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WASTE DUMP SPREADING

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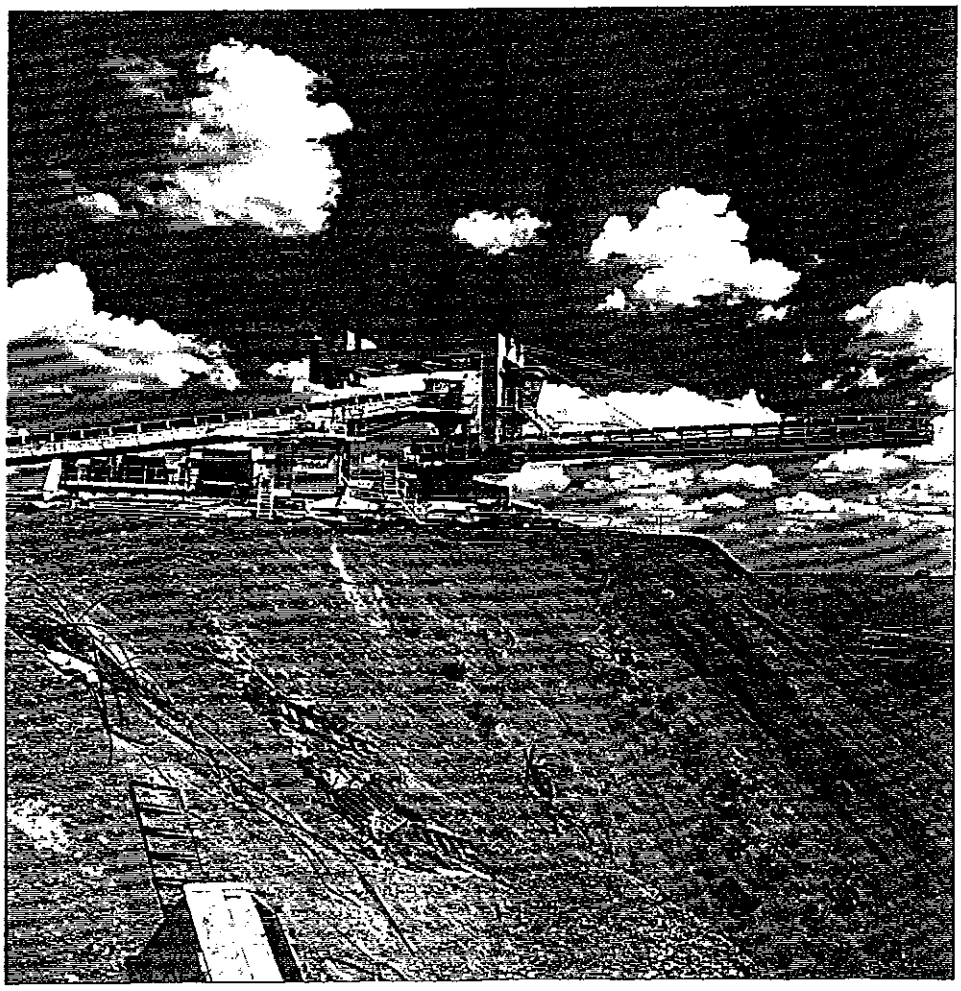
WASTE DUMP SPREADING

1.0 SYNOPSIS

The paper deals with the spreading of waste materials, such as ash and overburden.

The different systems of spreading are highlighted and particular emphasis is placed on South African installations in operation.

Alternative stacking systems are discussed and the writer endeavours to quantify the operating costs of such systems.



2.0 INTRODUCTION

The overburden and lignite in German mines was initially moved by discontinuous modes such as rail and road. Due to the ever increasing height of overburden, larger demand for coal an alternative cost effective solution had to be found. As these large deposits were covered by a soft sandy overburden the material lends itself ideally to belt conveying.

Continuous spreader systems were first introduced after the war in Germany and East European lignite pits. These mines rely heavily on the need to transport waste material speedily over long distances, the costs associated with these operations being substantial.

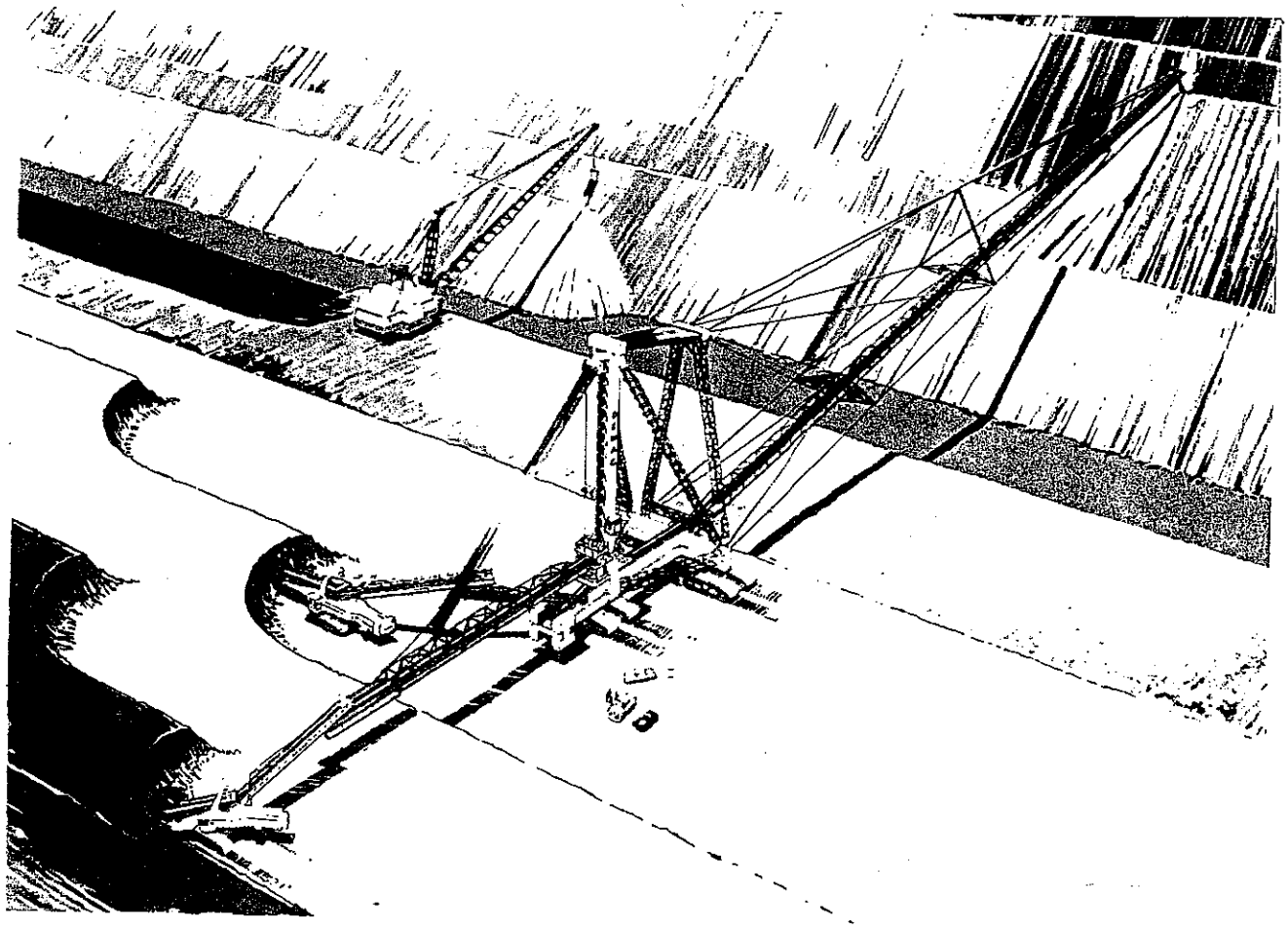
It is, therefore, most important that both overall efficiency in terms of energy requirements, together with optimum least cost performance over the life of the installations are obtained.

The continuous transportation mode of conveying and spreading proved to be a reliable and cost effective solution.

Spreaders with boom lengths of 100 to 200 metres were developed and installed. Belt speeds of 7,5 m/s are common and machines with 15m/sec. belt speeds are operational. Capacities of such spreaders vary from 1 to 1,8 million ton of overburden conveyed per annum.

The largest spreader in operation in the world is the X.P.S. machine at the Big Brown mine in Texas, U.S.A., with a total length of 305m. This machine is fed with a bucket wheel excavator via a 100 metre link conveyor discharging the overburden directly across the pit over a 205 metre discharge boom.

In South Africa, the first spreading system was installed at the Sishen Open Cast mine in 1982/1983 for the dumping of calcrete overburden. The material was blasted and transported by trucks to an inpit crusher, thereafter the crushed material was conveyed via an overland conveyor to a spreader system for building of the waste dump.



XPS - SYSTEM

Jobsite:	Big Brown Mine, Texas Utilities, Dallas/USA
System commissioned:	January 1986
Guaranteed capacity:	3060 bank m^3/h
Excavation:	by 2 twin crawler excavators HD 710

3.0 SPREADER INSTALLATIONS IN SOUTH AFRICA

1. ESKOM LETHABO

2 x SPREADERS

Boom Length	40 metre
Link Conveyor Length	36 metre
Spreading Capacity	2060 t.p.h.

2. ESKOM TUTUKA

1 x SPREADER

Boom Length	30 metre
Link Conveyor	35 metre
Spreading Capacity	1200 t.p.h.

3. ESKOM MATIMBA

1 x SPREADER

Boom Length	30 metre
Link Conveyor	35 metre
Spreading Capacity	1800 t.p.h.
1 x Belt Waggon	50 metre
Spreading Capacity	1800 t.p.h.

4. ESKOM KENDAL

1 x SPREADER

Boom Length	35 metre
Link Conveyor	30 metre
1 x Belt Waggon	50 metre
Spreading Capacity	2000 t.p.h.

5. ISCOR GROOTEGELUK

2 x SPREADERS

Boom Length	50 metre
Link Conveyor	40 metre
Spreading Capacity	6000 t.p.h.

6 a. ISCOR SISHEN

1 x SPREADER

Boom Length	50 metre
Link Conveyor	35 metre
Spreading Capacity	5000 t.p.h.

6 b. 2 x SPREADER

Boom Length	38 metre
Link Conveyor	20 metre
Spreading Capacity	3600 t.p.h.

7. SASOL SECUNDA ASH

2 x SPREADER

Boom Length	30 metre
Link Conveyor	35 metre
Capacity	1220 t.p.h.

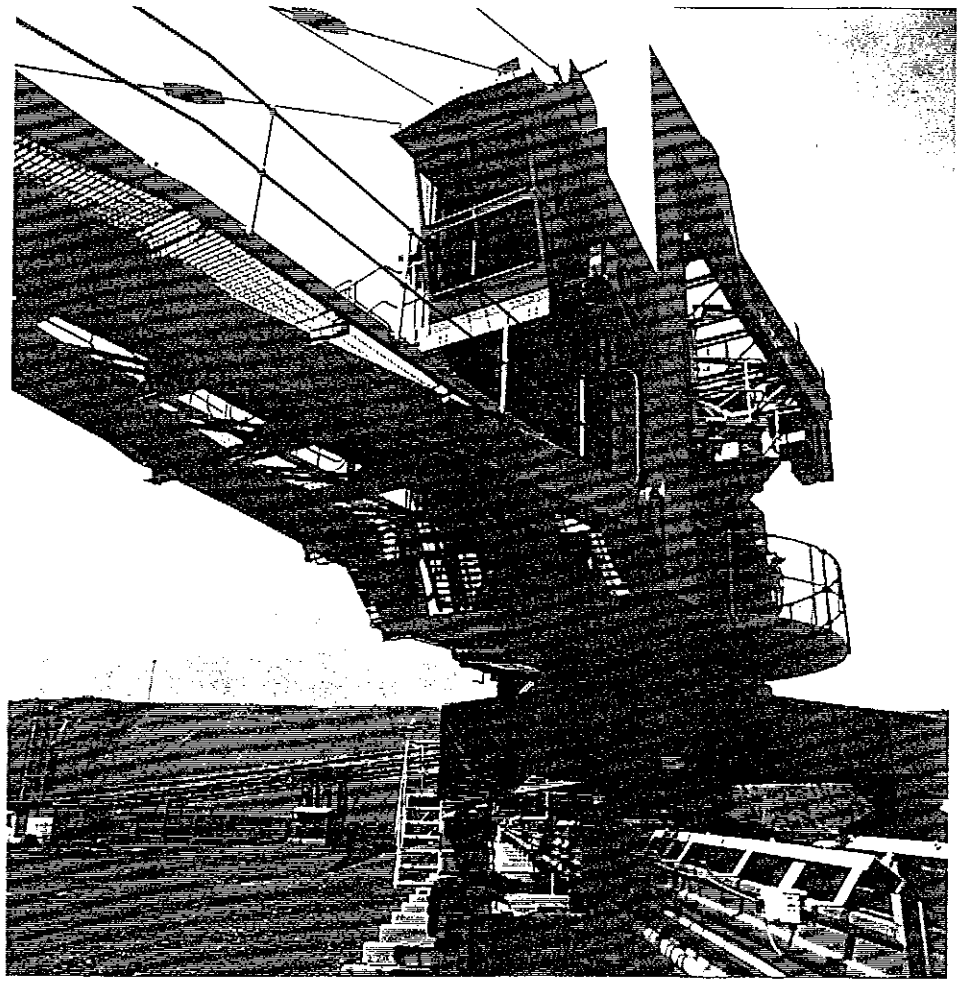
8. SASOL 1

SELF ADVANCING SPREADER CONVEYOR

Boom Length	22 metre
Capacity	1220 t.p.h.

9. ANGLO AMERICAN - NEW VAAL

1 x SPREADER



4.0 RAIL MOUNTED SELF-ADVANCING SPREADER SYSTEM

PREAMBLE

The equipment forms part of a feed conveyor and slewable spreader system handling a mixture of coarse and fly ash of a highly abrasive nature, and operating under extremely arduous conditions. The equipment is initially rail-mounted, the non-luffing spreader operating in conjunction with the hydraulically self-advancing elevated head-end of the feed conveyor. In the medium term the equipment will be converted to a crawler-mounted spreader and rail-mounted tripper carriage connected via a new articulated link conveyor.

DESIGN PARAMETERS

Material	Coal Ash
Angle of Repose	38°
Bulk Density	1100Kg/m³ (dry)
Design Ground Bearing Pressure	150KPa
Inclination of Conveyor at Head end	12°
Spreader Slew Angle	180°
Design Capacity	1220t.p.h.
Design Length of Feed Conveyor	1200 metre
On Board Belt Storage Length	180 metre

SYSTEM DESCRIPTION

Ash is fed onto the feed conveyor tail-end via a dump conveyor system. The tail-end structure is of the fixed modular design. The intermediate structure consists of shiftable pontoon-mounted modules for carrying the conveyor belt and extending the system.

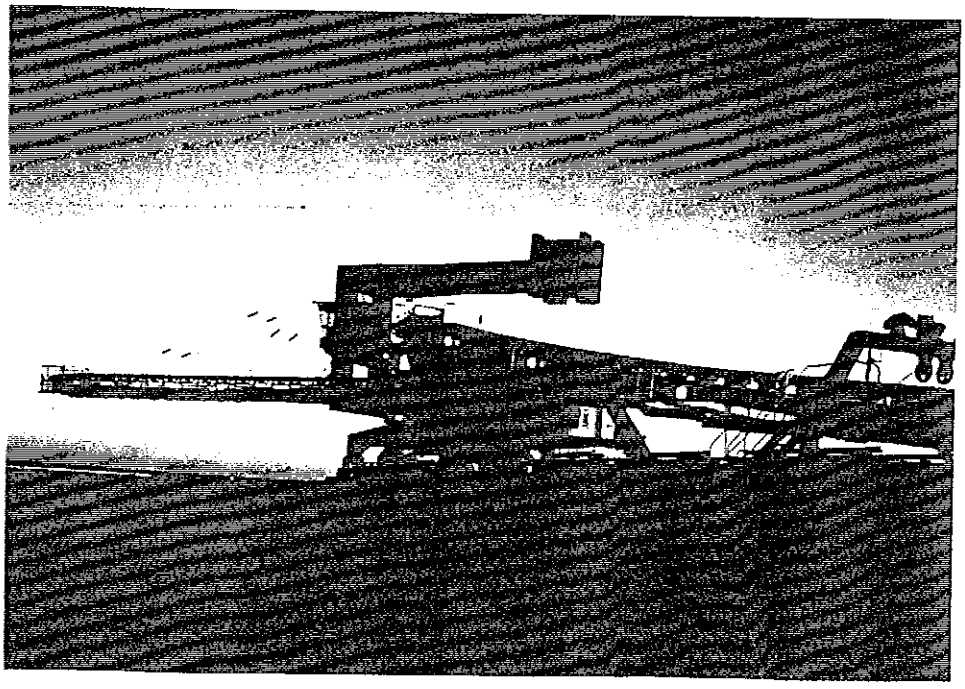
The head-end structure is elevated for discharging the ash onto the spreader boom conveyor, and rail-mounted on track sections for longitudinal travel by means of the self-advancing hydraulic system. A dual conveyor drive system is installed on the elevated boom. The power transformer, electro-house, and power and control cable reeling drums are installed on the lower equipment platform. Under specified full load conditions the feed conveyor advances in 1,3 m increments at 90-minute intervals corresponding to each 180 degree slewing cycle.

In the medium term the structure will be converted to a rail-mounted tripper carriage with motor driven bogie wheels, the dual conveyor drive system being re-located to the feed conveyor tail-end, and the self-advancing hydraulic mechanism being completely removed.

Advancing of the spreader is effected by two Hydraulic cylinders, each of which is capable of advancing the machine. Rail clamps are spring engaged and hydraulically disengaged. For advancing the machine, the hydraulic circuit is so designed as to release the brake's before fluid is supplied to the advancing cylinders. Rail clamps are used for maintaining the position or advancing the spreader.

The spreader undercarriage is rail-mounted on track sections for longitudinal travel, the lower ring girder supporting the slewing ring. The spreader superstructure is of the C-frame pylon and counterweight boom design supported on the upper ring girder. A central hydraulic power pack, slewing hydraulic system, and slewing central lubrication system are installed on the ring girder and circular access platform. The operator's cabin is installed in an elevated position on the C-frame vertical pylon. In the medium term the structure will be converted to a crawler-mounted stacker with motor driven tracks, the head-end of the new link conveyor being supported on the superstructure, and the bogie system being modified to support the tail-end of the new link conveyor.

The boom conveyor is of the cantilevered wire-rope suspended design, and remains horizontal (i.e. non-luffing) throughout the 180 degree slewing cycle for discharge of ash from the specified + 25 m dump top level. Under specified full-load conditions the boom conveyor slews in 4 degree increments at 2-minute intervals.



5.0 CRAWLER MOUNTED SPREADER SYSTEM

OPERATING PHILOSOPHY

1.0 GENERAL INFORMATION

The Lethabo Ash Handling System has the following data :

1.1 CONVEYORS

Maximum Conveying Capacity	2060 t/h
Belt Width	1500 mm
Belt Speed	2.8 m/s
Belt Troughing Angle	45 degrees

1.2 STACKER

Capacity	2060 t/h
Belt Width	1500 mm
Belt Speed	3.0 m/s
Link Conveyor Length	32 m
Boom Length	35 m
Ground Bearing Pressure	70 - 90 kPa
Power Supply	3,3 kV

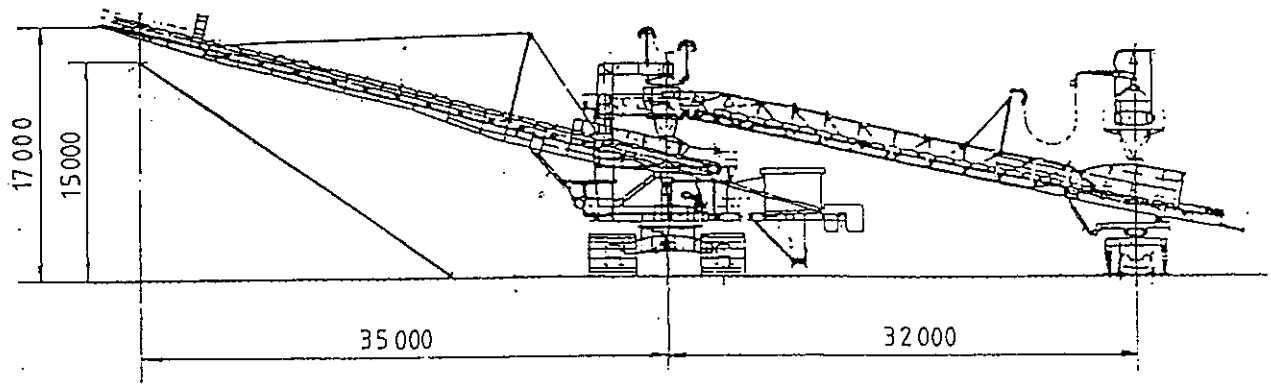
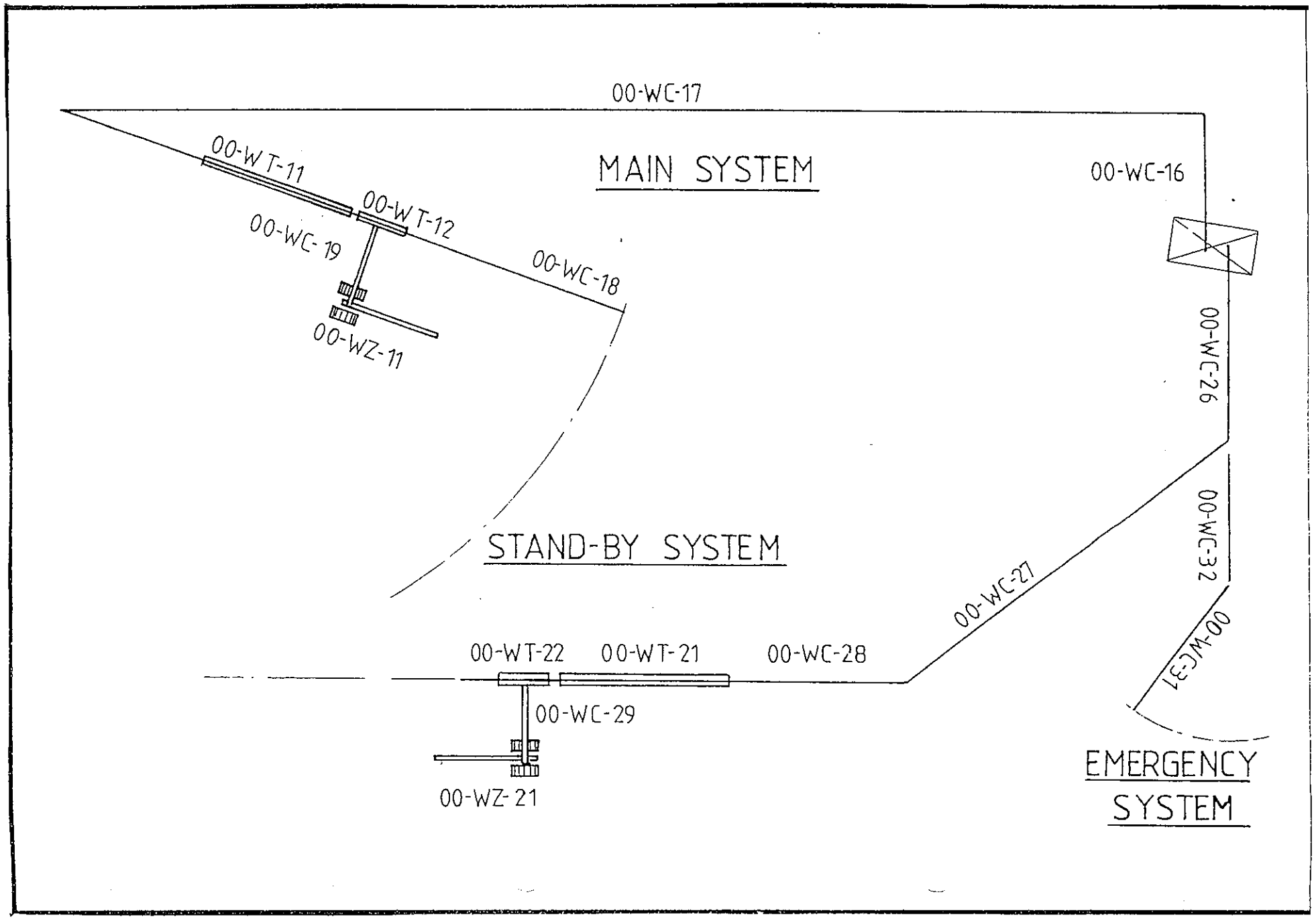


FIGURE 1

1.3 EQUIPMENT LIST
(SEE FIGURE 2)

ALPHA NUMERIC CODING	EQUIPMENT DESCRIPTION
	MAIN STACKING SYSTEM
00-WC-16	FIXED TRANSFER CONVEYOR
00-WC-17	EXTENDABLE TRUNK CONVEYOR
00-WC-18	SHIFTABLE DUMP CONVEYOR
00-WC-19	STACKER LINK CONVEYOR
00-WT-11	DUMP CONVEYOR TRIPPER CARRIAGE
OO-WT-12	LINK CONVEYOR TRIPPER CARRIAGE
00-WZ-11	CRAWLER MOUNTED STACKER
00-WZ-11	STACKER BOOM CONVEYOR
	STANDBY STACKING SYSTEM
00-WC-26	FIXED TRANSFER CONVEYOR
00-WC-27	EXTENDABLE TRUNK CONVEYOR
00-WC-28	EXTENDABLE DUMP CONVEYOR
00-WC-29	STACKER LINK CONVEYOR
00-WT-21	DUMP CONVEYOR TRIPPER CARRIAGE
00-WT-22	LINK CONVEYOR TRAILING CARRIAGE
00-WZ-21	CRAWLER MOUNTED STACKER
00-WZ-21	STACKER BOOM CONVEYOR
	EMERGENCY STACKING SYSTEM
00-WC-31	SLEWABLE SPREADER CONVEYOR
00-WC-32	MOVING-HEAD SHUTTLE CONVEYOR


00-WC-17
MAIN SYSTEM
00-WT-11
00-WT-12
00-WC-19
00-WC-18
00-WZ-11
00-WC-16
00-WC-26
00-WC-32
00-WC-31
00-WC-27
STAND-BY SYSTEM
00-WT-22
00-WT-21
00-WC-28
00-WC-29
00-WZ-21
EMERGENCY
SYSTEM

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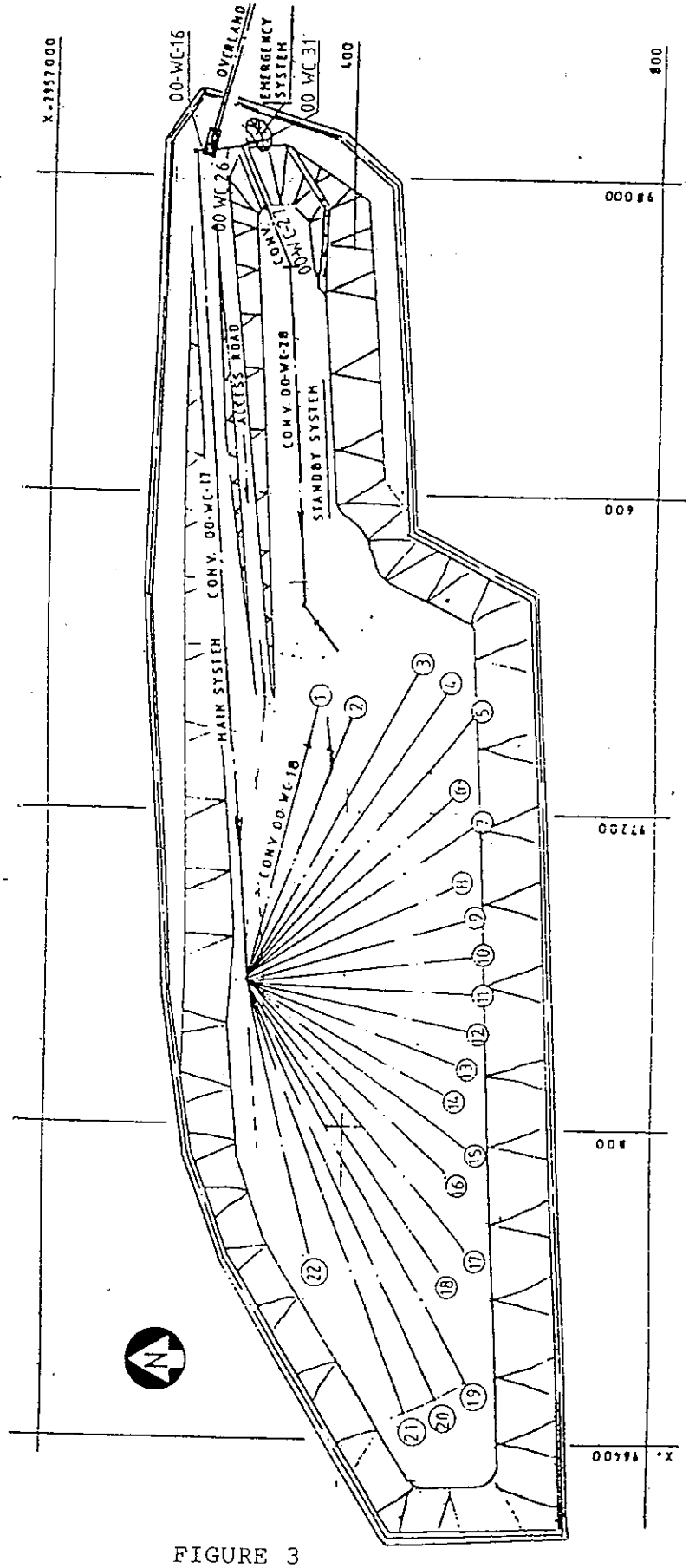

X+2357000
00-WC-16
OVERLAND
EMERGENCY SYSTEM
00 WC 31
00 WC 26
00 WC 21
CONV
ACCESS ROAD
CONV. 00-WC-18
STANDBY SYSTEM
MAIN SYSTEM
CONV. 00-WC-17
CONV 00-WC-18
N
600
800
97200
98400
X+

FIGURE 3

The Ash Stacking System consists of three streams :

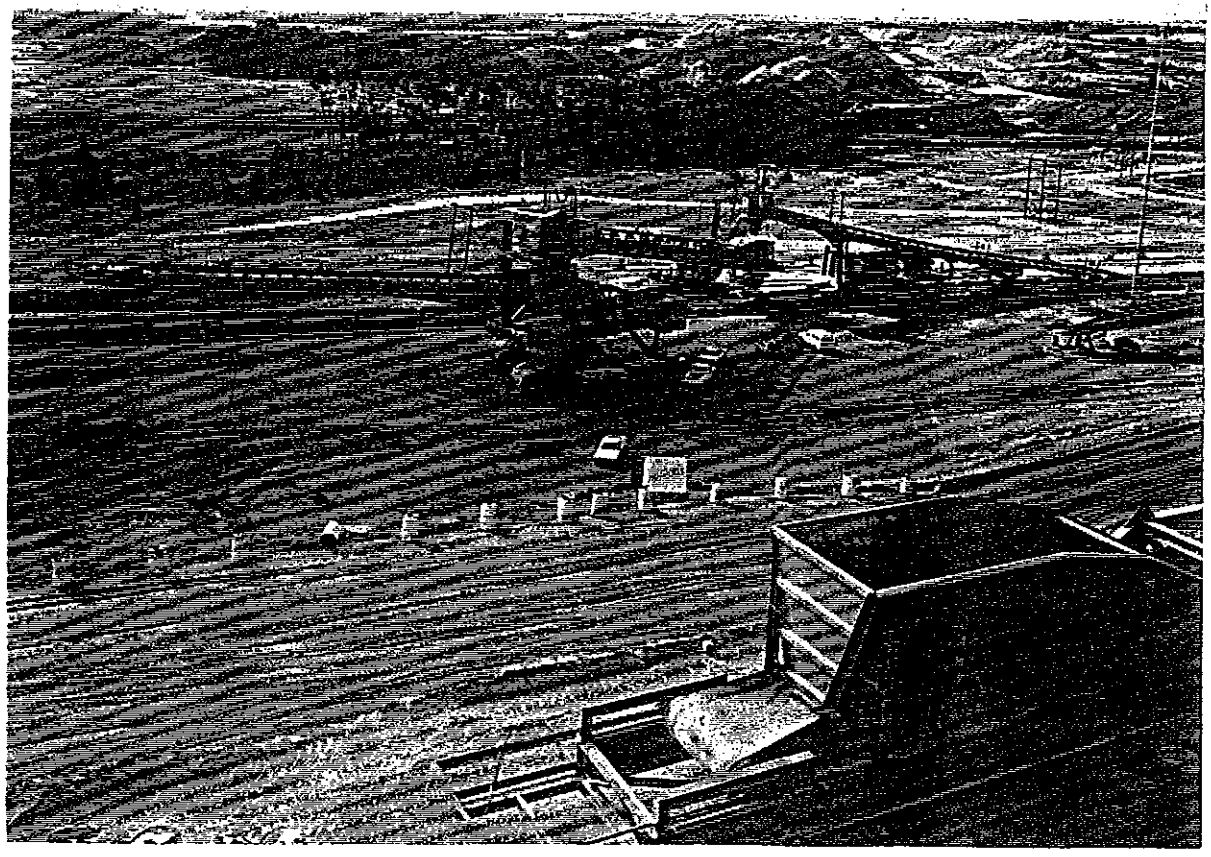
a) Main System

b) Standby System

c) Emergency System

It is intended to operate the Main System approximately 80% and the Standby System 20% of the time, while the Emergency System is intended to be solely used for emergencies.

The ash from the two overland conveyors can be distributed to either the Main or Standby System. In case of emergency, the ash is directed via the first Standby System Conveyor onto a Shuttle Conveyor, across which it is diverted onto the emergency slewing spreader. (Please refer to Figure 2).



PART 1

2.0 EMERGENCY SYSTEM

The Emergency System consists of :

a) Fixed Transfer Conveyor 00-WC-26

b) Moving-head Shuttle Conveyor 00-WC-32

c) Slewable Spreader Conveyor 00-WC-32

The Emergency System is designed for a capacity of 900 t/h only. The radial stockpile shown in Figure 4 has a capacity of 3500 cubic metres, which allows for approximately 4 hours of continuous operation.

The System is exclusively used in case of emergency.

The Material is fed along the Conveyor 00-WC-26 onto the Conveyor 00-WC-32 and onto Conveyor 00-WC-31.

2.1 FIXED TRANSFER CONVEYOR 00-WC-26

(Length 36 m)

Conveyor 00-WC-26 receives the ash from either of the two incoming overland Conveyor 00-WC-15/25.

Above conveyor normally feeds the ash onto Conveyor 00-WC-27. Only in case of emergency is the conveyor 00-WC-32 moved into the material stream to reroute the ash to the Emergency System.

2.2 MOVING-HEAD SHUTTLE CONVEYOR 00-WC-32

The Shuttle Conveyor is operational only when material is stacked onto the Emergency stockpile. It is designed to handle 900 t/h and is moved into the operating position by locally pressing a pushbutton. This actuates the start and stop of the long travel drive which operates via a rack and a pinion. It is manually locked when in final position. The start-up of the actual Emergency Stacker Spreader is also local.

2.3 SLEWABLE SPREADER CONVEYOR 00-WC-31

The Slewable Spreader Conveyor rotates 49 degrees around a centre feed point shown in Figure 4. The Conveyor has a discharge height of approximately 9 m. The long travel and the Conveyor are locally started and stopped.

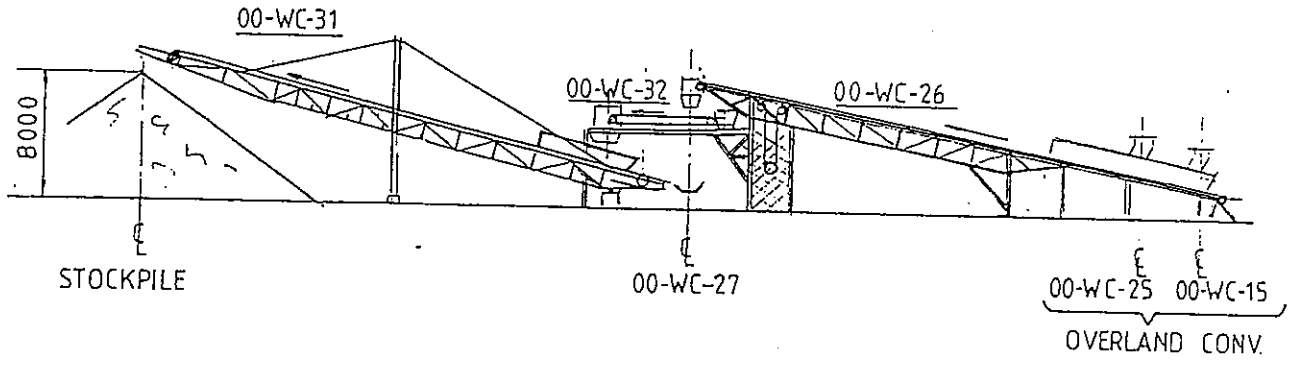


FIGURE 4

PART 2

3.0 **MAIN STACKING SYSTEM**, consisting of:

a) Fixed Transfer Conveyor 00-WC-16.

b) Extendable Trunk Conveyor 00-WC-17.

c) Shiftable Dump Conveyor 00-WC-18.

d) Crawler-mounted Stacker 00-WZ-11, Stacker Link Conveyor 00-WC-19 and Dump Conveyor Tripper Carriage 00-WZ-11.

3.1 FIXED TRANSFER CONVEYOR 00-WC-16 (22M LENGTH)

The short 22m conveyor receives the ash independently from either of the two incoming overland conveyors, 00-WC-15/25. A shaft mounted 45 kW/380 V drive unit complete with holdback is mounted at the end of the conveyor, while the screw take-up is at the tail end. Sufficient length of skirting plate guarantees smooth material flow and eliminates spillage, while a deflector plate allows the adjustment of the material trajectory onto downstream conveyor. The conveyor is mounted on a permanent foundation basis.

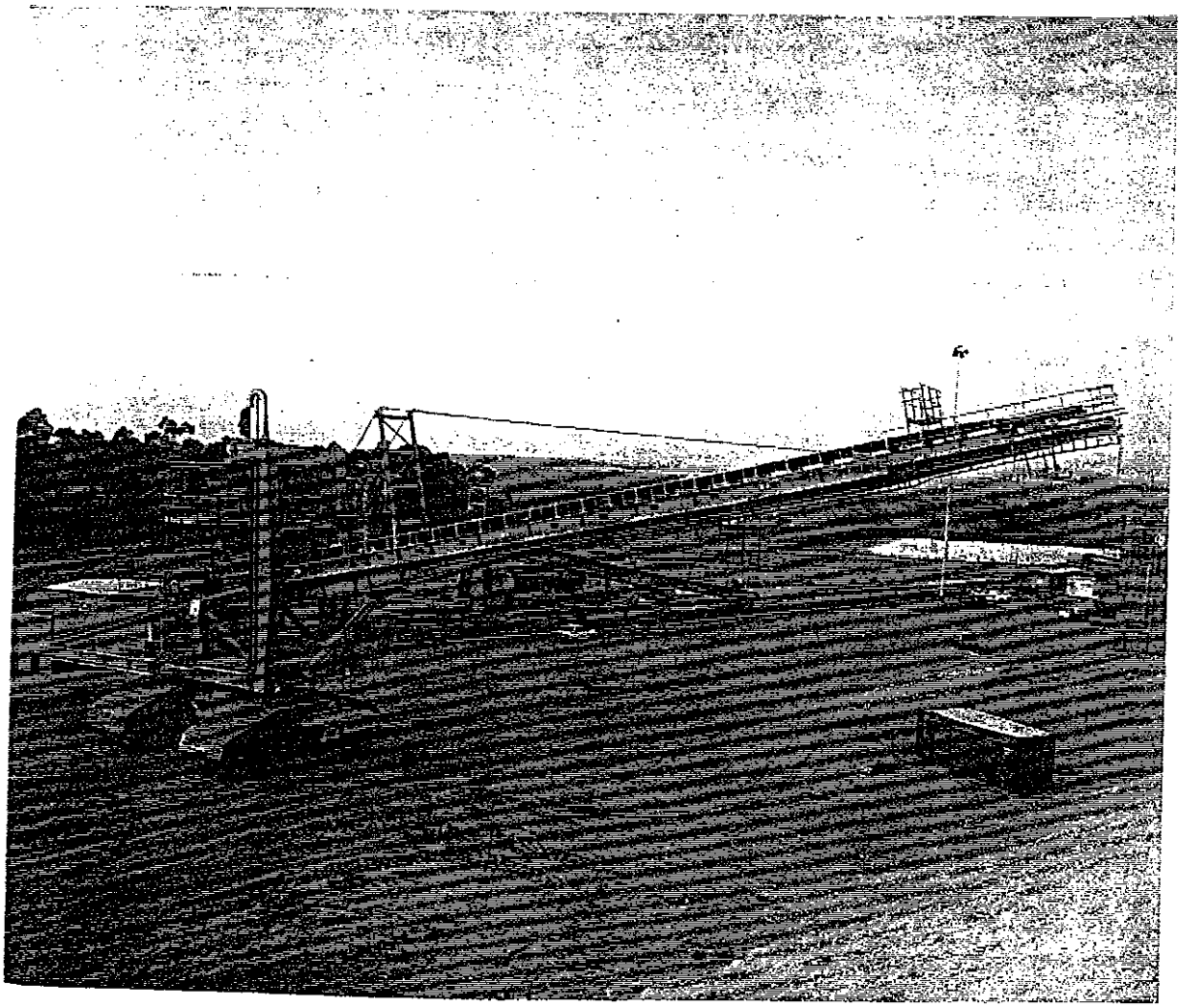
3.2 EXTENDABLE TRUNK CONVEYOR 00-WC-17

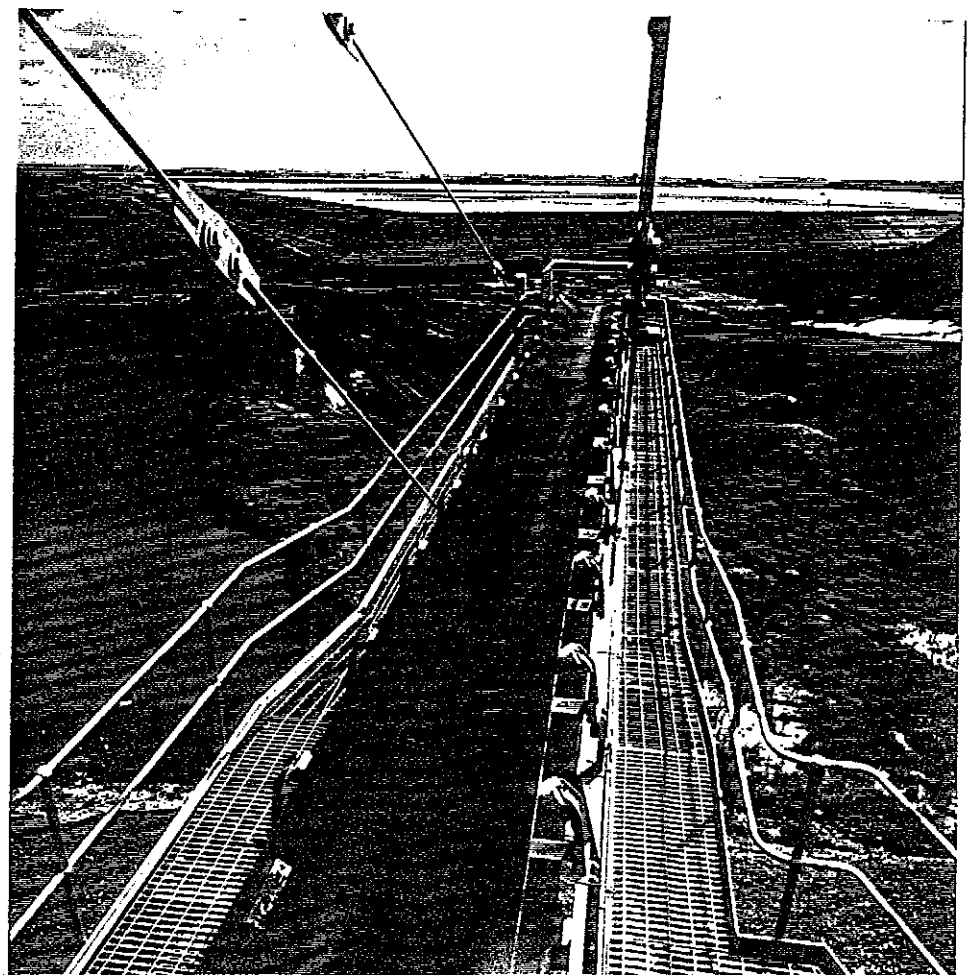
(Final length 1050m)

An initial 480m of above Conveyor is installed on a prepared earth ramp with an incline of 1 in 40 to an approximate height of 10m. (See Figure 5).

The Conveyor is made up of standard shiftable conveyor modules which are later used for a future conveyor. The drive station and head-return station are used from Conveyor 00-WC-18.

The Conveyor is equipped with a tail drive with 2 x 255 kW/ 3,3 kV drive units. They are shaft-mounted on either side of a single drive pulley.





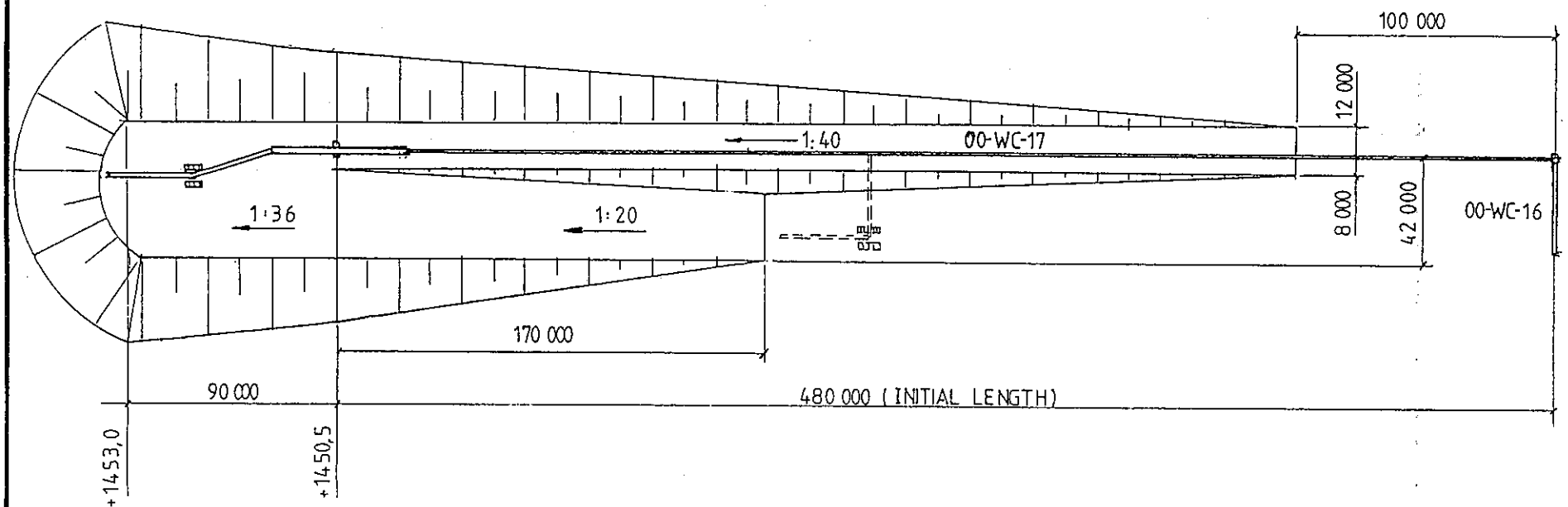


FIGURE 5

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3.2 EXTENDABLE TRUNK CONVEYOR 00-WC-17 (Cont'd)
(Final length 1050m)

Special provision on the conveyor head and bend pulley position of the tripper car allows to overrun the head station by 31,4m. This overrun is required to extend the conveyor as far as possible during a plant shutdown and conveyor extension. To allow the link conveyor carriage to travel uninterrupted into the extended position, 5-6 modular sections and rails have to be installed ahead of the head station.

With a total machine length of 67m, the maximum possible overrun could be 98,4m. In practice however, 15 modules per 6m length = 90m are used for every extension. (See Figure 5).

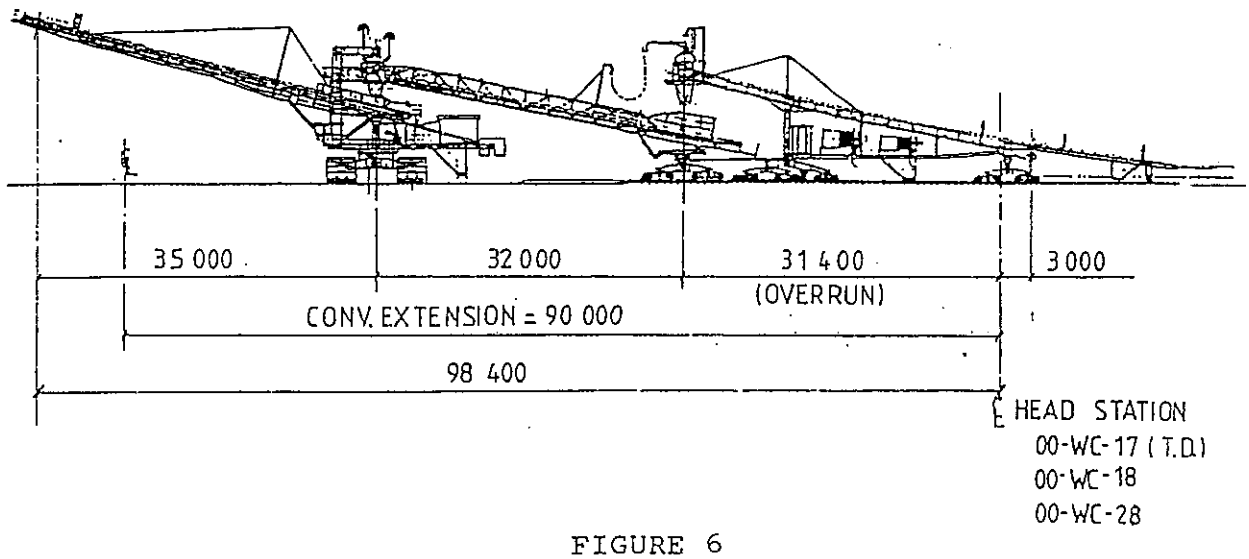

FIGURE 6

3.2 EXTENDABLE TRUNK CONVEYOR 00-WC-17 (Cont'd)
(Final length 1050m)

The modules are interconnected with a standard SAR rail of 48kg/m on both sides. Intermittent sleepers are provided initially for 480m but are not installed on the compacted earthramp. They are used on the ash dump only to accommodate the specified low ground bearing pressure.

The following extension phases, listed in Chapter 2.0 are required to reach the final conveyor length of 1050m : Phases 2A, 2B, 4-8, 10, 12B.

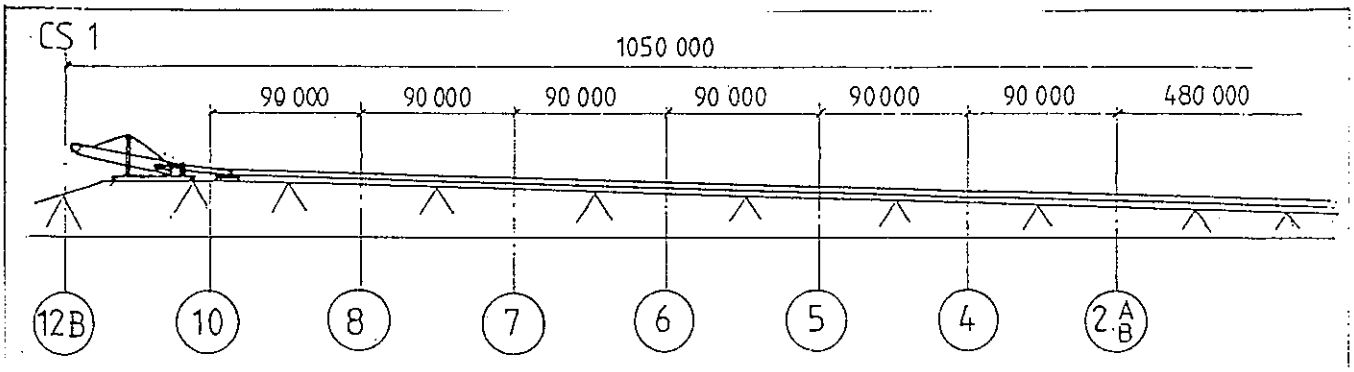

FIGURE 7

Once the final conveyor length of 1050m is reached, the machine overruns the drive station as far as possible and begins to run back along the travel path 32m from the centre line conveyor, thereby widening the crest to a width of 67m. (See Figure 8).

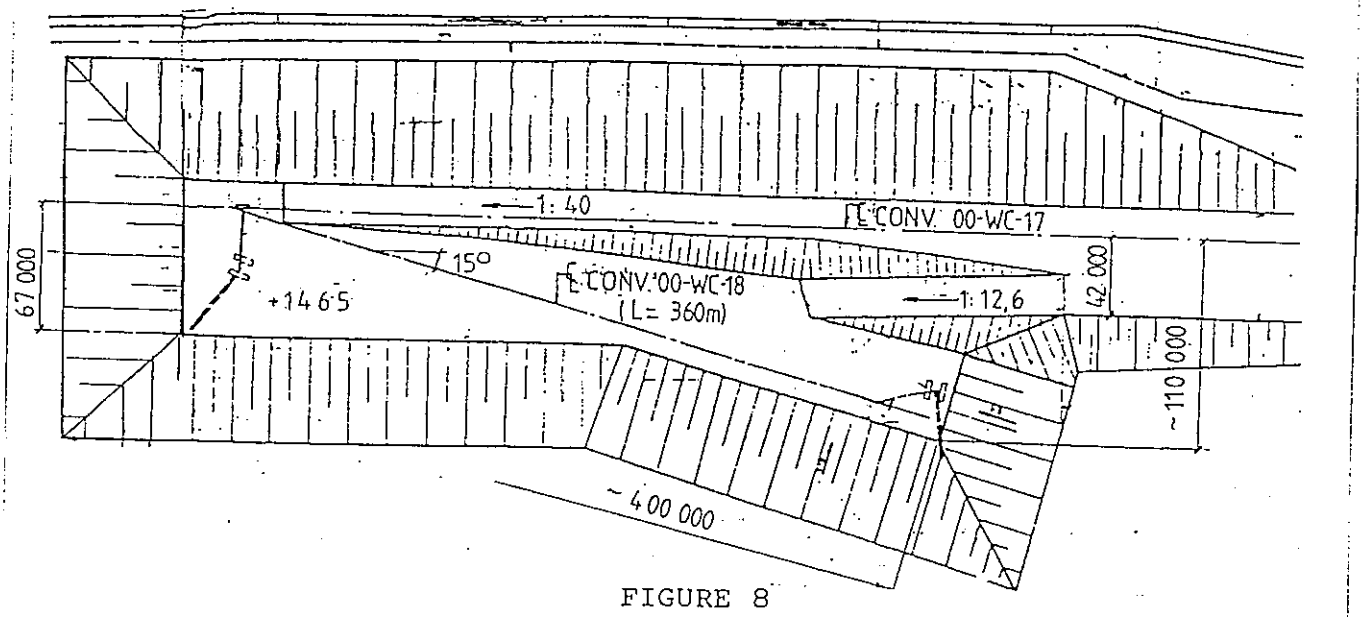

FIGURE 8

3.2 EXTENDABLE TRUNK CONVEYOR 00-WC-17 (Cont'd)
(Final length 1050m)

In preparation for the installation of Conveyor 00-WC-18, the crest must be locally extended by bulldozers to approximately 110m and an access and supply road with an incline of 1 in 12,6 must be cut. Please note that the platform for Conveyor 00-WC-18 is to be horizontal, and not with an incline of 1 in 40 as applicable to the Conveyor 00-WC-17. There is therefore a small increasing ramp between the two conveyors. (See Figure 8).

3.3 CRAWLER MOUNTED STACKER WITH LINK AND BOOM CONVEYOR

The Crawler Mounted Stacker is designed for an extreme low ground bearing pressure to safely operate on an ash dump. To achieve this, an equalised crawler system is used with the track rollers on fully compensated bogies. The track width is 3,0m. The crawler travel drive consists of two 75kW DC motors, connected via propshafts to planetary gearboxes. They allow the Stacker to negotiate an incline of 1 in 10 at an infinite variable speed of 0-8m/min.

3.4 TRIPPER CAR

Special features of the tripper car are:

a) The bend pulley is located at the tail end of the structure, which together with the cantilevered chute, allows for the beforementioned overtravel of the head station.

b) A special designed chute arrangement and a low conveyor head station allow the stacker to travel uninterrupted around the conveyor head as indicated in Figure 5.

c) Power and control cable reels are designed for 600m of flexible power and control trailing cables which is sufficient to travel over the full length of Conveyors 00-WC-17 - and 00-WC-18 of the main system, when fed at 480m and 180m respectively.

3.4 TRIPPER CAR (Cont'd)

The feed points for the Standby System Conveyors 00-WC-27/28 can be located at approximately 30m after the material transfer point. It is intended to have two feed points on the 2000m long future conveyors. They would be located at one third from each end of the conveyor. The tripper car is self propelled with 24 individual drive units of 1.1 kW each, of which 8 drives are mounted on the link conveyor support carriage. The fully automatic travel drives are infinitely variable from 1 - 8m/min. and are monitored from the machine Operation Desk located on the Stacker. Two manually operated storm brakes are provided.