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UNDERWATER FACILITIES INSPECTION AND ASSESSMENT BY  
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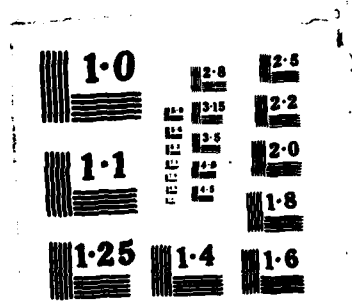
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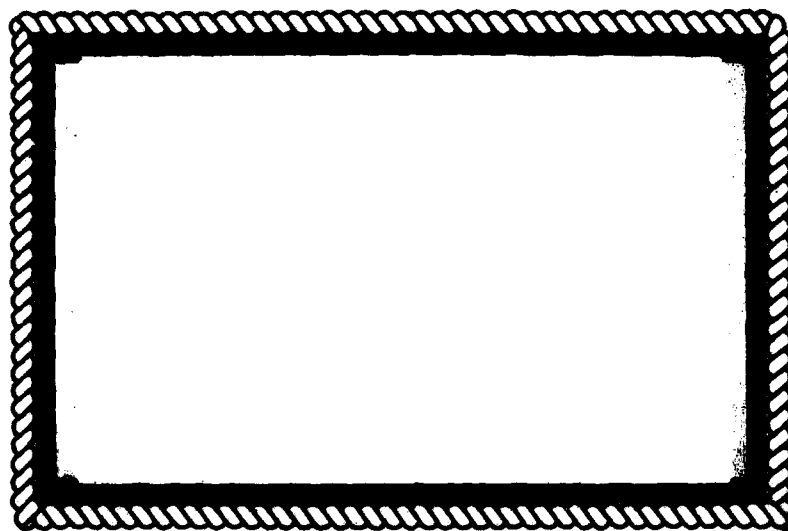
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# UNDERWATER FACILITIES INSPECTIONS & ASSESSMENTS

AD-A168 461



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CHESAPEAKE DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
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UNDERWATER FACILITIES  
INSPECTION AND ASSESSMENT  
AT

NAVAL WEAPONS STATION  
CONCORD,  
CALIFORNIA

F P O - I - 83 - (19)

May, 1983

Performed for:

Ocean Engineering and Construction Project Office  
Chesapeake Division  
Naval Facilities Engineering Command  
Washington, D.C. 20374

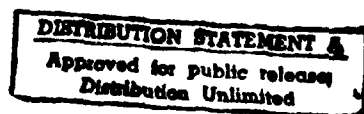
Under:

Contract N62477-81-C-0498  
Task 2

By:

J. Agi & Associates Co. Inc.  
141+ Alaskan Way, Suite 600  
Seattle, Washington, 98101

Project No: 83-1/3-2-100



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Two marine structures at Naval Weapons Station, Concord, California, were  
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and timber piles were examined in Piers 3 and 4. The structures were  
subjected to a Level I, II and in some cases, Level III inspection  
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visual/tactile and ultrasonic techniques. Significant elements were photo-documented.

The objective of the underwater facility assessment conducted at NWS Concord, is to provide a generalized structural condition and repair requirements report on the designated facilities within the activity.

In Pier 3, a Level I inspection was carried out on 200 concrete and 974 timber piles; a Level II inspection was carried out on 50 concrete piles; and Level III ultrasonic testing was carried out on 393 timber piles. The overall condition of the examined piles is very good. Two concrete piles were noted to have sustained significant damage as a result of mechanical impact and/or abrasion, marine borer infestation and/or fungal decay. In addition, a total of 30 timber piles were noted to have sustained minor attack or damage which is not of structural significance at this time. Repair of the 10 defective timber piles should be considered and periodic inspections are recommended.

In Pier 4, a Level I inspection was carried out on 222 concrete and 952 timber piles; a Level II inspection was carried out on 50 concrete piles; and Level III ultrasonic testing was carried out on 393 timber piles. The overall condition of the examined piles is very good. All concrete piles were found to be in excellent condition, no evidence of damage was found. A total 13 timber piles have sustained significant damage as a result of mechanical impact or abrasion, marine borer infestation and/or fungal decay. In addition, a total of 50 timber piles have sustained minor attack or damage which is not of structural significance at this time. Repair of the 13 defective piles should be considered and periodic inspections are recommended.

## EXECUTIVE SUMMARY

Two marine structures at Naval Weapons Station, Concord, California, were subjected to nondestructive testing and inspection. A sampling of concrete and timber piles were examined in Piers 3 and 4. The structures were subjected to a Level I, II and in some cases, Level III inspection using visual/tactile and ultrasonic techniques. Significant elements were photo-documented.

The objective of the underwater facility assessment conducted at NWS Concord, is to provide a generalized structural condition and repair requirements report on the designated facilities within the activity.

In Pier 3, a Level I inspection was carried out on 200 concrete and 974 timber piles; a Level II inspection was carried out on 50 concrete piles; and Level III ultrasonic testing was carried out on 393 timber piles. The overall condition of the examined piles is very good. Two concrete piles were noted to have sustained minor cosmetic damage. A total of 10 timber piles have sustained significant damage as a result of mechanical impact and/or abrasion, marine borer infestation and/or fungal decay. In addition, a total of 30 timber piles were noted to have sustained minor attack or damage which is not of structural significance at this time. Repair of the 10 defective timber piles should be considered and periodic inspections are recommended.

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which is not of structural significance at this time. Repair of the 13 defective piles should be considered and periodic inspections are recommended.

Refer to the accompanying Executive Summary Table for details.

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EXECUTIVE SUMMARY TABLE

| FACILITY | YEAR BUILT | STRUCTURE SIZE    | STRUCTURE TYPE                          | RECOMMENDATIONS        | ESTIMATED COST OF RECOMMENDATIONS |
|----------|------------|-------------------|-----------------------------------------|------------------------|-----------------------------------|
| PIER 3   | 1944       | 1248'<br>X<br>89' | 3783 timber piles<br>494 concrete piles | Repair 10 timber piles | \$20,000                          |
| PIER 4   | 1945       | 1248'<br>X<br>89' | 3783 timber piles<br>494 concrete piles | Repair 13 timber piles | \$26,000                          |

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## SECTION 1 - INTRODUCTION

### 1.1 CONTRACT

Department of the Navy,  
Chesapeake Division,  
Naval Facilities Engineering Command,  
Building 212, Washington Navy Yard,  
Washington, D.C. 20374

### 1.2 CONTRACT NO.

N62477-81-C-0498  
Task 2

### 1.3 CONTRACT DATE

September 30, 1982

### 1.4 CONTRACT DESCRIPTION

The contractor shall provide all required engineering services necessary for underwater assessment of various Navy waterfront facilities as directed by the officer in charge and as specifically described in individual orders. The second award under this contract is for the assessment of the structural condition of underwater structural members at waterfront facilities, Naval Weapons Station, Concord, California. The following table details the specific scope of work for this project.

| FACILITY | TYPE OF INSPECTION                     |                          |                        |
|----------|----------------------------------------|--------------------------|------------------------|
|          | LEVEL I                                | LEVEL II                 | LEVEL III              |
|          | No. of Piles<br>Concrete and<br>Timber | No. of Piles<br>Concrete | No. of Piles<br>Timber |
| Pier 3   | 1174                                   | 50                       | 393                    |
| Pier 4   | 1174                                   | 50                       | 393                    |
| Totals:  | 2348                                   | 100                      | 786                    |

#### 1.5 INTRODUCTION TO PROJECT

This report is prepared under the Underwater Inspection Program conducted by the Ocean Engineering Project Office (FPO-1), Chesapeake Division, Naval Facilities Engineering Command as part of NAVFAC's specialized Inspection Program. This is a task oriented engineering service program in support of inspection, analysis and design of repairs of the submerged portions of Navy Waterfront facilities.

This report covers the inspection carried out on the various facilities at the U.S. Naval Weapons Station, Concord, California. The purpose of the underwater assessment is to provide a generalized structural condition and repair requirements report on the designated facilities within the activity.

A description of each facility, its location and mission is provided. Detailed results with respect to individual piling, overall assessment of structural condition and recommendations are also given.

#### 1.6 DEFINITIONS: LEVEL I, II, III INSPECTIONS

Level I: General Inspection: This type of inspection is essentially a "swim-by" overview, which does not involve cleaning of any structural elements, and can therefore be conducted much more rapidly than the other levels of inspection. The Level I inspection should confirm as-built structural plans and detect obvious major damage or deterioration due to overstress (collisions, ice), severe corrosion, or extensive biological growth and attack. The underwater inspector shall generally rely primarily on visual and/or tactile observations (depending on water clarity) to make condition assessments. These observations are normally made over the specified exterior surface area of the underwater structure whether it is a quaywall, bulkhead, seawall, pile, or mooring. Visual documentation (utilizing underwater television and/or photography), may be included with the quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

Level II: Detailed Inspection: This type of inspection is directed toward detecting and describing damage/deteriorated areas which may be hidden by surface biofouling or deterioration and toward obtaining a limited amount of deterioration measurements. These data should be sufficient to enable gross estimates to be made of facility load capability. Level II inspections will often require cleaning of structural elements. Since cleaning time is consuming, it is generally restricted to areas that are critical or which may be representative of the entire structure itself. The amount and thoroughness of cleaning to be performed is governed by what is necessary to discern the general condition of the overall facility.

Simple instruments such as calipers, measuring scales and ice picks are commonly used to take physical measurements.

However, a small percentage of more accurate measurements may also be taken with more sophisticated instruments for several reasons. These measurements will validate large numbers of simple measurements and in some hard to measure areas, will actually be easier and faster to obtain. Where the visual scrutiny, cleaning, and/or simple measurements reveal extensive deterioration, a small sampling of detailed measurements will enable gross estimates to be made of the structure's integrity. For example, on extensively corroded steel H piles, a small percentage should receive ultrasonic thickness measurements to determine typical cross-section profiles. The cross-sections determined by these spot checks would be used to determine individual H pile load capability which would then be extrapolated to obtain a "ballpark" estimate of overall facility load capability. Visual documentation (utilizing underwater television and/or photography) should be included with the quantity and quality adequate to be representative of the range of facility damage/deterioration.

Level III: Highly Detailed Inspection: This type of inspection will often require the use of Non-Destructive Testing (NDT) Techniques, but may also require the use of partially destructive techniques such as sample coring through concrete and wood structures, physical material sampling, or in-situ surface hardness testing. The purpose of this type of inspection is to detect hidden or interior damage, loss in cross-sectional area and material homogeneity. A Level III inspection will usually require prior cleaning. The use of NDT techniques are generally limited to key structural areas, areas that may be suspect, or to structural members which may be representative of the underwater structure. Visual documentation (utilizing underwater television and/or photography) and a sampling of physical measurements should be included with quantity and quality adequate for documentation of the findings which will be representative of the facility condition.

## SECTION 2 - ACTIVITY DESCRIPTION

This section provides a general description of the Naval Weapons Station, Concord, (NWSC) which is the primary port of embarkation for ordnance materials on the West Coast. The description includes a brief discussion of the Weapons Station location, mission, climate and other environmental factors. This information which has been extracted from the government furnished information (GFI) Master plan, provides a more overall view of the activity.

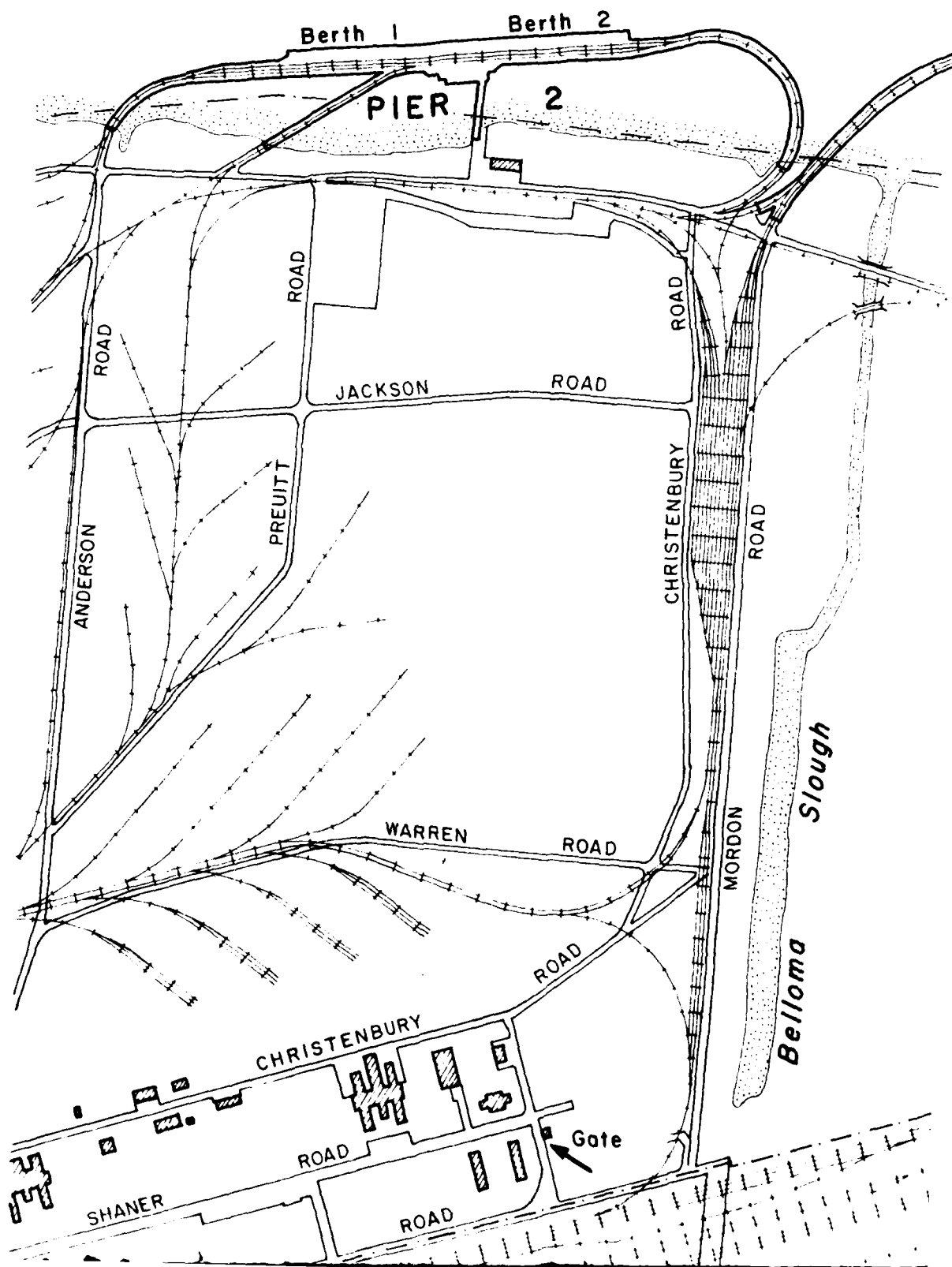
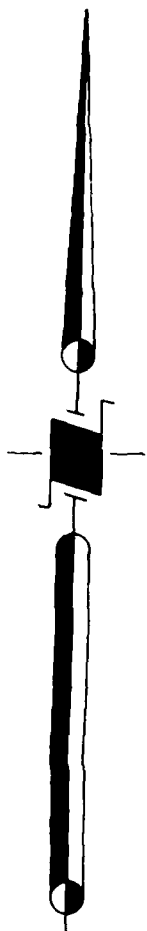
### 2.1 LOCATION OF ACTIVITY

The San Francisco Bay area (Drawing No.1), which encompasses 6100 square miles, has extensive shoreline along both the Bay and the Pacific Ocean. The area is composed of coastal mountain ranges, fertile valleys, numerous estuaries and marshes, and rolling hills. San Francisco Bay consists of four separate bays: Suisun, San Pablo, Lower San Francisco, and San Francisco Proper.

Lying southeast of San Pablo Bay and south of Suisun Bay is Contra Costa County. The Naval Weapons Station, Concord is in the north central portion of the 800-square-mile county. The station is about ten miles west of the confluence of the Sacramento and San Joaquin Rivers. This confluence forms the environmentally significant Delta region which contains about 600 miles of interconnected and meandering tidal waterways.

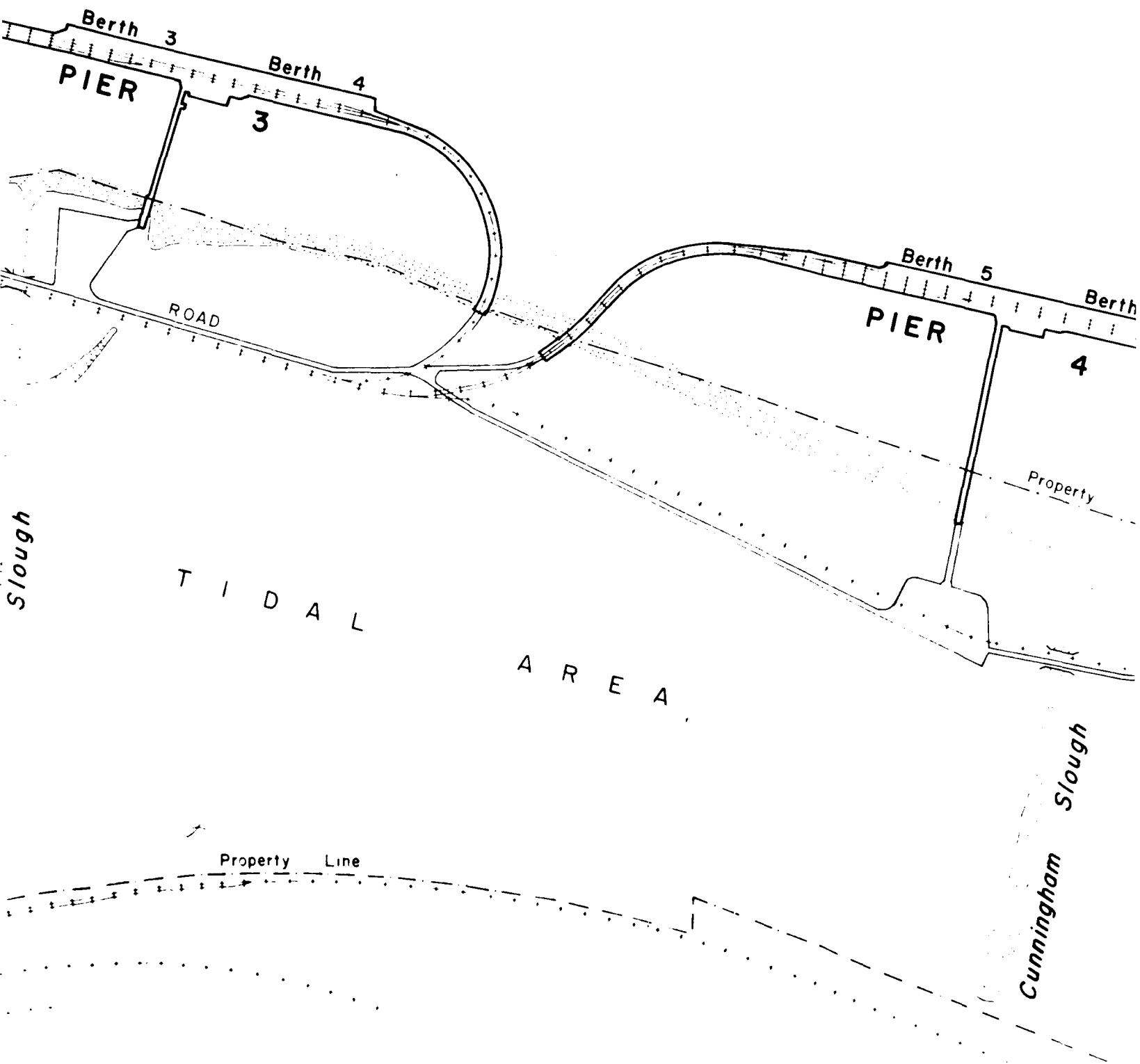
### 2.2 EXISTING WATERFRONT FACILITIES AT ACTIVITY

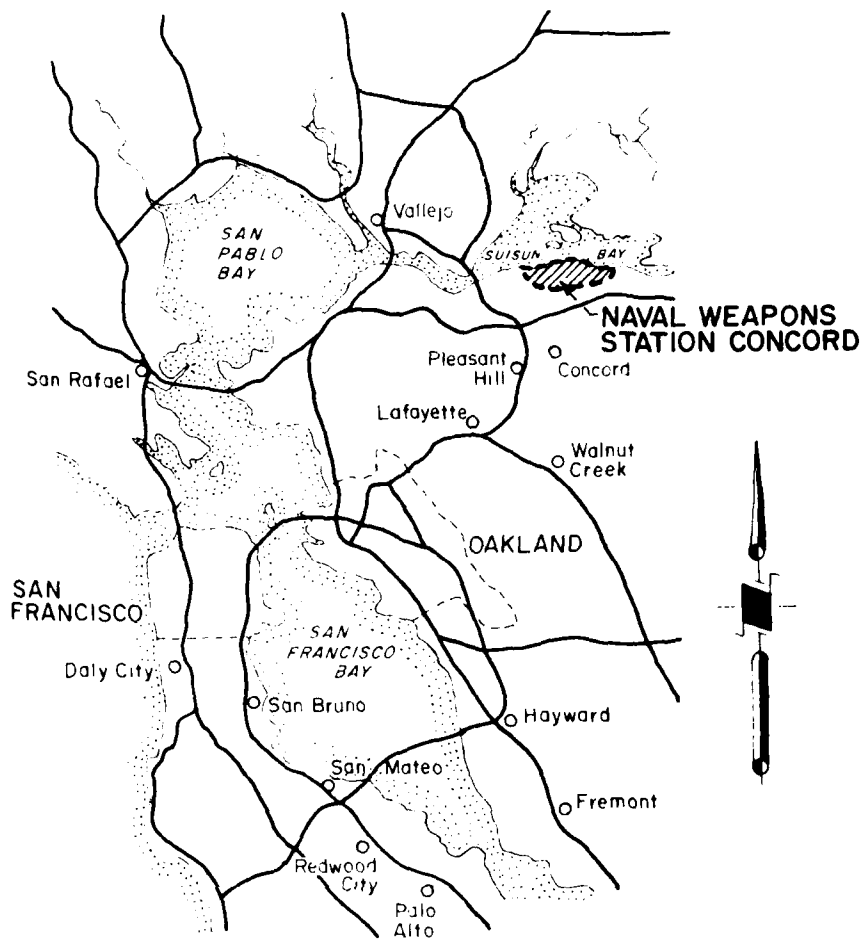
The major waterfront facilities at NWSC include Piers 2, 3 and 4. In addition, a barge pier and a series of lighter mooring dolphins are located to the west or downstream of Pier 2 (see Drawing No.1). The facilities are utilized to operate and maintain an ocean terminal facility to tranship ordnance material.



Suisun

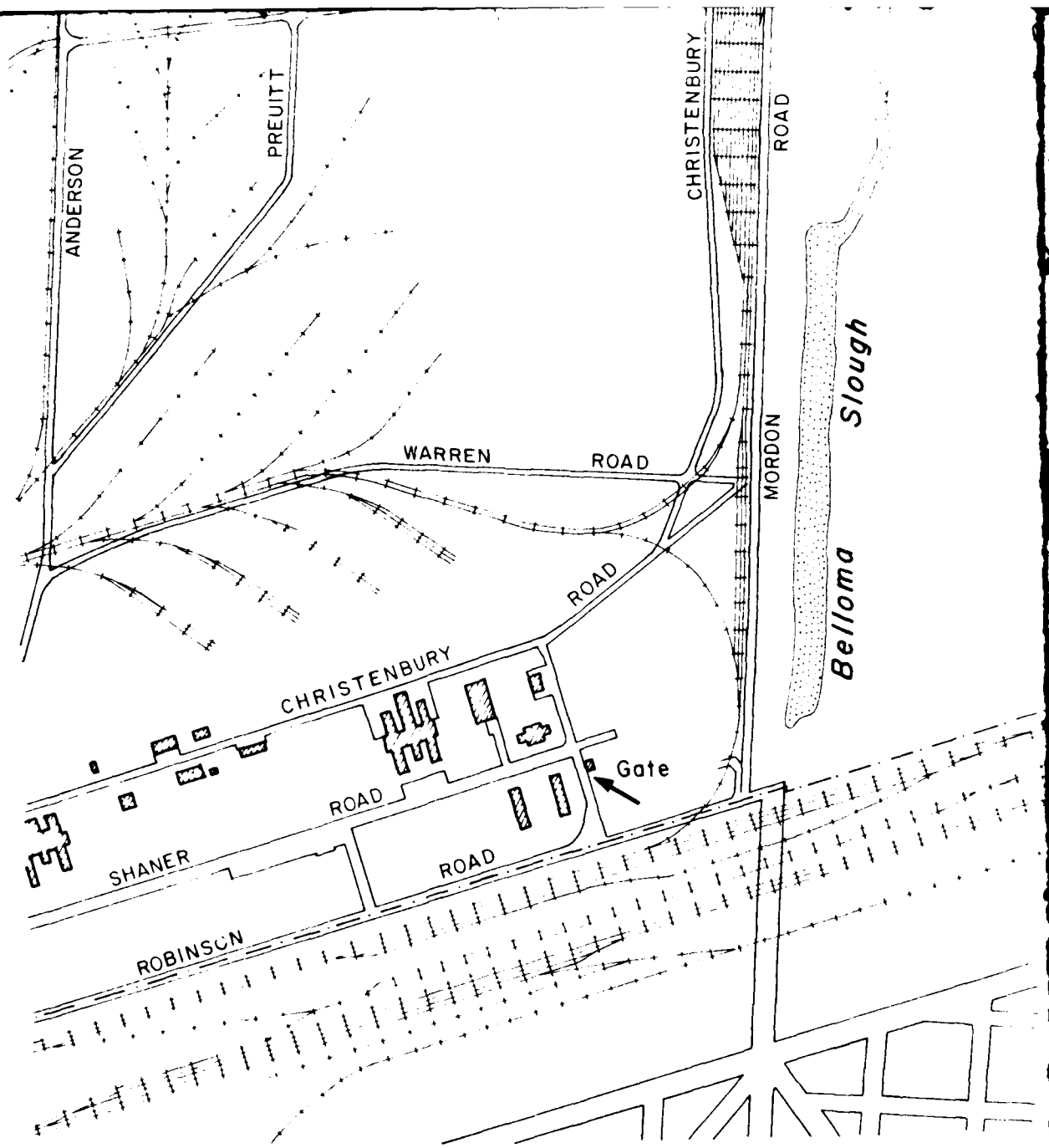
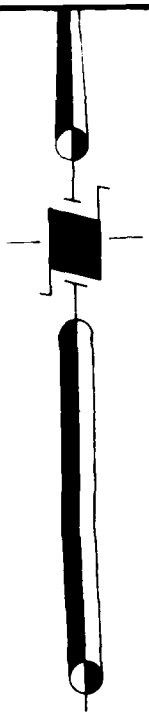
Bay

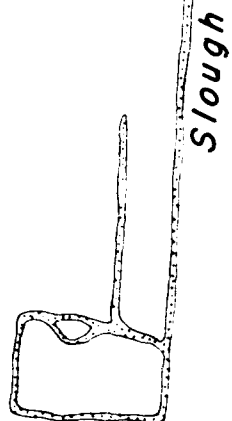




## REGIONAL MAP

1" = 10 miles



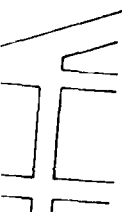


T I D A L

A R E A

Property Line

(Former)  
Town of  
Port Chicago



REGIONAL M

4

Property Line

Cunningham Slough

To Pittsburg

Reference Dwg., Y and D Dwg No. 1-83

**J. AGI & ASSOCIATES CO**  
Suite 600, 1414 Alaskan Way, Seattle

PLAN SHOWING VICINITY MAP A  
LOCATION OF INSPECTED STRUCTURE  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
REPORT No FPO-1-83- (1)  
CONTRACT No N62477-81-C-0  
TASK 2

**DWG. No. 1**

REGIONAL MAP

Reference Dwg. Y and D Dwg No. 1115131

**J. AGI & ASSOCIATES CO. LTD.**  
Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING VICINITY MAP AND  
LOCATION OF INSPECTED STRUCTURES  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
REPORT No FPO -1-83 - (19)  
CONTRACT No N62477-81-C-0498  
TASK 2

**DWG. No. 1**

SCALE 1" = 400'

DRAWN F P

CHECKED *z.f.*

APPROVED *XIE*

DATE MAY 25, 1983

PROJECT No  
**83-1/3-2-100**

### 2.3 MISSION OF ACTIVITY

Naval Weapons Station, Concord performs a dual role within the Naval Sea Systems Command. The station functions as the primary port of embarkation for ordnance materials on the west coast. It is the homeport for the ammunition ships (AE's). The station is also one of the five weapons stations maintained by NAVSEA to provide fleet combatants with ready-for-use ordnance.

### 2.4 ENVIRONMENTAL DATA

Climate: The wind blows from the northwest most of the year causing the Pacific Ocean and the Suisun Bay to influence the climate. As a result of the influx of moderate oceanic air, Contra Costa County has a dry, warm summer and moderately rainy winter climate. The countywide mean annual temperature is 59 degrees Fahrenheit with moderate variation throughout the county. The average January temperature is about 46 degrees and the average July temperature is about 76 degrees F. The average frost-free season is about 265 days.

Rainfall occurs almost exclusively in the period from October to May, with an average annual amount ranging from 13 inches in the eastern portion to over 30 inches on the upper slopes of Mt. Diablo. Snow falls on Mt. Diablo occasionally, but the accumulation is small and lasts only a few days.

Physiography: Contra Costa County consists of four general physiographic regions: the highlands of the Coast Range, the intermountain valleys, the San Francisco Bay depression, and the Sacramento-San Joaquin Delta. The Diablo Range has smooth rolling hills and relatively rugged mountains ranging from 100 feet along the San Francisco Bay depression and San Joaquin Valley to 3849 feet at Mt. Diablo, which is a prominent landmark.

The San Francisco Bay depression and intermountain valleys consist of nearly level flood plains and low terraces with gently rolling fans and old terrace remnants adjacent to the uplands. Most of the low lying river delta lands have been reclaimed by protective dykes and drainage ways forming islands ranging from 30 to 7000 acres.

Except for a few small streamways draining west into San Francisco Bay, the drainage of Contra Costa County enters the San Joaquin River, San Pablo Bay or Suisun Bay to the north and east.

Originally, the tidal area consisted of three distinct land formations: salt marshes along the shore of the Suisun Bay, upland colluvial slope, and the sandstone hills furthest from the water. A large section of the marshland was modified, when the original weapons station was constructed, by adding large amounts of fill material. Almost all existing tidal facilities were built in these areas. The land designated colluvial slope is the most suitable for development because of higher elevation and gentle slope. The former city of Port Chicago was located in this area. The area to the south of Contra Costa Canal is characterized by steeply sloping terrain, beginning with a 100-foot elevation and rising to over 600 feet. The hills are composed of soft sandstone which is poorly suited for construction.

Geology: The geology of Contra Costa County is dominated by several northwest trending fault systems which divide the county into large blocks of rock. Within a particular block, the rock sequence consists of: (1) a basement complex of broken and jumbled sedimentary, igneous, and metamorphic rocks; (2) a section of younger sedimentary rocks more than 35,000 feet thick; (3) volcanic rocks which locally interconnect with and overlie the sedimentary section, and (4) surficial deposits including slides, alluvial fans, and bay

plain deposits.

The California landscape is still being formed by geologic forces and is one of the most seismically active areas of the world. Lines of stress created by this formation process accumulate energy which is relieved only through movement of large structured blocks. The stresslines or faults, in Contra Costa County that have shown signs of movement include the Hayward and Calaveras faults. The Hayward fault is creeping in several locations and was the source of severe earthquakes in 1836 and 1868. Since 1934 nearly 200 earthquakes have been recorded in central Contra Costa County. Ten of these had magnitudes ranging from 4.0 to 5.4 on the Richter scale. Faults in the county that are considered to be active by the U.S. Geological Survey include the Antioch, Concord and Pleasanton faults. Additionally, faults of undetermined status include the Pinole, Franklin, Clayton-Marsh Creek and Mt. Diablo.

Parts of the Clayton-Marsh Creek geologic fault line and its lateral projections extend into the weapons station. This fault is considered a major active fault within Contra Costa County. In the period between 1934-1941, there have been at least five earthquakes with Richter Scale magnitudes between 2.5 and 3.4 which had epicenters on or very close to the weapons station's property. In addition, the Concord fault, which lies just to the west of the station, could produce an earthquake of the magnitude between 5.0 and 6.0 over the next 50 year period.

Hydrology: The drainage systems of the San Francisco Bay Area can be classified as (1) the Great Valley and Delta systems; (2) streams

flowing into San Francisco, San Pablo or Suisun Bays; and (3) streams flowing directly into the Pacific Ocean. The Great Valley drainage includes all those streams flowing into the Sacramento and San Joaquin rivers, and drains over 59,000 square miles. Most of the run-off through the watershed is derived from melting snow which creates a flow peak around February. Another peak flow period in April-May is caused by hard seasonal rains.

More than 77 local streams, draining 3450 square miles of watershed, enter San Francisco Bay between the delta and the ocean. Most of the run-off through the streams is derived from rain, resulting in peak flows during the late winter or early spring. Only two major rivers, the Russian and the Gualala, empty directly into the Pacific Ocean.

Flooding is of concern throughout the Bay Area. Historically, major flood problems have occurred in urban areas located in relatively flat valleys near the mouths of rivers. Major seasonal storms coinciding with high tides have resulted in severe property damage. In general, areas less than nine feet above mean sea level are subject to tidal flooding.

Adequate fresh ground water is available throughout the Bay Area. However, high density urbanization and high rates of drawdown create shortages in various communities during the summer months. Additionally, high drawdown rates can result in salt water intrusion into localized aquifers.

Naval Weapons Station, Concord lies within the Mt.Diablo-Seal Creek Watershed which drains about 36 square miles. The watershed is bounded on the south by the north peak of Mt. Diablo and on the north by Suisun Bay. Streams that drain the watershed have their headwaters on the slopes of Mt. Diablo and flow by way of Mt. Diablo Creek through Clayton

Valley and the weapons station to the outlet at Suisun Bay. From the beginning of the tidal marsh to Suisun Bay, a distance of about two miles, the name of the creek changes to Seal Creek.

Historical records show that flooding occurs in the watershed almost every year. Major floods occurred in 1938, 1952 and 1955. The area of Mt. Diablo Creek between Clayton Canal and Arnold Industrial Highway is not a source of severe overbank flooding because the channel has been deeply incised in that area. The channel downstream of Arnold Industrial Highway becomes progressively smaller and flooding occurs on the Concord Municipal Golf Course, the entrance to the weapons station, Port Chicago Highway and the tidal marsh. Flooding is more frequent in this reach than anywhere else in the watershed.

The water in Suisun Bay is a mixture of fresh and salt water with a resultant salinity ranging from 5 to 8 parts per thousand. The water quality is generally poor with high levels of turbidity and suspended solids.

Biological Systems: The combination of marine, fresh water and terrestrial ecosystems that occur in the San Francisco Bay Area provides a very wide range of habitat types. Some 50 square miles of marsh-land, 78 square miles of salt producing ponds, 65 square miles of tidal flats, and 400 square miles of open water allow a great diversity of species to inhabit the area.

The marine ecosystem is influenced both positively and negatively by run-off from land and fresh water outlets. The incoming nutrients sustain large crops of micro and macro algae that in turn support the remainder of an intricate food web made up of herbivorous and carnivorous organisms. Sediment loads carried into the Bay tend to smother both plants and animals and to block out the incident light

that is required by plants to function. The plants of the marine ecosystem consist predominantly of planktonic diatoms, but marine grasses and salt marsh plants also play a major role.

The fresh water ecosystem is also highly dependent on microform algae as a major food source, but the wetlands and marshes take on a very dominant role in the functioning of this system. Tules, reeds, sedges, and other woody water plants provide food and protection for wildlife and act as substrate stabilizers.

Basically, the vegetation is restricted to extremely drought resistant plant materials that show green coloration only during the winter. For this reason, the landscape lacks a permanent character, except in areas where exotic materials such as the eucalyptus tree have been planted, or where irrigation is practiced.

The San Francisco Bay Area provides food and protective habitat to a variety of fish, bird, and mammal species. The fishery resource includes: (1) transitory species such as striped bass, king salmon, sturgeon, steelhead trout, shark, and juvenile Dungeness crabs; and (2) resident species such as sole, flounder, croaker, perch, shad, shrimp, crabs, clams and some oysters.

The Bay Area is situated in the Pacific Flyway, which extends from South America to the Arctic Circle, and provides a stop-over site for large numbers of waterfowl moving north and south. Seventy-five different species of birds frequent the Bay Area and the waterfowl population fluctuates to numbers as high as 800,000.

The native mammal population has diminished dramatically over the years because of urbanization. The once prevalent beaver, muskrat, and mink have all but been eliminated, and the once large deer herd is now restricted to small pockets of undeveloped lands. Sea lions, harbor seals, and occasional porpoise frequent the waters of various bays.

### SECTION 3 - INSPECTION PROCEDURE

An underwater inspection of Piers 3 and 4 at the Naval Weapons Station, Concord, was carried out during the time period May 2 - May 20, 1983. The level of inspection to be carried out as detailed in the scope of work, the type of structure being inspected, on site environmental and structural conditions and past experience, dictated the inspection procedures that were employed on this project.

#### 3.1 LEVEL OF INSPECTION

Levels I, II and III inspections were carried out on the various structures as indicated by on site conditions and the scope of work as defined under Task 2 of this contract. This included visual/tactile inspection techniques, cleaning or removing of biofouling from certain members and nondestructive ultrasonic testing of other members as required. In addition, photographic documentation of typical conditions and/or damage was obtained.

#### 3.2 INSPECTION PATTERN/PROCEDURE

A Level I "rapid swim by" inspection of all perimeter piling and piles in every fifth bent in both Piers 3 and 4 was carried out. The results of the Level I inspection were used to form the basis for the selection of piles subjected to more detailed Level II and III inspections.

The Level II inspection of the concrete piles included the cleaning or removal of biofouling on three sides or faces of each inspected pile to a length of 10 inches to expose the underlying pile for inspection. Inspection sites were selected at the mid intertidal zone and at the mudline. Removal of the marine growth was carried out by the use of short handled scrapers.

A Level III ultrasonic inspection of selected timber piling in both Piers 3 and 4 was also carried out. These piles were tested using the unique B.C. Research developed ULTRASCAN PTM-4 ultrasonic testing instruments. The testing crew consisted of two to three men, diver/inspectors who provided visual observations and scanned the entire surface of the pile with the sonic "probe" and a surface technician who monitored the observations and readings produced on the meter. The probe is attached to the pile by the diver at the water surface. The diver then proceeds to scan the entire length of the pile from the surface to mudline. The instruments provide a continuous cross-sectional area readout which is recorded by the surface technician. When the mudline is reached, the probe is moved onto the adjacent pile in the bent and the process is repeated from mudline to surface. Removal of fouling is not required for operation of the unit. The pile "ratings" are given in terms of undamaged cross-sectional area remaining in each pile. These ratings are based on the least cross-sectional area found as revealed by sonic and visual data. The ratings are given in quartiles and indicate both the location and degree of loss of pile cross-section in damaged piles.

Based on the data provided, the new  $L/d$  ratio of a pile can be established in light of damage found. The  $L/d$  ratios and the reduced pile capacities of the damaged piles are provided in Tables 3 and 6, pages T5 and T21.

The ULTRASCAN is used to detect and assess marine borer and mechanical damage in the immersed areas of the pile from mudline to the high tide level. Additional inspection is carried out from the high tide level to the cap to locate any possible mechanical and fungal damage.

### 3.3 EQUIPMENT

- ULTRASCAN PTM-4 \*, timber pile testing instruments.
- Underwater telephone.
- Nikonos IV-A Camera and Strobe.
- Clearwater box for underwater photography.
- Short handled scrapers for cleaning concrete piles.
- Steel rulers for measurement of extent of deteriorated concrete.
- Miscellaneous ancillary equipment and SCUBA gear.

#### 3.3.1 Background on Ultrasonic Instrumentation

##### 3.3.1.1 ULTRASCAN PTM-4

The ULTRASCAN PTM-4 pile testing instruments are the result of studies initiated at B.C. Research in 1955, to develop instruments for nondestructive testing of in-place marine piling. It was found that the velocity and strength of sound waves passing through wood varied inversely with voids in wood caused by marine borers. Based on this principle, instruments were developed which use magnetostrictive transducers to provide an ultrasonic scan of the pile. The plane waves which penetrate the wood, from the transmitting transducer, initiate transmission of secondary sonic patterns in the direction of the wood grain. As these waves transit along the axis of the pile they produce radial sets of waves which are picked up by the transducer. Undamaged wood is an excellent transmitter of these waves, whereas damaged wood attenuates the sound. During the development stage extensive axial load testing of pile sections was carried out and correlations were established between the sonic readings and the remaining undamaged cross-section of the pile. A direct meter readout is provided

\* Patented

showing the percentage of sound wood remaining. Verification and refinement of the initial methods has been carried out by testing inplace piling, removing the piles and subjecting them to inspection and axial load testing. Good correlation was found between the sonic readings, the remaining undamaged area of the pile and the strength ratings based on the sonic instruments.

### 3.3.2 Reasons for Selection of ULTRASCAN PTM-4 Instrumentation

*Bankia* damage in piling can only be determined by underwater inspection, with many attendant difficulties. If the *Bankia* are alive and the siphons extended, recognition is not too difficult. If the siphons are retracted or the *Bankia* are dead, detection of the burrow openings is not easy. In many instances, fouling must be scrubbed off the piling in order to facilitate an inspection. If visibility is limited, as frequently occurs in industrial locations, visual inspection is hopeless. Even if teredine entry holes are observed, an evaluation of internal damage, by purely visual means, is not possible.

Because of these difficulties, the sonic testing method was initially developed to locate and evaluate teredine damage. It was felt that *Limonoria* damage could be readily detected visually, since the damage progressed from the surface inward. Experience, however, has shown that the sonic testing method substantially enhances the detection and evaluation of damage even in areas where *Limonoria* is the primary source of infestation. Some of the reasons for this are as follows:

1. In areas with poor or nonexistent underwater visibility, sonic testing expedites the examination by locating the damage and providing for a quantitative evaluation of the residual strength.

2. *Linnæa* attack very often takes the path of least resistance. That is, *Linnæa* will gain access into a pile through a small breach in the creosoted layer and destroy the untreated heartwood with very little surface evidence of damage. A good example of this is a U.S. Navy fuel pier. In this particular structure a considerable number of piles, which have been destroyed by *Linnæa*, show no obvious visual indication of damage. The reason for this is that the *Linnæa* has gained access to the pile through open boltholes. The boltholes are virtually impossible to detect unless all fouling is removed from the pile and a minute visual examination is carried out. This type of visual examination would be very time consuming and costly. It would be further restricted by poor underwater visibility.
3. *Linnæa* damage, particularly in Californian waters, very often exposes the treated pile to teredine attack which would be very difficult to detect and assess visually.

#### 3.4 PERSONNEL ON PROJECT

|                 |                          |
|-----------------|--------------------------|
| Jerry Agi       | - Project Manager        |
| Erling Vegsund  | - Project Supervisor     |
| Scott Christie  | - Engineering Technician |
| Fred Phillips   | - Technician/Draftsman   |
| Allan Jones     | - Computer Analysis      |
| Douglas Cassidy | - Computer Analysis      |
| Maria Sjoquist  | - Report Preparation     |

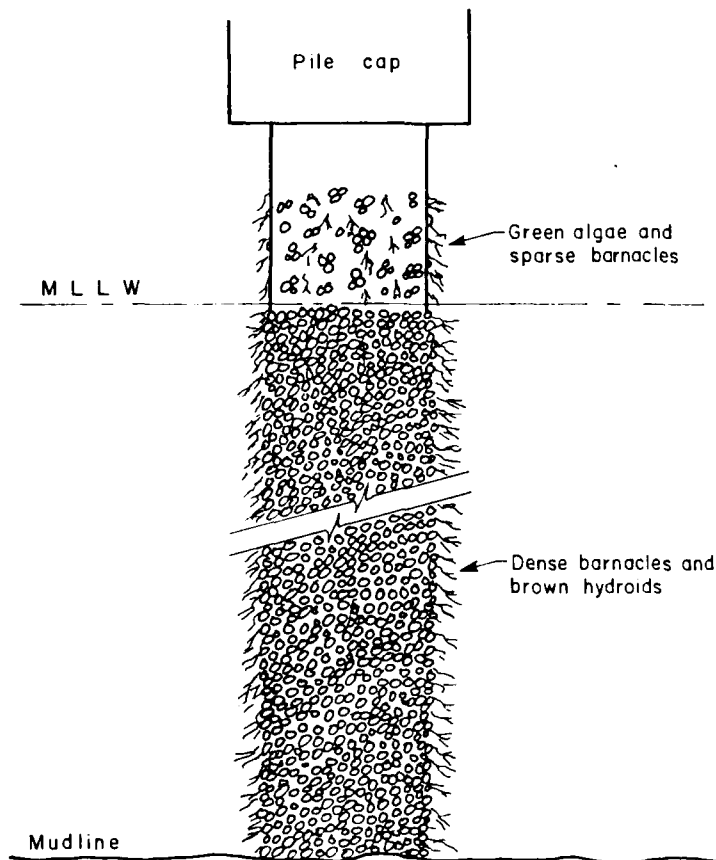
#### SECTION 4 - FACILITIES INSPECTED

Each of the two facilities at the Naval Weapons Station, Concord is referred to separately in this section of the report. The sequence of the presentation of the inspected structures is Pier 3 followed by Pier 4. The discussion of each facility is presented in four sections: (1) A description of the overall facility and its operations as well as a specific detailing of the construction and identification of the examined piles; (2) a detailing of the observed condition of the facility as determined by the field inspection; (3) a quantitative assessment of the structural condition of the facility based on the observed condition; and (4) recommendations for maintenance to ensure the structural integrity of the facility. Tables detailing the condition of the inspected piles as well as cost breakdowns for any necessary repairs are included in the accompanying appendices.

Marine growth or fouling profiles were found to be similar for both structures. Organisms found consisted mainly of barnacles and hair like brown hydroids as well as green algae. The fouling organisms were found to range from the upper intertidal zone to the mudline. Specifically they were found to range as follows:

|                                      |                                                   |
|--------------------------------------|---------------------------------------------------|
| Upper intertidal zone:               | green algae<br>sparse barnacles                   |
| Mid intertidal zone:                 | moderate to dense barnacles and<br>brown hydroids |
| Lower intertidal zone<br>to mudline: | dense barnacles and brown<br>hydroids.            |

The following Figure No.1 and Photographs 1 - 5 serve to illustrate the typical fouling organisms found throughout the inspected structures.



|                                                                                     |              |                                                                      |                         |
|-------------------------------------------------------------------------------------|--------------|----------------------------------------------------------------------|-------------------------|
| <b>J. Agi &amp; Associates Co. Ltd.</b><br>Suite 600, 1414 Alaskan Way, Seattle, WA |              | CHES DIV NAV FAC ENG COM                                             |                         |
|                                                                                     |              | <b>MARINE GROWTH PROFILE</b><br>NAVAL WEAPONS STATION<br>CONCORD, CA | <b>Fig.</b><br><b>1</b> |
| Not to scale                                                                        | June 1, 1983 |                                                                      |                         |



PHOTOGRAPH No. 1

Fouling profile - Green algae and sparse barnacles in upper intertidal zone.



PHOTOGRAPH No. 2

Fouling profile - Moderate to dense barnacle and brown hydroid growth in mid-intertidal zone.



PHOTOGRAPH No. 3  
Lower intertidal zone.



PHOTOGRAPH No. 4  
Submerged zone.



PHOTOGRAPH No. 5  
Submerged zone and  
mudline.

Photographs 3, 4 and 5.  
Fouling profile - Dense  
barnacle and brown  
hydroid growth from lower  
intertidal through the  
submerged zone to the  
mudline. Fouling was  
removed from center of  
pile to show the density  
of the marine growth.

#### 4.1 PIER 3

##### 4.1.1 Description

Pier 3 is located between Piers 2 and 4 at NWS. The Pier has two berths, numbers 3 and 4 which service ocean going AE ships. The Pier is serviced both by vehicular and rail traffic.

The Pier was originally constructed in 1944 on creosote treated timber piling with a timber cap, stringer and deck superstructure. The original configuration of the pier was crescent shaped with an approach trestle extending from the shore to an expanded width pierhead. A timber walkway or access trestle served to provide light vehicle and pedestrian traffic to the pierhead. In 1966 major modifications to the facility were carried out. These changes included the widening of the pierhead section and the installation of a second approach trestle continuous with the eastern end of the pierhead. Once completed, the new trestle allowed for a one way roll-on/roll-off traffic pattern. The section of the structure added in 1966 was constructed on prestressed concrete piles.

For the purposes of this inspection, the structure was subdivided into four sections. As shown in drawings 2 - 6, these sections are identified as the (1) Pierhead (photograph No.6); (2) Approachway Trestle; (3) Access Trestle (photograph No.7); and (4) Concrete Trestle (photograph No.8). For identification purposes, the piles within each of these sections have been designated bent and row numbers based on the identification system used on NAVFAC reference drawings: 11242-B1; 11242-B2; 11242-8; 11242-9; 1115145 and 1115132.

Pile lengths along the berth face in the pierhead section were found to be approximately 40 feet, mudline to top. Measurements of pile lengths were taken at intervals throughout the facility. These lengths are detailed in the accompanying drawings. In several areas, extensive

silting of the mudline has occurred resulting in shallow water.

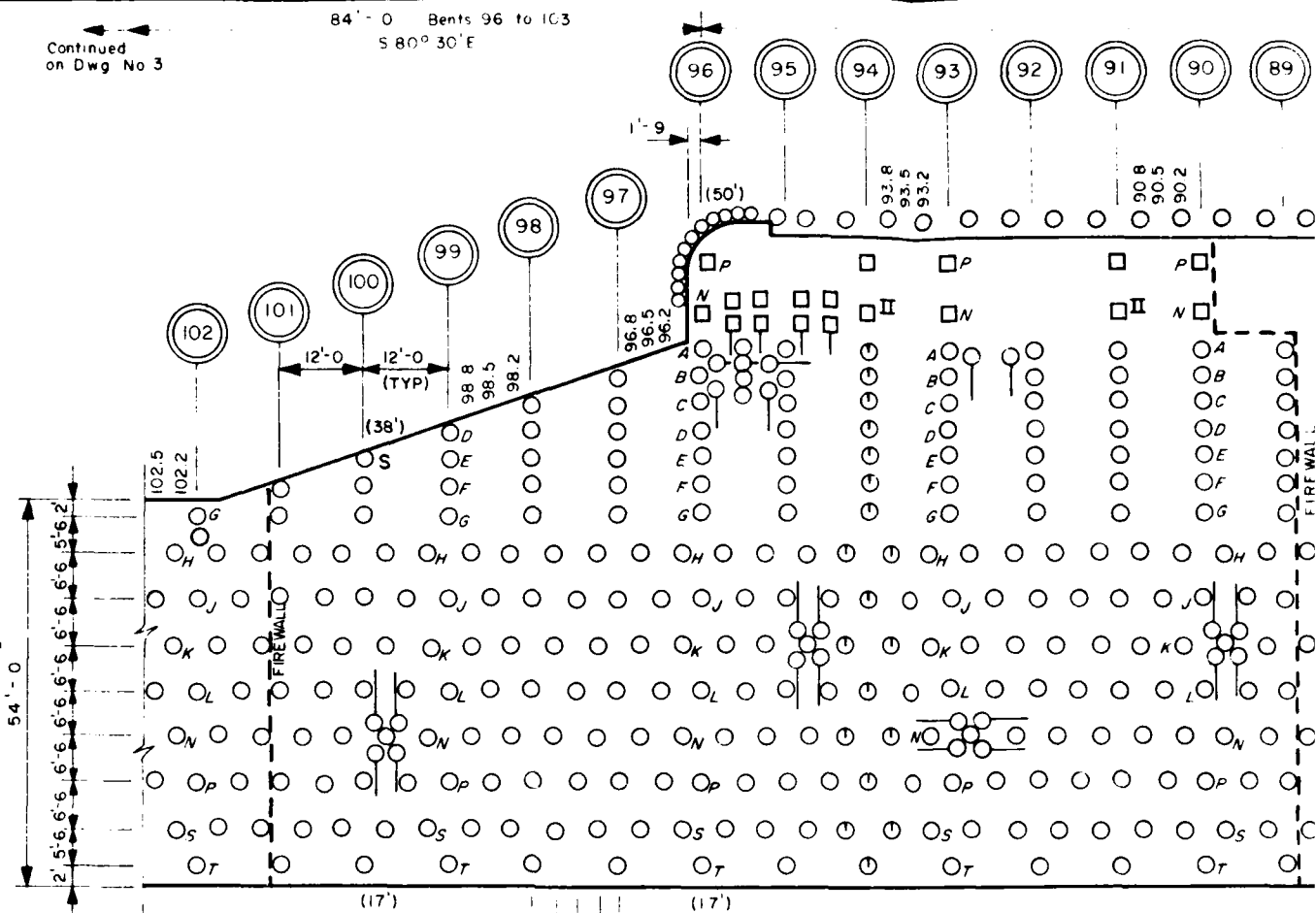
The timber pile diameters were found to average approximately 12". As detailed on Drawing No. 5, the concrete piles are either 20" or 18" square depending on their location within the structure.

At the time of the inspection, the underwater visibility ranged from zero to a maximum of 1 foot. Current conditions at the site ranged from minimal at slack tide to approximately 3 knots during the ebb tide.

Continued  
on Dwg No 3

84'-0 Bents 96 to 103  
S 80° 30' E

Continued on Dwg No. 3



# LEGEND



BENT No

K

PILE ROW DESIGNATION



TIMBER PILE



TIMBER BATTER PILE



18" x 18" OR 20" x 20" CONCRETE P



18" x 18" OR 20" x 20" CONCRETE B. P

m

PILE MISSING

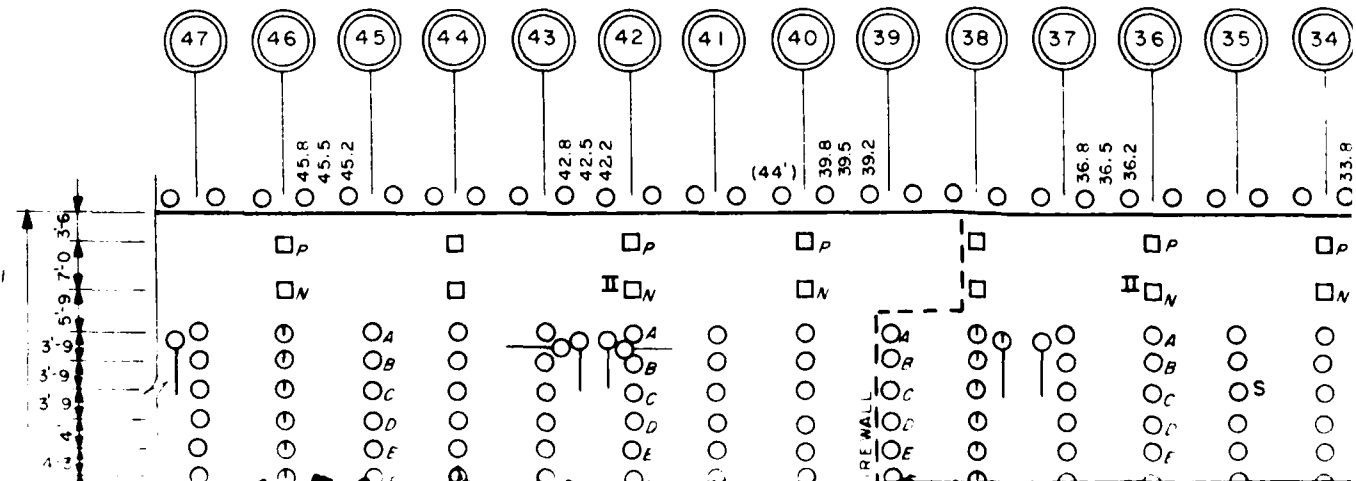
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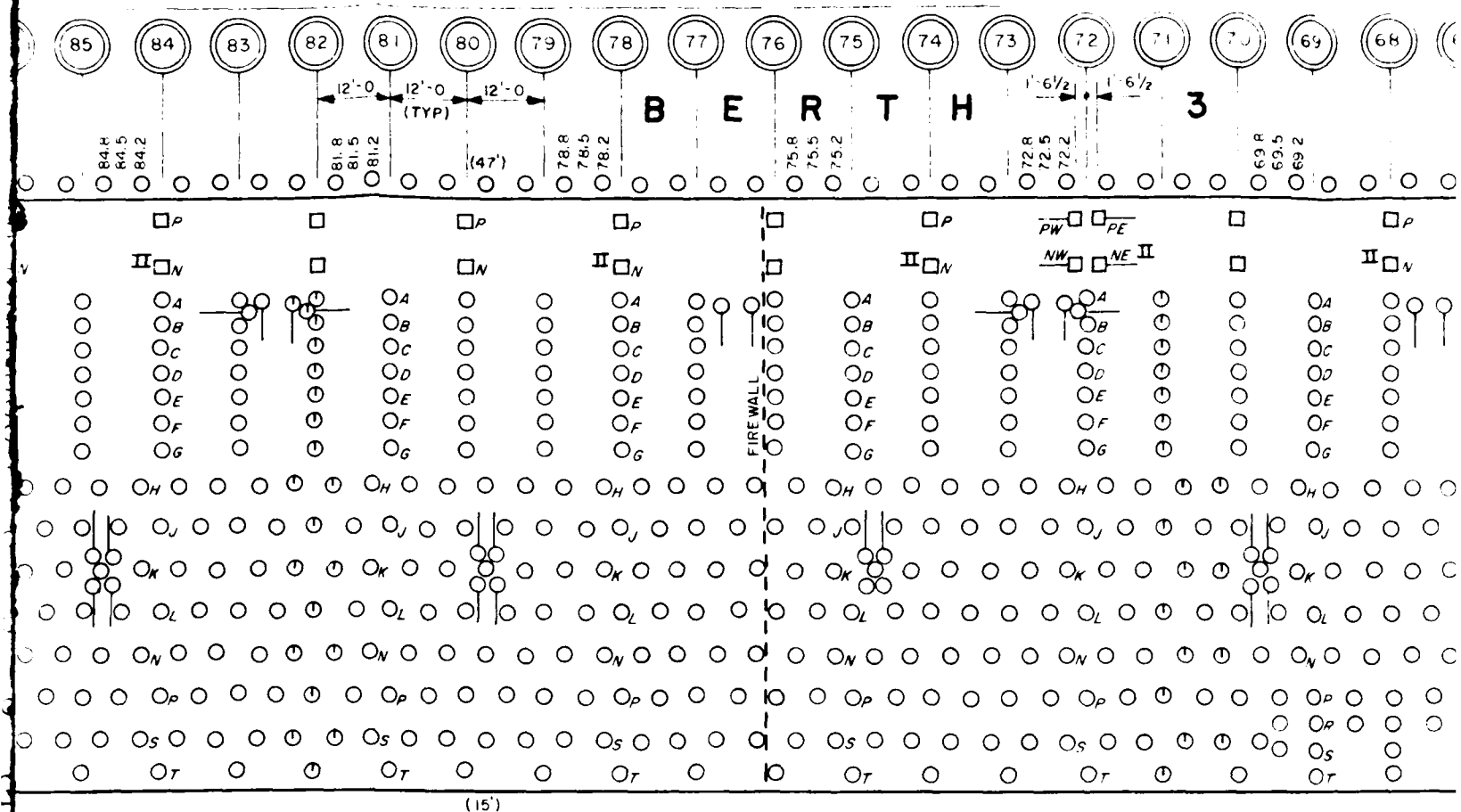
PILE NOT BEARING AT CAP

(46')

PILE LENGTH, CURB TO MUDD

Continued  
above





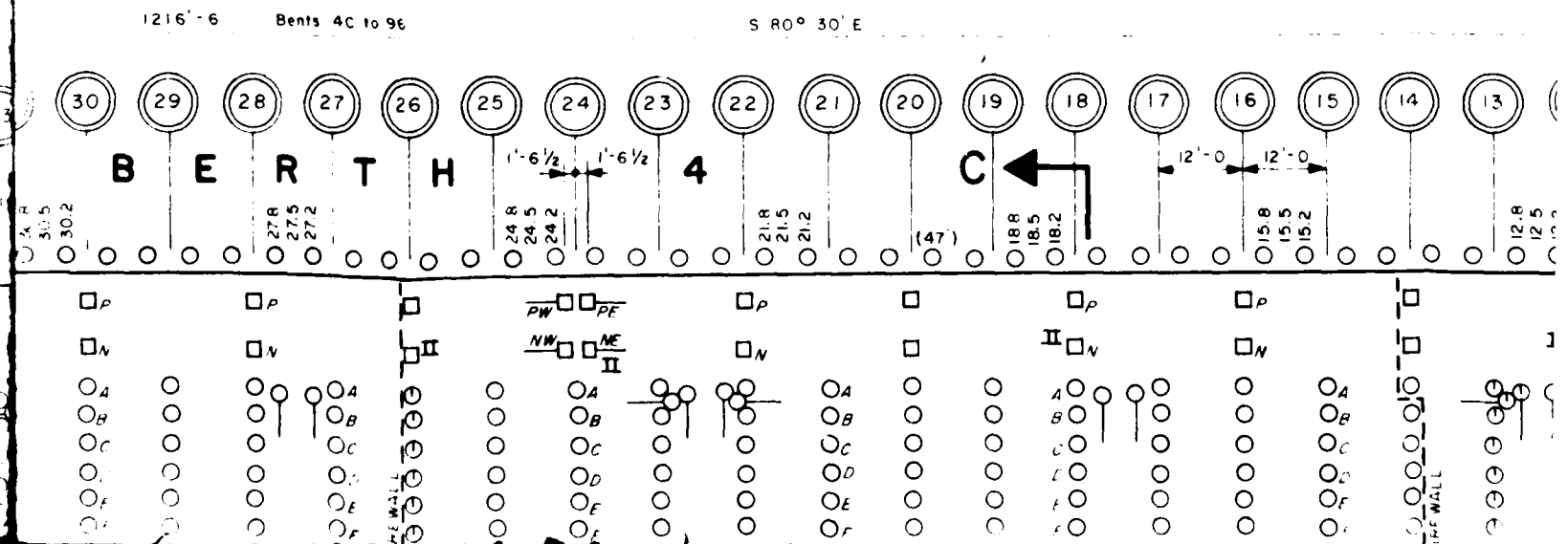
#### INSPECTION LEVEL DESIGNATIONS

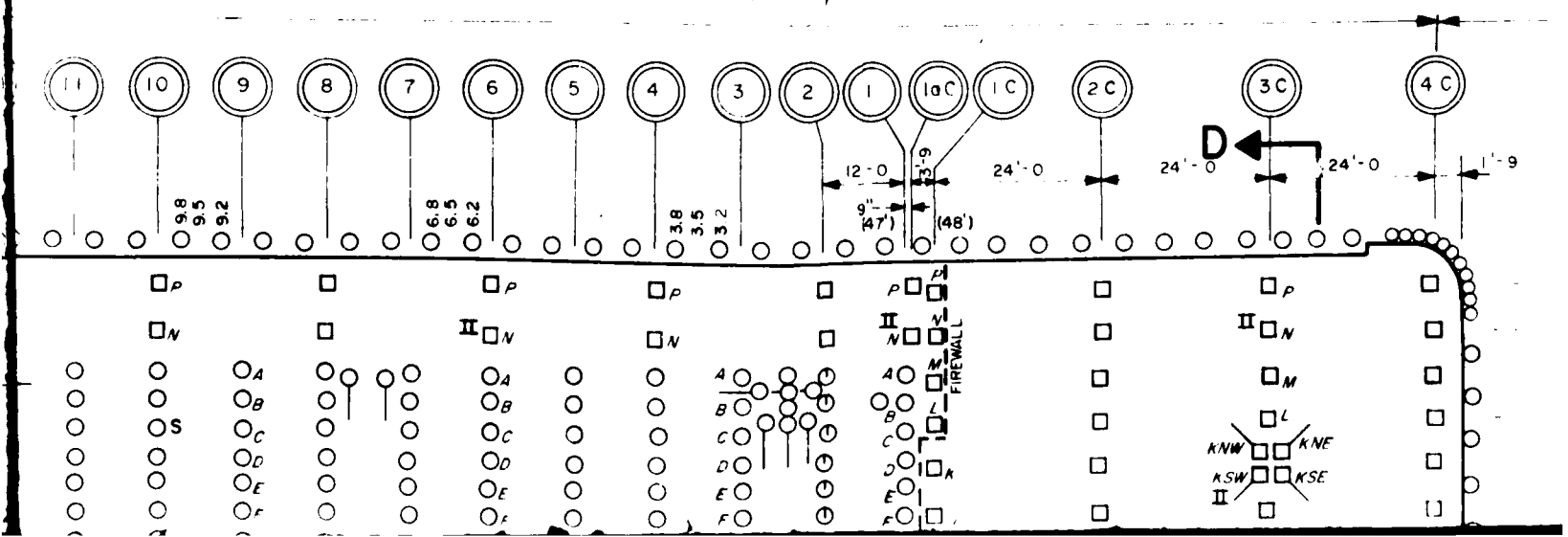
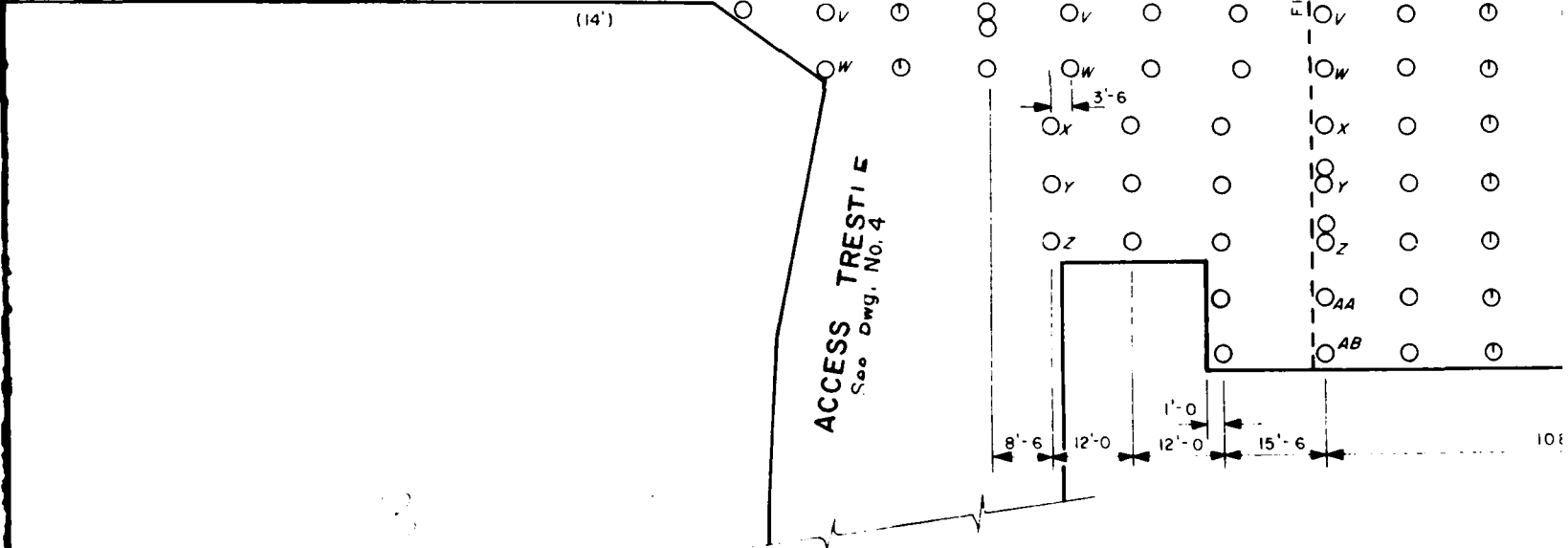
LEVEL I - all perimeter piles from bents 4C to 102  
 - all piles in every fifth bent, i.e. 1,5,10,15 etc. to 90 and 100, and bent 1C  
 S - SIGNIFICANTLY DAMAGED PILE

LEVEL II - inspected piles indicated by (II)  
 \* - SIGNIFICANTLY DAMAGED PILE

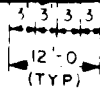
LEVEL III - inspected piles indicated by ;

- 100% REMAINING CROSS-SECTIONAL AREA
- ◐ 75% REMAINING CROSS-SECTIONAL AREA
- ◑ 50% REMAINING CROSS-SECTIONAL AREA
- ◒ 25% REMAINING CROSS-SECTIONAL AREA
- 0-25% REMAINING CROSS-SECTIONAL AREA









# LEGEND



BENT NO.

K

PILE ROW DESIGNATION



TIMBER PILE



TIMBER BATTER PILE



18" x 18" OR 20" x 20" CONCRETE PILE



18" x 18" OR 20" x 20" CONCRETE BATTE

m

PILE MISSING

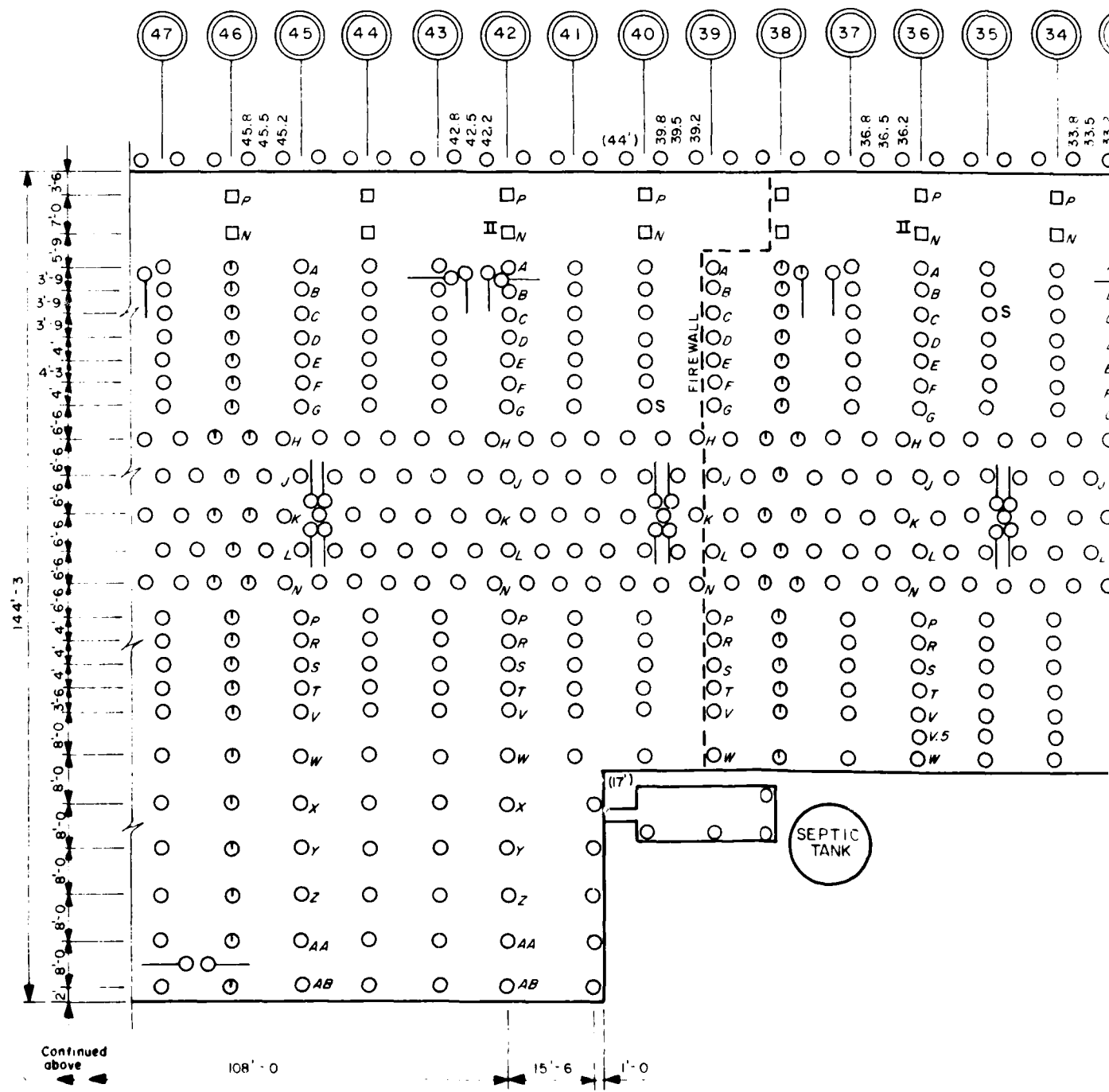
NB

PILE NOT BEARING AT CAP

(46')

PILE LENGTH, CURB TO MUDLINE

Continued above



# INSPECTION LEVEL DESIGNATIONS

LEVEL I - all perimeter piles from bents 4C to 102  
 - all piles in every fifth bent, i.e. 1, 5, 10, 15 etc. to 90 and 100, and bent 1C  
 S - SIGNIFICANTLY DAMAGED PILE

LEVEL II - inspected piles indicated by (II)  
 \* - SIGNIFICANTLY DAMAGED PILE

LEVEL III - inspected piles indicated by:  
 ○ 100% REMAINING CROSS-SECTIONAL AREA  
 ◐ 75% REMAINING CROSS-SECTIONAL AREA  
 ◑ 50% REMAINING CROSS-SECTIONAL AREA  
 ◒ 25% REMAINING CROSS-SECTIONAL AREA  
 ● 0-25% REMAINING CROSS-SECTIONAL AREA

CONCRETE PILE

CONCRETE BATTER PILE

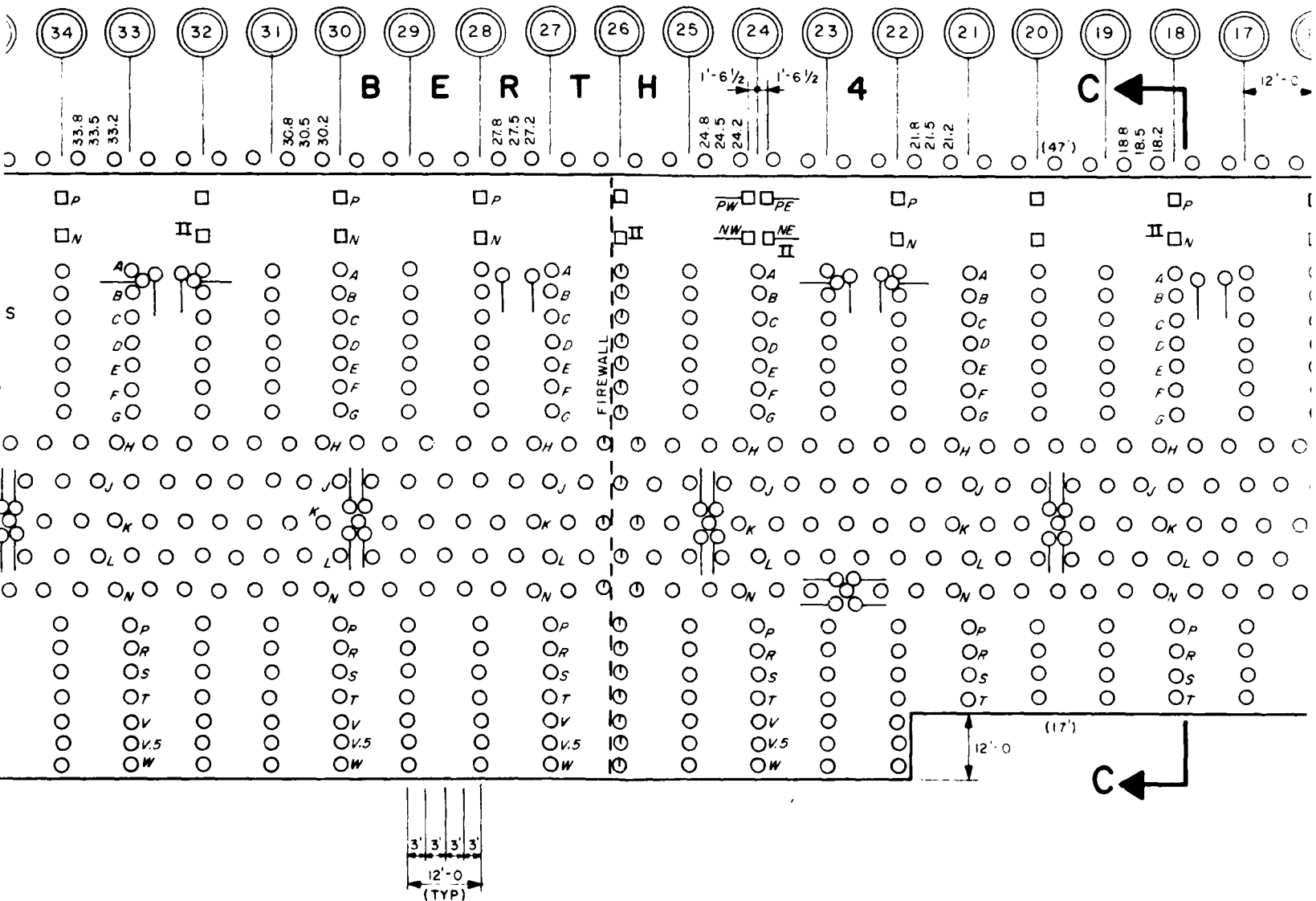
AT CAP

FROM MUDLINE

1216'-6

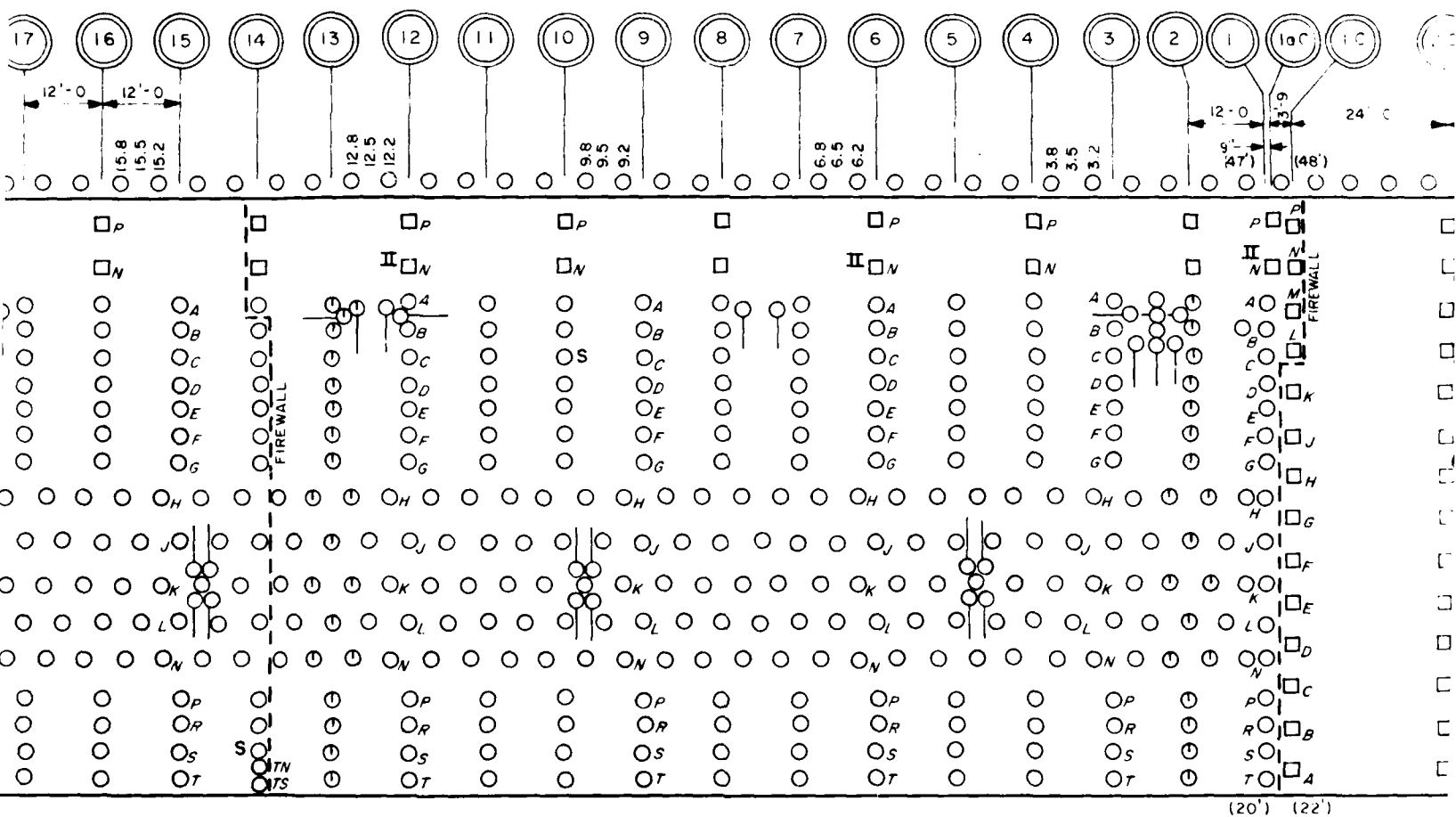
Bents 4C to 96

S 80° 30' E



Not

ACCESS TRESTLE  
Sec Dwg. No. 4



(20') (22')

Note: 18" concrete piles, bents 1aC to 96C  
20" concrete piles, bents 1C to 4C

#### PIER 3, Reference Drawings

P.W. Dwg. No.

11242-B1  
11242-B2  
11242-8  
11242-9

Y and D Dwg. No.

1115132  
1115145  
1115148

Navfac Dwg No.

1045971

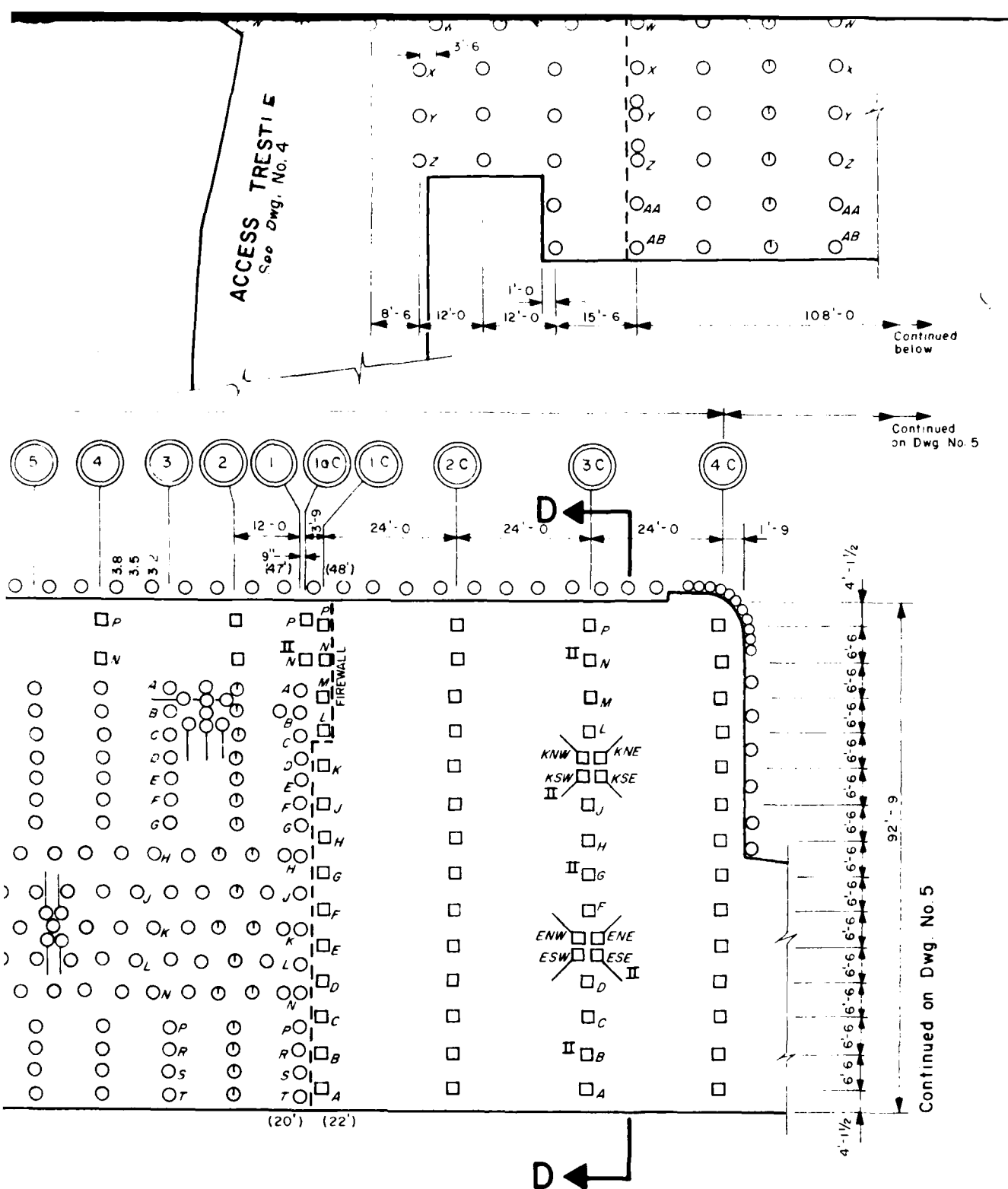
**J. AGI & A**

Suite 600, 14

PLAN  
AND CONDIT  
P

U.S. NA  
COI

CHES  
REPOR  
CONTRAC



# **J. AGI & ASSOCIATES CO. LTD.**

Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING LOCATION  
AND CONDITION OF INSPECTED PILING IN  
PIER 3, PIERHEAD  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
REPORT No. FPO-1-83-(19)  
CONTRACT No. N62477-81-C-0498  
TASK 2

**DWG No. 2**

SCALE 1" = 20'

DRAWN F P

CHECKED *J.P.*

APPROVED

*XIE*

DATE JUNE 6, 1983.

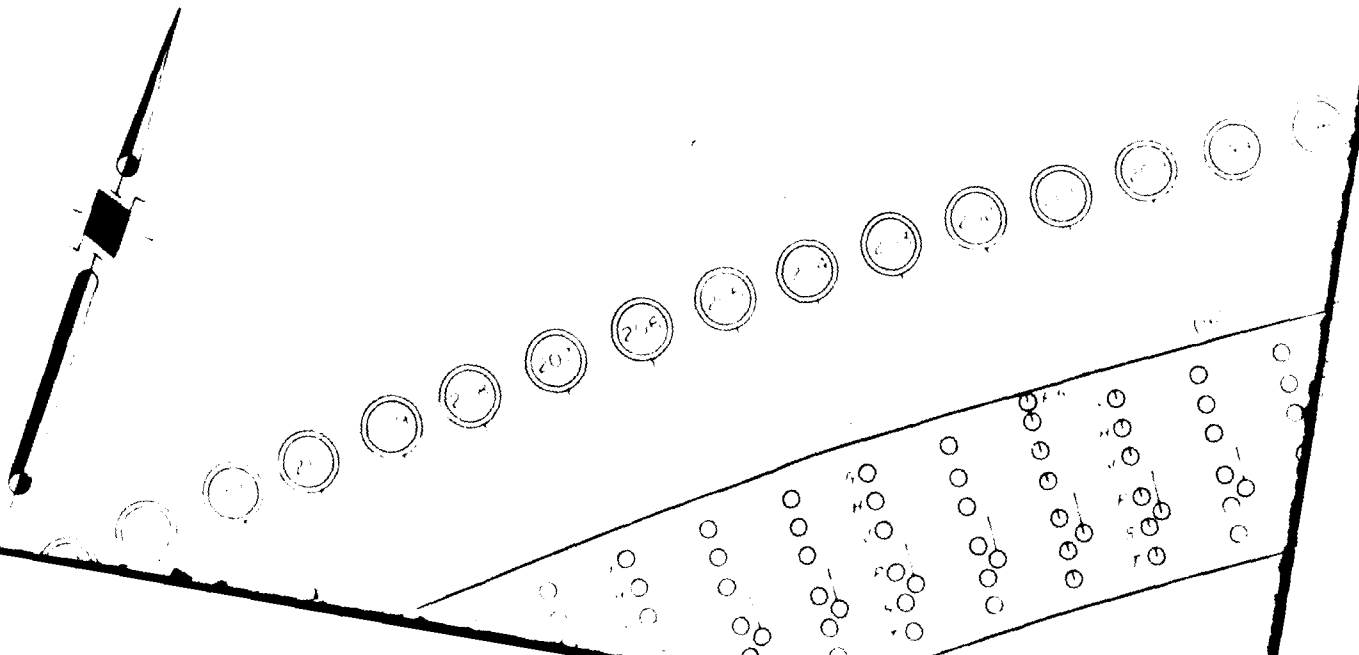
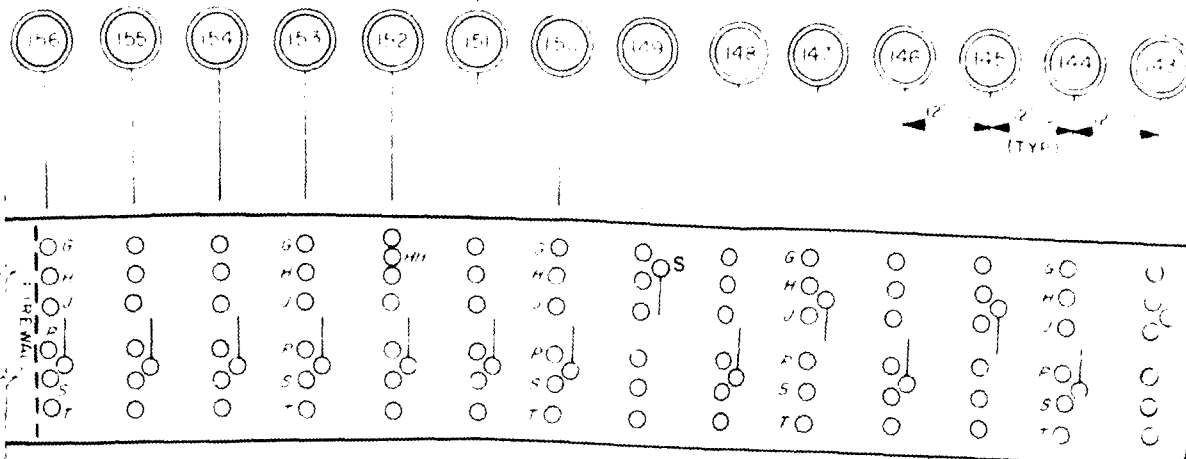
PROJECT No

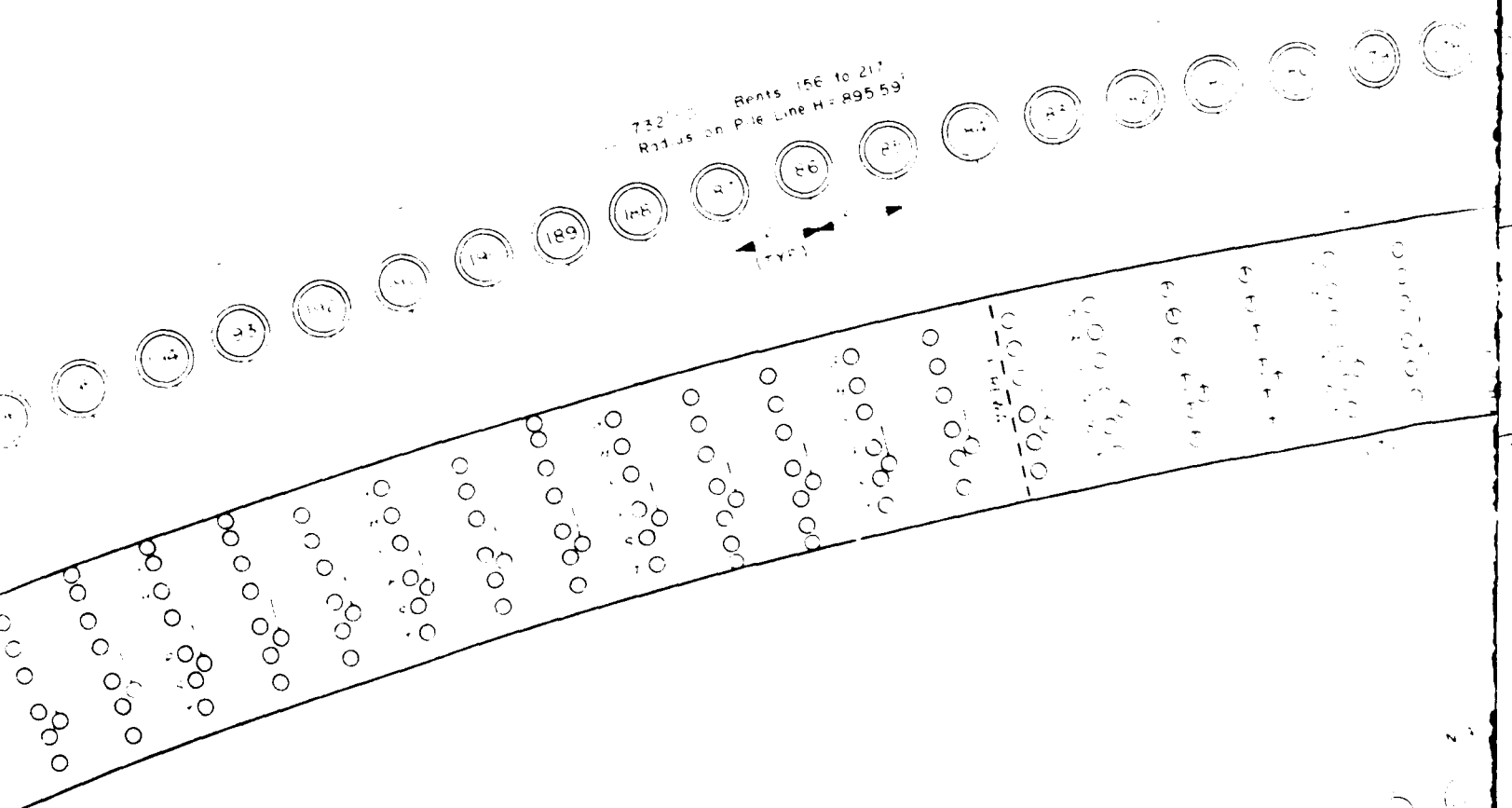
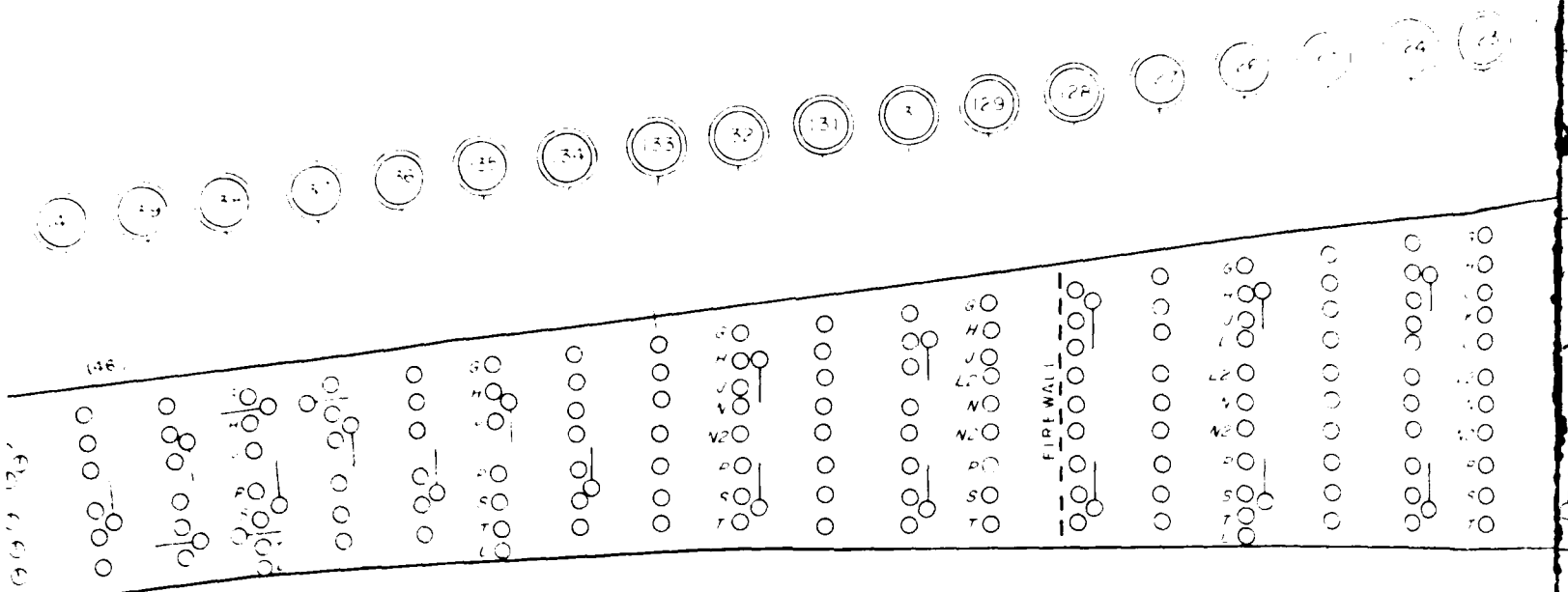
**83-1/3-2-100**

Continued  
below

60' ±  
N 88° 46' E on Pipe Line H

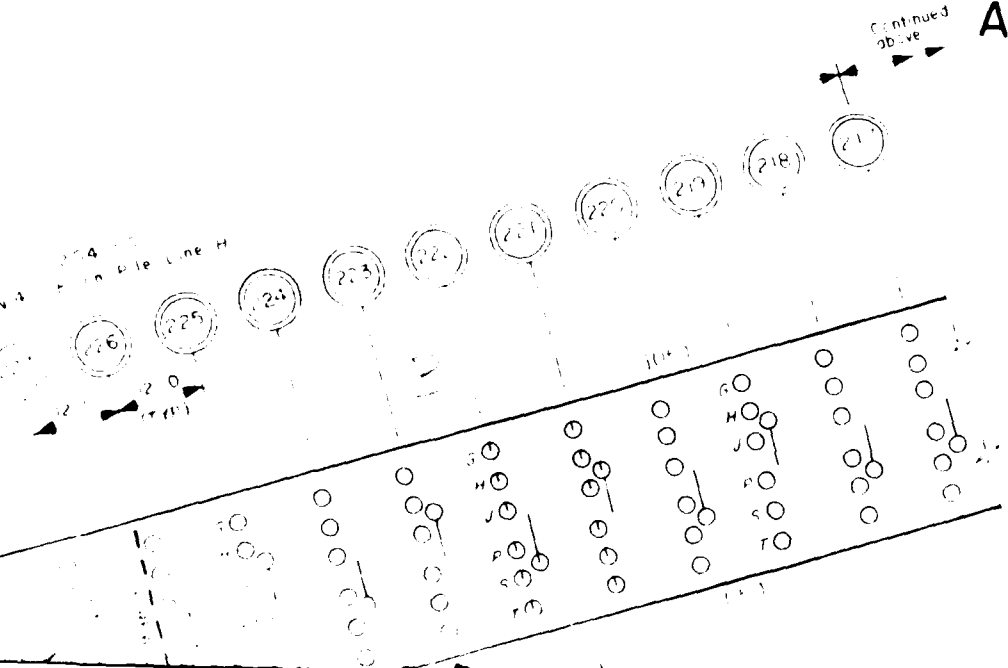
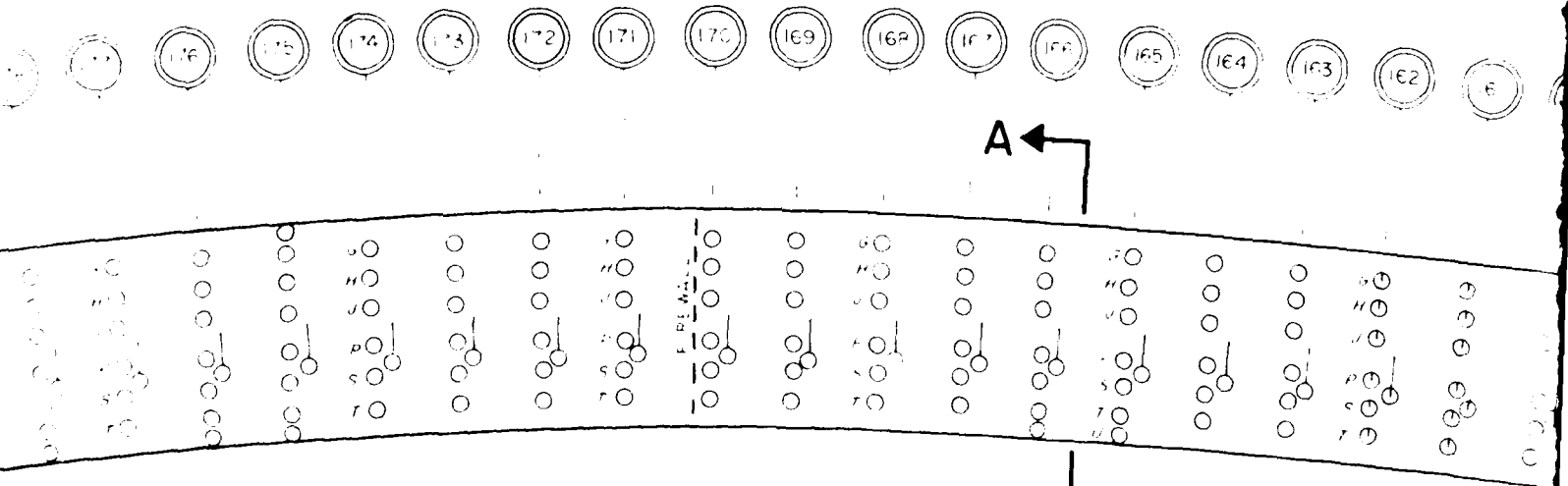
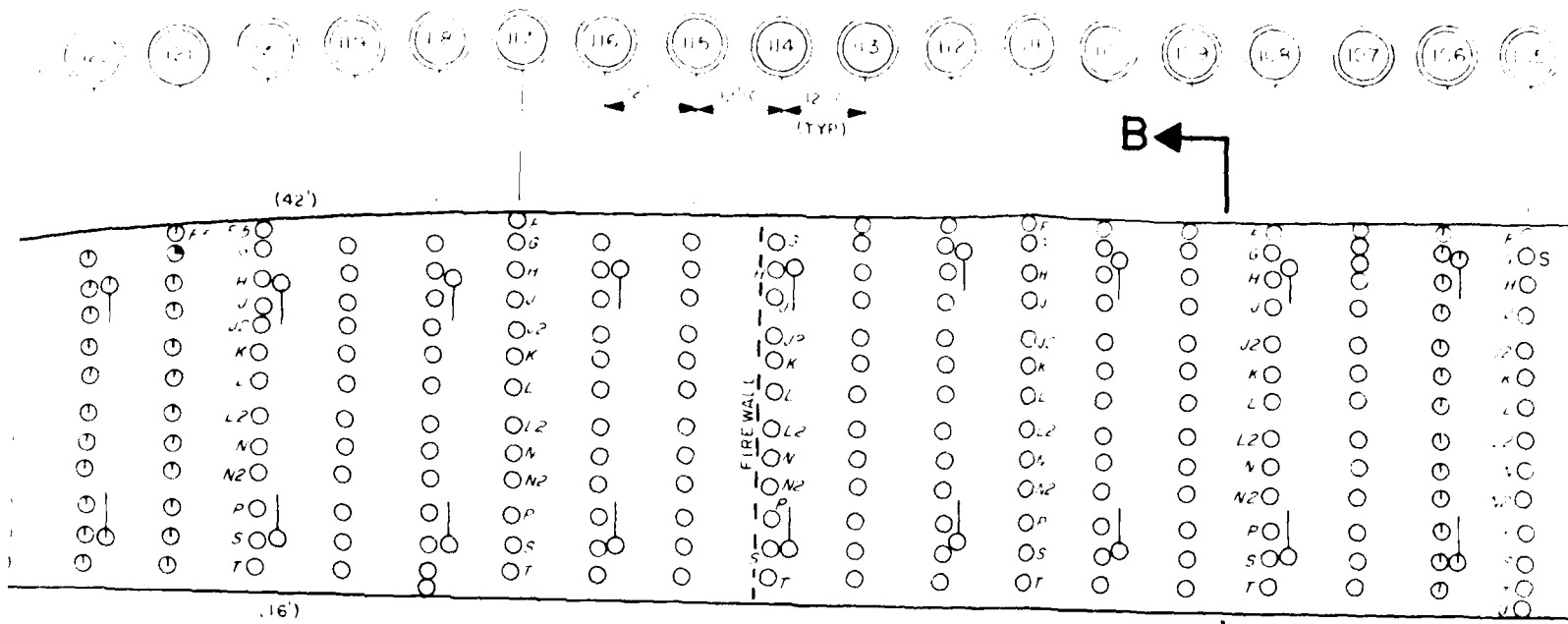
S 87° 34' E on Pipe Line





732-0 Rents 156 to 217  
R11 us on Pile Line H-89559

72-0  
732-0 E on Pile Line H



LEGEND

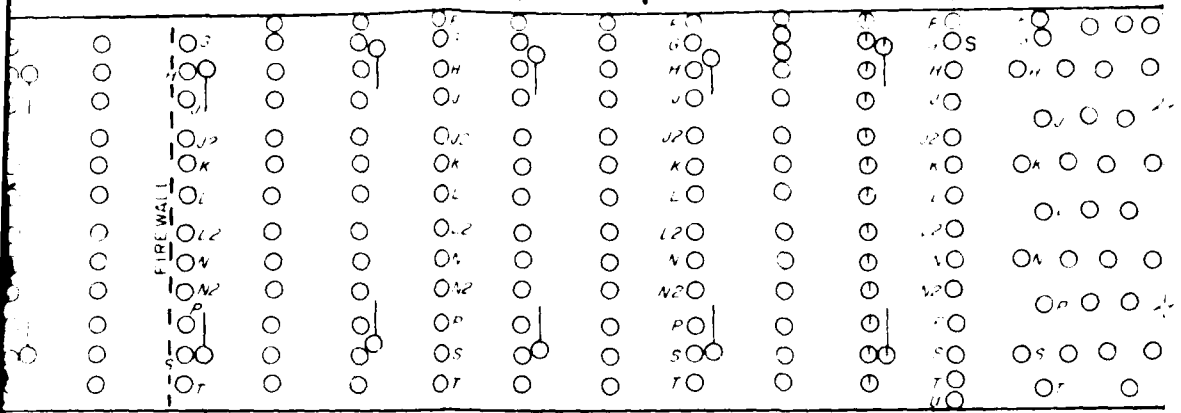
- BENT NO
- PILE ROW DESIGNATION
- TIMBER PILE
- TIMBER BATTER PILE
- PILE MISSING
- PILE NOT BEARING AT CAP
- PILE LENGTH, CORRESPONDING TO

SECTION A - PILE DESIGNATION

115 114 113 112 111 110 109 108 107 106 105 104 103

12' (TYP)

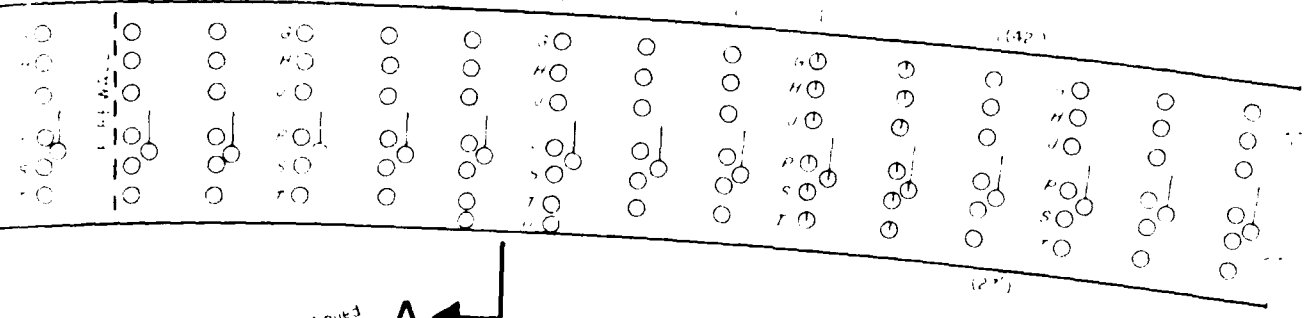
B



Continued on Dwg No 2

170 169 168 167 166 165 164 163 162 161 160 159 158 157

A



Continued above

A

LEGEND



PILE NO.

F

PILE ROW DESIGNATION



TIMBER PILE



TIMBER BATTER PILE

M

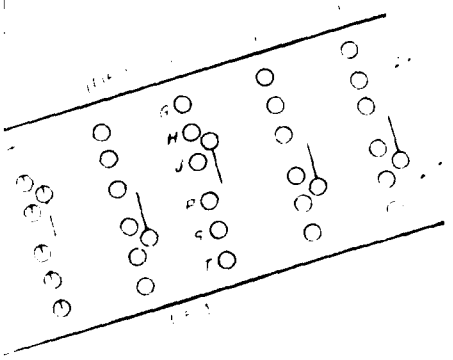
PILE MISSING

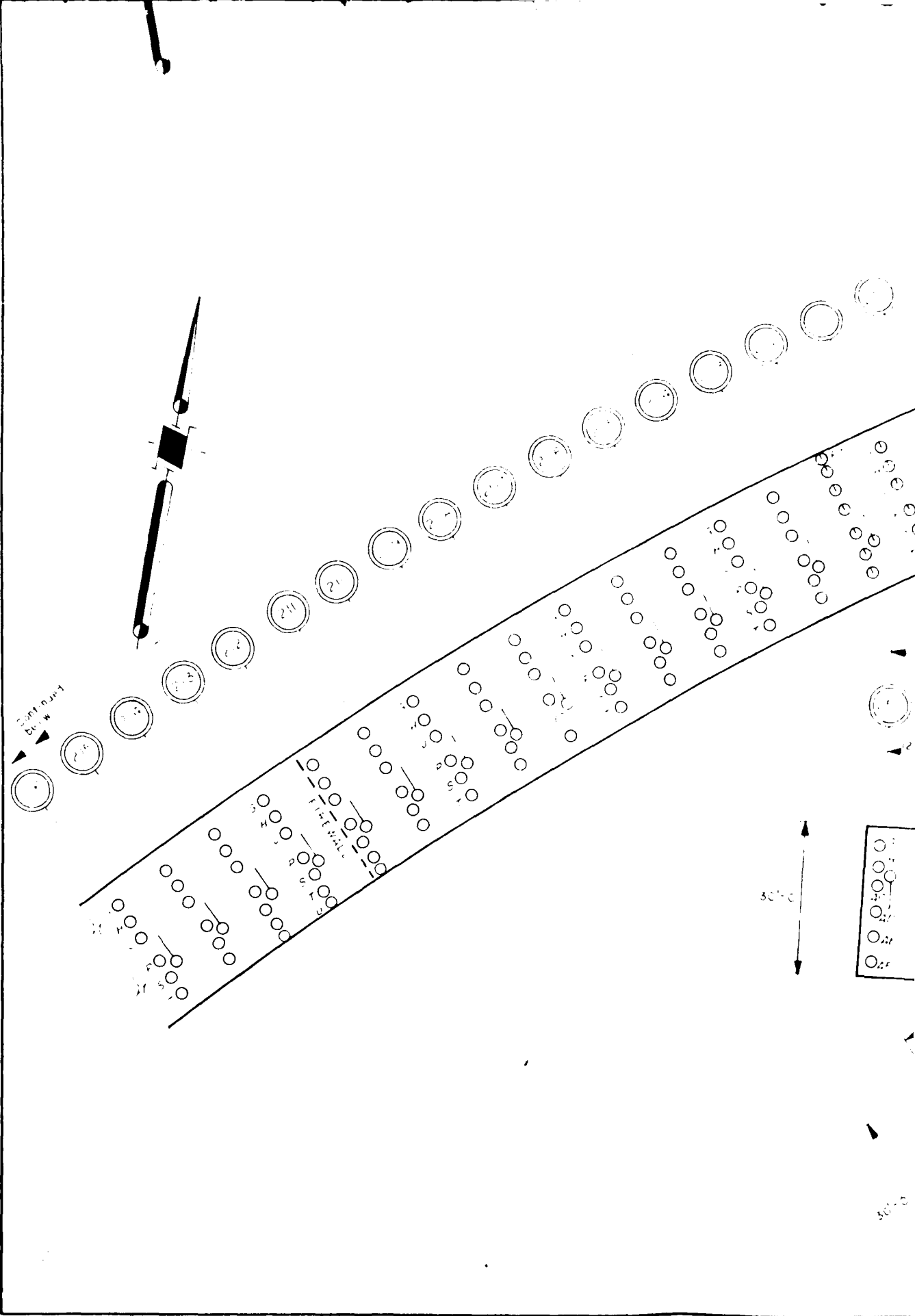
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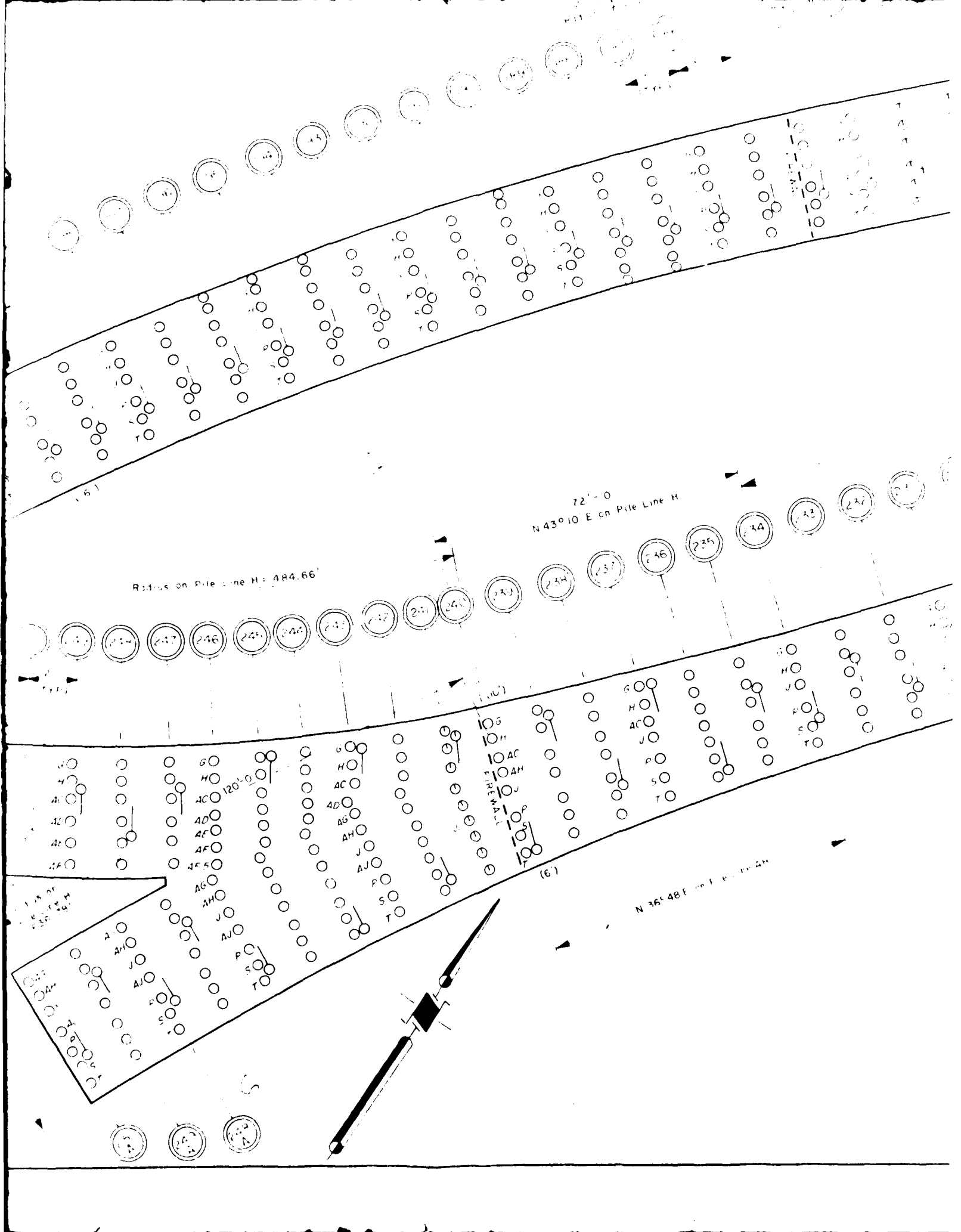
PILE NOT BEARING AT CAP

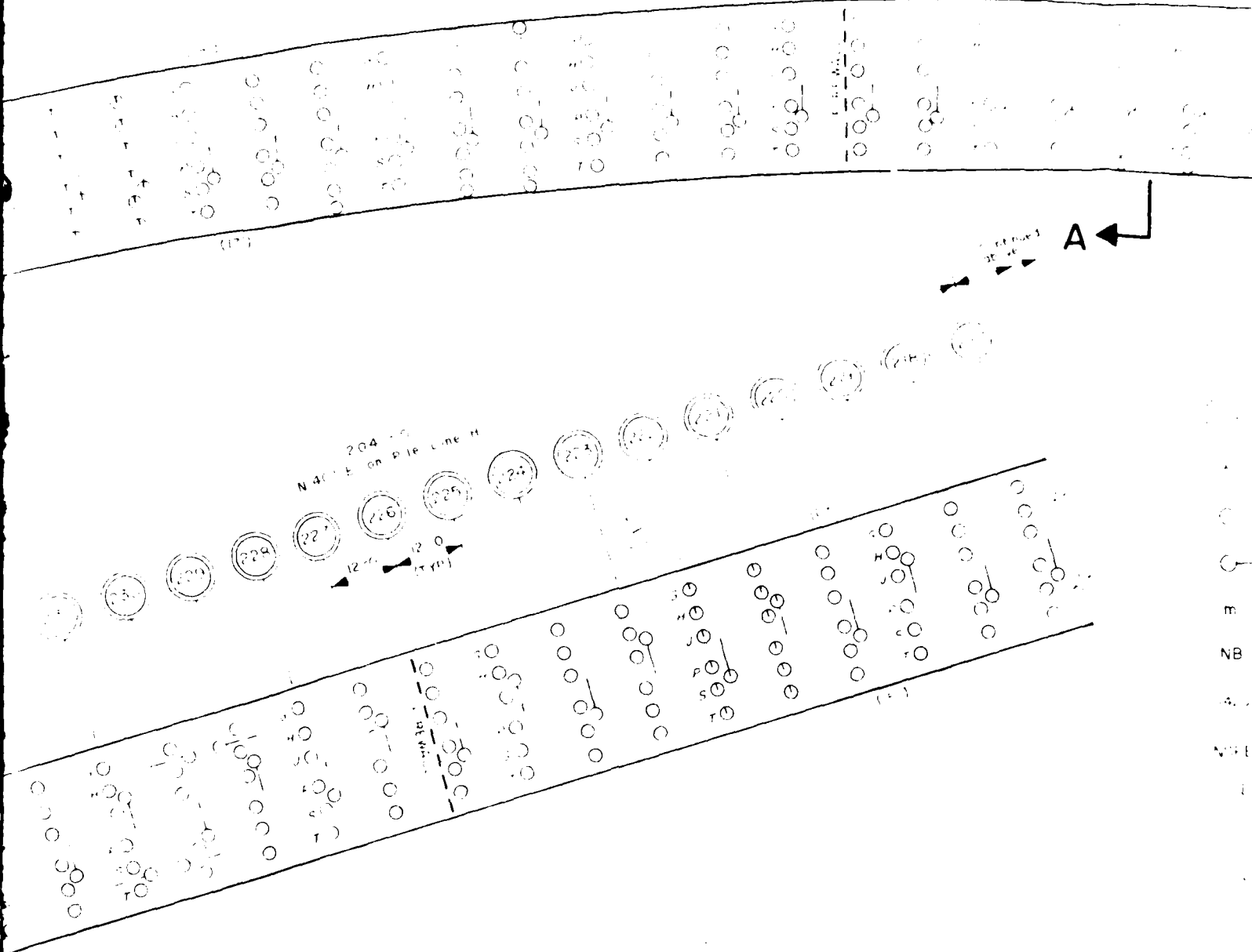
L

PILE LENGTH CORRECT MODIFIED





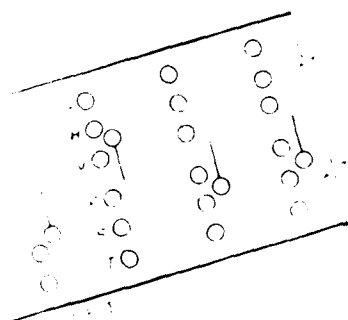
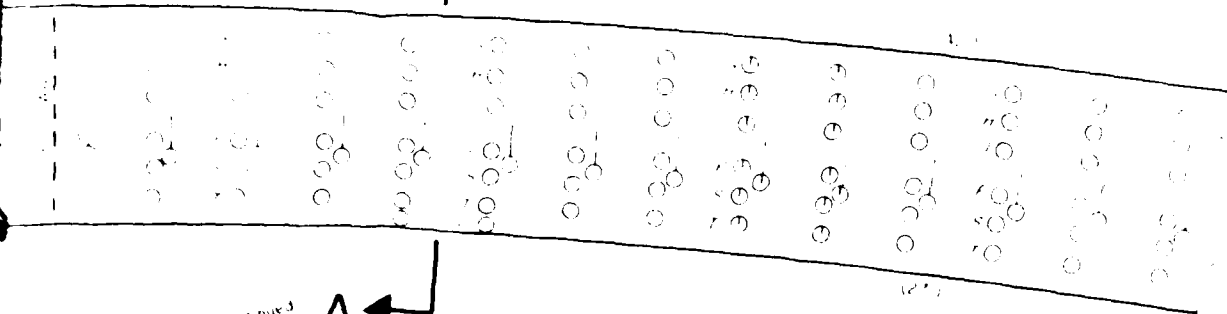




J. AGI  
Suite 6

AND CC  
PIE  
U.

R  
CON



# LEGEND



BENT NO. 1

A

PILE ROW DESIGNATION



TIMBER PILE



TIMBER BATTER PILE

m

PILE MISSING

NB

PILE NOT BEARING AT CAP

A/L

PILE LENGTH DIRECT TO MOORLINE

## INSPECTION LEVEL DESIGNATIONS

- LEVEL I - all perimeter piles from bents 103 to 250
- all piles in every fifth bent from 105 to 245
- S - SIGNIFICANTLY DAMAGED PILE

LEVEL III - inspected piles indicated by,

- ① 100% REMAINING CROSS-SECTIONAL AREA
- ② 75% REMAINING CROSS-SECTIONAL AREA
- ③ 50% REMAINING CROSS-SECTIONAL AREA
- ④ 25% REMAINING CROSS-SECTIONAL AREA
- 0 - 25% REMAINING CROSS-SECTIONAL AREA

## J. AGI & ASSOCIATES CO. LTD.

Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING LOCATION  
AND CONDITION OF INSPECTED PILING IN  
PIER 3, APPROACHWAY TRESTLE  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
REPORT No FPO-1-83-(19)  
CONTRACT No N62477-81-C-0498  
TASK 2

DWG. No. 3

SCALE

DRAWN

CHECKED

J.P.

APPROVED

XIB

DATE

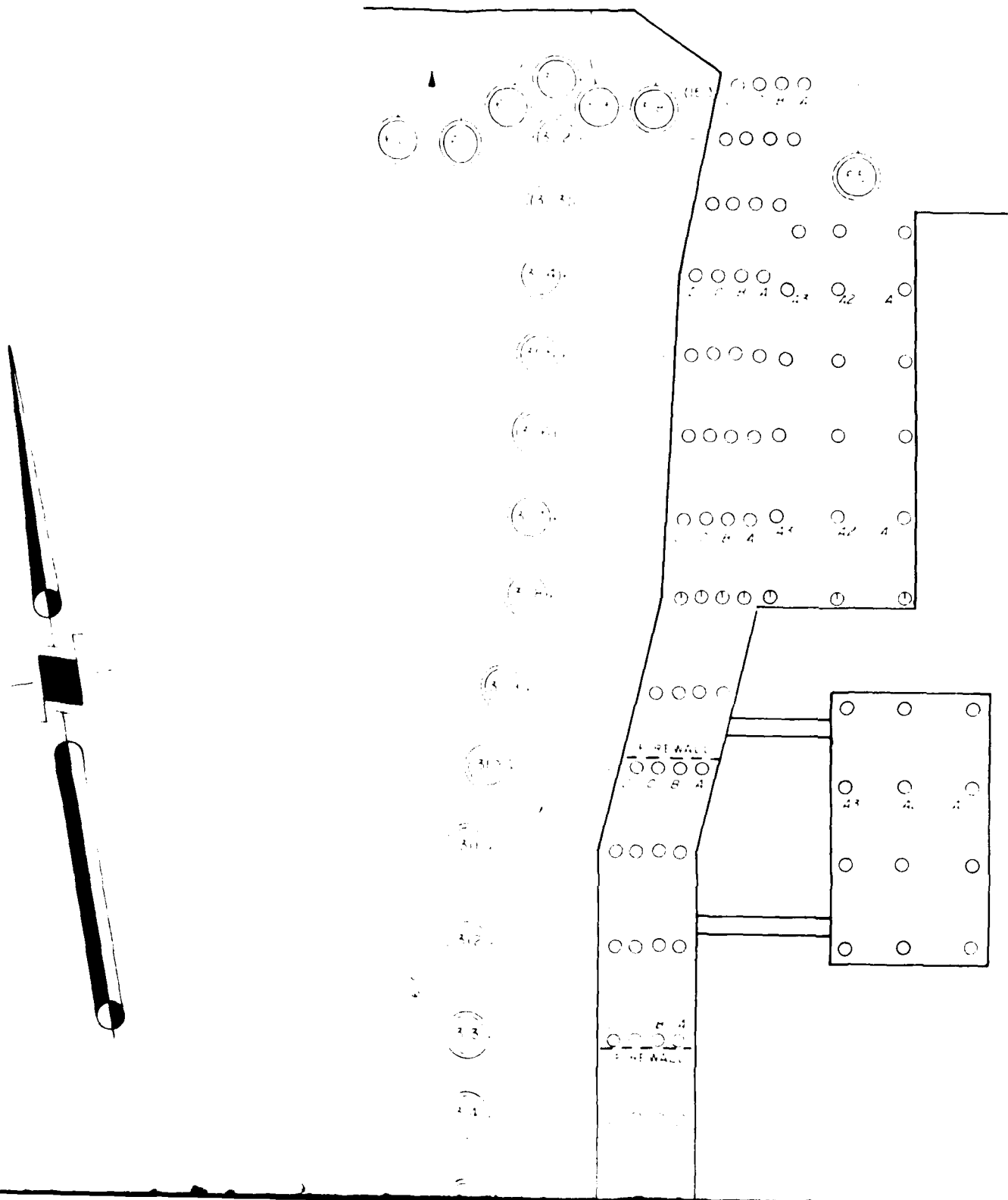
JUNE 1, 1983

PROJECT No

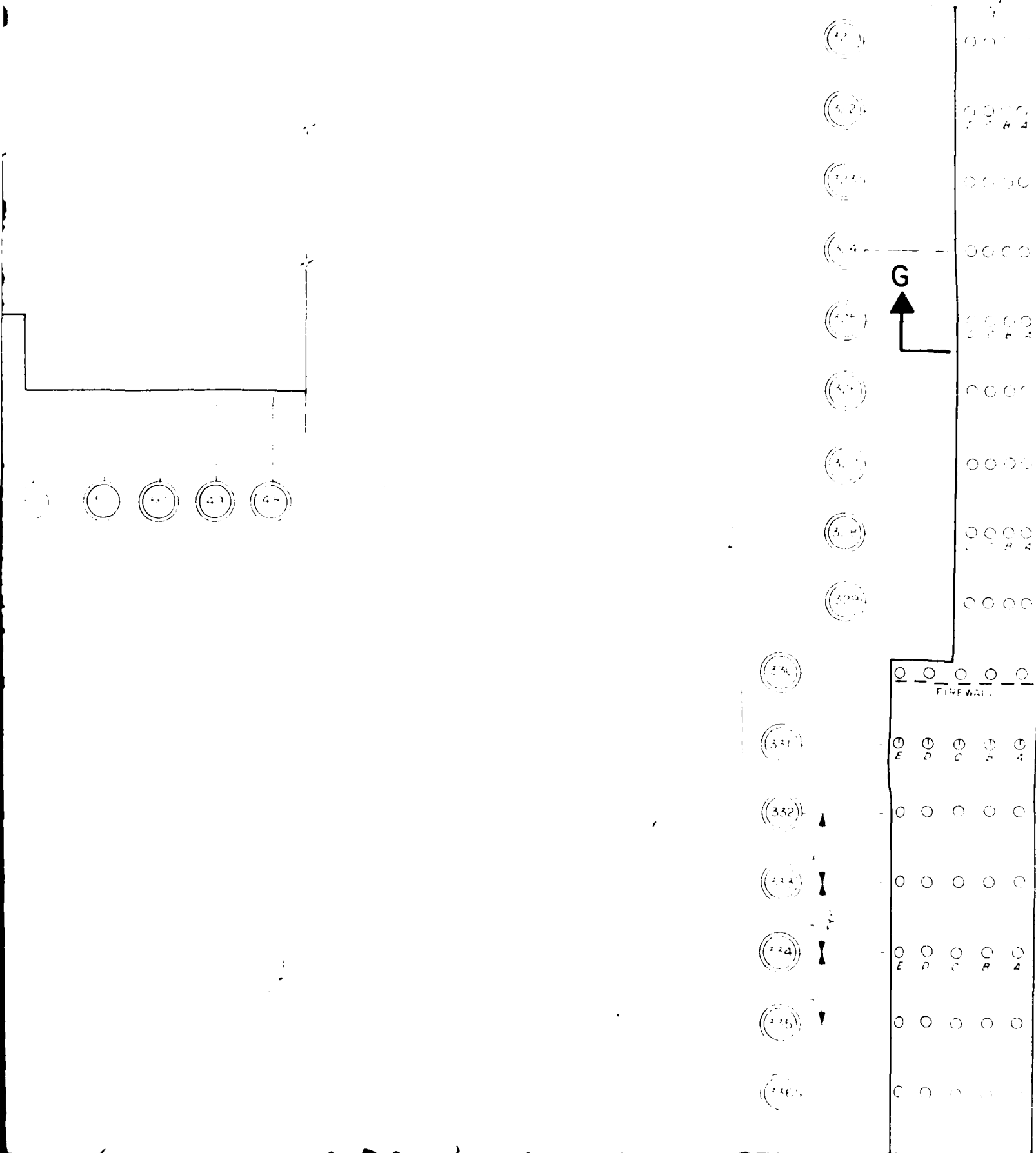
83-1/3-2-100

# PIER No. 3

See Dwg No 2



Cont. and  
Bent 3



# LEGEND



BENT NO

P

PILE ROW DESIGNATION



TIMBER PILE



TIMBER BATTER PILE

m

PILE MISSING

NB

PILE NOT BEARING AT CAP

(L)

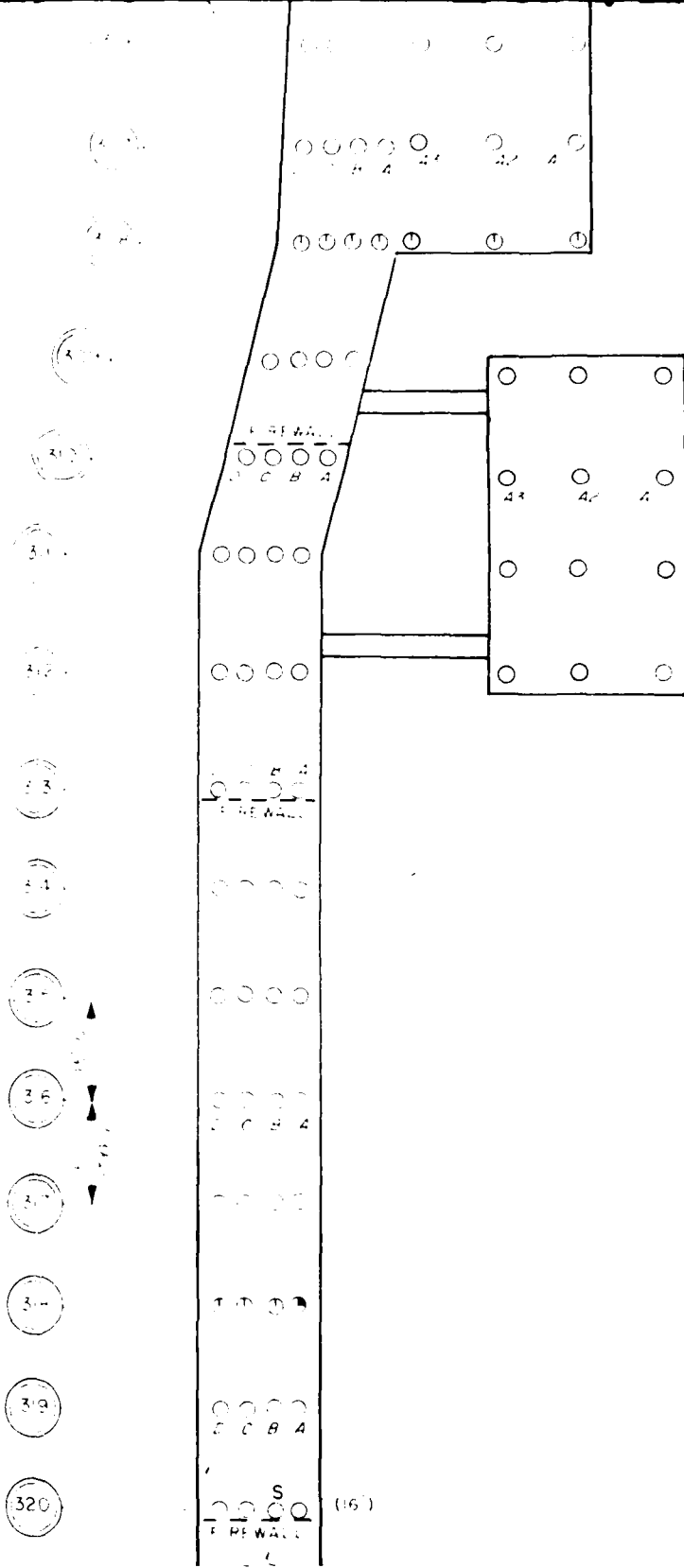
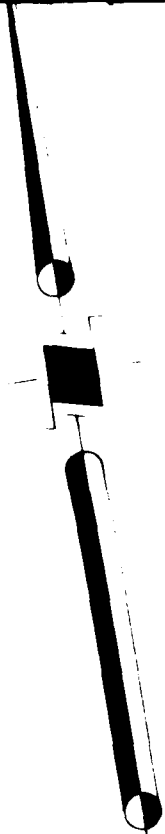
PILE LENGTH, CURB TO MUDLINE

## INSPECTION LEVEL DESIGNATIONS

LEVEL I - all perimeter piles from bents 301 to 335 on the west side  
and 303 to 335 on the east side  
- all piles in bents 301, 305, 310, 315, 320, 325 and 330  
S - SIGNIFICANTLY DAMAGED PILE

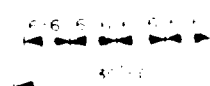
LEVEL II - inspected piles indicated by ,

- ① 100% REMAINING CROSS-SECTIONAL AREA
- ② 75% REMAINING CROSS-SECTIONAL AREA
- ③ 50% REMAINING CROSS-SECTIONAL AREA
- ④ 25% REMAINING CROSS-SECTIONAL AREA
- ⑤ 0-25% REMAINING CROSS-SECTIONAL AREA

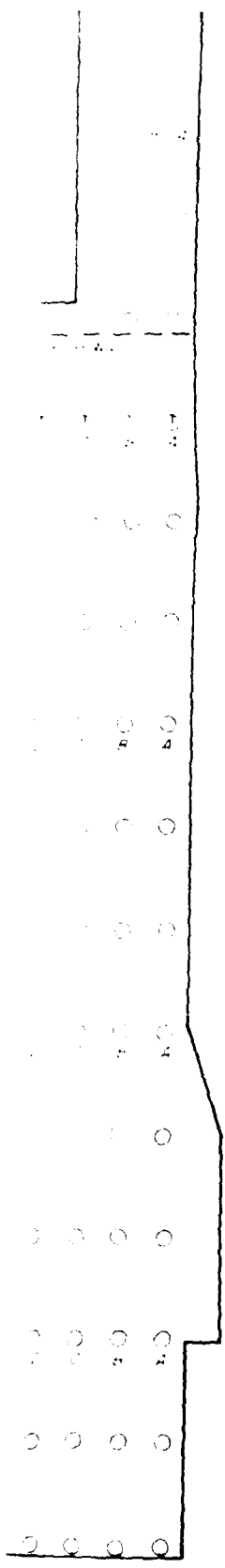


Project  
Bent 342

2-1 4-4 4-4 2-9  
7-6



1. LOCATION OF INSPECTED PILING  
 2. LOCATION OF INSPECTED TRESTLE  
 3. LOCATION OF INSPECTED AREA  
 4. REMAINING INSPECTED AREA



# **J. AGI & ASSOCIATES CO.**

Suite 600, 1414 Alaskan Way, Seattle, W

PLAN SHOWING LOCATION  
 AND CONDITION OF INSPECTED PILING  
 PIER 3, ACCESS TRESTLE  
 U.S. NAVAL WEAPONS STATION  
 CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
 REPORT No. FPJ-1-83-119  
 CONTRACT No. N62477-81-C-045  
 TASK 2

**DWG. No. 4**

**J. AGI & ASSOCIATES CO. LTD.**

Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING LOCATION  
AND CONDITION OF INSPECTED PILING IN  
PIER 3, ACCESS TRESTLE  
U S NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
REPORT No. FPJ-1-83-(19)  
CONTRACT No. N62477-81-C-0498  
TASK 2

**DWG. No. 4**

SCALE 1" = 20'

DRAWN F.P.

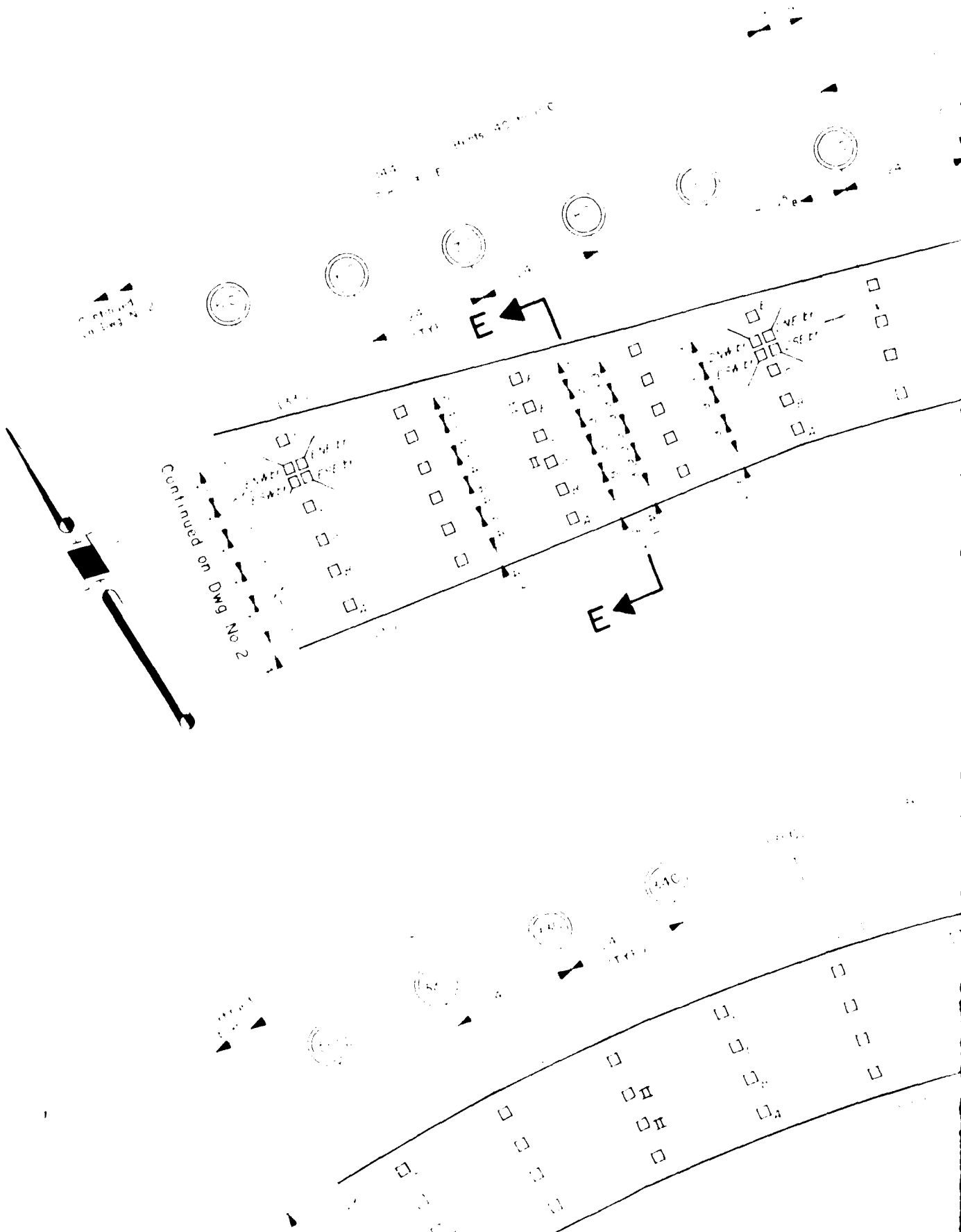
CHECKED *J.P.*

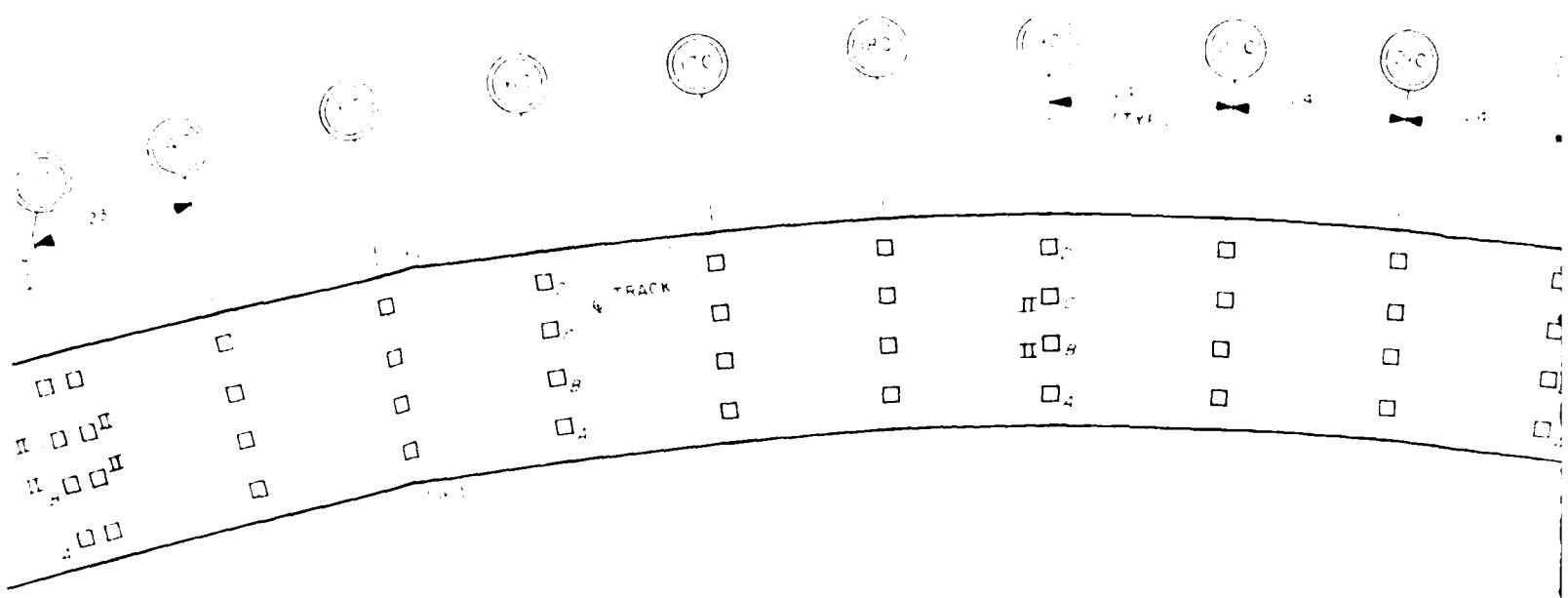
APPROVED *XIE*

DATE JUNE 6, 1983

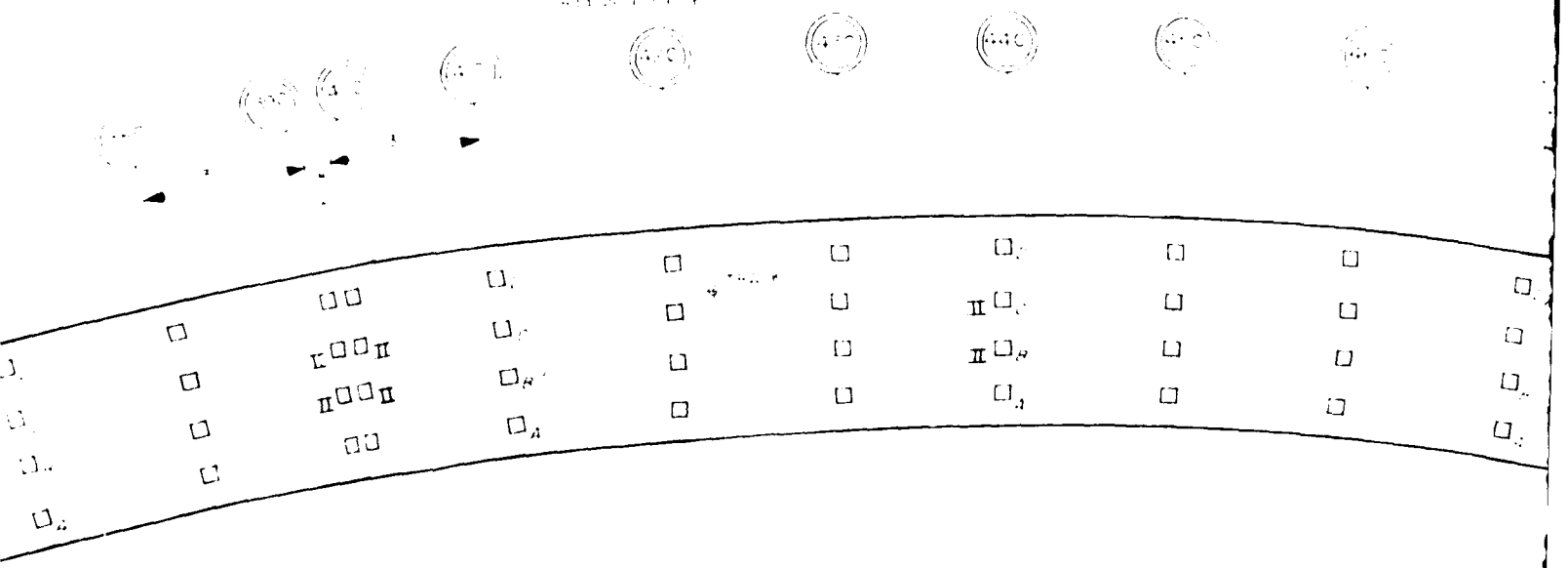
PROJECT No.

**83-1/3-2-100**

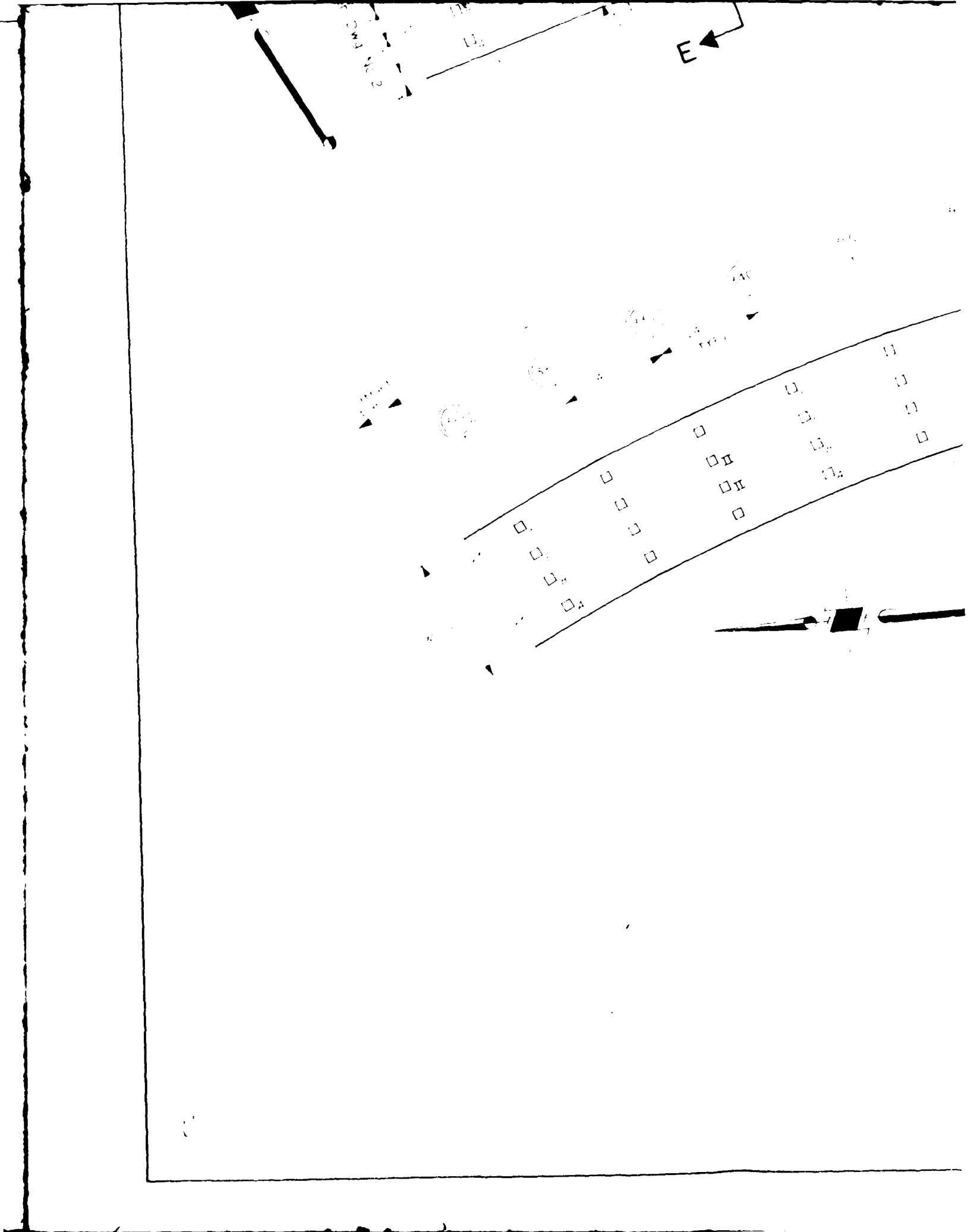


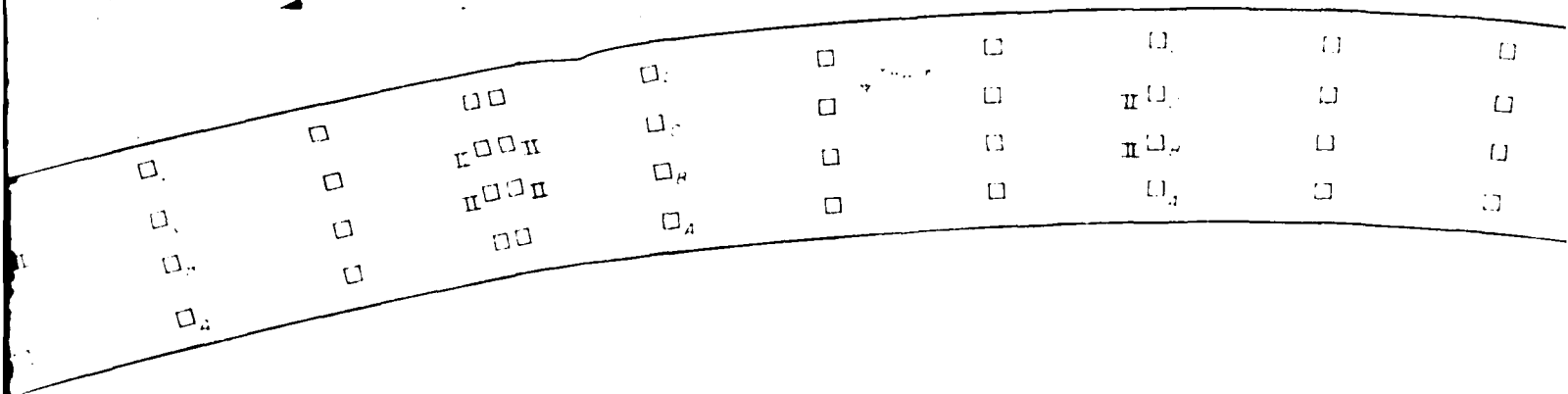


REMARKS: THE FBO  
WAS IN THE TRACK AND OF



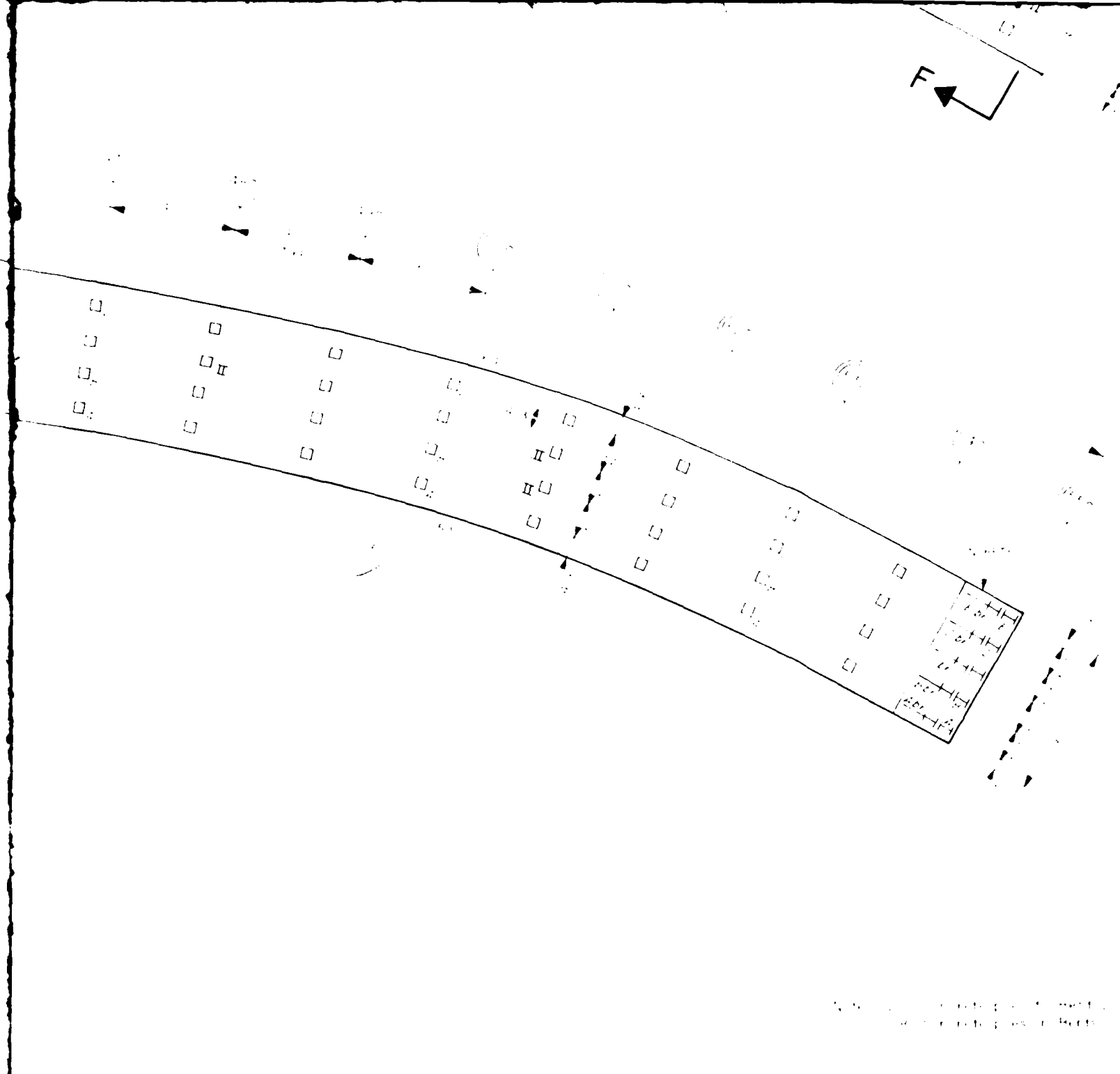






LEGEND

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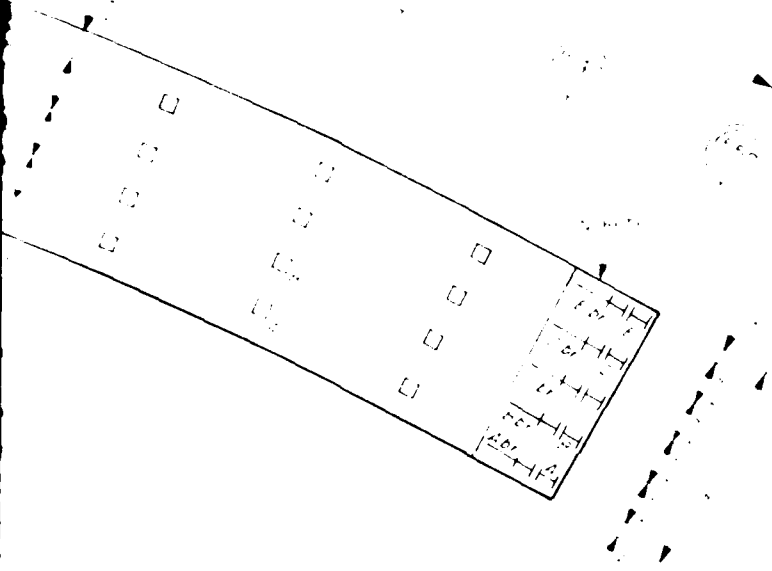


**J. AGI & ASSOCIATES**  
Suite 600, 1414 Alaskan Way, San Francisco, CA 94109

PLAN SHOWING LOCATION  
AND CONDITION OF INSPECTED  
PIER 3, CONCRETE TREES  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG  
REPORT No FPO-1-83  
CONTRACT No N62477-81-  
TASK 2

**DWG. No. 5**



# **J. AGI & ASSOCIATES CO. LTD.**

Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING LOCATION  
AND CONDITION OF INSPECTED PILING IN  
PIER 3, CONCRETE TRESTLE  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES. DIV. NAV. FAC. ENG. COM.  
REPORT No. FPO-1-83-(19)  
CONTRACT No. N62477-81-C-0498  
TASK 2

**DWG. No. 5**

DATE: 11-20

DRAWN: F.F.

CHECKED: J.P.

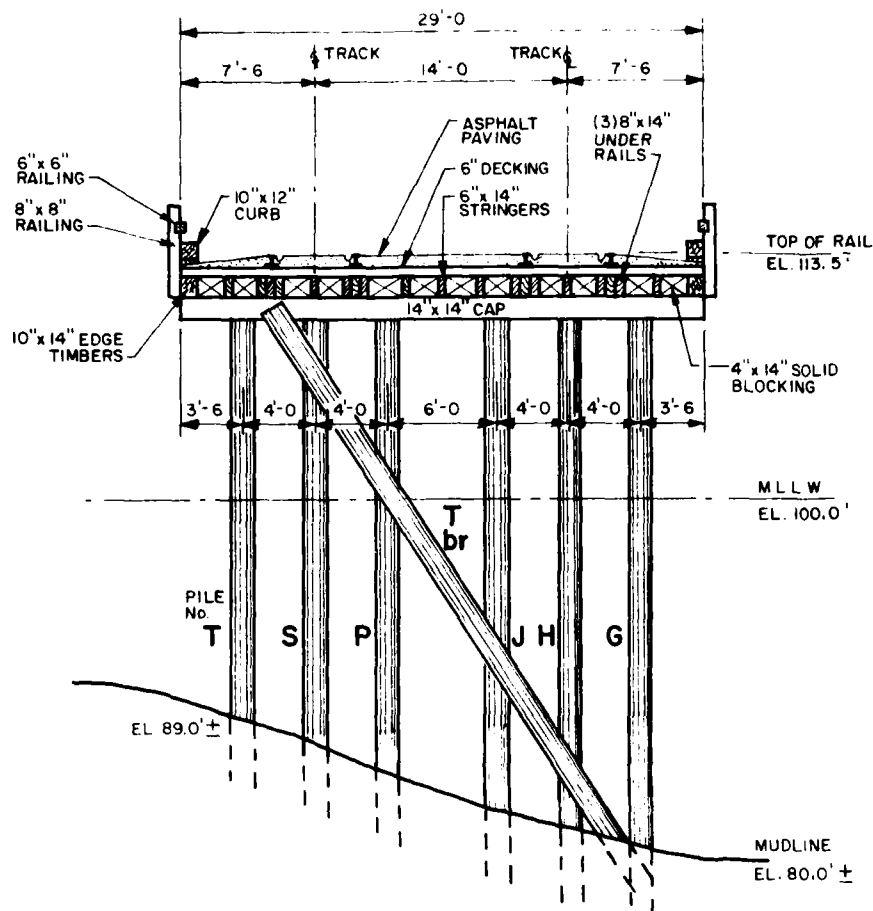
APPROVED: [Signature]

DATE: XIB

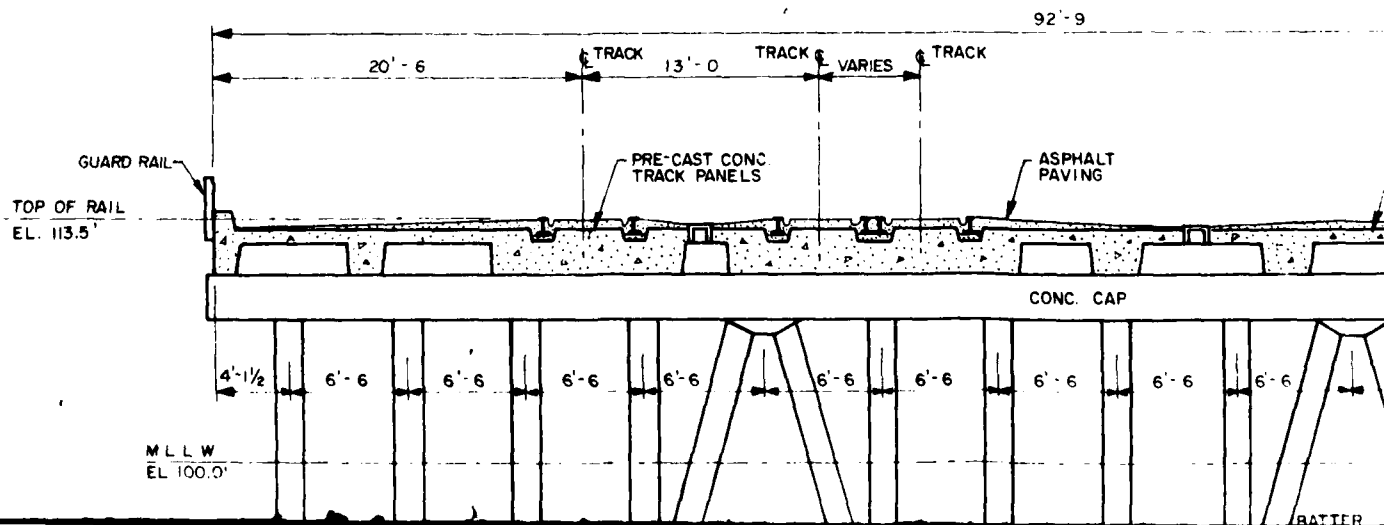
DATE: JUNE 1987

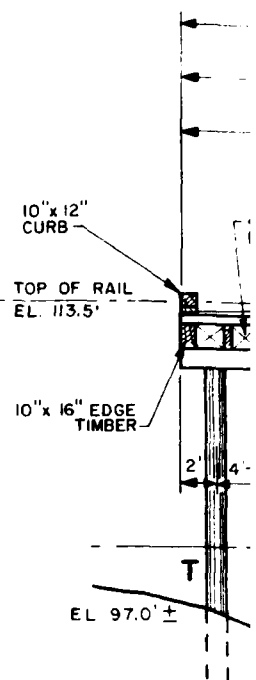
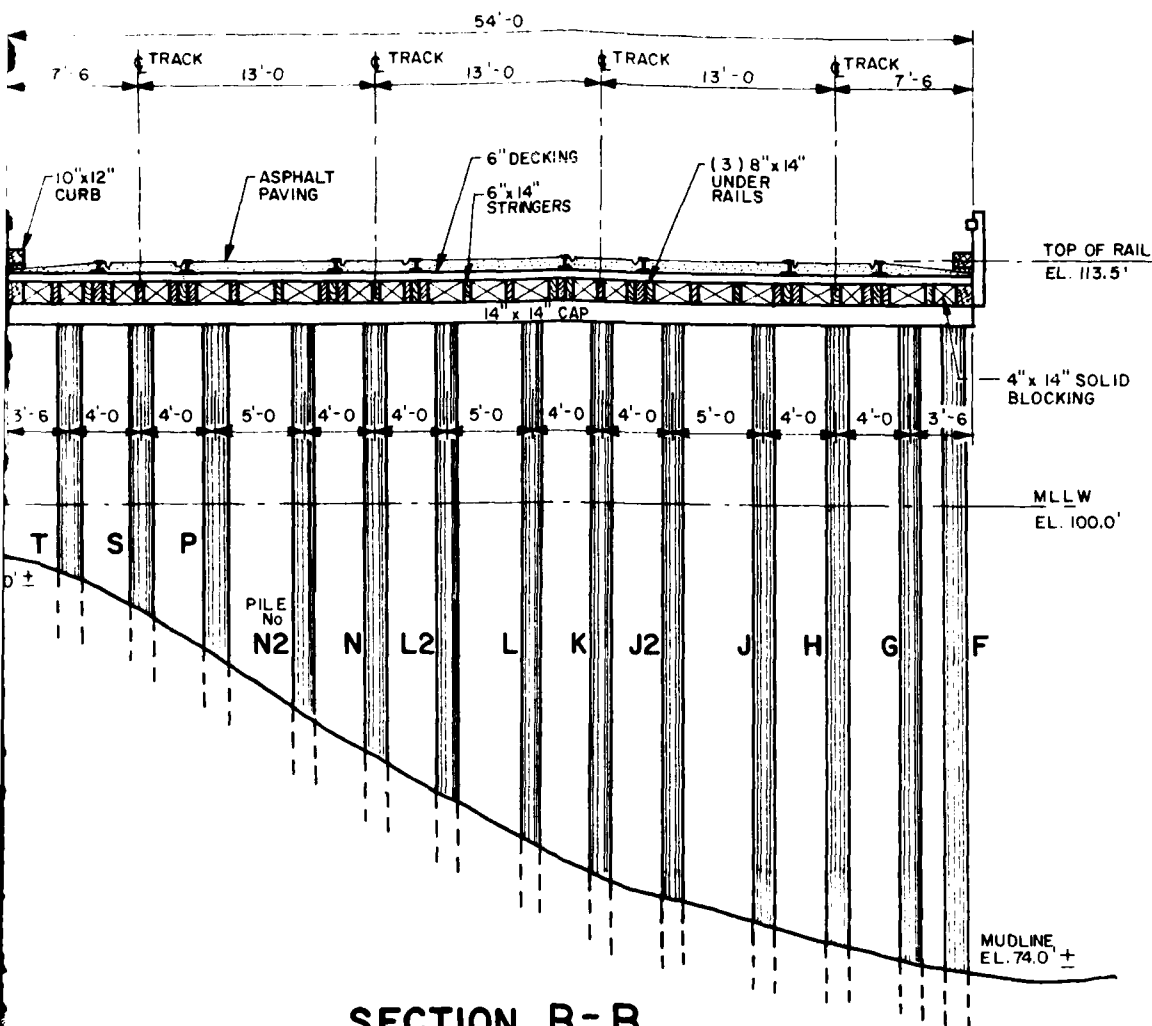
PROJECT NO.

**83-1/3-2-100**

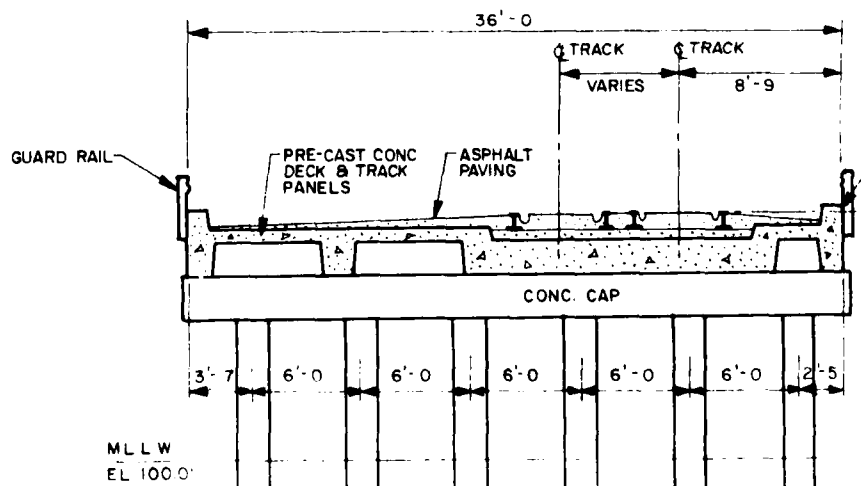
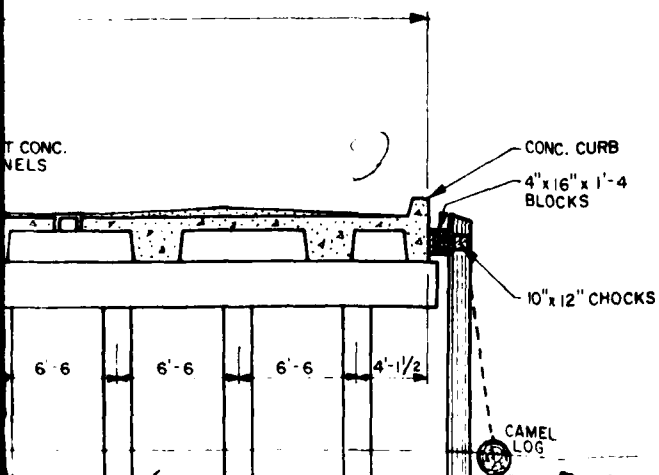


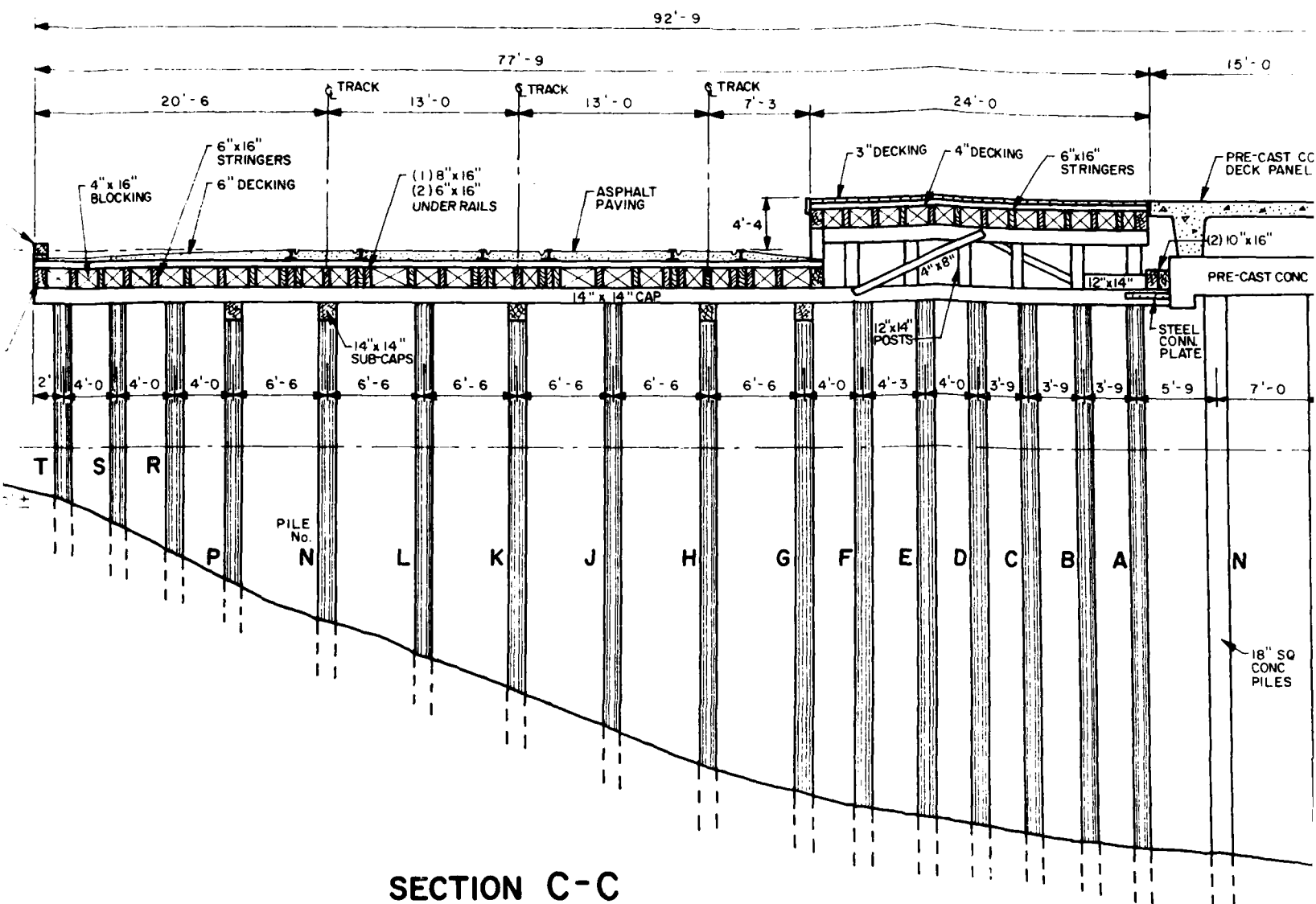
**SECTION A-A  
APPROACH TRESTLE  
BENT 166**



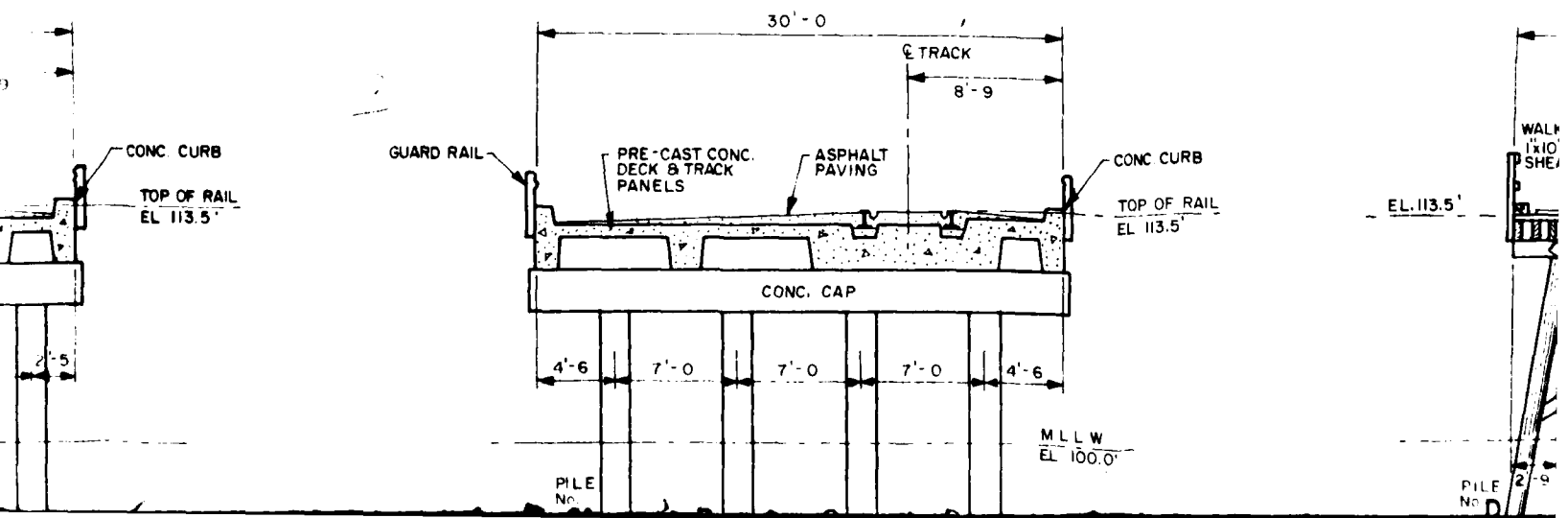


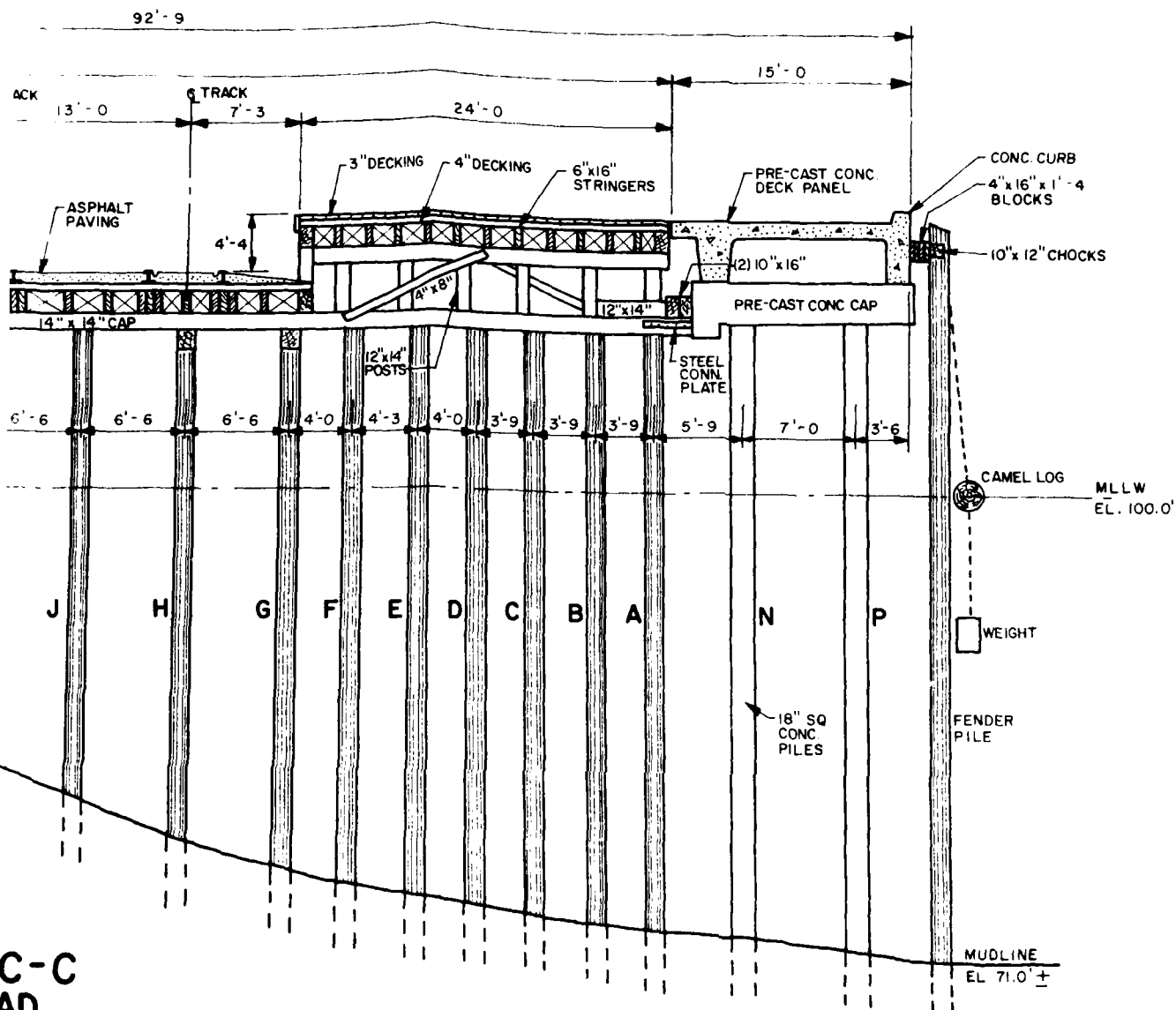
**SECTION B-B  
APPROACH TRETTLE  
BENT 109**



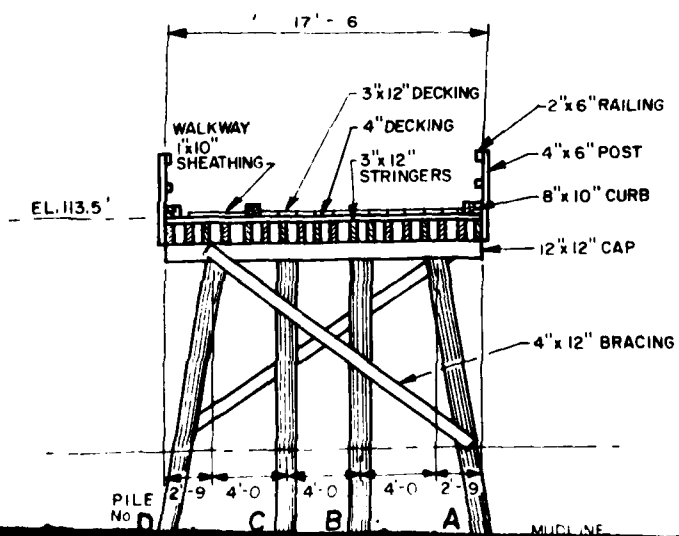
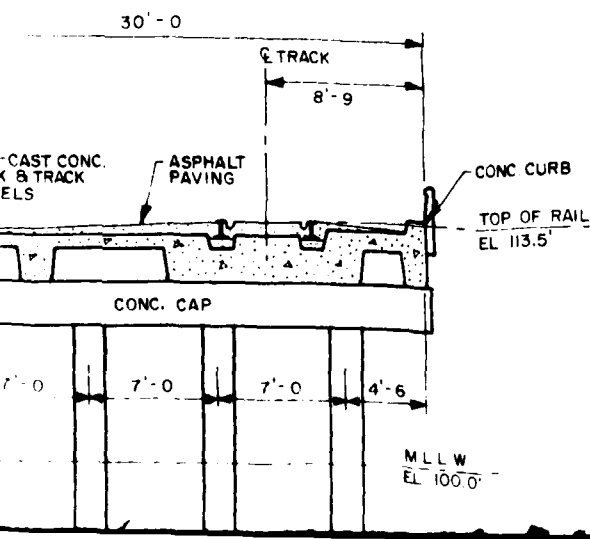


SECTION C-C  
PIERHEAD  
BENT 18





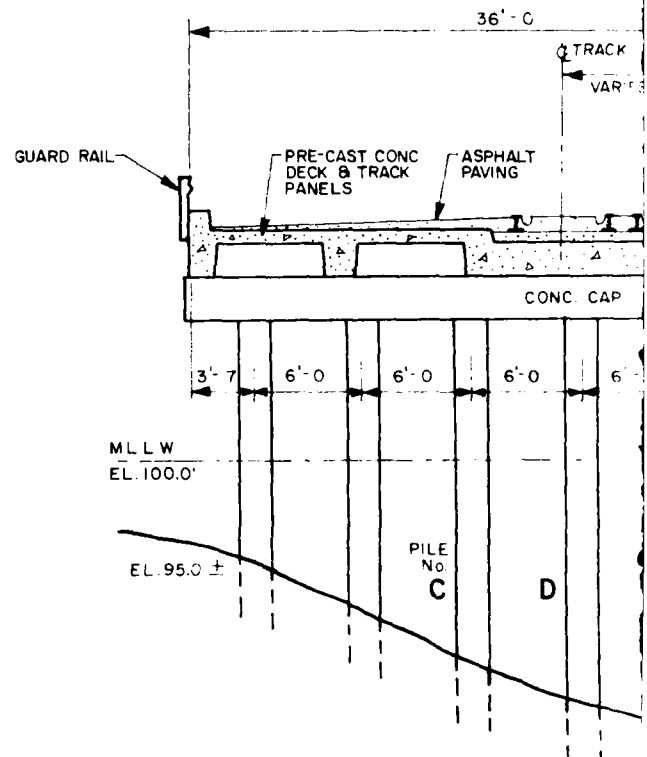
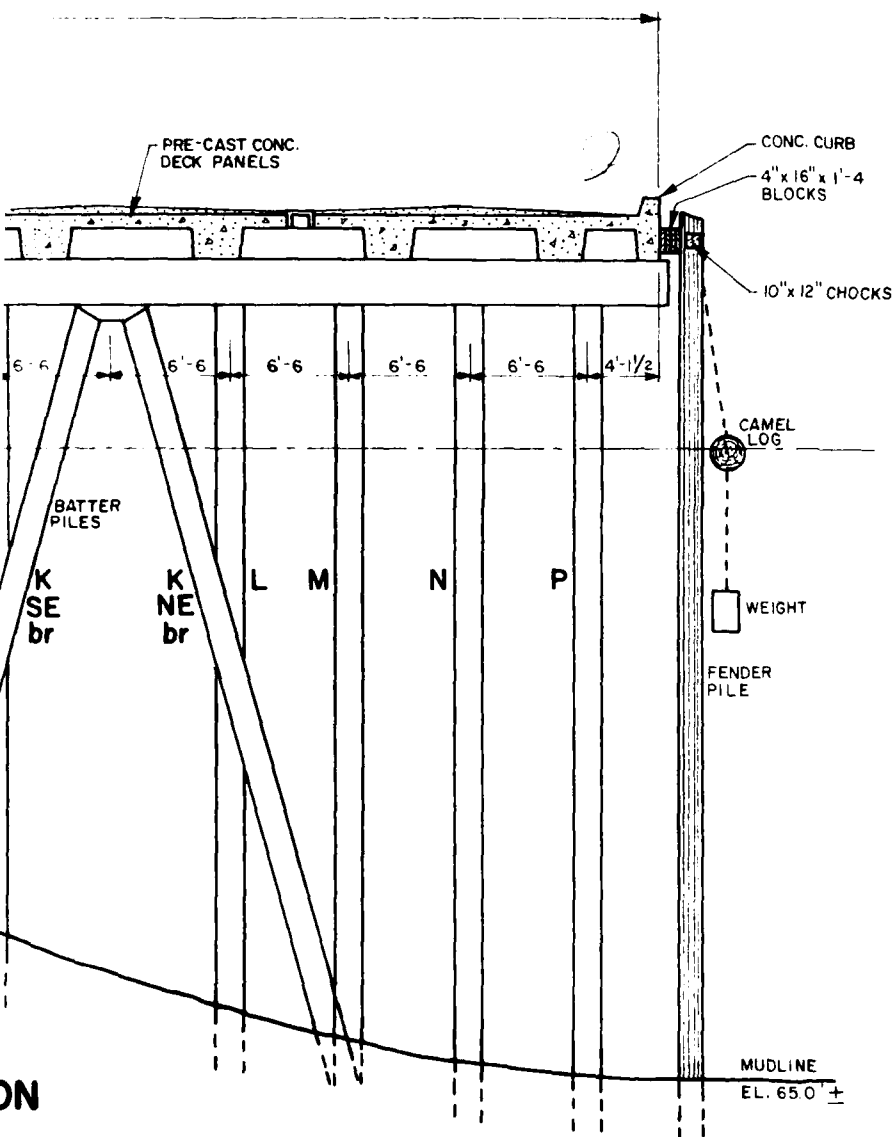
C-C  
AD  
8



MUPLINE  
F: 80.0' ±

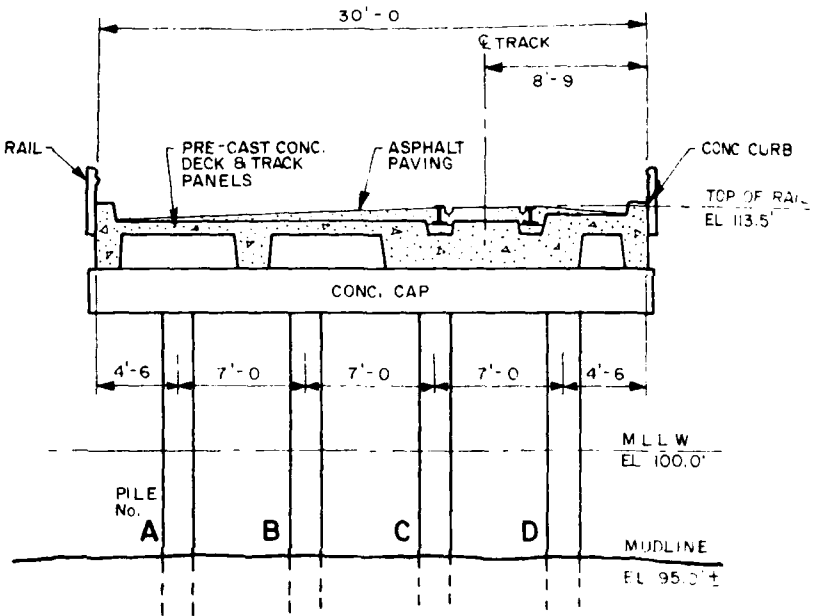
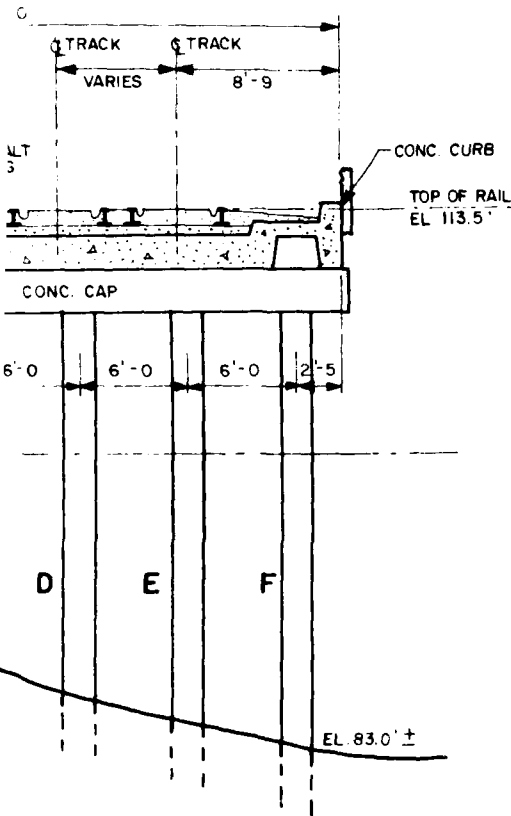


# SECTION B-B APPROACH TRESTLE BENT 109



# SECTION E- CONCRETE TRE BENT 7C

# SECTION C-C PIERHEAD BENT 18

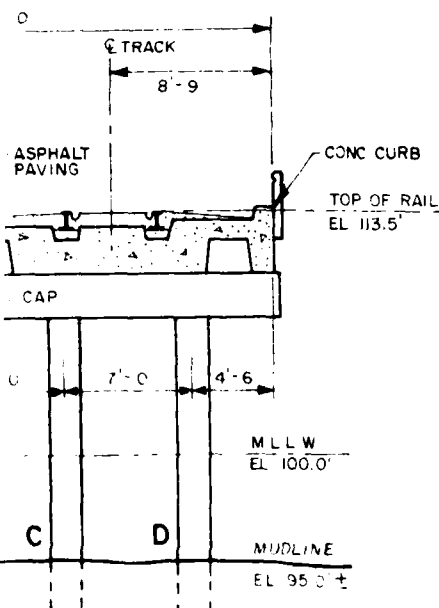
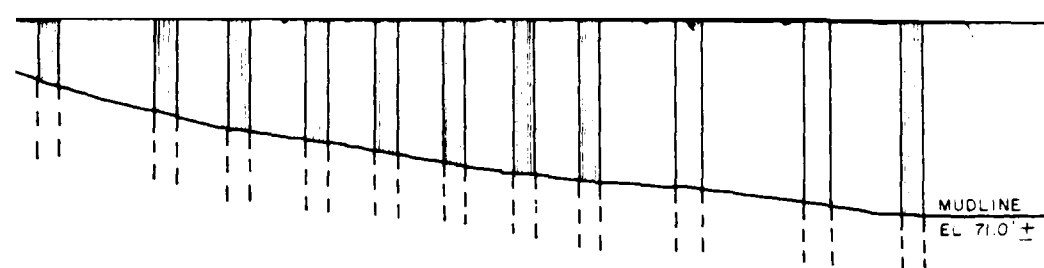


# SECTION F-F CONCRETE TRESTLE BENT 30C

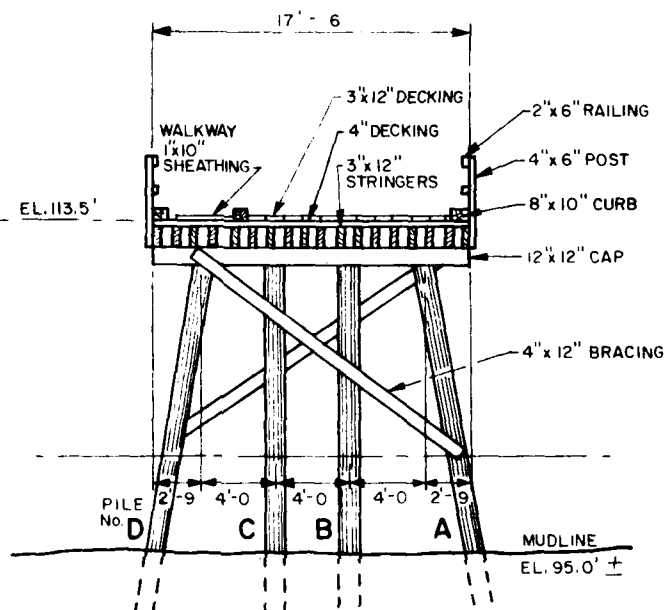
ON E-E  
E TRESTLE  
NT 7C

J. AGI 8  
Suite 60

TY  
US  
C  
RE  
CONT



SECTION F-F  
TRESTLE  
BENT 30C



SECTION G-G  
ACCESS TRESTLE  
BENT 325

**J. AGI & ASSOCIATES CO. LTD.**  
Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING  
TYPICAL SECTIONS THROUGH  
PIER 3  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA  
CHES DIV NAV FAC ENG COM  
REPORT No FPO-1-83-(19)  
CONTRACT No. N62477-81-C-0498  
TASK 2

**DWG. No. 6**

SCALE 1/8" = 1'-0"

DRAWN F P

CHECKED *J.P.*

APPROVED *XIE*

DATE JUNE 6, 1983.

PROJECT No  
**83-1/3-2-100**

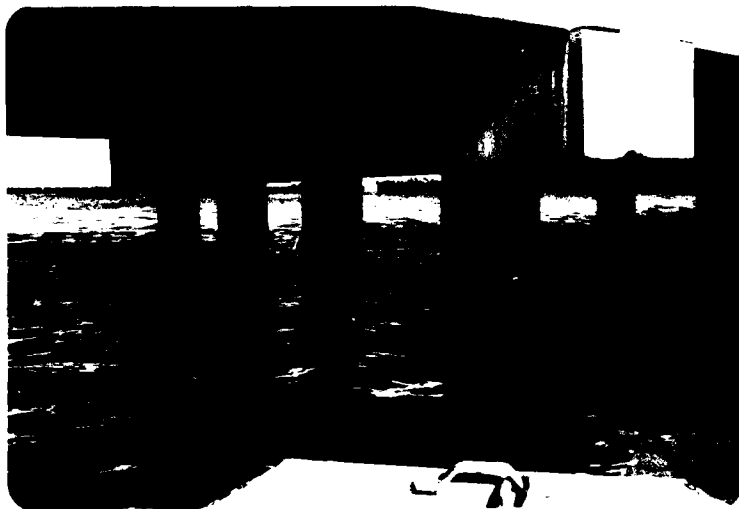


PHOTOGRAPH No. 6

Typical section at expanded pierhead showing original north face of timber pierhead and concrete extension. Note excellent condition of splash zones.

PHOTOGRAPH No. 7  
Typical construction  
in Access Trestle.  
Note good condition  
of upper intertidal  
and splash zones.





PHOTOGRAPH No. 8

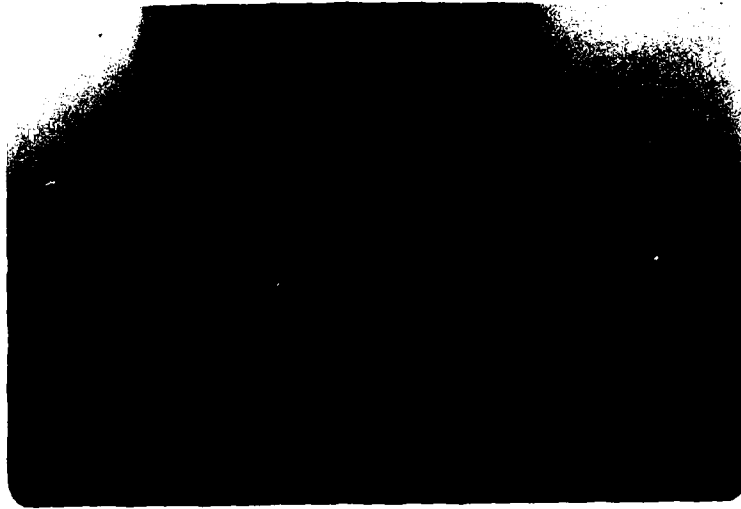
Concrete Trestle. Note typical construction and excellent condition of members in splash zone.

#### 4.1.2 Observed Inspected Condition

The overall condition of Pier 3 is very good. As shown in Photographs 9 and 10 and detailed in Tables 2 and 3, the majority of the timber piles are in excellent condition. The Level I inspection covered a total of 974 timber piles. Of the 974 piles inspected, 936 (96%) are undamaged; 30 (3%) piles have sustained marine borer attack or mechanical damage. At this time, the damage is of a minor or cosmetic nature and does not detract from the structural integrity of the piles. A total of 8 (1%) piles were found to have significant damage. Photographs 11 - 15 identify and illustrate several of the damaged piles found. As shown in these photographs, the damage has been caused by mechanical impact or abrasion, marine borer infestation and by fungal decay. The damaged piles were found throughout the structure and the damage on the individual piles was found to range from the pile top through the splash zone to the intertidal zone.

A total of 393 piles were subjected to detailed Level III ultrasonic testing and inspection. Of the 393 piles tested, 385 (98%) are undamaged and are in excellent condition; 6 (1.5%) piles have sustained minor marine borer attack or mechanical damage and are rated at 90 - 100% of their original cross-sectional area; and 2 (0.5%) of the piles have sustained moderate damage and are rated at 75 - 100%.

The condition of the concrete piles was also found to be very good. Photographs 16 and 17 serve to illustrate the condition of these piles in both intertidal and mudline zones. In the Level I inspection, a total of 200 piles were inspected. No significant damage was found on any pile, however, two piles were found to have minor or cosmetic spalling. The Level II inspection covered a total of 50 piles. As detailed in Table 1, these piles are in excellent condition; no significant damage was found.



PHOTOGRAPH No. 9

Timber pile with dense marine fouling; note no evidence of marine borer or mechanical damage.



PHOTOGRAPH No. 10

Undamaged timber pile with fouling organisms partially removed to expose pile surface. Also note density and thickness of fouling organisms.



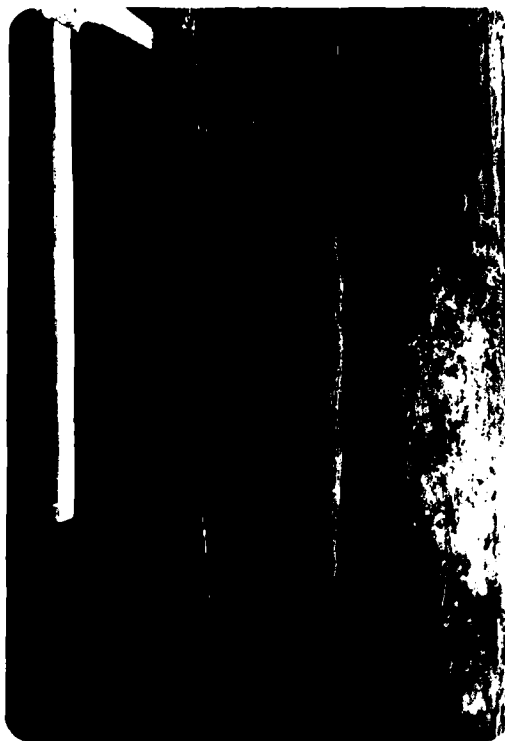
PHOTOGRAPH No. 11

Bent 42 - piles A and A-Br. Note extensive loss of cross-section due to mechanical abrasion from the trapped drift log.



PHOTOGRAPH No. 12

Bent 149 - G-Br. Note extensive section loss due to teredine damage in the mid intertidal zone.



PHOTOGRAPH No. 13

Bent 14 - pile TN. Approximately 50% section loss in splash zone and mid intertidal zone due to fungal and/or marine borer damage. Note new pile TS adjacent to it.

PHOTOGRAPH No. 14

Bent 100 - Pile E. Approximately 50% marine borer and fungal section loss in upper intertidal zone.





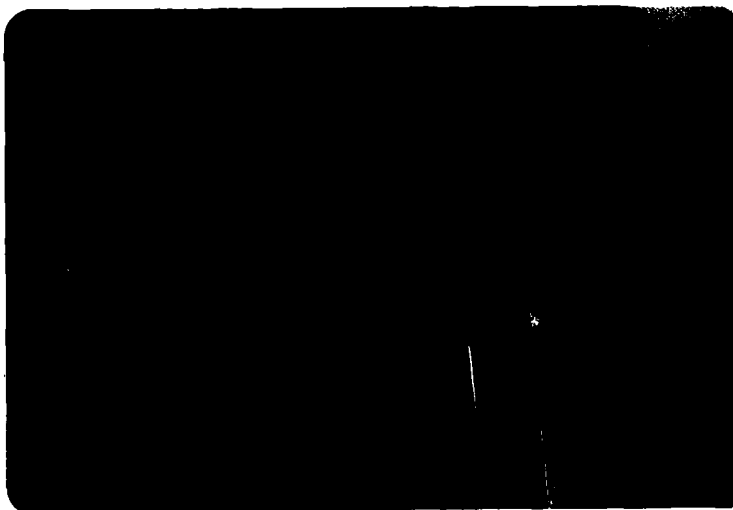
PHOTOGRAPH No. 15

Bent 320 - Pile B. Approximately 30% loss of cross-sectional area due to fungal and/or marine borer damage in the intertidal zone.



PHOTOGRAPH No. 16

Bent 11C - Pile B. Level II cleaned pile in mid intertidal zone. Note density of fouling organisms and also excellent condition of pile.



PHOTOGRAPH No. 17

Bent 49C - Pile A. Level II cleaned pile at mudline. Note excellent condition of pile.

#### 4.1.3 Structural Condition Assessment

The majority of the inspected timber piles were found to be in excellent condition. The pile loading capacity for all Level III inspected piles is given in the computer print-out, Table 3. This Table gives the P-ULT, ultimate capacity of the pile column in pounds, based on the measured parameters of length, original diameter and remaining cross-sectional area. For details on the program, see the appendices.

Of the 393 piles inspected in the Level III inspection, only two piles will require maintenance at this time. A total of 8 piles from the Level I inspection were found to have sustained significant damage and will also require restorative maintenance or replacement. In addition to the above significantly damaged piles, 6 piles from the Level III inspection and 30 piles from the Level I inspection were found to have sustained light attack or damage. As the damage to these piles is of a minor nature and does not significantly detract from the capacity of the piles, maintenance should not be required at this time. Periodic inspections should, however, be carried out to monitor the condition of these piles.

The concrete piling in Pier 3 are in excellent condition. Of the 200 piles inspected in the Level I inspection, 198 (99%) are undamaged; and 2 (1%) piles have sustained minor spalling. As this damage is of an insignificant or cosmetic nature, maintenance of these piles should not be required. All 50 piles cleaned and subjected to detailed Level II inspections were found to be in excellent condition. No evidence of damage was found and consequently, no maintenance will be required.

#### 4.1.4 Recommendations

It is recommended that the two defective timber piles identified in the Level III inspection and detailed on Tables 2 and 3, be maintained. In addition, the 8 significantly damaged piles identified by the Level I inspection and listed below, should also be maintained. The defective piles are:

| <u>Bent</u> | <u>Row</u> |
|-------------|------------|
| 10          | C          |
| 14          | S          |
| 35          | C          |
| 40          | G          |
| 100         | E          |
| 105         | G          |
| 149         | G-Br       |
| 320         | B          |

Effective maintenance of these piles could be achieved by the installation of a concrete jacket or alternately, as illustrated in Photograph No. 13, by driving a new replacement pile adjacent to the defective pile. The estimated unit cost per pile for either method is approximately \$2,000.00, therefore the total estimated cost for repairing the defects identified by this inspection is approximately \$20,000.00.

The total number of timber piles inspected in the Level I and Level III inspections is 1367. The total number of significantly damaged piles (10) represents only .7% of this total. When this level of damage is projected over the total 3783 timber piles in the structure, it is estimated that approximately 26 piles will require maintenance. The estimated cost of these repairs is approximately \$50,000.00. For a summary of required maintenance, see Table 7.

Given the excellent condition of the inspected concrete piles, no maintenance of these members will be required at this time.

Once the required maintenance to the timber piles has been carried out, the repairs should be re-inspected. This maintenance and re-inspection will serve to ensure the structural integrity of the facility.

In addition to the above re-inspection, it is also recommended that periodic inspections at three to five year intervals be carried out. These subsequent inspections will serve to identify any areas requiring maintenance and will thereby ensure the future structural integrity of the facility. All subsequent inspections should use this report as a datum or baseline.

## 4.2 PIER 4

### 4.2.1 Description

Pier 4 is located to the east of Pier 3 at NWSC. The Pier has two berths, numbers 5 and 6, which service ocean going AE ships. The pier is serviced by both vehicular and rail traffic.

The Pier was originally constructed in 1945 on creosote treated timber piling with a timber cap, stringer and deck superstructure. The original configuration of the Pier was crescent shaped with an approach trestle extending from the shore to an expanded width pierhead. A timber walkway or access trestle served to provide light vehicle and pedestrian traffic to the pierhead. In 1966 major modifications to the facility were carried out. These changes included the widening of the pierhead section and the installation of a second approach trestle continuous with the eastern end of the pierhead. Once completed, the new trestle allowed for a one way roll-on/roll-off traffic pattern. The section of the structure added in 1966 was constructed on prestressed concrete piles.

For the purposes of this inspection, the structure was subdivided into four sections. As shown in Drawings 7 - 11, these sections are identified as the (1) Pierhead; (2) Approachway Trestle (photograph No. 18); (3) Access Trestle; and (4) Concrete Trestle (photograph No. 19). For identification purposes, the piles within each of these sections have been designated bent and row numbers based on the identification system used in NAVFAC Reference Drawings: 11242-B4; 11242-B5; 11242-8; 11242-9; 1115132; 1115146 and 1115148.

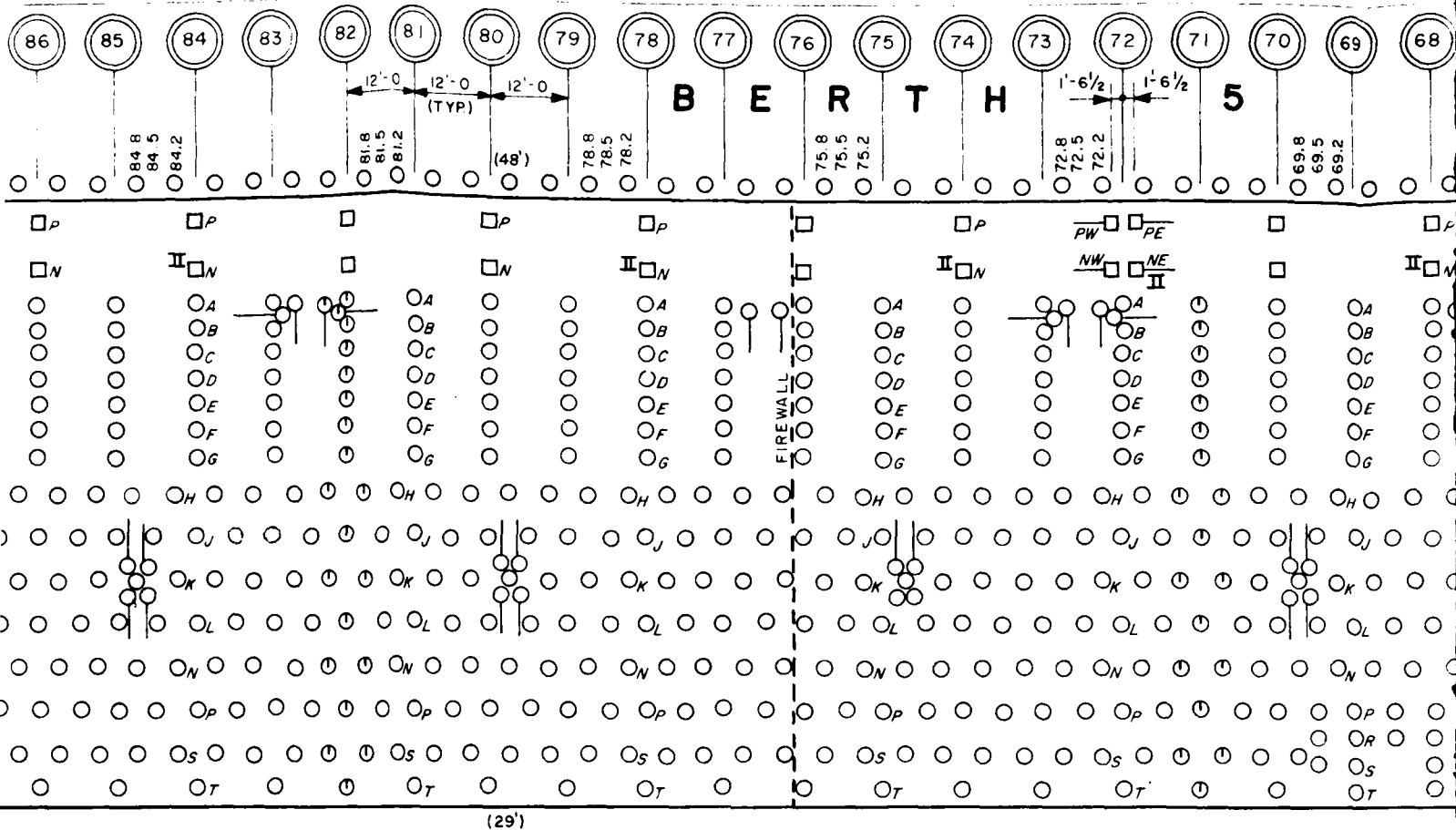
Pile lengths along the berth face in the pierhead section were found to be approximately 40 feet from mudline to cap. Measurements of the pile lengths were taken at intervals throughout the facility.

These lengths are detailed in the accompanying drawings. In several areas, extensive silting of the mudline has occurred resulting in shallow water.

The timber pile diameters were found to average approximately 12". As detailed on Drawing No. 10 the concrete piles are either 20" or 18" square, depending on their location within the structure.

At the time of the inspection the underwater visibility ranged from zero to a maximum of 1 foot. Current conditions at the site ranged from minimal at slack tide to approximately 3 knots during the ebb tide.





#### INSPECTION LEVEL DESIGNATIONS

LEVEL I - all perimeter piles from bents 4C to 102  
 - all piles in every fifth bent, i.e. 1, 5, 10, 15 etc to 100, and bent 1C  
 S- SIGNIFICANTLY DAMAGED PILE

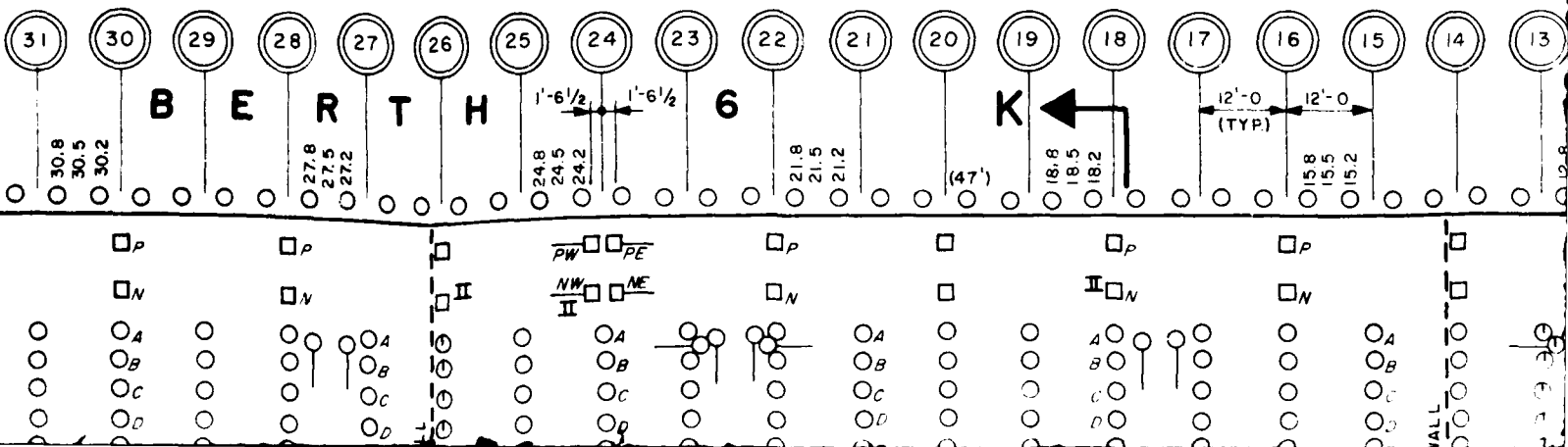
LEVEL II - inspected piles indicated by (II)  
 \* - SIGNIFICANTLY DAMAGED PILE

LEVEL III - inspected piles indicated by ;  
 ○ 100% REMAINING CROSS-SECTIONAL AREA  
 ◐ 75% REMAINING CROSS-SECTIONAL AREA  
 ◑ 50% REMAINING CROSS-SECTIONAL AREA  
 ◒ 25% REMAINING CROSS-SECTIONAL AREA  
 ● 0-25% REMAINING CROSS-SECTIONAL AREA

1215'-6

Bents 4C to 96

S 81°43'E



AD-A168 461

UNDERWATER FACILITIES INSPECTION AND ASSESSMENT BY  
NAVAL WEAPONS STATION (U) AGI (J) AND ASSOCIATES INC  
SEATTLE WA NOV 83 CHES/NAUFAC-FFO-1-83-(19)  
N62477-81-C-0498

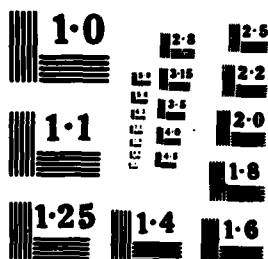
2/2

UNCLASSIFIED

F/G 13/2

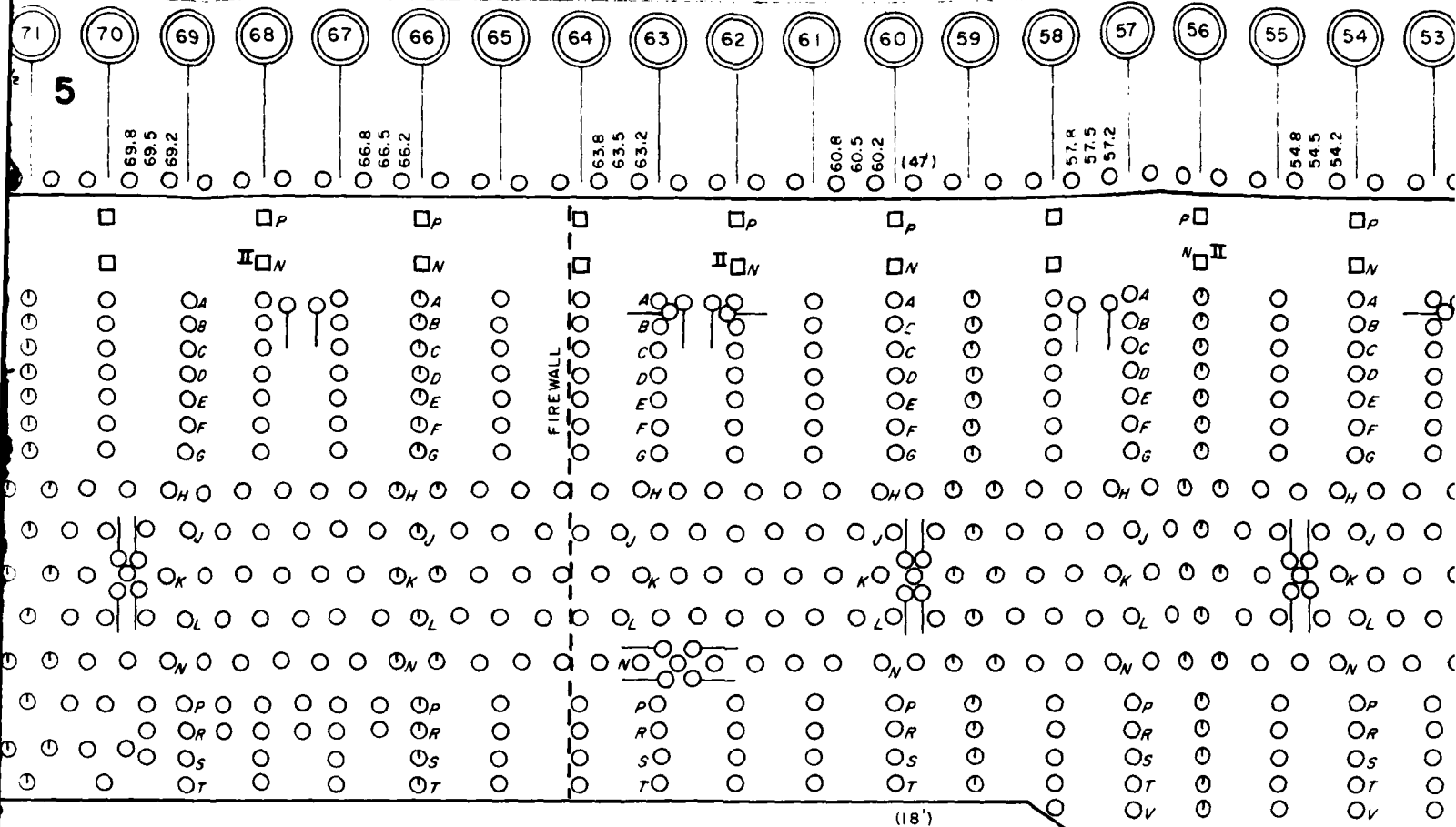
NL

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7-86  
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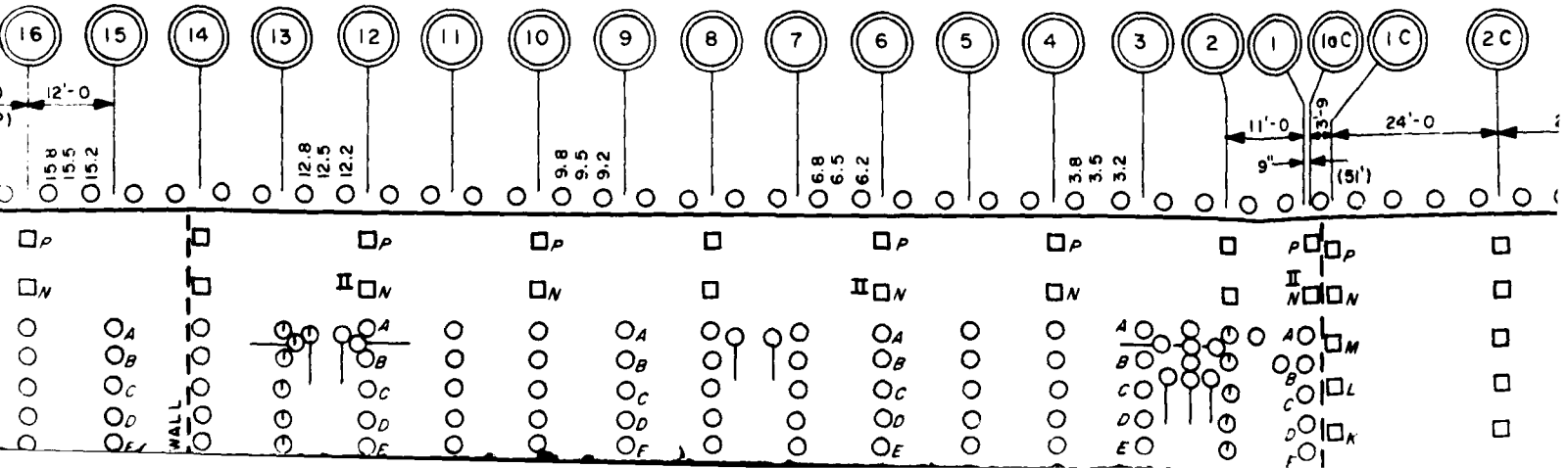
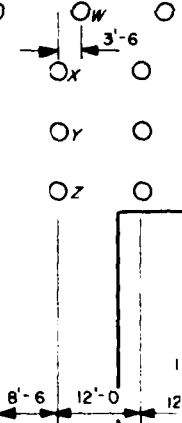
1215' - 6 Bents 4C to 96

581°43'E

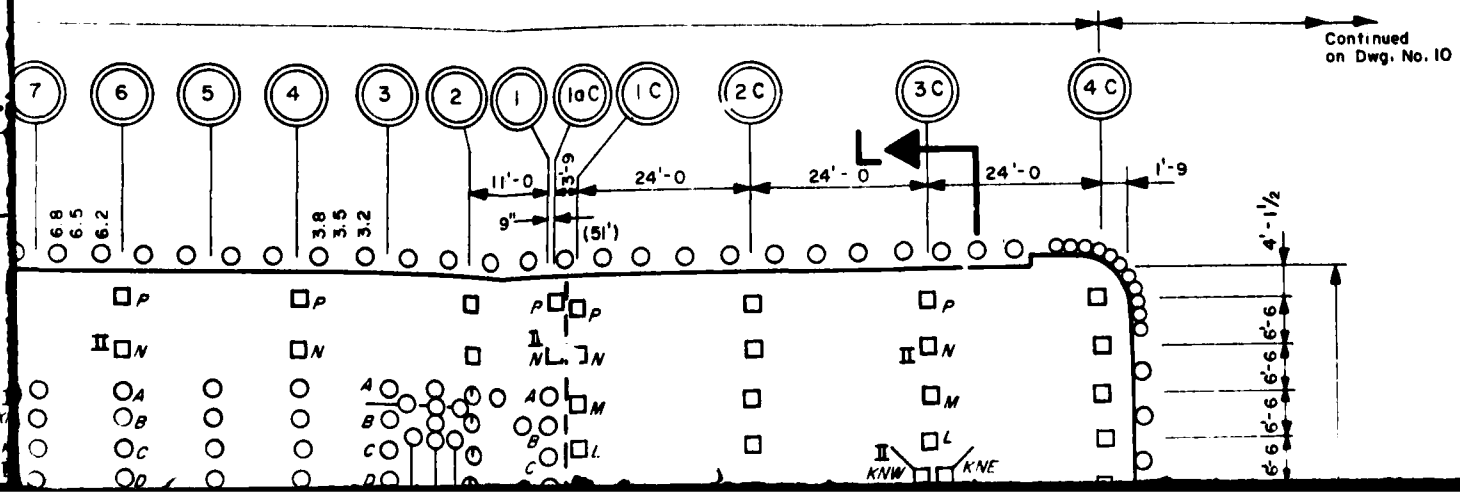
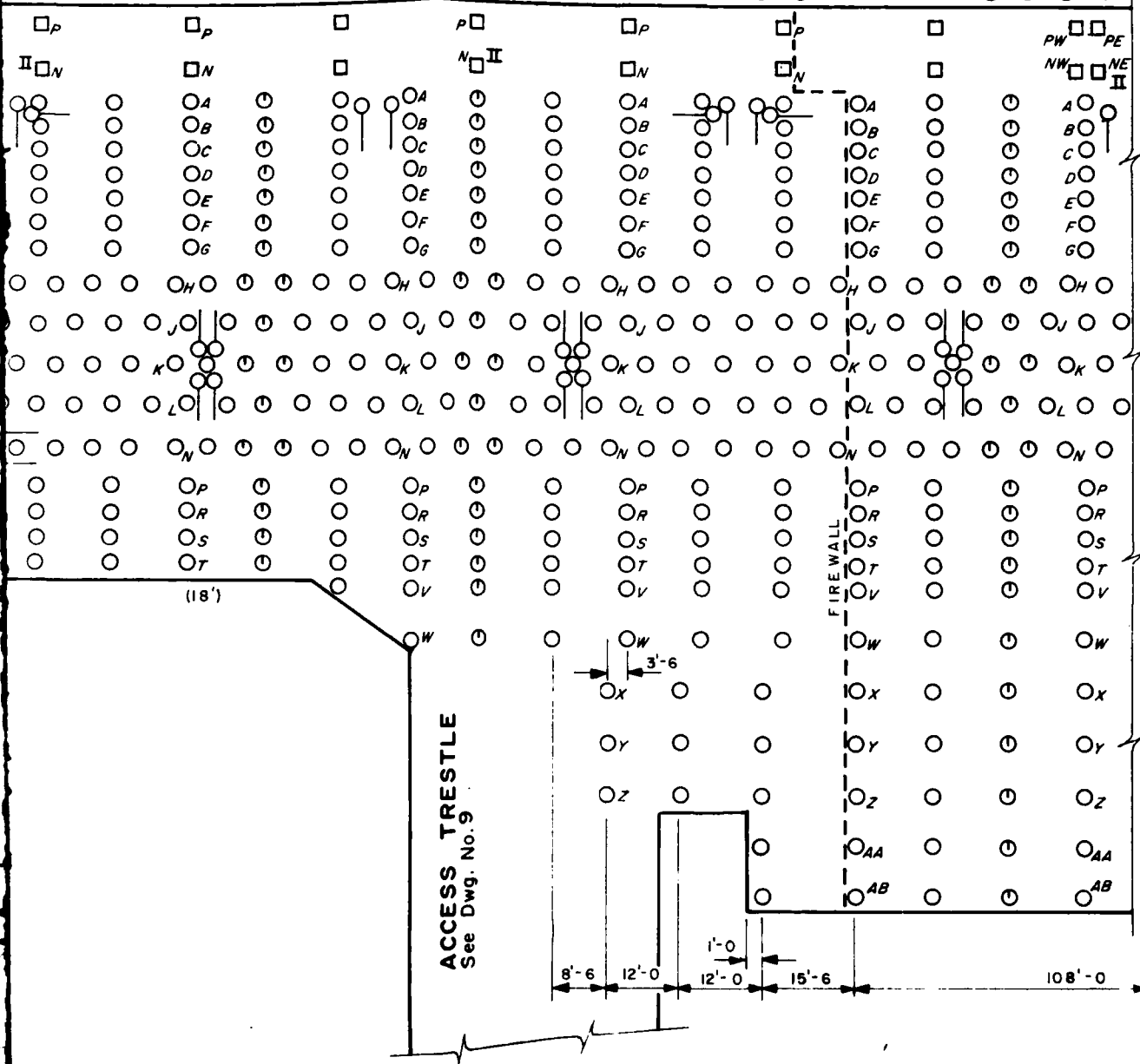
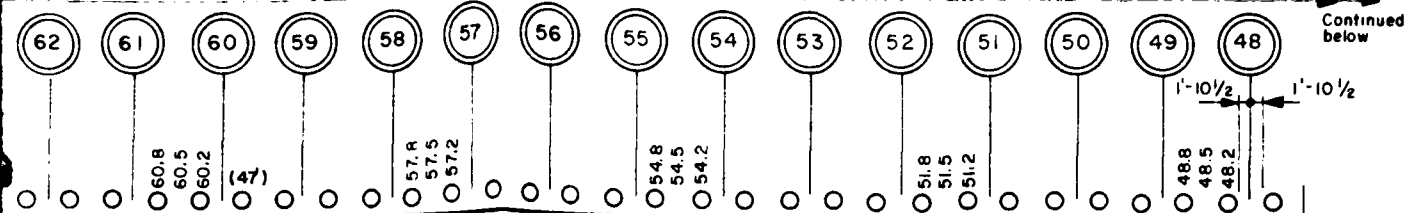


(18')

ACCESS TRESTLE  
See Dwg. No. 9



043 E

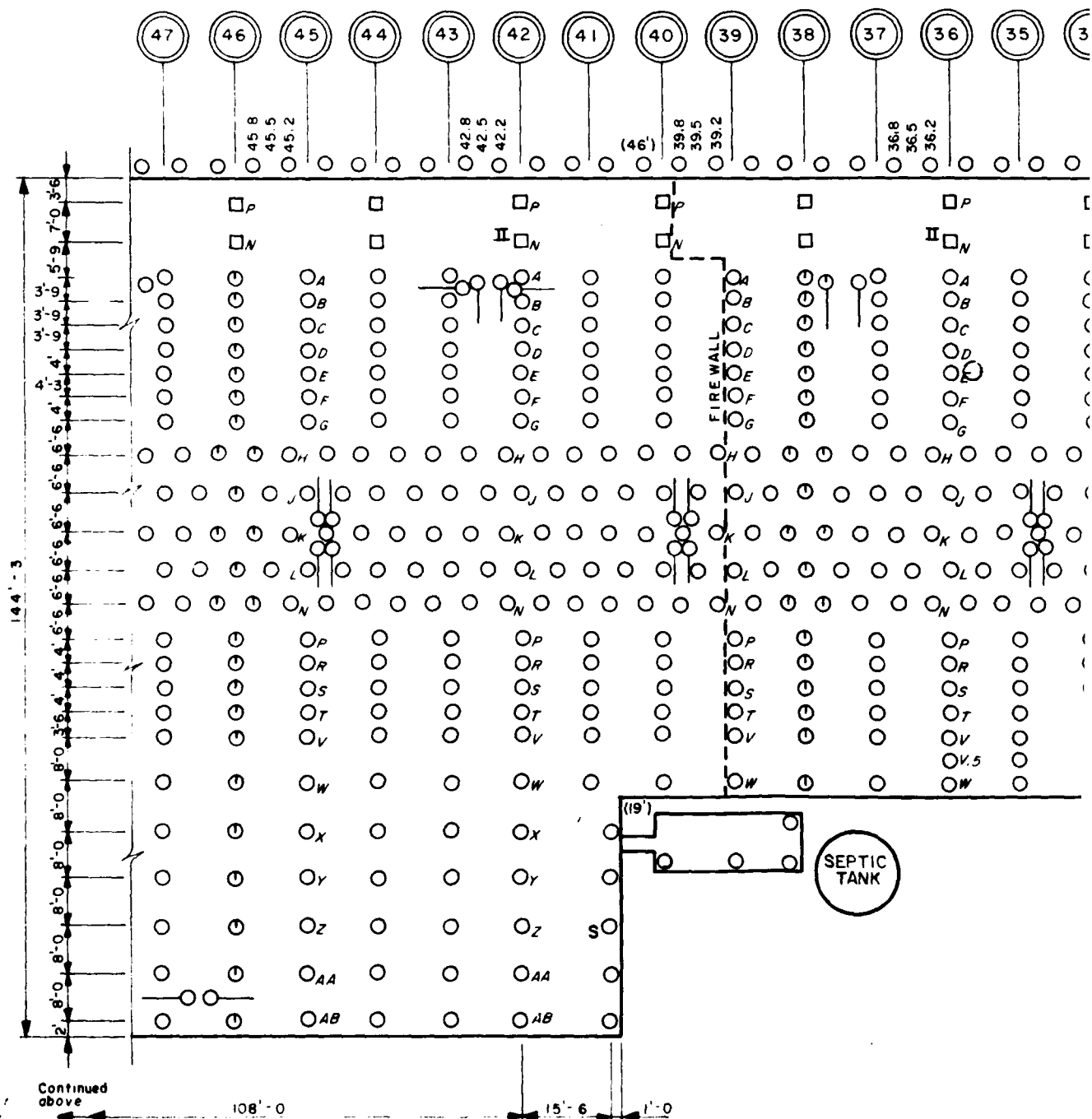


# LEGEND

- (29) BENT No
- R PILE ROW DESIGNATION
- TIMBER PILE
- TIMBER BATTER PILE
- 18" x 18" OR 20" x 20" CONCRETE
- 18" x 18" OR 20" x 20" CONCRETE
- m PILE MISSING
- NB PILE NOT BEARING AT CAP
- (47') PILE LENGTH, CURB TO MU



Continued  
above



# INSPECTION LEVEL DESIGNATIONS

LEVEL I - all perimeter piles from bents 4C to 102  
 - all piles in every fifth bent, i.e. 1, 5, 10, 15 etc to 100, and bent 1C  
 S - SIGNIFICANTLY DAMAGED PILE

LEVEL II - inspected piles indicated by (II)  
 \* - SIGNIFICANTLY DAMAGED PILE

LEVEL III - inspected piles indicated by ;  
 ○ 100% REMAINING CROSS-SECTIONAL AREA  
 ○ 75% REMAINING CROSS-SECTIONAL AREA  
 ○ 50% REMAINING CROSS-SECTIONAL AREA  
 ○ 25% REMAINING CROSS-SECTIONAL AREA  
 ● 0-25% REMAINING CROSS-SECTIONAL AREA

FILE

CONCRETE PILE

CONCRETE BATTER PILE

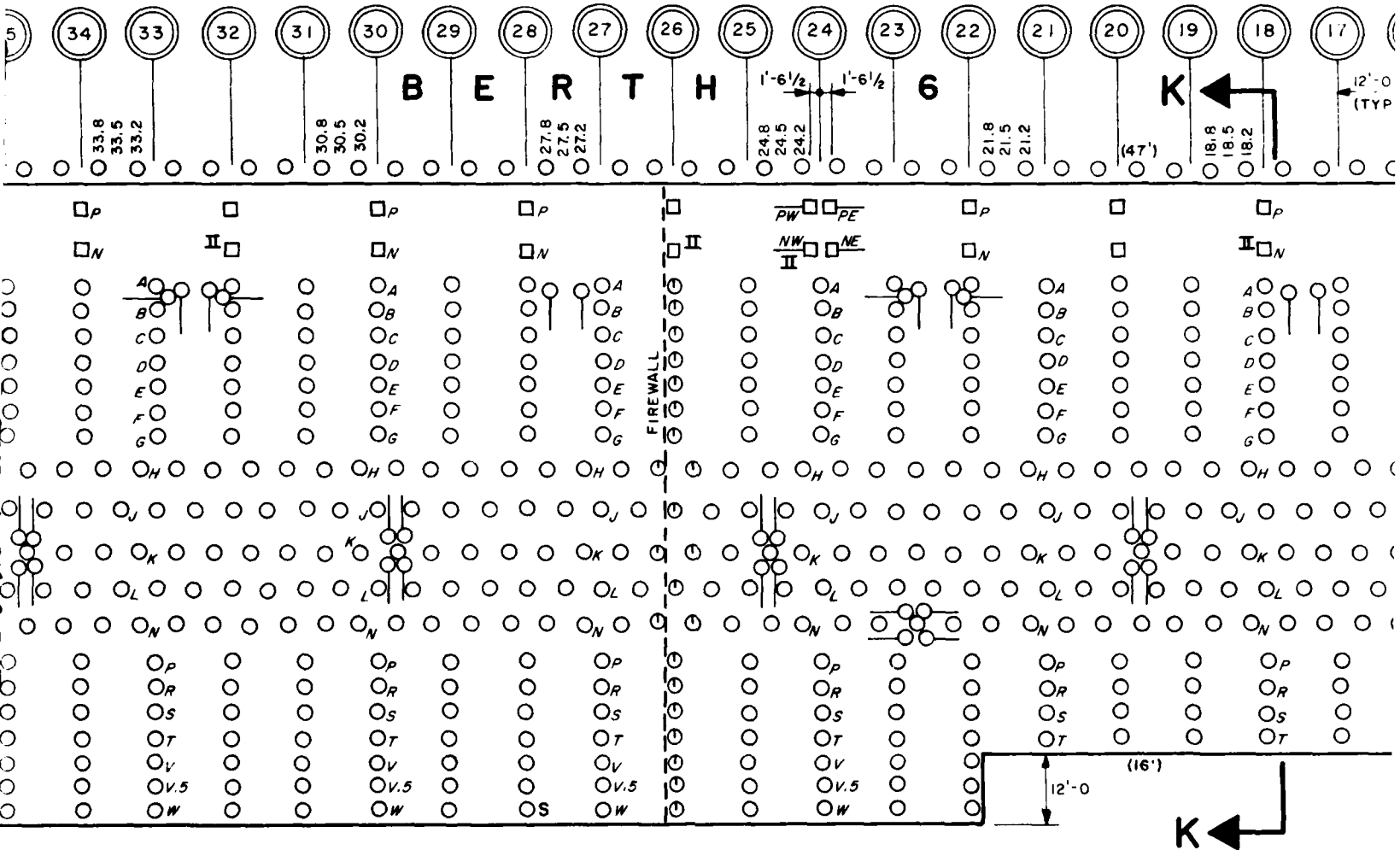
5 AT CAP

IRB TO MUDLINE

1215'-6

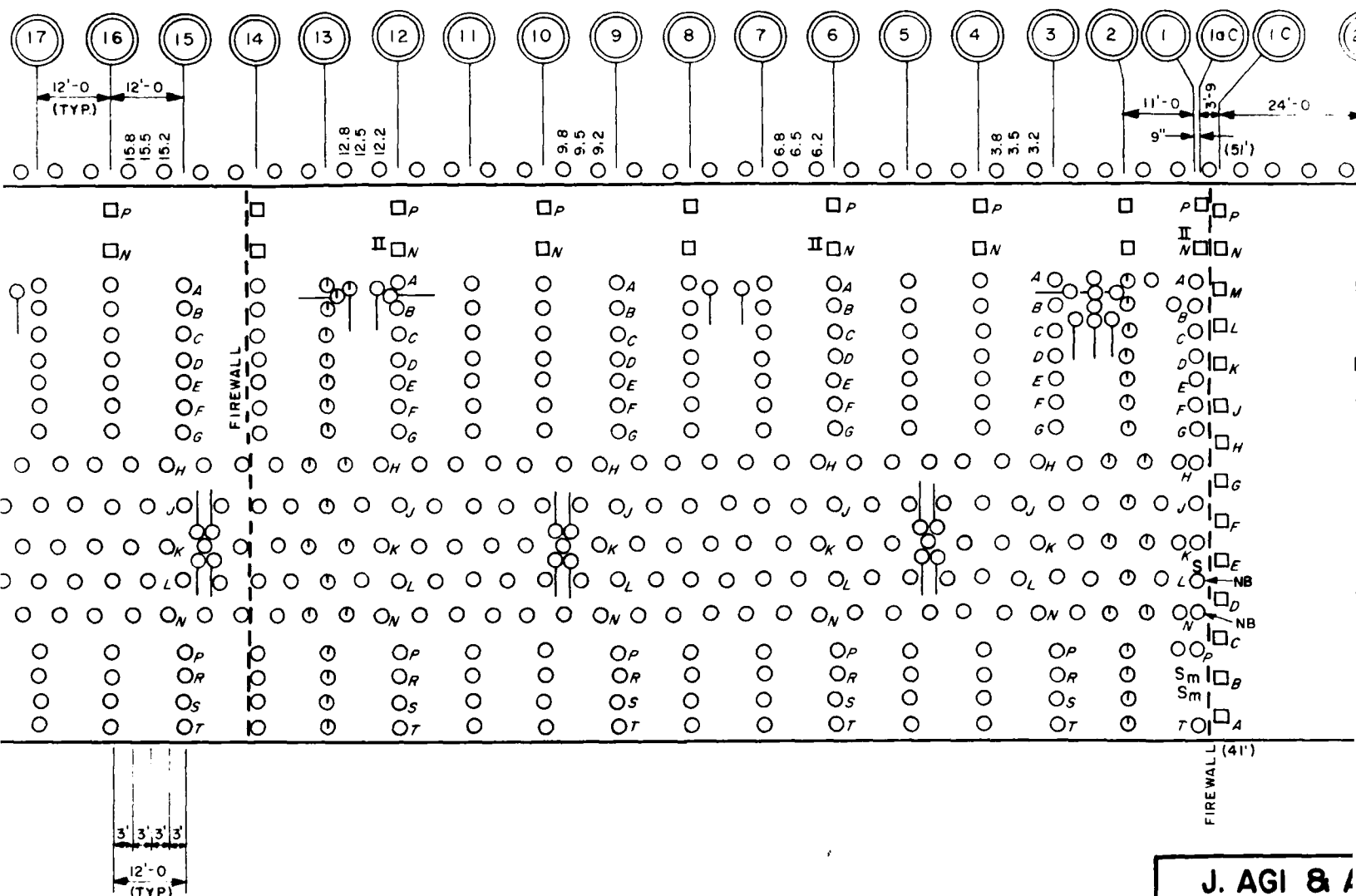
Bents 4C to 96

S 81°43'E



ACCESS TRESTLE  
See Dwg. No. 9

8'-6" 12'



Note: 18" concrete piles, bents 1aC to 96C  
20" concrete piles, bents 1C to 4C

PIER 4, Reference Drawings

P.W. Dwg. No

- 11266-B4
- 11266-B5
- 11242-8
- 11242-9

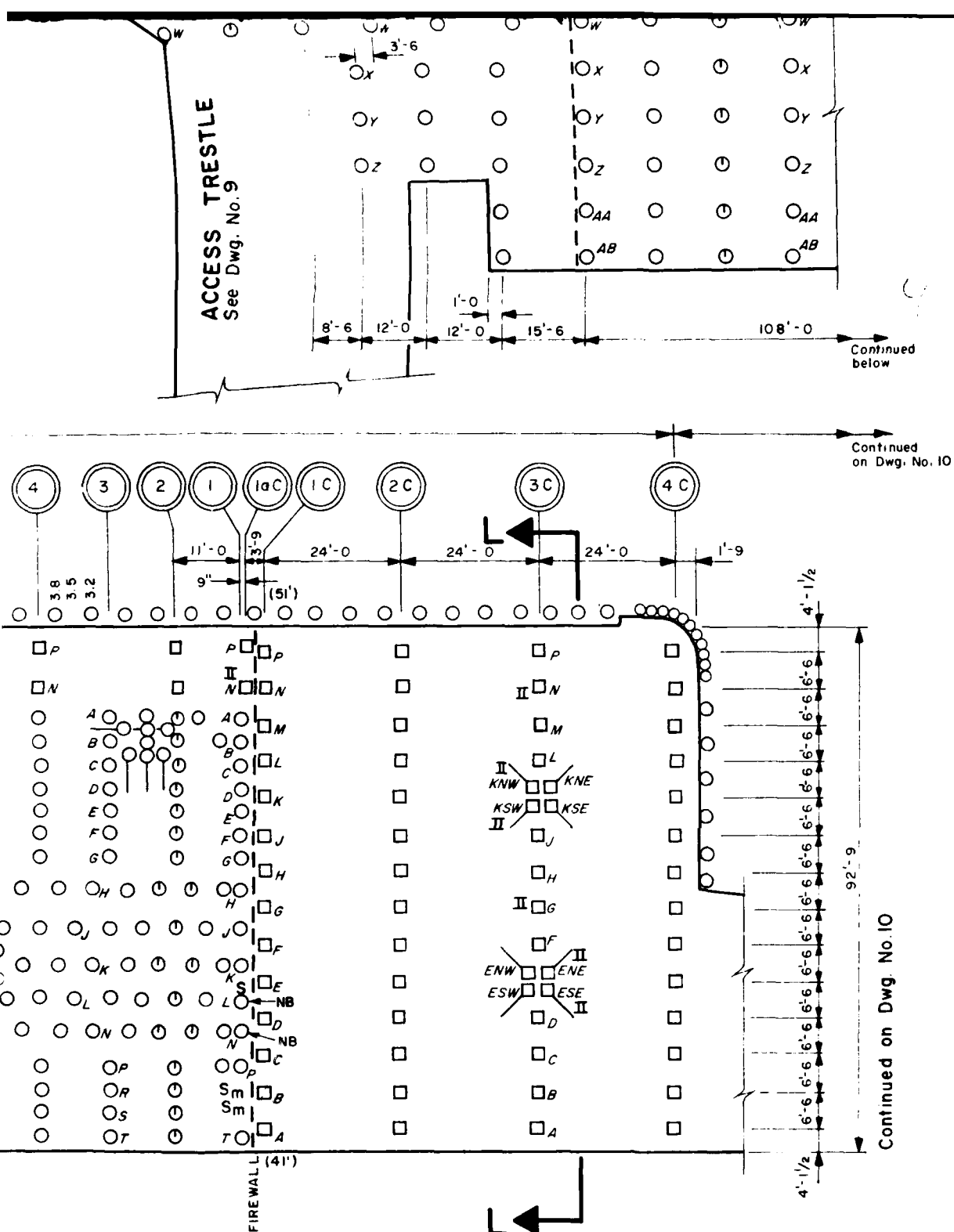
Y and D Dwg. No

- 1115132
- 1115146
- 1115148

J. AGI & A  
Suite 600,

PLA  
AND CONDIT  
F  
US NA  
CC

CHES  
REPOR  
CONTRAC



# **J. AGI & ASSOCIATES CO. LTD.**

Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING LOCATION  
AND CONDITION OF INSPECTED PILING IN  
PIER 4, PIERHEAD  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
REPORT No FPO-1-83-(19)  
CONTRACT No N62477-81-C-0498  
TASK 2

**DWG. No. 7**

SCALE 1" = 20'

DRAWN F P

CHECKED *J.P.*

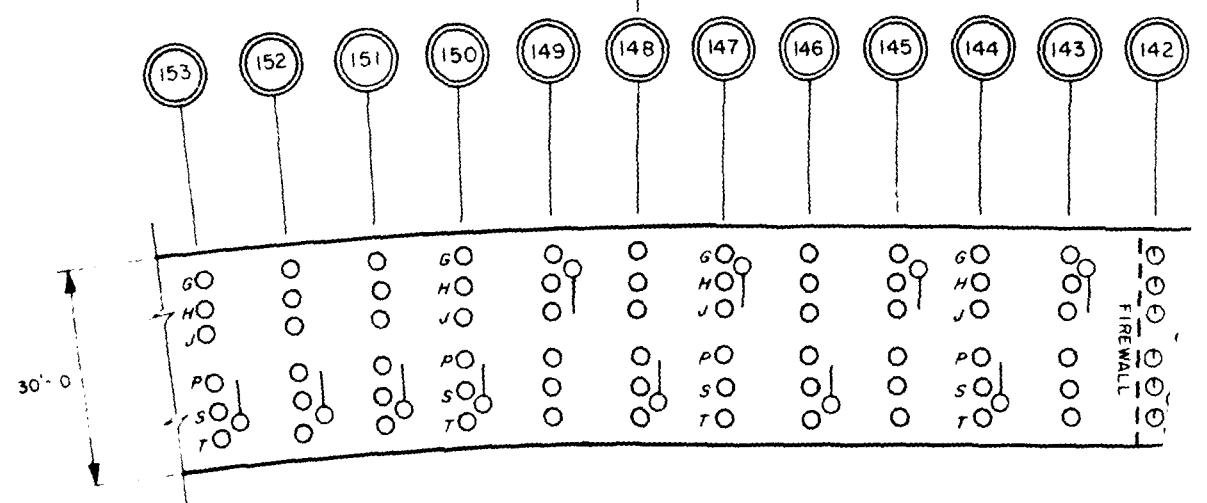
APPROVED *XIE*

DATE JUNE 6, 1983.

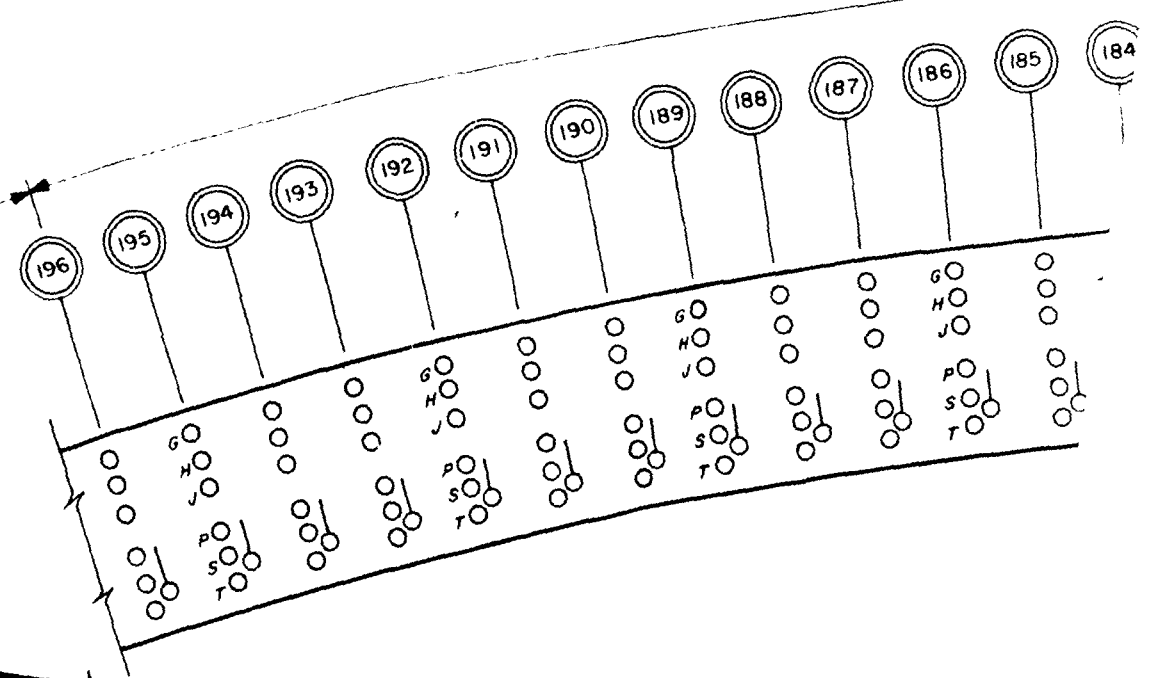
PROJECT No.  
**83-1/3-2-100**

Continued  
below

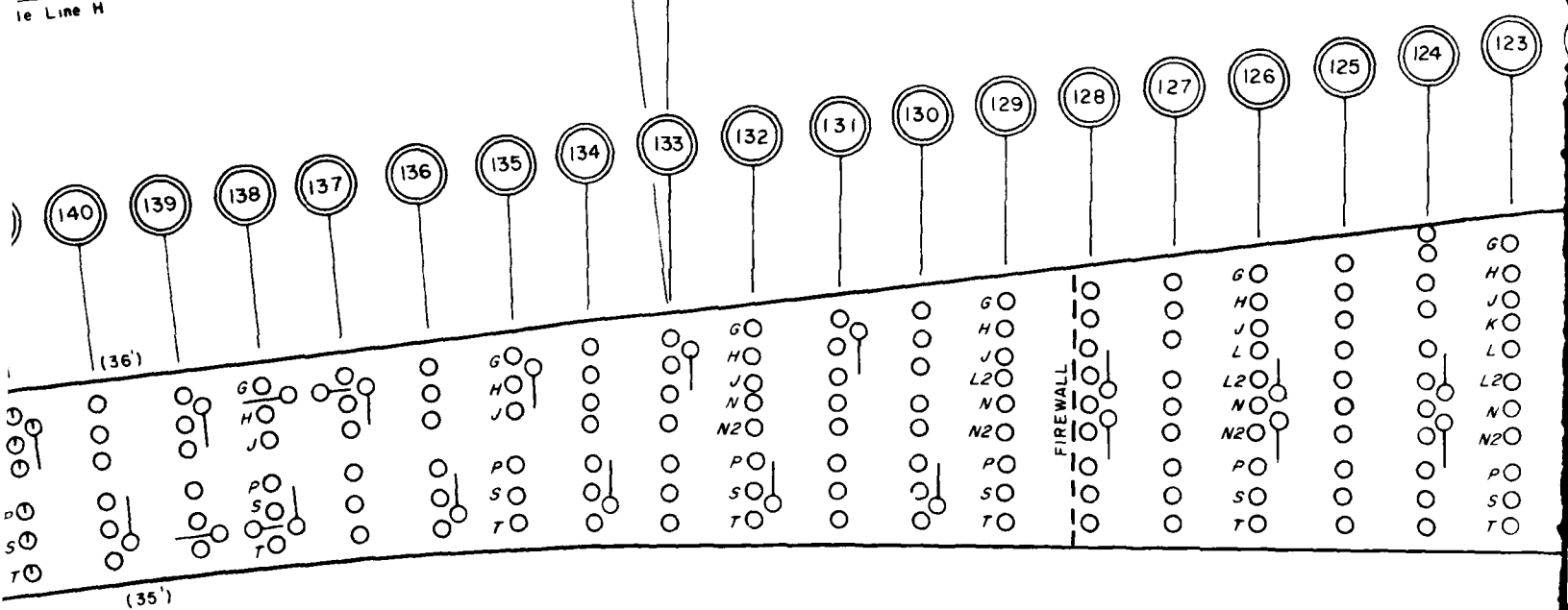
18'  
S 88° 57' E



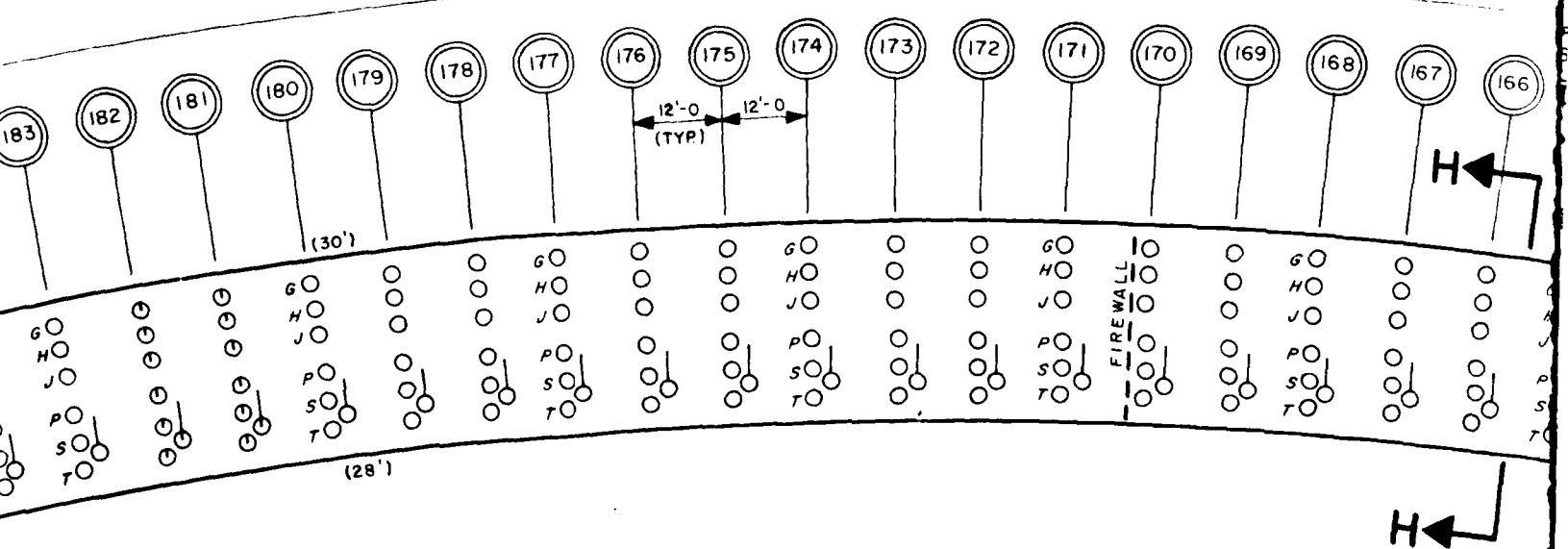
Continued  
below



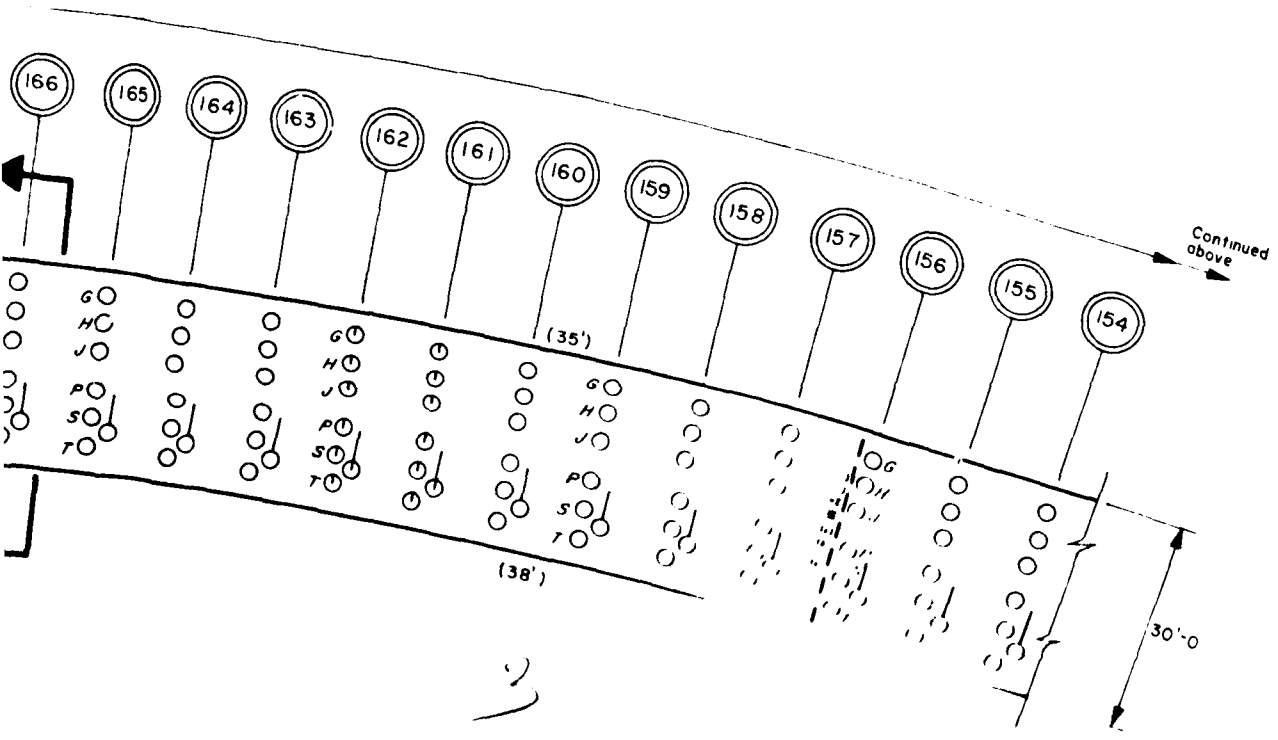
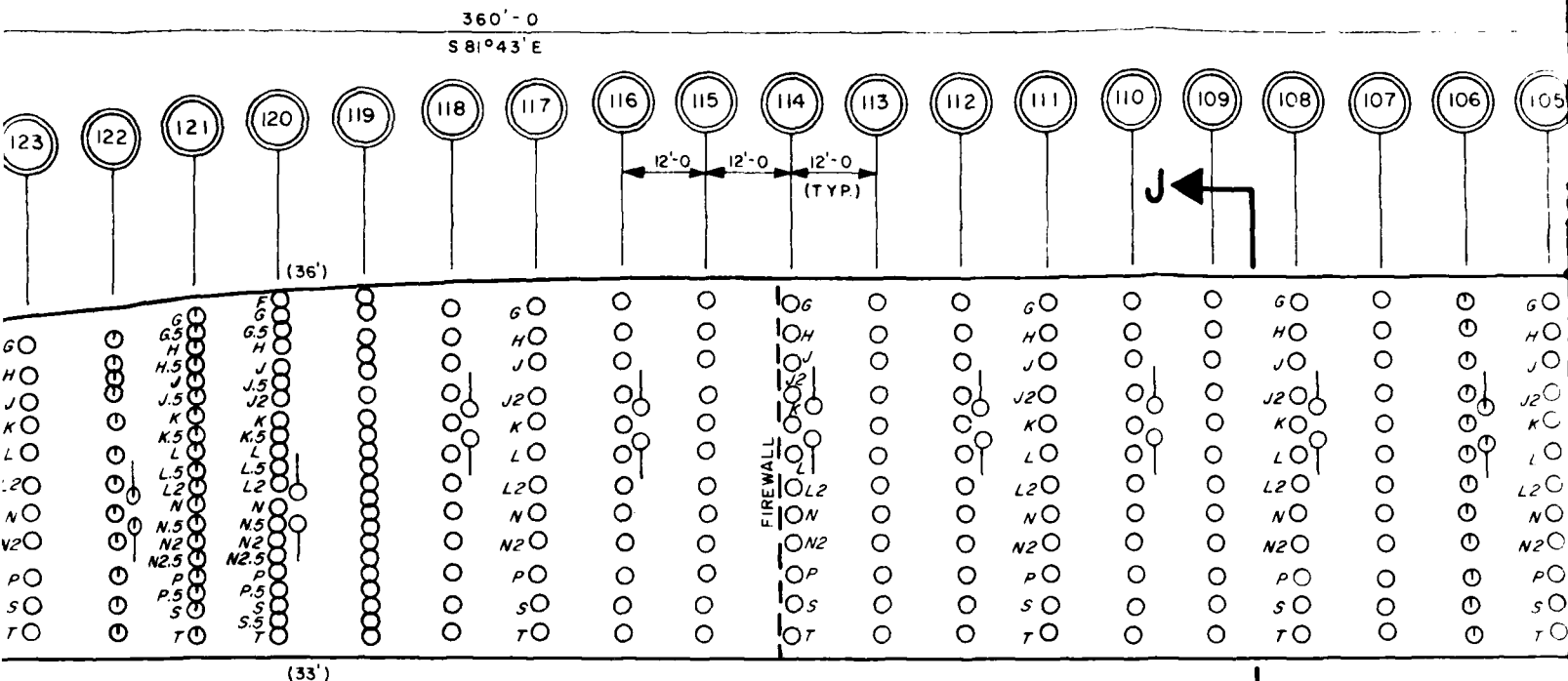
ie Line H



516'-0 Bents 148 to 196  
Radius on Pile Line H = 651.28'



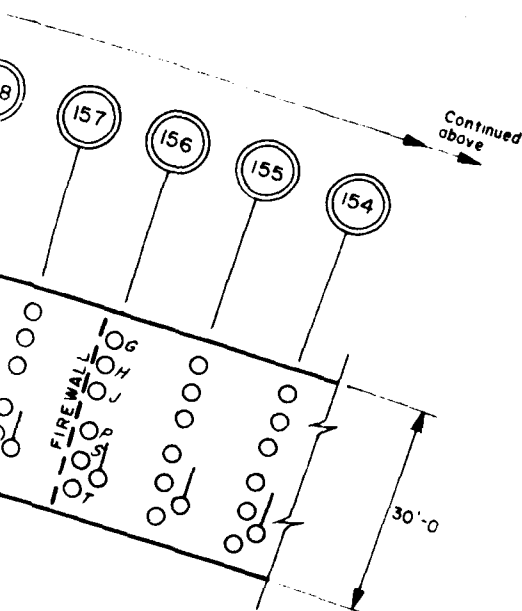
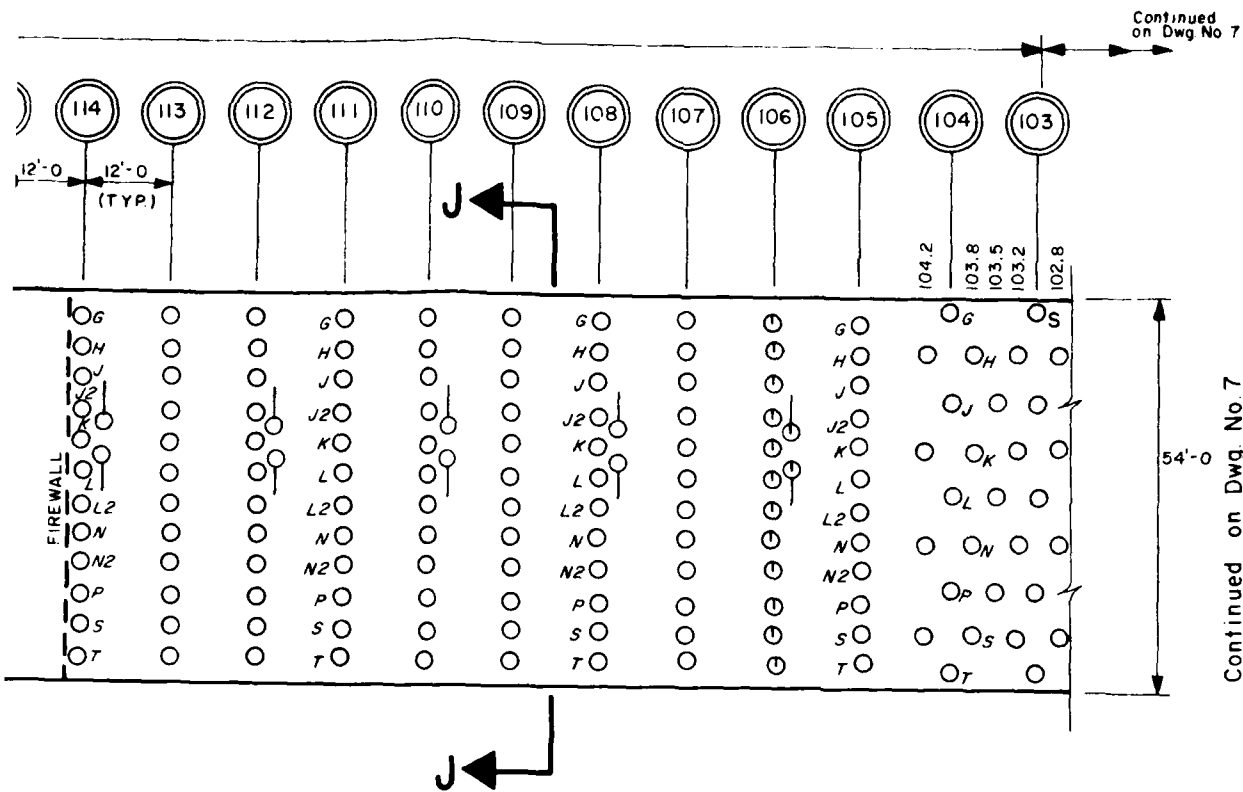
2



- LEGEND
- (184) BENT NO.
  - T PILE ROW
  - O TIMBER P
  - O— TIMBER B
  - m PILE MISS
  - NB PILE NOT
  - (30') PILE L

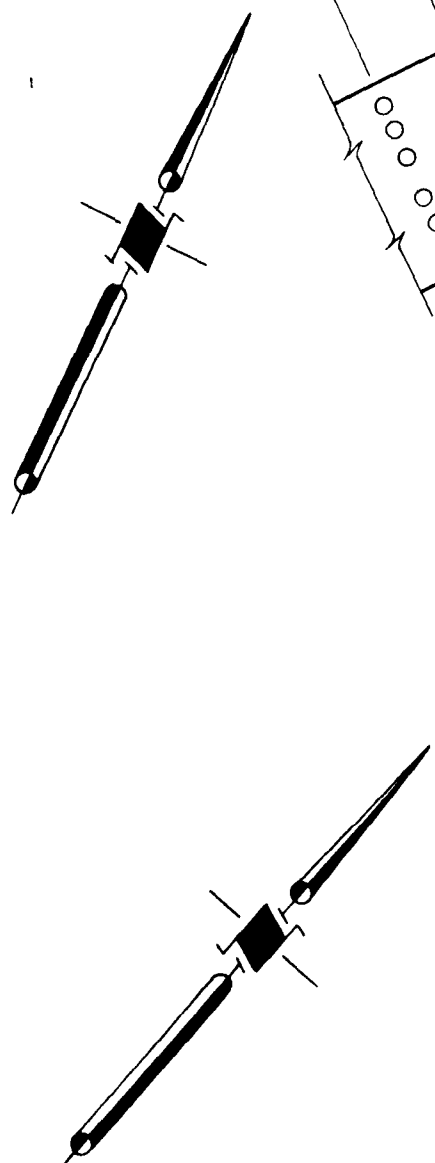
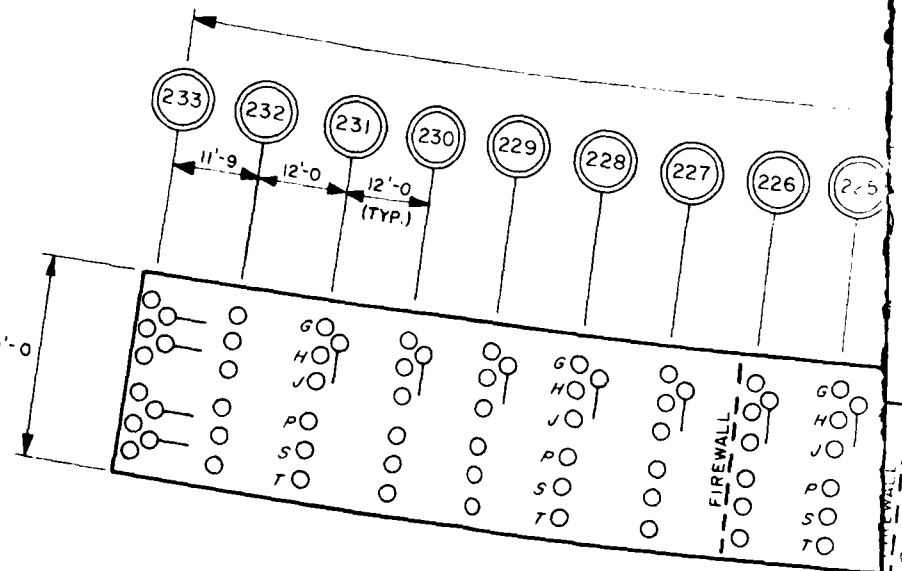
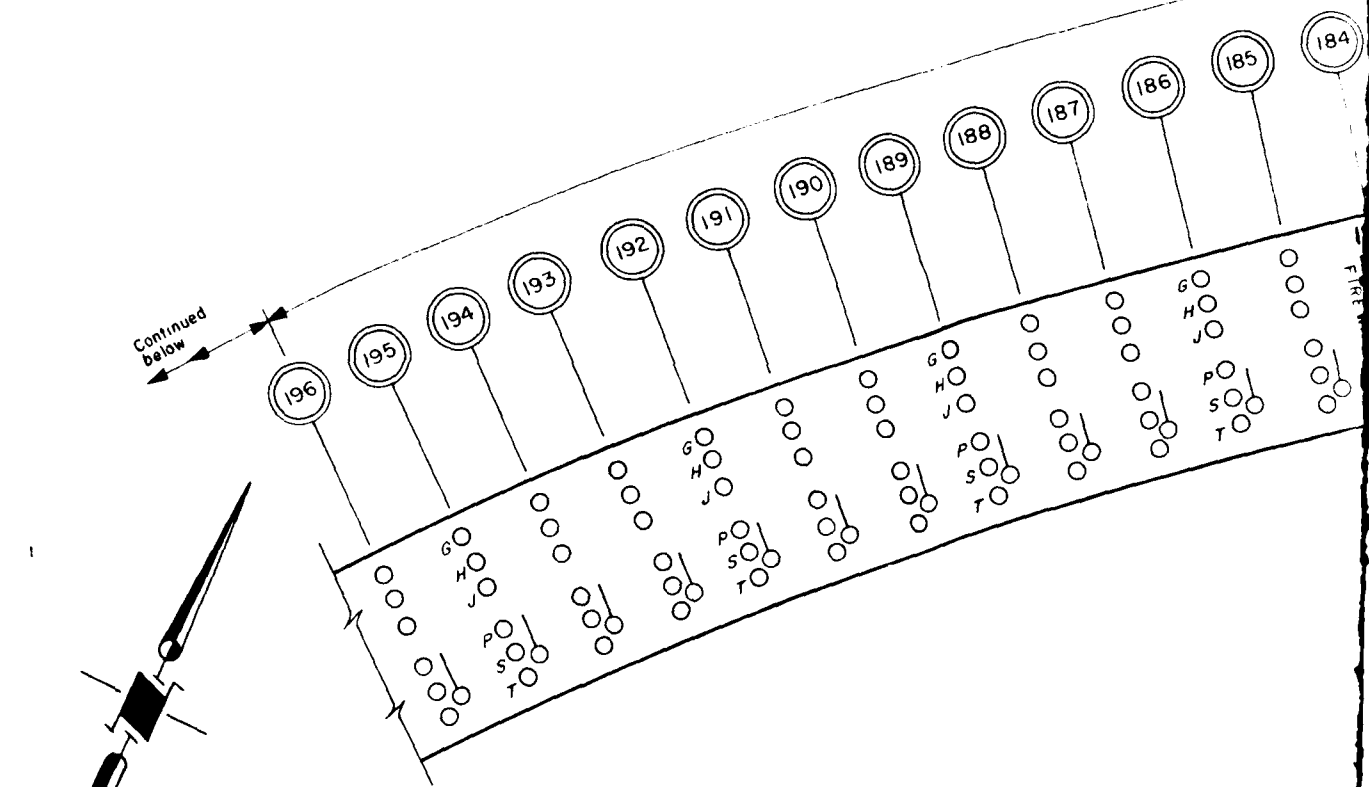
120'-0  
N 40° E

INSPECTION LEVEL

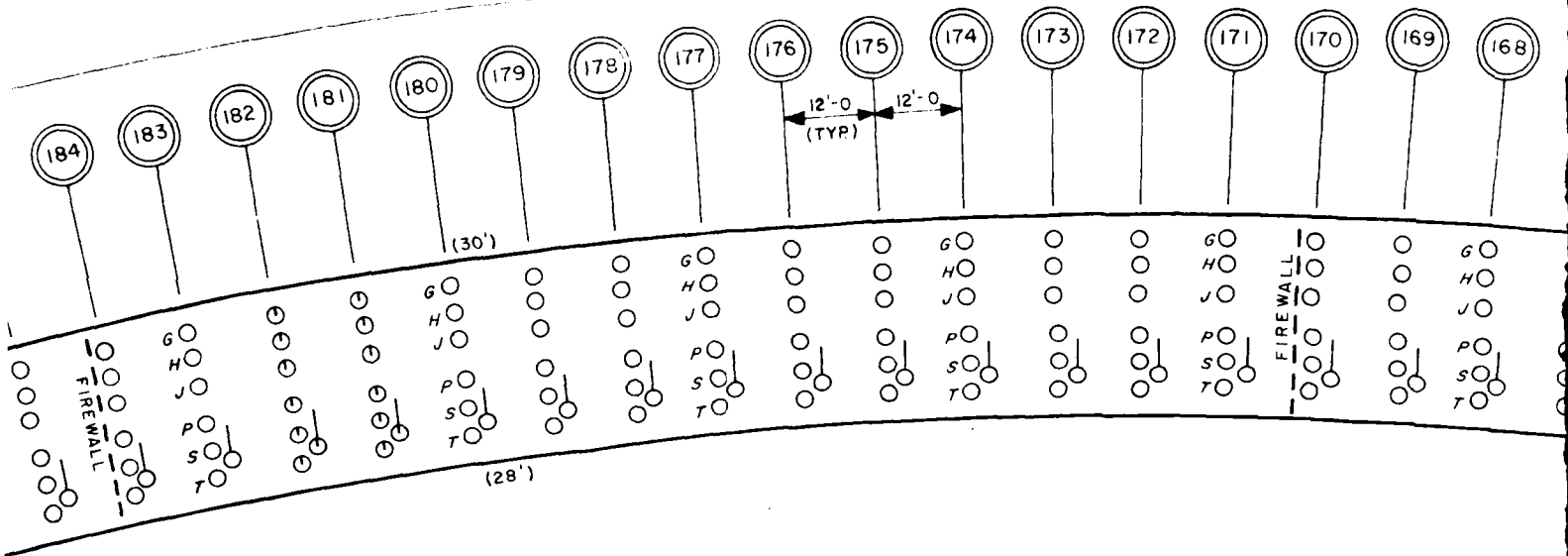


# LEGEND

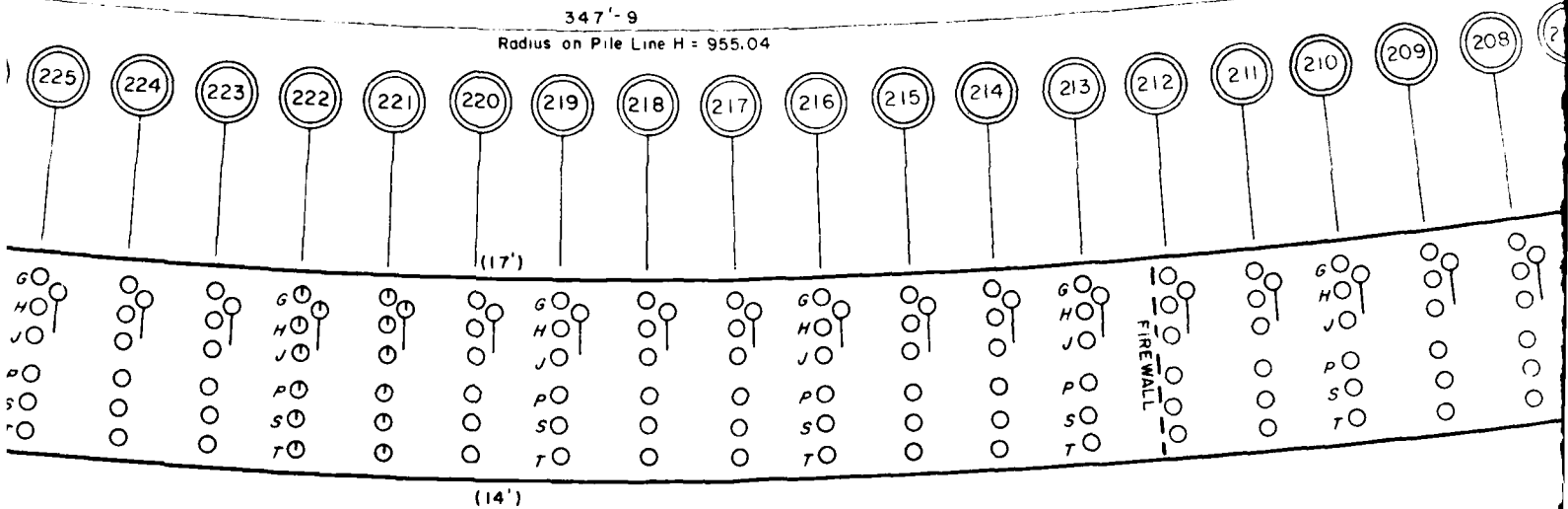
- (184) BENT No
- T PILE ROW DESIGNATION
- TIMBER PILE
- TIMBER BATTER PILE
- m PILE MISSING
- NB PILE NOT BEARING AT CAP
- (30') PILE LENGTH, CURB TO MUDLINE

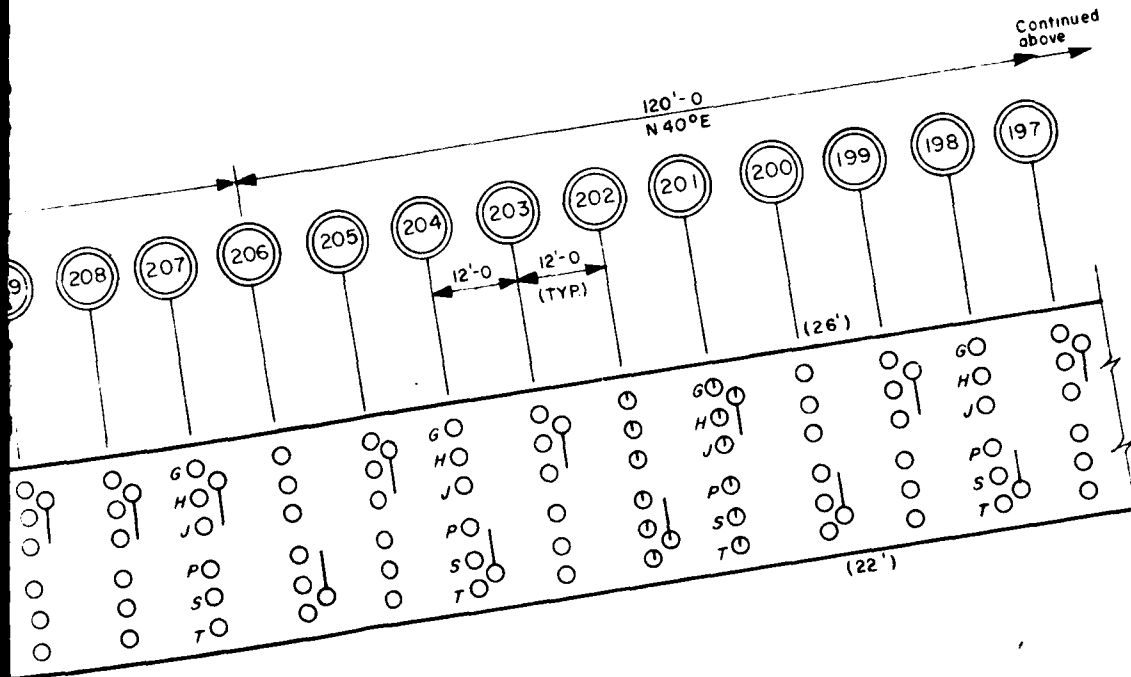
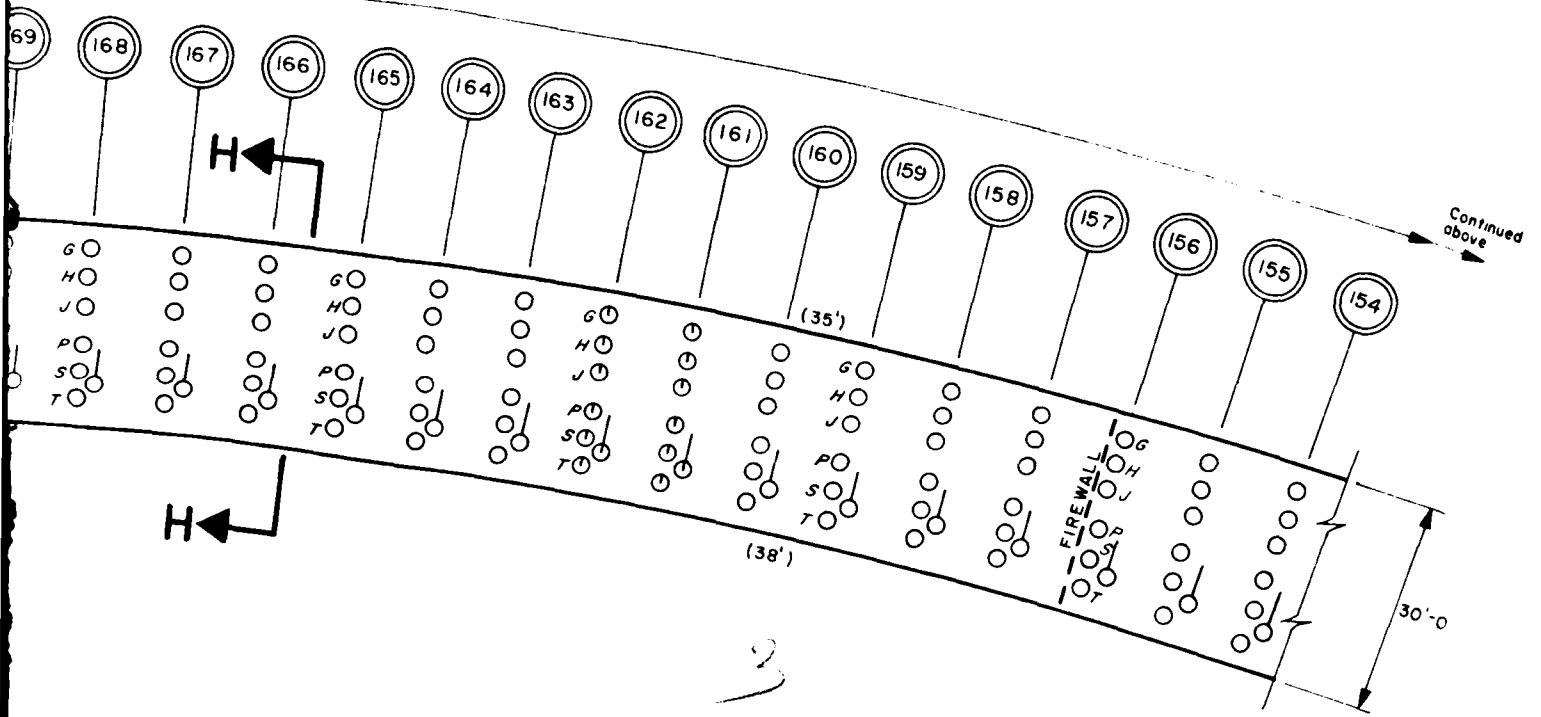


516'-0 Bents 148 to 196  
Radius on Pile Line H = 651.28'



347'-9  
Radius on Pile Line H = 955.04

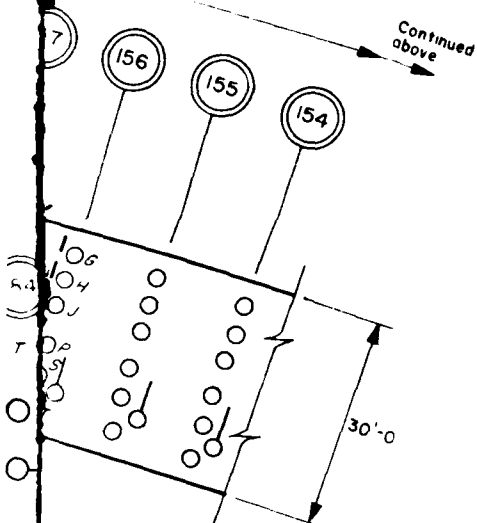




J. AG  
Suite

AND

CC



# LEGEND

- 184 BENT No.
- T PILE ROW DESIGNATION
- TIMBER PILE
- TIMBER BATTER PILE
- m PILE MISSING
- NB PILE NOT BEARING AT CAP
- (30') PILE LENGTH, CURB TO MUDLINE

## INSPECTION LEVEL DESIGNATIONS

- LEVEL I - all perimeter piles from bents 103 to 230
- all piles in every fifth bent from 105 to 220
- S SIGNIFICANTLY DAMAGED PILE

- LEVEL III - inspected piles indicated by;
- ① 100% REMAINING CROSS-SECTIONAL AREA
- ② 75% REMAINING CROSS-SECTIONAL AREA
- ③ 50% REMAINING CROSS-SECTIONAL AREA
- ④ 25% REMAINING CROSS-SECTIONAL AREA
- 0 - 25% REMAINING CROSS-SECTIONAL AREA

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Suite 600, 1414 Alaskan Way, Seattle, WA

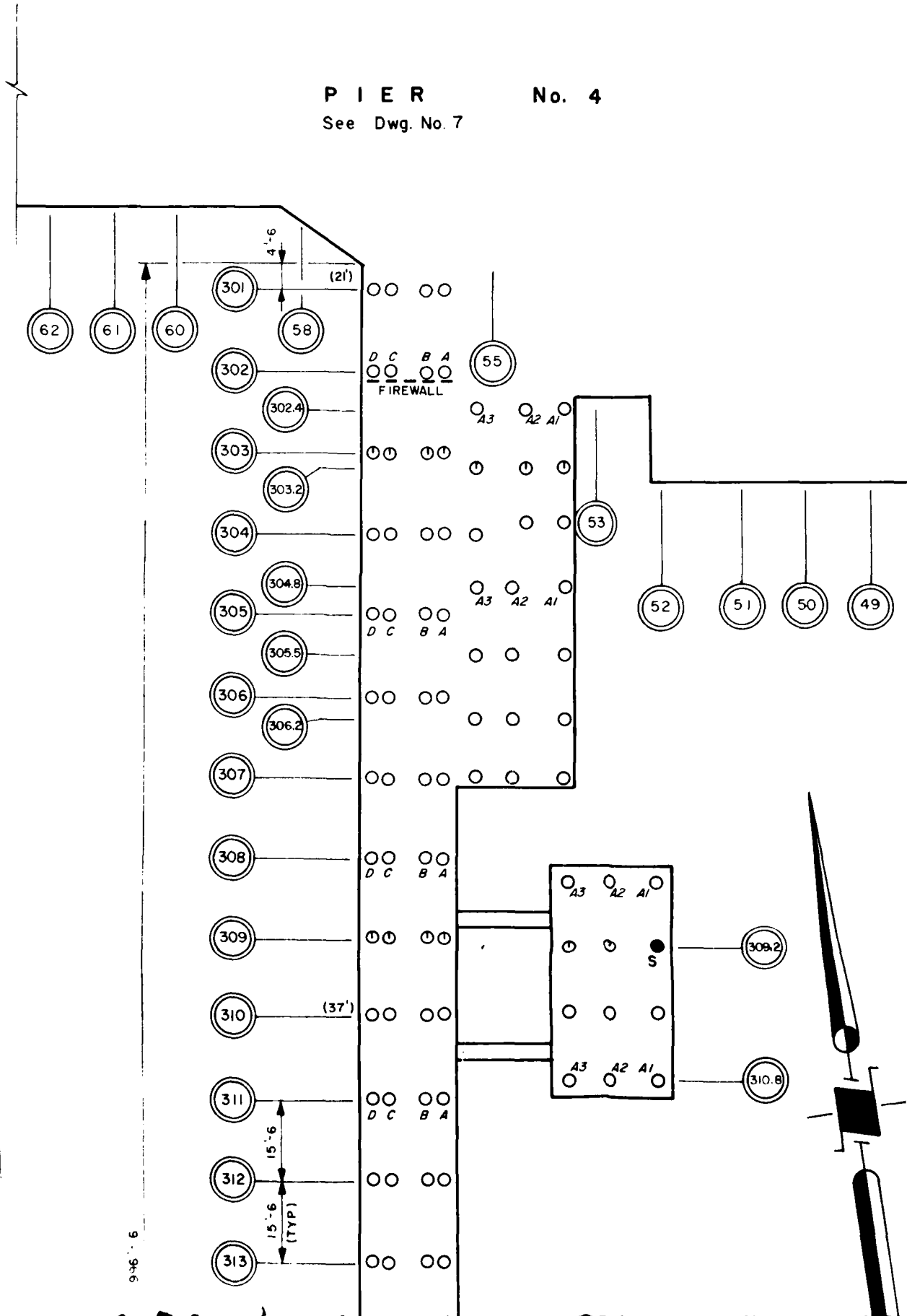
PLAN SHOWING LOCATION  
AND CONDITION OF INSPECTED PILING IN  
PIER 4, APPROACHWAY TRETTLE  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
REPORT No FPO-1-83-(19)  
CONTRACT No N62477-81-C-0498  
TASK 2

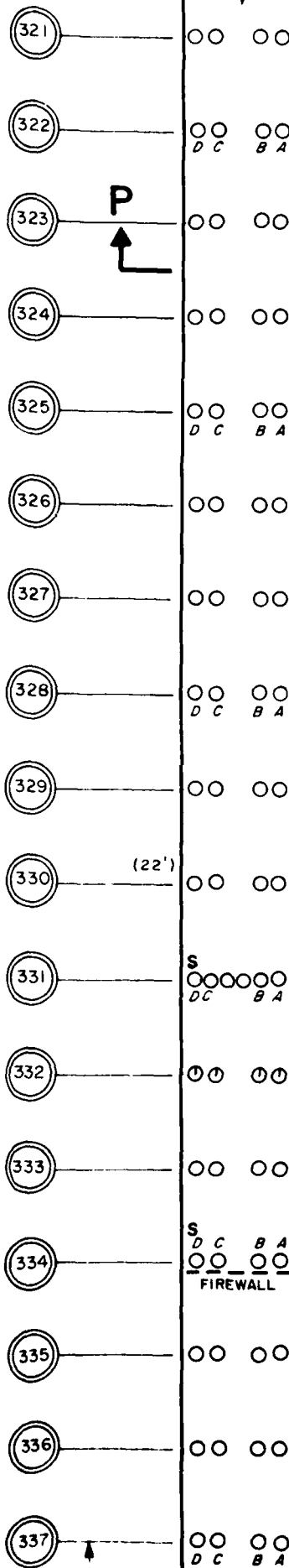
**DWG. No. 8**

|            |              |
|------------|--------------|
| SCALE      | 1" = 20'     |
| DRAWN      | F P          |
| CHECKED    | J.P.         |
| APPROVED   | XIE          |
| DATE       | JUNE 7, 1983 |
| PROJECT No | 83-1/3-2-100 |

See Dwg. No. 7



Continued  
to Bent 301



P



P



(22')

S  
D C B A

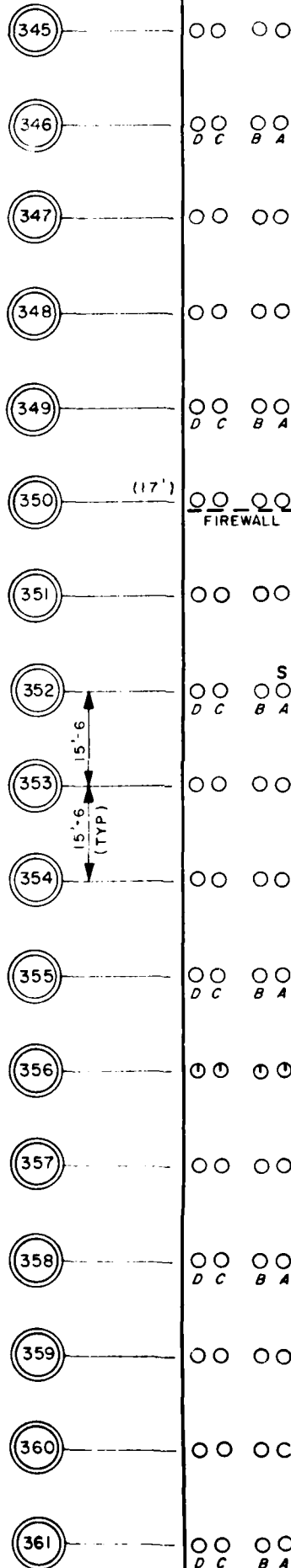
S  
D C B A  
FIREWALL

15'-6"  
(TYP)

996'-6"

Continued to  
Bent 301

996'-9



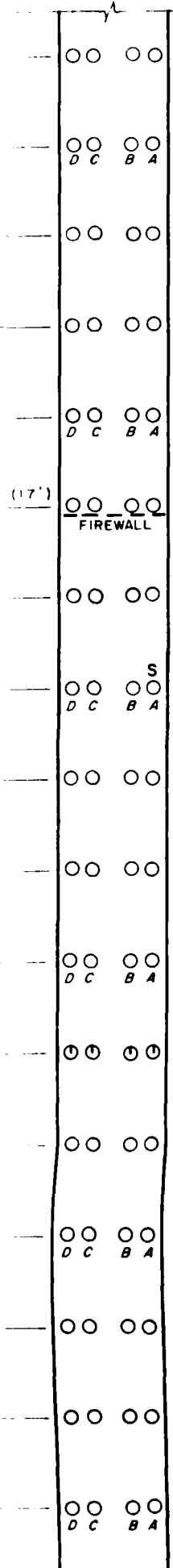
# LEGEND

- BENT No
- PILE ROW DESIGNATION
- TIMBER PILE
- TIMBER BATTER PILE
- PILE MISSING
- PILE NOT BEARING AT CAP
- PILE LENGTH, CAP TO MUD

## INSPECTION LEVEL DESIGNATION

- LEVEL I - all perimeter piles and 302.4 to 36
- all piles in bents 30
- 340, 345, 350, 3
- S SIGNIFICANTLY DAMA

- LEVEL III - inspected piles indic
- 100% REMAINING CR
- 75% REMAINING CR
- 50% REMAINING CR
- 25% REMAINING CR
- 0-25% REMAINING



# LEGEND

-  BENT No.
- B* PILE ROW DESIGNATION
-  TIMBER PILE
-  TIMBER BATTER PILE
- m* PILE MISSING
- NB PILE NOT BEARING AT CAP
- (22') PILE LENGTH, CAP TO MUDLINE

## INSPECTION LEVEL DESIGNATIONS

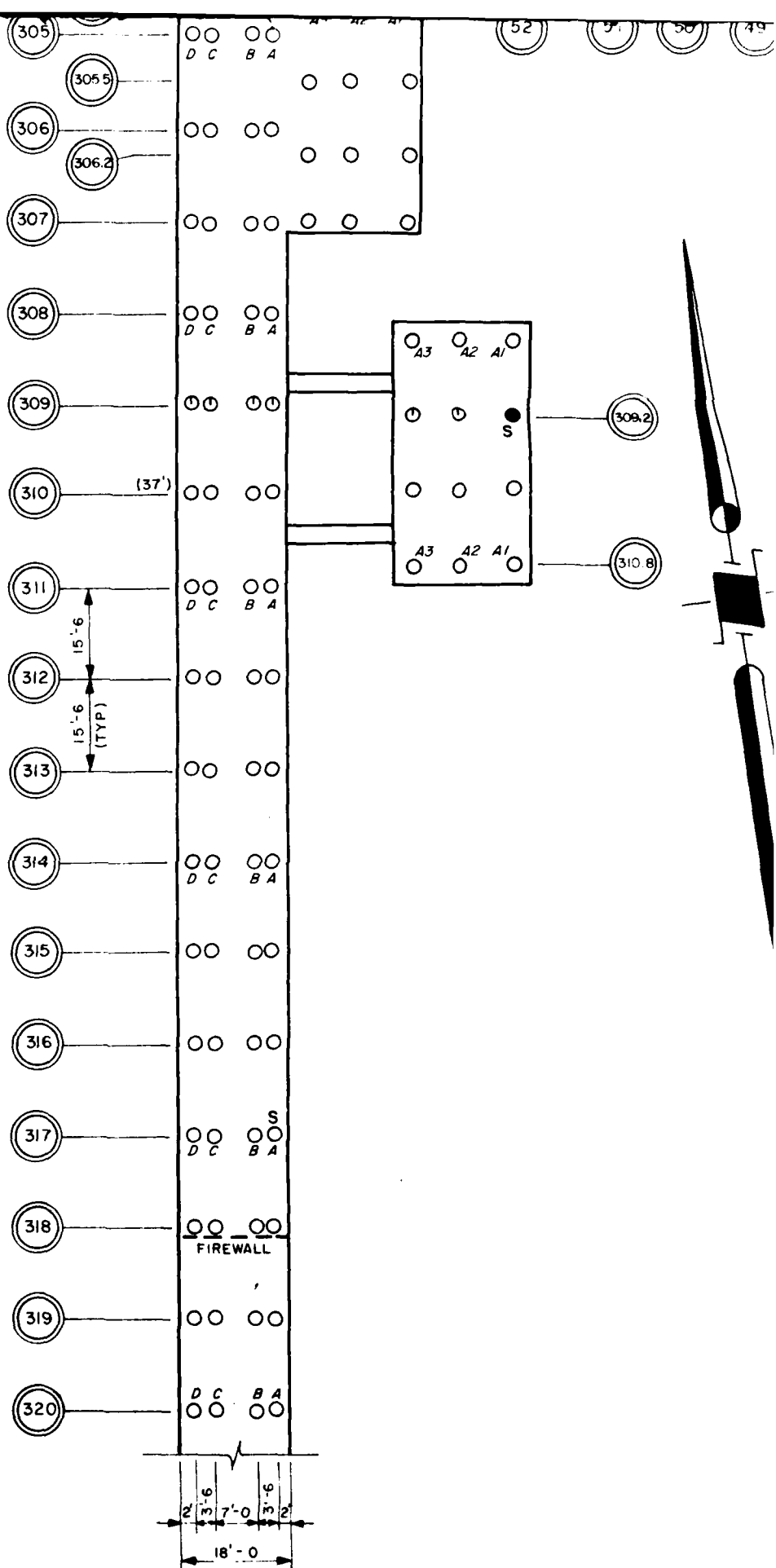
- LEVEL I - all perimeter piles from bents 301 to 365 on the west side and 302.4 to 365 on the east side
- all piles in bents 301, 304, 307, 310, 315, 320, 325, 330, 335, 340, 345, 350, 355 and 360

S SIGNIFICANTLY DAMAGED PILE

LEVEL III - inspected piles indicated by ;

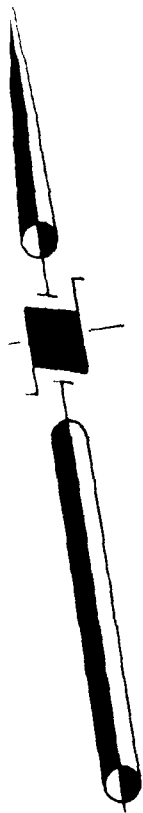
-  100% REMAINING CROSS-SECTIONAL AREA
-  75% REMAINING CROSS-SECTIONAL AREA
-  50% REMAINING CROSS-SECTIONAL AREA
-  25% REMAINING CROSS-SECTIONAL AREA
-  0 - 25% REMAINING CROSS-SECTIONAL AREA

4



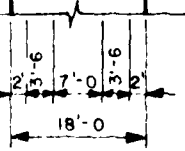
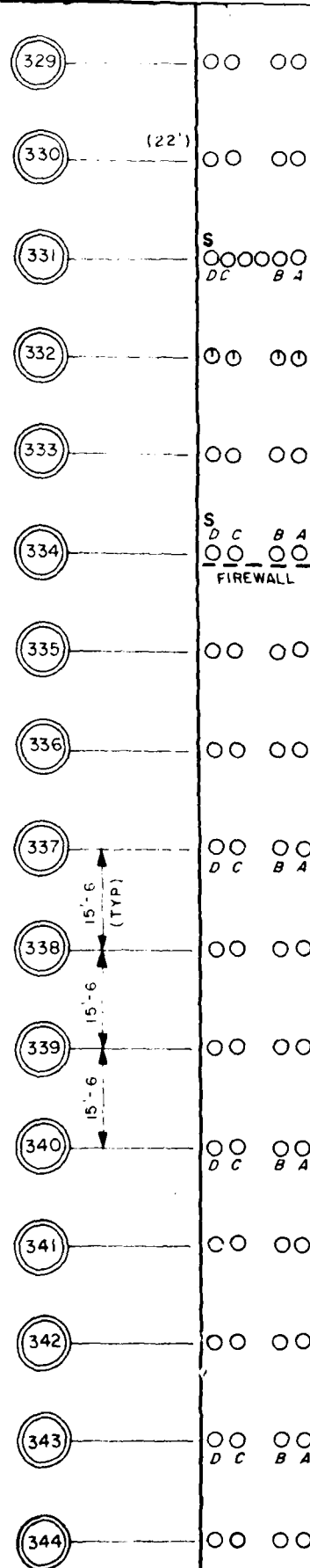
996'-6"

Continued to  
Bent 367



996'-6

Continued to  
Bent 367



99619

|       |             |            |            |
|-------|-------------|------------|------------|
| (353) | 15'6" (TYP) | ○ ○        | ○ ○        |
| (354) |             | ○ ○        | ○ ○        |
| (355) |             | ○ ○<br>D C | ○ ○<br>B A |
| (356) |             | ○ ○        | ○ ○        |
| (357) |             | ○ ○        | ○ ○        |
| (358) |             | ○ ○<br>D C | ○ ○<br>B A |
| (359) |             | ○ ○        | ○ ○        |
| (360) |             | ○ ○        | ○ ○        |
| (361) |             | ○ ○<br>D C | ○ ○<br>B A |
| (362) |             | ○ ○        | ○ ○        |
| (363) |             | ○ ○        | ○ ○        |
| (364) |             | ○ ○<br>D C | ○ ○<br>B A |
| (365) |             | ○ ○        | ○ ○        |
| (366) |             | ○ ○        | ○ ○        |
| (367) |             | ○ ○<br>D C | ○ ○<br>B A |

J. AGI  
Suite

AND

CC

- ① 100% REMAINING CROSS-SECTIONAL AREA
- ② 75% REMAINING CROSS-SECTIONAL AREA
- ③ 50% REMAINING CROSS-SECTIONAL AREA
- ④ 25% REMAINING CROSS-SECTIONAL AREA
- 0 - 25% REMAINING CROSS-SECTIONAL AREA

○ ○ ○ ○

○ ○ ○ ○

○ ○ ○ ○  
D C B A

○ ○ ○ ○

○ ○ ○ ○

○ ○ ○ ○  
D C B A

○ ○ ○ ○

○ ○ ○ ○

○ ○ ○ ○  
D C B A

○ ○ ○ ○

○ ○ ○ ○

○ ○ ○ ○  
D C B A

○ ○ ○ ○

○ ○ ○ ○

○ ○ ○ ○  
D C B A

# **J. AGI & ASSOCIATES CO. LTD.**

Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING LOCATION  
AND CONDITION OF INSPECTED PILING IN  
PIER 4, ACCESS TRESTLE  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA

CHES DIV. NAV FAC ENG COM  
REPORT No. FPO-1-83 - (19)  
CONTRACT No. N62477-81-C-0498  
TASK 2

**DWG. No. 9**

SCALE 1" = 20'

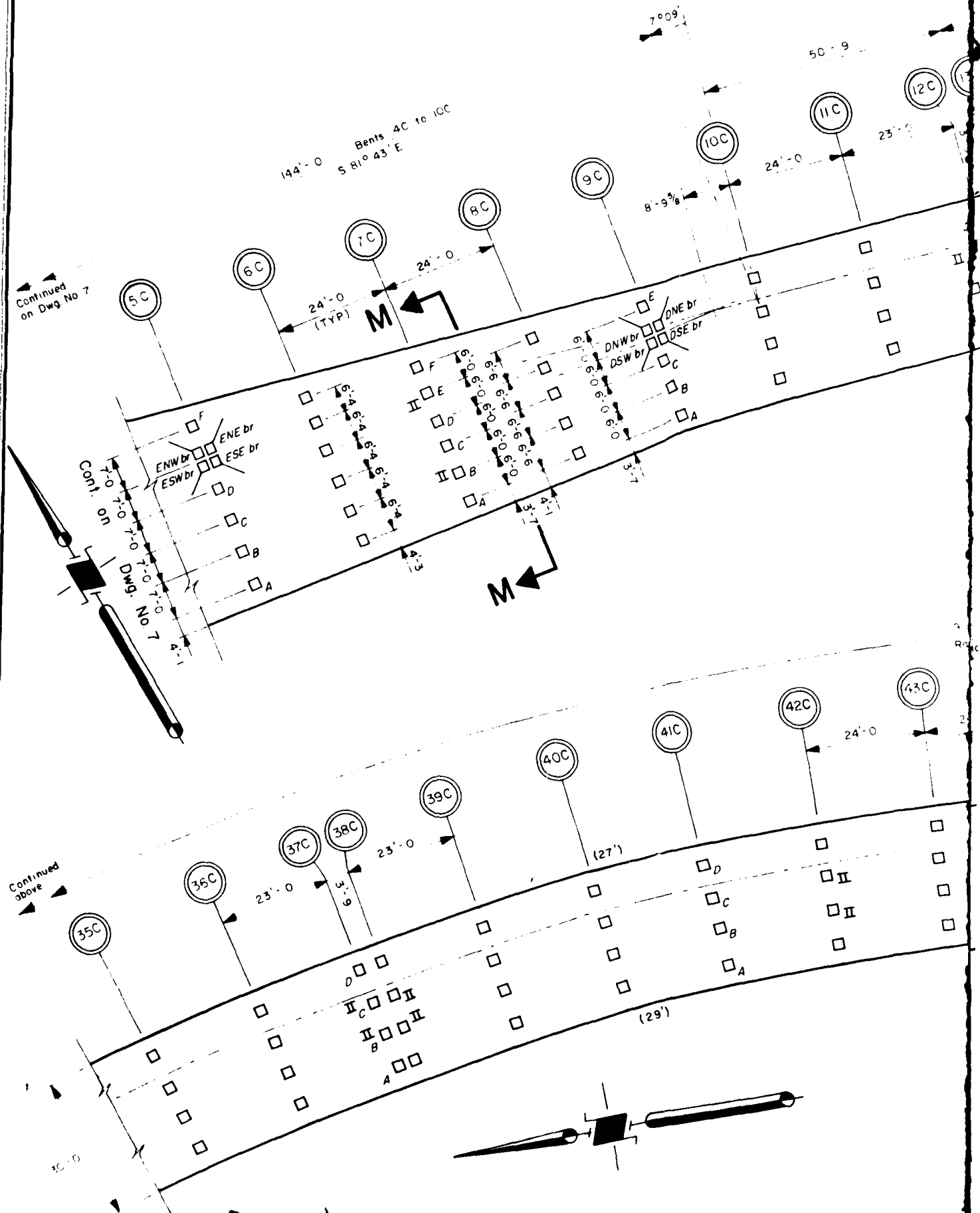
DRAWN F.P.

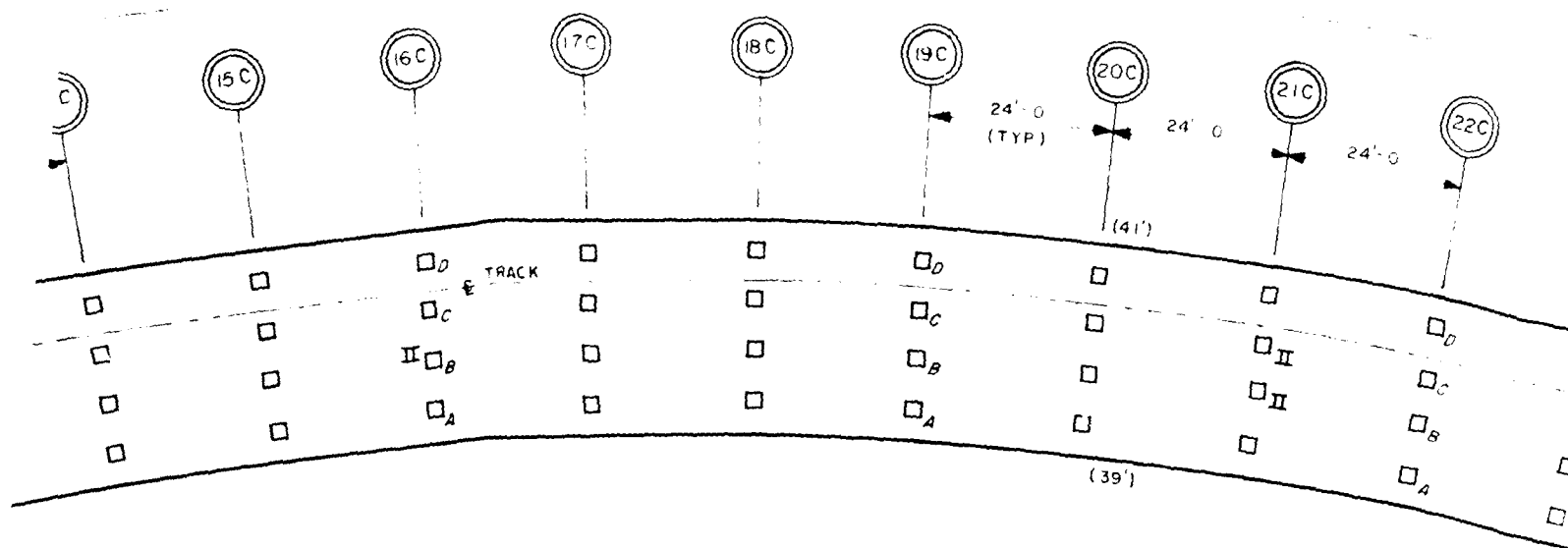
CHECKED *J.P.*

APPROVED *X/E*

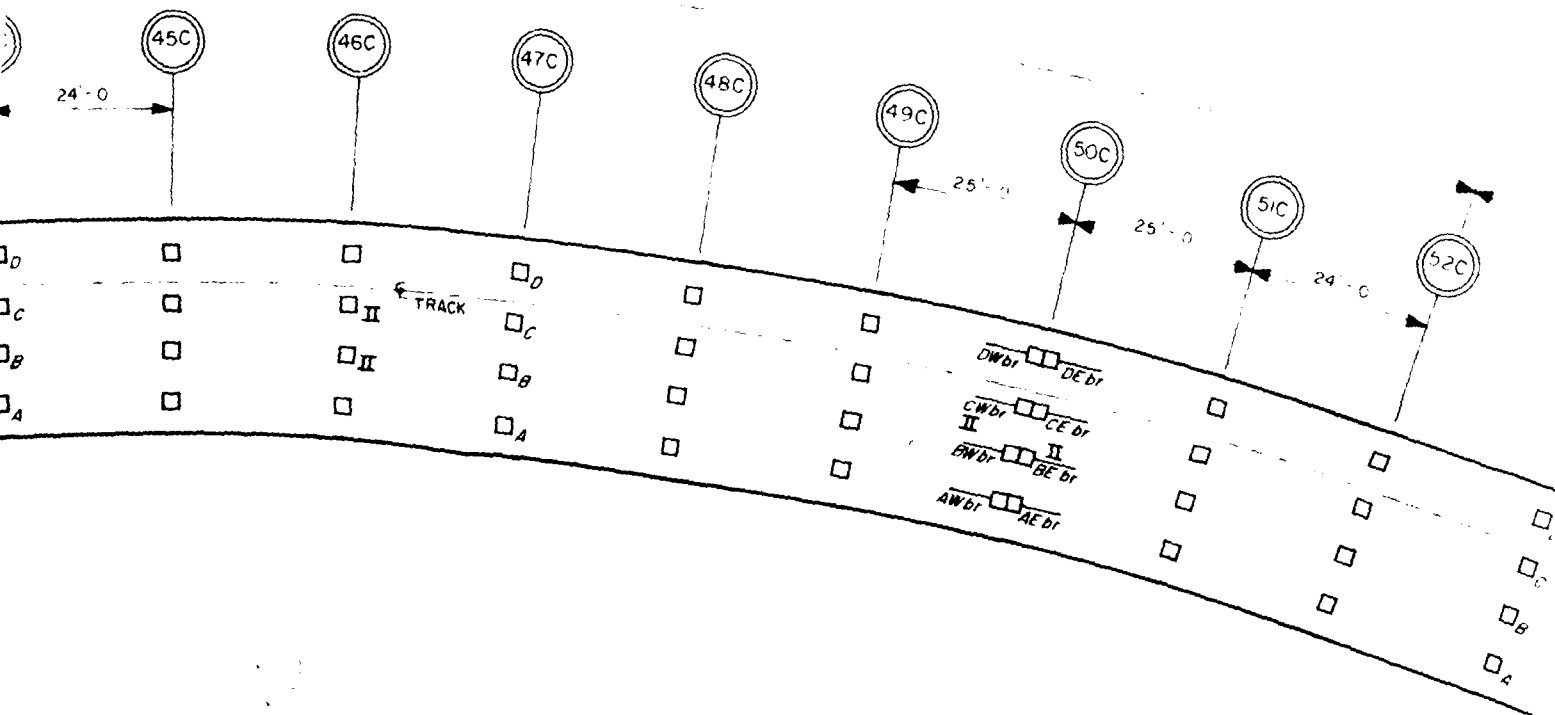
DATE JUNE 7, 1983

PROJECT No  
**83-1/3-2-100**

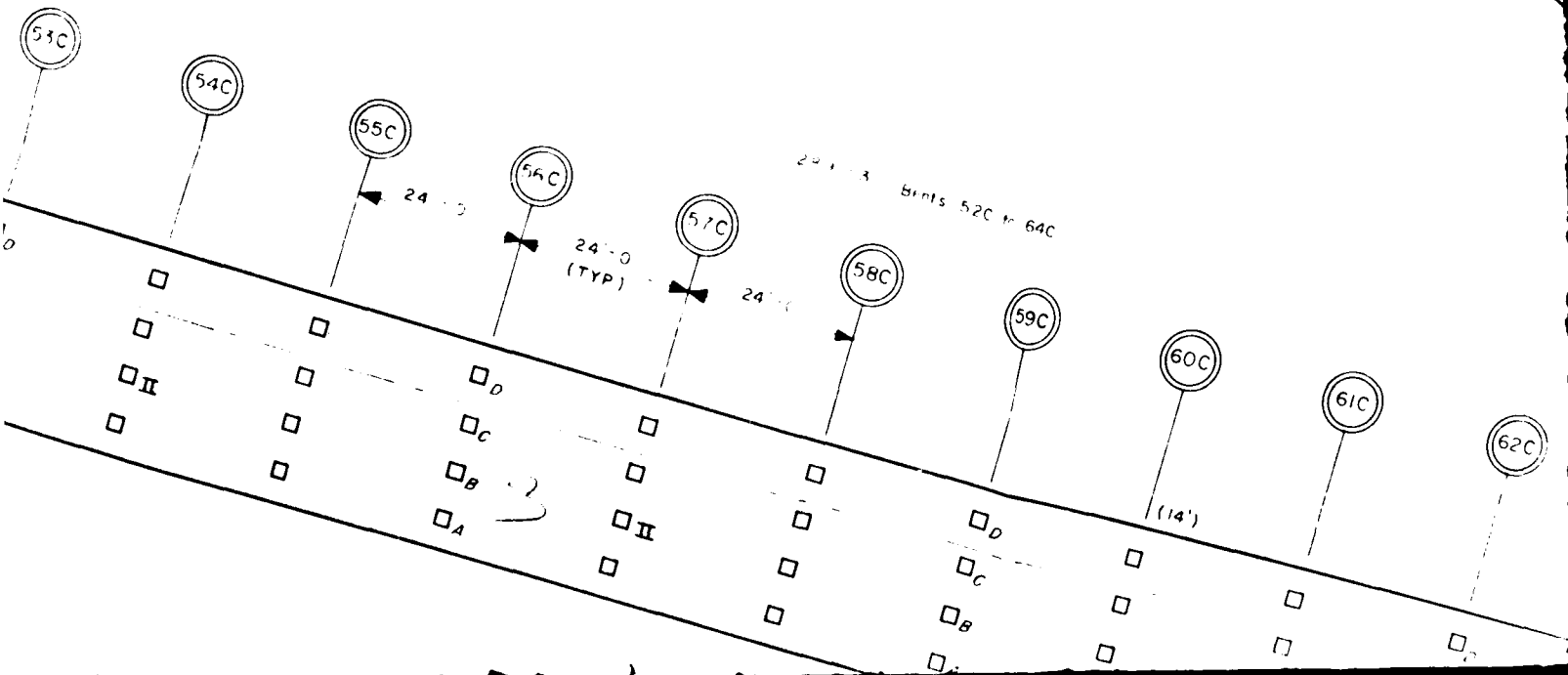
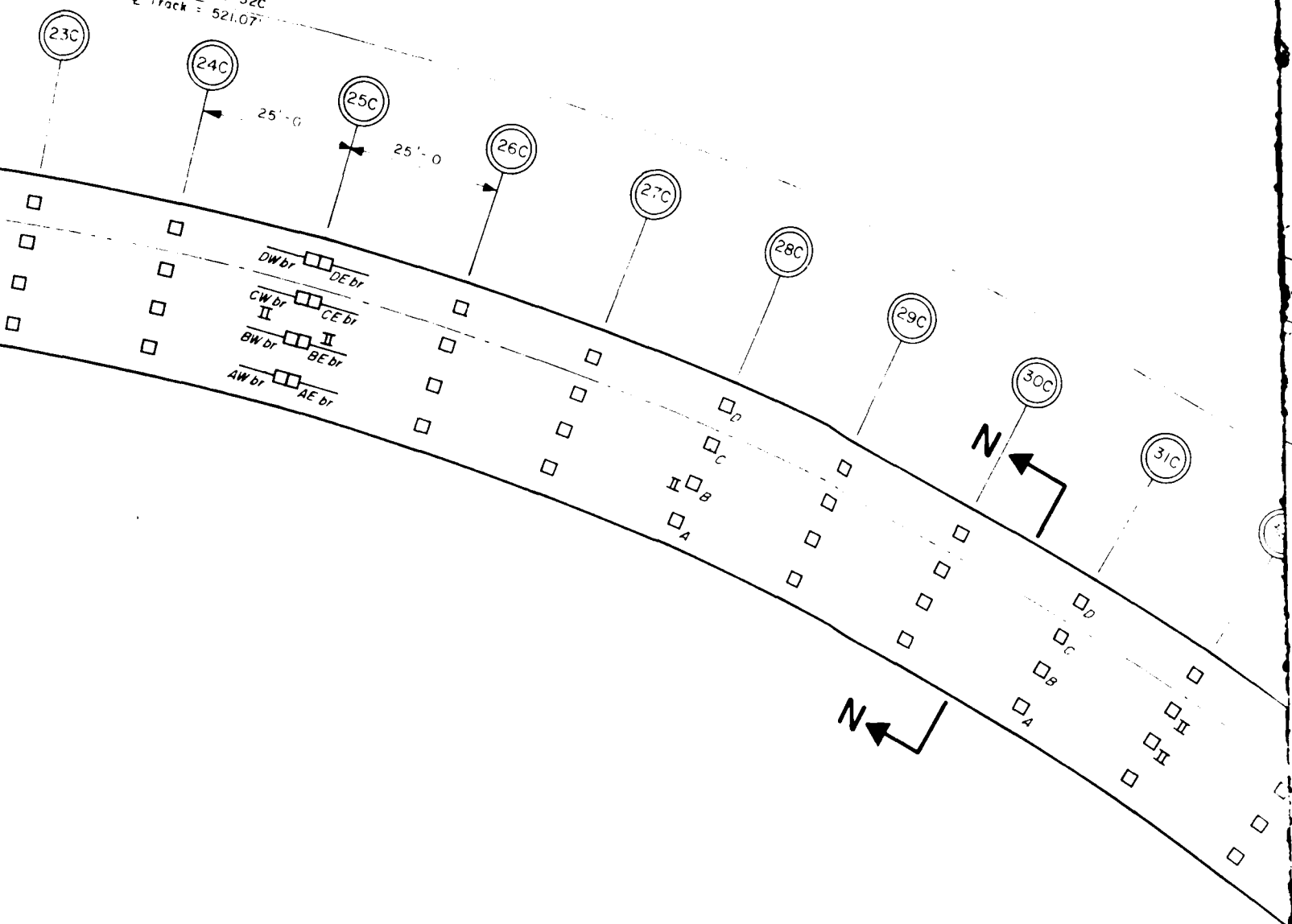


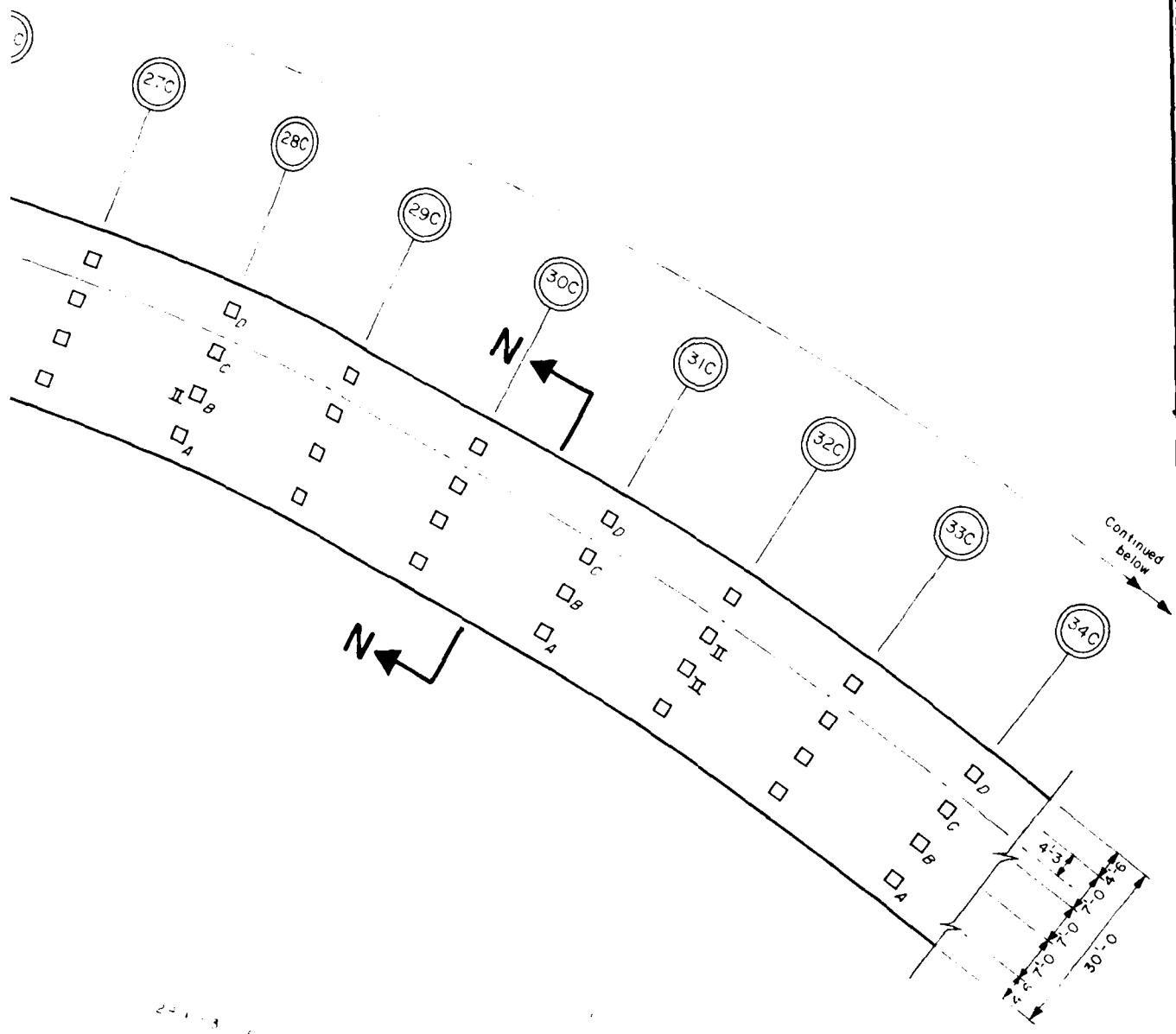


ts 13C to 55C  
Track = 521.07'

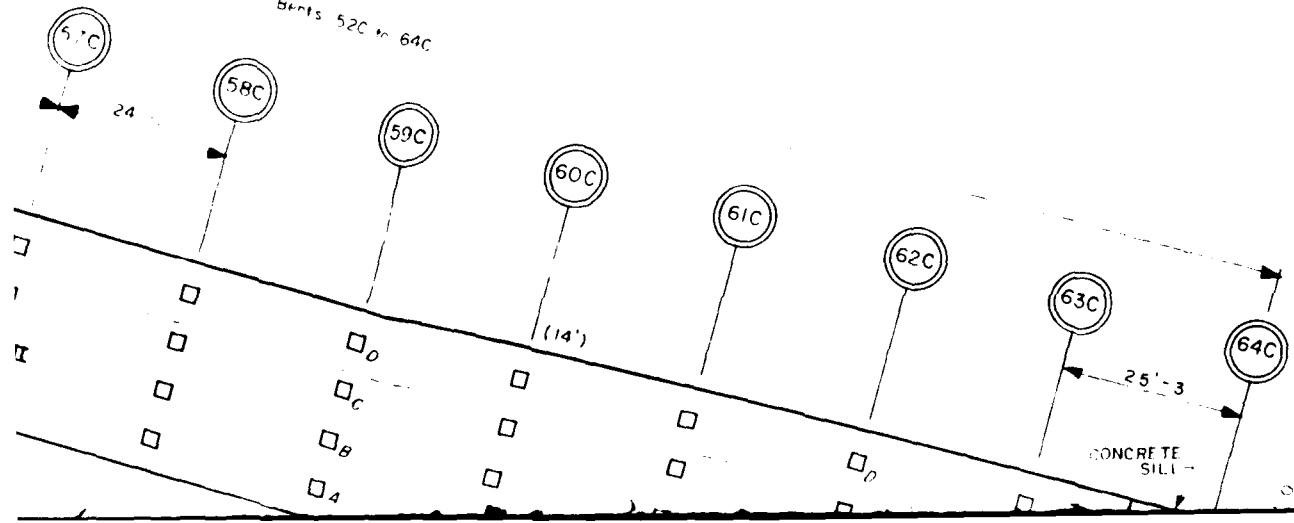


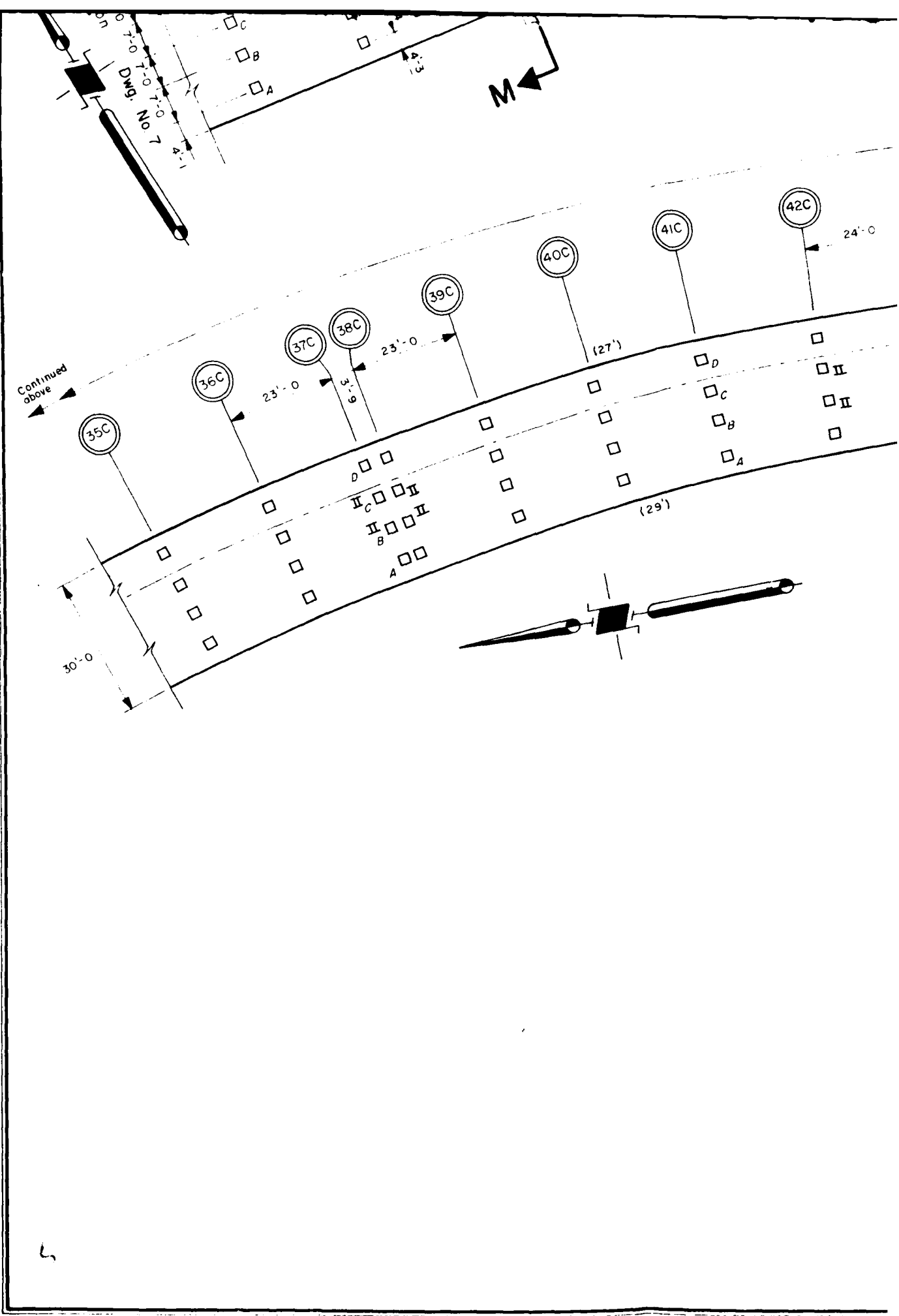
916'-9 Bents 13C to 52C  
 Radius along Q Track = 521.07'



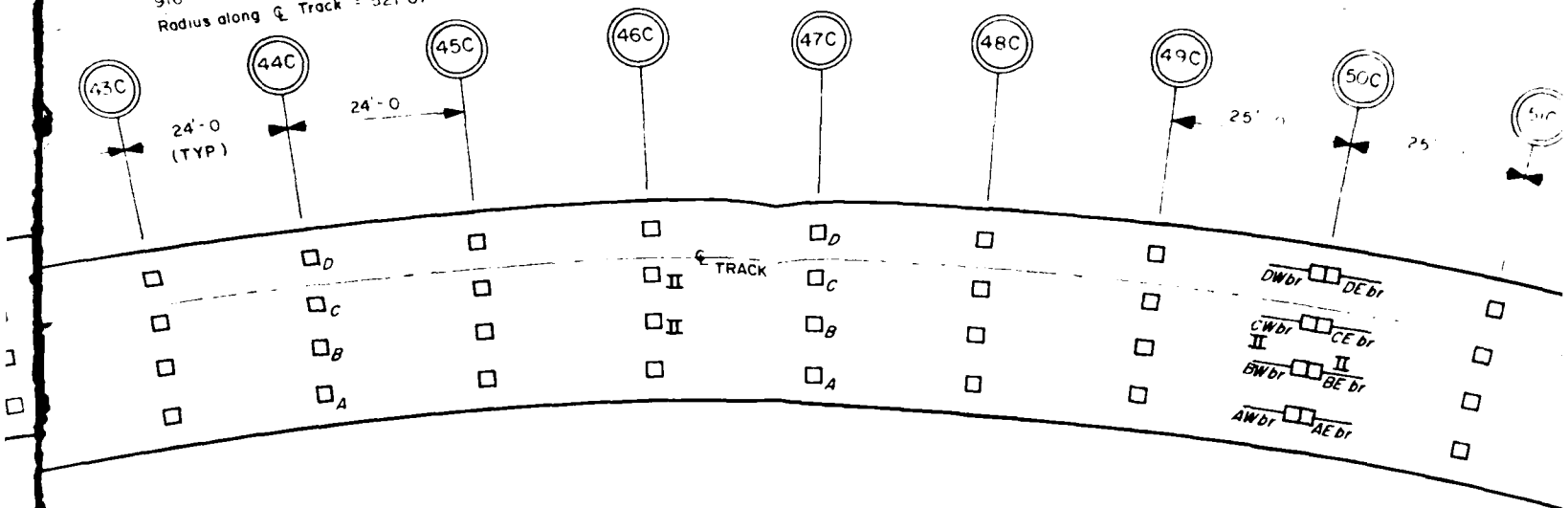


27C to 34C bents 52C to 64C





916'-9 Bents 13C to 55C  
Radius along Q Track = 521.07'



# LEGEND



BENT No.

A

PILE ROW DESIGNAT



18" x 18" OR 20" x 20" C



18" x 18" OR 20" x 20" C

m

PILE MISSING

NB

PILE NOT BEARING

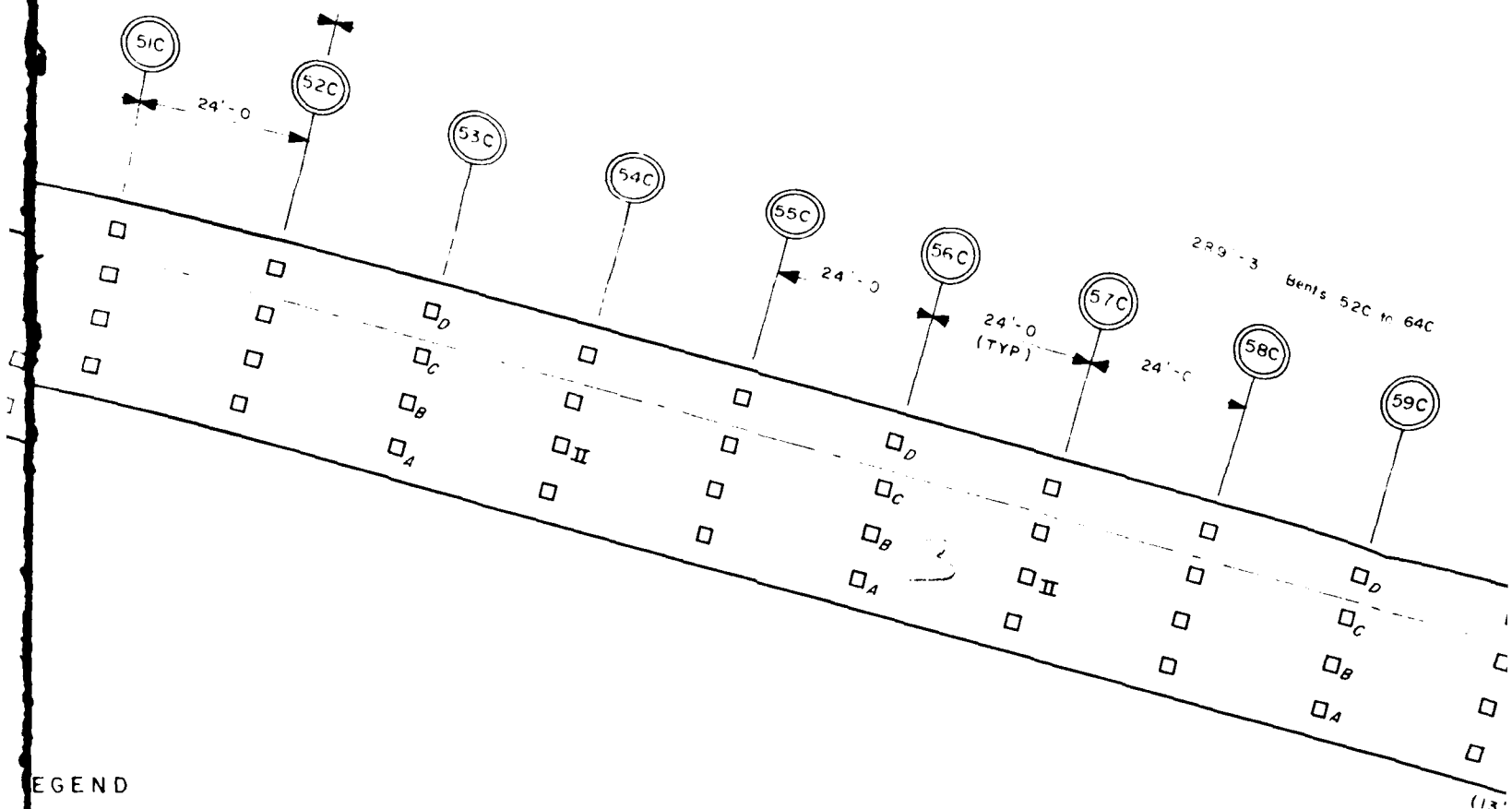
(27)

PILE LENGTH, CAP

## INSPECTION LEVEL DESIGN

LEVEL I - all perimeter  
- all piles in br  
S SIGNIFICANT

LEVEL II - inspected pile  
\* SIGNIFICANT

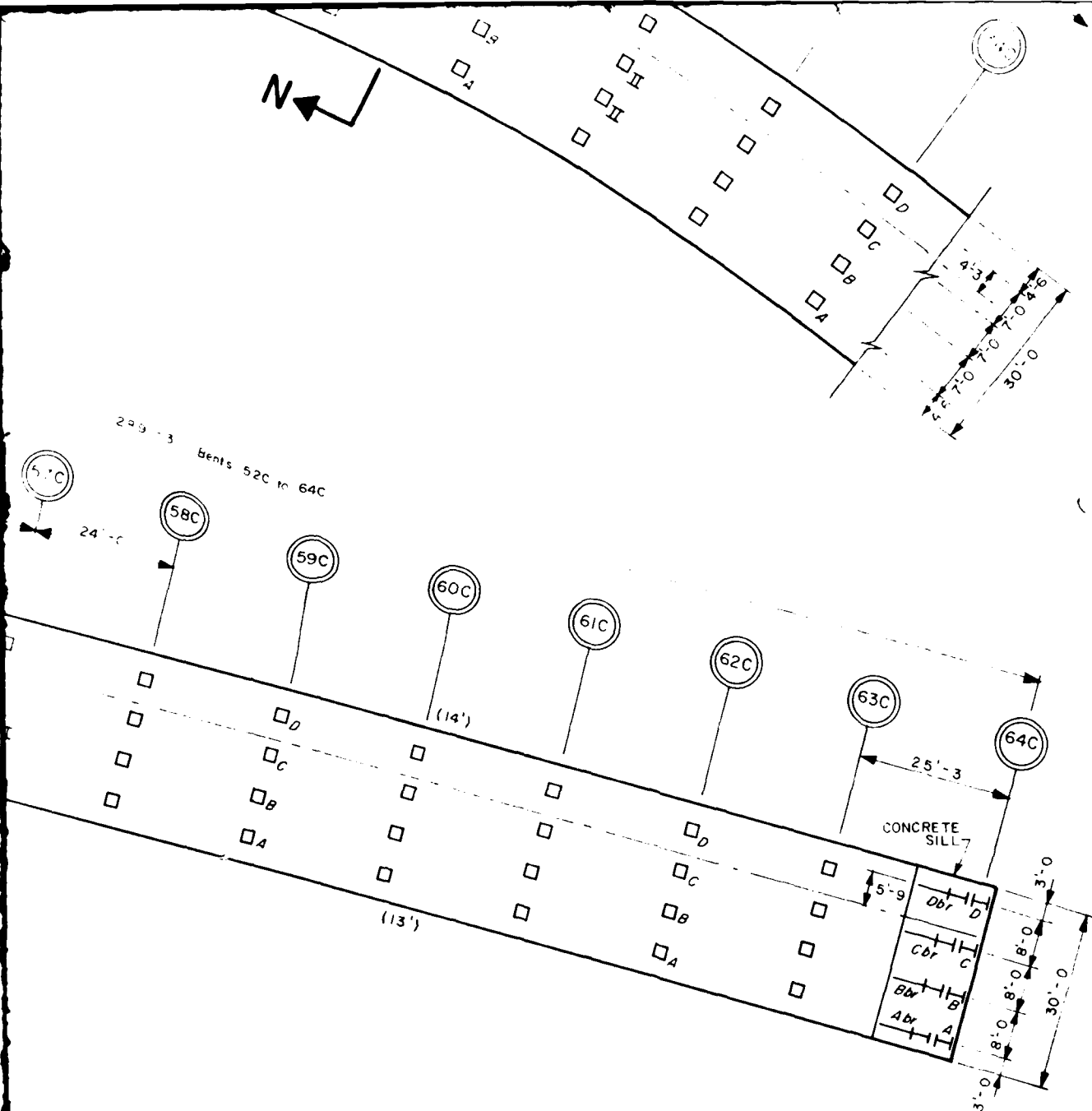


LEGEND

- No
- HOW DESIGNATION
- 18" OR 20" x 20" CONCRETE PILE
- 18" OR 20" x 20" CONCRETE BATTER PILE
- MISSING
- NOT BEARING AT CAP
- LENGTH, CAP TO MUDLINE
- LEVEL DESIGNATIONS
- all perimeter piles from bents 5C to 60C
- all piles in bents 11C, 14C, 20C, 29C, 36C, 39C, 49C and 60C
- S SIGNIFICANTLY DAMAGED PILE
- inspected piles indicated by (II)
- \* SIGNIFICANTLY DAMAGED PILE

Note

|           |
|-----------|
| J. A<br>S |
| AM        |



Note: 20" concrete piles to Bent 39C  
 18" concrete piles in Bents 40C to 64C

**J. AGI & ASSOCIATES CO. LTD.**  
 Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING LOCATION  
 AND CONDITION OF INSPECTED PILING IN  
 PIER 4, CONCRETE TRESTLE  
 U.S. NAVAL WEAPONS STATION  
 CONCORD, CALIFORNIA

CHES DIV NAV FAC ENG COM  
 REPORT No. FPO-1-83-(19)  
 CONTRACT No. N62477-81-C-0498  
 TASK 2

**DWG. No. 10**

SCALE 1" = 20'

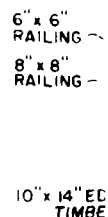
DRAWN F P

CHECKED *J.P.*

APPROVED *XIE*

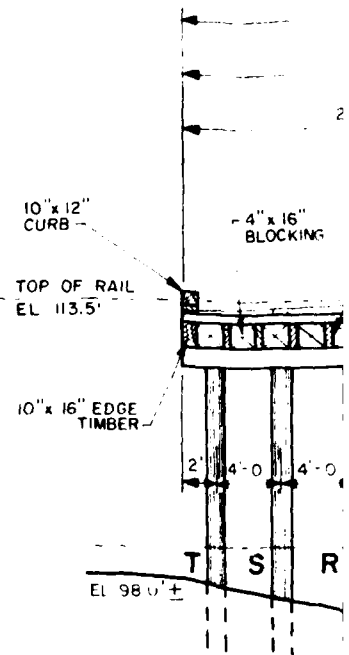
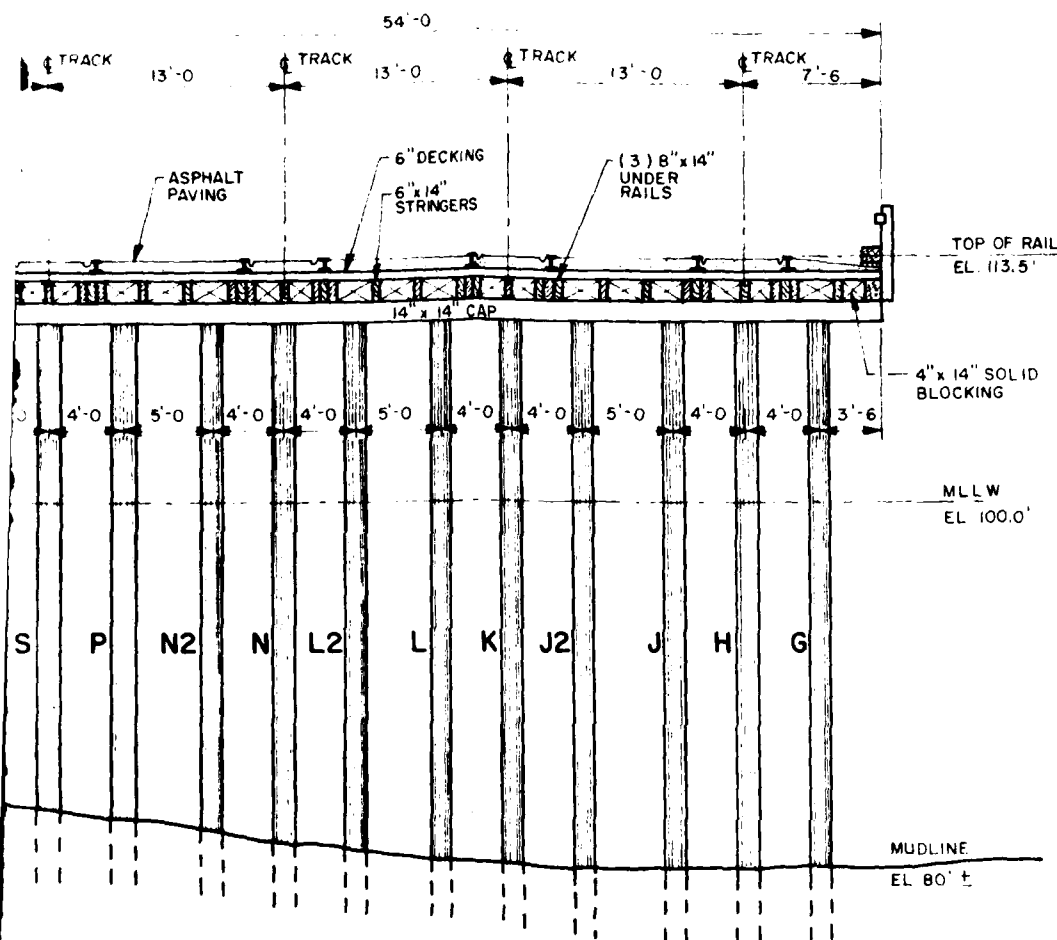
DATE JUNE 7, 1983.

PROJECT No  
**83-1/3-2-100**

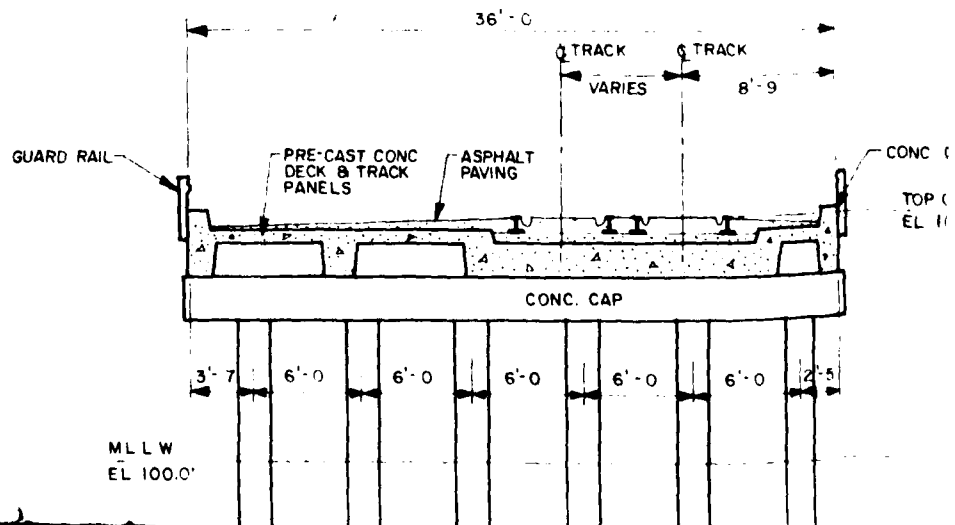
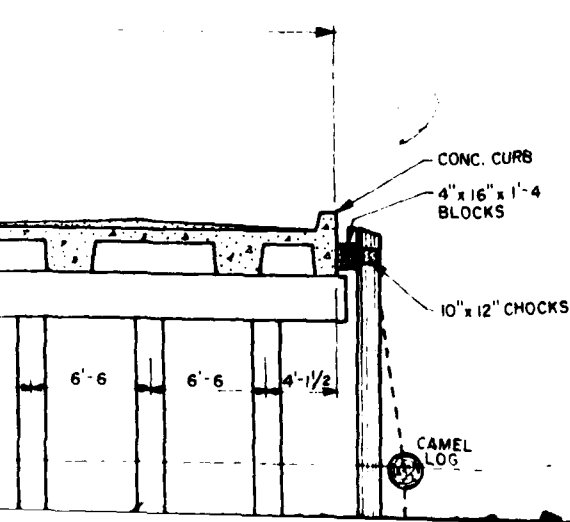


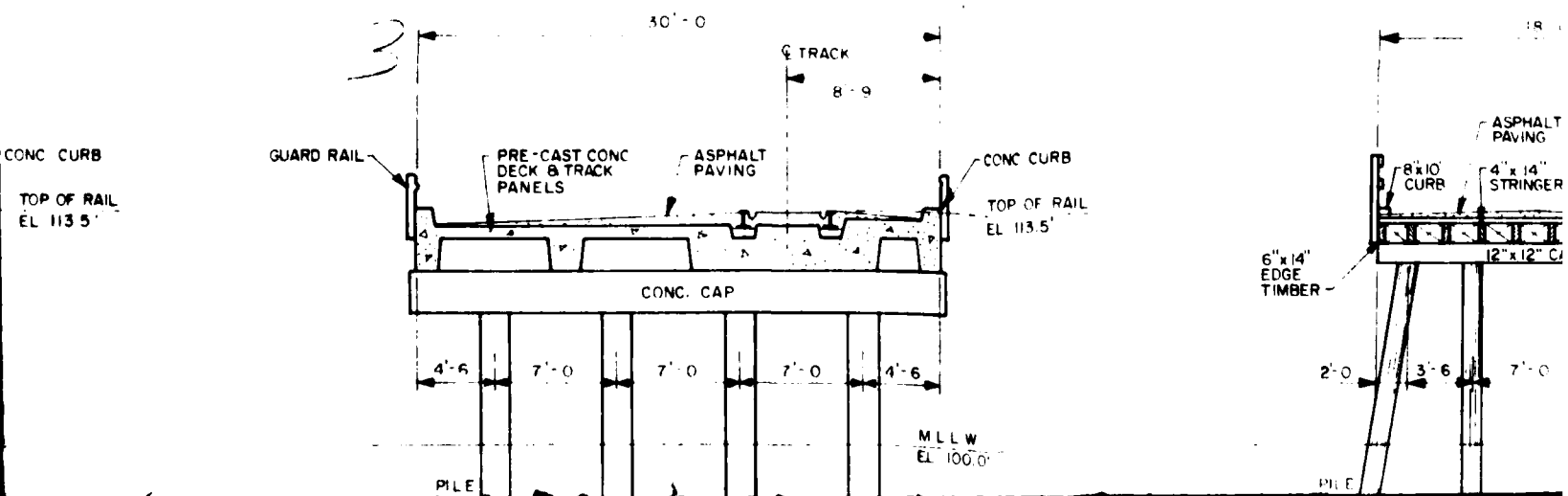
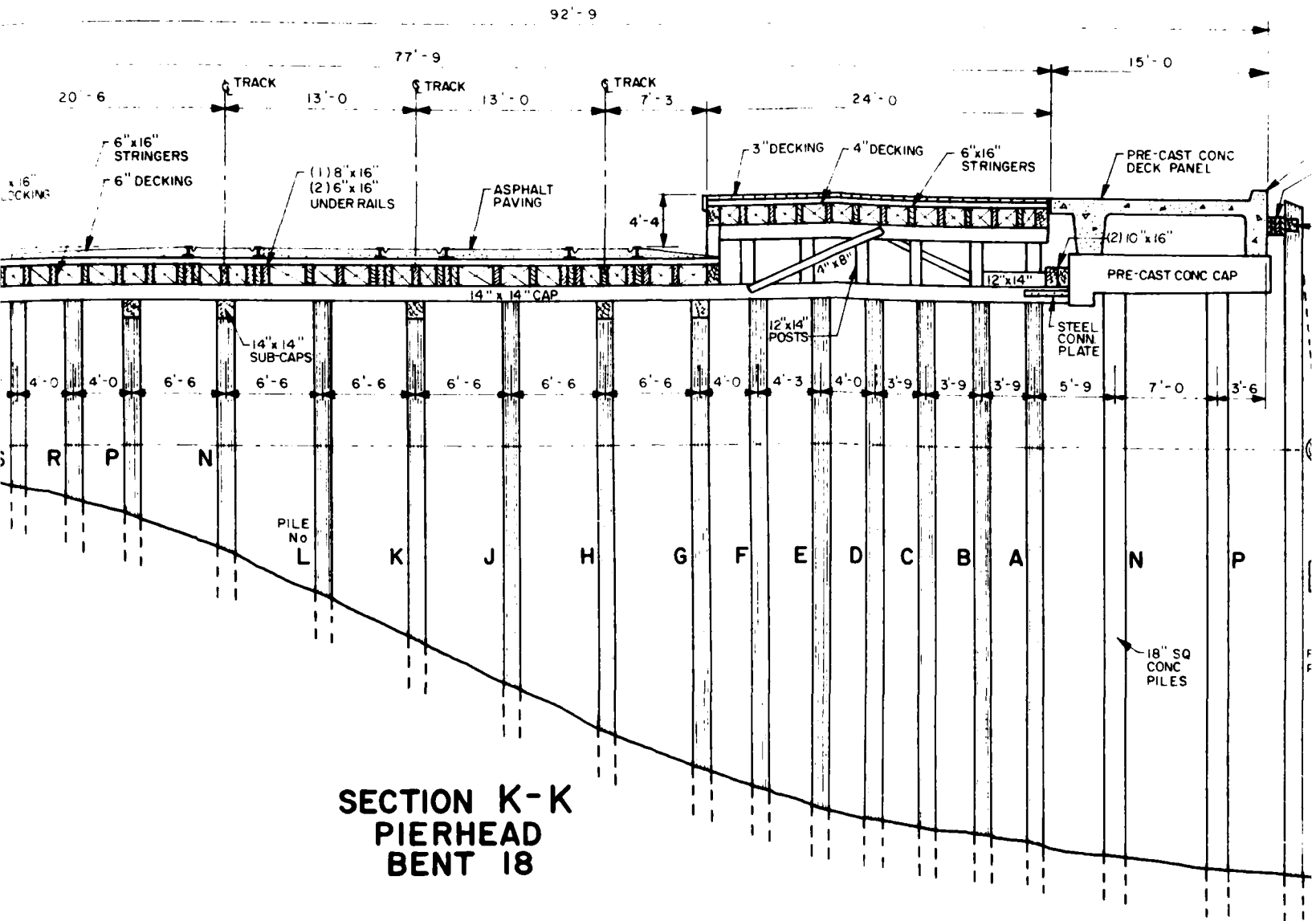
**E**



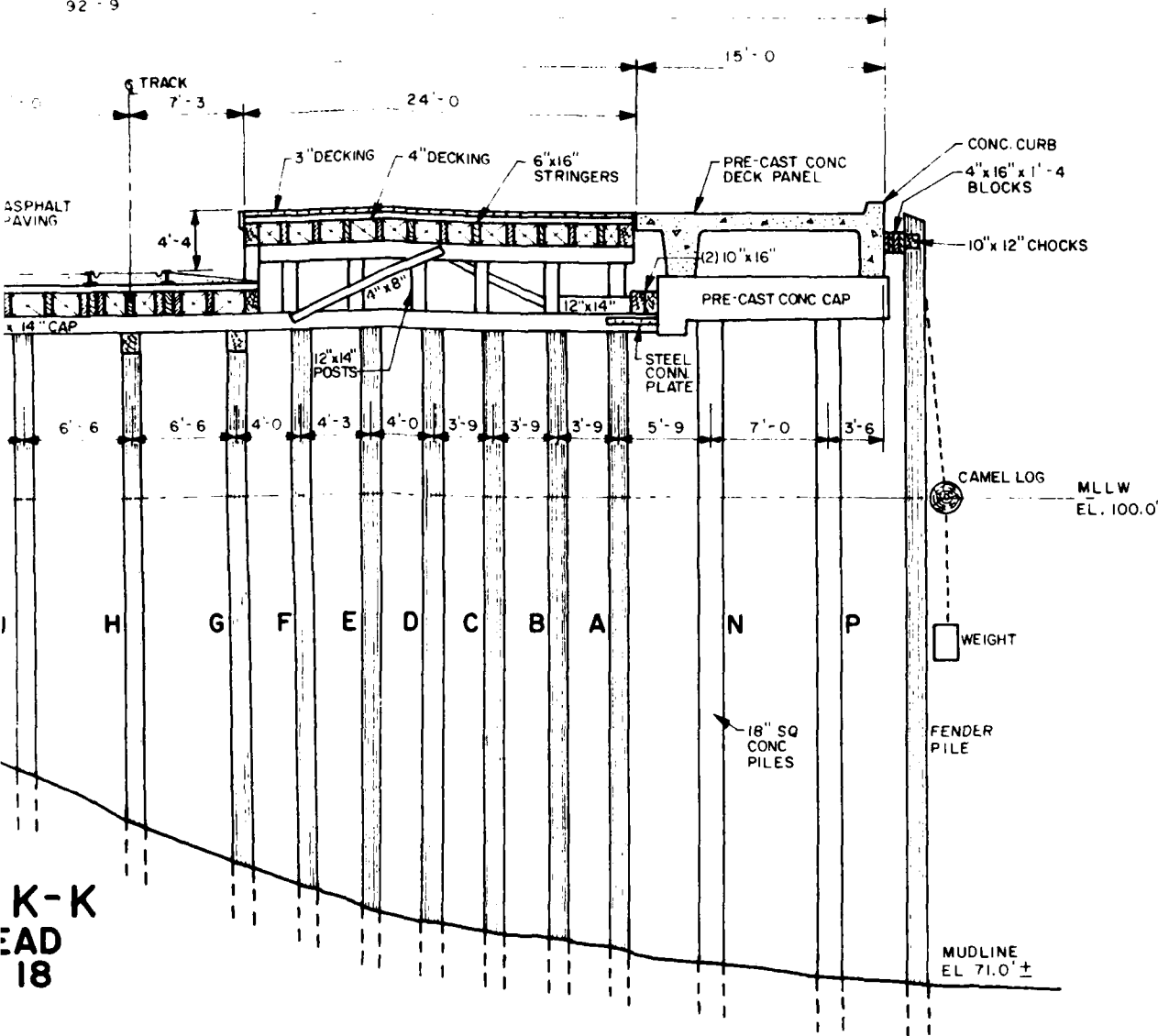


**SECTION J-J  
APPROACH TRESTLE  
BENT 109**

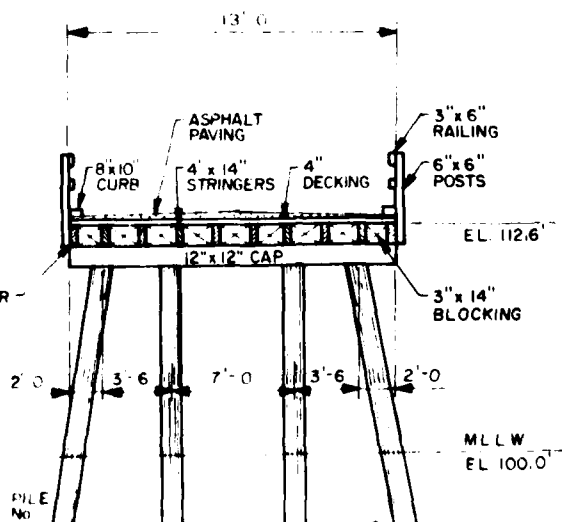
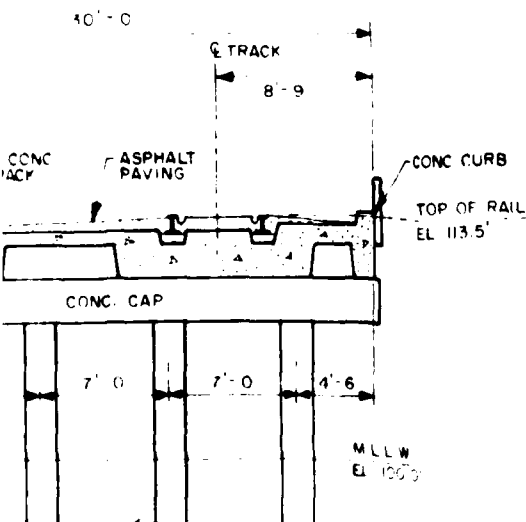




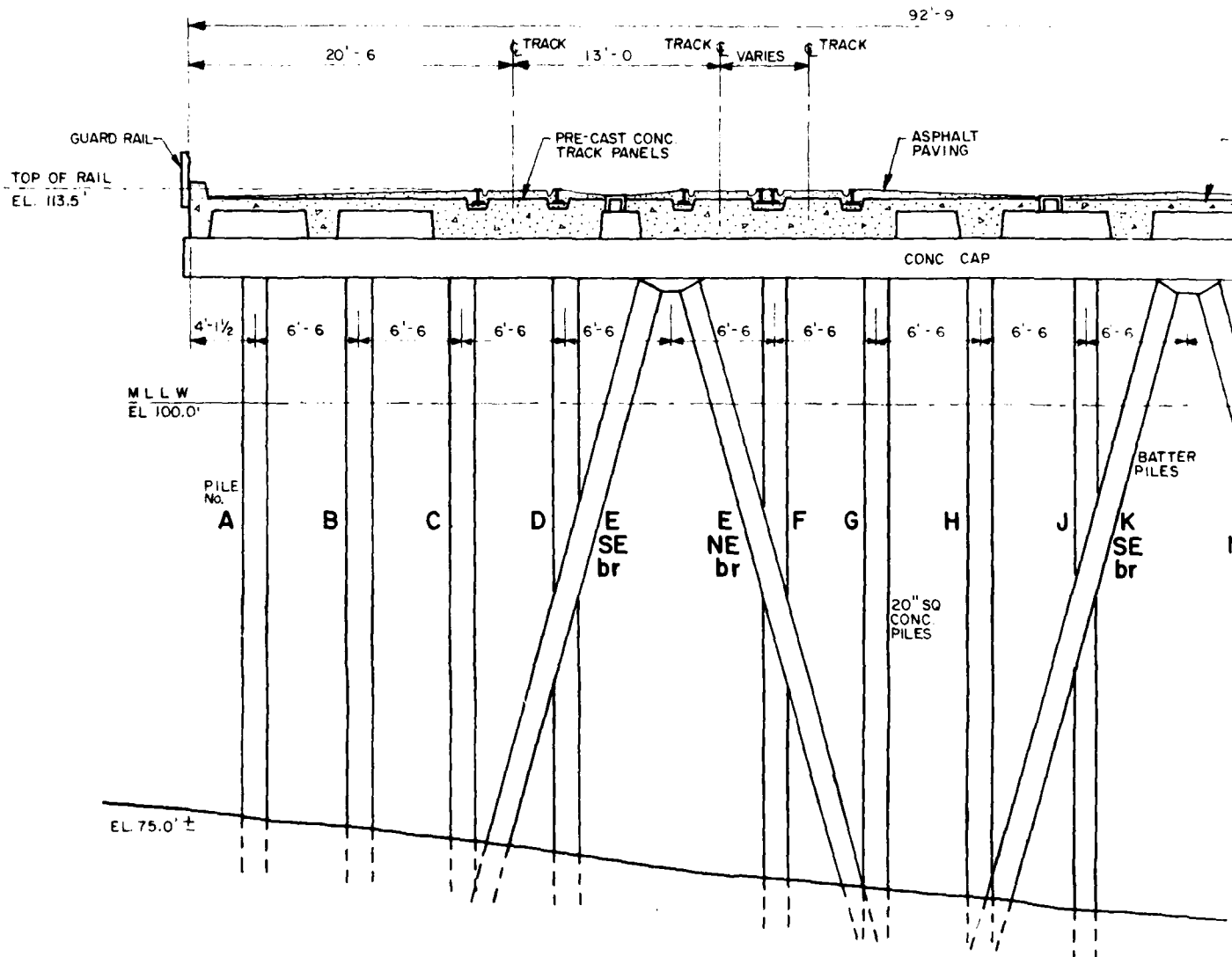
92'-9



K-K  
HEAD  
18



# SECTION H-H APPROACH TRESTLE BENT 166



## SECTION L-L PIERHEAD CONCRETE EXTENSION BENT 3C

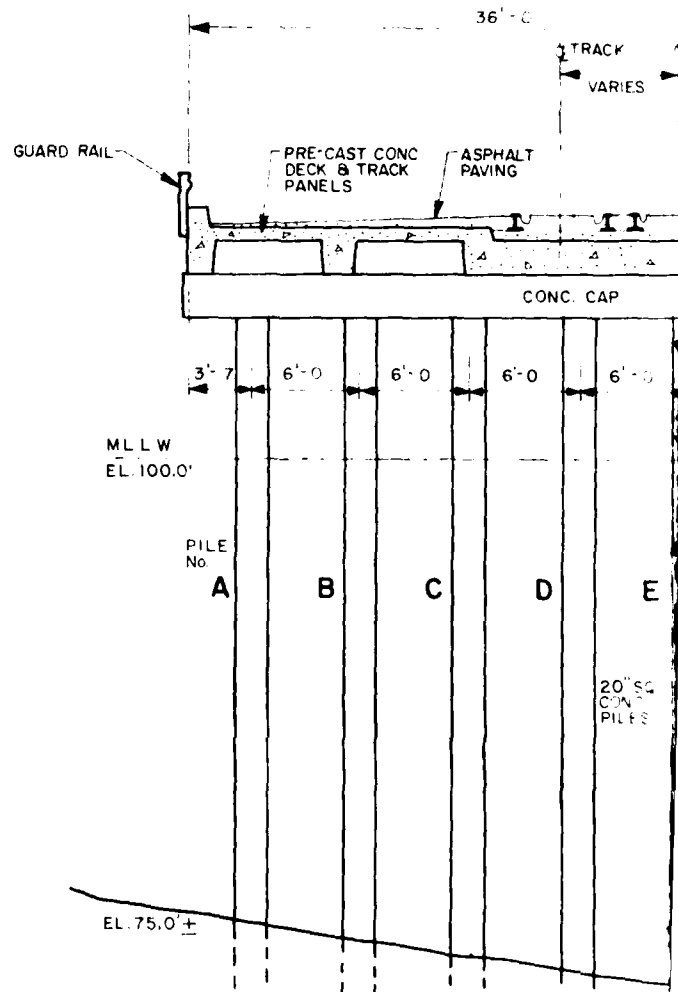
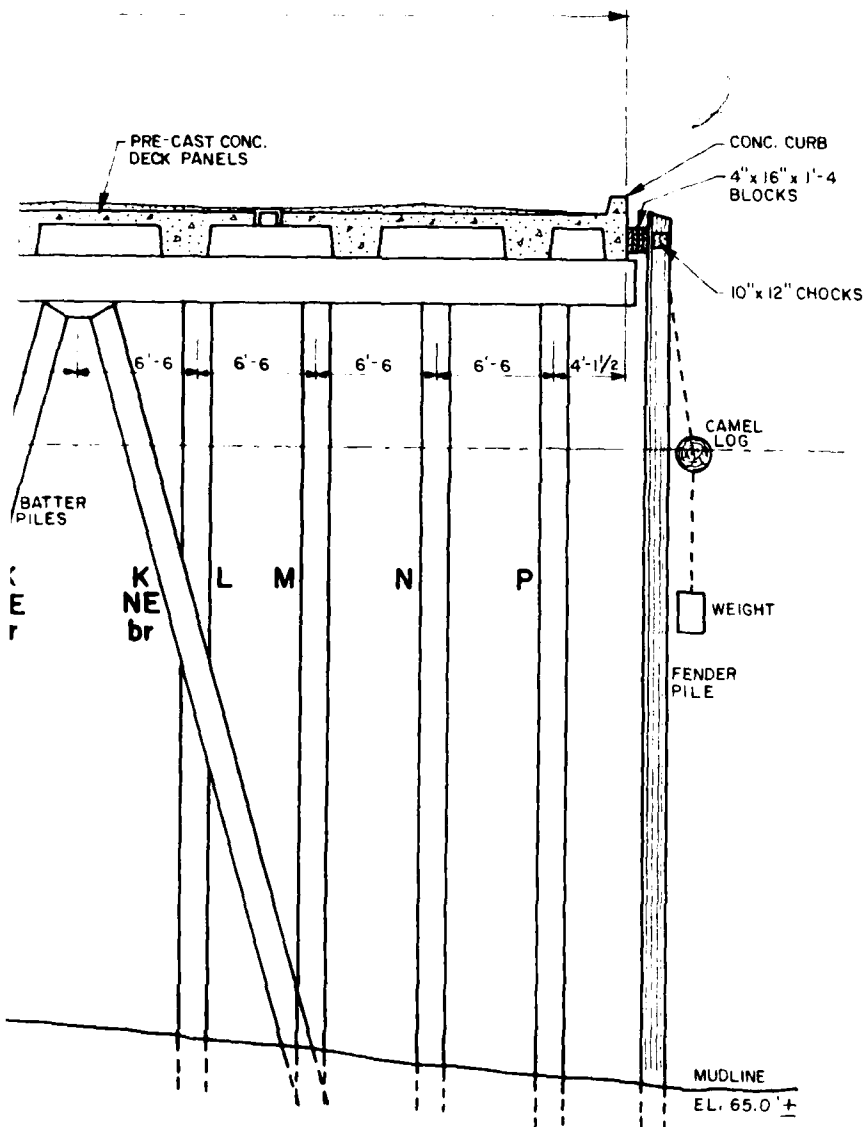
2

EL 84.0 ±

MUDLINE

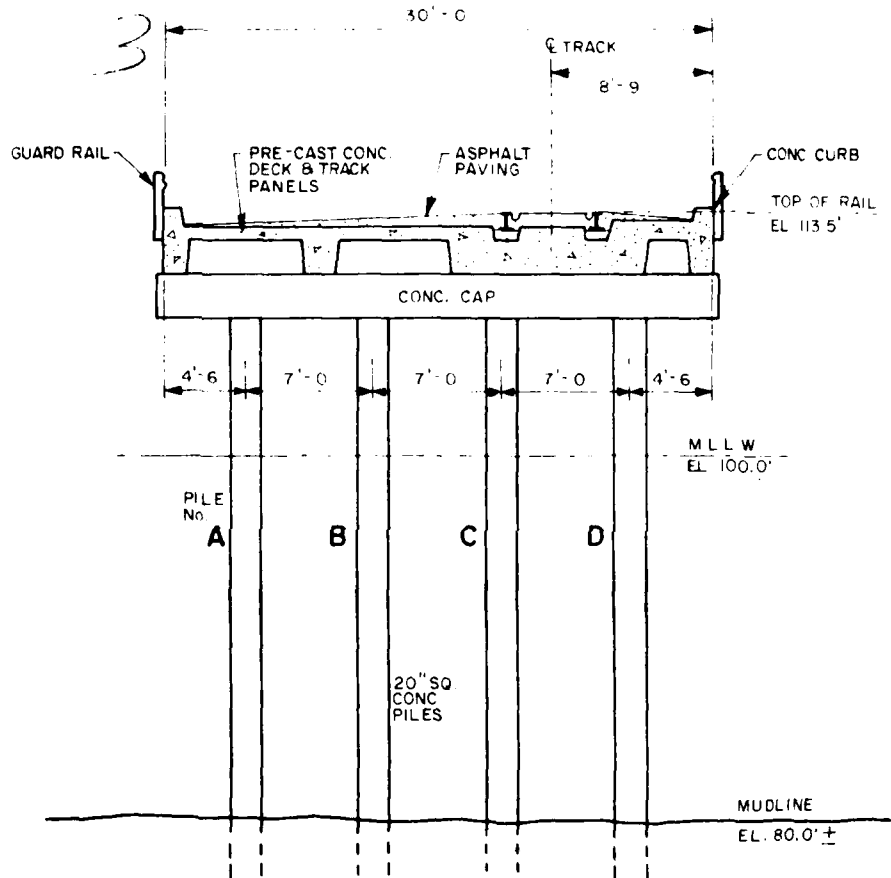
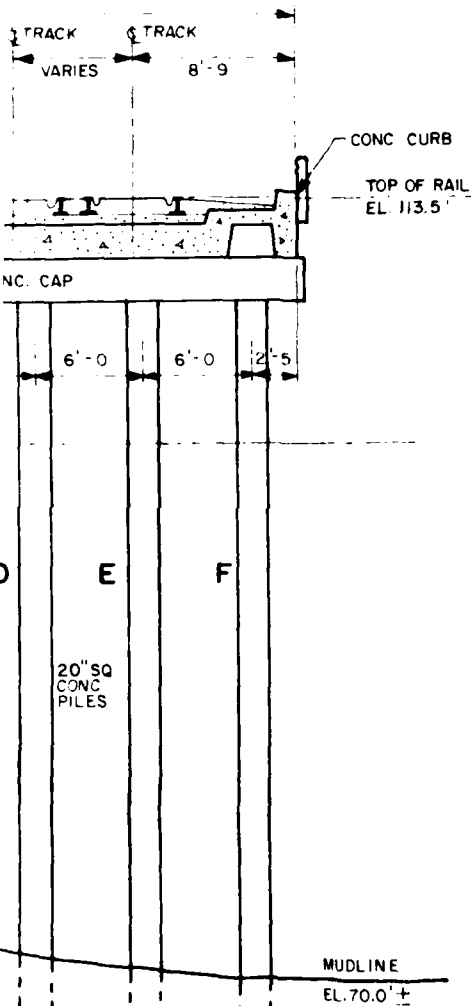
EL 80.0 ±

# SECTION J-J APPROACH TRESTLE BENT 109



# SECTION M-M CONCRETE TRESTLE BENT 7C

# SECTION K-K PIERHEAD BENT 18

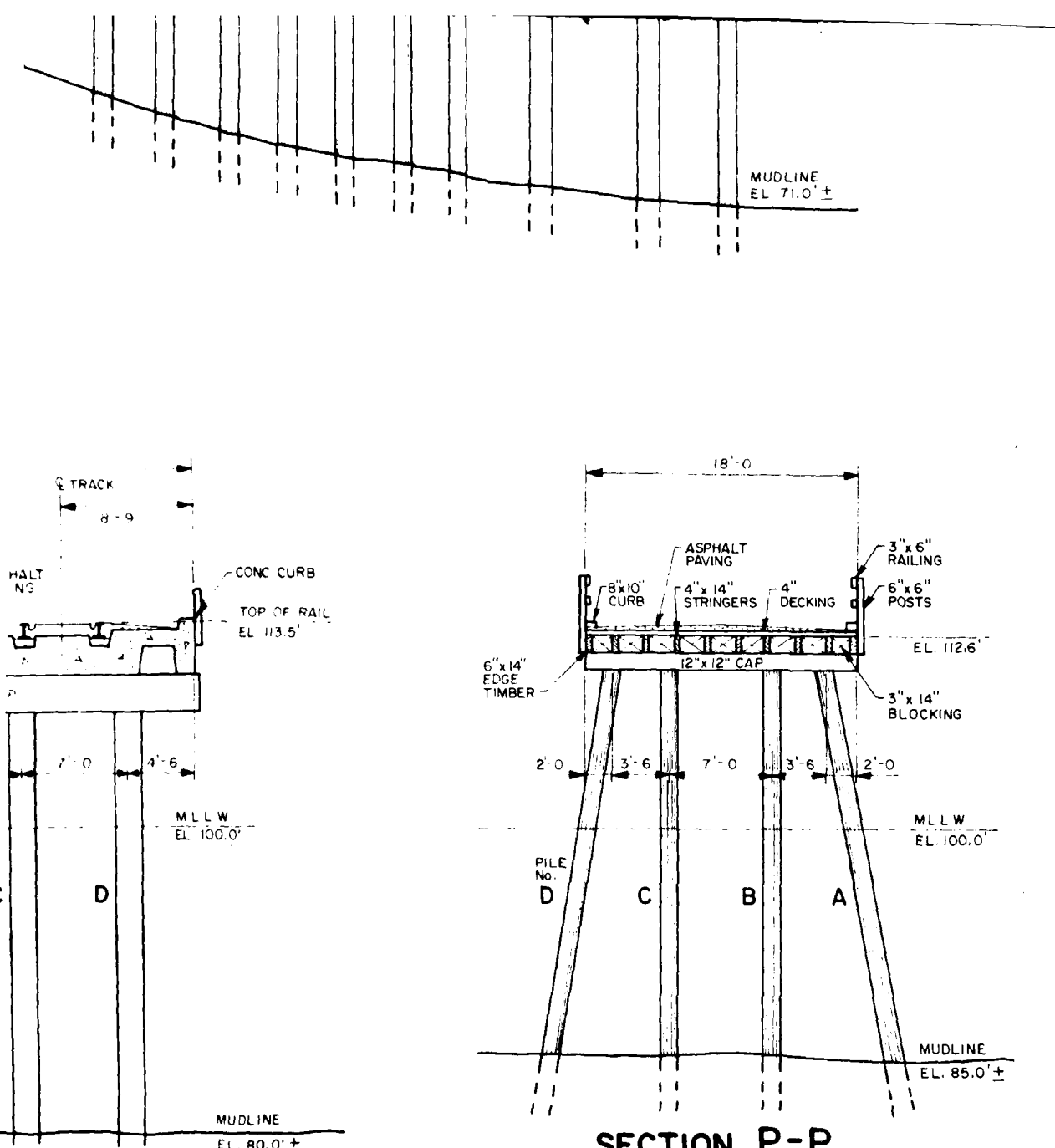


## SECTION N-N CONCRETE TREESTLE BENT 30C

M-M  
TREESTLE  
7C

J. AGI &  
Suite 600,

TYPIC  
U.S. N  
C  
CHES  
REPO  
CONTRA



N-N  
TRESTLE  
30C

# SECTION P-P ACCESS TRESTLE BENT 323

**J. AGI & ASSOCIATES CO. LTD.**  
Suite 600, 1414 Alaskan Way, Seattle, WA

PLAN SHOWING  
TYPICAL SECTIONS THROUGH  
PIER 4  
U.S. NAVAL WEAPONS STATION  
CONCORD, CALIFORNIA  
CHES DIV NAV FAC ENG COM  
REPORT No FPO-1-83-(19)  
CONTRACT No. N62477-81-C-0498  
TASK 2  
**DWG. No. 11**

|            |                     |
|------------|---------------------|
| SCALE      | 1/8" = 1'-0         |
| DRAWN      | F P                 |
| CHECKED    | <i>J.P.</i>         |
| APPROVED   | <i>X/E</i>          |
| DATE       | JUNE 7, 1983.       |
| PROJECT No | <b>83-1/3-2-100</b> |



PHOTOGRAPH No. 18

Approachway Trestle - new piles and brace timbers added subsequent to ship impact damage of 1982. Also note typical timber superstructure.



PHOTOGRAPH No. 19

Concrete Trestle - typical configuration of piles and caps. Note excellent condition of splash zones.

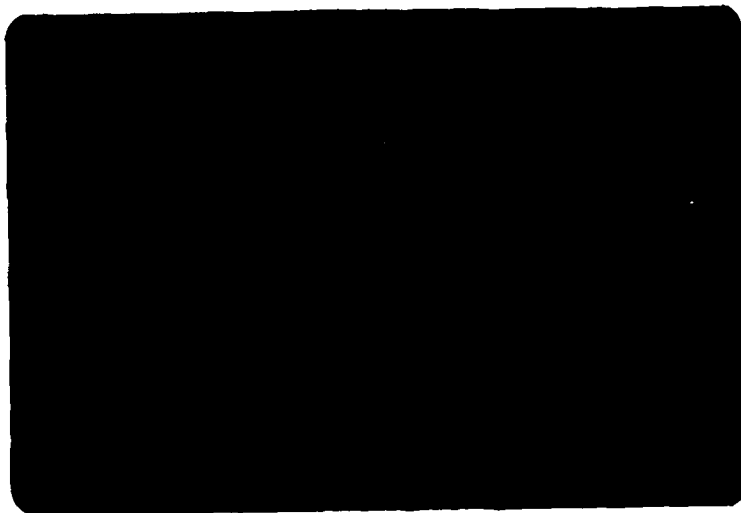
#### 4.2.2 Observed Inspected Condition

The overall condition of Pier 4 is very good. As shown in photographs 20 and 21 and detailed in Tables 5 and 6, the majority of the timber piles are in excellent condition. The Level I inspection covered a total of 952 timber piles. Of the 952 piles inspected, 890 (94%) are undamaged; 50 (5%) piles have sustained marine borer attack or mechanical damage. At this time, this damage is of a minor or cosmetic nature and does not detract from the structural integrity of the piles. A total of 12 (1%) piles were found to have significant damage. Photographs 22 - 28 illustrate and identify several of the damaged piles found. As shown in these photographs, the damage has been caused by mechanical impact or abrasion, marine borer infestation and by fungal decay. The damaged piles were found throughout the structure and the damage on individual piles was found to range from the pile top through the splash zone to the intertidal zone.

As shown in photograph No.18, one section of the Approach Trestle in the vicinity of Bent 120 has recently sustained ship impact damage. This damage occurred at approximately mid 1982. Maintenance to repair the damaged section included the installation of several new creosote treated piles and the addition of both diagonal and horizontal timber braces. These repairs which were completed by the end of 1982 appear to be in good condition.

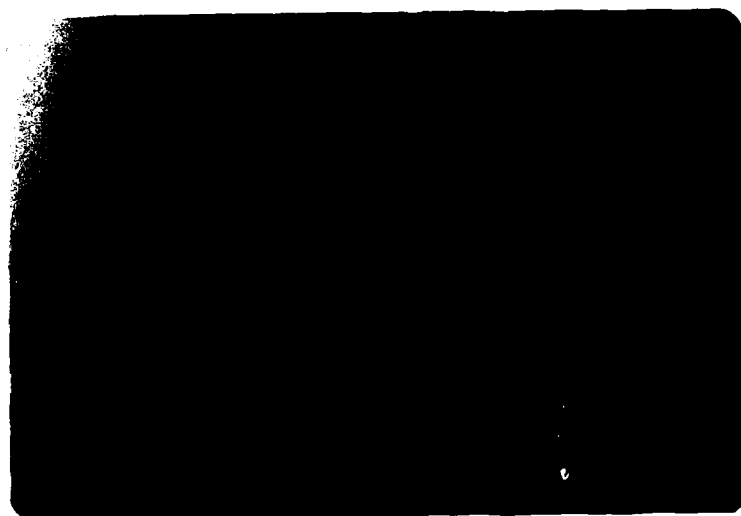
A total of 393 piles were subjected to detailed Level III ultrasonic testing and inspection. Of the 393 piles tested and inspected, 383 (97%) are undamaged and in excellent condition; 9 (2%) piles have sustained minor marine borer attack or mechanical damage and are rated at 90 - 100% of their original cross-sectional area, and 1 (1%) pile (photographs 22 and 23) has sustained heavy damage and is rated at 0 - 25% of its original cross-sectional area.

As shown in Table 4, the condition of the concrete piles is excellent. A total of 222 piles were included in the Level I inspection. No evidence of damage was found. Similarly, no evidence of damage was found on any of the 50 piles subjected to detailed Level II cleaning and inspection (see photographs 29 and 30).



PHOTOGRAPH No. 20

Bent 216 - Pile G. Note dense fouling and apparent good condition of pile.



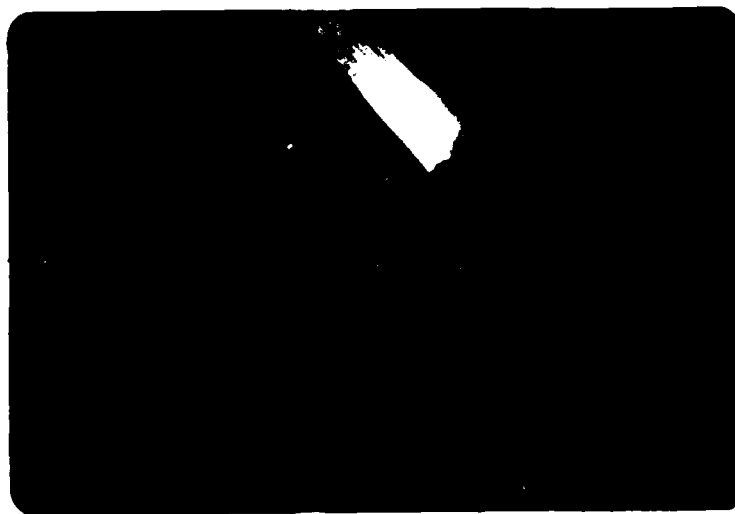
PHOTOGRAPH No. 21

Bent 216 - Pile G. Note good condition of pile confirmed by removal of fouling.



PHOTOGRAPH No. 22

Bent 309.2 - Pile A1. 90% fungal and/or marine borer damage in splash and intertidal zones.



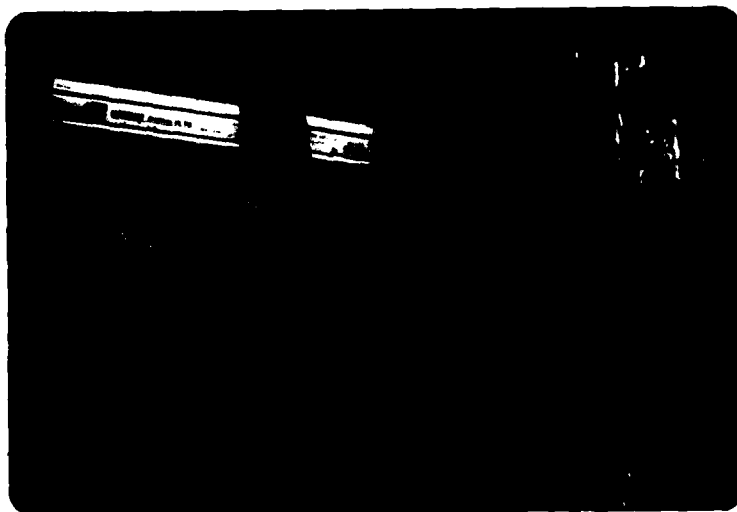
PHOTOGRAPH No. 23

Bent 309.2 - Pile A1. Approximately 90% section loss in intertidal zone.



PHOTOGRAPH No. 24

Bent 28 - Pile N. 75% mechanical and biological section loss from the cap to the intertidal zone.



PHOTOGRAPH No. 25

Bent 28 - Pile N. Approximately 50% marine borer and/or fungal section loss in intertidal zone.



PHOTOGRAPH No. 26

Bent 334 - Pile D. 90% cross section loss in splash zone due to fungal decay.

PHOTOGRAPH No. 27

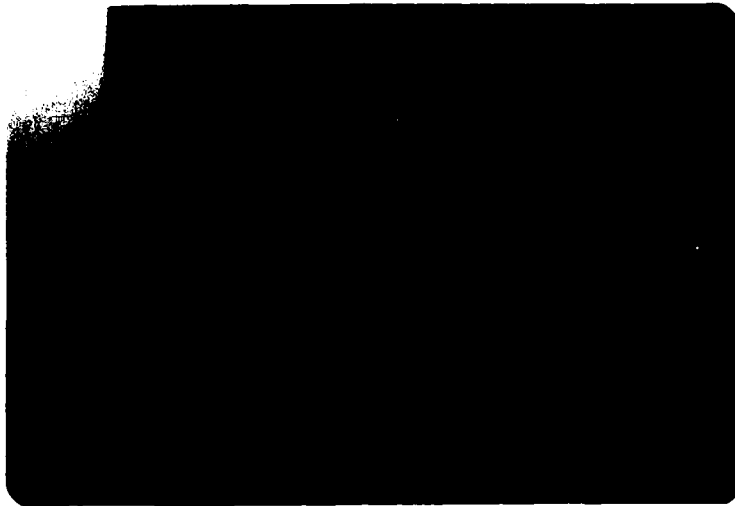
Bent 352 - Pile A. Pile has been stubbed. The lower stub has sustained a loss of approximately 90% cross sectional area due to marine borer and/or fungal damage.





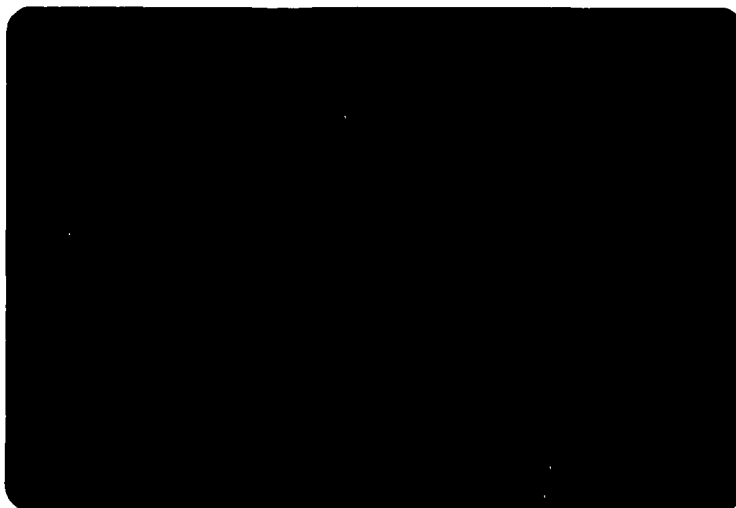
PHOTOGRAPH No. 28

Typical attack noted in intertidal zone of several piles. Decay extends in 1 - 2 inches and total section loss is generally less than 5%.



PHOTOGRAPH No. 29

Level II cleaned concrete pile. Note excellent condition of pile and density of fouling organisms.



PHOTOGRAPH No. 30

Level II cleaned pile. Note excellent condition of concrete at corner of pile. Also note turbidity of water.

#### 4.2.3 Structural Condition Assessment

The majority of the inspected timber piles were found to be in excellent condition. The pile loading capacity for all Level III inspected piles is given in the computer print-out, Table 6. This Table gives the P-ULT, ultimate capacity of the pile column in pounds, based on the measured parameters of length, original diameter and remaining cross-sectional area. For details on the program, see the appendices.

Of the 393 piles inspected in the Level III inspection, only one pile will require maintenance at this time. A total of 12 piles from the Level I inspection were found to have sustained significant damage and will also require restorative maintenance or replacement. In addition to the above significantly damaged piles, 9 piles from the Level III inspection and 50 piles from the Level I inspection, were found to have sustained light attack or damage similar to that illustrated in photograph No. 28. As the damage to these piles is of a minor nature and does not significantly detract from the capacity of the piles, maintenance could be deferred at this time. Periodic inspections should, however, be carried out to monitor the condition of these piles.

The concrete piling in Pier 4 are in excellent condition. All 222 piles inspected in the Level I inspection as well as the 50 piles cleaned and inspected in the Level II inspection are undamaged and consequently, no maintenance of these members will be required.

#### 4.2.4 Recommendations

It is recommended that the defective timber pile identified in the Level III inspection and detailed on Tables 5 and 6, be maintained. In addition, the 12 significantly damaged piles identified by the Level I inspection and listed below, should also be maintained. The defective piles are:

| <u>Bent</u> | <u>Row</u> | <u>Bent</u> | <u>Row</u> |
|-------------|------------|-------------|------------|
| 1           | L          | 103         | G          |
|             | R          | 309.2       | A1         |
|             | S          | 317         | A          |
| 28          | W          | 331         | D          |
| 40.8        | Z          | 334         | D          |
| 97          | B          | 352         | A          |

Effective maintenance of these piles could be achieved by the installation of a concrete jacket or alternately, by driving a new replacement pile adjacent to the defective pile. The estimated unit cost for either method is approximately \$2,000.00, therefore the total estimated cost for repairing the defects identified by this inspection is approximately \$26,000.00.

The total number of timber piles inspected in the Level I and Level III inspections is 1345. The total number of significantly damaged piles (13) represents only 1% of this total. When this level of damage is projected over the total 3783 timber piles in the structure, it is estimated that approximately 38 piles will require maintenance. The estimated cost of these repairs is approximately \$75,000.00. See Table 7 for a summary of all maintenance required.

Given the excellent condition of the inspected concrete piles, no

maintenance of these members will be required at this time.

Once the required maintenance to the timber piles has been carried out, the repairs should be re-inspected. This maintenance and re-inspection will serve to ensure the structural integrity of the facility.

In addition to the above re-inspection, it is also recommended that periodic inspections at three to five year intervals be carried out. These subsequent inspections will serve to identify any areas requiring maintenance and will thereby ensure the future structural integrity of the facility. All subsequent inspections should use this report as a datum or baseline.

1. The first step is to identify the problem or question that needs to be addressed. This involves understanding the context and the specific requirements of the task.

2. Next, it is essential to gather relevant information and data. This can be done through research, consultation with experts, or by analyzing existing resources.

3. Once the information is gathered, the next step is to analyze it and identify the key factors that influence the outcome. This often involves breaking down the problem into smaller, more manageable parts.

4. After analysis, a plan or strategy should be developed. This plan should outline the steps that need to be taken to address the problem, taking into account the resources available and the potential challenges.

5. The final step is to implement the plan and monitor the progress. This involves putting the plan into action and regularly checking in to see how things are going. If necessary, adjustments should be made along the way.

|           |   |                       |
|-----------|---|-----------------------|
| B         | = | <i>Bankia Setacea</i> |
| BR        | = | Batter pile           |
| Cap       | = | "0" elevation         |
| CR        | = | Crack                 |
| D         | = | Damaged               |
| E         | = | East                  |
| ITZ       | = | Intertidal zone       |
| <u>L.</u> | = | <i>Linnæa</i>         |
| MBC       | = | Marine borer cavity   |
| MDL       | = | Mudline               |
| N         | = | North                 |
| NB        | = | Not bearing           |
| S         | = | South                 |
| SP        | = | Spalling              |
| UD        | = | Undamaged             |
| W         | = | West                  |

Example: Typical damage notation for concrete piles

37 - A      SP      -10 to -15      12" x 6"      RB Exp.  
↑    ↑        ↑                    ↑        ↑  
Bent   Pile   Damage type   Elevation of damage with respect to the cap "O" point.   Width   Depth   Rebar   Exposed

TABLE 1  
PIER 3 - LEVEL II  
INSPECTION RESULTS OF CONCRETE PILES

| PILE IDENTIFICATION |   |      | DESCRIPTION OF DAMAGE |
|---------------------|---|------|-----------------------|
| Bent                |   | Pile |                       |
| <u>PIERHEAD</u>     |   |      |                       |
| 6                   | - | N    | UD                    |
| 12                  | - | N    | UD                    |
| 18                  | - | N    | UD                    |
| 24                  | - | NE   | UD                    |
| 26                  | - | N    | UD                    |
| 32                  | - | N    | UD                    |
| 36                  | - | N    | UD                    |
| 42                  | - | N    | UD                    |
| 48                  | - | NW   | UD                    |
| 56                  | - | N    | UD                    |
| 62                  | - | N    | UD                    |
| 68                  | - | N    | UD                    |
| 72                  | - | NE   | UD                    |
| 74                  | - | N    | UD                    |
| 78                  | - | N    | UD                    |
| 84                  | - | N    | UD                    |
| 88                  | - | N    | UD                    |
| 91                  | - | N    | UD                    |
| 94                  | - | N    | UD                    |
| 1aC                 | - | N    | UD                    |
| 3C                  | - | N    | UD                    |
|                     |   | KSW  | UD                    |
|                     |   | G    | UD                    |
|                     |   | FSE  | UD                    |
|                     |   | B    | UD                    |

Note: All piles were cleared and inspected at the mid intertidal zone and the mudline.

TABLE 1  
PIER 3 - LEVEL II  
INSPECTION RESULTS OF CONCRETE PILES

| PILE IDENTIFICATION |   |       | DESCRIPTION OF DAMAGE |
|---------------------|---|-------|-----------------------|
| Bent                |   | Pile  |                       |
| APPROACHWAY         |   |       |                       |
| 7C                  | - | E     | UD                    |
|                     |   | C     | UD                    |
| 12C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 13C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 19C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 23C                 | - | B     | UD                    |
| 26C                 | - | CW-Br | UD                    |
|                     |   | BE-Br | UD                    |
| 30C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 33C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 36C                 | - | C     | UD                    |
| 39C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 40C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 44C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 48C                 | - | C     | UD                    |
| 51C                 | - | B     | UD                    |
|                     |   | C     | UD                    |

TABLE 2  
PIER 3 - LEVEL III INSPECTION  
IDENTIFICATION AND DETAILS OF DAMAGED PILES \*

| Pile ID<br>Bent Pile                | Area<br>Rating | Remarks                                               | Pile ID<br>Bent Pile | Area<br>Rating | Remarks |
|-------------------------------------|----------------|-------------------------------------------------------|----------------------|----------------|---------|
| <u>PIERHEAD</u>                     |                |                                                       |                      |                |         |
| 13 - C                              | 100            | Trapped drift log.                                    |                      |                |         |
| 26 - L                              | 100            | 2 open bolt holes in ITZ.                             |                      |                |         |
| 38 - J                              | 90             | 1% MBC in ITZ.                                        |                      |                |         |
| R                                   | 90             | 1% MBC in ITZ.                                        |                      |                |         |
| 59 - J                              | 100            | Trapped drift log.                                    |                      |                |         |
| <u>APPROACH TRESTLE</u>             |                |                                                       |                      |                |         |
| 121 - G                             | 75             | Split at top down 3 ft., 25% mechanical section loss. |                      |                |         |
| 141 - T                             | 90             | 2% MBC in ITZ.                                        |                      |                |         |
| 142 - J                             | 100            | Open bolt hole in ITZ.                                |                      |                |         |
| P                                   | 100            | Open bolt hole in ITZ.                                |                      |                |         |
| S                                   | 90             | 1% MBC and open bolt hole in ITZ.                     |                      |                |         |
| T                                   | 100            | 1% MBC in ITZ.                                        |                      |                |         |
| 161 - J                             | 90             | 2% MBC in ITZ. Open bolt hole.                        |                      |                |         |
| 201 - G                             | 90             | 2% MBC in ITZ.                                        |                      |                |         |
| <u>ACCESS TRESTLE</u>               |                |                                                       |                      |                |         |
| 318 - A                             | 75             | Split at top down 4 ft., 25% mechanical section loss. |                      |                |         |
| * For undamaged piles, see Table 3. |                |                                                       |                      |                |         |

TABLE 3  
COLUMN LOAD CAPACITY CALCULATION  
OF TIMBER PILING

T-5

Pile load capacities were calculated by an inhouse computer program using the Southern Pine Association modified Euler equation for long columns where,

$$P_{ult} = \frac{0.30 E}{(L/d)^2} \times A$$

Pile lengths (L) were taken from mudline to cap. The unsupported length of pile (USL) was taken from below the bracing at the top and ten feet was added at the mudline to allow for the point of fixity. Effective length factor (K) of 0.8 was used. Other program parameters used are described below:

Bent - bent identification  
 Pile - pile (row) identification  
 ITP - type of wood (1=fir)  
 Length - unsupported length - in this project, 5 feet was added onto the USL since the point of fixity at the bottom was considered to be 5 feet below the mudline.  
 EFF-L Factor - effective length factor, K. K=0.8 was used for these calculations  
 ORG-DIA - original pile diameter - taken at mudline  
 EFF-ARA - remaining cross-sectional area based on sonic testing, on the following basis:

| <u>Factor</u> | <u>Cross-Sectional area<br/>remaining</u> |
|---------------|-------------------------------------------|
| 1.00          | 100%                                      |
| 0.90          | 90%-100%                                  |
| 0.75          | 75%-100%                                  |
| 0.50          | 50%- 75%                                  |
| 0.25          | 25%- 50%                                  |
| 0.005*        | 0%- 25%                                   |

(\*the program cannot handle 0.000)

EFF-DIA - effective pile diameter  
 EFF-ARA - effective cross-sectional area of pile  
 C - compression parallel to grain, in psi, for fir  
 L/D - length over diameter ratio

P-ULT, LB - ultimate loading capacity of the pile column in pounds. This refers only to the column length as shown and does not take into account soil conditions (other than to establish the point of fixity), and what the pile was originally driven to in terms of design loads.

It is strongly emphasized that these calculations deal only with the ultimate capacity of the wood pile column within the fixity conditions and USL parameters as perceived. These load calculations are not design load calculations.

(Structural analysis in light of lateral loading was not included since this is considerably beyond the scope of this project. Such an analysis would require details on imposed lateral loading and structural analysis of the entire facility in terms of these loads and existing structural parameters.)

PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT     | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|----------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| PIERHEAD |      |     |              |                 |               |                   |               |                |          |     |             |
| 1.8      | H    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | K    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | N    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
| 2        | A    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|          | B    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|          | C    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|          | D    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|          | E    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|          | F    | 1   | 31.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 825.     | 23  | 108831.     |
|          | G    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|          | J    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | L    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | P    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | R    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|          | S    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|          | T    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 2.2      | H    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | K    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | N    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
| 12.8     | H    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | K    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|          | N    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|          | ABR  | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
| 13       | A    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|          | B    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|          | C    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | D    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | E    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | F    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | G    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | J    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | L    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|          | P    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|          | R    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|          | S    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|          | T    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|          | ABR  | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
| 13.2     | H    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|          | K    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|          | N    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |

PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 25.8 | H    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | K    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | N    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 26   | A    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | B    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | C    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | D    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | E    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | F    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | G    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | J    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | L    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | P    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | R    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | S    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | T    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | V    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | V.5  | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 26.2 | H    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | K    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | N    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 37.8 | H    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | K    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | N    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 38   | A    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | B    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | C    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | D    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | E    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | F    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | G    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | J    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 111601.     |
|      | L    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | P    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | R    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 121693.     |
|      | S    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | T    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | V    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | W    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
| 38.2 | ABR  | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | H    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | K    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | N    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |

PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 45.8 | H    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | K    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | N    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 46   | A    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | B    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | C    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | D    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | E    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | F    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | G    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | H    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | J    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | L    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | P    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | R    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | S    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | V    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | W    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | X    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | Y    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | Z    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | AA   | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | AB   | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 46.2 | H    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | K    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | N    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 48.8 | H    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | N    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 49   | A    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | B    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | C    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | D    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | E    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | F    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | G    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | J    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | L    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | P    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | R    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | S    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | V    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | W    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | X    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | Y    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |

PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 49.2 | Z    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | AA   | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | AB   | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | G    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 55.8 | H    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | K    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | N    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | N    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 56   | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | K    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | N    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | NW   | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 56.2 | A    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | A.5  | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | B    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | B.5  | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 58.8 | C    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | D    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | E    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | F    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 59   | G    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | J    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | L    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 56.2 | P    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | R    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | S    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
| 58.8 | V    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | W    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | K    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 59   | N    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | K    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | N    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 56.2 | A    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | B    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | C    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | D    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 58.8 | E    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | F    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | G    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | J    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 59   | L    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | P    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | R    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | R    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |

PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 59.2 | S    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | K    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 65.8 | N    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | K    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | N    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 66   | A    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | B    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | C    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | D    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| H1.2 | E    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | F    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | G    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 70.2 | J    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | K    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | L    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | P    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
| 66.2 | R    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | S    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 70.8 | K    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | N    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | K    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 71   | N    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | A    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | B    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | C    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
| 70.2 | D    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | E    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | F    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | G    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 70.2 | H    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | J    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | L    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | P    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 70.2 | T    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |

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PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT             | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------------------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| APPROACH TRESTLE |      |     |              |                 |               |                   |               |                |          |     |             |
| 106              | F    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
|                  | G    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|                  | H    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|                  | J    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|                  | J2   | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|                  | K    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 79917.      |
|                  | L    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|                  | L2   | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|                  | N    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|                  | N2   | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|                  | P    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|                  | S    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|                  | T    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|                  | TBR  | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 121              | F.5  | 1   | 48.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 380.     | 36  | 50087.      |
|                  | G    | 1   | 46.00        | 0.800           | 1.080         | 0.750             | 0.935         | 98.94          | 310.     | 39  | 30677.      |
|                  | H    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
|                  | J    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|                  | K    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|                  | L    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|                  | N    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|                  | N2   | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|                  | P    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|                  | S    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|                  | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                  | TBR  | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                  | G    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|                  | H    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
| 122              | J    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|                  | K    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|                  | L    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|                  | L2   | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|                  | N    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|                  | N2   | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|                  | P    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|                  | S    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|                  | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                  | TBR  | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                  | G    | 1   | 52.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 324.     | 39  | 42678.      |
|                  | H    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
|                  | J    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 55420.      |
|                  | P    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 79917.      |
|                  | S    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |

PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 142  | T    | 1   | 33.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 650.     | 26  | 77171.      |
|      | GBR  | 1   | 52.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 324.     | 39  | 42678.      |
|      | G    | 1   | 52.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 324.     | 39  | 42678.      |
|      | H    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 386.     | 35  | 52241.      |
|      | J    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
| 161  | P    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 79917.      |
|      | S    | 1   | 36.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 608.     | 28  | 72125.      |
|      | T    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | TBR  | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | G    | 1   | 48.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 380.     | 36  | 50087.      |
| 162  | H    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | J    | 1   | 40.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 492.     | 31  | 58421.      |
|      | P    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | S    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|      | T    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
| 181  | TBR  | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | G    | 1   | 48.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 380.     | 36  | 50087.      |
|      | H    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | J    | 1   | 40.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 547.     | 30  | 72125.      |
|      | P    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
| 182  | S    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|      | T    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | TBR  | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | G    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 201  | J    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | P    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | S    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | T    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | TBR  | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 202  | G    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | H    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | J    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | P    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | S    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
| 203  | T    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | TBR  | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | G    | 1   | 22.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 1085.    | 17  | 128817.     |
|      | H    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | J    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
| 204  | P    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | S    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | TBR  | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | G    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |

PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 202  | F 5  | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | G    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | H    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | J    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | P    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | S    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | TBR  | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
| 221  | G    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | H    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | J    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | P    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | S    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | T    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | TBR  | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | GBR  | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
| 222  | G    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | H    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | J    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | P    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | S    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | T    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | TBR  | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | GBR  | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
| 241  | G    | 1   | 16.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1170.    | 12  | 154342.     |
|      | H    | 1   | 16.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1170.    | 12  | 154342.     |
|      | AC   | 1   | 16.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1170.    | 12  | 154342.     |
|      | AH   | 1   | 16.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1170.    | 12  | 154342.     |
|      | J    | 1   | 15.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1185.    | 11  | 156321.     |
|      | J2   | 1   | 14.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1185.    | 11  | 156321.     |
|      | P    | 1   | 13.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1200.    | 10  | 158300.     |
|      | S    | 1   | 12.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1200.    | 9   | 158300.     |
| 308  | T    | 1   | 16.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1170.    | 12  | 154342.     |
|      | GBR  | 1   | 0.0          | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1200.    | 0   | 158300.     |
|      | A1   | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | A2   | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | A3   | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | A    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | B    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | C    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
| 318  | D    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | A    | 1   | 22.00        | 0.800           | 1.080         | 0.750             | 0.935         | 98.94          | 1025.    | 19  | 101411.     |

ACCESS TRESTLE

PIER 3  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 331  | B    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | C    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | D    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | A    | 1   | 19.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1150.    | 14  | 151704.     |
|      | B    | 1   | 19.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1150.    | 14  | 151704.     |
|      | C    | 1   | 19.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1150.    | 14  | 151704.     |
|      | D    | 1   | 19.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1150.    | 14  | 151704.     |
|      | E    | 1   | 19.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1150.    | 14  | 151704.     |

TABLE 4  
PIER 4 - LEVEL II  
INSPECTION RESULTS OF CONCRETE PILES

| PILE IDENTIFICATION |      |      | DESCRIPTION OF DAMAGE |
|---------------------|------|------|-----------------------|
| Bent                | Pile |      |                       |
| <u>PIERHEAD</u>     | 6    | - N  | UD                    |
|                     | 12   | - N  | UD                    |
|                     | 18   | - N  | UD                    |
|                     | 24   | - NW | UD                    |
|                     | 26   | - N  | UD                    |
|                     | 32   | - N  | UD                    |
|                     | 36   | - N  | UD                    |
|                     | 42   | - N  | UD                    |
|                     | 48   | - NE | UD                    |
|                     | 56   | - N  | UD                    |
|                     | 62   | - N  | UD                    |
|                     | 68   | - N  | UD                    |
|                     | 72   | - NE | UD                    |
|                     | 74   | - N  | UD                    |
|                     | 78   | - N  | UD                    |
|                     | 84   | - N  | UD                    |
|                     | 88   | - N  | UD                    |
|                     | 91   | - N  | UD                    |
|                     | 94   | - N  | UD                    |
|                     | 1aC  | - N  | UD                    |
|                     | 3C   | - N  | UD                    |
|                     | KSW  | UD   |                       |
|                     | KNW  | UD   |                       |
|                     | G    | UD   |                       |
|                     | ENE  | UD   |                       |
|                     | ESE  | UD   |                       |

Note: All piles were cleaned and inspected at the mid intertidal zone and the mudline.

TABLE 4  
PIER 4 - LEVEL II  
INSPECTION RESULTS OF CONCRETE PILES

| PILE IDENTIFICATION |   |       | DESCRIPTION OF DAMAGE |
|---------------------|---|-------|-----------------------|
| Bent                |   | Pile  |                       |
| <u>APPROACHWAY</u>  |   |       |                       |
| 7C                  | - | B     | UD                    |
|                     |   | E     | UD                    |
| 12C                 | - | C     | UD                    |
| 13C                 | - | B     | UD                    |
| 16C                 | - | B     | UD                    |
| 21C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 25C                 | - | CW-Br | UD                    |
|                     |   | BE-Br | UD                    |
| 28C                 | - | B     | UD                    |
| 32C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 37C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 38C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 42C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 46C                 | - | B     | UD                    |
|                     |   | C     | UD                    |
| 50C                 | - | CW-Br | UD                    |
|                     |   | BE-Br | UD                    |
| 54C                 | - | B     | UD                    |
| 57C                 | - | B     | UD                    |

TABLE 5  
PIER 4 - LEVEL III INSPECTION  
IDENTIFICATION AND DETAILS OF DAMAGED PILES \*

| Pile ID<br>Bent Pile                                         | Area<br>Rating | Remarks                                   | Pile ID<br>Bent Pile  | Area<br>Rating | Remarks                                  |
|--------------------------------------------------------------|----------------|-------------------------------------------|-----------------------|----------------|------------------------------------------|
| <u>PIERHEAD</u>                                              |                |                                           | 122 - H.5             | 100            | New pile.                                |
| 2 - C                                                        | 90             | 1% MBC in ITZ.                            | T                     | 100            | 1% MBC in ITZ.                           |
| F                                                            | 90             | 1% MBC in ITZ.                            | 141 - G               | 100            | 1% MBC in ITZ.                           |
| 13.2 - H                                                     | 90             | 1% MBC in ITZ.                            | T                     | 100            | 1% MBC in ITZ.                           |
| 26 - L                                                       | 100            | Open bolt hole in ITZ                     | 142 - G               | 100            | 1% MBC in ITZ.                           |
| 46 - V                                                       | 90             | 2% MBC in ITZ.                            | 201 - G               | 100            | 1% MBC in ITZ.                           |
| X                                                            | 90             | 1% MBC in ITZ.                            | P                     | 100            | 1% MBC in ITZ.                           |
| 49 - Y                                                       | 90             | 1% MBC in ITZ.                            | <u>ACCESS TRESTLE</u> |                |                                          |
| 56 - A                                                       | 90             | 1% MBC in ITZ.                            | 303 - A               | 90             | 1% mech. and fungal sec.<br>loss in ITZ. |
| B                                                            | 90             | 1% MBC in ITZ.                            | 309.2 - A             | 0              | 90% MB/fungal section loss<br>in ITZ.    |
| 65.8 - K                                                     | 100            | Less than 1% mech.<br>sec. loss in ITZ.   |                       |                |                                          |
| 66 - B                                                       | 100            | Light <u>L.</u> attack.                   |                       |                |                                          |
| 71 - F                                                       | 100            | Small mech. ring-shake<br>off at MDL.     |                       |                |                                          |
| 82 -                                                         |                | Trapped drift log<br>between Bents 82-83. |                       |                |                                          |
| <u>APPROACH TRESTLE</u>                                      |                |                                           |                       |                |                                          |
| 106 - L-Br                                                   | 100            | 1% MBC in ITZ.                            |                       |                |                                          |
| 121 - G.5                                                    | 100            | New pile. **                              |                       |                |                                          |
| H.5                                                          | 100            | New pile.                                 |                       |                |                                          |
| J.5                                                          | 100            | New pile.                                 |                       |                |                                          |
| K.5                                                          | 100            | New pile.                                 |                       |                |                                          |
| L.5                                                          | 100            | New pile.                                 |                       |                |                                          |
| N.5                                                          | 100            | New pile.                                 |                       |                |                                          |
| N2.5                                                         | 100            | New Pile.                                 |                       |                |                                          |
| P.5                                                          | 100            | New pile.                                 |                       |                |                                          |
| * For undamaged piles, see Table 6.                          |                |                                           |                       |                |                                          |
| ** New pile installed Fall '82 to repair ship impact damage. |                |                                           |                       |                |                                          |

TABLE 6  
COLUMN LOAD CAPACITY CALCULATION  
OF TIMBER PILING

T-21

Pile load capacities were calculated by an inhouse computer program using the Southern Pine Association modified Euler equation for long columns where,

$$P_{ult} = \frac{0.30 E}{(L/d)^2} \times A$$

Pile lengths (L) were taken from mudline to cap. The unsupported length of pile (USL) was taken from below the bracing at the top and ten feet was added at the mudline to allow for the point of fixity. Effective length factor (K) of 0.8 was used. Other program parameters used are described below:

- Bent - bent identification
- Pile - pile (row) identification
- ITP - type of wood (1=fir)
- Length - unsupported length - in this project, 5 feet was added onto the USL since the point of fixity at the bottom was considered to be 5 feet below the mudline.
- EFF-L Factor - effective length factor, K. K=0.8 was used for these calculations
- ORG-DIA - original pile diameter - taken at mudline
- EFF-ARA - remaining cross-sectional area based on sonic testing, on the following basis:

| Factor | Cross-Sectional area<br>remaining |
|--------|-----------------------------------|
| 1.00   | 100%                              |
| 0.90   | 90%-100%                          |
| 0.75   | 75%-100%                          |
| 0.50   | 50%- 75%                          |
| 0.25   | 25%- 50%                          |
| 0.005* | 0%- 25%                           |

(\*the program cannot handle 0.000)

- EFF-DIA - effective pile diameter
- EFF-ARA - effective cross-sectional area of pile
- C - compression parallel to grain, in psi, for fir
- L/D - length over diameter ratio

P-ULT, LB - ultimate loading capacity of the pile column in pounds. This refers only to the column length as shown and does not take into account soil conditions (other than to establish the point of fixity), and what the pile was originally driven to in terms of design loads.

- It is strongly emphasized that these calculations deal only with the ultimate capacity of the wood pile column within the fixity conditions and USL parameters as perceived. These load calculations are not design load calculations.

(Structural analysis in light of lateral loading was not included since this is considerably beyond the scope of this project. Such an analysis would require details on imposed lateral loading and structural analysis of the entire facility in terms of these loads and existing structural parameters.)

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT     | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|----------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| PIERHEAD |      |     |              |                 |               |                   |               |                |          |     |             |
| 1.8      | H    | 1   | 50.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 350.     | 37  | 46160.      |
|          | K    | 1   | 49.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 364.     | 36  | 48064.      |
|          | N    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
| 2        | A    | 1   | 54.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 300.     | 40  | 39575.      |
|          | B    | 1   | 53.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 311.     | 39  | 41082.      |
|          | C    | 1   | 52.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 291.     | 41  | 34569.      |
|          | D    | 1   | 52.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 324.     | 39  | 42678.      |
|          | E    | 1   | 52.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 291.     | 41  | 34569.      |
|          | F    | 1   | 51.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 336.     | 38  | 44368.      |
|          | G    | 1   | 50.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 350.     | 37  | 46160.      |
|          | J    | 1   | 49.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 364.     | 36  | 48064.      |
|          | L    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
|          | P    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|          | R    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|          | S    | 1   | 45.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 432.     | 33  | 56988.      |
|          | T    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
| 2.2      | H    | 1   | 50.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 350.     | 37  | 46160.      |
|          | K    | 1   | 49.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 364.     | 36  | 48064.      |
|          | N    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
| 12.8     | H    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
|          | K    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|          | N    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
| ABR      |      | 1   | 51.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 336.     | 38  | 44368.      |
| 13       | A    | 1   | 51.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 326.     | 38  | 44368.      |
|          | B    | 1   | 50.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 350.     | 37  | 46160.      |
|          | C    | 1   | 49.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 364.     | 36  | 48064.      |
|          | D    | 1   | 48.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 380.     | 36  | 50087.      |
|          | E    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
|          | F    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|          | G    | 1   | 45.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 432.     | 33  | 56988.      |
|          | J    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|          | L    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|          | P    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|          | R    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|          | S    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|          | T    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
| ABR      |      | 1   | 51.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 336.     | 38  | 44368.      |
| 13.2     | H    | 1   | 44.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 407.     | 34  | 48282.      |
|          | K    | 1   | 49.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 364.     | 36  | 48064.      |
|          | N    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
| 25.8     | H    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 26   | K    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | N    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | A    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | B    | 1   | 45.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 432.     | 33  | 56988.      |
|      | C    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | D    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | E    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | F    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75917.      |
|      | G    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 79301.      |
|      | J    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | L    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | P    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 26.2 | R    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | S    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | V    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | V.5  | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | W    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | H    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | K    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | N    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | K    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | N    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
| 37.8 | A    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | B    | 1   | 45.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 432.     | 33  | 56988.      |
|      | C    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | D    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | E    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | F    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75917.      |
|      | G    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 79301.      |
|      | J    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | L    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | P    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | R    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | S    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 38   | T    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|      | V    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | W    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | ABR  | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | K    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | N    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 46   | K    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | N    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | A    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | B    | 1   | 45.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 432.     | 33  | 56988.      |
|      | C    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | D    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | E    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | F    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | G    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 79917.      |
|      | J    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|      | L    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | P    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | R    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | S    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | T    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | V    | 1   | 25.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 990.     | 20  | 117538.     |
| 46.2 | W    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | X    | 1   | 24.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 1025.    | 19  | 121693.     |
|      | Y    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | Z    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | AA   | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | AB   | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | K    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | N    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | N    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
| 48.8 | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | K    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | N    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | A    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | B    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
|      | C    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | D    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | E    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | F    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | G    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | J    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|      | L    | 1   | 31.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 825.     | 23  | 108831.     |
|      | P    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | R    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | S    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | T    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 49   | V    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | W    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | X    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | Y    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | Z    | 1   | 23.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 1060.    | 18  | 125848.     |
|      | Z    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | Z    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | Z    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 49.2 | AA   | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | AB   | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | K    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
| 55.8 | N    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | K    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | N    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
| 56   | A    | 1   | 46.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 372.     | 36  | 44175.      |
|      | B    | 1   | 45.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 389.     | 35  | 46160.      |
|      | C    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | D    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
| 58.8 | E    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | F    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | G    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | J    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
| 56.2 | L    | 1   | 31.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 825.     | 23  | 108831.     |
|      | P    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|      | R    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | S    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 58.8 | T    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | V    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | W    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
| 56.2 | K    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | N    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
| 58.8 | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | K    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | N    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
| 59   | A    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
|      | B    | 1   | 45.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 432.     | 33  | 56988.      |
|      | C    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | D    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
| 59.2 | E    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | F    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | G    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 850.     | 22  | 117406.     |
|      | J    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
| 59.2 | L    | 1   | 31.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 825.     | 23  | 108831.     |
|      | P    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | R    | 1   | 26.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
|      | S    | 1   | 25.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1025.    | 19  | 135215.     |
| 59.2 | T    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|      | H    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 65.8 | K    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | N    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
| 66   | H    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | K    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | N    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 75917.      |
|      | A    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
| 71   | B    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | C    | 1   | 45.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 432.     | 33  | 56988.      |
|      | D    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
|      | E    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | F    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | G    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | J    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 75917.      |
|      | L    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | P    | 1   | 31.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 825.     | 23  | 108831.     |
|      | R    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | S    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | T    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
| 66.2 | H    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | K    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
| 70.8 | N    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 75917.      |
|      | H    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | K    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 75917.      |
|      | N    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
| 71   | S    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | A    | 1   | 48.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 380.     | 36  | 50087.      |
|      | B    | 1   | 47.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 396.     | 35  | 52241.      |
|      | C    | 1   | 46.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 413.     | 34  | 54537.      |
|      | D    | 1   | 45.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 432.     | 33  | 56988.      |
|      | E    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
|      | F    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | G    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | J    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | L    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | P    | 1   | 33.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | T    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
| 71.2 | H    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | K    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 75917.      |
|      | N    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | S    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
| 81.8 | H    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | K    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | N    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 75917.      |
|      | T    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 121  | K    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | L    | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | L2   | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | N    | 1   | 38.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 606.     | 28  | 79917.      |
|      | N2   | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | P    | 1   | 37.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 639.     | 27  | 84296.      |
|      | S    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | T    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | JZER | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | LBR  | 1   | 39.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 575.     | 29  | 75872.      |
|      | G    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | G.5  | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | H    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | H.5  | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | J    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | J.5  | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
| 122  | K    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | K.5  | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | L    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | L.5  | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | L2   | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | N    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | N.5  | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | N2   | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | N2.5 | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | P    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | P.5  | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | S    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | T    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | G    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | H    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | H.5  | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
| 141  | J    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | K    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | L    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | L2   | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | N    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | N2   | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | P    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | S    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | T    | 1   | 40.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | LZER | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | NZER | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 547.     | 30  | 72125.      |
|      | G    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | H    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | H.5  | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | J    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | P    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 142  | S    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | T    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | GBR  | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | G    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
| 161  | H    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | J    | 1   | 42.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 496.     | 31  | 65420.      |
|      | P    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | S    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
| 162  | T    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | TBR  | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | G    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | H    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
| 181  | J    | 1   | 41.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 520.     | 30  | 68650.      |
|      | P    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|      | S    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
|      | T    | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
| 182  | TBR  | 1   | 44.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 452.     | 33  | 59608.      |
|      | G    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | H    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | J    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
| 201  | P    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|      | S    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|      | T    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | TBR  | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
| 202  | G    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | H    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | J    | 1   | 36.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 675.     | 27  | 89044.      |
|      | P    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
| 203  | S    | 1   | 35.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 650.     | 26  | 85746.      |
|      | T    | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | TBR  | 1   | 34.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 705.     | 25  | 93001.      |
|      | G    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
| 204  | H    | 1   | 31.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 825.     | 23  | 108831.     |
|      | J    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|      | S    | 1   | 29.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | T    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
| 205  | TBR  | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|      | G    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|      | H    | 1   | 31.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 825.     | 23  | 108831.     |
|      | J    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT           | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|----------------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 202            | G    | 1   | 32.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 760.     | 24  | 100257.     |
|                | H    | 1   | 31.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 825.     | 23  | 108831.     |
|                | J    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|                | P    | 1   | 30.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 890.     | 22  | 117406.     |
|                | S    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|                | T    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|                | TBR  | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
| 221            | G    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|                | H    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|                | J    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                | P    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                | S    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                | T    | 1   | 20.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1130.    | 15  | 149066.     |
|                | GBR  | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| 222            | G    | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
|                | H    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|                | J    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                | P    | 1   | 22.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                | S    | 1   | 21.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1110.    | 16  | 146427.     |
|                | T    | 1   | 20.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1130.    | 15  | 149066.     |
|                | GBR  | 1   | 24.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1060.    | 18  | 139832.     |
| ACCESS TRESTLE |      |     |              |                 |               |                   |               |                |          |     |             |
| 303            | A    | 1   | 27.00        | 0.800           | 1.080         | 0.900             | 1.025         | 118.72         | 940.     | 21  | 111601.     |
|                | B    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|                | C    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|                | D    | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
| 303.           | 2A1  | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|                | A2   | 1   | 27.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 990.     | 20  | 130597.     |
|                | A3   | 1   | 0.0          | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1200.    | 0   | 158300.     |
| 309            | A    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|                | B    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|                | C    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|                | D    | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
| 309.           | 2A1  | 1   | 43.00        | 0.800           | 1.080         | 0.005             | 0.076         | 0.66           | 2.       | 450 | 2.          |
|                | A2   | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
|                | A3   | 1   | 43.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 473.     | 32  | 62413.      |
| 332            | A    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|                | B    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|                | C    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |
|                | D    | 1   | 28.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 940.     | 21  | 124002.     |

PIER 4  
PILE LOADING CAPACITIES  
NWS CONCORD CA.

| BENT | PILE | ITP | LENGTH<br>FT | EFF-L<br>FACTOR | ORG-DIA<br>FT | EFF-ARA<br>FACTOR | EFF-DIA<br>FT | EFF-ARA<br>IN2 | C<br>PSI | L/D | P-ULT<br>LB |
|------|------|-----|--------------|-----------------|---------------|-------------------|---------------|----------------|----------|-----|-------------|
| 356  | A    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | B    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | C    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |
|      | D    | 1   | 23.00        | 0.800           | 1.080         | 1.000             | 1.080         | 131.92         | 1085.    | 17  | 143130.     |

TABLE 7  
COST ESTIMATE FOR REQUIRED MAINTENANCE

| STRUCTURE          | DAMAGE/DEFECTS FOUND     | RECOMMENDED REPAIRS                                                                     | UNIT COST OF REPAIR | TOTAL COST OF REPAIRS FOR CURRENT INSPECTION (SAMPLING) | TOTAL ESTIMATED NUMBER OF DAMAGED MEMBERS * | ESTIMATED TOTAL COST OF REPAIRS FOR PROJECTED DAMAGE |
|--------------------|--------------------------|-----------------------------------------------------------------------------------------|---------------------|---------------------------------------------------------|---------------------------------------------|------------------------------------------------------|
| PIER 3<br><br>T-34 | 10 Timber piles<br>(.7%) | Replace with new creosoted pile or install concrete jacket to restore bearing capacity. | \$2,000             | \$20,000                                                | .7% 26 piles                                | \$50,000                                             |
| PIER 4             | 13 timber piles<br>(1%)  | Replace with new creosoted pile or install concrete jacket to restore bearing capacity. | \$2,000             | \$26,000                                                | 1% 38 piles                                 | \$75,000                                             |

\*Based on projecting the percentage of damage found over the total number of piles in the structure

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