

THE SALE OF
CAPE SORELL QUARTZITE

AUG 1976

OPEN FILE

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THE SALE OF CAPE SORELL QUARTZITE

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Z. Johnson
Aug 1976

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Summary

It is estimated that the capital cost to prove suitable material, select the best mining site and set up a mining and shipping operation to supply TEMCO at Bell Bay with 50 000 tonnes per annum crushed and sized quartzite for ferro silicon manufacture would be about A\$1.8 million.

It is estimated that the annual costs (at 1976 values) would be A\$1,025,000 equal to A\$20.50/tonne of quartzite delivered alongside the marine board or Comalco wharf at Bell Bay.

To obtain a D.C.F. of 14% after tax over 20 years on the total capital development cost the selling price would have to be A\$30/tonne.

The foregoing makes no provision for the recovery of exploration costs or costs of evaluating silicon production already incurred.

TEMCO's Requirements

We believe TEMCO's requirements are for about 50 000 tons of quartzite of suitable chemical and physical grade for ferro silicon manufacture. It was supposed that we could conserve quartzite which might be potential silicon grade and sell lower grade of say .7% Al_2O_3 to 2% Al_2O_3 content. I think it unlikely we can sell rock worse than about .7% Al_2O_3 and I understand TEMCO would like to get 99.5% SiO_2 content material. I think we will need to sell good quality material for the following reasons -

TEMCO will wish to control its quartzite source. Less pure quartzite will be available at lower cost than Cape Sorell material. To have any chance of being competitive Cape Sorell material must give operating economics, e.g. less fines production, lower power usage no slag problems. Just what grade might be suitable is not clear to us and may depend on experimentation but looking at the chemical purity now processed in other plants (some .1 - .2% Al_2O_3) a .5% Al_2O_3 level may be necessary. It will also be uneconomic to set aside any better grade mined along with maximum impurity level material as the mine is developed on the outcrop.

The most competitive source known (Weld River) has about a 1% Al_2O_3 level which has been proved useable material.

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The increased power consumption in making 50% ferro silicon between .5% and .8% Al_2O_3 content is said to be about .1 KWH per lb. or about \$1.30²₃ per ton if TEMCO pay 6 mils for extra power. That is .5% Al_2O_3 rock is worth about \$1.06 per tonne more than .8% Al_2O_3 content rock.

The extra value for power saving of .5% Al_2O_3 rock compared to 1% rock may be about \$1.75 per tonne.

The Cape Sorell material is said to be harder and there may be savings on this account and in furnace operation costs and slag separation from product costs.

Alternate Sources

The Alternate sources and approximate cost as known to us are shown in Appendix 1. This shows that if TEMCO can hire A.P.M.'s bulk loader at the Huon River or can build a bulk loader at Port Huon, the Weld River source is likely to be cheaper than Cape Sorell material.

Cape Sorell Operation

The foregoing costs are based on a minimum operation for mining, crushing, road transport and ship loading by a contractor working about five months per annum from January to May and on shipping about four months per annum between about mid January and mid May.

Quartzite is mined, crushed and screened at the quarry, transported in say 10-12 ton trucks dumped on a rock floor stockpile at the shore, loaded through a small bin with an apron feeder to a fixed belt conveyor loader. The ship is moored at a dolphin berth and warped for loading. The loader is designed to load in four hours in order that the ship entering on a low water slack tide may be turned round before high water slack. This is advantageous during the long daylight hours in summer. The ship is expected only to manourve during daylight.

Mine Site

The mine site will be determined when more information is available on the grade required and that available at the various outcrops.

The road development allowed is enough to reach one or more of the Mt. Antill, North Escarpment or Mt. Obvious outcrops. It is supposed that the Grandfathers area will not have suitable grade quartzite.

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Mining

The contractor will mobilise each January and transport trucks, drill rig, front end loader, four wheel drive utility and camping equipment from Strahan on local boats and barge.

Comalco Capital Costs

It is expected that Comalco will have to provide for the deposit testing, trial mining and trial shipment, development of roads and if the trials are successful and a long term sale negotiated the berth, loader, power generation and reticulation and probably a permanent crusher and screening installation.

The total cost is estimated to be \$1.8m. See Appendix 2. Trial sample and shipment and Appendix 3 Site Capital Costs.

ShippingMethod Chosen

Shipping is costed on the shipment of 50 000 tons per annum in the "Poolta", The "Poolta", on long term charter to C.S.R. is used in the Queensland sugar trade from about July to December. A rate quoted by them on 16/8/76 has been used for this study.

Allowable draught for Macquarie Harbour is from 13' to 14' due to the inner bar on the Bonnet Bay leads, and depending on the tide and the level in Macquarie Harbour, itself dependent in part on run off in the Gordon and King Rivers. For January - May period 13' 0" is likely and the "Poolta" could pass over this in ballast if necessary.

The Poolta is 328'8" overall which is somewhat longer than any ships which have used the port in recent times. Ships length is important because in the entrance, about half a cable (360') wide, between Macquarie Heads and Entrance Island, the tide sets obliquely across the entrance and there is also a deviation of the channel just inside the entrance, (Hell's Gate).

The Harbour Masters notes say "Interstate vessels (length 240' draught 13 ft) do not normally work the entrance with a current exceeding two knots", and in response to enquiries about barge towage "this is restricted to a draught of 13 ft. 6 ins. due to the inner bar on the Bonnet Bay leads.

During daylight hours in winter slack water may occur once daily but during summer two or three slack water periods may be encountered. Normal slack water lasts for 30 to 40 minutes. It is not advisable to work the Entrance during hours of darkness except at slack water.

Tides at the Entrance are not predictable as the barometric pressure has a greater effect than the normal factors controlling sea levels".

The Australian Pilot Vol. 2 (pages 259-267) says quote - "Hells Gates is approached by a narrow channel between the western side of Kawatiri shoal and West breakwater which extends about $4\frac{1}{2}$ cables (1 cable = 720 ft.) northward from Beach Rock, on the eastern side of Pilot Bay situated about $3\frac{1}{2}$ cables north-westward of Macquarie Heads. This channel is obstructed by a bar, which in 1964 had a least depth of 16 feet (4m 9) over it close north-eastward of Beach Rock". For these reasons I have allowed only for entering or leaving the harbour at slack water (which is probably too conservative) and in day light.

The bar on the Bonnet Bay leads is further up harbour than the proposed loading site. There is a channel width of about 800 - 900 feet opposite the loading point and if the ship can be manouvered in this area then it would save about a five mile trip up the Kelly Channel to the open deep water of Macquarie Harbour where the ship can be easily turned. Local turning would also favour mooring at slack water if the entrance is only worked near slack water.

The ship can be loaded for the outer bar depth which will need investigation but may permit 14' draught or more.

Since permission to enter the harbour, safe draught and other harbour practice are so vital to the economics, I believe one should not seek advice from the Harbour Master or the Hobart Marine Board at this point for fear of obtaining a premature and overly restrictive judgement, That approach would be better made when the requirement was real and we are as well informed as possible.

For this estimate we have allowed 13'0" draught, a conservative cargo of 1 750 tons so that 29 voyages are required.

Shipping Cost

The cost of sea freight is estimated as \$14.11 per ton. See Appendix 4.

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If larger cargoes can be carried in good weather, at say 14' draught, 2 050 tons, freight would fall from \$14.11 to \$12.04 per ton.

It must be emphasised that this depends on permission for "Poolta" to enter Macquarie Harbour.

Mooring at Loader

The loading point chosen is on the outside of the main tidal stream and will be subject to strong tidal flow.

Normal tide flows in this area of the channel are about 4 knots but during great freshets after heavy rains may attain 6 knots in the channel and 8 or 9 knots in Hells Gates.

It would seem possible to provide secure mooring close by the land for a ship of Poolta's size. The fore and after strain at 4 knots and 6 knots on the mooring lines is estimated to be 21 and 30 tonnes respectively. See Appendix 8.

The cost of the berthing structure is estimated on the basis of six dolphins each comprised of three concrete piles about 60' overall.

No provision for special fendering arrangements have been allowed. The maximum wave size, generally in a direction parallel to the berth, is envisaged to be about 6' crest to trough. It is expected that the waves would not contribute to appreciable mooring line loadings or that long ocean swells would appreciably affect the berth location. Both these assumptions need expert enquiry and confirmation.

The problems of warping a ship in the strong tide have not been investigated but no great difficulty is expected.

Voyage Schedule "Poolta"

A voyage schedule was investigated to check the assumptions of the shipping estimate.

Basis

1. No restrictions on entry or departure Port Dalrymple,
2. Entry Macquarie Harbour on slack water daylight, only,
3. Departure Macquarie Harbour on high slack water daylight only,
4. Loading Macquarie Harbour between tides - 6 hours turn round,

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5. Unloading Bell Bay 8 hours on the basis of TEMCO crane at 350 ton/hour free grabbing and some delays and slow work near end of discharge. 24 hour unloading at Bell Bay available.

On the basis of theoretical tide times, the provisions above and without allowance for delays 29 voyages can be accomplished in 98 successive days or at 3.38 days per voyage. Within this schedule no sailings were made from Bell Bay after dark and the ship after unloading layover and departed 6.00 a.m. or later the next day. If Macquarie Harbour is only departed on high tide this provision has little effect on the schedule.

If the low tide slack water occurs between 7.00 a.m. and midday then a 3 day 1½ hour voyage is possible. About four successive fast voyages are possible then one of 3 days 14 hours and then about three long voyages of 4 day 2 hours as the tide time falls back and high tide occurs after dark on the day of loading so that the loaded ship must depart on the morning high tide the next day.

Capacity to load the ship between low tide entry and high tide departure saves about 16 days in a 29 voyage schedule.

The average turn round of 4.37 days allowed for freight costing should be easily achieved between mid January and the end of May even after some industrial action, rough passage, slow load and discharge, berthing and other delays.

A detailed examination might show that departure on slack low water was advantageous and it is almost certain that a larger average cargo than 1 750 tons could be carried, on the Poolta. See Appendix 4.

Other Shipping Systems

The cost of shipping round the year in a small dedicated 750 DWT vessel was estimated to be \$1,311,000 per annum for 50 000 tonnes equivalent to \$26.02 per tonne. See Appendix 5.

The cost of shipping in the "Cycle" an 8 000 DWT vessel by barging out to the ship anchored in pilot bay was estimated to be \$25.09 per tonne if 600 TPD were loaded by ships gear. This is the cost before barge and tow hire. See Appendix 6.

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Overland Shipping

The cost of barging across Macquarie Harbour, road haul to Melba Flats (near Rosebery) and rail haul to Bell Bay was estimated to be \$34 per tonne plus a capital contribution to the railways of about \$700,000. See Appendix 7.

Contractors Costs

Cost per annum -20 week operation	
Wages and on costs 13 men x 6 000	85 000
Mobilisation	10 000
Hire Charge 4 trucks (12 ton) 32 per hour	
3 F.E. loaders 30	
Drill Rig 15	
Compressor 3	
Other Equip. 20	
	100 x 1 080 hrs 108 000
Messing @ \$25/week each	6 000
4 Huts @ \$30/week each	2 200
Launch hire @ \$10/hour 20 hrs/week	3 600
Contingencies Miscellaneous	34 000
Profit	50 000
	\$300 000
Cost per tonne for 50 000 tons	\$ 6.00

Quartzite Sale Price

If the capital cost is \$1.8 million then the sale price in ship alongside at Bell Bay needs to be a minimum of \$30 per tonne.

Cost of Sales - 50 000 tonnes/annum.

	<u>Per Annum</u>	<u>Per Tonne</u>
General Administration	20 000	.40
Contractors Costs	300 000	6.00
Shipping	705 000	14.10
	1 025 000	20.50
Receipts	1 500 000	30.00
Profit before tax	475 000	9.50
Profit after tax	273 125	5.46

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	<u>Per Annum</u>
R.O.I. after tax	15.2%
D.C.F. rate of return over 20 years	14%

It is likely that TEMCO could obtain good quality quartzite from Weld River for about \$ 23 per tonne.

Appendix 1Alternate Sources for TEMCOTasmanian Sources

Hastings - Gold Fields concluded that this deposit was not adequate for their proposed Electrona operation. We suppose that the material was unsuitable for silicon production and that there was insufficient reserves for ferro silicon.

Weld River (Glovers Bluff) (See C.G.F. report 1975-3) and memo. I.D.P. 9/7/76.)

Gold Fields have terminated their agreement with Mr. Forster, the lease holder. (Memo. IDP) "From Gold Fields final report on the deposit, it appears that approximately 15 million tons of quartzite suitable for ferro silicon have been indicated. This is based on two diamond drill holes and four shallow percussion holes. The average grade indicated is around 1% Al_2O_3 and .1% Fe_2O_3 .

Gold Fields successfully completed a trial smelting operation using the Electrona works. 75% ferro silicon was produced, but some difficulties were experienced with "fines" generated during material handling".

The most informative drill hole was drilled from near the cap of the outcrop at an angle of 45° in the vertical dipping beds. It was 360' long and terminated in quartz of about 1.2% Al_2O_3 and .11% Fe_2O_3 . 5 ft. sections of drill core vary in quality from about .4% Al_2O_3 , .06 Fe_2O_3 to about 1.4% Al_2O_3 and .13% Fe_2O_3 . Minor elements in a composite sample were all low.

A second hole 84' long, distant about 75m and parallel to the first intersected similar grade quartzite.

The C.G.F. report indicates that 3,500,000 tons can be open cut in this block to supply 200 000 tons for 15 years. The open cut was limited to 100m depth and 1/1 overburden. It was considered that together with the indicated reserves in other outcrops no further prospecting was necessary.

The quartzite would have to be road hauled about 20 miles to Port Huon or somewhat further to APM's pulp plant. It is likely that APM's belt loader could be used for loading "Lake" class vessels or the "Zincmaster".

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The depth alongside is 25' and APM regularly use "Lake" class vessels which, however, are not fully draughted due to the low pulp density. About 10,000 ton quartzite can be loaded. If APM's facility is utilised a stockpile and reclaim system feeding the existing belt would be necessary. In estimating shipping cost I have allowed 2 days for loading.

Alternatively a stockpile and loading capability might be developed at Port Huon.

Cost to TEMCO

(Assuming APM loader)

	<u>Operating Cost</u> <u>\$ per tonne</u>
Mining (as Cape Sorell)	6.00
Road Transport 40 miles return @ 10c/ton mile	4.00
Sea freight APM to Bell Bay (See Appendix 9)	6.00
Stockpiling loading loader hire etc.	3.00
Overheads, Admin. Royalty,	1.00
Payment to Lease Holder	<u>.50</u>
	<u>\$20.50</u>

Capital Costs

Roads (8km upgrade, 2km new) say	200 000
Crushing Plant	385 000
Stockpiling and Conveying plant say	<u>200 000</u>
	<u>\$585 000</u>

Allowing 20% charge on capital = 2.34
Total Cost per tonne about \$23.00.

Rocky Cape - This deposit is largely within the Rocky Cape scenic reserve, which is on the north west coast approximately 20 miles west of Wynyard.

If the area outside the reserve can be mined then it would be cheaper source than Cape Sorell. It is doubtful that mining will be permitted.

Comalco investigated this area with a view of locating high grade quartzite for silicon manufacture. Only thin beds were observed outside the scenic reserve, The area was not considered for ferro silicon.

Minerals Holdings Australia

These deposits of Neil Thomas are considered by our geologists to be thin and unsuitable beds. They are located on EL 43/70 near Meunna, near Burnie.

Beaconfield Deposit

The Beaconfield deposit currently worked by TEMCO for *silico* ferro manganese flux has a limited amount of marginal quality material. The surface leached area of a quartzite conglomerate sequence has about .3% Al_2O_3 but below the leached zone (10m) this rapidly increases above 1.5%.

It is reported that TEMCO may have only two or three years supply for ferro silicon.

Seven samples of Beaconsfield and Lefroy quartzite analysed as a method check by Bell Bay laboratory contained about .5% Al_2O_3 and .2 - .3% TiO_2 . The best Beaconsfield material is about .1% TiO_2 .

South Australian Sources

Ardrossan - TEMCO have received a 1 000 ton shipment of quartzite over their own wharf at Ardrossan.

Two outcrops are shown in the area, one about 18 and the other 45 miles from Ardrossan wharf.

We have no information on the material but shipped as part cargoes in a BHP ship, the delivered cost would be less than Cape Sorell material.

Birdwood

A deposit at Birdwood, 30 miles from Adelaide has been mined for silica brick manufacture. 10 000 tons was mined in 1971.

New South WalesMudgee

Small deposit. 1 333 tons mined at cost of \$17 per ton 1971.

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Marrangaroo (near Lithgow) Newbold General Refractories
70 000 tons mined in 1971. \$6 at quarry. It is estimated
that the minimum cost delivered Bell Bay would be \$40.

Rock Flat (near Cowra) Newbold General Refractories.
Estimated cost at Bell Bay \$40 if suitable reserves exist.

Overseas Sources

Spain - TEMCO are reported to have bought some Spanish
quartz/quartzite. The current FOB cost is about US\$30,
so the delivered cost at Bell Bay must be very high. No
doubt the material is being used to prove the new furnace
and perhaps to upgrade by blending the Beaconsfield ore.

Appendix 2Cost of Proving Deposit and Trial ShipmentDiamond Drilling

It has been estimated that 10 holes are required to investigate the grade at depth and prove a minimum tonnage of reserves.

The estimated cost is about \$80,000.

Trial Shipment

Even if laboratory trials are conducted it is likely that TEMCO would require a sizeable trial shipment to prove the suitability of the material especially as to thermal shock resistance in the process.

If two 1 000 ton samples (in two grades) are supplied then the estimated development and shipping cost is \$146,000.

A mining and shipping operation similar to that described by D.A. Salkeld in his report of September 1974 would be required.

Cost of Mining, haulage, barging, 54 mile road haul to Rosebery, rail to Burnie (1974 cost \$100,460 for 2,500 t).

	say	120 000
Cost transfer to Tasmanian rail		
2 000 tons	say	6 000
Rail Burnie to Bell Bay		
2 000 tons	say	<u>20 000</u>
		146 000
Less Recovery 2 000 x \$35 (from TEMCO)		<u>70 000</u>
Nett Cost		<u>\$76,000</u>

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Appendix 3Cape Sorell Site Costs

Beyond the road development for the trial samples and despite mining on a contract basis capital will be required for permanent roads, the shipping and berthing facility and probably for a permanent on site crushing and screening plant and for power supply. Whatever the arrangement which can be negotiated with a contractor for simplicity for this evaluation I assume Comalco will supply everything outside the portable mining equipment necessary to start up the operation.

Roads

To connect the loading point with the Mr. Obvious and North Escarpment areas and improve the track to the existing Marine Board jetty. About 3 km of road following the foot of outcrop as far as possible, but also having to transverse some low button grass areas. Generally, by dozing off the surface soil on outcrops and surfacing with quartzite and local rock and by building a thick pavement over the button grass areas.

Stockpile Area and Mine Development

Dozing and shooting off outcrop rock to prepare a stockpile area near the loader and to develop a working face in the quarry.

Crushing Plant

"Poolta" shipment is estimated to take 125 days for 50 000 tons from mid January to late May.

Mining could spread from the beginning of January to late May a period of about 140 days. On the basis of a 18 week crushing operation 6 days per week (108 crushing days) a minimum capacity of about 500 ton per day product is required.

This is provided in two skid mounted units. One with feed chute, plate apron feeder, fixed bar grizzly and 36" x 25" double toggle jaw crusher set at 3 1/4", and discharge belts. The second unit has a receiving chute elevating belt, double deck vibrating screen, a product belt and a -20 mm waste stacking conveyor. A 170 Hp generator is required.

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Purchase cost Melbourne (complete)	300 000
Shipping	30 000
Foundations (grout over rock base)	25 000
Feed Hopper	10 000
150 Kw diesel generator	20 000
	<hr/>
	385 000

Berth and Loader

It is expected that 18 - 20' water depth will be found about 60' off shore.

The berth is conceived as six, three pile cluster reinforced concrete pile dolphins. This number is needed to provide two berthing dolphins at all times as the 330' ship is warped through about 250'.

Kaiser Engineers estimate that to provide the piles from a mainland source transport and drive them and concrete cap them, would with mobilisation of equipment cost from 1.0 to 1.25 million dollars. \$1.0 million is allowed.

The loader is allowed as a 36" belt conveyor 100' long supported on a light pile structure and cantilevered about 25' beyond the berthing pile line.

Estimated Cost

Conveyor system (30" belt and apron feeder)	125 000
All supports and installation	200 000
	<hr/>
	325 000

Capital Cost Summary

Diamond Drilling	80 000
Trial Shipment nett cost	76 000
Roads - Additional to trial shipment	15 000
Crushing Plant	385 000
Dolphin berth	1 000 000
Conveyor and support structure	325 000
	<hr/>
	1 880 000

It is my personal view, that if no problems are encountered driving the piles, if higher maintenance steel or timber piles were used, if one of the Tasmanian Marine Board's pile driving barges and gear were hired that the cost of the dolphins should be about \$300 000. Other construction methods e.g. a prefabricated floating structure might also provide a solution at about the same cost. This would reduce the total capital to about \$1,100,000.

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Refer Mr. Von Mackay-Syd. 20515
50,000 tons in 29 voyages

Appendix 4 016

VOYAGE ESTIMATE

L.O.A. 328'8"
Breadth 43'6"
DWT 3280
Fuel consumption-At Sea 7½ tons M.D.O.
-In port ¼ tons M.D.O.

VESSEL: "POOLTA"
(29 crew I/State articles-21 crew Intrastate Articles)

DAILY T/C RATE: A\$4600

TRADE: Quartzite

Speed - 10 Knots
FIOST
SSHINC
¼ day purposes

PORTS AND DISTANCES

ESTIMATED TIME

Estimated costs on basis as above and each 24 hour period in excess of time allowed - ¼ day purposes, would represent an additional \$2.63 per ton of cargo carried and similar reduction could apply if time reduced

In Port At Sea
Days Days

Portion of 1st positioning ballast voy. & cleaning	.05	.07
Bell Bay/Macquarie 240/10K		1.00
Macquarie/Bell Bay 240/10K		1.00
Pilot/berth/pilot transit time B.Bay & Macquarie		.50
Loading 6hrs. & Discharging 12hrs	.75	
Allowance Macquarie A/C Daylight & Tides	.50	
Allowance in transit due weather		.33
Allowance - Await berth occupied-crew etc.	.17	
TOTAL DAYS:	1.47	2.90

EXPENDITURE

Hire	4.37	days @ \$ 4600	=	20102	
Bunkers At Sea	7.5 x 2.9 x 100		}	=	2175
In Port	.75 x 1.47 x 100				
Stevedoring			=		
Port Costs)			=		
Agency Fees)			=	2000	
Pilotage)			=		
Incidentals (Hold Cleaning etc.)			=	300	
TOTAL:				\$24688	

CARGO 1750 tons (on 13' draft) \$14.11 per ton

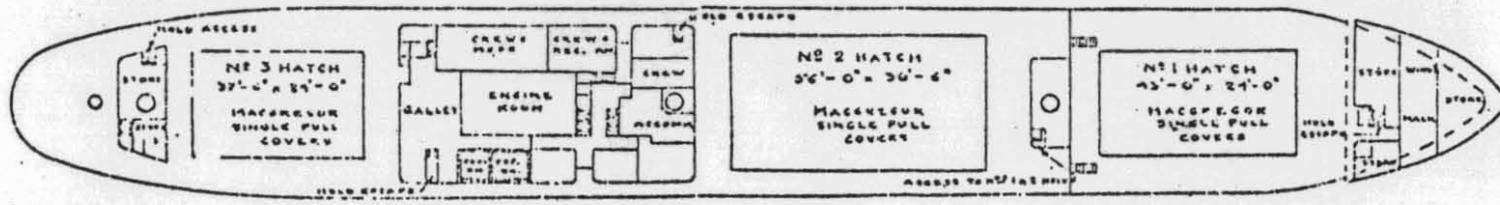
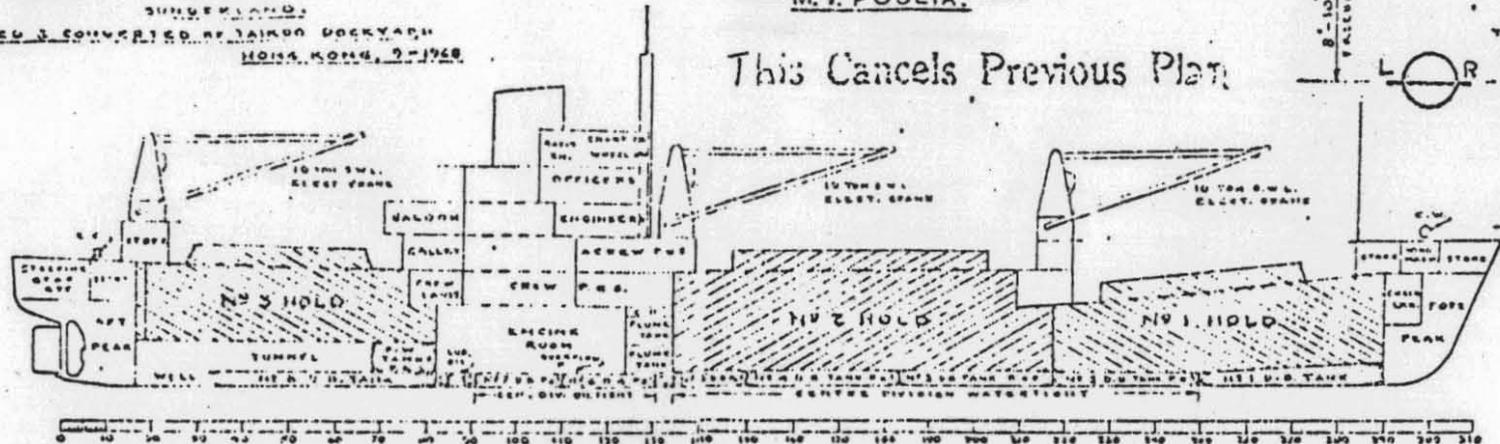
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BUILT BY HENDY POSE LTD.
 KEITH 5-1949
 LIMITED BY GEORGE CLARK (INSULATED)
 SINGAPORE
 LENGTHENED & CONVERTED BY JAIKOO DOCKYARD
 HONG KONG, 9-1948

UNION STEAM SHIP CO. (UK) LTD

M.V. POOLTA

This Cancels Previous Plan



DRAFT FEET	DEAD WEIGHT
16	3120
	3015
	2850
15	2683
	2516
14	2350
	2182
13	2011
	1855
12	1495
	1525
11	1380
	1235
10	1073
	925
9	775
	608
8	438
	210
7	100
	0
6	

DIMENSIONS

LENGTH B.M.	310'-0"
DEPTH MLD.	43'-6"
DEPTH MLD. (DOWNS)	25'-1"
GROSS TONNAGE	2850 GRT
NETT	1411 GRT
LOADED DRAFT (MEAN)	16'-3"
LEADWEIGHT AT LOADED DRAFT	3150 TONS
TONS PER INCH AT LOAD LINE	20.5

PARTICULARS OF ENGINES

SINGLE SCREW	
ONE SET TWO-CYCLE SINGLE ACTING	
3 CYLINDER CLARK & SULZER	
DIESEL ENGINES	
AVERAGE SPEED ON SERVICE	12 KNOTS
CORRESPONDING FUEL CONSUMPT	
PER 24 HOURS	TONS
MAXIMUM SEA SPEED	12 KNOTS
CORRESPONDING FUEL CONSUMPT	
PER 24 HOURS	TONS

CARGO CAPACITIES

NO 1 HOLD	43500	968	871
" 2 "	79730	1771	1594
" 3 "	41980	933	839
TOTAL	165210	3672	3304

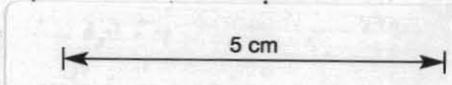
TANK CAPACITIES (TONS)

TANK	WATER BALLAST	FRESH WATER	OIL FUEL
FORE PEAK	79	-	-
NO 1 L.B. TANK	72	-	-
" 2 " (P. & S.)	79	-	-
" 3 " (P. & S.)	129	-	-
" 4 " (P. & S.)	129	-	-
" 5 " (P. & S.)	-	58	-
" 6 " (PORT)	-	-	20
" 7 " (STAR.)	-	-	15
" 8 " (P. & S.)	89	-	49
AFTER PEAK	82	-	-
TUNNEL SIDE TANKS (P. & S.)	-	53	-
SETTLING TANKS	-	-	7
DAILY SERVICE TANKS	-	-	6
O.F. OVERFLOW TANK	-	-	5
UPPER FLUME TANK	41	-	-
LOWER FLUME TANK	42	-	-
TOTALS	785	111	97

STEWARDS STORES (INSULATED)

REFRIGERATED CHAMBER	207
COOL CHAMBER	207
TOTAL	414

LUB. OIL DRAIN TANKS (P. & S.) = 2273 GALLS.



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Appendix 5

VOYAGE ESTIMATE

VESSEL: 750 DWT Vessel (approx. size) Fuel Consumption - At Sea 3T gas oil
Lifting 700 tons cargo In port 1/2 Tgas oil

DAILY T/C RATE: Est. A\$3750 Speed - 10 Knots

TRADE: Quartzite FIOST
S Shinc
1/2 day Purposes

<u>PORTS AND DISTANCES</u>	<u>ESTIMATED TIME</u>	
	<u>In Port</u> Days	<u>At Sea</u> Days
Bell Bay/Macquarie 240/10K		1.00
Macquarie/Bell Bay 240/10K		1.00
Pilot/berth/pilot transit time B.Bay & Macquarie		.50
Loading 4 hrs. Discharging 8 hrs.	.50	
Allowance Macquarie A/C daylight & Tides	.50	
Allowance in transit due weather		.33
Allowance await berth occupied crew etc	.17	

Basis 72 Voyages = 50,400 tons TOTAL DAYS: 1.17 2.83
@ 4 day voys = 288 days

Daily rate based on 335 days
47 days @ \$3750 = \$176250 or \$3.50 additional on each ton cargo carried
which needs to be included in freight estimates.

EXPENDITURE

Hire	4 days @ \$ 3750	=	15,000
Bunkers	At Sea 3 x 2.83 x 150) ::	1,274
	In Port .5 x 1.17 x 150		=
Stevedoring		=	
Port Costs)		=	
Agency Fees)		=	1,750
Pilotage)		::	
Incidentals (Hold Cleaning etc.)		::	100

TOTAL: 18,212

CARGO 700 tons \$ 26.02 per ton

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Appendix 6

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 Refer Mr. Ivon Mackay-Syd. 20515
 50,000 tons in 7 voyages
 DWT 8000
 Fuel consumption-At Sea 16½ tons M.D.O.
 -In port 1½ tons M.D.O.

VOYAGE ESTIMATE

VESSEL: "CYCLE"

Speed-Loaded-14 Knots
 " -in ballast-16 Knots

DAILY T/C RATE: A\$9700

FIOST
 SSHINC
 13.83 days purposes

TRADE: Quartzite

POINTS AND DISTANCES

ESTIMATED TIME

Estimated costs on basis as above and each 24 hour period in excess of time allowed - 13.83 days purposes, would represent an additional \$1.32 per ton of cargo carried and similar reduction would apply if time reduced.

	<u>In Port</u>	<u>At Sea</u>
	<u>Days</u>	<u>Days</u>

Portion of 1st Positioning ballast Voy. & Cleaning	.21	.22
Bell Bay/Macquarie 240/16K		.63
Macquarie/Bell Bay 240/14K		.72
Pilot/berth/Pilot transit time B.Bay & to Anch.Macquarie		.50
Loading 600 TPD = 12.33 & Disc. 1.50	13.83	
Allowance delays off Macquarie A/C weather		1.23
Allowance - Awaiting berth B. Bay & Crew etc.	.33	
TOTAL DAYS:	14.37	3.30

EXPENDITURE

			\$
Hire	17.67	days @ \$ 9700	= 171,399
Bunkers At Sea	16.5	x 3.30 x 100	} = 5,445
In Port	1.5	x 14.37 x 100	
Stevedoring			=
Port Costs)			=
Agency Fees)			= 5,000
Pilotage)			=
Incidentals (Hold Cleaning etc.)			= 1,700
TOTAL:			\$185700

CARGO 7400 Tons

\$ 25.09 per ton

Appendix 7Overland Shipping Costs

This method of shipping contemplates barging quartzite across Macquarie Harbour to Strahan, grabbing it from the barge or sea bottom, loading trucks for the road haul 52 miles to Melba Flats and railing by Emu Bay railway to Burnie and Tasmanian railway to Bell Bay.

The railways have asked for capital to purchase trucks ex the Commonwealth Railways, for road access and siding at Melba Flats and siding work at Bell Bay.

The method is unattractive because of the high cost of road haul to Melba Flats near Rosebery.

	<u>Cost per ton</u>
Barge and tug hire	.90
Stacking Strahan and truck loading	.40
Road haul Strahan to Melba Flats	13.20
Handling and Storage Melba Flats	.80
Rail freight to Burnie (no capital component)	6.00
Rail freight to Bell Bay (No capital component)	<u>10.00</u>
	\$ 31.30

Capital Required (Roughly)

Loading site Melba Flats	100 000
Rail trucks (not a full train)	400 000
Siding Bell Bay	<u>200 000</u>
	<u>\$700 000</u>

Allowing \$2.50 for capital if provided by others, the total cost is about \$34 per ton.

Appendix 8Dolphin Design LoadsBerthing Impact

Allow 2 ft./sec. impact on a single dolphin to provide for berthing in strong winds or current without tug assistance. "Poolta" in ballast DWT about 1 000.

$$\begin{aligned} \text{Impact Energy} &= 1/2 w/g V^2 \\ &= 62.4 \text{ ft. tons} \end{aligned}$$

If about half the impact is absorbed by the dolphin maximum impact is about 35 ft. tons.

Dolphin Design

The impact load is greater than mooring loads. To provide long life prestressed concrete piles are preferred to timber or steel piles. On the basis that the concrete fibre stress does not exceed the prestress three 14" square piles driven to 60 ton load and united with a concrete cap are required.

The bottom is expected to have at least 50' depth of consolidated sand and gravel and the piles need to be 60' to provide 15' above L.W. 20' max. water depth and 25' max. driven depth.

Wind Forces

Gale force winds can be expected from the south to north west. The berth lying N.W. is protected by the cape range from the S.W. component.

"Poolta" in ballast (10') Side Area	7,200 sq. ft.
Fore and After area	2,000 sq. ft.
at 14' draught fore and after area	1,800 sq. ft.

Allow 55 mph direct on shore on offshore component which with a shape factor of 1.3 is equal to 10 lbs./sq. ft. force.

Maximum lateral force = 43 tonnes which is distributed over a minimum of two dolphins, say 22 tonnes per dolphin.

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Mooring Forces - Wind (Fore and after)

Allow 80 mph, shape factor 1.3, for which force is 20 lb/sq.ft.
Maximum force 17 tonnes (light ship 10' draught)
15 tonnes (at 14' draught)

Current Forces

Assume ship is moored directly in current flow,
Normal maximum current 4 knots,
Maximum after rain and S.W. wind 6 knots

"Poolta" immersed cross section areas -

at 10' draught in ballast 430 sq ft. and
at 14' draught part loaded 600 sq. ft.

Immersed total areas -

at 10' draught in ballast 6 500 sq. ft.
at 14' draught part loaded 8 900 sq. ft.

P_a (dynamic force) = $A_d k_s 2.86 v^2$
for $k_s = 1.0$

	<u>6 Knots</u>	<u>4 Knots</u>
Light ship	20.6	9.3 tonnes
Part loaded ship	28.0	12.5 tonnes
P (friction force) = $A_f k_c v^2$		

for $K_c = .01$

Light ship	1.1	.5
Part Loaded Ship	1.5	.7

At 6 knots total current force, -

Light ship 21 tonnes
Part loaded 30 tonnes

Total wind and current forces acting together

Light ship	38 tonnes
Part loaded	45 tonnes

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Under such extreme conditions mooring loads would be distributed over more than one dolphin if the ship were caught alongside.

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VOYAGE ESTIMATEVESSEL: Motor "Lake" Class Vessel

Fuel Consumption - At Sea

11 T Fuel

+ 1 T Diesel

In port 1T Diesel

DAILY T/C RATE: A\$7245

Speed 11 Knots

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TRADE: QuartziteESTIMATED TIMEPORTS AND DISTANCES

	<u>In Port</u> Days	<u>At Sea</u> Days
Departure B/Bay		.17
Bell Bay/Port Huon 277/11		1.05
Berthing & Departure Port Huon		.34
Loading	2.00	
Port Huon/Bell Bay 277/11		1.05
Berthing B/Bay		.17
Discharging Bell Bay	1.50	
Contingencies	.50	
	TOTAL DAYS: 4.00	2.78

EXPENDITURE

		\$
Hire	6.78 days @ \$ 7245	= 49,121
Bunkers	Fuel 2.78 x 11 x 65	} = 1,988
	Diesel 6.78 x 1 x 110	
Stevedoring		=
Port Costs)		=
Agency Fees)		= 7,000
Pilotage)		::
Incidentals (Hold Cleaning etc.)		:: 1,500
2 Rates per ton shown - 10,000 tons (Part Cargo) or 10,800 tons (Full cargo)		TOTAL: 60,355

CARGO

10,000tons

\$ 6.04 per ton

10,800tons

\$ 5.59 per ton