Dalrymple Bay Coal Terminal Port of Hay Point, Queensland

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Der Dalrymple Kohlenhafen von Hay Point, Queensland
Terminal charbonnier de la Baie de Dalrymple — Port de Hay Point, Queensland
Terminal de carbón de Dalrymple de Port of Hay Point, Queensland

ダルリンプル湾石炭ターミナル——クイーンズランド，ヘイポイント港

德林帕尔湾煤炭集散站—昆士兰州 黑帕英特港

محطة دالريمبل باى للفحم. ميناء هاي بوينت. كوينزلاند

Summary

With the opening of several new coal mines in Central Queensland, it became necessary to plan for increased storage and shiploading facilities to cater for the anticipated additional $30 \cdot 10^6$ t/year production.

The Port of Hay Point was selected as the site for these new facilities, some of the reasons being the existing rail line to the port, and suitably deep water (Fig. 1).

The overall facilities have been designed to allow staged development to proceed to match the capacity of the new mines coming into production.

Because of the number of different grades of coal that will be handled it was essential that maximum flexibility of equipment, and therefore flexibility of stockpile management be incorporated.

The first phase will allow the stockpiling of 1.5 million tonnes of coal, will have an annual throughput of 15 million tonnes, and is scheduled for completion by mid-1983.

1. Onshore Mechanical Equipment

Coal will be received from unit trains fitted with bottom dump wagons. The rail loop has been designed to allow the storage of 2 full trains on the entry side of the bottom dump hopper, and 2 empty trains on the outgoing side whilst still providing space for the train to unload. Recovery of the coal from the bottom dump pit will be by a batch of 6 electromagnetic vibrating feeders at the rate of 3,600 t/h.

When duplication of the first stage is completed the train unloading rate will be doubled to achieve a rate of 7,200 t/h, thus enabling a unit train to be unloaded in approximately 55 minutes.

The materials handling system allows the coal from trains to be stockpiled or pass directly to the shiploading system. The conveyors onshore are of fabric belt construction to minimise the risk of longitudinal tearing, are 1600 mm wide and run at the rate of 5 m/sec.

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Tramp iron magnets will be installed to protect the conveyor belting and chutes and hoppers will be fitted with fused alumina, and cast basalt tiles for impact and wear resistance.

Drives to conveyors, in general, consist of an electric motor, traction fluid coupling, bevel helical gearbox and output coupling fitted to each side of the drive pulley. Where possible standardisation of drive components, belting, conveyor pulleys etc. has been utilised to minimise spares holdings.

Special attention has been given to the specified requirements of the gear reducers to ensure reliable operation for the life of the plant.

The mobile machinery to be incorporated in Stage I of port facilities comprise one (1) Bucket Wheel Stacker/Reclaimer, two (2) Bucket Wheel Reclaimers and one (1) Stacker.

The stacking capacity will be 3,600 t/h and the reclaimers will have an average reclaim rate of 3,300 t/h. During shiploading, two (2) reclaim machines will operate simultaneously to achieve to shiploading rate of 6,600 t/h.

The mobile stockyard machines utilise booms 62.3 m long to enable efficient stacking and reclaiming of the flat topped stockpiles which are 15 m high and approximately 63 m wide. Reclaiming is achieved by 8.75 m diameter bucket wheels, and can be by either bench reclaiming, or pilgrim step reclaiming.

The layout of the plant provides for two (2) reclaim machines (Stacker/Reclaimer and Reclaimer or two (2) Reclaimers) to operate on the same tracks, and reclaim to individual stockyard conveyors.

Luffing of the booms is achieved hydraulically, and slew and long travel drives are electro-mechanical (DC).

Special attention has been given to the structural design of the machines to ensure adequate fatigue life, and the machines will be operational in wind velocities not exceeding 20 m/sec. Wind velocities in excess of 20 m/sec require the machines to drive to their respective parking areas. For wind velocities in excess of 35 m/sec, it will be necessary to anchor the machines to the ground by way of storm ties.

A dust suppression system, using surfactant, has been incorporated in the onshore works, and will treat coal at each transfer point in the conveyor system and at the reclaimer bucket wheels and stacker booms. Provision has been made for the future installation of stockpile sprays.

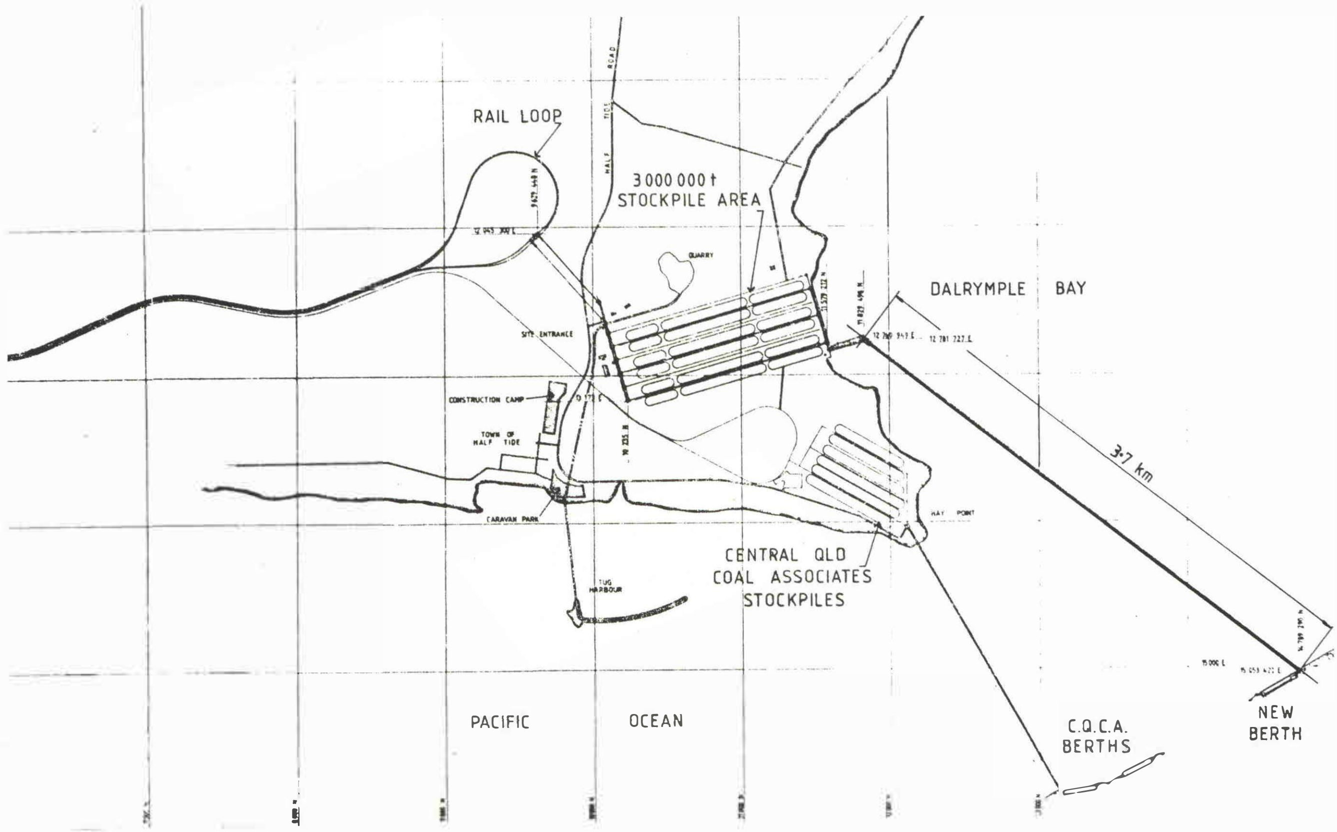

Fig. 1: General arrangement of Coal Terminal

Belt weighers will be installed on the inloading conveyor to monitor input and to regulate the vibrating feeders, and on the reclaim conveyors as a means of stockpile inventory.

2. Outloading Mechanical Equipment

The outloading mechanical equipment is designed to receive coal from stockpile or train at a rate of 6,600 t/h, and deliver to the shiploader which is located on berthing facilities approximately 3.7 km from shore.

The coal reports to a surge bin where recovery is by means of two (2) belt feeders, each having a variable feed rate between 1,650 t/h and 3,300 t/h. Drives to these belt feeders are electric motor, scoop control fluid coupling, bevel helical gear reducer and output coupling. The belt feeders incorporate 2,500 mm wide belts and operate at 0.72 m/sec maximum.

Coal is delivered by the belt feeders to the Jetty conveyor which has pulley centres of approx. 3700 m. This conveyor incorporates a 2,000 mm wide steel cord belt travelling at 5 m/sec.

Primary and Secondary head drive pulleys are utilised for this conveyor, each drive incorporating 2 x 750 kW motors, scoop control couplings, bevel helical gear reducers and output couplings, giving a total installed power for this conveyor of 3,000 kW.

Because of the high system inertia of this conveyor, special attention had to be given to sizing and location of the brakes to be employed. Hydraulically operated disc brakes were decided upon, and are located at the tail pulley, and adjacent to the gravity take-up. For environmental reasons, a belt turnover system will be installed on this conveyor.

The Jetty conveyor transfers coal to the wharf conveyor, which in turn, via a tripper, feeds the coal to the travelling luffing shiploader.

The shiploader, designed by Macdonald Wagner & Priddle Pty. Ltd., incorporates a winch operated luffing boom, a shuttle conveyor within the boom, and a telescopic loading chute (Fig. 2).

The loader has been designed for a blocked chute load of approximately 60 tonne and cyclonic wind loads of 280 km/h. Emergency power will be supplied on board by means of a diesel generator set.

The belt feeders at the surge bin are under the control of the shiploader operator, and with a readout from the belt weigher fitted to the jetty conveyor the operator can accurately control tonnages placed in various hatches, and can regulate throughput to enable hatch trimming to be carried out at a reduced rate.

3. Electrical Services

3.1 Power Supply and Distribution

The power supply to the site is via a new 33 kV overhead line built by the Mackay Electricity Board. The main substation at the site accepts the supply at this voltage using indoor metal-clad SF6 type switchgear.

An indoor type substation was chosen to avoid flash-over problems caused by coal dust and salt accumulation on outdoor insulators since the substation is located within 200 m of the shoreline. Outdoor insulators at the termination of the 33 kV feeder line have increased tracking distance to overcome this problem.

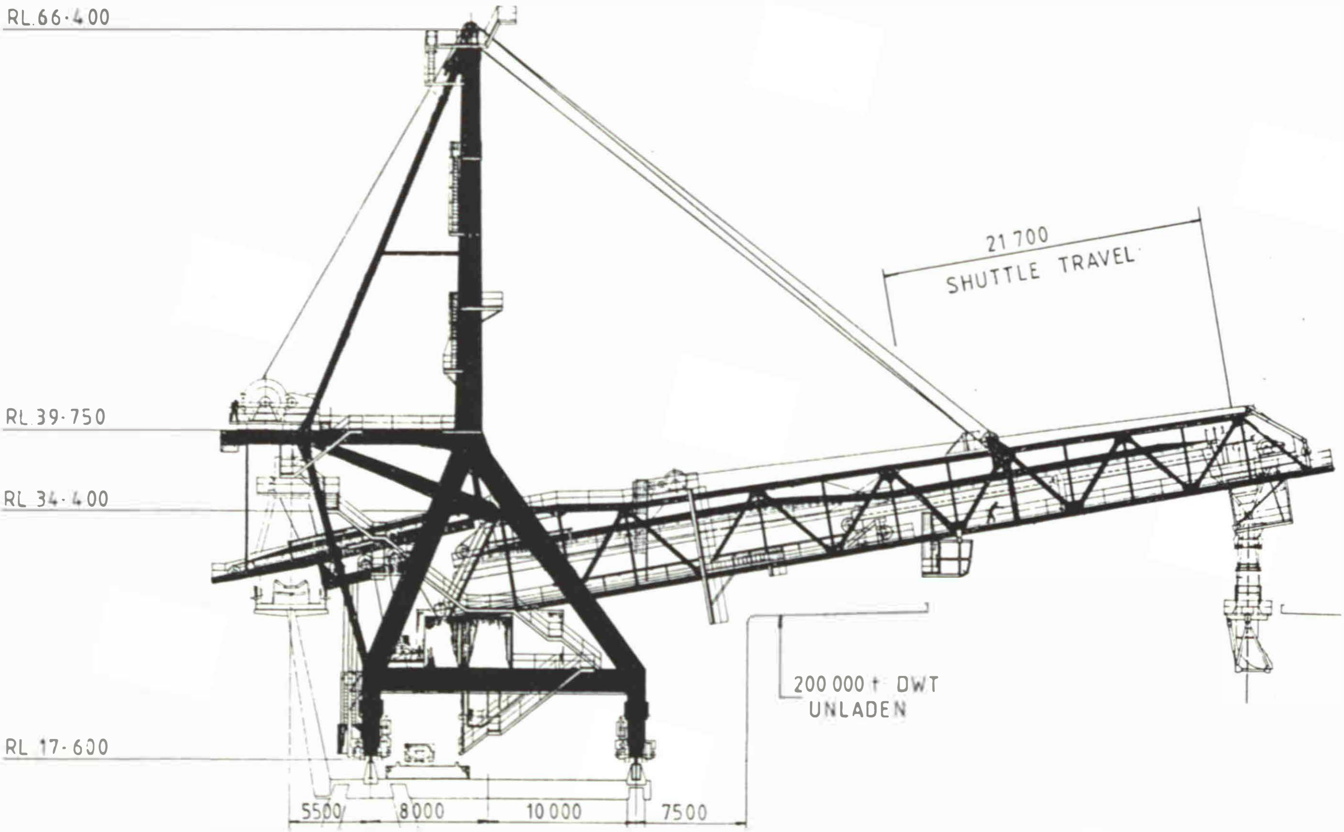

Fig. 2: General arrangement of Ship Loader

The operating range of the boom is +12°, —10° and the telescopic chute can reach 41.5 m from the front rail or 34 m from the berthing face to service a ship of 52 m beam and 200,000 DWT.

The A-frame is of box plate fully welded construction completely sealed thus eliminating the need for internal corrosion protection.

The boom is fabricated entirely from hollow sections presenting a minimum weight, easily painted and maintained structure. Of the 24 wheels 12 are driven through shaft mounted gearboxes. Long travel speed is up to 30 m/min with controlled acceleration and deceleration.

Whilst not in use the loader will be parked against buffers at the strong point and automatically latched against longitudinal loads. Fixed brackets on the bogies and matching brackets on the support structure mean that uplift loads are catered for automatically each time the loader is parked.

Space has been provided on the machine for safe maintenance and operation. Total mass of the loader when completed will be 850 tonnes, 200 of which will be the structure and mechanical equipment on the boom.

The initial development at the site will have an average demand of approximately 9.6 MVA with an ultimate average demand of approximately 18 MVA. Worst case maximum demands have been estimated at 13 MVA initially and 26 MVA ultimately.

The power supply is transformed at the main substation by 10/12.5 MVA ONAN/ONAF OLTC 33 kV/11 kV transformers. Power supply is distributed throughout the site at 11 kV to five (5) major substations. Each substation is supplied by parallel feeders on an open ended ring arrangement with each feeder capable of carrying the ultimate power requirements of the substation it feeds.

All 11 kV switchgear consists of metal-clad indoor small oil volume withdrawable circuit breakers.

Supply for conveyor drives and the shiploader is transformed at the various substations by 11 kV/3.3 kV ONAN transformers. These substations also provide low voltage supplies via 11 kV/433 V ONAN transformers.

The number and arrangement of transformers is such that the loss of any one transformer will not restrict the operation of the plant.

All major conveyor drive motors are rated at 3.3 kV and are controlled by withdrawable 3.3 kV vacuum contactor motor starters. Capacitors are fitted to the 3.3 kV contactor outputs to avoid low power factor when the motors are running lightly loaded. All conveyor motors are started DOL but fluid couplings are used for torque limitation.

Speed variation of belt feeders is attained by using scoop control fluid couplings. Scoop control couplings are also used on the Jetty conveyor with individual couplings on each of the four (4) 750 kW drive motors. This arrangement allows individual no-load starting of each motor prior to starting of the belt. Motor current feedback is used to control insertion of the scoops thus limiting starting torque and ensuring load sharing of the motors while accelerating the belt in the fastest time allowable which is dependent on the loading on the belt. The arrangement also allows the belt to be stopped and started without stopping and starting the drive motors.

The shiploader is supplied at 3.3 kV via trailing cable and is provided with an onboard 630 kVA 3.3 kV/433 V AN epoxy encapsulated indoor type transformer. A diesel alternator is installed on the shiploader to provide power for parking in the event of a power failure.

Each of the yard machines is supplied at 11 kV via trailing cable and are provided with onboard 11 kV/433 V dry type transformers.

3.2 Control and Monitoring System

The control and monitoring system consists of a distributed system of programmable logic controllers (PLCs) and a central computer system.

PLCs are located in each substation, the shiploader and each yard machine and are responsible for the control and interlocking of all items of plant within their area. Inter-PLC communications and interlocking between PLCs is all performed via the central computer.

As well as control, the PLCs perform data marshalling functions for data and diagnostic reporting to the central computer.

Each PLC is connected to the central computer via dual communication links to provide greater reliability of the communications.

The PLCs are provided with computer interfaces, modems, marshalling cubicles and uninterruptible power supplies at each location.

A mimic/control panel is provided in the central control tower for control and selection of the plant. The central control tower operator controls all plant except the yard machines, the outloading system downstream of the surge bin and the shiploader which are under the control of their individual operators (the outloading system being controlled by the shiploader operator). However, these operators must receive permissive signals from the central control operator before commencing operation. The mimic/control panel signals are processed by a PLC which communicates directly with the central computer system.

Primary collision avoidance of the yard machines is performed by the central computer system from position information transmitted from the machines. The central computer system gives initial alarm and then stop signals to prevent impending collisions.

An auxiliary collision avoidance system using radar and a stand alone microcomputer facility is used as a back-up system and trips the 11 kV circuit breakers on the machine power supplies after first giving a warning. Override of this system is provided to allow machines on adjacent tracks to pass.

The central computer system (CCS) is a fully redundant system with dual CPUs to provide system reliability. The CCS is provided with all necessary storage, VDU, printer and communication peripherals. The central control tower operators are provided with VDU terminals and a system printer to aid in plant control and monitoring. The maintenance offices are provided with a VDU for display of plant status and operation which allows rapid investigation of any problems since the status of all items of plant including all switchgear and field devices is monitored and available at the CCS.

As well as its plant control and diagnostic reporting functions, the CCS is programmed for stockpile inventory, plant maintenance history and spares records. A programme is also provided to restrict power consumption to within limits specified by the Mackay Electricity Board during their periods of peak consumption.

Provision is made for future computer terminals in the administration building for running accounting and port modelling programmes if required.

The CCS is powered through a static converter/inverter system with battery and diesel alternator back-up to ensure continuous operation.

3.3 Communications

Telephone communications to outside the site have been kept to a minimum and use a small PMBX system. Exchange lines and extensions associated with this system at the wharf are connected to the local Telecom Australia exchange via a radio link.

The main site communications use a microprocessor based PAX system which allows complete flexibility within the system such as hands free operation, group calls, conference calls and loud speaker operation. In plant areas, weather proof, dust proof stations are used which incorporate both loud speaker and private (handset) capabilities. Provision in this system is made for future interfacing with mobile radio and pocket paging systems if necessary.

For operations communications a dual channel UHF radio system is provided with base stations at the central control tower and mobile stations on each of the yard machines and the shiploader.

4. Future Development

As demand for further stockpile and shiploading capacity dictates, the facility, designed for duplication to achieve $30 \cdot 10^6$ t/year throughput, will be extended.

When the adjacent coal terminal operated by Central Queensland Coal Associates is taken into account, the Port of Hay Point will be the largest coal port in the world, having an annual throughput of approximately $50 \cdot 10^6$ tonnes.