Corps Report
Scott 85

SAND POINT DETAIL PROJECT REPORT

FOUNDATION AND MATERIALS

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1.0 REGIONAL GEOLOGY

Dome Quarry is located near Sand Point on Popof Island at the southern tip of the Alaska Peninsula north of the beginning of the Aleutian Chain. It is a member of the Shumagin Island Group. The island has an approximate diameter of nine miles with a maximum elevation of 1520 feet above sea level.

The Shumagin Islands are bounded to the north by the Alaska Peninsula and to the south by the Aleutian Trench. Subduction of the Aleutian Trench is the major force affecting the geology of the region. The area is one of the most seismically active in the world.

A string of active volcanoes occupy the Alaska Peninsula and these are aligned parallel to the Aleutian Trench.

Popof Island has varied terrain, with rugged mountains to the east and a broad lowland valley to the west. Most lowland slopes are covered with unconsolidated sediments, brush and tundra; however, bedrock is generally well exposed at higher elevations along the sea cliffs, which bounds much of the island. Although Tertiary sedimentary rocks of the Stepovak formation crop out on the north west portion of Popof Island, the island is composed primarily of Tertiary volcanic rocks. The majority of the volcanic rock units are intermediate to mafic andesite flows and flow breccias which dip southwesterly and overlie a sequence of welded tuff - breccias. Some volcanic rock units are significantly altered. Occasional small domes and other intrusive structures composed of andesite basalt or dacite have intruded the slightly older volcanic rock units. (Gallagher, 1984).

2.0 GEOLOGY OF DOME QUARRY

Dome Quarry occurs as an elliptical outcrop of mafic intrusive rock that originally was projected about 60 to 100 feet above the surrounding terrain prior to its development as a quarry. The rock is a fresh gray to black porphyritic basalt, bounded by altered volcanic rocks and sediments. The altered volcanic rocks appear to be unsuitable for the production of large high quality riprap. Joints and seams are filled with hard crystalline materials with strengths near that of the basalt itself, but also contain weaker calcite.

3.0 SITE INVESTIGATIONS:

DETAILED PROJECT REPORT FOR SAND POINT HARBOR

SOILS SECTION

3.1 HARBOR SITE INVESTIGATIONS

a. PREVIOUS INVESTIGATIONS: Subsurface investigations for the original harbor construction were performed in years 1967, 1973 and 1974 by the Alaska District Corps of Engineers. These initial investigations included 2 drive samples, 4 pile probe holes and 127 jet probe holes. A limited number of these holes fall within the area of Alternative "A". Because the original harbor depth was minus 18 feet MLLW, most of these holes do not reach the proposed new depth of minus 20 feet MLLW.

Since no samples were taken from the jet probe holes, it is difficult to determine the depths at which the materials change size. Soils gradations were determined by the relative difficulty of maneuvring the jet probe down through the material. Drillers logs stated that the material graded from sand up to and including boulders. Often, the bottom of hole did not signify refusal. In instances where refusal was encountered, it was judged to be refusal on cobble or boulders.

In one hole split-spoon samples were taken. Analysis of the samples indicate that the material was a gravelly, silty sand of a medium density. Bottom of the hole was at minus 26-feet, with no indication of refusal.

The probe holes were jetted down with a 25 gpm (100 psi) gear type water pump and a 3/4-inch pipe probe. The drive samples were taken with a 2" O.D. by 1-3/8" I.D. split-spoon sampler. The sampler was driven with a 140 lb. hammer falling 30". A location map and boring logs are included in this report.

b. RECENT INVESTIGATIONS

In May 1985, Woodward-Clyde Consultants performed additional subsurface investigations for the proposed harbor expansion, Alternatives "B" and "C". Their field work included six test borings and a geophysical survey for the subsurface conditions, coupled with geologic reconnaissance of bedrock outcrops and beach deposits. A location map and boring logs are attached.

A barge mounted drill rig and tug were used for the test borings. Soils samples were obtained with the use of a 2.5" I.D., 18" long split-spoon sampler. A 340 lb. hammer with a 36" drop was used to drive the sampler. When resistant material was encountered, a double-tube Christiansen NX diamond corebarrel was used. Samples and blow counts were obtained on the sea floor, at 2.5 feet below sea floor, at 5 feet below sea floor and every 5-foot interval thereafter.

Holes SBH-1 through SBH-3 were drilled close to shore in water depths ranging from minus 7'MLLW to minus 20'MLLW at top of hole. These are in the area which will require dredging to the project depth of minus 20'MLLW.

Top of hole elevation for auger hole SBH-1 was at minus

13'MLLW. Six feet of silty sand with organics was encountered. Blow counts for this material indicated that it has a medium density. The remaining one foot of material was a silty clay with some sand and gravel.

Auger hole SBH-2 started at a depth of minus 20'MLLW and as such, there will be no dredging required in this immediate area. However, the log shows that 15.25 feet of silty sand with organics was encountered in this hole.

Auger hole SBH-3 started at a depth of minus 7'MLLW. Only 1/2-foot of sand with organics was encountered. The remaining 10 feet of hole was determined to be highly altered and weathered volcanic bedrock. Core samples were taken from minus 13.5'MLLW to minus 17.5'MLLW.

Auger holes SBH-4 through SBH-6 were drilled on the alignment of the proposed breakwater. Top of hole elevations varied from minus 23'MLLW minus 30'MLLW.

Auger Hole SBH-4 had a mixture of sand with a trace of clay and gravel down to a depth of minus 47.5'MLLW. The Log indicates that a highly altered and highly to completely weathered volcanic bedrock existed from this elevation to the bottom of hole at minus 88.5'MLLW. This material exhibits the character of a sandy-clay soil. Results of the penetration tests had an erratic pattern and ranged from medium dense to very dense. Bottom of Hole in this instance did not signify refusal.

A sandy gravel mixture was encountered in SBH-5 down to a depth of minus 32.5'MLLW. Below this depth a silt with some sand existed down to minus 35'MLLW. The remainder of the hole was determined to be a highly to completely altered and weathered andesitic bedrock with closely space joints. Density for the materials encountered ranged from loose to refusal (in a number of instances). Bottom of the hole was reached at minus 59.5'MLLW.

Auger Hole SBH-6 had a sandy material down to minus 41.5'MLLW. At this elevation the characteristics of the material changed to a silty clay which extended down to minus 64.5'MLLW. At minus 64.5'MLLW the material changed to a highly altered and weathered bedrock which resembled a dense silt with some clay. Densities for the material in this hole ranged from medium to dense, becoming more dense with depth. As experienced in other holes, the density values were erratic.

The geophysical survey of the proposed harbor site was performed with the use of both a side scan sonar and a tuned transducer system. Each of these was towed behind a 24-foot commercial fishing vessel.

The side scan sonar record presents a continuous sonic picture of the sea floor and may be used for identifying changes in bottom characteristics. The record has the ability to locate bedrock outcrops as well as man-made objects lying on the seafloor. The tuned transducer system was used to create a subbottom profile for vertical location of the sediment/bedrock interface.

DISCUSSION AND RECOMMENDATIONS

a. Harbor Dredging - Alternative "A": Cross sections were plotted for this area based on the October, 1984 Condition Survey. The jet probe hole information was then plotted on these cross sections. It was determined that the majority of the probe holes for the original harbor do not extend down deep enough to delineate the sediment/rock interface with a reasonable degree of accuracy. Therefore, it is recommended that additional exploration be performed here prior to determination of the dredging quantities.

Harbor Dredging - Alternatives "B" and "C": A review of auger holes SBH-1 through SBH-3 indicates that the dredging of the harbor will include both removal of a silty sand mixture and a highly weathered bedrock. It was found that the quantities of these materials were highly variable throughout the harbor. Additionally, the holes were widely spaced and distant from the harbor limits due to limited funding and the use of a large but available barge. Therefore, an accurate estimate of the relative quantities of bedrock and soil to be removed can not be made until more field information is gathered. Additional exploration wwill be needed.

Recommended side slopes for the harbor limits are the same as were for initial construction. The following should be used:

1 V on 6 H in silt, sands and loose gravels;
1 V on 2 H in coarse gravel or boulders;
1 V on 0.5 H in bedrock.

b. Breakwater Foundation: Auger holes SBH-4, SBH-5 and SBH-6 were reviewed in the anaysis of the breakwater foundation. As mentioned earlier, these are on the alignment of the breakwater extention for Alternates "B" and "C". Of the three, SBH-6 was the most critical from an analysis standpoint. This area of the breakwater is underlain by a 23-foot thick layer of medium density silty clay. Reference to the plan map of the area shows that this auger hole is in close proximity to the existing south breakwater. It can reasonably be assumed that this silty clay layer extends below the breakwater. Since there is no record of any excessive settlement following construction, it is felt that the new breakwater extention will perform in a similar manner. Therefore, foundation materials underlying the alignment of the proposed breakwater are capable of supporting the additional load.

c. Slope Stability Analysis: The stability of the breakwater section was analysed for a 1V on 1.5H slope in the original General Design Memorandum. The analysis was computed by the use of the modified Swedish Method - Finite Slice Procedure. Assumed strengths were as follows:

Embankment: Assumed to be a free draining granular fill. Shot rock and angular basalt rubble. Assumed $\phi = 40$; $\tan \phi = 0.839$.

Foundation: Firm silty sand, overlying gravelly sand. Assumed $\phi = 20$ degrees, $\tan \phi = 0.364$.

Earthquake: Zone III.

The resultant safety factor for the foundation with this condition is 1.0 including the earthquake. Without the inclusion of earthquake loading the safety factor of the foundation is 2.5.

Inclosures:

1. Plan views showing breakwater alignment and exploratory hole locations for Alternatives "A", "B" and "C".
2. Soils logs.