AGGREGATE EXPORT FACILITY
Bella Coola, B.C.

Project Description
And
Design Criteria

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File: 99124

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CONTENT

1. INTRODUCTION

Arthon Construction Ltd. is considering to develop an **Aggregate Export Facility** at Bella Coola, British Columbia, Canada.

In July 1999, **Villholth Jensen & Associates Ltd.** was retained as consulting engineers to prepare the conceptual design of the marine structures and loading facilities for the overall development.

This brief report gives a description of the proposed facility, the location and general site conditions. It also outlines the proposed design criteria.

2. PROPOSED DEVELOPMENT

2.1 General

Bella Coola is located on the west coast of British Columbia at the easterly end of the North Bentinck Arm which is a deep fjord approximately 15 km long and 2.3 km wide. The depth is 400m to 200m with the 200m contour line within approximately 750m of the shoreline. The North Bentinck Arm is exposed to winds from the south west and the north east. Wind data from Cathedral Point, located on King Island, approximately 35 km to the west, indicates maximum wind speeds of 56 to 70 km/h in the SW or NE direction. In general, the wind speed most of the time is below 30 km/h. The significant wave height at Sutlej Point is estimated to be approximately 1.5 m during a south westerly storm.

The new facility is planned to be located at Sutlej Point.

The marine facility could be constructed east of the light house between the light house and the existing breakwater. The berth would be arranged in an east/west position. The berthing line would be located approximately 75m from the HW line. The following should be noted:

1. From a vessel operational point of view, this would be the best berth orientation considering the prevailing wind and wave direction.

2. The land area to the south is available for development of the aggregate storage area and can easily be connected by conveyor system to the future new quarry to be developed further east.

3. Because of the stationary shiploader, the vessel has to be moved along the berth to allow loading into all hatches. A berth length of approximately 300m is required. To avoid construction of berthing dolphins at water depth more than 15m, some dredging will be required. The estimated dredging area is 2700 m^2 and the volume is 6900 m^3 .

4. The area is considered to be prime fish habitat area. However, the dredged area and main marine structures would be located in the sub-tidal area and only a few steel pipe pile support structures would be required in the inter tidal area.

It is understood that the gravel pit/quarry will be located approximately 1.2 kn east of the storage area. **(NOTE – This location changed with exchange of lands …. Arthon Construction)**

The materials handling equipment required for the facility would in general consist of: the crushing, sorting and washing equipment located in the quarry; an overland conveyor from the quarry to the storage area; a retrieving tunnel conveyor in the storage area feeding to an overland conveyor delivering the material to the shiploader which will be able to shuttle approximately 20m in order to cover the full width of hatches as the vessel is moved along the berthing line.

2.2 Marine Facilities

The proposed marine facilities would consist of six berthing dolphins and four mooring points. A shiploader tower support would be located centrally behind the berthing line. The berthing dolphins would be interconnected by gangway structures. Two gangways would provide connection to shore for handling of mooring lines. The four breasting mooring points would be located on the shoreline at the high water line. The general arrangement of the facility is shown on DWG No. 99124-CA-002. Sections and elevation are shown on DWG. 99124-CA-002, -003 and -004.

If the sea bottom consists of bedrock with little or no overburden, light caisson gravity structures could be used for berthing dolphins and tower support structures. The caissons consisting of prefab concrete elements would be placed on a prepared base. Each dolphin would consist of approximately 8 elements placed on top of each other. The footprint of a berthing dolphin would be approximately 7m x 7m. A concrete plug would be poured at the bottom and the dolphin would be filled with sand to within 1.5m from the top and closed of by reinforced concrete. The caisson would then be anchored to the sea bottom by rock anchors drilled and installed through vertical holes in the caisson walls. A mooring bollard would be installed on the top of each dolphin.

The fendering system would consist of a steel fender panel with rubber fender units bolted to the face of the dolphin.

The four mooring points located along the shore line would each consist of a reinforced concrete block anchored into the bedrock. Each mooring point would have a mooring bollard installed.

The gangways would be light steel space frame structures.

The shiploader tower support structure would be similar to the berthing dolphin structures. It would have a foot print of about 10m x 10m, and be located back from the berthing line to avoid being impacted by berthing vessels.

If the sea bottom consists of bedrock overlaid by 4m to 8m of sand and gravel, steel pipe pile supported structures could be considered for berthing dolphins and tower support. The steel pipe piles would be driven open ended to refusal in the rock. To ensure lateral stability, rock anchors would have to be installed in some of the piles. Reinforced concrete pile caps would be constructed and fender system and mooring bollards installed.

2.3 Storage Area

An existing quarry is located a few hundred meters south east of the light house. It is expected that the initial mining will take place here to develop enough area for the future aggregate storage. See DWG. 99124-CA-001. The effective storage area should be able to hold material for several panamax ships.

The initial loading operation would be by front end loaders feeding into a hopper. A conveyor would transport the material from the hopper to the shiploader.

2.4 Gravel Pit/Quarry

The future gravel pit/quarry will be located approximately 1.2 km east of the storage area. **(NOTE – location modified following this report - Arthon Construction)** It is understood that most of the aggregates will come from blasted rock which will be crushed, sorted and washed before being loaded to the vessel. It is expected that the environmental authorities will require control of surface and process water at the quarry.

2.5 Materials Handling System

The initial planned capacity of the facility is 1,000,000 tonnes per year. This would require approximately 15 calls per year, 3.5 weeks between sailings. It is understood that the loading capacity shall be minimum 2000 mt/h. We recommend that the conveyor system from the storage area to the wharf be designed so that a simple increase in belt speed can increase the loading capacity to 3000 to 4000 mt/h in case that the yearly capacity is doubled or tripled.

It is expected that the equipment to be used in the pit/quarry could be as fabricated by El-Russ or similar.

The over land conveyor from the future pit to the storage area could be a standard belt conveyor. At the storage area, the conveyor would be elevated to about 20m above ground and run level over the storage area with trippers which will allow the material to be discharged into different aggregate piles.

The future retrieving conveyor would be installed in the tunnel below the storage. A heavy apron feeder would be located under each aggregate pile. The tunnel would be closed except for heavy grating located at ground elevation over each apron feeder. At the start of the loading to a vessel, the material will gravity feed into the apron feeders, and later, front end loaders will feed the material into the feeders.

The retrieving conveyor would transport the material to the first transfer point from where a second conveyor would transport the material to the second transfer point where the material is delivered to the shiploader conveyor.

The shiploader conveyor deliver the material to the shuttle conveyor at the top of the support tower, which then load the material into the vessel.

If the material is coming from crushed and washed rock, dust development should be minimal and dust covers over the belts should not be necessary. However, if dust is considered to be a problem, dust covers may be required.

It is expected that the materials can be dropped from the end of the shuttle conveyor without having to use a chute. If a chute is required, the height of the shiploader will have to be increased.

3 PROPOSED DESIGN CRITERIA

3.1 General

The design of this facility shall be based on the latest editions of the following codes and standards:

NBCC, The National Building Code of Canada,

CSA A23.3-94, Design of Concrete Structures,

CAN-S16.1-94, Steel Structures for Buildings,

CAN/CSA-S6, Design of Highway Bridges.

3.2 Design Vessels

The vessels which will call on this facility will be panamax size self unloaders. In addition, bulk barges may also take on materials at the facility.

Design Vessel, M/V Bernhard Oldendorff
77,500 DWT
L.O. 245.0m
L.B.P. 235.0 m
B.M. 32.2 m
D.M. 20.1 m
Draft Fully Loaded 14.01 m.

Ballast drafts :
Forward 8.7 m
Aft 9.4 m.

Design Barge :
16,000 tonnes capacity
L.O. 122 m
B. 30.5 m
D.M. 7.62 m.

3.3 Environmental Conditions

The Supplement to the NBCC does not provide Design Data for the Bella Coola area. For the moment, we suggest that the data for the Ocean Falls area would be applicable.

Snow Load: S_S = 3.5 kPa; S_R = 0.7 kPa.

Hourly Wind Pressure: p = 0.65 kPa, (1/100)

Seismic Data: Za = 2; Zv = 4; v = 0.20.

HHW Elevation 5.6m; LLW elevation -0. lm.

Maximum wave height: H = 1.5 m from the south west.

3.4 Marine Structures

The marine structures shall be designed for the berthing impact from the design vessel in full ballast. Design berthing velocity to be 0.2 m/see, 1/4 point landing.

The fender system shall be able to absorb the energy of the design berthing impact at 25 % deflection.

3.5 Storage Area

The future storage area shall be sized to hold the material for the loading of several panamax size vessel and allow for equipment movement. In the planning of the layout, additional area will be required for handling of other commodities as well..

3.6 Materials Handling Equipment

The initial capacity of the materials handling equipment is 2000 mt/h. This is a relatively low capacity for aggregate loading equipment.

We suggest that the system be designed for wide belts and that the drives and feeders be designed for 3000 to 4000 mt/h.

The airdraft of the shiploader shuttle should not be less than 14.5 m over HHW elevation. The shuttle distance should be 20m from the berthing line.

BELLA COOLA
GRAVEL EXPORT FACILITY
PRELIMINARY CAPITAL COST ESTIMATE

Item	Description	Unit	Quantity	Unit Rate	Total Cost ($)
A.	**MARINE FACILITIES**				
A.1	Berthing Dolphins	each	6	$500,000	$3,000,000
A.2	Mooring Points	each	4	$100,000	$400,000
A.3	Tower Support	each	1	$600,000	$600,000
A.4	Seven Gangways	l.s.			$800,000
A 5	Dredging	cu.m.	6,900	$35	$241,500
	Estimated Total				**$5,041,500**
B.	**STORAGE AREA**				
B.1	Leveling Work	m3	68,000	$25	$1,700,000
B.2	CV Tunnel				
	Reinforced Concrete	m3	1,000	$500	$500,000
	Steel Grating	m2	345	$300	$103,500
	Divlders, Concrete blocks	l.s.			$50,000
	Estimated Total				**$2,353,500**
	If storage area is developed by mining, cost would be reduced by approx $1,700,000.				
C.	**MATERIALS HANDLING EQUIP.**				
C.1	CV, Pit to Storage	lm	1,200	$3,000	$3,600,000
C.2	Tunnel CV	lm	270	$2,800	$756,000
C.3	Transfer CV	lm	160	$4,000	$640,000
C.4	Shiploader CV	lm	200	$4,000	$800,000
C.5	Shuttle CV	lm	40	$3,000	$120,000
	Estimated Total				**$5,916,000**
D.	**ELECTRICAL**				
D.1	Generator	l.s.			$120,000
D.2	Plant Electrical	l.s.			$600,000
	Estimated Total				**$720,000**
Subtotal					**$14,031,000**
Contingency		15.00%			**$2,104,650**
Engineering		Approx 4%			**$600,000**
Estimated Total capital Cost					**$16,735,650**