Larch 303 Seattle Waterfront Project

Pier Engineering

Page

Date: Mon, 16 May 2005 10:20:09 -0700
From: Mike Hartley <mhartley@pndsea.com>
To: Garrett Adam Devier <gdevier@u.washington.edu>
Subject: RE: questions about waterfront piers and pilings?

See comments below next to your questions.
Hope this helps.
Mike

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-----Original Message-----
From: Garrett Adam Devier [mailto:gdevier@u.washington.edu]
Sent: Thursday, May 12, 2005 1:37 PM
To: David Pierce; Mike Hartley
Subject: questions about waterfront piers and pilings?

Hello,

I am a graduate student in the Landscape Architecture Department at the University of Washington. Our studio class is currently working on redesigning sites along the Seattle Waterfront.

I am looking for information regarding pier structures. Some questions I
have are:

What alternatives are there besides treated wood piling?

Treated wood pilings are typically not an option anymore. Permitting agencies discourage use of treated wood piles. Most preservatives, except ACZA are not allowed(Pentachlorophenol (Penta) or creosote have been used in the past but are not allowed by agencies due to contamination). Steel or reinforced (pre-cast or pre-stressed) concrete
piles are typically used now.

What are the weight bearing capacities of these pilings and how closely spaced do they need to be? Bearing capacities are dependent on pile type (concrete or steel), pile thickness, and yield strength of the material being used. Bearing capacities are dependent on soil type, shear strength, thickness and a myriad of other factors so there is not one answer for this. If liquefaction is possible this must also be taken into consideration along with any lateral spreading or down drag forces in determine the allowable bearing capacity. Spacing is dependent on soil type and beam sizes- i.e. how much load will be going to each pile.

What is the largest depth a piling can go? This is dependent on type of pile and density of the soil and other factors. Many piles can be stopped at 30 to 40 feet in dense soils that are not subject to liquefaction. On the other hand if loose, unconsolidated soils are encountered piles may be 100 feet in length or deeper. We are currently working on projects in Everett where very soft soils are present to 140 in depth requiring 180 foot-long piles. There are other options that can be considered besides piles including deep soil mixing, stone columns, open-cell sheet pile, etc. Open cells are a proprietary and patented system PND has developed which you can view on our website (below).

Do you know the mud depth off the Seattle Waterfront, until you hit solid ground?

There has been some differing opinions about the amount of bythmetry movement at depths below 50' do you know if there is a little or a lot?

I'm not quite sure what this question means. If you mean does the surface elevation of the mud line consolidate with time or due to earthquakes and liquefaction -- yes this is possible. The surface or mud line elevation can change if earthquakes occur, soil is soft or loose. Typically liquefaction results in subsidence of the top surface elevation through consolidation during an earthquake. Liquefaction normally occurs in soft silts or loose sands and can occur to depths of 50 to 60 feet in depth. Lateral spreading can also occur during an earthquake when loss of support occurs due to increase pore water pressure in the soil that causes instability and sliding. This is similar to what occurred in the 1964 earthquake in Anchorage where a magnitude 9.1 earthquake caused lateral spreading and liquefaction of a very large area (search of Turnagain Arm and Great Alaskan Earthquake, 1964 will provide some background on this or type in lateral spreading under Google. Lateral spreading and sliding over a 1 mile-long area occurred. Areas along the coastline had vertical displacements of 5 to 20 feet. This earthquake had over 5 minutes of strong shaking. Some structures moved horizontally up to 16 feet but structures were not damaged since the entire structure moved horizontally with less than 1 inch of vertical displacement. Some tennis courts had vertical displacements of up to 5 feet from one side to the other side of the court where tension cracks formed.

How can I find the estimated weight of a cubic foot of sand and gravel? You can get this by searching the internet for unit weight sand or gravel but typically sand will weight around 125 to 135 pcf and gravel around 140 to 148 pcf.

Note: Many engineers in the Seattle area consider concrete, prestressed piles to be a more appropriate design. They mistakenly believe that corrosion of rebar will not occur since water cannot attach rebar. The more appropriate solution is to use steel pipe piles for design with appropriate cathodic protection system and use of galvanized piles. Galvanizing results in a passive cathodic protection system that results

in much longer life. They work well for seismic loads and provide a small surface area for attack by corrosion. Concrete piles, in the marine environment are difficult to inspect the condition and can result
in corrosion of rebar (concrete is not impermeable). If you must use concrete piles they should use galvanized rebar. However you will note many of the bridge structures and concrete structures have been retrofitted in the downtown Seattle area with steel jackets. This was required due to damage in the Nisqually earthquake (take a look at the Magnolia bridge as an example). We typically do not use H-piles either.
Although cheaper our long-term research has shown that saltwater concentrates at angles resulting in additional corrosion. Our preferred
method is use of pipe piles that are galvanized. Galvanizing will last 10 to 15 years before starting to loose this and then an active cathodic
protection system can be employed.

The answers for these questions are only being used as general guidlines
for conceptual designs.

Thanks for your time,

Garrett Devier

http://www.mass.gov/czm/coastlines/2004-2005/habitat/glouc.htm

Urban Marine Habitats—Spotlight on Gloucester Harbor

By Dr. Todd Callaghan and Anthony R. Wilbur, CZM

Amidst an undulating mass of eelgrass, a snail moves along a single green strand, gently grazing on a thin slime of algae. Beneath the thicket of eelgrass blades, a juvenile lobster cautiously pushes its way out of its sandy burrow to forage on small worms and clams. Suddenly, the shadow of what appears to be a large fish passes over the lobster. With a kick of its tail, it retreats to shelter. The shadow moves over and abruptly changes direction. Several hundred small mirrors turn at the same moment in a silvery flash. It isn't one fish, but a school of juvenile menhaden feeding on a patch of nutritious plankton. In an instant, two more shadows pass over the lobster's burrow and it wisely stays inside. A pair of hungry striped bass propel themselves toward the trailing edge of the school of menhaden, isolating a few stragglers and quickly swallowing them whole. Remnants from the feeding frenzy fall lightly to the bottom. The juvenile lobster hurries out of its burrow and secures an easy meal.

Is this a scene from the Discovery Channel? Feeding time at the New England Aquarium? No, this is an example of some of the ecological interactions that occur beneath the surface in any one of the Bay State's many busy harbors. Televised nature programs have made us aware of the diverse and colorful life swimming, burrowing, eating, and being eaten in remote locations across the globe, but how many of us know and appreciate the diversity and tenacity of aquatic life right here in local ports?

Many commercial ports along the Massachusetts coast (including Gloucester, Salem, Boston, Plymouth, Provincetown, Hyannis, Nantucket, New Bedford, and Fall River) have been active for centuries. Together these ports provide the Commonwealth with waterways and dockage for fishing fleets, tankers, container ships, recreational boats, and ferries. While many of these man-made additions to natural harbors and their associated environmental impacts are obvious, what is less known is that these ports contain viable habitats (albeit fragmented, sometimes polluted, and frequently disturbed) that continue to provide ecological value to a number of species. The key to continued aquatic diversity in high human impact areas such as ports is the persistence of a variety of habitat types in which organisms can forage, seek shelter, and reproduce.

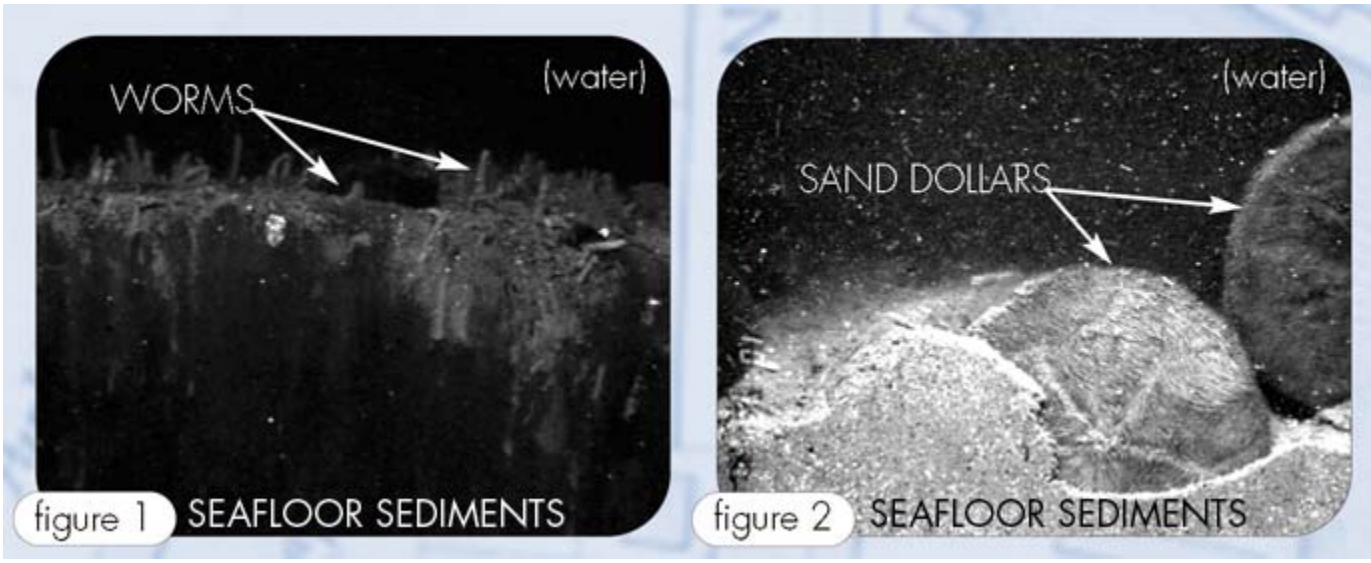
This article focuses on specific habitats in Gloucester Harbor, which supports nearly 3,000 full-time and 800 part-time employees and generates $720 million in sales, largely in the commercial fishing and frozen seafood sectors. Dramatic changes to Gloucester's inner harbor resulted from the filling and armoring the entire inner harbor, especially around Five Pound Island with the creation of the State Pier. While these changes had unavoidable environmental impacts, the port of Gloucester continues to harbor several habitat types that support a variety of species.

Seafloor

Even with dozens of recreational and commercial boats passing through the harbor every day, the mud, sand, and rock of the seafloor, and the waters above continue to provide habitat for numerous organisms. For example, trawl surveys in 1998-1999 revealed that some commonly known fish species, such as winter flounder (*Pseudopleuronectes americanus*), skates, and Atlantic cod (*Gadus morhua*), were the fish species of greatest abundance on the Gloucester Harbor seafloor throughout the year. Some other well-known species such as hake (*Urophycis chuss* and *U. tenuis*), pollock (*Pollachius virens*), cunner (*Tautogolabrus adspersus*), windowpane (*Scophthalmus aquosus*), and butterfish (*Peprilus triacanthus*) were also present, but in lower numbers. The survey also turned up some fish that sound more like they belong in a science fiction novel than on a dinner plate: lumpfish (*Cyclopterus lumpus*), longhorn sculpin (*Myoxocephalus octodecemspinosus*), rock gunnel (*Pholis gunnellus*), grubby (*Myoxocephalus aenaeus*), snailfish (*Liparis spp.*), radiated shanny (*Ulvaria subbifurcata*), ocean pout (*Macrozoarces americanus*), sea raven (*Hemitripterus americanus*), and pipefish (*Syngnathus fuscus*). Interestingly, while skate and winter flounder dominated the catch from June to October (60-80 percent of total abundance), winter flounder enjoyed the number one spot without rival from November to January (30-80 percent of total abundance) and then was surpassed by cod from March to May (20-50 percent of total abundance).

The appearance and disappearance of species in the survey record is at least in part determined by the different habitat needs of those species. Species that prefer cool water for spawning or foraging, (e.g., winter flounder and

cod) move into Gloucester Harbor during the cooler months, while others like skate find their niche in the harbor in the warmer months. In addition to this temporal variability, these species also have spatial preferences. According to a 2001 survey, 63 percent of the Gloucester Harbor seafloor is silt (soft mud), while the remainder is a combination of silt, sand, and hard bottom. The silty seafloor attracts juvenile and adult fish of many species that feed upon the abundance of polychaete worms and small bivalves burrowed into the sediments. Silty seafloor habitat is attractive to hermit crabs, green crabs (*Carcinus maenas*), and lobsters as well. Estimates of lobster abundance in this area based upon dive surveys in 1999 and 2001 range from 0.06-0.20 lobsters per linear meter, indicating good lobster habitat. The number of lobstermen fishing Gloucester harbor waters confirms the existence of a substantial lobster population.



Inner harbor of Gloucester has a thin line of oxidized sediments (lighter colored areas on seafloor surface). Worms are an indication of a disturbed environment.

Outer harbor has a thicker layer of oxidized sediments, indicating a healthier seafloor environment.

Rocky Intertidal

Along the edges of Gloucester Harbor, the rocky outcrops, boulders, and tide pools form niches where numerous species can find shelter in an otherwise turbulent and energetic tidal zone. For example, a survey by the Massachusetts Audubon Society of tide pools on Eastern Point in outer Gloucester Harbor found up to 24 species in a single tide pool, including 10 species of algae; six mollusks; two species each of starfish, sea squirts, and hydroids; one species of crab; and one species of sea urchin.

Salt Marsh

Salt marshes are relatively protected and highly productive areas that provide refuge for juvenile fish and crustaceans. Salt marshes also act as biofilters for removing excessive nutrients (like nitrogen) from the waters passing through them, absorbing as much as 30 percent or more of the waterborne nitrogen entering the system from upstream. Current research is aimed at determining if the small fish that inhabit the marshes impact nutrient levels in the water column. See http://ecosystems. mbl.edu/tide/ for a study funded by the National Science Foundation that is being conducted in the Plum Island watershed and is looking at whether removing mummichogs (*Fundulus heteroclitus*), an abundant fish species, makes marshes less resistant to the effects of nutrient loading.

Sixteen acres of salt marsh occur on the western edge of Gloucester Harbor. Although the geology of the harbor shoreline is predominately exposed rock ledge and not conducive to salt marsh formation, port infrastructure such as roads and culverts have also limited its extent. To help address this issue on Eastern Point in the southeastern corner of the harbor, Massachusetts Audubon, the CZM Wetlands Restoration Program, the National Oceanic and Atmospheric Administration's Restoration Center, and the Natural Resources Conservation Service have replaced

an undersized culvert to restore tidal flow to approximately six acres of formerly filled and buried tidal creek.

Submerged Aquatic Vegetation

Patches of eelgrass (*Zostera marina*—a flowering plant, not at all related to seaweed—see *Spotlight on Eelgrass*) occur on the northwestern and southeastern edges of Gloucester Harbor. Eelgrass is a productive nearshore marine habitat that supports diverse floral and faunal assemblages, absorbs nutrients, stabilizes sediments, and provides decayed matter that is consumed by species lower on the food web. A 1996 study of the eelgrass beds in Gloucester Harbor supports this characterization, finding up to 100 invertebrates, 25 bivalves, and 20 mysid shrimp per quarter of a square meter of eelgrass. This study also documented a preference of immature benthic fishes for eelgrass, finding three times as many immature fish in eelgrass beds than in unvegetated areas. The Gadidae family (pollock, cod, tomcod [*Microgadus tomcod*], and hake) made up the largest proportion of immature fish in eelgrass beds, although young winter flounder and tautog were also present.

Coastal Beach

Seine hauls along four Gloucester beaches in June 1999 revealed that many of the fish species found along the beaches were the same as those found in the deeper water trawls. The most noticeable and abundant addition was the Atlantic silverside (*Menidia menidia*, a common minnow), but an occasional stickleback (*Gasterosteus aculeatus*), puffer (*Sphoeroides maculatus*), or juvenile bluefish (*Pomatomus saltatrix*) was also found in the seine. These shallow areas are also visited by adult predatory fish, such as striped bass (*Morone saxatilis*), on the hunt for their crustacean or fish prey.

Port Infrastructure as Habitat

While active ports pose threats to natural habitats and the species that inhabit them, certain species of marine life continue to hang on, in some cases literally. Docks, piers, and jetties are settlement areas for a number of marine invertebrates. Walk out on a dock and take a look at the bright orange sponges and squishy sea squirts, notice the constellations of white barnacles and clumps of mussels woven together by their byssal threads. You may also see crabs or shrimp scuttling along algae-covered pilings. These encrusting and bottom-crawling communities originally inhabited only the boulders and ledges left by the receding glaciers thousands of years ago. However, these organisms can also be found on rock jetties, riprap, pilings, mooring lines, navigational aids, and some boat bottoms. The increased open space on new docks and piers creates settlement areas for entire aquatic communities. Not all new substrate has positive benefits, however. Recent scientific studies suggest that docks and piers may be unintentional promoters of invasive species. For example, a survey at the Gloucester State Pier identified at least 12 invasive species, including four tunicates, two shrimp, two crabs, a hydroid, an anemone, a bryozoan, and a red alga.

Forward into the Future

Ports are very important parts of the economic and historical landscape of Massachusetts. What is sometimes forgotten is that these busy industrial areas still contain intact and fragmented habitats that are populated by a wide variety of marine organisms. Ports do not have to be wastelands to sustain human uses, and can be managed with an eye toward maintaining and remediating the fragments of productive habitat that remain.

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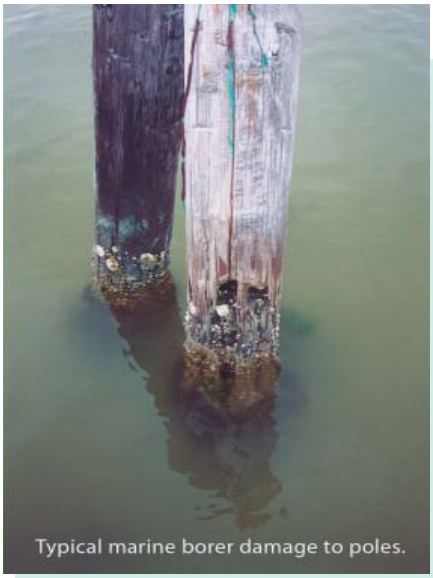
TimberGuard: New Technology Helps Protect Coastal Properties

Stephen Conway is an expert at fixing all kinds of structures. However, he knew he must be creative in order to save an old duck hunting camp along the Alligator River in North Carolina. The camp's owners approached him with a big problem. Their beloved, remote weekend getaway was in danger of disappearing.

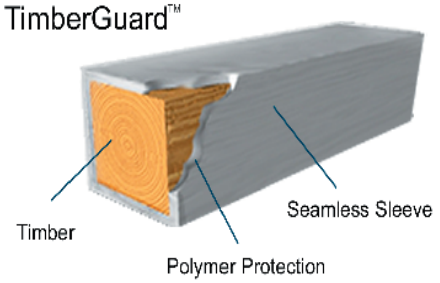


Typical marine borer damage to poles.

Fifteen duck camps sit along a section of the river near Columbia, NC. Over the past 20 years, high water and fires destroyed nearly half of the camps. The owner of one of these properties turned to Conway's company, Southeastern Marine Contractors, to keep their vacation home from washing away. "These homes are completely surrounded by water and have really settled," says Conway. "When a strong wind blows, waves actually crash right into the home!"

Conway knew he would have to raise the house in order to save it. He immediately ruled out using standard wood pilings. Although the could have used standard wood, it would only be a temporary fix because parasitic marine borers would start to destroy the underwater wood almost immediately. Construction experts and coastal property owners have long been on the receiving end of the damage caused by the marine borers known as shipworms and gribbles. These crustaceans and mollusks are tiny, but they have enormous appetites. They can eat through more than two inches of timber a year, quickly destroying a structure. "It's a big problem on the coastline," Conway says. "They eat the hearts right out of regular wood piling in just a couple of years. Once they get at it, say 'goodbye' to your wood. It's all downhill from there."

He then considered using concrete for the job, but that would require prohibitively



heavy equipment. The home's inaccessible island location would make even getting a crane to the home a difficult and expensive proposition. Conway needed a solution that would be both permanent and cost effective. "I thought 'Wait a minute! Crane Materials International has a product that could do the job'," he says. "It dawned on me that we could raise the

"They eat the hearts right out of regular wood piling in just a couple of years. Once they get at it, say 'goodbye' to your wood. It's all downhill from there."

house with TimberGuard pilings."

Based on technology that has been performing for the U.S. Navy for nearly 50 years, Crane Material International's patent pending breakthrough, TimberGuard, is an exclusive, high performance product that combines timber piling with a protective polymer barrier providing dramatically longer service life. "No one wants

to see their docks, piers, and marinas deteriorate because of hungry shipworms and gribbles. The technology is effective because marine borers don't like to eat the plastic," says John Irvine, President of Crane Materials International. "We are proud to play a role in protecting our customers' investments."

Until TimberGuard, wrapping was the typical solution, only to cover damage that has already occurred to piles. Fixing deteriorated wood is expensive and often requires frequent maintenance. In contrast, TimberGuard actually helps prevent damage from ever taking place. TimberGuard is the first product created by applying polymer to timbers in a continuous sleeve, reducing the chance of infestation.

For the first time, private property owners have an economical, long-term solution to defending their structures against the tough marine environment, protecting real estate values and providing peace of mind. In addition, TimberGuard is available in attractive colors, making it a great choice for an endless variety of applications.

Conway's clients now talk about someday taking their grandchildren to the secluded duck hunting camp. That dream seemed

unlikely before Conway introduced them to TimberGuard. "They are extremely happy with TimberGuard. And so am I. Tim-

—Joe Gondek, Crane Materials International, jgondek@cmilc.com

CRANE MATERIALS INTERNATIONAL

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California Wetlands Protection Faces Modern Challenges

Project offers solution to balancing a rare ecosystem alongside homeowner flood protection concerns with leading edge composite material.

Most tourists do not notice the marsh along the Pacific Coast Highway in Santa Barbara County, California. From the outside, it often looks like any other muddy field, but visitors who stop quickly learn that the Carpinteria Salt Marsh is full of life and offers one of the last thriving examples of a rare ecosystem. "The Carpinteria Salt Marsh is one of the largest remaining intact salt marshes in California. It supports many rare and endangered plants and animals, " says Jim Mazza, the conservation director of The Land Trust for Santa Barbara County.

The 230-acre marsh is one of the only places in the state where land and ocean meet, creating unique conditions for native wetland species. However, life in the Carpinteria Salt Marsh has been threatened. For decades, the construction of highways and homes has cut into the marsh and severely altered the ecosystem. "Over the years there was sediment brought into the marsh that has had a lot of negative impact and allowed non-native plant species to invade the area," says Mazza.

"We want to restore the wetlands," says Mazza. "But we must also keep the human community safe and happy."

The Land Trust and Santa Barbara County are working together to restore the Carpinteria Salt Marsh by removing non-native plants and dredging channels that are filled with sediment or cut off by roads. Opening the channels will increase tidal flow into the salt marsh, which is crucial to many of the plants and animals that live in the wetlands. However, the area is also home to nearly 40 families, so it was important to implement a plan that also protects the properties from flooding. "We want to restore the wetlands," says Mazza. "But we must also keep the human community safe and happy."

The county decided to build a 2,010 foot-long flood containment wall, creating a divide between the road and private homes and the marsh. County engineers first considered constructing a conventional concrete flood wall, but decided it was expensive and offered few benefits. While evaluating the alternatives, they realized they would be best served by GeoGuard UltraComposite sheet piling, an exclusive product from Crane Materials International (CMI).

GeoGuard UtraComposite sheet piling is made from fiber reinforced polymer (FRP). FRP is used in everything from spacecrafts to bulkheads. It is a high performance, corrosion resistant product that has created a lot of excitement in the marine construction industry because of its durability and versatility. Santa Barbara County engineers were especially impressed by GeoGuard Ultra Composite's high strength to weight ratio.

"We went with GeoGuard because it had the smallest footprint of any of the options that are out there. For environmental reasons we needed the sheets to be a thin as possible but strong enough to hold back flood waters," says county engineer Rob Tyzer. "This wall is going to be very strong and resistant to corrosion, but only about a foot thick. The county, Land Trust, and residents are all very happy with the plan."

Foundation Pile, Inc. began installing 1,400 GeoGuard UltraComposite sheets in the Carpinteria Salt Marsh in December 2004 and will finish the job by the end of February 2005. Onsite crews report that the work is going well. Michael Yates, lead engineer at CMI, says he knew Foundation Pile, Inc. would be happy with the product. "Extensive testing proves GeoGuard UltraComposite is the strongest FRP sheet piling in the world," says Yeats. "We say this with confidence because the truth is in the numbers. We have the longest and most successful performance record of any fiber reinforcement system in the industry."

CMI creates GeoGuard UltraComposite sheet piling in an ISO (International Organization for Standardization) certified facility to ensure consistent, high quality products. The pilings have been installed across the country, providing long-term solutions for shorefront erosion, soil reinforcement, and flooding. The U.S. Army Corps of Engineers is among the many organizations praising GeoGuard UltraComposite's durability and effectiveness.

...not all FRP manufacturers adhere to strict ISO standards, and quality can vary greatly between product lines.

However, not all FRP manufacturers adhere to strict ISO standards, and quality can vary greatly between product lines. Jeff Redman, Foundation Pile's sales manager, looked at many manufacturers before making his final selection. He says CMI quickly stood out from the competition. "We felt very confident in CMI's proven track record of providing great products," says Redman. "I've had a very good experience dealing with CMI. They gave me all of the facts I needed and then bent over backwards to make the delivery. They're constantly on the phone helping us out with different issues. I would definitely go back to them."

Restoring the salt marsh is a $3.5 million project funded by federal, state, and local grants and numerous private donations. When it is complete, the native wetlands will once again provide a place for endangered wildlife to thrive. GeoGuard UltraComposite sheet piling is helping to restore harmony to the area by allowing vital tides to wash into the marsh without flooding nearby homes. "The neighboring private property owners understand the value and magnitude of saving the marsh, but they also want to make sure their homes are safe," Mazza says. "This provides the best of both worlds and makes everyone happy."

—Joe Gondek, Crane Materials International, jgondek@cmilc.com

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http://www.oceansurveys.com/mackinac.htm

Bridge Design and Investigation

Bridge Scour Investigation

Straits of Mackinac, MI

Owner: Mackinac Bridge Authority

The Mackinac Bridge, constructed during 1954-57, is the ninth largest suspension bridge in the world. It has a total length of five miles and a main span of 3800 feet.

Ocean Surveys conducted an ultra high resolution multibeam hydrographic survey of the lakebed adjacent to thirty (30) bridge piers to generate an extremely detailed digital terrain model (DTM) for the purpose of identifying and detailing scour activity. Data deliverables included contoured plan, isometric and profile presentations.

Figure 1: One of the thirty Mackinac Bridge piers investigated for scour assessment using OSI's 455kHz multibeam sonar.

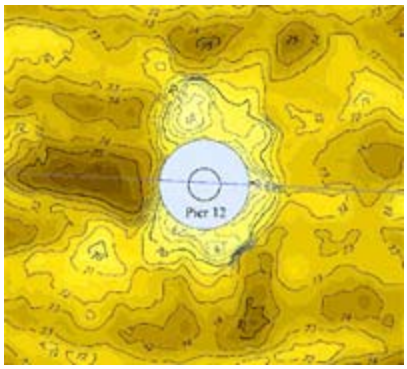
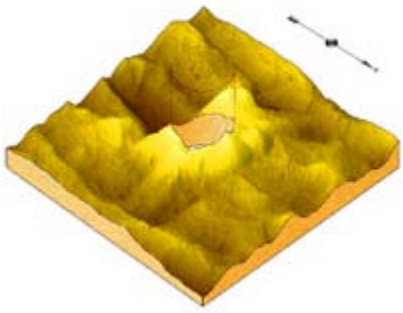


Figure 2: Plan view depth contour presentation of area adjacent to the pier.



Docks and Piling

TimberGuard offers the outstanding look for your piers, docks, and boatlift with colors that will match up with your investments and your style.

You have better things to be worried about than marine borers and replacing your dock down the road. TimberGuard will still be there for years to come with the look it had when you made the right decision to go with the best product in marine construction on the market.

Both the dock and boatlift were built using traditional equipment and traditional installation methods. The customers had lost their previous wood structures to marine borers and were each looking for a viable replacement for their shorefront property. Because TimberGuard's polymer coating is so durable, their contractors were able to transport and install the new boat lift and dock "just like wood.

The contractors found it simple to drive the 10" x 25' and 10" x 30' piles with a 3000 pound drop-hammer, confident that TimberGuard could perform under impact. Unlike competitors' products with fragile, easily damaged coatings, TimberGuard withstood all of the rigors of installation without a single flaw. What the customers purchased was TimberGuard polymer coated wood. What they bought with was ease of installation as well as the reassurance of years of beauty and structural integrity.

http://www.gerwick.com/experience.asp?Version=Long&StructureTypeID=1

Gerwick pioneered the use of large diameter concrete cylinder piles in marine terminals. The firm recently designed 48-inch and 54-inch hollow cylinder piles for terminals in areas of deep soft mud, which were successfully constructed. The firm is also participating in the development of seismic criteria for marine oil terminals in the state of California.

Underwater World, San Francisco

In recent years, Gerwick has performed design, analysis, innovative repair investigations, preparation of construction drawings, specifications, cost estimates, schedules, and constructability reviews for projects at numerous ports, including the Port of Oakland, Port of San Francisco, Port of Los Angeles, Port of Long Beach, and Port of Port Arthur.

Howard Terminal, Oakland

Gerwick has provided engineering services for a variety of projects, including design and analysis of composite piers, seismic upgrades, pile supported platforms, large-diameter steel caissons for mooring and breasting dolphins, fender systems, container terminals, breakwaters, and various wharf improvements. The firm's extensive construction and design experience gives Gerwick a unique background for innovative and cost effective designs of marine terminals.

Port Arthur, Texas

Gerwick has successfully designed rehabilitation schemes for piers located in harsh marine environments such as the Pacific Ocean. At Venice Pier in Southern California, Gerwick developed a construction concept allowing the contractor to support launching beams on the existing piles so the precast deck segments could be lined up and pushed out over the water. The concept eliminated the required use of an expensive trestle.

Venice Pier, Los Angles

http://www.mass.gov/czm/dockpiersummary.htm

THE SCIENCE & MANAGEMENT OF DOCKS PIERS WORKSHOP SUMMARY

Workshop Purpose

To provide coastal managers with the latest scientific data and management tools relating to the siting and construction of small docks and piers.

Key Points from Panel on Ecological Impacts from Dock and Pier Construction

- Shading from dock/pier construction reduces the density of submerged aquatic vegetation (SAV) growth directly under structure. Height is the most important variable, with docks of 10 feet and higher significantly reducing impacts. Spacing between planks does not noticeably affect plant growth. Orientation is also a factor, with north/south orientation being optimal.
- While it is clear that docks affect SAV growth, it is likely that other factors such as vessel propellers and land-based nutrient inputs also contribute to SAV loss.
- Shading has similar impacts on salt marsh vegetation. For a four-foot wide walkway, heights of 4 ½ feet over *Spartina patens* and 4 feet over *Spartina alterniflora* seem to minimize impacts, but additional research is necessary. It is not currently known what the threshold is for shading impacts for vegetation, nor is there an easily implemented means of calculating shading based on the various parameters such as height, width and orientation.
- Chromated copper arsenate (CCA) is commonly used to pretreat wood for placement in the marine environment. CCA treated piles and bulkheads can leach copper in both controlled lab experiments and in the marine environment. The effect of copper on marine organisms in the field is localized, with impacts detected only within 3 meters. While evidence exists that bulkheads of CCA material have impacts on water and sediment quality, particularly in poorly flushed areas, similar evidence has not been developed for pilings either in salt marsh sediments or in tidal waters.
- Floats on the bottom of docks should not be flat. Flat floats cause hydraulic pumping that can cause erosion under the float and can alter sediment size effectively changing habitat.

Key Points from Panel on Practical Approaches to Managing Docks & Piers

- Developing local dock and pier siting plans based on demand data and the identification of sensitive resources is a good approach. Such local plans can be used to strengthen state authorities.
- It is important for management programs to establish standards for evaluating dock and pier siting and construction. In addition to ecological thresholds, aesthetic, recreational, and navigational standards are also important.
- Pleasant Bay Resource Alliance divided the Bay into 26 geographic subsections and surveyed each area for biological, environmental, and human use factors. A sensitivity scale was developed for each subarea. The sensitivity scale was used to determine where additional docks and piers would be allowable subject to performance standards.

Key Points from Panel on Best Management Practices of Docks and Piers

- The primary material used today for docks and piers is CCA, but new innovations include steel-reinforced plastic and recycled plastic.
- Docks and piers should be designed based on specifics of each site (natural resources, wind, waves, water depth, boat wakes, current, ice, and soil).
- Fewer piles generally cause fewer impacts.
- Designers of public facilities need to design to Americans with Disabilities Act (ADA) standards (includes slope, turnarounds, and width).
- Dock and pier permit conditions need to have adequate flexibility to take into account safety and site practicality.

Research/Management Needs Identified

- Very little work has been done on the cumulative impact of docks and piers.
- A buildout analysis for a sample town would be a good tool to demonstrate the extent of dock development allowable under current regulations.
- The state's Chapter 91 licensing program should encourage raising the height of docks and piers to allow access under structures, rather than encouraging stairway access. Stairs create additional shading impacts and concentrate foot traffic.
- The eelgrass/dock model by Burdick/Short is limited to a discrete number of conditions. It needs to be expanded to take into account turbidity, current and depth as well as other combinations of height, width and orientation.
- A similar model needs to be developed for predicted shading to salt marsh vegetation.
- We need to clarify the definition of "significant" resources under the Wetlands Protection Act to clarify its application.
- Need to evaluate optimal height, width, orientation and length of docks to minimize ecological impacts.
- Municipalities are in need of guidance materials/training on dock and pier permitting.

Massachusetts Regulatory Programs that Relate to Dock and Pier Construction

- DEP regulates navigation and public access through the issuance of Chapter 91 licenses, pursuant to the Waterways Regulations at 310 CMR 9.00.
- Massachusetts General Laws Chapter 91, the Public Waterfront Act, requires state authorization for the construction of docks and piers extending below mean high water. The Waterways Regulations include a provision that authorizes municipalities to license non-commercial docks and piers affiliated with residences using a three-step process: 1) designate a local official, 2) establish one formal access point to all water bodies, 3) direct all fees to waterways. All local permitting programs must be consistent with the Waterways Regulations under Chapter 91.
- Designated Areas of Critical Environmental Concern (ACEC) that currently lack a comprehensive resource management plan have a moratorium on the licensing of new privately-owned docks and piers.
- Municipalities may develop state-approved municipal harbor plans to customize Waterways Regulations to suit their specific needs.
- The Waterways Regulations contain an underutilized but potentially powerful provision that allows a municipality to develop a "formal area-wide policy or plan" that assigns priorities to competing uses in a waterway. Once a town approves such a policy or plan,

it would generally govern DEP Waterways licensing of private docks and piers. The Wetlands Protection Act (WPA) regulates docks and piers in wetlands. Temporary (less than one year) impacts can be approved. The WPA cannot allow "adverse impacts" to shellfish resources if the shellfish resource is "significant." "Significant" is defined as mapped by Conservation Commission or the Division of Marine Fisheries.

Tools that Municipalities Can Use to Manage Docks and Piers

- Development of a state-approved Municipal Harbor Plan that can be enforced through the Chapter 91 license process.
- The Department of Environmental Protection is developing a guidance document on docks and piers, outlining the science, management practices, and implementation strategies. The guidance should be available in 2001. Workshops will be held at that time.
- Incentives to encourage landowners to share docks could include fast track permitting or flexibility in meeting standards.
- The Division of Marine Fisheries and town shellfish officers are developing maps of shellfish habitat. These maps, which will be available both digitally and in paper format, should be completed by next summer (2001).
- Municipalities can regulate anything that the state doesn't already regulate. If the state does regulate an issue, a municipality can strengthen the regulation. All by-laws must address the police powers of health, safety, and welfare. Dock and pier regulation is sometimes difficult to justify under police powers; Chapter 91 generally regulates to protect the public trust interests in waterways. Municipalities can regulate docks and piers under local wetland by-laws. By-laws should have a clear connection with resource values.
- Municipalities cannot enforce the public trust doctrine. Only the state is vested with that responsibility.
- See last bullet in previous section.

Resources Available for Further Information

- Dock Design with the Environment in Mind: Minimizing Dock Impacts to Eelgrass Habitats, CD ROM, Dave Burdick and Fred Short. Contact: Marie Polk, NH Sea Grant, Kingman Farm/UNH, Durham, NH 03824; (603) 749-1565, [marie.polk@unh.edu]. The cost of the CD is $5 plus $1 for shipping. When ordering, ask for Item # UNHMP-V-SG-98-18
- Video of Dock and Pier Workshop, 2001. Contact: Tracy Crago, WHOI Sea Grant Office, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, (508)457-2000 x2665, [tcrago@whoi.edu]. Cost: $20 per 4-video set. Quantities are limited and orders will be filled on a first come, first served basis. Workshop videos are also available for loan by CZM. Contact: CZM Information line (617) 626-1212.
- The Waterfront Construction Handbook: Guidelines for Design and Construction of Waterfront Facilities, Maine Coastal Program, 1997. Contact: Lorraine Lessard, Maine Coastal Program, (207) 287-1486, [lorraine.lessard@state.me.us]
- Guidelines and Performance Standards for Docks and Piers in Pleasant Bay, Pleasant Bay Resource Management Alliance, 1999. Contact: www.pleasantbay.org. The guidelines can be found on the programs/projects page, listed under shoreline structures.
- Reprints of review articles pertaining to the ecotoxicology of chromated copper arsenate

(CCA), including: Effects of Chromated Copper Arsenate (CCA) Pressure Treated Wood in the Aquatic Environment, Weis and Weis, Ambio Vol. 24 pp 269-274. Contact: Pete Weis [weis@umdnj.edu]

- Dock and Pier By-laws for towns of Bourne and Falmouth. For the Bourne by-law, contact: Matt Boulanger, Conservation Agent, 24 Perry Ave, Buzzards Bay, MA 02532, (508) 759-0625. The by-law can also be found on the Conservation page of the town's web page, www.townofbourne.com. For the Falmouth by-law, contact: Conservation Commission, 59 Town Hall Square, Falmouth, MA 02540, (508) 548-7611. The cost of reproducing the Falmouth by-law is $8 per copy.
- MA DEP Dock and Pier Guidance, expected publication date is spring 2001. Contact: Sharon M. Pelosi, DEP, One Winter Street, Boston, MA 02108, (617) 556-1104.
- Guidance for Dock and Pier Construction in ACECs and Ocean Sanctuaries, Massachusetts Office of Coastal Zone Management, 1988. Contact: CZM Information line (617) 626-1212.

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Tuesday, August 5, 2003

E-mail this story to a friend

Marine life gone bad: Scientists inventory invaders

By MEREDITH GOAD, Portland Press Herald Writer

A group of scientists in rain gear huddled over a floating dock that had been pulled from the water at Portland Yacht Services on Monday morning.

Staff photo by Jack Milton
Dr. James Carlton, director of the Williams-Mystic Program, collects marine life from a dock at Brewers South Freeport Marine on Monday. He is part of a group of scientists searching docks and piers for signs of exotic marine species in coastal waters from Maine's Casco Bay to New York Harbor.

Undisturbed by the showers that swept over the waterfront, they scraped off curtains of kelp, sucked up water samples with eyedroppers, and pored over the colorful creatures with unusual shapes that still clung to the dock.

The team of 25 scientists is conducting a week-long survey of floating docks and piers to find out how many exotic marine species have invaded the coastal waters from Maine's Casco Bay to New York Harbor. The group includes about a dozen taxonomic experts with different specialties, from tiny crustaceans to colorful sea squirts. They hail from places as varied as Rhode Island, England, New Hampshire, Seattle and the Carolinas.

European green crabs, Asian shore crabs, periwinkles and other non-native species can enter a coastal area naturally or spread from port to port through a ship's ballast water. While some species are benign, others can spread rapidly and cause widespread economic and ecological harm.

The green crab, for example, preys on commercially valuable shellfish. Other species chew up piers and pilings, damage fisheries or cause public health problems.

A similar survey conducted three years ago in Massachusetts found that 10 percent of the species identified were not native to the state, including two species that had never been seen before on the East Coast. This year's expanded survey will give scientists a broader look at which exotic species are here and how far they've spread.

"One reason that we've chosen Portland is because, with all the ship traffic coming in and out of here, there's a good chance that some of them may have come in on some of the ships," said Jan Smith, director of the Massachusetts Bays National Estuary Program.

The survey began Monday with a visit to Port Harbor Marine in South Portland, then moved to Portland Yacht Services on Fore Street. The group spent the afternoon at Brewers South Freeport Marine.

At Portland Yacht Services, Niels Hobbs of the University of Rhode Island used a strainer and an eye dropper to capture tiny animals called arthropods and isopods, which are closely related to crabs and shrimp. He pointed to a small, dark shape scurrying through the water in a plastic container.

"They look a lot like little shrimp," he said, "and there are a number of species that we've found around here that are non-native, that we've found in the past. They're little fast swimmers that you can see in the corner there. Some of them are a little too fast for the eyedropper."

Hobbs said he is collecting as many species as he can, trying to develop a baseline of what's in the water. Scientists don't know yet whether the animals cause any damage, he said.

"As little as we know about what ones are here," he said, "we know even less, really, about what impact they actually have."

It's a different story for the sea squirts, or tunicates, which were being examined Monday by Gretchen and Charles Lambert of the University of Washington in Seattle. Gretchen Lambert is a taxonomist who, among other things, identifies sea squirts for the Smithsonian. Her husband Charles is a physiologist who also works on the animals, but on this trip is performing a variety of tasks, from sorting critters to making sure that microscopes are working.

"Of the many invasive animals, the most abundant one in this

harbor is a sea squirt from Japan," Charles Lambert said, pointing to an orange colony of squishy sea squirts on the dock.

Gretchen Lambert pointed to another one nearby, a brown, knobby creature known as a club tunicate. As tunicate colonies grow, she explained, they smother shellfish fisheries.

"They are causing millions of dollars worth of damage to mussel and oyster growers on Prince Edward Island," she said. "We were there at the end of March to talk to about 100 aquaculturists about how to get rid of them, actually, which is very difficult once they've come into an area. So one thing we hope to accomplish with surveys of this type is to enact more stringent rules on processing the ballast water and profiling suspect vessels."

In March, U.S. Sen. Susan Collins, R-Maine, and other lawmakers introduced a broad invasive-species bill that would set more aggressive rules for the shipping industry and how it handles ballast water. The Environment and Public Works Committee held hearings on the bill last month, but it has not yet been sent to the full Senate.

Lambert said she is also keeping an eye out for a tunicate called Didemnum, a relatively new invader that simultaneously appeared in New England, California, western France and Brittany, New Zealand, most likely carried in ballast water.

"Unlike some introduced species, which so far have mainly been found on what we call artificial surfaces, Didemnum has the ability, we've found, to easily colonize natural rock surfaces," Lambert said. "So it is now subtidal all along New England and parts of northern California, where it is growing in subtidal rock walls, smothering native species and very drastically changing the marine ecology of these areas."

Jan Smith said the scientists will also be watching for "a nasty whelk" from Korea that was introduced into the Virginia Beach area, probably by a Navy ship.

"It's very predatory on shellfish," he said. "We're nervous about it getting up here, so we're kind of keeping an eye out."

The scientists were brought to Maine by the Northeast National Estuary Program Partners, the Casco Bay Estuary Program and MIT Sea Grant, with the help of a $60,000 grant from the U.S. Environmental Protection Agency. Their expenses are being paid, but otherwise the scientists are doing the work for free, Smith said.

The National Geographic Society is filming the group for two

days for an upcoming segment on its "Explorer" television program.

Staff Writer Meredith Goad can be contacted at 791-6332 or at: mgoad@pressherald.com

To top of page

http://www.djc.com/news/en/11146937.html

July 17, 2003

Port Townsend dock promotes fish habitat

Diverse team redesigns dock to encourage eelgrass growth

By HEIDA DIEFENDERFER
Battelle Marine Sciences Laboratory

Diefenderfer

If necessity is the mother of invention, then surely today's crisis in permitting overwater structures should be spawning design solutions for docks and bridges.

The recent redesign of a derelict dock in Port Townsend to provide water access for the planned Northwest Maritime Center (NWMC) proved to be an opportunity for an interdisciplinary design team to seek creative solutions. The project site showed evidence of important nearshore habitat that had been bisected when the dock was built in the 1930s, and would warrant serious review before any reconstruction was permitted.

In 2001, the nonprofit NWMC pulled together a dock design team that included marine scientists, architects, engineers, educators, regulators and user groups. The team's directive was to create a demonstration dock that would provide the desired moorage yet allow nearshore habitat functions to be restored. Of particular concern were threatened fisheries resources, and the eelgrass (Zostera marina) with which they are associated.

However, this goal would need to be achieved while accommodating the unique requirements of a planned educational facility. The NWMC charter called for docking visiting vessels ranging in size from historic tall ships to sea kayaks. A fleet of educational program vessels, including a variety of sailboats and rowboats, would need to be berthed at the dock during the summer months, the prime growing season for eelgrass.

Illustration by Mike Kowalski

One of the unique requirements of the Northwest Maritime Center's demonstration dock on Port Townsend Bay is that it can handle vessels ranging in size from historic tall ships to sea kayaks.

An eelgrass restoration project was also planned for the site, independent of mitigation for demolishing and rebuilding the structure.

The challenges faced by the design team, however, are by no means isolated to this dock or this small Victorian seaport. Some 30,000 recreational boating slips were identified in Washington by the Department of Natural Resources' ShoreZone Inventory in 2001. In addition, large docks are operated by the state's ports, ferry system and industries. Taken together, the impacts of these docks are substantial on a regional scale.

Let there be light

Docks reduce nearshore eelgrass habitat directly by limiting the incident light required by these flowering plants, which is greater than that needed by macroalgae (seaweed). Docks also affect the resource indirectly, through associated activities, by means such as propeller wash and shading from vessels.

In turn, the loss of eelgrass affects Pacific herring populations, because herring deposit their eggs on blades of eelgrass during spawning. The eelgrass is also used by juvenile Dungeness crab, salmon and other species as cover and forage habitat.

The magnitude of this problem convinced the National Oceanic and Atmospheric Administration (NOAA), which has jurisdiction over the nation's fisheries resources, to fund the NWMC's dock design and eelgrass restoration project through its community-based habitat restoration grant program.

Photo courtesy of the NWMC

From a kayak underneath the NWMC dock, Heida Diefenderfer uses a meter to measure how much light is reaching potential eelgrass habitat.

The architect on the project is Miller/Hull and the engineer is Peratrovich, Nottingham & Drage. With the design now complete, reconstruction of the dock is planned for September 2003, and eelgrass planting is planned for May 2004.

Surveys under the dock by Battelle research divers provided the basis for decision-making related to the nearshore environment: data on the type of substrate such as sand, the location and density of eelgrass and macroalgae, and bathymetry or depth.

With maps in hand highlighting this data, the team viewed several versions of draft designs relative to their potential effects on the resources. This information also allowed researchers to estimate the extent and location of area on the site with conditions suitable for eelgrass, much as a gardener would consider soils, water and light.

The team reviewed several candidate technologies that transmit or reflect light under docks. It examined data from Battelle's tests for the Washington State Department of Transportation (WSDOT) of a metal halide greenhouse light, SunTunnel, deck prisms, grating and glass blocks.

Photo courtesy of Battelle

Amy Borde, a research scientist at Battelle Marine Sciences Laboratory, prepares a tray of bundled eelgrass shoots for transplantation by divers.

Also, the NWMC allowed Battelle to field-test deck prisms and a SunTunnel for WSDOT at its derelict dock, which already had holes in its decking. The data this generated on light diffusion and attenuation were specific to the site and particularly useful in the design process.

The design

A shade model constructed for the site allowed the team to consider the relative effects of different materials and designs. Battelle calculated the expected incidence of photosynthetically active radiation, that portion of the spectrum available to plants, at the depth of eelgrass on the site under different design scenarios. These results were compared with eelgrass requirements to evaluate design alternatives.

Photo courtesy of the NWMC

The derelict dock extends 230 feet into Port Townsend Bay. The design team recommended that the trestle be extended 60 feet further offshore and that the piles be converted from wood to steel to reduce impacts on the underlying marine habitat.

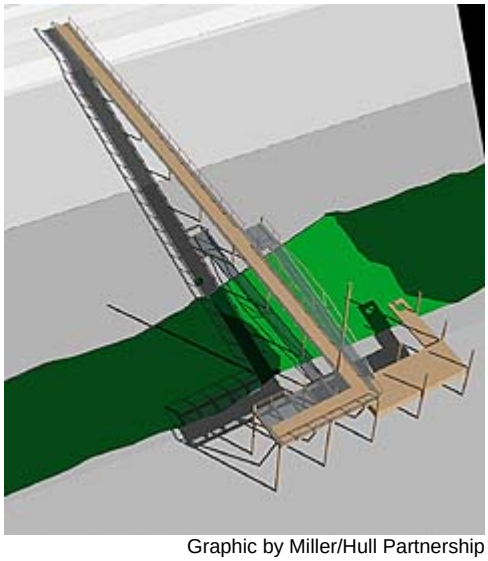
Three key design recommendations relative to nearshore ecology evolved from the team's work:

- To extend the dock trestle 60 feet further offshore, to 286 feet, so that the large platform at its terminus would be over water deeper than eelgrass can tolerate and also provide moorage for deeper draft vessels.
- To reduce the number of piles and associated structure and therefore shading by converting the piles from wood to steel.
- To use grating in strategic locations to reduce the potential of an abrupt light/dark barrier to fish passage.

Ultimately, reflection was the technology selected by the team to field-test at the demonstration dock. Although this technology does not provide the greatest increase in light of those reviewed, it is the most compatible with planned uses of the dock and with the aesthetics of the Port Townsend waterfront.

Plans call for highly reflective metal panels to be affixed to stringers under the deck. This has been tested on a smaller scale under docks at the Battelle Marine Sciences Laboratory in Sequim Bay and at the Port of Anacortes. The hypothesis is that with the design changes and the light provided by reflection, eelgrass will be able to survive under the entire 11-foot-wide trestle of the new dock, whereas today there is no eelgrass in this area.

To test this hypothesis and to speed the recolonization of eelgrass, Battelle research divers will plant eelgrass in existing gaps in the spring following the dock reconstruction.



Graphic by Miller/Hull Partnership

A shade model constructed for the site allowed a committee to consider the relative effects of different dock materials and designs. The dark green areas represent existing eelgrass; the light green represents the area where eelgrass will be transplanted.

A helping hand

Under the NOAA restoration grant program, volunteers from the Port Townsend area are being recruited to help bundle eelgrass for planting. Up to 5,000 eelgrass plants, which originated at the Clinton ferry terminal on nearby Whidbey Island, will be donated from stocks maintained at Battelle for WSDOT.

The Clinton ferry terminal is the site of long-running research on eelgrass transplantation. Although early eelgrass restoration efforts in the Puget Sound have had mixed results, the last five years' work at Clinton has proven highly successful. Two reasons for this advance are increased understanding of the controlling factors on eelgrass habitat and improved planting techniques.

Photo courtesy of the NWMC

The site is in Port Townsend's historic waterfront district. The pier to be rebuilt is to the left of Point Hudson Marina.

Long-term monitoring of transplanted and reference sites has been key to objectively evaluating and improving restoration and mitigation methods.

A similar monitoring program is planned at the NWMC site. The goal is to assess the effects of the new dock design on eelgrass and the nearshore environment. The information generated by small, directed research projects such as this one can be expected to contribute to regional restoration efforts. The Puget Sound Nearshore Ecosystem Restoration Project, for example, is currently gathering momentum to preserve and restore habitats around the Sound.

The demonstration dock is envisioned as a model for how sensitive rehabilitation of an existing overwater structure can preserve a recreational resource while compatibly allowing for a quicker recovery of the marine environment. The benefits demonstrated in this community-based habitat restoration project offers a prototype for reducing the fragmentation of nearshore habitats in the region in the context of sustainable development.

Heida Diefenderfer is a senior research scientist at the Pacific Northwest National Laboratory's Battelle Marine Sciences Laboratory, operated by Battelle for the U.S. Department of Energy Office of Science. A biologist, Diefenderfer conducts applied research for state and federal agencies and other partners for nearshore, wetland, and watershed assessment and restoration.

http://www.nwmaritime.org/news/news_23.html

Northwest Maritime Center dock project goes out to bid

Sep 19, 2003

The Northwest Maritime Center is excited to move forward with its first actual construction project – demolition and reconstruction of an existing high-trestle pier.

A 120-foot-long steel pile is swung into place at the end of the NWMC dock. Two test piles were driven in mid-August, providing dock engineers with information they needed to finalize construction plans.

The project, estimated at $750,000, was sent out to public bid in mid-September. We expect to award the contract to the lowest bidder in early October, and then the real work can begin!

The tentative project schedule is as follows:

June 2003:	Shoreline & environmental permits approved
Mid-August:	Test piles driven
Mid-September:	Public bids sought
Early October:	Contract awarded; work can begin
February 2004:	Dock demolition & pile-driving complete
April:	Dock reconstruction complete
May:	Floating docks installed

"We're excited to get the first construction project of the Northwest Maritime Center under way," says NWMC Executive Director Dave Robison. "We timed it to occur

after the Wooden Boat Festival, so as not to impact festival activities or the hundreds of visiting boaters."

Test pile driving

This summer, the Port Townsend waterfront was abuzz with the rumor that the old Northwest Maritime Center dock was starting to be demolished – but it was only a test. A pile-driving test, that is.

On Aug. 14, a barged-in crane was used to drive test piles deep into the mud until they encountered stable ground. Measurements of that depth informed the dock engineers how long the piles for the new dock need to be.

"That was a critical piece of information to know in order to finish the construction drawings," explains Robison.

Since steel piles will replace creosote-treated wood piles in the new dock, a steel pile was used for these tests. First a hole was cut in the end of the existing dock, and the crane operator lowered a 120-foot pile 18 inches in diameter into the gap. A vibrating "hammer" secured to the top of the pile forced it downward through the sediments.

The pile was then plucked out and driven 60 feet seaward of the end of the existing dock, the outer limit of where the new dock is designed to extend. That test pile didn't hit bedrock until it had passed through 35 feet of mud, according to NWMC project manager Bob Little of Little & Little Construction.

Reconstruction schedule

Securing environmental permits for the overwater structure, a notoriously lengthy procedure, was streamlined by the participation of representatives of state and federal agencies in the dock design process, Robison notes. "Permitting that might have taken two years was wrapped up in eight months," he says.

On Sept. 11, the dock project was sent out to public bid.

"The start date will be flexible in order to secure the best possible bid," says Robison. "Depending on the firm selected and its own work schedule priorities, work on the dock will begin sometime this fall."

In-water construction work (demolition and pile-driving) must be completed within the biological work window mandated by the Washington Department of Fish and Wildlife, which closes on Feb. 14, 2004. The floating docks will be installed by May 1 in time for the 2004 boating season.

Boater- and eelgrass-friendly design

Plans for the new dock include a 290-foot-long high-trestle pier that is 60 feet longer than the existing structure, two floats offering 175 lineal feet of moorage, and the deepest-draft moorage on the downtown waterfront.

With a 100-foot face aligned parallel to the shore (and the currents), the Maritime Center will offer a comfortable berth for large, deep-draft vessels. In fact, the new pier will have at least twice the water depth (24 feet minimum at MLLW) of either of the city's two public wharves.

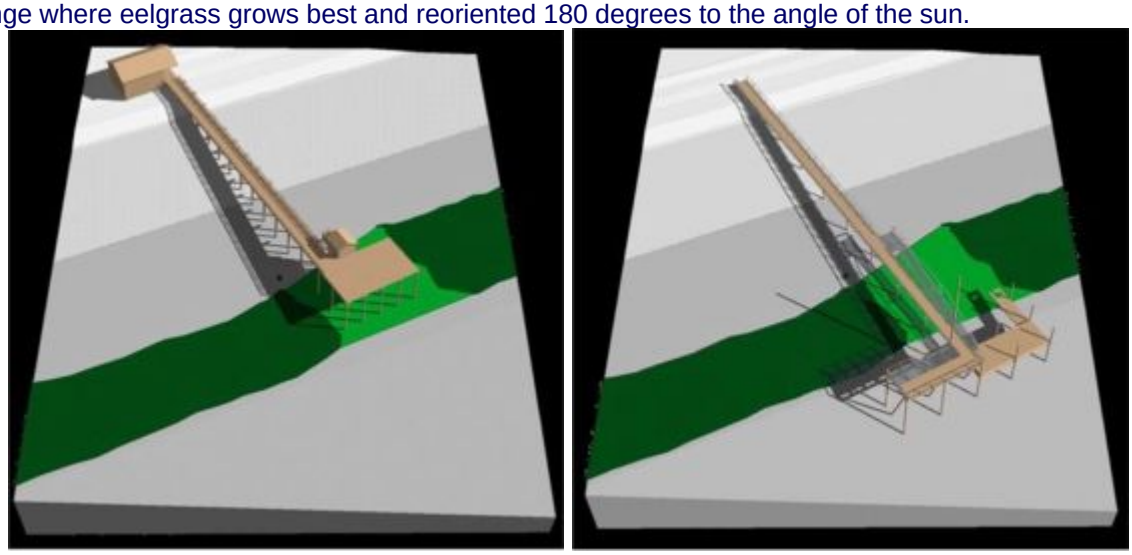
This will facilitate visits from ships that currently can't dock at the public wharves or that do so with some difficulty.

Capt. Karl Mehrer of the historic schooner Zodiac, billed as "the largest working sailboat on the waters of the Pacific Northwest," says he'll be one of the first to tie up at the Maritime Center pier.

With a draft of 16 feet, Zodiac's port visits here are limited by the lack of deep-draft moorage.

"It would be a wonderful thing," Capt. Mehrer says of the new dock. "Because right now we can't come ashore at Port Townsend. All we can do is anchor out."

Extending the 230-foot pier an additional 60 feet into deeper water will not only provide better moorage but also will reduce shading of the marine eelgrass below, which is critical habitat for herring, Dungeness crab, and juvenile salmon. Architects employed computer-generated shadow studies to determine that the large platform at the end of the pier should be moved out of the depth range where eelgrass grows best and reoriented 180 degrees to the angle of the sun.



The existing dock footprint is shown at left; the proposed dock footprint on the right. Extending the dock 60 feet further into the bay and reorienting the platform at the end will minimize shading of the eelgrass beds below, as shown in these images from a shade model created for the site. The dark green areas represent existing eelgrass; the light green represents the area where eelgrass will be transplanted.
Graphic by Miller/Hull

Where the pier walkway still overshadows eelgrass habitat, metal reflective panels will be used to direct sunlight to the plants. Next spring, 5,000 shoots of eelgrass donated by the ferry division of the Washington State Department of Transportation will be planted under and around the pier as part of an associated habitat restoration project to connect fragmented habitat.

One of the nation's foremost eelgrass researchers considers this a prototype project.

"The next big challenge is how to have development and have it result in a more productive ecosystem," explains Dr. Ron Thom, a scientist at Battelle Marine Sciences Laboratory who helped develop the restoration plan. "The Northwest Maritime Center dock project is an example of what we're going to have to do in the future…. In my opinion, it's really ground-breaking."

Plank sponsorships

Contributions to the pier reconstruction are encouraged through the Pavers & Planks Building Campaign.

Boat lovers have a special opportunity to show their support for the dock project through sponsorships of individual dock planks. Your favorite vessel's name and port of registry can be cast in a bronze nameplate and inset in one of the new planks. A Pavers & Planks order form is on-

line at www.nwmaritime.org.

Dock reconstruction will be the second significant phase of work on the site. The first was environmental cleanup of the oil-contaminated property, a $400,000 project that was completed in July 2002.

On-the-water programs

The pier, with the addition of seasonal floating docks, will become the staging area for on-the-water programs at the Northwest Maritime Center—rowing and sailing classes, longboat expeditions, regattas, small boat rentals and tours, marine research cruises, and tall ship sail- and seamanship-training.

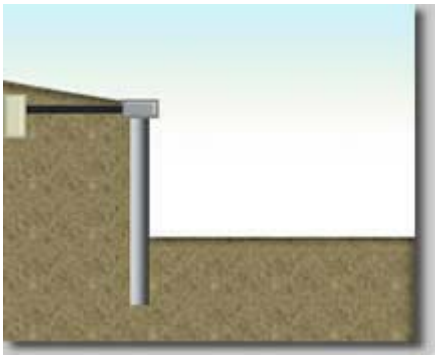
Chris Kluck, the executive director of the Wooden Boat Foundation—the anchor tenant at the future Center—says his organization's boats can start using the new dock even before the shoreside facilities are constructed.

"When it comes on line next spring," he says, "the Northwest Maritime Center's new dock will be a highly visible hub for the Wooden Boat Foundation's educational and on-the-water activities.

Be assured that we will keep you updated each step of the way as this exciting project progresses!

<< Back to NEWS HEADLINES

Retaining Walls



Our attractive sheet piling color options combined with either matching or contrasting accessory components, allow you to create a distinctive, low cost retaining wall that lasts. The fact that CMI sheet piling require minimal maintenance over their lifetime is a big reason many commercial applications such as golf courses choose our products.

With tougher environmental legislation on treated wood for the use of retaining walls, our sheet piling is the perfect solution for soil retention and flood control. For the latest in the Environmental Protection Agency's restrictions on treated wood in retaining walls, visit the EPA website.

Proven Performance

Install Faster Than You Ever Thought Possible

Grand Casino Resort

Tunica, MS

The Grand Casino Resort in Tunica, Mississippi was designed to contain over four miles of man-made shoreline. By carving out so many waterways they were able to use the excavated soil to build up aesthetically pleasing hills and berms on an otherwise flat terrain. They chose CMI sheet piling to enhance the contoured shoreline, both to protect against erosion and to create a clean, consistent appearance. Additionally, the large scale of the project required a material that would drive fast and allow for the quickest installation possible. By using CMI sheet piling, they achieved over 500 feet of installed wall per day.

National Park Service, Jefferson Memorial

Washington, DC

The Jefferson Memorial's original construction, dating back to 1946, included a steel sheet piling wall around the base for foundation protection. When renovations started on the memorial, workers discovered that the original steel sheet piling had deteriorated from the salt water content of the swampy Washington DC terrain. Because of the scale and important nature of the project, they required a replacement material that would out-perform steel in those conditions. They chose CMI sheet piling for the project because it met their 100-year design life criteria.

CMI Sheet Piling Enhances Other Barrier Materials and Reduces Overall Costs

US Army Corps of Engineers, Ram Island Causeway
Long Island, NY

CMI sheet piling was the product of choice for soil reinforcement along the Ram Island Causeway. The sheet piling was installed in combination with rip rap to prevent soil from sifting away and causing the road surface to settle. The durable, strong interlocking sheet piling created an effective barrier that reduced the amount of rip rap necessary to complete the project, and provided a longer-term solution than rip rap alone. Additionally, CMI's sheet piling reduced the cost and surpassed the expected design life over steel sheet piling

Supporting Local Businesses Against Mother Nature

South Padre Island, La Quinta Hotel
South Padre Island, TX

South Padre Island is located in hurricane country, and to try to reduce flood damage, the island building codes required new structures to be built at higher elevations than many of the existing lots. The La Quinta Hotel solved this dilemma by building up the soil using CMI sheet piling. They reduced their costs by choosing vinyl over steel, and because vinyl requires less heavy machinery for transportation and installation than steel sheet piling, they were able to maneuver more easily in the small space between their property line and the beach front.

CMI Sheet Pile Protects Infrastructure and Ecosystems Alike

US Fish and Wildlife,
Hagerman National Wildlife Refuge
Sherman, TX

The Hagerman National Wildlife Refuge sees frequent fluctuations in water levels which can cause dirt roadways through the refuge to wash out. In this case, the US Fish and Wildlife Department was not interested in controlling the water or preventing the flooding. Instead, they viewed the change as part of the natural cycle of the habitat and wanted to find a way to ensure that their roads could withstand the flooding without eroding and washing away. They chose CMI vinyl sheet piling for two reasons. First, vinyl is an inert material that would not impact the chemical balance of the delicate ecosystem in which it was to be installed. Second, vinyl's ease of installation meant they could shorten their installation time as much as possible to lessen the impact on the surrounding habitat.

County of San Mateo
Werder Pier
Restoration Feasibility Study

March 2004

Prepared for:

San Mateo County
Environmental Services Agency
Parks and Recreation Division

COUNTY OF SAN MATEO

WERDER PIER

Restoration Feasibility Study

March 2004

Prepared for:

San Mateo County
Environmental Services Agency
Parks and Recreation Division
Attention: Samuel Herzberg

Prepared By:

Concept Marine Associates

Programming

Planning

Design

Construction Management

With Assistance From:

Callander Associates
Landscape Architecture, Inc.

Treadwell&Rollo
Environmental & Geotechnical Consultants

WDP Whitlock Dalrymple Poston & Associates, Inc.
Consulting Engineers

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDICES

I. BACKGROUND (CMA)

With the opening of the San Mateo/Hayward Bridge on March 3, 1929, the Dumbarton Bridge lost the title of the world's longest bridge. The $6.5 million bridge measured 12 miles long, with seven of those miles over water. The bridge was originally constructed and operated as a privately owned joint venture. On September 12, 1951, the State of California paid $6 million and took control of the structure. With traffic on the bridge increasing from 2,000 vehicles per day in 1929 to 56,000 per day in 1968, and with drawbridge openings, malfunctions and accidents causing major delays for vehicles crossing the bridge, the opening of the new, high-level fixed bridge in 1968 was imminent. For the token sum of ten dollars, the County of San Mateo purchased the remaining 4,055 foot long trestle approach from the western shoreline out to where the first truss span had been.

The County then operated the facility as a public fishing pier through a lease with the California Transportation Department (Caltrans). One contingency of this lease is that Caltrans can revoke the lease at any time so that they can utilize the pier as a staging area and work platform to perform repairs or upgrades to the San Mateo/Hayward Bridge. This has been done on several occasions. A second contingency mandated that the County was to maintain the pier and keep it open for public use for 25 years. The County fulfilled this obligation in 1993 and continued to operate the pier for another three years. Over the period of the bridge's existence, the marine environment had taken its toll on the concrete structure. The aging components had deteriorated significantly, causing liability concerns resulting in the closure of the facility to public use in 1996. Due to the increase in public access to this area with the construction of the Bay Trail, and with the desire to regain this historic structure as a public attribute, the County of San Mateo solicited consulting services to perform a feasibility study on the pier. The focus of the study was as follows:

- Evaluate the structural capacity of the pier
- Estimate repair needs and costs
- Perform public outreach to gain input on the desired uses for the facility
- Identify permitting agencies and the related issues
- Identify funding sources.

The following report presents the findings of this study.

II. SITE DESCRIPTION (CMA)

The Werder Fishing Pier is located along the Foster City shoreline, just south of the existing San Mateo/Hayward Bridge, as shown on the Figures 1 & 2 – Location and Vicinity maps. Along with the pier, the County owns an associated 2.75 acre, landside parcel. This parcel can be accessed from Beach Park Boulevard and is situated between a Caltrans maintenance yard and Caltrans wetland mitigation sites. See Figure 3 for an aerial showing these parcels. The pier is 30 feet wide and 4,055 feet long and extends into the deepwater shipping channel, as shown on Figure 9 of the Pier Rehabilitation section of this report. The pier has a restroom facility located approximately ¾ of the way out along the pier that is no longer operational. Fish cleaning stations were also once present on the pier.

The landside parcel is occupied by a restroom building, parking lot and small picnic area. The restroom is near the foot of the bridge and is also not functional, due to a severed sewage line. The condition of these improvements has also degraded as a result of being unused and, therefore not maintained.

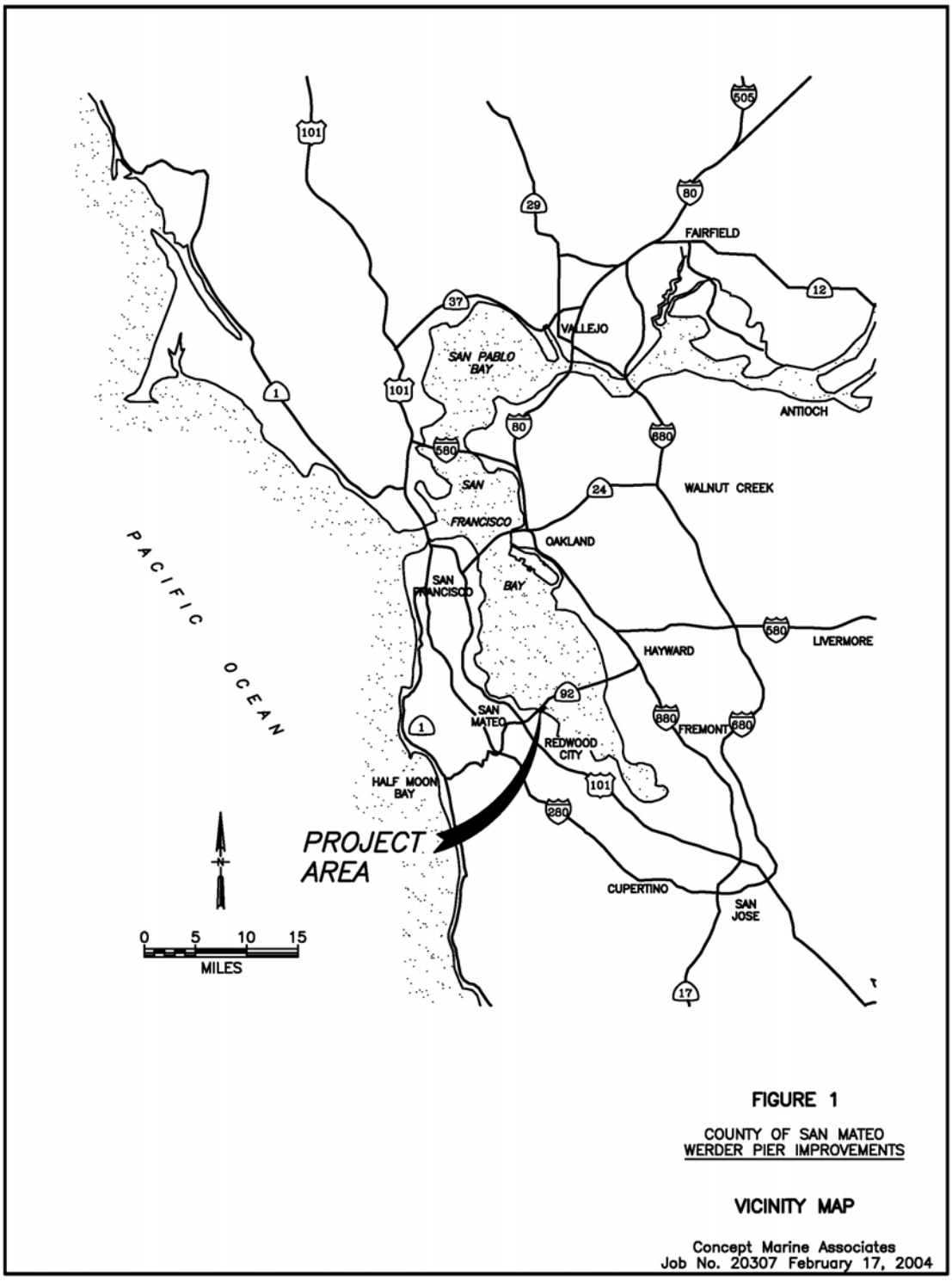


FIGURE 1

COUNTY OF SAN MATEO
WERDER PIER IMPROVEMENTS

VICINITY MAP

Concept Marine Associates
Job No. 20307 February 17, 2004

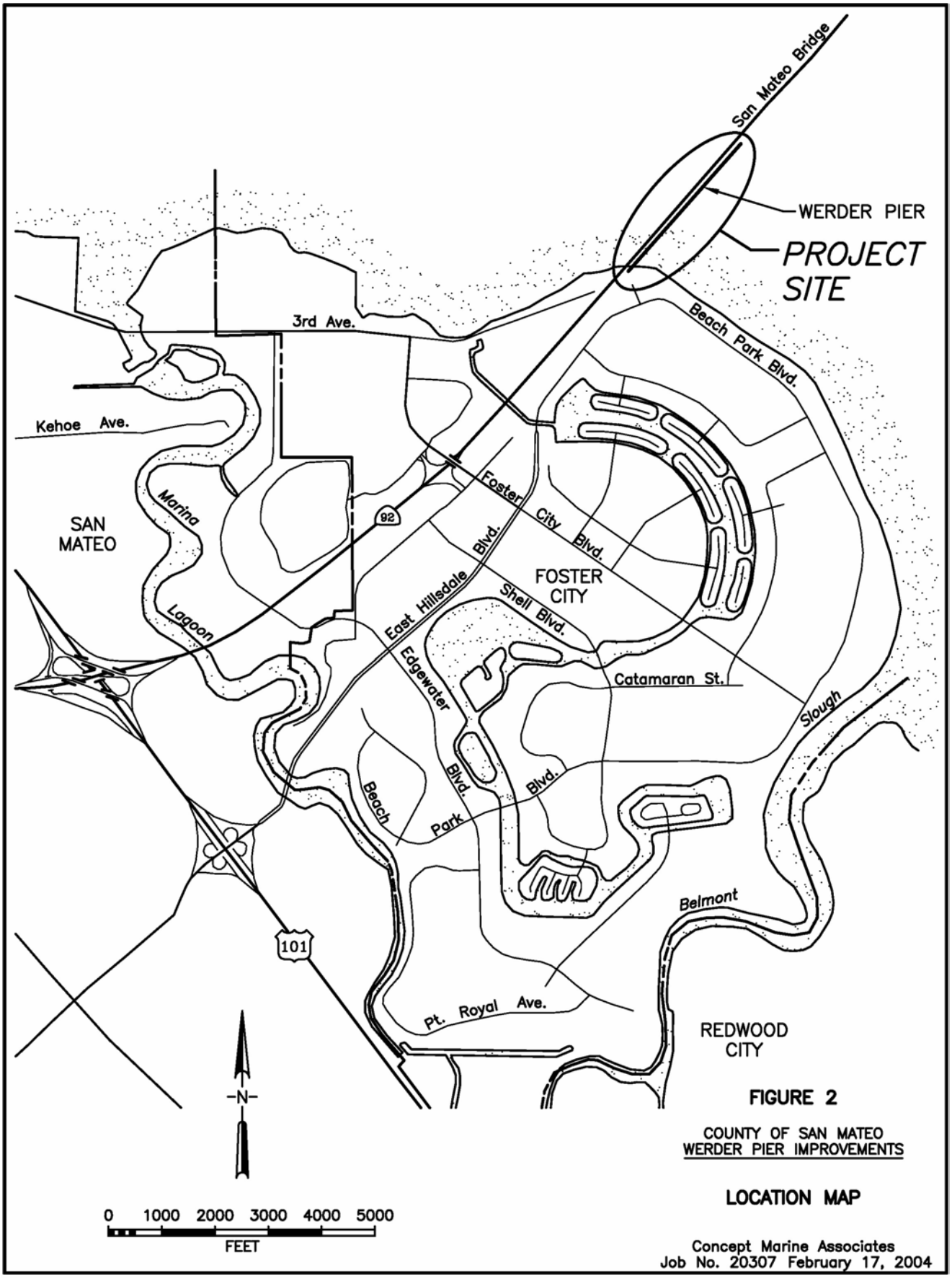


FIGURE 2

COUNTY OF SAN MATEO
WERDER PIER IMPROVEMENTS

LOCATION MAP

Concept Marine Associates
Job No. 20307 February 17, 2004

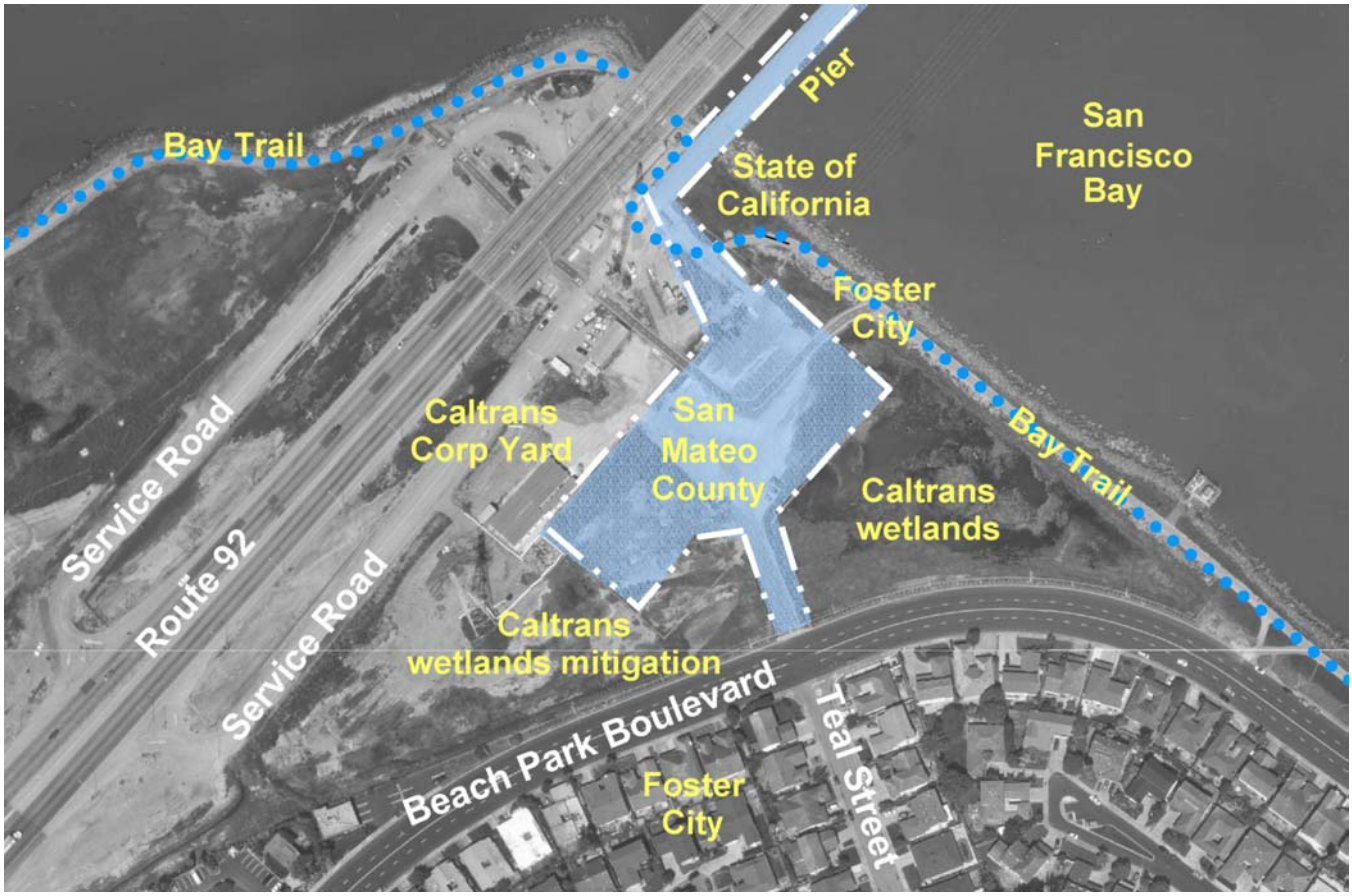


Figure 3: Site aerial depicting parcel ownership.

III. SITE ANALYSIS (CMA, Callander Associates, Treadwell & Rollo)

A. Condition Review (CMA)

During the initial phases of evaluation, visual observations of the pier's condition were made by the consultant team. The observations were made both from on the pier and from the water. Water access was provided by staff at the Coyote Point Marina. Due to the extreme currents, the vessel was not able to travel beneath the pier, limiting observations from the water to a distance of approximately 15 feet from the pier. The observations were documented with digital photographs of typical damages and with written notes. The following sections summarize the findings of the observations made of the pier's components.

1. Pier Surface and Concrete Deck

A majority of the pier surface has been overlaid with asphalt. This was conducted on at least two separate occasions, due to the presence of asphalt overlays of differing ages. The asphalt is in relatively good condition, particularly along the outer portion of the pier where the asphalt was most recently placed. Although the asphalt is in good condition, it may not be beneficial due to its ability to hold moisture against the underlying concrete. This will be discussed further in the Pier Rehabilitation portion of this report.

Although the presence of the asphalt overlay inhibited the full review of the concrete deck from the top of the pier, a limited number of locations beneath the asphalt were inspected. This was done by removing the asphalt in randomly selected locations along the length of the pier. The locations also varied across the width of the pier. The location along the width was selected at random and to expose joints at connections between structural components. The locations inspected revealed no indication of significant structural decay of the deck. However, the presence of the asphalt layer, which would have been costly to install along the entire length of the pier, raises the question of why it was needed. It is possible that the asphalt was installed to cover damages and/or exposed steel. Since no evidence of such damages were found within the limited locations uncovered, the question relating to the purpose of the asphalt layer remains unanswered.

Also inspected were two approximately one foot wide areas beneath the railings along either side of the pier and the underside of the deck. The areas beneath the railing were observable since asphalt had not been placed in these areas. Observations of both areas revealed varying levels of damage, including cracks in the concrete, spalls and exposed and corroded steel reinforcing. Although the locations of the observed damages varied, a majority were associated with the connection between the deck and railing posts. See Figure 4 for an illustration and photographs of typical observations along the pier surface. Figure 5 shows a typical spall on the underside of the deck.

2. Railing

The existing railing system is the original cast-in-place concrete system. The condition of the railing varies along the length of the pier, from moderately damaged to heavily damaged and failing. Damage to the railing includes concrete cracks, spalls and large amounts of exposed steel reinforcement. See Figure 4. Damage at the curb along the bottom of the railing system consistently showed spalling and cracked concrete that correlate with the joint locations in the deck slab and girders. The lack of joint within the curb appears to be a primary contributor to the damage at these locations, since movement at the joints along the deck could not transmit through the railing without damage.

Past repairs observed along the railings varied, depending on the locations and extent of damage being repaired and on the agency or contractor performing the work. Discussions with County staff indicated that repairs have been performed by contractors during Caltrans related activities on the pier and by the County of San Mateo. The observed repairs included new horizontal railing beams (steel) mounted into the existing posts, and replacement of entire railing sections. These repairs were conducted in a manner to restore the failed component of the existing railing to a condition similar to the original design. The repairs did not address code issues related to the oversized gaps in the railing and exposed reinforcement, or the repairs needed at the significant number of cracks and spalls present. Concerns regarding the integrity of these repairs were noted. These concerns were related to the types of materials used, the methods used to attach the repair members, and the location at which these attachments were made. Recommendations for future rehabilitation and/or replacement of the existing railing will be presented later in this report.

The design of the rail does not meet current design standards for public access due to gaps in the railing that exceed four inches. This would present a significant hazard to users if the railing were restored as originally designed. Any effort to restore the railing, which public comment identified as desirable, would need to also include a retrofit to bring the railing up to current design standards. This will be discussed further in the pier rehabilitation portion of this report. An additional hazard to the public is the presence of exposed rebar with sharp edges and points, which contributed to the closing of the facility and will need to be removed prior to reopening. The condition of the railing varies significantly along the length of the pier, which should be considered when deciding whether to restore or replace the railing. This will be discussed further in the pier rehabilitation section of this report, along with alternative railing types.

3. Concrete Girders and Beams

The condition of the concrete girders and pile cap beams also varies significantly. Although only observed from a distance, the primary type of observed damage was spalling of concrete and loss of reinforcing section due to corrosion. Cracking was also observed but was hard to identify due to the distance from which observations were made. The areas of spalled concrete vary significantly in size. See Figures 5 and 6 for depictions of typical spalls. The extent of the spalls within the members appeared to be primarily limited to the outer layers of the reinforcing steel which will reduce the amount of labor and materials necessary to perform the repairs if the remaining concrete and reinforcing are in good condition.

Also observed along these members were many areas that had previously been repaired. Repair plans obtained from Caltrans showed the details of these repairs. Although these repairs were conducted in a manner very similar to repair methods used today, current industry standards have significantly improved he details of how the repairs are performed and the quality of the materials used. Of particular concern regarding past repairs is the level of cleaning (steel and concrete) and surface preparation that is performed prior to placing the concrete based grout or fill material. If proper cleaning is not performed, the patch will not bond properly with the existing surface and damages will reoccur. Although some of the existing repairs appeared sound, many of the areas at which spalls were observed appeared to be locations at which previous repairs had been performed. Therefore, the integrity of the previous repairs should be confirmed. Recommendations for future repairs and possible costs associated with these repairs are presented later in this document.

4. Concrete Piles

A limited review of the above water portion of the piles supporting the pier was conducted from a distance during the condition review of the pier. Observations of the piles revealed cracks in the concrete and some spalls. Many of the cracks had rust stains associated with them, indicating that corrosion of the underlying steel had occurred. See Figure 5 for a depiction and photographs of a cracked pile. Although damage was observed, the piles were noted as having fewer observable damages than the other structural components (girders, beams and underside of deck). Possible causes of these observed conditions

include the piles being constructed in a more controlled manner (precast), the repairs performed were more effective, and/or the repairs were concealing underlying issues. Of these possible scenarios, the first two appeared to be more likely since any flaws concealed by the repairs, conducted some time ago, would probably have resulted in observable damages. This observation should be confirmed during the rehabilitation process.

Repairs to the piles appeared to be limited to the upper portion of the piles and consisted of encasing the piles in a concrete grout material. Some of these repairs resulted in a significant increase in the diameter of the piles. Since no underwater inspection was performed during this study, it is recommended that future efforts include this type of inspection to confirm the integrity of the piles and identify any damages that may be concealed below water.

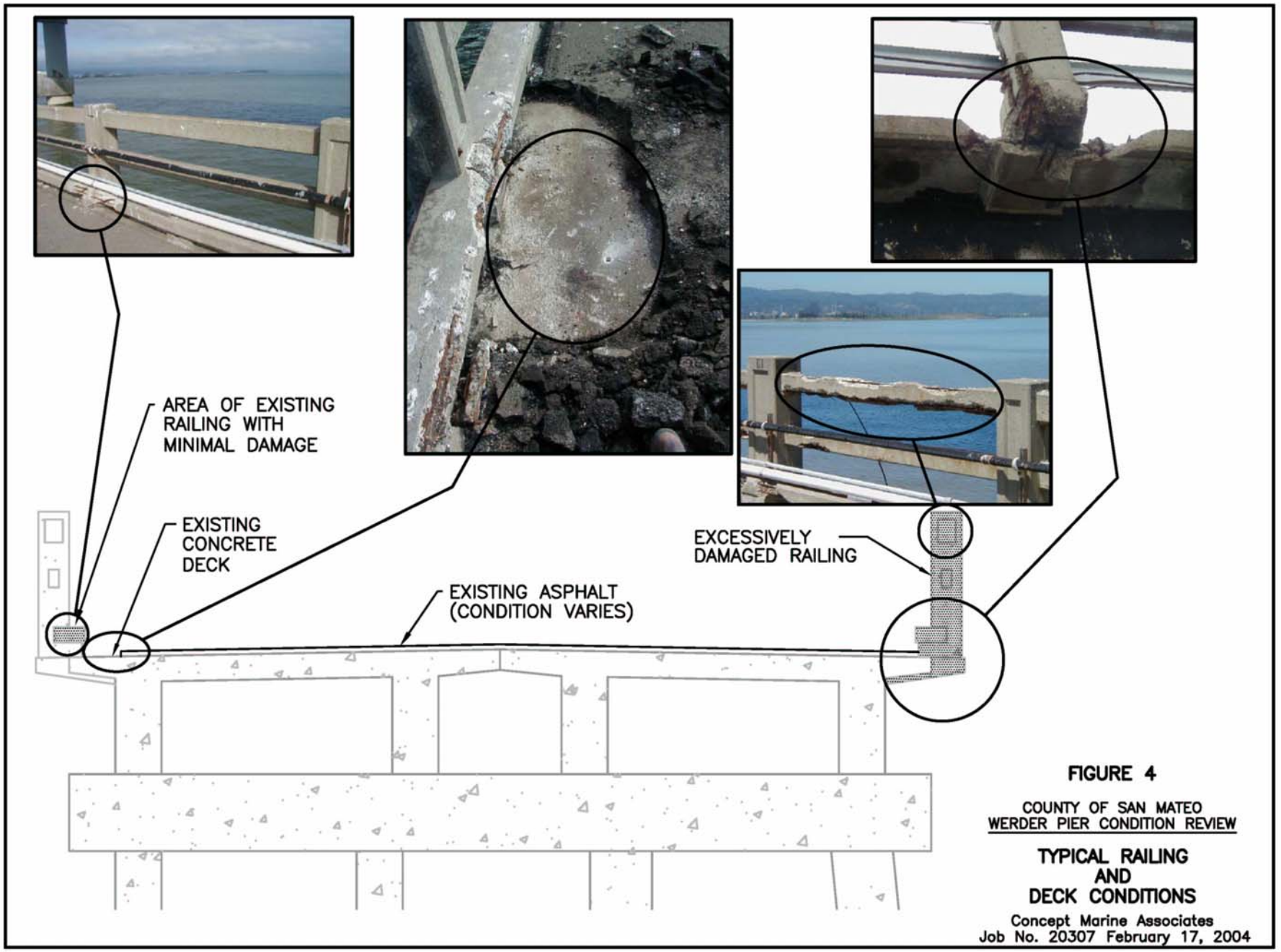


FIGURE 4

COUNTY OF SAN MATEO
WERDER PIER CONDITION REVIEW

TYPICAL RAILING AND DECK CONDITIONS

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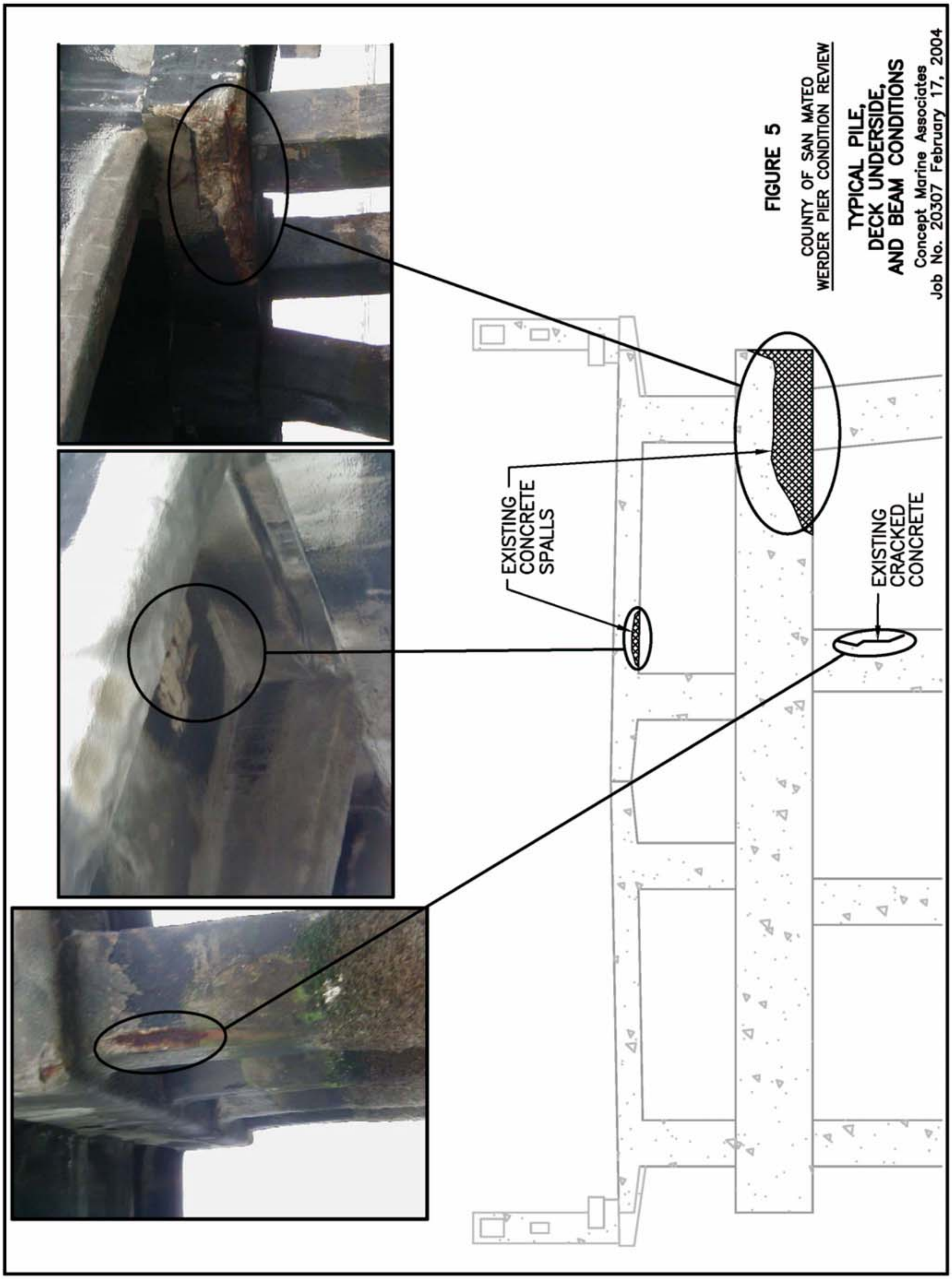


FIGURE 5
COUNTY OF SAN MATEO
WERDER PIER CONDITION REVIEW
TYPICAL PILE, DECK UNDERSIDE, AND BEAM CONDITIONS
Concept Marine Associates
Job No. 20307 February 17, 2004
EXISTING CONCRETE SPALLS
EXISTING CRACKED CONCRETE

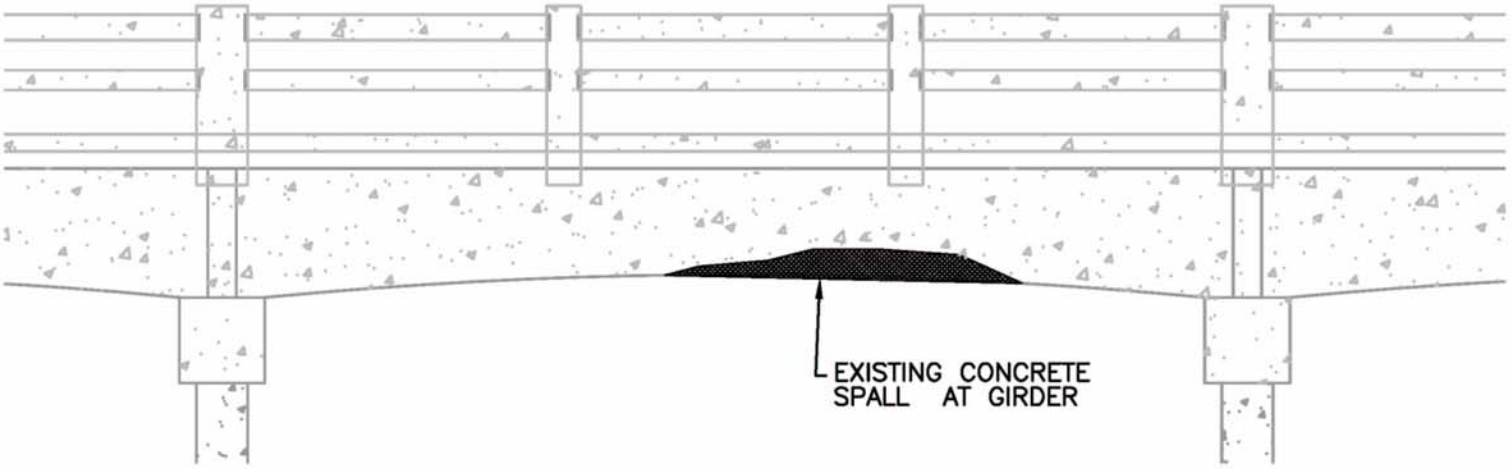


FIGURE 6

COUNTY OF SAN MATEO
WERDER PIER CONDITION REVIEW

TYPICAL GIRDER SPALL

Concept Marine Associates
Job No. 20307 February 17, 2004

B. Geotechnical Evaluation (Treadwell & Rollo)

1. Description of Evaluation

We understand the project team's approach to this project is to conduct a site review using available existing information to evaluate the current condition of the pier in support of the County of San Mateo Werder Pier Restoration Feasibility Study. According to WDP, the project structural engineer, the pier is supported by 24-inch-square prestressed, precast concrete pile foundation. The base of the pier is at approximately Elevation 10 feet[1]. Compression and uplift loads for each pile and pile lengths were not available for review during this study.

2. Subsurface Conditions

The site is located approximately 1,000 feet southeast of the existing San Mateo-Hayward Bridge. Available subsurface information indicates the mudline varies from Elevation 0 feet at the shoreline to Elevation -10 feet at approximately 2,750 feet offshore. The mudline drops to Elevation -48 feet at 4,055 feet offshore. A layer of soft, plastic clay, known locally as Bay Mud extends from the mudline to about Elevation -70 feet. Interbedded layers of loose silty sand are encountered within the Bay Mud between Elevations -45 to -60 feet. The Bay Mud is underlain by approximately 5 to 20 feet of dense sand. Beneath the dense sand is stiff and over consolidated clay, known locally as Old Bay Clay that extends beyond Elevation –160 feet.

3. Regional Seismicity

The major active faults in the area are the San Andreas, San Gregorio, Hayward, and Calaveras Faults. These and other faults of the region are shown on Figure 2 in Appendix A. For each of the active faults, the distance from the site and estimated maximum Moment magnitude[2] are summarized in Table 1.

---

1 All elevations referenced to the Mean Lower Low Water Datum.

2 Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

TABLE 1
Regional Faults and Seismicity

Fault Segment	Approximate Distance from Site (km)	Direction from Site	Maximum Magnitude
San Andreas - 1906 Rupture	8	SW	7.9
San Andreas – Peninsula	8	SW	7.2
Monte Vista	15	S	6.8
Hayward – Total	19	NE	7.1
San Gregorio North	22	W	7.3
Northern Calaveras	32	NE	6.9
Hayward - South East Extension	34	E	6.4
Mount Diablo Thrust	38	NE	6.7
San Andreas - North Coast South	39	NW	7.5
Central Calaveras	42	E	6.6
Concord	43	NE	6.5
Northern Greenville	49	NE	6.6
Central Greenville	49	NE	6.7
San Andreas - Santa Cruz Mountains	50	SE	7.2

Figure 2 in Appendix A also shows the earthquake epicenters for events with magnitude greater than 5.0 from January 1800 through January 1996. Since 1800, four major earthquakes have been recorded on the San Andreas Fault. In 1836, an earthquake with an estimated maximum intensity of VII on the Modified Mercalli (MM) scale (Figure 3 in Appendix A) occurred east of Monterey Bay on the San Andreas Fault (Toppozada and Borchardt 1998). The estimated Moment magnitude, $M_{w,}$ for this earthquake is about 6.25. In 1838, an earthquake occurred with an estimated intensity of about VIII-IX (MM), corresponding to a M_w of about 7.5. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the San Andreas Fault from Shelter Cove to San Juan Bautista approximately 470 kilometers in length. It had a maximum intensity of XI (MM), a M_w of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The most recent earthquake to affect the Bay Area was the Loma Prieta Earthquake of 17 October 1989, in the Santa Cruz Mountains with a M_w of 6.9, approximately 68 km from the site.

In 1868, an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward Fault. The estimated M_w for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude

(probably a M_w of about 6.5) was reported on the Calaveras Fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill earthquake (M_w = 6.2).

In 1999, the Working Group on California Earthquake Probabilities (WGCEP 1999) at the U.S. Geologic Survey (USGS) predicted a 70 percent probability of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area by the year 2030. More specific estimates of the probabilities for different faults in the Bay Area are presented in Table 2.

TABLE 2
WGCEP (1999) Estimates of 30-Year Probability (2000 to 2030)
of a Magnitude 6.7 or Greater Earthquake

Fault	Probability (percent)
Hayward-Rodgers Creek	32
San Andreas	21
Calaveras	18
San Gregorio	10
Concord-Green Valley	6
Greenville	6

4. Foundation Design Recommendations

Based on the results of our limited engineering analyses, we conclude the 24-inch-square prestressed, precast concrete piles gain strength support through skin friction from the stiff clay or dense sand underlying the Bay Mud. For compressive, dead-plus-live load, we recommend using allowable skin friction of 425 pounds per square foot (psf). Skin friction derived from Bay Mud or loose silty sand within Bay Mud layer should be ignored. The skin friction value recommended above include a factor of safety of at least two; this value may be increased by one-third for total loads that include wind and/or seismic. Support from end bearing should be ignored. For temporary uplift loads, we recommend using allowable skin friction values equal to the allowable values for compressive, dead-plus-live load.

Piles provide lateral resistance from passive pressure acting on the upper portion of the piles and from their structural rigidity. Lateral resistance of piles depend on the pile size, pile head condition (restrained or unrestrained), length of pile above mudline, allowable deflection of the pile top, and the bending moment resistance of the piles. We have performed lateral load analyses for isolated, 24-inch-square prestressed, precast concrete piles at 1000, 3000, and 4000 feet from the shoreline using both restrained and unrestrained head conditions. The results of our analyses are summarized in Table 3.

TABLE 3
24-inch-square Prestressed, Precast Concrete Piles

Location	Pile Head Condition	Deflection at Pile Head	Lateral Load	Maximum Moment
1000 feet from shore, 17.5 feet stick-up	Unrestrained	1.0 inch	3.2 kips	900 kip-inch
3000 feet from shore, 38 feet stick-up	Unrestrained	1.0 inch	0.9 kips	500 kip-inch
4000 feet from shore, 60 feet stick-up	Unrestrained	1.0 inch	0.3 kips	300 kip-inch
1000 feet from shore, 17.5 feet stick-up	Restrained	1.0 inch	9.5 kips	1000 kip-inch
3000 feet from shore, 38 feet stick-up	Restrained	1.0 inch	3.4 kips	700 kip-inch
4000 feet from shore, 60 feet stick-up	Restrained	1.0 inch	1.4 kips	450 kip-inch

Plots of deflection and bending moment versus depth for both restrained and unrestrained head conditions are presented on Figures 4 through 7 in Appendix A.

5. Seismic Design

For design in accordance with the 2001 California Building Code, we recommend the following parameters:

a. Seismic Zone Factor 4

b. Soil Profile Type S_E

c. Seismic Source Type: Type A (San Andreas Fault located 8.2 kilometers from site)

d. Near Source Factors N_a and N_v of 1.07 and 1.34, respectively.

C. Structural Evaluation (WDP)

1. Structural Analysis

A limited preliminary structural analysis was performed as a structural design check of the different components of the bridge. Due to the scope of the overall evaluation, this analysis required making several assumptions regarding the mechanical properties of the *in situ*

materials, i.e., concrete compressive strength, concrete unit weight, and structural steel yield stress. The structural analysis included seismic analysis of a general section of the pier. Further analysis included more specific consideration of general structural members including beams and piles. Analysis of these members considered dead and live loads. Specifically excluded from the analysis were any considerations of soil-structural analysis from geotechnical testing as well as consideration of the bent caps. Based on our structural calculations, the typical structural components, including piles and beams appear to be in fair condition. Given the limited nature of the analysis and the scope of the investigation, the capacity and acceptability of specific members cannot be assessed based on the results of the analysis performed. See Appendix B for the structural calculations.

The structure was checked against seismic loading and appears to be capable of resisting this type of loading. The shear force resulting from the seismic loading can be balanced by friction between the diaphragms and the bent caps alone. The presence of steel dowels running from the bent caps through the diaphragms enhances this shear capacity.

The piles appear to have enough capacity to withstand the weight of the superstructure. The flexural capacity of the piles under seismic loading is somewhat limited by its “effective length”. The ultimate flexural strength of a typical pile section used for analysis exceeds the ultimate loads determined by a geotechnical analysis performed by others. Additional data from the geotechnical analysis shows the “fixity,” or fixed point, depth of the piles to range between 50 and 70 feet. Based on our analysis using a conservative value of 50 feet, the piles can safely withstand seismic loading.

The pier girders were checked for gravity loading. In addition to checking the original design, which was found as satisfactory, two levels of deterioration of the original steel reinforcement were considered: 25% and 50%. These levels of deterioration consider the possibility that part or all the bottom layer of steel in the girders may be significantly affected by corrosion. For the first case, the girders appear to be capable of sustaining 100% of the dead load plus only 50% of the live load on the structure. For the second case, the dead load alone exceeds the girders’ capacity.

2. Nondestructive Testing

Testing methods included visual evaluation from the surface of the pier as well as by boat, chloride sampling, half-cell corrosion testing, and impact-echo testing. The results of the test methods, including specific comments and raw data, are included in Appendix C. Generally, chloride sampling indicated that those sites tested on the deck and rail portions of the structure contained chloride contents beyond the threshold value at which corrosion of reinforcing steel is theoretically possible. The increasing values of chloride content with depth found in some test locations are not consistent with the nature of chloride intrusion. Based on visual observation of the exposed aggregates in some distressed locations, it is concluded that the phenomenon can be attributed to aggregates with high chloride contents, such as sea shells; anecdotal information regarding the construction practices supports this conclusion as well. Half cell testing of the deck revealed test values both above and below those limits indicating active corrosion at the time of testing. The results are site specific. Generally, effects from active corrosion could not be visually confirmed in the half-cell

testing areas. Impact-echo testing, likewise, did not indicate apparent concrete flaws that might be associated with corrosion activity in the test areas. Clearly though, visual observations from below indicated there were selected areas of the deck slab that had delaminated from underneath due to corrosion.

IV. COMMUNITY OUTREACH (Callander Associates)

The community outreach for the Werder Pier Feasibility study was key to this planning process. Gaining input and insight from the community residents and potential park and pier visitors helped guide the "vision" and needs for these facilities. This process included input from four different focus groups, a public survey, two public workshops and other interagency and staff meetings. The following presents summaries of these activities in the order in which they occurred.

A. Focus Group #1 – Fishermen, May 24, 2003

The purpose of this meeting was to allow people to fish from Werder Pier and at the same time present their views, aspirations and visions for the pier. Nine adults and two children were in attendance, spending a total of five hours of fishing and discussing the pier that morning. The fishermen traveled from Daly City, Roseville, San Bruno, San Jose, Belmont, Millbrae and Redwood City for this event. The fishing occurred at the end of the pier, in the deep water channel approximately a mile off shore.

Suggested items of concern and potential proposed improvements are summarized below.

Concerns

- Security of parked vehicles in the parking lot should be addressed.
- Personal safety and security while using the pier is a concern. This includes debris flying from bridge above.

Suggested Improvements

- Majority of users felt a minor charge for parking and concessionaire operation would be extremely beneficial, especially if attendant and security patrol were present.
- Many expressed interest in nighttime use to avail themselves of the best fishing hours, including after 9 pm.
- A broad range of recreational activities on the pier was strongly supported, including biking, strolling, and jogging.
- Improvements relating to improved safety and security included:
    1. use of security cameras or other appropriate security devices
    2. private security company to provide surveillance
    3. limited lighting for improved visibility
    4. restricted and enforced access hours, gating the pier and parking lot during evening hours except by reserved/permitted use (including fishing), special events or promotional fundraising events
    5. police patrol on bikes
    6. improved safety railings, especially for the protection of children
    7. life buoys and throw ropes

8. use of parking lot as California Highway Patrol parking lot
9. public emergency phone and restroom facilities access desired by many

Suggested improvements by more than one attendee included the following:

- Fishing amenities: fish cleaning station, garbage cans, fish landing floats, railing mounted rod holders, designated fishing area, and an imposed limit on "fish take"
- Seating area and benches, including some with windscreens.
- Small concessionaire snack stand and bait shop.
- Picnic area and increased landscaping at Bay Trail and along pier.
- Bicycle racks.
- Interpretive panels at the park and along the pier for pier history, wildlife, ecology, and shipping lane information.

The fishermen sought multi-purpose access to the pier to include fishermen, bikers, strollers, joggers, skaters, bird watchers, and fishing spectators. The participants were appreciative of the opportunity to use the pier and looked forward to the planning process, especially future implementation of the shoreside and waterside improvements to the pier.

B. Focus Group #2 – Interagency Staff, July 31, 2003

This meeting was an information gathering session to uncover opportunities, ideas and concerns associated with reopening Werder Pier. Staff from the City of Foster City included the Parks Department, Community Development and Planning, the County of San Mateo Parks Division, California State Coastal Conservancy, Bay Conservation and Development Commission (BCDC), and Caltrans attended the meeting.

Discussion included the following topics and comments:

Pier Structural Condition

- Some corrosion of the pier has taken place, including to the concrete and railing.
- Visual inspection underneath the pier had been performed.
- Further evaluation of the piles was in progress.

Potential Pier User Groups

- Desirable user groups include fishermen, strollers, joggers, bikers, skaters, and bird watchers.

Recreational Opportunities

- A multi-use park and pier sought by all.
- Access for boating and windsurfing may be difficult due to tides and water depth at this location.

Potential Funding Sources

- Various environmental funding sources were cited.
- Some grant funding sources provide varying levels of funding depending upon degree of bay restoration contemplated. For example, removing pier sections and exposing the Bay to daylight may increase funding levels.

Existing Conditions of the Werder Pier Area

- Existing gates, picnic areas, restrooms, parking, wetlands, Bay Trail access, utilities were discussed. Pending utility improvements and future vision of the adjacent Caltrans site were reviewed.

Lessons Learned from Prior Public Access

- Concerns over security, maintenance, traffic impacts, vandalism, bonfires, property damage, utility and plant theft, feral cats, and hours of operation were explored.

Permitting and Implementation

- BCDC generally regards increased public access as a benefit and is favorably disposed toward the project.

Responsibility for the Pier

- San Mateo County and the City of Foster City discussed possibilities of collaboration, especially in times of limited funding and limited staff availability.

Maintaining Security

- Some proposals were made including lighting, and restricted hours of use.
- Further concerns and ideas to be provided through community participation and public questionnaire response.

Potential Park and Pier Amenities

- “Park-like” amenities sought, including picnic areas, benches, restroom, drinking fountain, trees and open space, parking lot and Bay Trail access.

Public Outreach Process

- Further input to be gathered from community workshops, focus group meetings, and public questionnaire.
- The City of Foster City to provide some assistance in this outreach effort.

The meeting helped to generate enthusiasm and define the planning process, and initiated the collaborative efforts between the County of San Mateo and the City of Foster City.

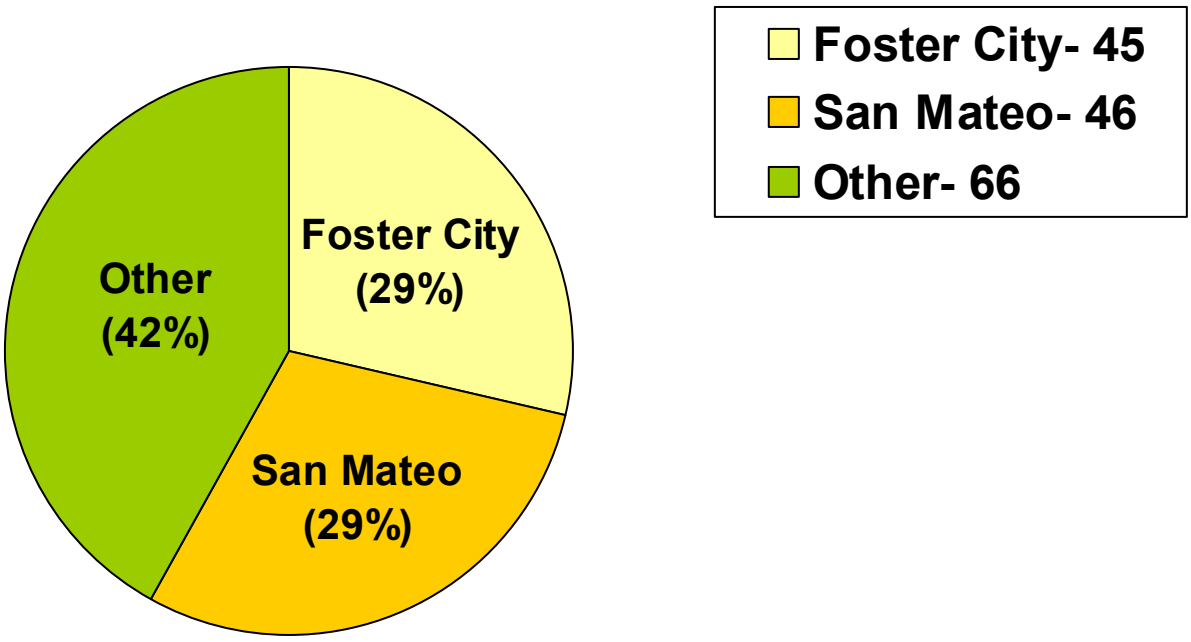
C. Werder Pier Questionnaire, August to December 2003

A questionnaire was created to help gather insight, recreational needs, and concerns about reopening the park/pier facility. This questionnaire included a section to educate the public on the history of the project and provided opportunities for comment that might not be otherwise shared in a public forum. Questionnaires were mailed to individual residents in the Werder Pier area and were made available at local bike shops, bait shops, community centers and libraries. The questionnaire also posted to UPSAC's website. The questionnaire was divided into two main topics: prior use and anticipated use. Recreational needs, hours of operation, site amenities, and safety issues were some of the issues covered in the community's responses.

General Findings

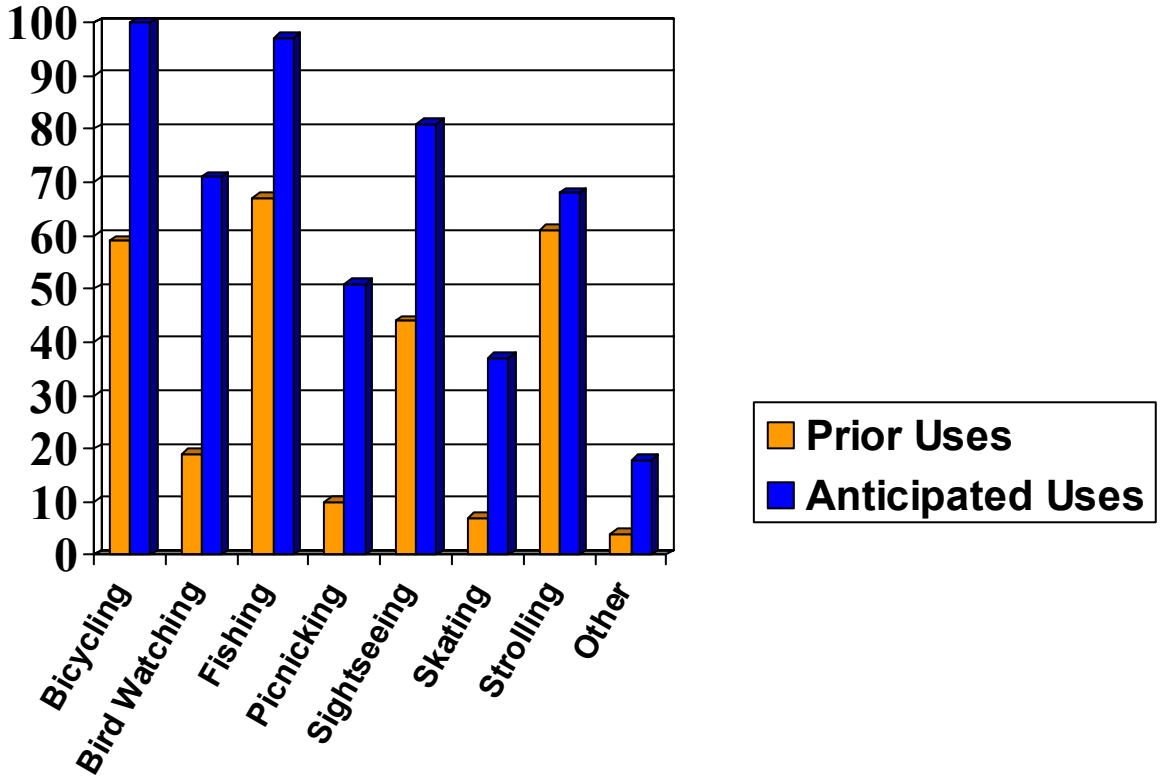
Overall, one hundred and fifty-seven responses from diverse recreational users and members of several Bay area communities were received. The Werder Pier questionnaire received input from Foster City, San Mateo, and other Bay Area residents. See Figure 7 for a graph of the resident locations. Over forty percent of the responses received were from community members outside of the Foster City and San Mateo area. Responses from the Foster City and San Mateo community were equally numbered. Over a majority of respondents had previously used the facilities. The main prior uses included bicycling, fishing and strolling, throughout the year, with little carpooling used to visit the site. Trips to the site were taken in small groups with friends or family, with neither weekday nor weekend trips favored.

Figure 7: Resident Locations for Survey Responses



The respondents currently participate in active and passive recreation use along the Bay. With the reopening of the pier, respondents perceived that use of the pier and park would exceed prior usage and that a greater variety of activities would take place. Routine fishing trips, daily walks, and bicycling were among the activities experienced when the pier was previously open. Bicycling, fishing, and strolling were at the top of the list for anticipated uses. Sightseeing, bird watching, picnicking, strolling, and skating were other anticipated activities. See Figure 8 for a graph showing the anticipated uses and number of respondents that previously participated and anticipate participating in the use of the facilities.

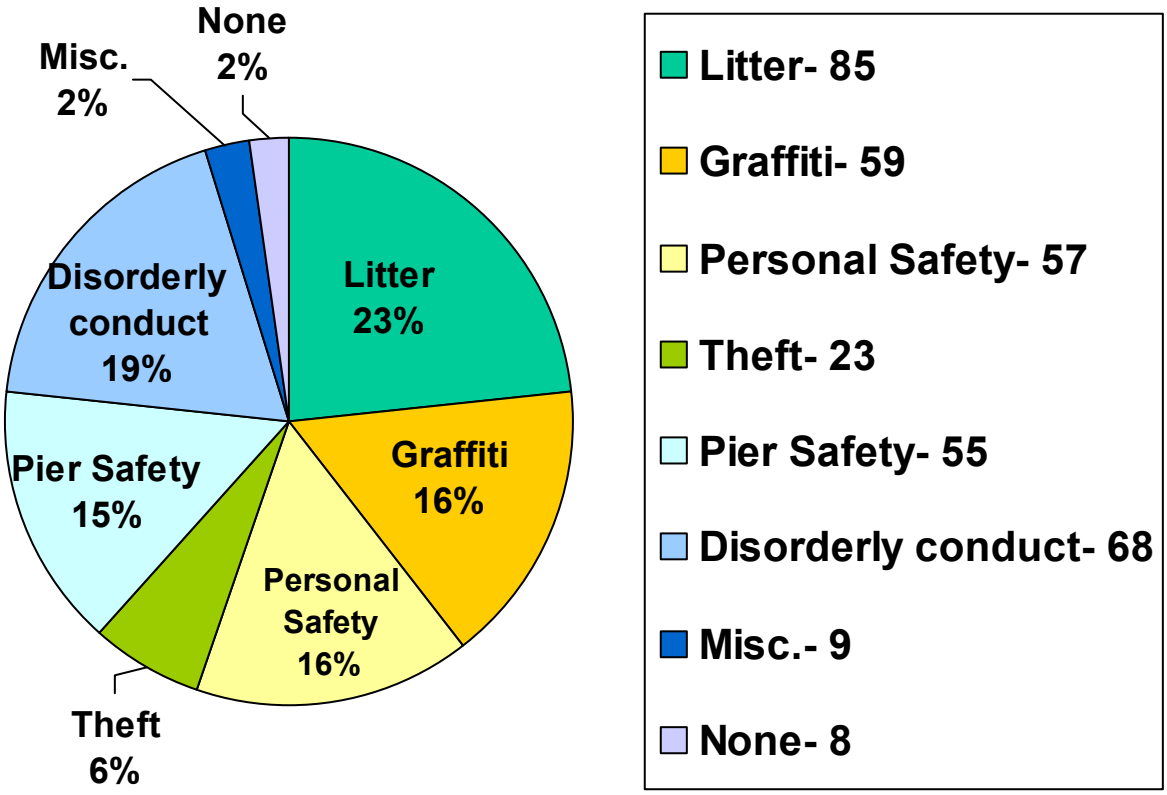
Figure 8: Identified Uses for Werder Pier



Public Concerns

A number of concerns were identified by the responses to the questionnaires in regard to reopening the pier. Questionnaire respondents were allow to check none, several, or all of these topics regarding concerns about the facilities. Answers were generally expressed with respect to prior experience when the pier was previously open. See Figure 8 for the Concerns about Reopening the Pier.

Figure 9: Concerns about Reopening the Pier



There was mixed response on the desire to pay for park or pier use. Some felt access should be free while others didn't mind paying a minimal fee to help with maintenance and cleanup of the facilities. There were also opinions on charging for parking entrance versus pier use. Nearby residents preferred free parking to minimize impacts on the on-street parking availability or traffic in their neighborhood.

Safety and maintenance concerns were also expressed. A concern for lack of maintenance regarding litter, graffiti, and disorderly conduct were expressed, in addition to pier safety, personal safety, and theft. Alcohol use, illicit behavior, and after hours use were not desirable. Increased patrolling, security measures, gated facilities, increased recreational activities, and maintained park facilities were suggested.

Park amenities are desired such as restrooms and drinking fountains. Regular site visitors such as fishermen and families expressed a preference for a small concessionaire bait and snack shop, while others were opposed to any concessionaire use because of concerns for added trash and types of patrons that may frequent the store.

Sample Comments Received on Questionnaires

- "This is a valuable asset to the Foster City community and needs to be preserved."
- "We do not have any kids, but enjoyed walking on the pier. The pier needs to be "Kid Friendly" and safe. Open daylight to dark only. …. A charge would be in order if it would help keep the place clean. I ride the path 3 or 4 times a week."
- "Must be free, it is our bay."
- "A pier always adds a unique way to explore and enjoy the natural beauty and wonders of the bay. Would be a great addition to the existing public parks and trails."
- "The pavement on the bridge will need improvements to facilitate walking and bicycling."
- "To improve the area, plant some shade trees at the entrance to the pier with benches, tables, improved toilet facilities, protected from the wind by some kind of a wind break. Better landscaping around the entrance to the pier and also the parking lot. Plant trees over the parking area as well."
- "Certain shading area should be provided for sitting and fishing. It should be wheelchair accessible."
- "The pier should be closed and chained at sunset to prevent damage to restrooms and fish cleaning stations. Also to prevent it from becoming a teen/young adult hangout."
- "We think it will need some sort of security by day and securely locked at night."
- "I think fixing it up is long overdue. People love walking and strolling all over out there because it is so scenic. "

Overall, great enthusiasm was received to reopen the pier and park facilities. Issues of security, maintenance, and safety needed to be addressed to balance this recreational desirability. The County's mailing list grew with the community's interest in being informed of the planning process.

D. Concept Alternatives Meeting, September 10, 2003

A meeting was held with the County and the consultant team to evaluate the design concepts before they were presented to the public. Two landside alternative plans were prepared for discussion. Desired pier and landside improvements, existing conditions, donation opportunities, and concept development where the main topics covered. The two concepts were reviewed with the City of Foster City, and refined for presentation to the public. A third alternative was developed for presentation to Caltrans for feedback on an enlarged park site area, including a land-swap of County land for Caltrans land nearer the Bay edge.

E. Public Workshop #1, October 2, 2003

This public workshop presented the alternative concepts to the community for the first time. Pier and shoreside existing conditions, three park alternative plans, and pier alternatives for restroom, fish cleaning stations, railings, and windbreak/bench designs were presented. These concepts were used as a discussion tool to refine the design towards a preferred alternative.

Workshop #1 Desired Elements

PIER

- More and larger windbreaks incorporating the railing design
- Security (gate/lighting/security cameras)
- Safe railing system
- Bike racks
- Dredging to increase fishing area
- Emergency vehicle access
- Adequate lighting
- Haul carts
- Bait boxes
- Human-powered boat launch

SHORESIDE

- More off-street parking
- Drop off area
- Minimize pedestrian/vehicular crossings
- Concession building
- Gathering space/group space
- Interpretive opportunities
- Easy surveillance

Amenities for both pier and shoreside developments are desired. Comments received reiterated the desire to reopen the facilities. The concept plans were further refined to reflect the comments received from this workshop and prepared for the second public workshop.

F. Public Workshop #2, December 4, 2003

At the second public workshop, the preferred pier and shoreside plan were presented. This included a windbreak, railing and restroom design on the pier. The preferred park plan illustrated a drop off area, large parking area, minimal sidewalk and vehicular intersections, restroom and concessionaire facility, large meadow, group gathering area, and marsh-edge interpretive pathway. A phase 2 overlay concept was illustrated with pathway, picnic tables and dry boat storage to the north and a wetlands interpretive trail loop to the south, both needing approval from landowners before further development.

Concerns

- Members would like input from Foster City police and fire department.
- Bay Trail and boat ramp may conflict with each other.
- Proximity of the pier (fishermen) to the human powered boat launch is a concern.
- Kayaker concern regarding the distance from the drop off area to the shore.

Suggested Improvements

SHORESIDE

- Sea kayakers desire floating dock or launch ramp access. Ramp materials, distance from the pier and precedents were discussed.
- Signage to educate both fishermen and kayakers should be installed to appraise both parties of safety issues and awareness of other recreational activities.
- Signage to educate kayakers on the bay currents should also be installed (i.e. deep ship channel can have high-speed currents).
- The pier should be renamed to "San Mateo" versus Werder, since it was previously the San Mateo Bridge.
- Funding from corporate sponsors should be considered.

The preferred pier and shoreside plan were consensually agreeable. Minor additions of safety signage and details of how to create an accessible human-powered boat ramp were discussed. These features will be developed further during design development, which is outside the scope of this feasibility study.

G. Focus Group #3 – Funding and Permitting, December 16, 2003

This group of City, state, and federal agencies with permitting and potential funding authority were invited to share their concerns about and objectives for the project. The group was organized to help the project gain momentum towards implementation. Over nine funding agencies were invited to attend. Several agencies suggested multiple grants that may be applicable to the project. Approximately ten permitting agencies were also invited to discuss jurisdictional limits and permit application procedures. Some agencies addressed both funding and permitting needs of the site.

A draft Preferred Plan and Phase 2 Plan, were presented. Members of the County Parks Division, Army Corps of Engineers (USACE) and Caltrans Permits office attended. A summary is outlined below.

Funding

- The San Mateo County of Public Works Department should be contacted for potential grant sources regarding transportation or pedestrian trail funding.
- The San Mateo County Parks has a mechanism so that private donations may be volunteered for park use.
- Other funding opportunities were identified for further research.

Permitting

- The Army Corps of Engineers is generally supportive of public access that does not degrade the environment.

- The USACE does not anticipate permitting obstacles if no pilings are being added and just repairs are made. The entire project would be reviewed not just that portion within their jurisdiction.
- In reopening the pier, the potential for resource degradation needs be evaluated.
- Entry drive new construction would need a permit from Caltrans.

Property Ownership

- Acquisition of Caltrans land to the west would require Caltrans review.
- Caltrans to look into excess lands at site area and Phase 2 that is not needed for Caltrans operations and could be incorporated into landside improvements.

Other Issues

- Parking lot surfacing materials and off-site drainage should be evaluated with respect to the impact to the adjacent wetland areas design and the existing hydrologic flow.
- Impacts of fishing on the pier may require mitigation.
- Mitigation 'in kind' is preferred by the Army Corps.

Attendees were very insightful and helpful. A potential opportunity for partnership and/or property acquisition from Caltrans was explored that had been previously contemplated. Subsequently, internet and phone interview research was completed to gain additional information on funding and permitting opportunities. Many funding sources are tied to the state budget and may not be available in the future. Details on potential funding sources are included later in this document.

H. Focus Group #4 – Environmental Education Opportunities, January 15, 2004

This focus group was conducted to identify environmental education themes and methods. Over fifteen different environmental non-profits, research, university, and museum directors and educational coordinators were invited. Attendees included representatives from the Coyote Point Museum, the United Pier and Shore Anglers of California (UPSAC), and the Foster City Parks Director. Opportunities for interpretive/educational outreach and potential themes present on site (shoreside and pier) were explored.

Potential Educational Themes

- Trail systems
- History of Foster City and Werder Pier
- San Mateo bridge/growth of the Peninsula
- Fishing
- Shipping industry
- Ecology: the Bay, the Pier, Wetlands, Shoreline
- Native and non-native species
- Tidal cycles
- Climatological phenomena

- Water and land species
- Pier/Park construction and rehabilitation
- Site stewardship
- Unique pier features
- Diversity of users to area
- Exercise

Potential Educational Methods

- Docent walks
- Fishing rod loaner program
- Backpack check-out
- Field trips or interactive outings (school groups, docent programs, ranger walks, etc.)
- In-class educational programs
- Interpretive signage
- Brochures
- Interactive opportunities
- Public art
- Community or regional fundraisers
- Organize “Friends of the Werder Pier”

Numerous themes and outreach methods were identified.

I. Security & Safety Meeting, January 21, 2004

A meeting was held with members of the County Parks Division, City of Foster City Parks Department, consultants, California Highway Patrol (CHP) and the Foster City Police. The Foster City Fire Department was also notified of the meeting but was not in attendance. Issues of accessibility to park and pier facilities were discussed. History of previous security needs, how the chain of response to emergencies occurs, and suggested improvements for safety and security were addressed. Collaborative efforts need to be further developed between the County and the City of Foster City on patrolling, maintenance, response to calls and overall park security measures. The following is a list of the issues and information provided by the Foster City Police and CHP.

1. Foster City Police

   Issues/Comments:

   - When open to public, the pier was a drain on police resources, particularly due to being open 24 hours a day
   - Two response units are needed per incident
   - Incidents include: fires, fireworks, alcohol & drugs
   - Past closure of pier during the night was not effective because people cut through or jumped over the fence to gain access to the pier
   - Fence continues to be cut to unlawfully gain access

- During fish runs, 25 to 50 people can be on the pier at night
- Clam beds near pier will also attracts people to the facility
- Rules set at the pier are only as good as the enforcement

Recommendations:

- Emergency phones should be provided on the pier
- Joint effort with County Sheriff for patrolling and response
- Public patrols are not helpful
- Pier and parking lot needs to be well lit
- Fence or access barrier needs to be full proof (no cutting or climbing possible)
- Landscaping vegetation should be kept high off the ground to maintain good visibility for patrols from the street
- Bathroom would ideally be located near the street and be visible
- Provide lots of garbage cans
- Provide emergency access to facilities

2. California Highway Patrol

Issues/Comments:

- San Mateo Hayward bridge has been identified as a #1 priority site for terrorism prevention
- Would not be able to provide support to security at pier
- SFO should be contacted with respects to airport security issues
- Parking lot may also present security issues since it provides access to vehicles in close proximity to the San Mateo/Hayward Bridge.

Recommendations:

- CHP would not support re-opening due to current, post 9-11 security situation
- Emergency phones should go directly to the response agency
- CHP would like to be appraised of further plan development

V. LANDSIDE CONCEPT PLAN (Callander Associates)

The Preferred Plan is a graphic summary of park planning efforts to date, including Focus Groups, questionnaire and pubic workshops. Further design development and funding are needed to permit further advancement of the plans.

A. Preferred Plan

This site plan calls for improved access, open space, parking, and park amenities on this approximately 2.75-acre site. The park links the community to the Bay Trail and to the pier. A meadow, interpretive trail, group gathering space, concession, public restroom, parking area, human powered boat launch, and grand entry to the pier are main features of the park concept. See Figure 7.

Access to the site is located at the intersection of Beach Park Boulevard and Teal Street in Foster City. A new entry drive with planting buffer and sidewalk will provide wheelchair access to the site. The entry will be gated for closure after hours. The drop off/loading area is centrally located for ease of dropping of groups of school children or unloading sea kayaks on the edge of the meadow. An increased parking lot with a capacity for over 90 vehicles is located on the south side of the site, away from the Bay edge. Run-off from the parking area will be designed in a manner that does not impact the adjacent wetland areas.

Security and safety measures should be provided to provide a safe user experience. To discourage misuse, lighting at the parking lot is recommended even when the park is closed for security reasons. Trees may be planted to help buffer the residential area from the large parking area and adjacent Caltrans corporation yard. Trees shall be pruned up to provide a clear line of vision underneath the main tree canopy. Low ground cover plantings and native seeded meadow areas are also appropriate.

Open space and meadow area are natural features of the site to be restored and celebrated. The eastern side of the site is planned as a passive recreational meadow area, providing clear views of the Bay. This green edge buffers users of the Bay trail from adjacent housing. The meadow is bounded by the parking lot, two park trails including an interpretive trail, and the Bay Trail.

From the drop-off area at the parking lot, the main paved trail curves past a new concession stand and public restroom. This location is convenient for visitors traveling from the park to the pier and also Bay Trail patrons. Snacks and bait are items that could be made available at this location. A salesperson could provide a constant presence on-site. Informational interpretive signage and computer terminal for educational use may also be available at the concession area.

Where the trail to the pier intersects the Bay Trail, an enlarged plaza node is proposed. This will help prevent user conflict at this juncture. The pathway continues to curve, climbing a raised berm to the pier entry. On top of this grassy berm, views to the east and south down to the Bay Trail and the Bay itself will be predominant. Here seating areas and gateway

landmark features such as banners or metal sculptures will make the pier entry vibrant. A gate will control entry to the pier, to be closed after hours.

The Bay Trail just south of the Route 92 overpass will be realigned. A section of the shoreside pier is proposed for removal to allow a more graceful Bay Trail alignment and clearer line of sight at the trail intersection. The Bay Trail segment from the pier node to the launch area will be widened to minimize conflicts between Bay Trail users and persons transporting human powered watercraft to the launch ramp. Across from the launch area a secondary spur trail meanders west of the Bay Trail along the side of the large meadow. A small group gathering space and marsh edge interpretive trail, allow opportunity for educational outreach on site. These are proposed to be ADA accessible and connect back to the entry drive sidewalk area. A continuous trail loops around the meadow.

Adjacent Caltrans mitigation wetlands area to the west and south of the site, along Beach Park Boulevard will be maintained. A delineation of the wetland areas needs to be prepared for respective permitting and potential mitigation measures that may be needed for park and pier development. Trails along these environmentally sensitive areas need to have a buffer or setback from the wetland areas. The established native habitat features of the surrounds need to be respected and protected. Educating the public of the presence of habitat areas and ecological lifecycles through interpretive signage and possibly docent walks can help ensure this sustainability.

Input was obtained from the Trails Advisory Committee by staff from the County Parks Division in an interim meeting to review three projects including the Werder Pier. Comments included that the concession building could be constructed by a concessionaire to reduce development costs. The Committee also noted that the parking improvements could be phased.

B. Preferred Plan Phase 2

Phase 2 of the Preferred Plan illustrates enlarged park facilities that could occur at a future time. This concept takes into consideration enlarged park area facilities, beyond the County's current property ownership. This plan illustrates one concept although other concept ideas may be explored. See Figure 8.

To the north, additional property would be developed for passive recreational use. This long, narrow addition is adjacent to a service road parallel to Route 92, currently utilized as a Caltrans corporation yard. This addition might include a trail spur from the parking lot to the concession stand/restroom area. Picnic tables and a human powered boat storage area are also suggested. The storage area would be accessed from the Bay Trail for ease of boat portage to the water. Fencing along the service road would be maintained to prevent access into this road and under the Route 92 bridge area.

To the south, an additional wetlands interpretive trail is proposed as an extension of the marsh edge trail. This spur trial would increase the interpretive and native habitat experience of the park user. Buffers of the proposed trail with the wetlands and sensitive areas would be

established and maintained. A detailed wetlands delineation map and areas of environmental mitigation need to be prepared before interpretive trails may be further developed.

For Phase 2 to occur, property ownership, site development, and funding need to be further defined. A collaborative effort with District 4 Caltrans for such park shoreside improvements must occur. Safety and security of the bridge facilities also needs to be sufficiently addressed.

Figure 10: Preferred Landside Plan

Preferred Plan
San Mateo County Fishing Pier

prepared by Callander Associates

December 4, 2003
Revised December 16, 2003

Figure 11: Preferred Landside Plan – Phase 2

0 20 40 80 FEET

Preferred Plan Phase 2
San Mateo County Fishing Pier

prepared by Callander Associates

December 4, 2003
Revised December 16, 2003

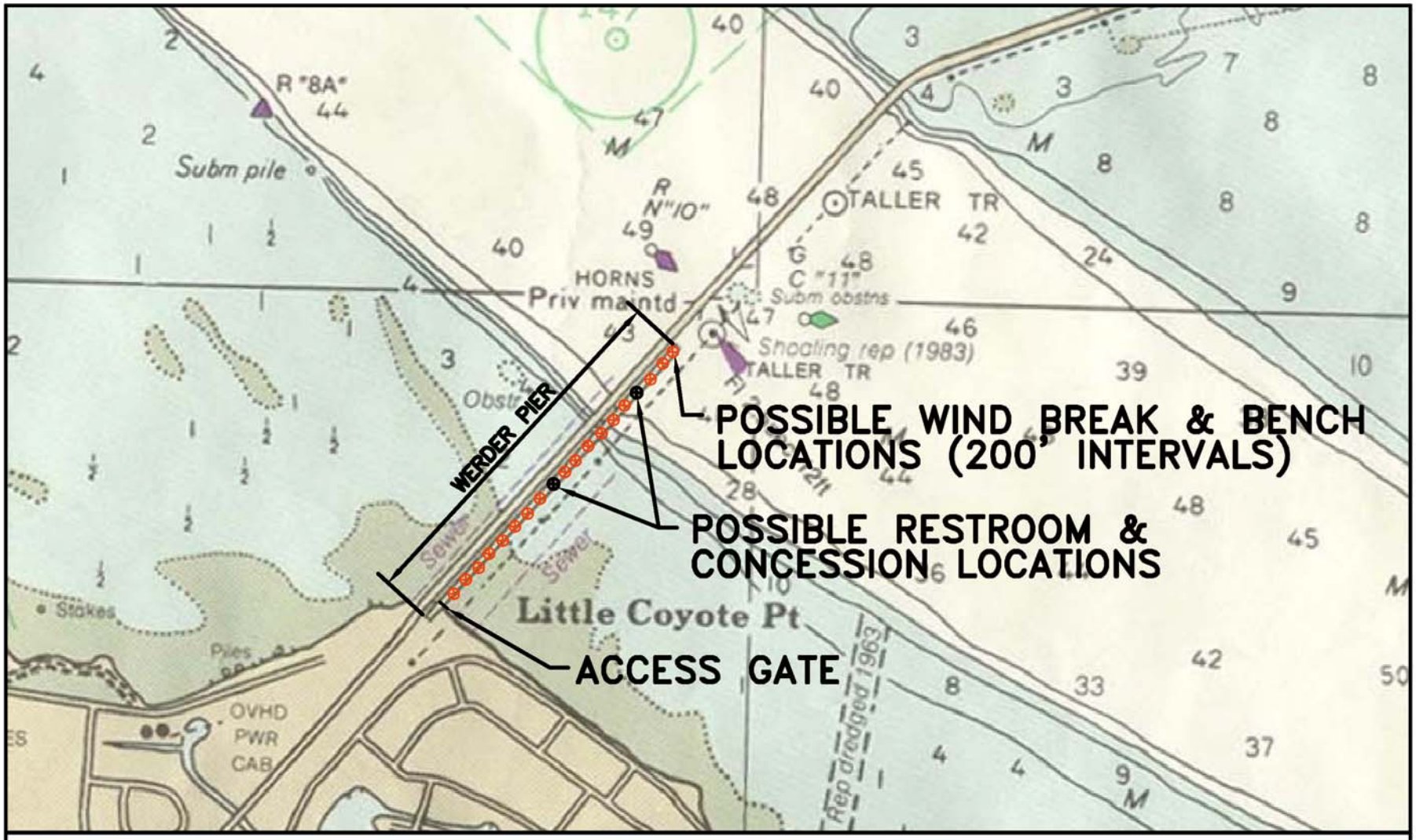
VI. WATERSIDE IMPROVEMENTS (CMA)

The waterside improvements refer to the facilities to be constructed on the pier and along the shoreline or in the water. The pier improvements include benches, wind breaks, fish cleaning stations and restroom facilities. The shoreline improvements refer specifically to a launch ramp facility for human powered vessels.

A. Pier Improvements

Through the evaluation of this study and public input, a number of improvements have been identified as needed on the pier as part of the rehabilitation. Two restrooms have been identified as desirable. One would be placed approximately 600 to 800 feet from the end of the pier to serve the fisherman near the deepwater channel and pedestrians enjoying the views. Another restroom is proposed at the halfway point of the pier to serve users along the remainder of the structure. See Figure 12 for a navigational chart showing the proposed locations for the restrooms. One of the restrooms could also contain a concession stand although a roll off stand was identified as an alternative to reduce opportunities for vandalism. The restroom buildings, as shown in Figure 13, have two unisex stalls each and a utility/storage area. Utilities for the facility are shown hung under the pier to reduce exposure and vandalism.

Fish cleaning stations are also shown on Figure 13 near the restrooms. This allows cleaning and maintenance supplies to be kept in the nearby restroom building. Since disposal of fish waste in the Bay is no longer allowed for new facilities, the type of disposal system to be used with the cleaning station will require careful consideration. The two typical types of systems are the simple trash receptacle type and the grinder type. The trash receptacle type will need to be cleaned out frequently to minimize odors from the fish waste, but will require little maintenance. The grinder type utilizes a grinder to allow fish waste to be disposed through a sewer system (pipe). Although the frequency of cleaning is reduced, such stations require maintenance to keep the grinder operational and to keep the piping clear and flowing properly, which may be a challenge along this long fixed pier. Additional consideration regarding the grinder type is whether the local sewage treatment facility will accept fish waste and safety hazards. Some facilities cannot handle these materials, which would result in the need for a holding tank to hold the fish wastes. The necessary periodic pumping of the holding tank can be costly. Because of the numerous issues and maintenance needs associated with the grinder type fish cleaning station, the trash receptacle type appears to be a more appropriate solution for Werder Pier.



NOTE: SEE FIGURES 10 & 11 FOR LANDSIDE IMPROVEMENTS

FIGURE 12

COUNTY OF SAN MATEO
WERDER PIER REHABILITATION

PIER LAYOUT

Concept Marine Associates
Job No. 20307 March 2004

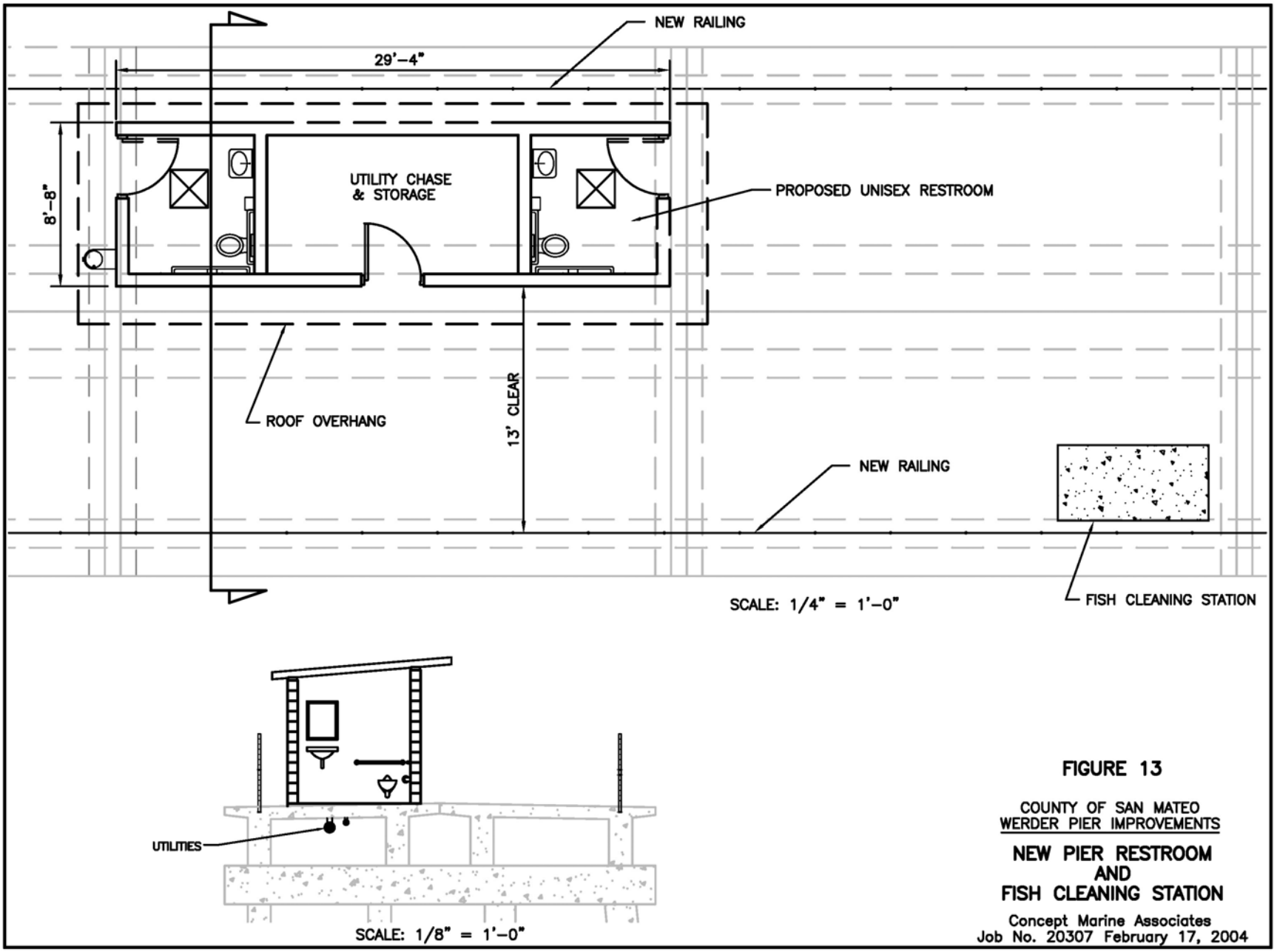


FIGURE 13

COUNTY OF SAN MATEO
WERDER PIER IMPROVEMENTS

NEW PIER RESTROOM AND FISH CLEANING STATION

Concept Marine Associates
Job No. 20307 February 17, 2004

Wind breaks and benches will also be needed. The wind break locations are proposed every 200 feet along the pier, and the orientation could be varied to provide protection from the different wind exposures. See Figure 14 on the following page for a depiction of these improvements. The wind breaks are shown as concave to improve protection from the winds from varying angles. The benches and wind breaks will need to be constructed of durable materials that are vandal resistant. See through wind breaks were suggested and preferred by the public and security officials since this reduces areas where users can conceal illegal activities. See Figure 15 for a picture for an example of a wind break. Numerous trash receptacles will also be needed along the pier. Bait boxes were also suggested by participants from the fishing community as a desirable improvement.

Figure 15: Wind Break at Eckley Pier, Crockett CA

An access gate will be an important part of the rehabilitation of the pier since the facility is not intended to be a twenty-four hour facility. As the local law enforcement noted, the design of the access gate will have to be well devised, since illegal cutting and climbing of the existing chain link fence continues even though the pier has been closed to public access for some time. The access gate could also be designed as an architectural feature to improve the aesthetic experience of walking onto the pier. See Figure 16 for a picture of a gate at Hermosa Pier as an example.

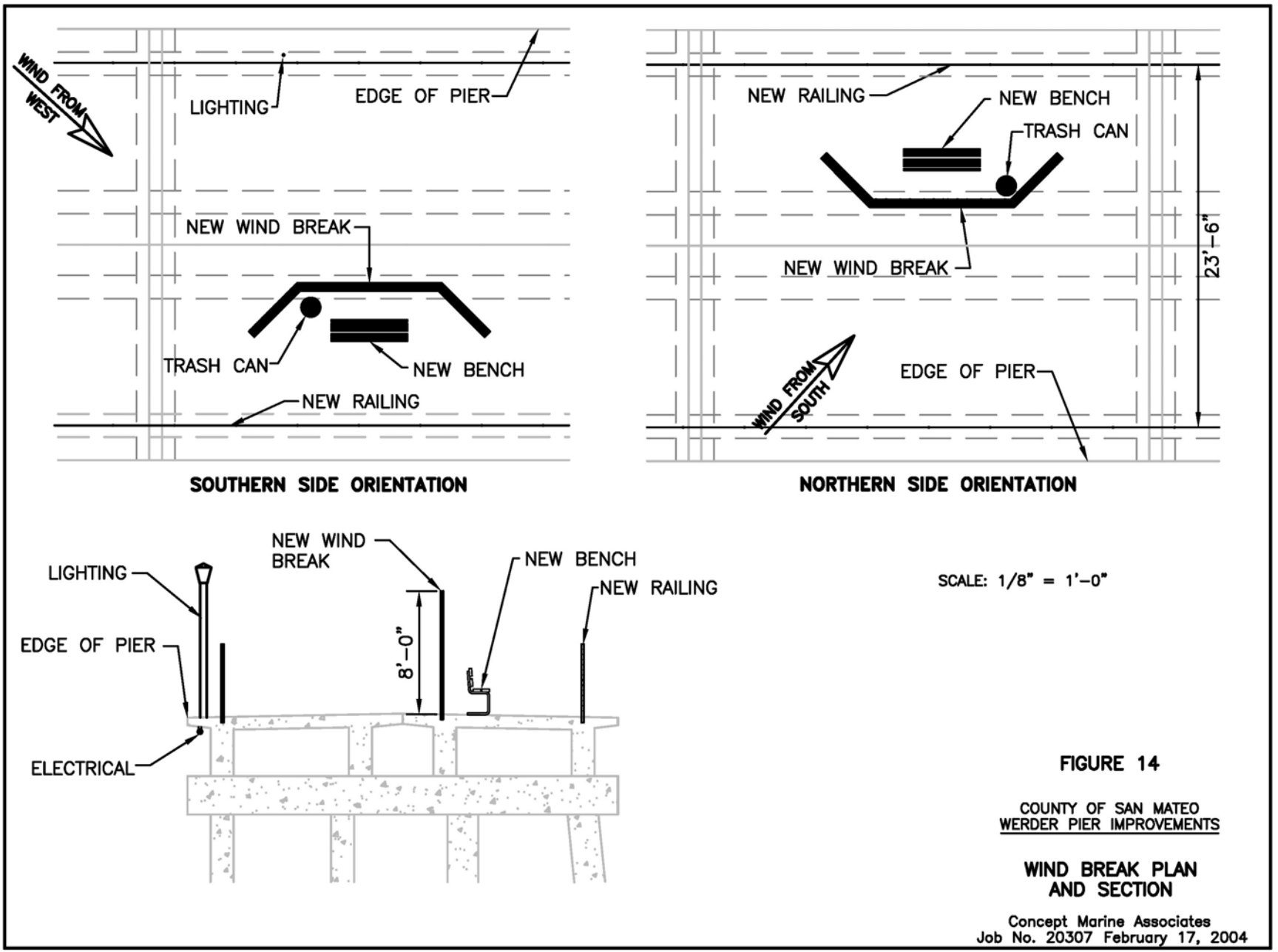
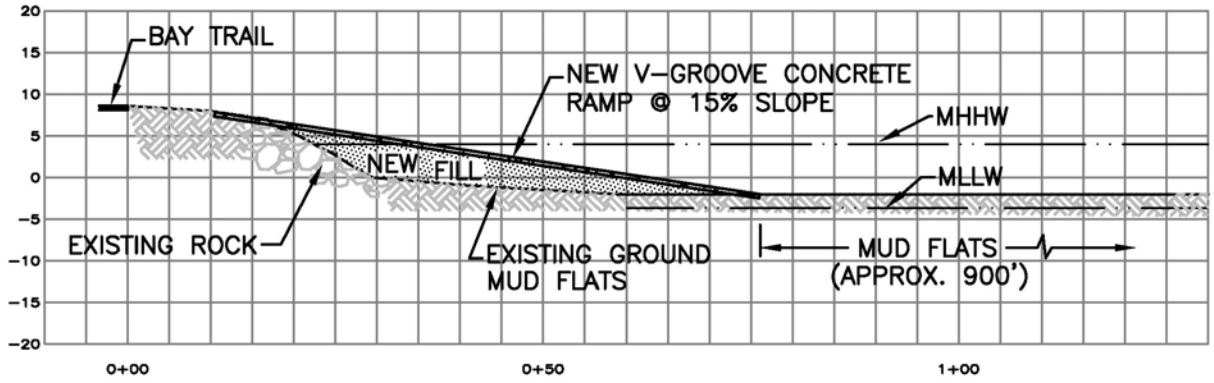

WIND FROM WEST
LIGHTING
EDGE OF PIER
NEW WIND BREAK
TRASH CAN
NEW BENCH
NEW RAILING
SOUTHERN SIDE ORIENTATION
NEW RAILING
NEW BENCH
TRASH CAN
NEW WIND BREAK
23'-6"
WIND FROM SOUTH
EDGE OF PIER
NORTHERN SIDE ORIENTATION
LIGHTING
EDGE OF PIER
ELECTRICAL
NEW WIND BREAK
8'-0"
NEW BENCH
NEW RAILING
SCALE: 1/8" = 1'-0"
FIGURE 14
COUNTY OF SAN MATEO
WERDER PIER IMPROVEMENTS
WIND BREAK PLAN AND SECTION
Concept Marine Associates
Job No. 20307 February 17, 2004

Figure 16: Hermosa Pier Access Gate

B. Shoreline Improvements

Through public comments and surveys, the desire to have a pedestrian launch ramp for human powered vessels was identified. The Werder Pier location is situated conveniently between two similar pedestrian launch ramps that are approximately five miles from the site. Funding for such facilities is possible through the California Department of Boating and Waterways, and is discussed later in this report. The ramp would be concrete and v-grooved to improve traction and direct water flow of the ramp. One limitation of the site as a launch location is the presence of the extensive mud flats along the shoreline. These flats are exposed during low water events which would leave the ramp as much as 900 feet from the water's edge. See Figure 17 for a section of the proposed ramp and associated mud flats. If a launch ramp is developed, fishing activities on the pier will have to be taken into consideration and the ramp's location be situated an appropriate distance away to reduce hazards.



SCALE: 1" = 20'

FIGURE 17

COUNTY OF SAN MATEO
WERDER PIER IMPROVEMENTS

PEDESTRIAN LAUNCH RAMP (NON−VEHICULAR)

Concept Marine Associates
Job No. 20307 February 17, 2004

VII. PIER REHABILITATION (CMA)

Due to the proportions of Werder Pier and the amount of damages present along the pier's entire length, the refurbishment of the structure will likely need to incorporate a detailed database to organize the observed issues, to track restoration measures, and to allow the information to be readily available. Some of the items to be included are the type, location and size of damages, the type and date of repairs conducted, the observed performance of the repairs, and observations of continued degradation of the pier. Due to the limited amount of funding available for this report, the intent of the structural evaluation, geotechnical study and condition review was to obtain a preliminary determination of the pier's capabilities, needed repairs or upgrades, and the relative cost associated with these needs. This will allow the determination of funding requirements and drive the decision making process for the continuation of the rehabilitation of the pier. The following will present the findings and recommendations for the issues identified during this evaluation. Recommendations are based on industry standards, the knowledge and experience of the consultant team, and discussions with contractors specializing in this type of work.

F. Railings

As discussed in the Condition Review section, two primary alternatives have been identified for the railings present on Werder Pier. The first is the total removal and replacement of the railings. The second is the restoration of the existing system for historical and aesthetic purposes. As previously mentioned, restoration of the railing will need to incorporate an upgrade to the system to bring it up to current safety codes. A combination of the two approaches could be considered to allow portions of the railing with lower levels of damage to be restored and upgraded for historical purposes, while heavily damaged areas would be removed and replaced. Issues to be considered for the removal and replacement of the rail include the demolition and disposal of the existing system, the type of new system to be utilized, and the means by which and location where the new system is to be attached.

The demolition of the existing railing will have to be conducted in a manner that will minimize costs and limit exposure of the structure to future decay. Two means by which this could be performed were identified. One method would be to saw cut along the outer edge of the concrete deck just inside the railing connection. The railing and a small portion of the deck could then be placed into a barge and disposed of. This approach would be efficient with regard to time and labor, but would expose steel in the deck and generate more debris. Although the exposed steel could be protected through corrosion inhibiting treatment and a urethane sealer, the protection would have to be reapplied periodically, resulting in increased maintenance costs. An alternative approach would be to remove the railing by demolishing the connections between the railing components and deck. Although more labor intensive, the amount of debris to be disposed and the amount of exposed rebar to be protected and maintained would be reduced. Of the two options, the second appears to be the better long term solution.

Alternative railing types include wood, galvanized steel, aluminum, brass, or a composite material (plastic, fiber reinforced, etc.). Wood is not a good alternative due to decreasing

resources and the possible costs associated with the disposal of treated lumber, which may significantly increase in the future. Composite materials raised concerns for possible vandalism and are also not considered to be viable alternatives for this location. Aluminum is a very attractive material that is recommended for such a facility due to its corrosion resistance, but is very costly, particularly when the amount of railing needed to be installed at Werder Pier is considered. Anodized aluminum would be the ultimate alternative; however, it is even more costly. A more economical approach would be a galvanized steel system. This could be accomplished with either steel posts and beams or steel posts and cables. A very economical but unattractive approach would be a steel post and chain link fence system. This could be installed as a temporary railing (with permanent posts) to allow public access while funds are secured to install a more attractive system. The following table presents relative costs for labor and materials for typical aluminum, brass and steel railing systems. A picture of an example railing system is presented in Figure 17.

Table 4: Relative Railing Costs

Material	Cost per Foot	Approximate Overall Cost
Aluminum	$80	$651,200
Anodized Aluminum	$100	$814,00
Galvanized Steel	$65	$529,100

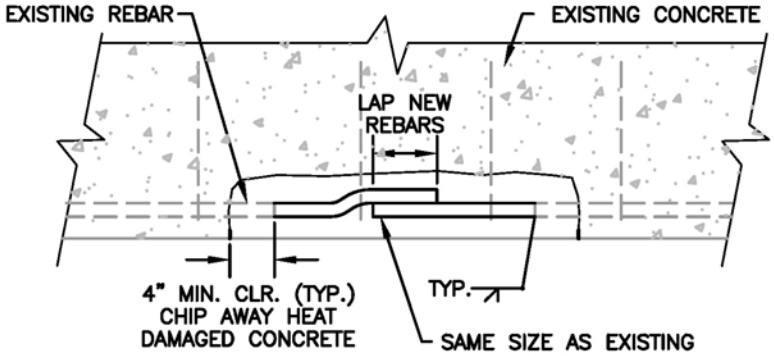
Figure 18: Example Railing System.

If restoration of all or part of the railing is to be conducted, a number of issues need to be addressed. These include the repair of existing cracks and spalls, the upgrade to current design codes with regard to safety, and the design life of the rehabilitated railing. Cracks and spalls can be repaired in the same manner that the girders and beams will need to be repaired. Figures 19 and 20 give typical repair methods for these damages. Two approaches to upgrading the railing have been identified. The more aesthetically pleasing, but more costly, approach would be to attach additional precast concrete rails and, possibly, additional posts if the existing posts are unable to withstand the additional loads. A second, more economical method would be to attach steel cables and/or extend them through the posts. Further investigation regarding the integrity of the existing railing components and their remaining useful life should be conducted prior to the rehabilitation of the railing.

G. Structural Components (Girders, Beams, Deck Slab, and Piles)

The structural components of the pier were identified as having varying levels of cracks and spalls along the length of the pier. Since physical examination of these elements was not conducted, a detailed tabulation of the amount of damage present was not prepared. However, the observations made did reveal the type of repairs that will need to be made. Typical repair procedures have been prepared and are provided in Figures 19 and 20. Particular care should be taken to ensure that all loose or unsuitable concrete is removed and the reinforcing steel to remain is well cleaned. This can often be done efficiently through sandblasting, particularly when the areas to be cleaned are large. Additional protection can be provided through the use of corrosion inhibitors. Inhibitors can be applied to both the concrete and/or steel to improve repair performance.

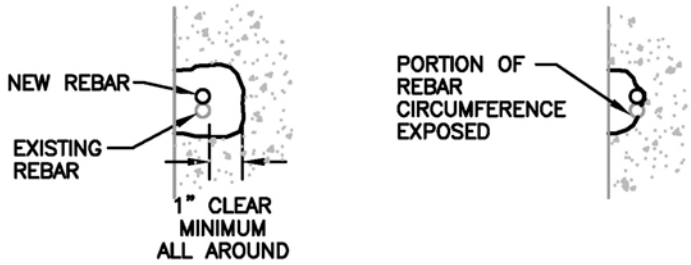
Although the structural calculations revealed that the pier would perform adequately under static and dynamic (seismic) loadings, a number of assumptions were made in these calculations and not all elements of the pier and associated soil properties were evaluated. Important in the further evaluation of the pier will be to confirm that the assumptions made are valid and that all elements of the pier perform adequately and the soils are capable of providing adequate support. Included in the structural analysis previously discussed was an evaluation of the remaining steel reinforcing needed to withstand the necessary static and dynamic loads. It is recommended that this be continued during the rehabilitation of Werder Pier. In this way the priority for a given section should be determined according to that area's ability to withstand the desired static and dynamic loads. Areas with significant damage that cannot withstand the loads would need to be repaired prior to the reopening of the pier, while areas with little damage could be repaired at a later date. It will be important to also determine when the areas that are not in need of immediate repair will require repair in order to maintain public access, since damaged areas that are not repaired will continue to degrade. In this manner the priority for repairs and the funds needed to perform the repairs can be determined and used to create a timetable for the rehabilitation and continued maintenance of the pier.



NOTES

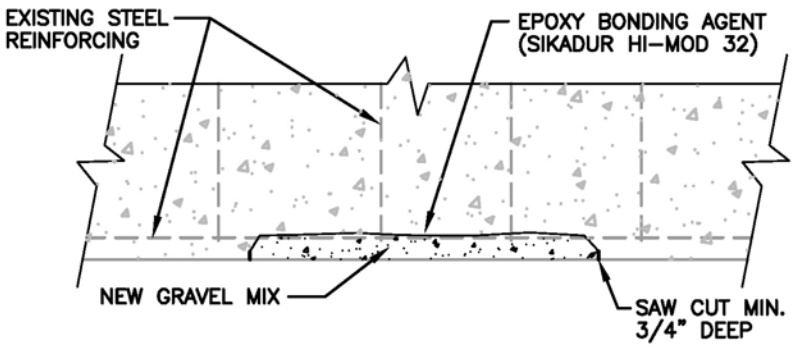
1. EXPOSE 4" OF UNRUSTED REBAR AT BOTH ENDS. CUT RUSTED PORTION OF EXISTING REBAR. USE COMPLETE PENETRATION GROOVE TO CONNECT NEW REINFORCEMENT TO EXISTING REBAR.
2. SANDBLAST REBAR TO REMOVE RUST.
3. REPAIR WITH SPECIFIED SPALL REPAIR MATERIAL.

TYPICAL REBAR CUT & WELD SECTION



IF MORE THAN 1/3 OF THE CIRCUMFERENCE AND/OR THE REBAR IS CORRODED THEN CHIP AWAY CONCRETE OR MORTAR TO EXPOSE THE ENTIRE CIRCUMFERENCE AND TO PROVIDE 1" MINIMUM CLEARANCE.

MINIMUM CLEARANCE AROUND REBAR



BUSHHAMMER EXISTING CONCRETE AROUND CRACKS AND SPALLS IN CONCRETE PENETRATING A MINIMUM 3/4" DEEP, REMOVE LOOSE, CRACKED AND SPALLED CONCRETE AND SANDBLAST. SANDBLAST EXPOSED REBAR TO CLEAN AND REPAIR WITH SPECIFIED SPALL REPAIR MATERIAL.

TYPICAL SPALLED CONCRETE REPAIRS

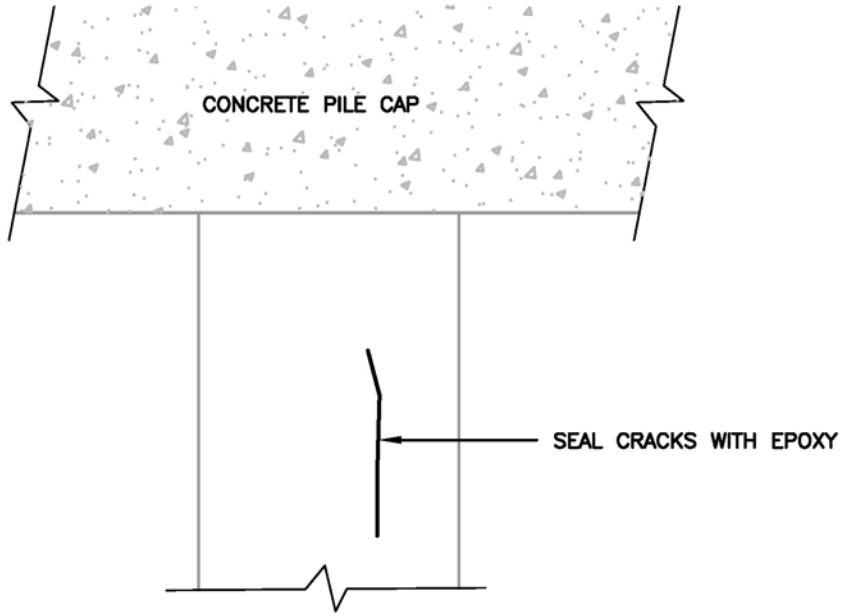
NOTE:
1. ALTHOUGH A SPECIFIC COMPONENT OF THE PIER IS DEPICTED, THE TYPICAL REPAIRS COULD APPLY AT LOCATIONS ON THE PILES, BEAMS, GIRDERS, DECK SLABS, OR RAILINGS.
2. CORROSION INHIBITORS CAN BE APPLIED TO THE CONCRETE AND EXPOSED REBAR TO IMPROVE THE PERFORMANCE OF REPAIRS

FIGURE 19

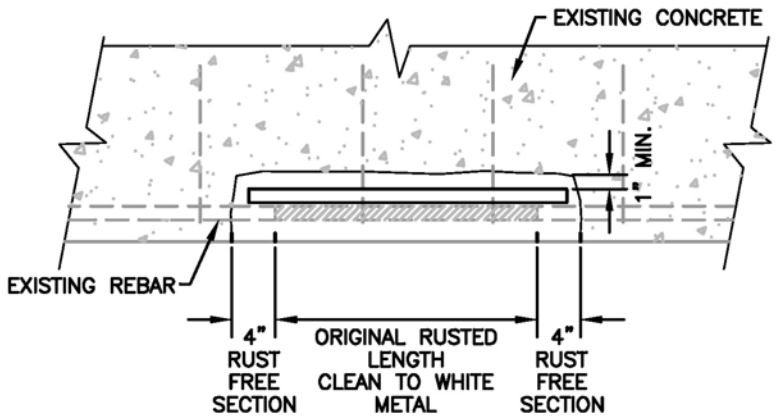
COUNTY OF SAN MATEO
WERDER PIER REHABILITATION

REPAIR DETAILS

Concept Marine Associates
Job No. 20307 March 2004

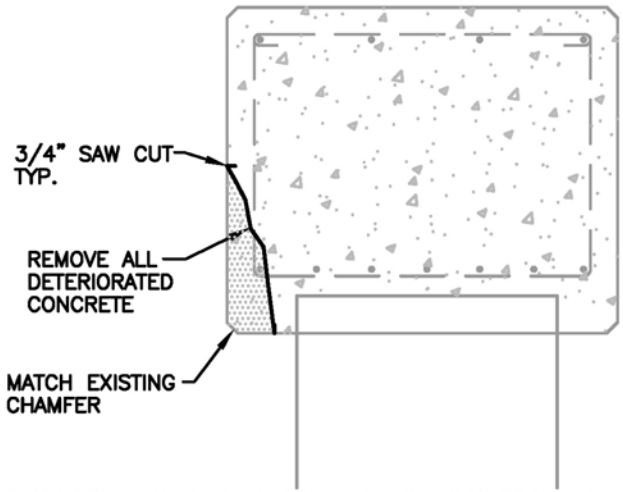


TYPICAL CRACK REPAIR



EXPOSE 4" OF UNRUSTED REBAR AT BOTH ENDS. ADD ENOUGH ADDITIONAL REBARS TO EQUAL CROSS-SECTIONAL AREA OF ORIGINAL. SANDBLAST TO CLEAN RUSTED AREA OF REBAR.

TYPICAL REBAR REINFORCEMENT SECTION



TYPICAL SPALL REPAIR @ CONCRETE CAP (BEAM)

NOTE: 1. ALTHOUGH A SPECIFIC COMPONENT OF THE PIER IS DEPICTED, THE TYPICAL REPAIRS COULD APPLY AT LOCATIONS ON THE PILES, BEAMS, GIRDERS, DECK SLABS, OR RAILINGS.

2. CORROSION INHIBITORS CAN BE APPLIED TO THE CONCRETE AND EXPOSED REBAR TO IMPROVE THE PERFORMANCE OF REPAIRS

FIGURE 20

COUNTY OF SAN MATEO
WERDER PIER REHABILITATION

REPAIR DETAILS

Concept Marine Associates
Job No. 20307 March 2004

VIII. RELATIVE COSTS (CMA)

Cost estimates for design and construction have been developed on an order-of-magnitude basis. These cost estimates reflect the proposed Preferred Plan concept design as envisioned in this feasibility study. The costs illustrate a range of pricing to allow for variability in the amount of damage in need of repair on the pier and for flexibility in the number and quality of amenities and site features selected. Because the estimates have been developed without the benefit of specific design drawings, they are considered to be preliminary and subject to change. See Appendix E. for a slightly more detailed breakdown and the assumptions made in the pier rehabilitation portion of the estimates given below.

Table 5: Relative Cost Estimate

	low	high
Pier Rehabilitation		
damaged concrete	$300,000	$2,000,000
railings	$700,000	$1,400,000
surface	$550,000	$950,000
improvements (lighting, restroom, etc.)	$500,000	$800,000
Landside Improvements		
parking lot	$350,000	$600,000
restroom	$150,000	$250,000
paths	$50,000	$150,000
planting & irrigation	$50,000	$150,000
amenities	$150,000	$250,000
launch ramp	$400,000	$600,000
Possible Cost Range	**$3,200,000**	**$7,200,000**

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IX. PHASING OF WORK (CMA)

Due to excessive costs associated with the project and the existing financial status of public funds, it will probably be necessary to phase the work on the Werder Pier facilities. To the extent possible, the phasing will have to be linked to an anticipated funding time table. Although full funding may not be achieved for future phases, it will be important to move forward with the portions of the work that can be funded. This is likely to start on the landside since this can be accomplished more economically. Plans have already been initiated between Foster City and the County to attempt to reopen the existing landside restroom due to the high public interest in having a facility in this area. Once redevelopment has been initiated, the facility will begin to take on a more attractive appearance and, as public usage increases, interest and public support for continued improvement of this unique, coastal attribute will increase. As public support intensifies, funding from both public and private sources will also gain support.

Phasing the work will also help to facilitate the management, maintenance needs and security needs for the site in a more controlled and acceptable manner. For example, security of the site is a big issue for both the public and law enforcement agencies. Since law enforcement did not give support to the reopening of the pier, it may be beneficial to reopen the landside portion first and allow law enforcement to work out the details of how the facility is to be patrolled and who is to respond to incidents at the facility. Once the policies are set to manage the initial rehabilitated landside facilities and the facilitation of these policies has become common, the rehabilitation of the pier and the associated security issues relating to its reopening will be less daunting.

X. PERMITTING (CMA)

During the feasibility study a variety of local and regional agencies were identified that will be involved in the permitting process. The primary agencies to be contacted will be the U.S. Army Corp of Engineers (USACE) and the San Francisco Bay Conservation and Development Commission (BCDC). After submittal of permit applications, the agency review period could be four to six months prior to approval, which will need to be factored into the planning process. Additional environmental documentation will have to be completed to comply with the California Environmental Quality Act (CEQA) on a local level, and with the National Environmental Policy Act (NEPA) on a national level, which will likely be needed if federal funding is obtained.

As mentioned above, the USACE and BCDC will act as lead agencies, which means that it is probable that formal permits will need to be submitted. These agencies will provide the appropriate information to additional agencies that will require consultation, such as the National Marine Fisheries Service. As a part of these reviews, and as a result of the permit process, requirements for construction techniques and work windows will be determined. Since the rehabilitation of the pier will require work over the water, it is anticipated that fish and environmentally sensitive species windows will apply. A review of these windows for this area revealed concerns for Steelhead, Herring, and the California Least Tern. If all of the windows associated with these species need to be applied, then an allowable work period from August 1st to November 3oth could be enforced. Further design and consultation with the respective agencies will be needed to determine the actual windows to be applied. One the work windows are determined, they will have to be incorporated into the phasing of the rehabilitation work.

Another consideration with regard to the permitting process is the possible impact to Bay fill, which BCDC regulates. Since the pier was constructed prior to 1966, it is considered part of the shoreline band and its rehabilitation will not be considered new Bay fill, as long as the repairs do not extend outside the existing footprint. A benefit of the structure being considered part of the shoreline is that removal of a portion of it would be considered the removal of Bay fill, which is seen as a benefit, and such activities can receive funding from the Removal of Bay Fill Fund through BCDC.

The following is a list of the identified agencies:

A. U.S. Army Corps of Engineers (USACE)

- ***Corps of Engineer Permits***
  Responsible for the following: Section 10 of the River and Harbor Act requiring a permit for any work on structures in or affecting the navigable waters of the U.S.; Section 404 of the Clean Water Act requiring a permit for discharge of dredge or fill materials into the waters of the U.S.; and Section 103 of the Marine Protection, Research and Sanctuaries Act of 1972 requiring a permit for transportation of dredged material for purposes of disposing it into ocean waters, including tidelands and coastal wetland areas.

Contact:

U.S. Army Corps of Engineers
Regulatory Branch
333 Market Street, 8th Floor
San Francisco, CA 94105-2197
p.415. 977-8436 (general info)
p. 415. 977-8343
p. 415. 977-8462 (regulatory)

Ed Wylie, South Section Chief
p. 415. 977-8464
f. 415. 977-8343
email: edward.a.wylie@spd02.usace.army.mil

B. San Francisco Bay Conservation and Development Commission (BCDC)

- ***BCDC Permit***
  Jurisdiction limits are tidal waters of the San Francisco Bay from mean high tide to 100' inland of mean high tide.

Contact:

Brad McCrea, Bay Design Analyst
San Francisco Bay Conservation
and Development Commission
50 California Street, Suite 260
San Francisco, CA 94111
p. 415. 352-3615
f. 415. 352-3606
email: bradm@bcdc.ca.gov

C. California Department of Fish and Game

- ***Streambed Alteration Permit***
  Responsible for the protection and conservation of State fish and wildlife resources under sections of the Fish and Game Code. The agency must be notified of any activity that impacts rivers, streams or lakes.

Contact:

Sandy Brunson
Department of Fish and Game
p. 707. 944-5500 (main)
p. 707. 944-5520 (Water Quality, Streambed Alteration)
f. 707. 944-5563

D. State of California Department of Transportation (Caltrans)

- ***Encroachment Permit***

  Jurisdiction includes the State of California lands, Caltrans property and Caltrans easements on or adjacent to project parcel.

  All work within the vicinity of the State Toll Bridges must be coordinated and concurred by the California Highway Patrol to ensure that any security concerns are addressed. Wetlands mitigation area on adjacent Caltrans property must be maintained in perpetuity. Changes to the State right-of-way would require an amendment to the Freeway Agreement and approval of the Federal Highway Administration and the California Transportation Commission to decertify the proposed right-of-way.*

  Contact:

  Sean Nozzari, District Office Chief
  Caltrans, District 4
  Office of Permits
  111 Grand Avenue, M.S. 7-D
  Post Office Box 23660
  Oakland, CA 94623-0660
  p. 510. 286-4435
  f. 510. 286-5513
  email: snozzarri@dot.ca.gov

  Thomas Franklin, District Branch Chief
  Caltrans, District 4
  Office of Permits
  Mail Station 5E
  Post Office Box 23660
  Oakland, CA 94623-0660
  p. 510. 286-4424
  f. 510. 286-4712
  email: thomas_franklin@dot.ca.gov

*per Caltrans letter of 9/23/03, 2 pages addressed to Callander Associates

E. City of Foster City

- ***Project Development Oversight***

Contact:

Kevin Miller, Director of Parks and Recreation
City of Foster City
Parks and Recreation Department
p. 650. 286-3388
f. 650. 345-1408
email: kmiller@fostercity.org

Richard Marks, Community Development Director
City of Foster City
Community Development Agency
610 Foster City Boulevard
Foster City, CA 94404
p. 650. 286-3232
f. 650. 286-3589
email: cdddirector@fostercity.org

Jeff Juarez, Assistant Planner
City of Foster City
Community Development Agency
p. 650. 286-3242
f. 650. 286-3589
email: jjuarez@fostercity.org

F. County of San Mateo

- ***Building Permit***
  Lands of County of San Mateo

Contact:

Jim Eggemeyer
Development Review and Service Manager
Planning and Building Division
455 County Center, 4th Floor
Redwood City, CA 94063-1646
p. 650. 363-1930
f. 650. 363-4849
email: jeggemeyer@co.sanmateo.ca.us

G. National Marine Fisheries Service (NMFS)

- ***Consultation; Concurrence letter; Permit (if endangered species present)***
  Must be contacted if a project is Federally initiated, licensed, or permitted, that has the potential to alter any aquatic environment and impact the biological resources which depend on those habitats.

  Contact:
  National Marine Fisheries Service
  Southwest Division
  501 West Ocean Boulevard, Suite 4200
  Long Beach, CA 90802-4213
  p. 562. 980-4000

  Santa Rosa Office:
  Gary Stern
  p. 707. 575-6060
  f. 707. 578-3435

H. Regional Water Quality Control Board (RWQCB)

- ***Notice of Intent for Storm Water Pollution Prevention Plan compliance and any new or changed discharge of storm drain waters into the Bay; Water Quality Certification***
  Regulation of construction activity that would result in an impact to State water quality under Section 401 of the Clean Water Act. Projects with a federal component must obtain approval from this agency.

Contact:
Habte Kifle (San Mateo, Bayside)
Regional Water Quality Control Board
p. 510. 622-2371
f. 510. 622-2460

I. U.S. Fish and Wildlife Service

- ***Consultation; Concurrence letter; Permit (if endangered species present)***
  Must be contacted if project is Federally permitted. Responsible for evaluation of the site for presence of endangered species and critical habitats. If a species is present, further consultation is required to determine the affect of the project on the species and identify any alternatives.

  Contact:
  U.S. Fish and Wildlife, Region 1
  Chief, Division of Endangered Species
  Eastside Federal Complex
  911 N.E. 11th Avenue
  Portland, OR 97232-4181
  http://pacific.fws.gov/ecoservices

  Endangered Species Permits
  Main p. 503. 231-2071
  Main f. 503. 231-6243
  Linda Belluomini
  p. 503. 231-6283
  f. 503. 231-6243

J. State Lands Commission

- ***Lease Agreement***
  Amendment to current lease held through Caltrans may be needed. Although Caltrans will have primary review responsibility, plans should be provided to State Lands for review and comment during the development of rehabilitation plans.

  Contact:
  State of California
  State Lands Commission
  100 Howe Ave., Suite 100 South
  Sacramento, CA 95825
  Dave Plummer
  p. 916. 574-1858

XI. FUNDING (CMA)

The following list provides possible sources for funds and a brief description of the purpose for which the funds are set aside.

A. Association of Bay Area Governments (ABAG)

- ***Bay Trail Grant Program***
  Grants may be used for planning studies to identify a preferred Bay Trail alignment, trail design, trail construction and trail improvements, including repaving and signs. This does include trail spurs, though not a high priority. They anticipate to receive $4 million for projects in spring of 2004, while the remaining funds from the last cycle ($7.5 million) are almost fully allocated. Prop 40 funds will be the next to be allocated which might amount to $1 million for the entire Bay Area. An application has been provided in Appendix F. No current deadline for application submittals, but funding decisions will begin being made this summer.

  www.baytrail.org/grants 2003.htm#overview

  Contact:
  Janet McBride, Regional Planner
  Association of Bay Area Governments
  Post Office Box 2050
  Oakland, CA 94604-2050
  p. 510. 464-7919
  f. 510. 433-5519
  email: MelissaB@abag.ca.gov

B. San Francisco Bay Conservation and Development Commission (BCDC)

- ***Bay Fill Cleanup and Abatement Fund***
  Funding that helps restore natural bay environments due to development impacts that affect the Bay. Focus is on removal of Bay Fill. Available funding is currently spoken for, but funding is replenished periodically.

  Contact:
  Brad McCrea, Bay Design Analyst
  Bay Conservation and Development Commission
  50 California Street, Suite 260
  San Francisco, CA 94111
  p. 415. 352-3615
  f. 415. 352-3606
  email: bradm@bcdc.ca.gov

C. California Department of Education

- ***Environmental Education Grant Program (EEGP)***
  Grants are available for public agencies, schools, non-profits, and resource conservation districts for various environmental education outreach methods. Sites and facilities may receive up to $15,000.
  www.cde.ca.gov/cilbranch/oee/

  Contact:
  Bill Andrews
  California Department of Education
  p 916. 322-9503
  f. 916. 322-9360
  email: bandrews@cde.ca.gov

D. California Department of Parks and Recreation

- ***Habitat Conservation Fund***
  Funding provided for conservation for wetlands, riparian or recreational use. Applications are reviewed competitively against other projects with funding being allocated to the selected projects. An application and eligibility requirements are available on the internet. Applications are due by October 1st each year for funding to be available at the beginning of the next year.

  www.parks.ca.gov

  Contact:
  Albert Ventura
  California Department of Parks and Recreation
  p 916. 651-8579
  f. 916. 653-6511
  email: avent@parks.ca.gov

- ***Recreational Trails Program***
  Funding allotted for development of recreational trails and trail related projects. Projects are reviewed competitively with other applicants. An application and eligibility requirements are available on the internet. Applications are due by October 1st each year for funding to be available at the beginning of the next year.

  www.parks.ca.gov

  Contact:
  Albert Ventura
  California Department of Parks and Recreation
  p 916. 651-8579
  f. 916. 653-6511
  email: avent@parks.ca.gov

E. California Department of Transportation Planning

- ***Community-based Transportation Planning Grants***
  Funding provided to transportation and land use planning projects that support livable community concepts and promote community identity and quality of life.
  www.dot.ca.gov/hq/tpp/grants

  Contact:

  Stuart Mori
  California Department of Transportation Planning
  p 916. 651-8204
  f. 916. 653-4570
  email: stuart_mori@dot.ca.gov

F. Caltrans

- ***Transportation Equity Act (TEA-21)***
  Funding allotted to assist Caltrans, metropolitan regions and local governments for a variety of projects, including freeway improvements to sidewalk improvements. Public access improvements would more likely apply for this project. Additional funding is anticipated to be approved at the end of 2004.
  www.dot.ca.gov/hq/LocalPrograms

  Contact:
  Geoff Kline
  County of San Mateo
  Congestion Management Agency
  p. 650. 363-4105
  f. 650. 361-8220

- ***Bicycle Transportation Account (BTA)***
  Funding for City and County programs that improve safety and convenience for bicycle commuters. County must have a Bicycle Transportation Plan to quality. Additional funding is anticipated to be approved at the end of 2004.
  www.dot.ca.gov/hq/LocalPrograms/bta/btaweb%20page.htm

  Contact:
  Geoff Kline
  County of San Mateo
  Congestion Management Agency
  p. 650. 363-4105
  f. 650. 361-8220

G. Coastal Conservancy

- ***San Francisco Bay Area Conservancy Program Grants***
  Grant program provides funding for the nine Bay Area counties for projects that promote the preservation, protection and restoration of the California Coast. Restoration/public access is required to a part of the project, but can be completed in phases. Projects are required to report on other funding sources. Local funding is beneficial. Funding is provided year-round, but grants are approved at board meetings which occur every six months. An application is available on the internet.
  www.coastalconservancy.ca.gov/Programs/BACP.htm

  Contact:
  David Hayes, Project Manager
  California State Coastal Conservancy
  1330 Broadway, 11th Floor
  Oakland, CA 94612-2530
  p. 510. 286-0736
  f. 510. 286-0470
  email: dhayes@scc.ca.gov

H. State of California: Wildlife Conservation Board (WCB)

- ***Riparian Habitat Conservation Program***
  Funding is aimed at restoring the State's riparian ecosystems that include threatened or endangered species habitats. Grant amounts can be as much as a few hundred thousand dollars depending on the project. Currently there is a backlog of projects requesting funding. No natural resource restoration is required to be part of the project. There is no deadline for submittal of applications, but grant approval is given at board meetings that occur four times a year. Applications are available the internet at www.dfg.ca.gov/wcb/.

  www.dfg.ca.gov/wcb/habitat_enhancement_and_restoration_program

  Contact:
  Scott Clemens
  Wildlife Conservation Board
  p. 916. 445-1072
  f. 916. 323-0280

- ***Public Access Program***
  Financial assistance provided for fishing piers, floats, access roads, boat launching ramps, trails, boardwalks and interpretive facilities. Funding is made available to most projects that qualify, with funding partnerships perceived as a benefit. Funding limit is around $250,000 per project. Project appears to be a likely candidate and the County is encouraged to file an application, which is available on the internet. Applications are

accepted year-round, with board approval made at quarterly meetings. Funding allocations are made in June.
www.dfg.ca.gov/wcb/

Contact:
Peter Perrine
Wildlife Conservation Board
1807 13th Street, Suite 103
Sacramento, CA 95814
p 916. 445-1109
f. 916. 323-0280

I. U.S. Fish and Wildlife Service

- ***Sport Fishing Restoration***
  Funding available to enhance and restore sport fish populations and public use/benefits from such resources.
  www.fa.r9.fws.gov/sfr/fasfr

  Contact:
  Jay Alvarado, grants fiscal officer
  Verlyn Ebert, planning/grant management
  Ray Temple, fishery biologist/grants management
  U.S. Fish and Wildlife Service
  Eastside Federal Complex
  911 N.E. 11th Avenue
  Portland, OR 97232-4181
  p. 503. 231-6128
  f. 503. 231-6996

- ***Wildlife Restoration***
  Funding available to restore, enhance, or conserve populations of wild birds and mammals and access of public of these resources.

  www.fa.r9.fws.gov/wr/fawr

  Contact:
  Jay Alvarado, grants fiscal officer
  Verlyn Ebert, planning/grant management
  Ray Temple, fishery biologist/grants management
  U.S. Fish and Wildlife Service
  Eastside Federal Complex
  911 N.E. 11th Avenue
  Portland, OR 97232-4181
  p. 503. 231-6128
  f. 503. 231-6996

- ***North American Wetlands Conservation Fund (NAWCF)***
  Funding available to acquire real property and restore/manage/enhance wetland ecosystems.

  www.cfda.gov/public/viewprog.asp?progid=457

  Contact:
  Jay Alvarado, grants fiscal officer
  Verlyn Ebert, planning/grant management
  Ray Temple, fishery biologist/grants management
  U.S. Fish and Wildlife Service
  Eastside Federal Complex
  911 N.E. 11th Avenue
  Portland, OR 97232-4181
  p. 503. 231-6128
  f. 503. 231-6996

J. State of California: Department of Boating & Waterways

- ***Boating Trails Grant Program (BTGP)***
  The BTGP was established to aid Cities, Federal agencies, Counties, districts and other State agencies in the development, enhancement, or rehabilitation of small craft boating facilities (human powered vessels) that provide convenient and safe boating access to California. The grant submittals are competitively examined, with emphasis on those projects that provide new access sites and serve large numbers of boaters. The program currently has an annual budget of $300,000, with many requests having been made. Although local agency funding is not required, it is factored in favorably in the application review and awards process. A copy of the Guidelines for Preparing an Application will be provided to the County.

  Timeframe: BTGP receives funding on July 1st of each year. Applications can be submitted throughout the year.

  Contact:
  Mike Ammon
  Department of Boating & Waterways
  Boating Facilities Division
  2000 Evergreen Street, Suite 100
  Sacramento, CA 95815-8163
  p. 916. 263-8163
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K. California State Library

- ***California Cultural and Historical Endowment***
  The Endowment was created to administer the Proposition 40 funds dedicated to preserving historic and cultural resources. Approximately $128 million will be available to government entities and non-profit organizations through a competitive grant application process. The program guidelines and application materials are being developed with public hearings to be performed as part of the review process. Additional information is available on the internet.
  www.library.ca.gov/CCHE/index.cfm#grantz

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L. Public and Private Contributions

Funds could be raised through public and private contributions with incentives for significant contributions. Possible incentives include name plates, commemorative plaques, and possibly even renaming the pier for a major contributor.

XI. SUMMARY OF FINDINGS (CMA)

A. Condition Review

The condition review of Werder Pier revealed an aged structure with concrete cracks, spalls, and exposed steel reinforcement. Previous repairs were noted along the structure and varied in condition from what appeared to be sound to failing. Limited structural, seismic and geotechnical evaluations were performed to develop a preliminary idea of the pier's stability. Although further evaluation is needed, these reviews disclosed a surprisingly stable structure, given the age of the pier. Although repairs were identified as needed, depending on the level of damage present, the pier's apparent ability to withstand seismic and static loadings as originally designed will enable its repair to be more economical, since retrofitting structural components does not appear to be necessary.

B. Community Outreach

The community outreach portion of this feasibility study resulted in a significant amount of input from both public and private sectors. The majority of public input was positive and ranged from concerns for security to the desire to gain access to this unique fishing and sightseeing opportunity. The security concerns were received from both the public and law enforcement agencies. The California Highway Patrol was particularly concerned, due to the San Mateo/Hayward Bridge being considered a #1 target for terrorist attacks. Therefore, the safety issue will need to be addressed and resolved early in the design process.

H. Improvements and Rehabilitation

Improvements were proposed and supported on both the landside and waterside of the facility. Landside improvements that were found to be desirable included a restroom, amphitheater, picnic areas, parking, and environmental/interpretive education opportunities. The presence of adjoining wetlands that have been designated by Caltrans as remediation sites provides additional possibilities for future development of the natural environment at the site. Waterside improvements that were identified included restrooms on the pier, frequent wind breaks, shade structures, and fish cleaning stations. An additional improvement along the water is a pedestrian launch ramp for the launching of kayaks, canoes, etc. The rehabilitation of the pier will require a new or upgraded railing system, and a variety of concrete repairs will be needed to ensure that the structure will withstand the given loads. However, major retrofitting for seismic events does not appear to be necessary at this time. For general planning purposes, costs associated with the proposed improvements and pier rehabilitation range from $3 million to over $7 million, depending on the amount and quality of improvements selected and the amount of concrete that is determined to need repair. Additional funding may be needed if further evaluation of the concrete structure reveals more damage than was noted through visual observations.

I. Permitting and Funding

The first steps in the continuation of this rehabilitation process will be to initiate discussions with funding agencies and to address safety concerns. This will help to identify available sources of funds and begin the necessary processes to receive those funds. Once funding sources have been secured, preparation of a phasing plan is recommended to match the available dollars with the work that can be completed with the funds. Permitting issues for this type of project will likely be related to construction windows and construction methods for the work to be performed. It will be important to understand how much work can be performed during a given construction window since this will relate directly to how much funding is needed on an annual basis.

Because the pier has been in existence since before 1966, it is considered a part of the shoreline band. As long as additional surface area, which is considered new bay fill, is not added to the pier during the rehabilitation, it is likely that the regulatory agencies will be concerned with how debris is disposed and when the repairs are performed.

J. Continuation of the Project

In order for the restoration of Werder Pier to become a reality, it will be important to continue the planning process, which will include completion of preliminary design, environmental documentation and resolution of outstanding security issues. See Figure 21 for a proposed project timeline. Since the project is likely to be funded and completed in phases, the tasks that follow the funding can be applied to each phase of the project with the time required to complete each task changing to reflect the scope of that particular phase.

Since the California Highway Patrol could not support the re-opening of the pier due to potential terrorist risks associated with Werder Pier's proximity to the San Mateo/Hayward Bridge, further discussions will be needed and security issues resolved to gain the support of the law enforcement agencies. Once the security issue is resolved and funding is secured, preliminary design plans can be completed. This will allow the environmental documentation and permitting to be completed.

Due to the high cost associated with the re-opening of the pier, it may be beneficial to restore the landside area and attract more users to the facility, which could increase support for the project making funds easier to obtain. An agreement between the County and Caltrans will also be needed to memorialize the intent of the piers rehabilitation.

Figure 21: Project Timeline