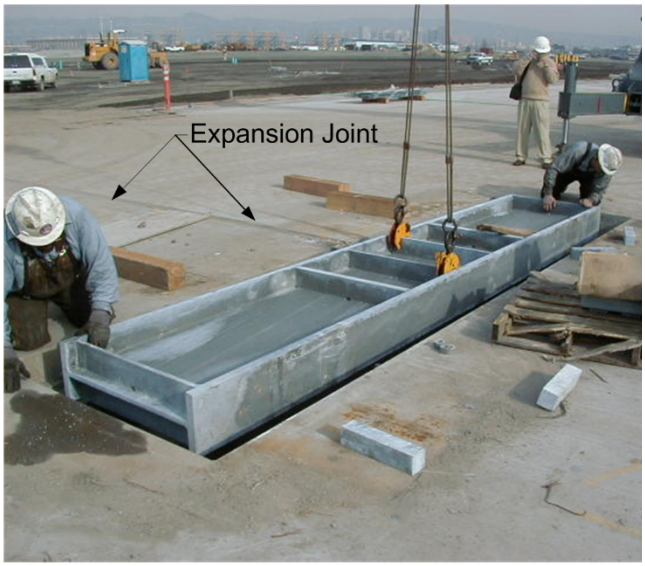
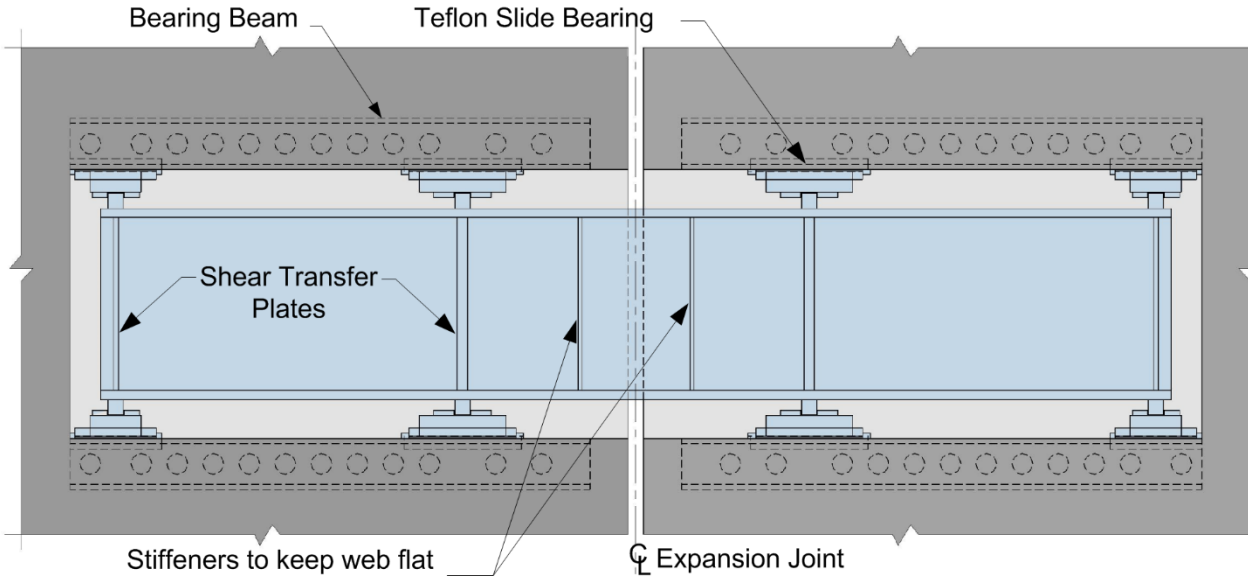


Plan View – Deformed Beam





Beam Installation



Wharf Ductile Shear Key

Shear keys connect wharf sections at expansion joints, permitting relative longitudinal movement between sections while restraining transverse movement. Shear keys experience large loads during earthquakes and are sometimes damaged. Traditionally, keys have been made of reinforced concrete.

The ductile shear key is made of a steel beam. It will yield in a large earthquake and provide significant energy absorption and damping through multiple cycles of deformation. The beam can be easily removed and replaced.

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Finned Monopile

Pile supported dolphins are used to moor and berth vessels. Supporting a dolphin structure with one large pile is often advantageous compared to using multiple smaller piles. One pile is often easier to fabricate and install than a structure with several piles; and fenders, platforms, and other hardware can be secured with one simple connection to the pile, facilitating the use of a prefabricated superstructure.

Large lateral soil pressures develop where the pile enters the soil. If the pressure is too large, the soil might fail plastically and the pile could become out of plumb.

Liftech developed a design in which fins are welded to the pile as shown in the photograph above. The fins develop large forces near the soil surface, reducing the required pile embedment. If an accidental overload occurs, the fins reduce the permanent lateral displacement.

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Container Yard Construction, Berths 55 & 56
Port of Oakland, California

Liftech performed the structural design for this 34-acre container terminal. The terminal includes buildings for administration, marine operations, and maintenance and repair. Other structures designed for special operations included gate structures, reefer wash facility, marine restroom, guardhouse, and trouble kiosk.

Reference:
Port of Oakland
Oakland, California, USA

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Berth 30 Container Terminal Buildings
Port of Oakland, California

Liftech performed the structural design for three marine terminal buildings. The three-story administration building has an eccentrically braced steel frame. The entrance lanes to the terminal are located under the building. The marine operations and the maintenance and repair buildings have exterior concrete walls and steel framing.

The project was awarded a 1995 Honor Award from the American Institute of Architects and the Waterfront Center "Excellence on the Waterfront Award" in 1994.

Reference:
Trans Pacific Container Service Corp.
Oakland, California, USA

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Port of Oakland Berths 57 & 58 Container Yard Construction
Oakland, California

Liftech performed the structural design for new container terminal buildings and structures, including masonry longshore buildings, foundations for three maintenance pre-engineered metal buildings, a gear storage building, a clerk/cashier building, gate structures, and other miscellaneous yard structures used for operations and to monitor traffic through the yard.

Reference:
Port of Oakland
Oakland, California, USA

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SELECTED CRANE GIRDER CAPACITY ANALYSIS PROJECTS

Client & Location	Year	Project Description
Total Terminals International Port of Long Beach Pier T Long Beach, California	2016 & 2018	Phase 1: A two-dimensional finite element analysis (FEA) of the crane girders to determine the feasibility of justifying increased crane girder capacity to accommodate EEE-compatible container cranes. Phase 2: A three-dimensional FEA of the waterside crane girder and two-dimensional FEA of the landside crane girder to determine if the existing structure requires strengthening to accommodate new and larger container cranes. A strut-and-tie analysis was also used to evaluate the waterside girder.
Port of Oakland Oakland, California	2017	Several years ago, Liftech conducted an extensive wharf and crane study to help the Port of Oakland in their overall planning. Liftech calculated the ultimate wheel load capacity of all crane rail girders, waterside and landside, at all container wharves for current and future channel depths. Liftech also calculated the wheel loads of all the dockside container cranes at the port. The port can use the calculated capacities to determine which cranes can be relocated from one wharf to another or what new cranes are practical. Liftech provides periodical updates due to code changes or more refined analyses to justify increased capacity.
Port of Felixstowe Felixstowe, England, UK	2015	Evaluated the landside crane girder system at Berths 5, 6, and 7 of the Trinity III wharf to determine the existing capacity. Analyzed the landside crane girder and pile caps using strut-and-tie analysis. Developed procedures for load testing the landside girder to determine whether the existing structure requires strengthening. Provided recommendations regarding possible reinforcement.
Ports America Port of Oakland, California	2015	Assessed the capacity of the existing crane girders at Berths 22 to 26 to determine the adequacy of the wheel loads for new and larger container cranes. Provided girder strengthening suggestions, cost estimates, and anticipated schedule for upgrading the girders.
Halifax Port Authority Halifax, Nova Scotia, Canada	2012	Using strut-and-tie model analysis, justified the crane girder capacity up to 70% higher than the published capacity, allowing placement of new ZPMC cranes.
APL Limited Port of Los Angeles, California	2011	Performed two-dimensional finite element analyses of the existing concrete crane rail girders at Pier 300 and justified girder capacities 15% and 45% greater than the reported capacities.
Panama Ports Company Port of Cristobal, Panama	2011	Performed two-dimensional finite element analysis of the existing concrete and steel crane rail girders and determined that there was sufficient capacity for new cranes.
Matson Navigation Sand Island, Hawaii	2011	Performed calculations for the existing concrete crane rail girders, and justified girder capacities 9% to 80% greater than the reported capacities.

Client & Location	Year	Project Description
New York Container Terminal Port Authority of New York	2010	Performed two-dimensional finite element analysis and strut-and-tie analysis for the existing concrete crane rail girders, and justified girder capacities significantly larger than the reported capacities. Assisted NYCT with a detailed Port of New York and New Jersey review.
APL Limited Dutch Harbor, Alaska	2010	Performed two-dimensional finite element analysis for the existing concrete and steel crane rail girders and justified girder capacities 30% to 140% greater than the reported capacities.
Port Authority of Guam	2009	Performed a two-dimensional finite element analysis of the existing concrete crane rail girders and determined that there was sufficient capacity for newly modified cranes that were being installed at the port.
Yusen Terminal Port of Los Angeles, California	2007	Performed conventional two-dimensional finite element analysis and strut-and-tie analysis of the existing concrete crane rail girders and justified girder capacities 45% to 70% greater than the stated capacities.
Esperance Port Authority Esperance, Western Australia	2007	Performed a two-dimensional finite element analysis of the existing concrete crane rail girders and determined that there was sufficient capacity for new bulk unloaders being installed at the port. Strut-and-tie analysis was used to justify greater girder capacities.
Matson Navigation Hilo & Kahului, Hawaii	2007	Performed two-dimensional finite element analysis of the existing concrete crane rail girders and determined that there was sufficient capacity for planned cranes.

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SELECTED CRANE LOAD STUDY PROJECTS

Client & Project Location	Year	Project Description
Virginia Port Authority NIT North, Virginia	2022	Provided a feasibility study and budgetary cost estimates for up to eight of the largest low profile shuttle boom cranes to date and estimated crane wheel loads for wharf modifications for NIT North.
WSP Port of Guam	2022	Provided engineering services for crane load study for a 50 gage crane capable of sustaining 210 mph wind. Assisted WSP/Port of Guam with technical crane specifications, crane procurement documents, and developing scope for wharf improvements and crane review.
Port of Oakland SSA Terminals Oakland, California	2020	Verified weighing procedure, observed weighing, and reviewed wheel load and stability calculations.
Everport Terminal Services Ports of Oakland and Tacoma	2019	Estimated crane wheel loads for potential raise modifications of three cranes for Port of Oakland and seven cranes for Port of Tacoma.
CH2M Hill Virginia Port Authority NIT South, Virginia	2019	Estimated crane wheel loads for increasing the lift height of up to eight existing ZPMC STS cranes by 40 ft to determine if wharf capacity would be exceeded.
Everport Terminal Services Port of Los Angeles	2018	Provided engineering services for a wheel load study to determine if the wharf capacity is adequate to accommodate the wheel loads of three potential future cranes.
Moffatt & Nichol Long Beach Container Terminal, California	2017	Calculated automatic stacking crane longitudinal rail loads based on acceleration measurements.
Moffatt & Nichol T5 Wharf, Seattle, Washington	2017	Developed recommended wharf design loads for potential future cranes to service ultra large container vessels.
Hongkong International Terminals, Hong Kong	2017	Estimated crane wheel loads and tie-down loads for the purchase of two STS cranes for HIT's Hong Kong terminal.
DP World Saint John, NB, Canada	2016	Estimated wheel loads for operating larger used cranes relocated to the terminal.
Modern Terminals T1 & T2, Hong Kong	2015	Estimated crane loads based on supplier proposed designs to determine if wharf capacity would be exceeded.
Port Everglades, Florida	2015	Developed concept design for new low profile crane. Estimated crane loads for the design of the new crane girder system.
Port of Oakland Berth 25-26	2015	Estimated wheel loads for a potential raise modification of two existing cranes.
CH2M Hill Port of Anchorage, Alaska	2015	Assisted with definition of crane geometry based on the port's operational requirements. Estimated crane loads for this geometry and provided design review for crane-wharf interface hardware.
KPFF Consulting Engineers Port of Tacoma, Washington	2015	Estimated crane loads for the design of a new wharf at Pier 4 for 100 ft gage cranes capable of serving ultra large container vessels.
PBI/CYS MOTCO, Concord, California	2014	Estimated crane design loads for a new wharf structure to support military operations.

Client & Project Location	Year	Project Description
APM Terminals	2014	Estimated crane loads to assist in the potential relocation of cranes from a terminal on the West Coast to one in the southwest.
ZPMC Intermodal Yard Crane Concept Design Review	2014	Estimated crane loads including those for travel on a curved rail, e.g., lateral loads on rollers and reactions between gantrying system components.
Moffatt & Nichol TraPac, Port of Los Angeles, California	2013	Estimated crane loads for 42 m gage RMG cranes at Berths 142 to 147 for design of crane rail and foundation.
McKay International Engineers Mississippi State Port Authority, Gulfport	2013	Estimated crane loads and recommended design loads for upgrading the existing wharf to support larger container cranes that are capable of serving larger vessels.
APM Terminals	2013	Estimated crane loads for a potential crane raise to confirm that the crane loads would not exceed the wharf rated capacity.
Parsons Long Beach Container Terminal, California	2013	Estimated crane loads for 51 m gage RMG cranes at Pier E for design of crane rail and foundation.
CH2M Hill Port Newark Container Terminal, New Jersey	2013	Estimated crane loads for new low profile cranes for design of new wharf structure.
CH2M Hill Port Newark Container Terminal, New Jersey	2012	Estimated crane loads for new Super post-Panamax cranes for design of wharf structure.
Virginia Port Authority Norfolk, Virginia	2012	Estimated crane loads for hurricane winds for existing ZPMC cranes in Houston to assess the feasibility of relocating the cranes from Portsmouth, Virginia, to Houston, Texas.
Officine Meccaniche Galileo La Spezia, Italy	2012	Developed conceptual design for a 62 m outreach crane with a narrow rail gage on an old wharf with limited wheel load capacity. Optimized crane design to minimize wheel loads.
Port of Houston Authority Houston, Texas	2012	Estimated crane loads and recommended design loads for upgrading the existing Barbours Cut Terminal wharves to support larger container cranes capable of serving 22-wide vessels. Assisted the port in selecting the crane configuration criteria.
Moffatt & Nichol Port of Long Beach, California	2011	Collected crane data from five crane manufacturers, reviewed equipment arrangements, developed seismic and wind load criteria, and estimated wheel loads for automated stacking cranes at an automated yard at Pier E.
TransHoist Engineering Inc. Cai Lan (Hanoi), Vietnam	2011	Estimated crane loads for new 49 m outreach, 42 m lift height ZPMC cranes. Wheel loads were estimated for 20 m and 30.48 m crane gages.
Moffatt & Nichol Port of Long Beach, California	2010	Provided recommended design crane loads for new wharf structure at Pier E to support cranes with a 120 ft rail gage, dual trolleys, tandem front lift, and single back lift.
APL Limited Dutch Harbor, Alaska	2010	Calculated crane loads on wharf for a modified MES crane with articulating boom, evaluated wharf capacity for crane loads, and designed wharf modifications to stow crane on wharf.

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SELECTED RAIL PROJECTS

Client & Location	Year	Project Description
Power Engineering Construction Company Alameda, California	2018	Designed new wheel and rail system for several marine gangway systems.
Port Everglades, Florida	2015	Designed new DIN A150 gantry rail system on new crane girders to accommodate the largest low profile cranes in the world and new 171 pound crane rail for extending the existing crane rail system. Included frog details for rail crossing.
AECOM Melbourne, Australia	2014	Designed new gantry rail system to accommodate existing and new cranes at Swanson Dock. Included typical and expansion joint details.
APM Terminals	2011	Designed trolley rail replacement, including a new detail at boom hinge and epoxy grouted support to improve rail vertical alignment.
Hutchison Port Holdings Sydney, Australia	2011	Detailed review of boom rail stresses for a low profile container crane.
Johnson, Mirmiran & Thompson Port of Baltimore, Maryland	2009	Provided consulting for gantry rail replacement project at the Dundalk Terminal. Rehabilitation work was due to vertical and lateral alignment issues.
Yusen Terminals Inc. Port of Los Angeles, California	2008	Designed temporary landside crane rail and foundation system to temporarily support four new MES cranes at Berth 218. The temporary rail was used during erection and storage until the new wharf was ready.
Whitney Bailey Cox & Magnani Baltimore, Maryland	2008 & 2006	Provided trolley rail replacement procedures for two cranes involving increasing the rail size and redesigning the rail joint at the boom hinge.
Manson Construction Co. Sacramento, California	2007	Provided wharf design as part of design-build team for a 550-ft long cement unloader wharf with rail systems nearly the full length at Cemex West Sacramento Import Terminal.
Moffatt & Nichol Port of Tampa, Florida	2005	Provided curved gantry rail design for transferring container cranes between non-linear berths at Berth 213.
Gantry SA Belgium Bremerhaven, Germany	2005	Provided curved gantry rail design geometry for transferring container cranes between non-linear berths. A constant radius curve was used at the waterside.
TG Engineers Port of Guam	2004	Designed a two-berth wharf structure, including new rail systems for post-Panamax cranes.
Holmes and Narver Port of Los Angeles, California	2003	Curved gantry rail design for Pier 400 at the Port of Los Angeles, including a detailed review of rail and grout stresses at Pier 400.

Client & Location	Year	Project Description
Port of Oakland, California	2001 to 2003	Provided structural design of the rehabilitation of an existing 1,700-ft container wharf at Berths 32–33. Modifications included adding a new waterside crane girder with rail systems for 100-ft gage container cranes.
Modern Terminals Hong Kong	2002	Provided design of curved rail at Berth One, Kwai Chung. Reviewed design of switching system and frog to enable crane transfer between adjacent non-parallel wharves. Evaluated stresses in rail and grout and assisted in designing special rail clips to resist rail uplift from typhoon winds.
Port of Oakland, California	1999 to 2000	Designed structure of a new 3,600-ft container wharf at Berths 57–59, including container crane gantry rail systems with multiple expansion joints.
Port of Amsterdam	1998	Designed curved gantry rail design geometry for transferring cranes around perpendicular rails.

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SELECTED WHARF DESIGN AND ANALYSIS PRODUCTS

Client & Project Location	Year	Project Description
Tropical Shipping St. Croix US Virgin Islands	2024 & Ongoing	Review wharf condition. Evaluate crane loading for potential new crane. Analyze crane girder system to calculate capacity. Report findings and recommendations. Potentially design strengthening.
Reyes/Larison JV Berths 177–182 Port of Los Angeles, California	2024	Provide calculations confirming that the new mooring system meets the specified design criteria.
Port of Oakland Berths 34–38 and Berths 60–63 Oakland, California	2024 & Ongoing	Perform site condition survey of soffit corrosion damage of cover delamination, spalling, and reinforcing corrosion loss. Analyze strength of the damaged deck to evaluate acceptability of various operational vertical loads.
Michael Baker International, Inc. Port of Oakland Berths 24–25, TraPac Terminal Oakland, California	2024 & Ongoing	Perform analysis of Berths 24–25 landside and waterside crane girders to justify larger capacity supporting the proposed new cranes, allowing TraPac to procure new cranes and expand the terminal operation to B24-25.
Colon Container Terminal Panama	2024 & Ongoing	Review wharf condition including specifying inspections. Analyze crane girder system to calculate capacity. Report findings and recommendations for strengthening. Potentially design strengthening.
Matson Terminals Port of Alaska – Terminal 1 Anchorage, Alaska	2024	Performed design review of new wharf design with focus on crane-wharf interface, including electrical system, tie-downs, stowage sockets, rail, and crane stop design. GHD-WSP JV designed Terminal 1 (T1) wharf. Providing engineering support for crane procurement.
Virginia Port Authority Norfolk International Terminal (NIT) North Wharf Improvements Norfolk, Virginia	2023	Performed design review of new wharf design for crane-wharf interface hardware including electrical system tie-downs, stowage sockets, rail, and crane stop design at NIT North Wharf. WSP designed the North Wharf improvements.
Mott MacDonald Port of Oakland, Berth 10 Oakland, California	2023 & Ongoing	Designed mooring and berthing systems and limited concrete repairs for berthing varying sized barges and tugboats. Confirmed wharf structure capacity and designed localized reinforcing. Prepared construction documents for steel pipe piles fendering system and reused bollards.
Paradise Beach Pier County of Marin Parks Marin, California	2023	Performed structural assessment and repair study of Paradise Beach fishing pier, constructed in 1979, precast Tee beams spanning between precast girder bents. Recommended corrosion damage repairs and repair schedule.

Client & Project Location	Year	Project Description
McNears Beach Fishing Pier Marin, California	2023	Severe winds blew a concrete boat into the pier causing significant localized damage. Performed damage evaluation and recommended the damaged section be shored for structural stability and repairs. Developed shoring plan that avoided costly in-water work. Designed two repair options depending on extent of underwater pile damage discovered after boat removal.
Matson Terminals Port of Dutch Harbor Unalaska, Alaska	2023 & Ongoing	Structural analysis of existing crane girder system for new crane loads, including increased crane girder capacities. Develop preliminary design modification concepts for upgrades to the crane stowage areas, including girder reinforcements, tie-downs, stowage sockets, and crane stops. Provide engineering support for crane procurement.
Mott MacDonald Port of Oakland California State Grant Support Oakland, California	2023	Developed technical basis and cost estimates for various potential upgrades as part of grant submittal. Work included evaluating existing and required crane girder capacities, concept designs for crane girder system upgrades including strengthening and new girders, crane fender and bollard upgrades, grading, input on electrical system upgrades, and arrangements for storm water trash collection vaults.
Confidential	2022	Designed concept for extending wharf for bulk operations including strengthening for larger vessel and fender lowering, the addition of on-wharf hoppers, supports for added conveyor system, and new on-land mooring platforms. Provided report explaining required modifications, concept design, and cost estimate.
Port of Oakland Berths 9, 10, 20, 21 Oakland, California	2022	The concrete wharf structure at Berths 9, 10, 20, and 21 was constructed in the 1940s and had damage to the pilings and deck. Various repairs were performed over the years. At Berth 10, the port wanted to use the wharf for storing and handling dredging materials. Performed wharf assessment review and documented the damaged condition. Based on the existing condition, performed analysis to determine the safe loading that can be applied on the wharf deck. At Berths 9, 20, and 21, the port wanted to perform berth dredging and was concerned about the impact to the wharf structure. Performed analysis to demonstrate the impact to the wharf structure is small. Performed a wharf assessment at pre-dredged condition and another assessment at post-dredged condition. Documented the existing damage for future reference.

Client & Project Location	Year	Project Description
AAK USA, Inc. Terminal 2 Port of Richmond Richmond, California	2022	Designed short-term repair of a fender system that was damaged by vessels berthing. Work included removing damaged timber piles, designing 55-ft-long steel waler beams spanning between the undamaged composite piles, and providing support to assist obtaining repair permit through approval agencies.
Winehaven Legacy LLC Point Molate Pier Richmond, California	2021	As part of Point Molate Development, evaluated the wharf condition and recommended follow-up work to address the damage identified in the assessment. Developed a concept layout for a water taxi terminal.
WSP USA Berths F4 to F6 Port of Guam Piti, Guam	2021	Designed Berth F5 in 1998 and provided crane girder upgrade design at Berths F4 and F6 in 2008. Provided girder capacities for Berths F4 to F6 to help the port determine the allowable crane wheel loads for larger cranes and with preparing the crane specification.
Power Engineering Construction Company Pier 22 ½ Port of San Francisco San Francisco, California	2019	Designed the marine components of the new floating San Francisco Fire Station 35. Included a landside pier near the bulkhead of the San Francisco seawall. The design dealt with significant seawall seismic design movements. The steel superstructure was installed into sockets on top of driven steel piles allowing for rapid installation.
ASR/ C&H Sugar Crockett, California	2019	Wharf seismic performance evaluation of an older wharf structure with reinforced concrete piles socketed into bedrock and with a tie-back deadman system. Provided recommendations, repair concepts, and cost estimates.
Port of Oakland Berth 22 -25 Oakland, California	2018	Performed a study to strengthen the landside spread footing girder at Berths 22 to 25 using jet grouting column to re-level the girder, increase girder capacity, and improve seismic performance.
Matson Terminals Sand Island Terminal Honolulu, Hawaii	2017 to Present	Evaluate and justify larger girder capacity to support new crane wheel loads. As prime consultant, Liftech worked with Damatt Engineering to provide electrical upgrade design to serve the new cranes, including conversion to cable power and replacement of the crane and terminal switchgears. Provided project coordination including permitting assistance, bidding assistance, equipment procurement assistance, and construction administration.
Mott MacDonald Berths 25 and 26 Port of Oakland, California	2017	Designed fender and bollard upgrades for EEE-size vessels. Upgrades included verifying the existing wharf structural capacity.
Power Engineering Construction Company Alameda, California	2016	As part of WETA Central Bay Maintenance facility design, designed reinforced concrete pier on steel piling to support gangway to float system.

Client & Project Location	Year	Project Description
Port Everglades Department of Broward County Fort Lauderdale, Florida	2015 to 2024	Large project spanning nine years involving assisting the port to procure six new larger low profile cranes and upgrade their existing cranes and wharf infrastructure at Southport. Involved from start to finish with concept design and cost estimates, procurement specifications, designing new crane girder systems, designing new building housing the electrical switchgear and crane group, designing new electrical system, and comprehensive construction support including on-site construction representative. Designed approximately 10,000 feet of new crane rail girders including crane stowage hardware, stops, cable trenches, and power vaults and systems.
Ports America Berths 23 to 25 Oakland, California	2015	Developed concepts for strengthening landside and waterside crane rail girders and provided cost estimates.
Port of Oakland Berths 25 and 26 Oakland, California	2015	Developed wharf upgrades including mooring and berthing systems and wharf strengthening for mooring larger vessels including cost estimates.
Manson Construction Co. IMTT Richmond Terminal Richmond, California	2015	Designed new MOTEMS-compliant wharf structure that uses significant off-site fabrication to minimize on-site construction and permit continued operations. This was the state's first major MOTEMs project.
Manson Construction Co. Redwood City Wharves 1 & 2 Redwood City, California	2014	Designed a 426-ft replacement wharf, 955-ft seawall, and longshoreman building. The wharf is designed to state-of-the-art seismic criteria and to support mobile crane operations. This project was a competitive design-build project.
Manson Construction Co. Ports America Shore Power Vault Modifications	2014	Designed modifications for the shore power vault at Berth 24 for improving access and opening to the waterside wharf face.
Moffatt & Nichol New Shore Power Vaults	2012	Designed structural modifications to wharf for installing shore power vaults at Berths 25, 30-32, 35-37, 55, 59, 67, 68.
Global Rigging & Transport Port of New Orleans New Orleans, Louisiana	2010	Designed repairs and modifications for a l940s pile supported wharf structure at Berths 7 and 8, Pt. Potrero Terminal. The modification work included wharf strengthening for large berthing and mooring loads, fender and bollard design, justifying wharf capacity for automobile offload ramp for ro-ro operation, justifying wharf capacity based on as-is deck conditions that had lost concrete cover with exposed corroded bars, and repairing damaged piles. Designed repairs and advised of load limitations at unrepaired locations.

Client & Project Location	Year	Project Description
TransDevelopment Group Port of Richmond, Pt. Potrero Terminal, Berths 7 and 8 Richmond, California	2010	Designed repairs and modifications for a l940s pile supported wharf structure at Berths 7 and 8, Pt. Potrero Terminal. The modification work included wharf strengthening for large berthing and mooring loads, fender and bollard design, justifying wharf capacity for automobile offload ramp for ro-ro operation, justifying wharf capacity based on as-is deck conditions that had lost concrete cover with exposed corroded bars, and repairing damaged piles. Designed repairs and advised of load limitations at unrepaired locations.
Port of Richmond Terminal 3 Extension Richmond, California	2009	Designed wharf extension to the pile supported container wharf that Liftech designed in the 1970s to provide berthing length for three 600 ft vessels. The wharf extension was designed as a pile supported wharf using ductile batter piling details.
Manson Construction Co. Dutra Group Joint Venture Marin, California	2009	Designed repairs, including seismic upgrades, to most portions of McNears Beach Park Pier damaged by a severe barge collision. Work involved evaluating the damage and providing a report, developing repair concepts with the JV, designing the repairs, and construction support.
Horizon Lines Port Authority of Guam Piti, Guam	2008	Designed Berth F6 wharf modifications for stowing cranes modified and delivered from Los Angeles.
Manson Construction Co. Cemex West Sacramento Wharf Sacramento, California	2007	Provided wharf design as part of design-build team for 550-ft wharf for Cemex West Sacramento for unloading cement from vessels. Included design of new wharf, access bridge, fendering and mooring systems, embankment, and landside mooring platforms. This project was a competitive design-build project.
TG Engineers Port Authority of Guam Piti, Guam	2004	Designed two-berth wharf structure for the Guam Port Authority. Structure included a rail girder and supports for post-Panamax cranes.
Virginia Port Authority Norfolk, Virginia	2004	Provided structural design to significantly improve the capacity of the existing stowage hardware in the Newport News Marine Terminal North Berths that involved modifications of the existing hardware, new hardware, and improved integration with the existing wharf structure.
Virginia Port Authority Norfolk, Virginia	2003	Analyzed all crane rail girders at the Portsmouth Marine Terminal to justify larger girder capacities. The increased rated capacity eliminated the need to strengthen the existing wharf or to limit crane operations. Performed structural design of new stowage hardware and its integration with the existing wharf structure.

Client & Project Location	Year	Project Description
Port of Oakland Berths 32–33 Oakland, California	2003	Designed structural rehabilitation of an existing 1,700-ft container wharf, Berths 32–33. Modifications included adding a new waterside crane girder, changing the crane rail gage to 100 feet, and a new sheet pile embankment toe wall to permit deeper dredging.
Modern Terminals Limited Hong Kong	2002	Reviewed design load criteria on wharf design, Berth One, Kwai Chung. Made design changes to increase the crane girder capacity. Designed curved rail. Reviewed design of switching system and frog to enable crane transfer between adjacent non-parallel wharves.
Port of Oakland Berths 57–59 Oakland, California	2000	Designed structure of a new 3,600-ft container wharf that used 48 in diameter cylinder piles and standard 24 in prestressed piles in combination with cement deep soil mixing (CDSM), Berths 57–59. Also developed a new ductile shear key design for use between wharf sections that is economical and easily repairable.
Marine Terminals Corp. Port of Los Angeles Los Angeles, California	1999	Calculated wheel loads for the ZPMC cranes operating on Berths 121 and 126 and evaluated crane girder capacity. Determined the maximum possible outreach extension for the existing MHI cranes that does not exceed the allowable wheel loads.
Port of Oakland Oakland, California	1997	Conducted an extensive wharf and crane study to help the port in their overall planning. Calculated the ultimate wheel load capacity of all crane rail girders, waterside and landside, at all container wharves for current and future channel depths. Calculated the wheel loads of all dockside container cranes at the port.
Virginia International Terminals Norfolk, Virginia	1996	Calculated the ultimate wheel load capacity of the crane rail girders at all wharves at Norfolk, Portsmouth, and Newport News. The calculated capacities were used by the port to determine which existing cranes may be relocated to other wharves. Calculated the wheel loads of all dockside container cranes at the port.
Port Authority of Guam Piti, Guam	1996	Designed structure for replacement of an earthquake-damaged container wharf consisting of tied back sheet piles and fill with a new concrete deck on pile structure, Berths F3–F6.

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SELECTED FLOAT DESIGN AND ANALYSIS PROJECTS

Client & Location	Year	Project Description
Power Engineering Construction Co. Treasure and Yerba Buena Islands Ferry Terminal San Francisco, California	2019 to 2020	Designed the steel float for a new ferry terminal located at Treasure Island. Design included berthing and mooring systems, access for future battery systems for ferry electric power, integration with access structures, and compatibility with WETA operations, e.g., ferry vessels, fenders, operations.
Power Engineering Construction Co. Seaplane Lagoon Ferry Terminal Alameda, California	2018 to 2019	Designed the steel float for a new ferry terminal located at Seaplane Lagoon in Alameda. Design included integration with access structures and compatibility with WETA operations, e.g., ferry vessels, fenders, operations.
Power Engineering Construction Co. San Francisco Fire Department 35 San Francisco, California	2017 to 2021	Designed the marine structures for a new floating fire boat station located at Pier 22 ½ in San Francisco. Structures included a 95 ft x 173 ft x 9 ft steel float to support a two-story building with berths for four fire boats, a guest boat, and two jet ski lifts; landside steel pier adjacent to the embarcadero; steel access ramp between pier and float; and piling to moor the float and support the pier.
Power Engineering Construction Co. WETA Downtown SF Ferry Terminal Expansion San Francisco, California	2017 to 2019	Designed the piling, two new steel floats with associated super structures and mooring and berthing systems, and three new gangways for the WETA Downtown SF Ferry Terminal. Designed refurbishment modifications to the existing float to allow for greater compatibility with other WETA floats and vessels and to strengthen the fender supports.
Power Engineering Construction Co. WETA Central Bay Operations & Maintenance Facility Alameda, California	2016 to 2019	The project consisted of a four-story building and a floating system for berthing 12 ferry vessels. Liftech was the prime design engineer for the building and marine structures, designing portions of the building and floating system and integrating the designs of others. Landside design included the building and associated structures. Marine design included a pile-supported concrete pier and a variety of designs for the float system, e.g., platform and ramp systems, berthing and mooring systems, float guide and dolphin piles, a maintenance shed, and the access and connection for a pile-supported crane.
Manson Construction Co. WETA East Bay Ferry Terminal Improvements Alameda and Oakland, California	2014 to 2015	Coordinated and designed various modifications to the Harbor Bay Ferry Terminal in Alameda and the Clay Street Ferry Terminal in Oakland, e.g., supports on top of the existing Harbor Bay float deck for new fixed and moveable ramps, new landside gangway support, and 24 in float mooring piling for Clay Street.
Manson Construction Co. WETA Clay Street Ferry Terminal Oakland, California	2012	Designed a 78-ft long steel replacement float to berth ferry vessels at the Clay Street Ferry Terminal in Oakland. The pile collars are removable and adjustable to accommodate future piles that will be larger than the existing piles. The aluminum walkway has six hinged and mechanically adjustable ramps to allow multiple different ferry types access to either side of the float.

Client & Location	Year	Project Description
Manson Construction Co. WETA Pier 9 San Francisco, California	2010 to 2011	Designed steel float layover berths for Pier 9 in San Francisco consisting of two pile moored floats with berthing, mooring, and access systems.
Manson Construction Co. WETA SSF Ferry Terminal, Oyster Point Marina, So. San Francisco, California	2010 to 2012	Designed a steel truss gangway, mooring dolphins, and post-tensioned concrete float to berth ferry vessels at the South San Francisco Ferry Terminal.

Liftech
LIFTECH CONSULTANTS INC.

COMPANY PRINCIPALS

Erik Soderberg
President, Structural Engineer
Mr. Soderberg is a skilled designer and project manager. He is experienced in the design, review, repair, and modification of a variety of structural and crane related systems including wharves, container cranes, and bulk loader structures. Other structures include crane lift and transfer systems and concrete and steel floats. He oversees the technical and contractual aspects of Liftech's projects in addition to his design work.

Jonathan Hsieh
Vice President, Structural Engineer
Mr. Hsieh is experienced in design, review, analysis, and modification of container cranes, bulk handling cranes, and special structures. His expertise includes crane procurement, fatigue failure investigation and repair, and computer modeling and analysis. He has also worked on structural maintenance programs, seismic design of container cranes, crane instrumentation, and voyage bracing.

Arun Bhimani
Founding Principal, Past President, Structural Engineer
Mr. Bhimani is an expert in all phases of container crane and wharf design. He has developed innovative solutions to container crane design problems, including a technique for combining analysis with heat straightening for repairing damaged container crane booms, the first seafastening design for transporting fully erected container cranes on barges, and a structural maintenance program used to periodically inspect cranes.

Catherine Morris
Vice President, Structural Engineer
Ms. Morris has a wide range of experience in the design of container cranes, buildings, and miscellaneous special structures. She has worked on all facets of container crane design including designing new cranes, reviewing crane designs, designing modifications, and voyage bracing. She has also reviewed and designed reinforcing for barge structures for transport of various equipment, designed chassis storage racks, and analyzed and designed equipment to lift and replace steam generators in nuclear power plants.

Nicholas Grebe
Principal, Mechanical Engineer
Mr. Grebe has extensive experience performing conceptual and detailed designs of mechanisms and systems, analyzing dynamic mechanical systems, and developing designs and detailed drawings suitable for manufacture. He is responsible for developing purchase specifications and reviewing contractors' mechanical, hydraulic, and electrical designs for feasibility and contract compliance. He is experienced in reviewing heavy machinery and container crane controls including logic, interlocks, system architecture, and automation features. He provides project management, condition assessment, commissioning, troubleshooting, and acceptance testing of material handling equipment including container cranes and bulk loaders.

Sugiarto Loni
Principal, Structural Engineer
Mr. Loni has extensive management experience and design expertise with marine terminal structures including crane-wharf interface, container and intermodal yard structures, building facilities, and marine structures. He is responsible for contract negotiations, technical oversight, and quality assurance of project deliverables. His work includes managing a variety of engineering projects ranging from small projects with short duration to large projects with multi-discipline coordination. As project engineer, he performs civil and structural design of marine terminal facilities, seismic retrofit design of existing building structures, and civil and structural design of wharves and marine structures.

Kenton Lee
Principal, Structural Engineer
Mr. Lee is experienced in design, analysis, and project management of container cranes, floating cranes, rigging, and special structures. He specializes in container and floating crane procurement projects and crane modification projects. He is also involved in preparing structural maintenance programs. Some of the technical aspects of his work that are of special interest to him are steel connection design, wind effects on structures, wind tunnel testing, and structural fatigue of steel structures.

Patrick McCarthy
Principal, Professional Engineer
Mr. McCarthy is experienced in ship-to-shore and port yard container crane procurement, modification, reliability, and repairs. His work includes project management, condition assessment, and developing structural maintenance programs and repair procedures. He is Liftech's manager for developing crane technical specifications and helps clients with various aspects of the crane procurement process, including pre-bid assistance, post-award design and fabrication review, and post-delivery structural assessment. He also has expertise in wind provisions, has been involved in wind tunnel and other wind studies, and is an associate member of the Wind Load Subcommittee of ASCE 7.

Derrick Lind
Principal, Structural Engineer

Mr. Lind is experienced with project management, design, review, analysis, and modification of many types of structures, including container cranes, unique industrial equipment, buildings, wharves, and bridges. He specializes in all facets of crane modification, including crane raises, boom extensions, capacity upgrades, and wheel load feasibility studies. His work has included crane procurement, structural analysis and design, checking shop drawings, developing construction documents, and managing design teams and project budgets and schedules.

Anna Dix
Principal, Structural Engineer

Ms. Dix has experience in the design and analysis of various steel and concrete structures. Her focus is on ship-to-shore cranes and other structures that reside next to, in, or on top of the water, such as heavy lift and container handling equipment, wharves, and floating cranes. She likes earthquake and fatigue engineering topics and working with clients.

Leah Olson
Principal, Professional Engineer

Ms. Olson has managed multiple wharf and float projects, and has participated in the design, analysis, and modification of wharf and float structures, container cranes, steel barges, and other rigging structures. She has evaluated the behavior of various concrete and steel structures using finite element analysis (FEA) computer software. Her work includes project management, structural analysis and design, and site inspection and reporting.

Di Liu
Principal, Professional Engineer

Mr. Liu is an experienced designer and project manager. His work includes structural analysis, design review, modification review, and feasibility studies of container cranes, wharves, and other structures.

Tais Shiratsubaki
Principal, Professional Engineer

Ms. Shiratsubaki is experienced in project management and structural design, review, analysis, modification, and repair of various marine structures including container cranes, bulk material handling equipment, and special structures. She is involved in research and development and enjoys collaborating with clients to produce improved designs and solutions.