FINAL REPORT

SALINITY CONTROL AND RECLAMATION PROJECT 2-A

West Pakistan

Water and Power Development Authority

U.S. AID LOAN NO. 391-H-055

R-1680

PD-AAL-324
ISN 12938
39101

FINAL REPORT

WEST PAKISTAN

WATER AND POWER DEVELOPMENT AUTHORITY

SALINITY CONTROL AND RECLAMATION PROJECT 2-A

U.S. AID LOAN NO. 391-H-055

R-1680

COMMONWEALTH ASSOCIATES INC.

SEPTEMBER, 1975

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Jackson, Michigan 49201
September, 1975

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September 17, 1975

Chief Engineer (GS) Construction
Water And Power Development Authority
Sunny View Estates
Kashmir Road
Lahore, Pakistan

SUBJECT: SALINITY CONTROL AND RECLAMATION
PROJECT 2-A, FINAL REPORT
U.S. AID LOAN NO. 391-H-055

Dear Sir:

We are pleased to transmit herewith the Final Report required by Implementation Letter No. 1 of U.S. AID Loan No. 391-H-055 for the SCARP 2-A Project.

On behalf of Commonwealth Associates Inc. and all our personnel who worked on this Project, we would like to thank you for the cooperation and assistance we received from you and members of your staff during the implementation of this Project.

We look forward to working with you and WAPDA on future projects in Pakistan.

Very truly yours,

R. E. Folmsbee, P.E.
Division Director
Construction Management Systems

CJS/AJR/smd

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

SUMMARY

The West Pakistan Water and Power Development Authority, a semi-autonomous corporate body established by the Government of West Pakistan, and charged with the responsibility for the unified and co-ordinated development of the water and power resources of West Pakistan, is financed as a public agency and may, with the sanction of the Government, obtain foreign loans or aids. Payment of such loans is guaranteed by the Government of Pakistan.

Over a period of seventy years since the construction of irrigation systems over a large area of Northern Pakistan known as the Punjab, a gradually rising saline water table endangered and in some areas destroyed the agricultural productivity of the land. The reclamation of these lands was undertaken by the Authority using a system of drains and tubewells to be powered by the West Pakistan High Tension Grid and West Pakistan Secondary Transmission Projects constructed concurrently.

Following the successful completion of the initial phase of the reclamation project known as SCARP 1, the Authority undertook the reclamation of the Chej Doab district under the designation of SCARP 2 and further divided into sectors 2A and 2B. The electrification of SCARP 2A is the subject of this report.

July 1964 the Authority submitted a loan application and plan of execution to the United States Government for the purchase of transmission and substation materials necessary to expedite the project.

Pre conditions to financing were fulfilled in November 1964 and letters of commitment were issued as the project segments and their respective requirements developed.

The services of Commonwealth Associates Inc. of Jackson, Michigan U.S.A. were retained to assist the Authority in the execution of the project and were responsible for the following services:

1. Prepare specifications for substations and overhead line materials and equipment.

2. Prepare engineering plans, estimates, designs and working drawings for construction of the various lines and substations.

3. Coordinate requirements for village electrification and general distribution with the requirements of the project in planning lines and substations.

4. Plan construction schedules of lines and substations in order that these schedules may be coordinated with the tubewell construction schedules.

5. Administer contracts for construction and inspection of contract work to determine that construction conforms to drawings and specifications and complies with established construction schedules.

6. On behalf of the Authority, prepare and certify purchase orders on forms approved by the Authority and AID covering purchases of equipment and materials in the USA and forward such purchase orders to the Authority for its signature and Issuance, or its authorization for Commonwealth to sign and issue as agent for the Authority. Payments for all such orders shall be made directly by the Authority.

7. Make inspections and witness manufacturers' tests of equipment and materials as deemed necessary by Commonwealth to determine Conformance with specifications and drawings. These services will be performed in manufacturers' plants prior to shipment and/or at the job sites. Reports of such inspections and tests shall be prepared and submitted for the Authority's and AID's permanent records.

8. Provide, as needed, services for expediting equipment and materials shipments. Regular or special visits to suppliers' factories were scheduled as necessary in an effort to obtain or maintain promised shipment schedules and/or to discover and correct, if possible, defaults in manufacturers' schedules that might lead eventually to construction delays.

9. Assist in settling disputes or differences that may arise between the Authority and the Contractors excepting arbitration and litigation.

10. Review expenditures to determine consistency with physical progress made.

11. Certify fulfillment of electrical supply requirements and certify completion of the project electric lines and substations.

12. Prepare progress reports and, as necessary, make them available to other Authority consultants for inclusion in consolidated reports as required by AID.

13. Perform other engineering management and supervisory services as may be required to properly coordinate the progress of the work.

The project consisted of the design and supervising of construction of 70 miles of 132 kV transmission lines, three associated grid stations and approximately 850 miles of 11 kV distribution lines serving 884 tubewells.

Construction was scheduled to coincide with the progress of the tubewell installations which were under another contract and completed in October of 1968.

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WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

DESCRIPTION

The project was located in an area known as the Chenab Doab Area in West Pakistan, located about 110 miles northeast of Lahore, the headquarters of the Authority, and about 900 air miles northeast of Karachi, the nearest seaport.

Urdu is the most widely spoken language in West Pakistan, however, English is used almost universally in the Government and in commerce and business.

The territory is generally flat and varies from irrigated agricultural land to arid plains. The climate is hot except during the winter months of November through February. Maximum temperatures reach 120° Fahrenheit in the summer. During the monsoon period of July, August and September, the area can be subjected to sudden heavy rain storms resulting in runoffs creating river overflow, breaching canals and general overland floods. The project was situated in the Indus Valley alluvium which consists of fine to medium to coarse grained sand and silt of great depth with a generally high water table.

The project consisted of the designing and supervising the construction of 132 kV transmission lines, their associated grid stations and distribution lines to supply power to the 884 land reclamation tubewells constructed by the Authority under a separate contract.

132 kV TRANSMISSION LINES

A twenty three mile 132 kV double circuit transmission line was constructed from Kharian to Helan.

A thirty seven mile 132 kV double circuit transmission line was constructed between Helan and Kuthiala Sheikhan.

A twenty mile 132 kV double circuit line was constructed from Kuthiala Sheikhan to Head Faqirian.

The work was performed by the Imperial Electric Company Ltd. of Lahore W. Pakistan using Pakistani labor.

The steel lattice towers were fabricated in Pakistan by the Batala Engineering Company Ltd.

The conductor was 795 Mcm Cuckoo and was manufactured by Pakistan Cables Ltd. with 543,000 lbs. of Alcoa Aluminum redraw rod purchased in the United States and financed by U.S. AID under this loan agreement.

Line hardware and insulators were purchased from the United States under this U.S. AID loan from the A.B. Chance Corp.

132 kV GRIDSTATIONS

The three gridstations at Helan, Kuthiali Sheikhan and Head Faqirian were equipped with 132/11 kV - 20 Mva power transformers and an exhisting station at Gujrat was augmented with a 132-11 kV 5.0/6.25 Mva transformer. All of which were pruchased from Westinghouse Electric and were owner furnished.

The 132 and 11 kV Gantrys were fabricated in Pakistan by the Batala Engineering Co. Ltd. and were owner-furnished.

The work was performed by the Pakistan Contractor Greaves Crompton and Parkinson Ltd. using Pakistani labor.

11 kV DISTRIBUTION SYSTEM

Approximately 850 miles of 11 kV distribution lines were constructed utilizing 6,960 steel lattice poles, 850 distribution transformers - 11 kV/230/440 in varying sizes from 25 KVA to 75 KVA,

6 Distribution feeders originated from Helan substation

6 Originated from Busal substation

4 Originated from Bhabra Head Faqirian substation

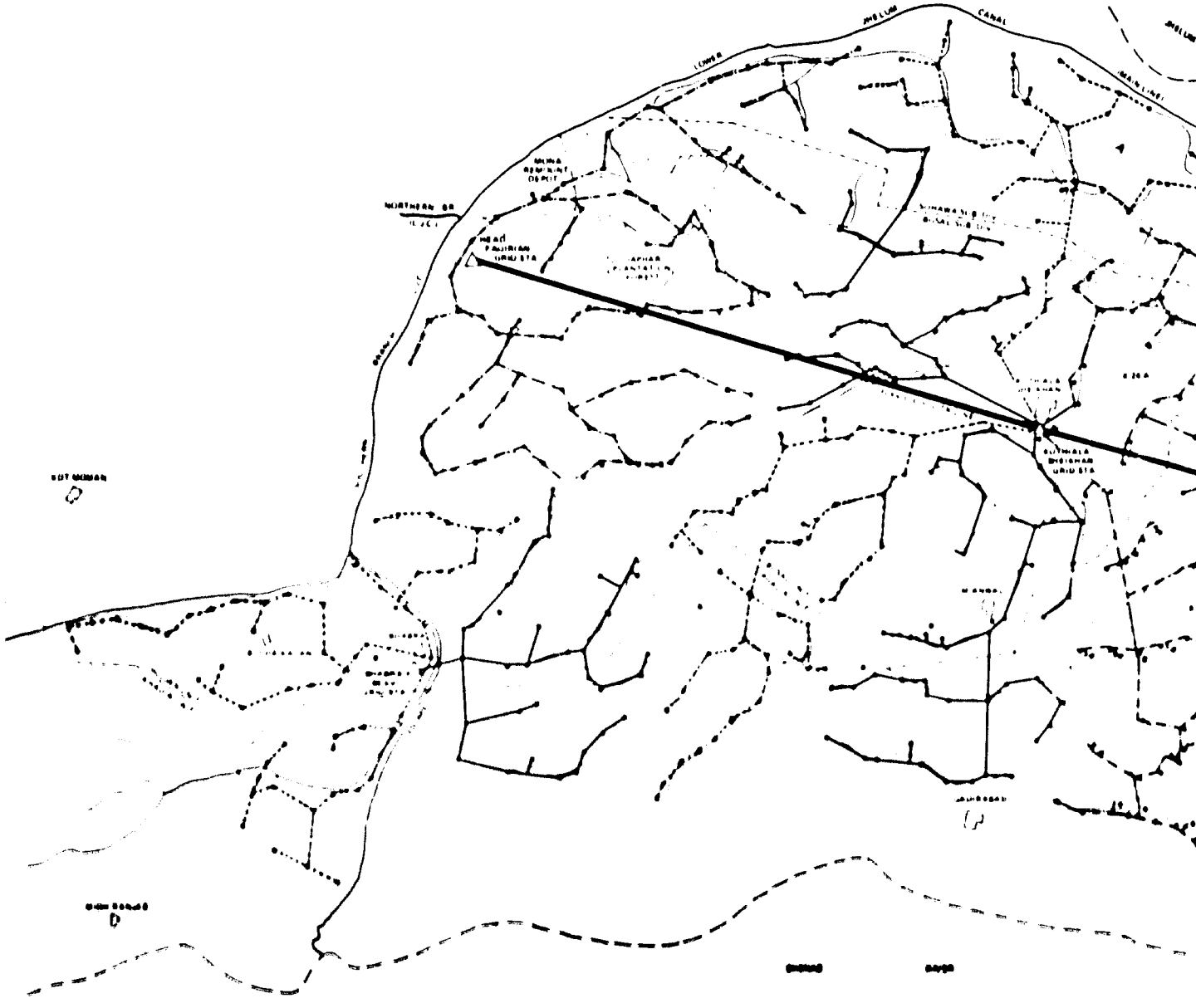
1 Originated from Gujrat substation

The 13,600 lattice pole structures were manufactured by Karachi Shipyard Co. Ltd. and were owner furnished as were the wood crossarms.

The distribution transformers were manufactured by Climax Engineering Co. Gujranwala, Pakistan and S. Mohammed Din & Sons, Shahdara, Pakistan.

Construction contractor for the works was Imperial Electric Co., Lahore, W. Pakistan and performed with Pakistani labor.

1


JHELUM
CANAL
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GRID STA
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GRID STA
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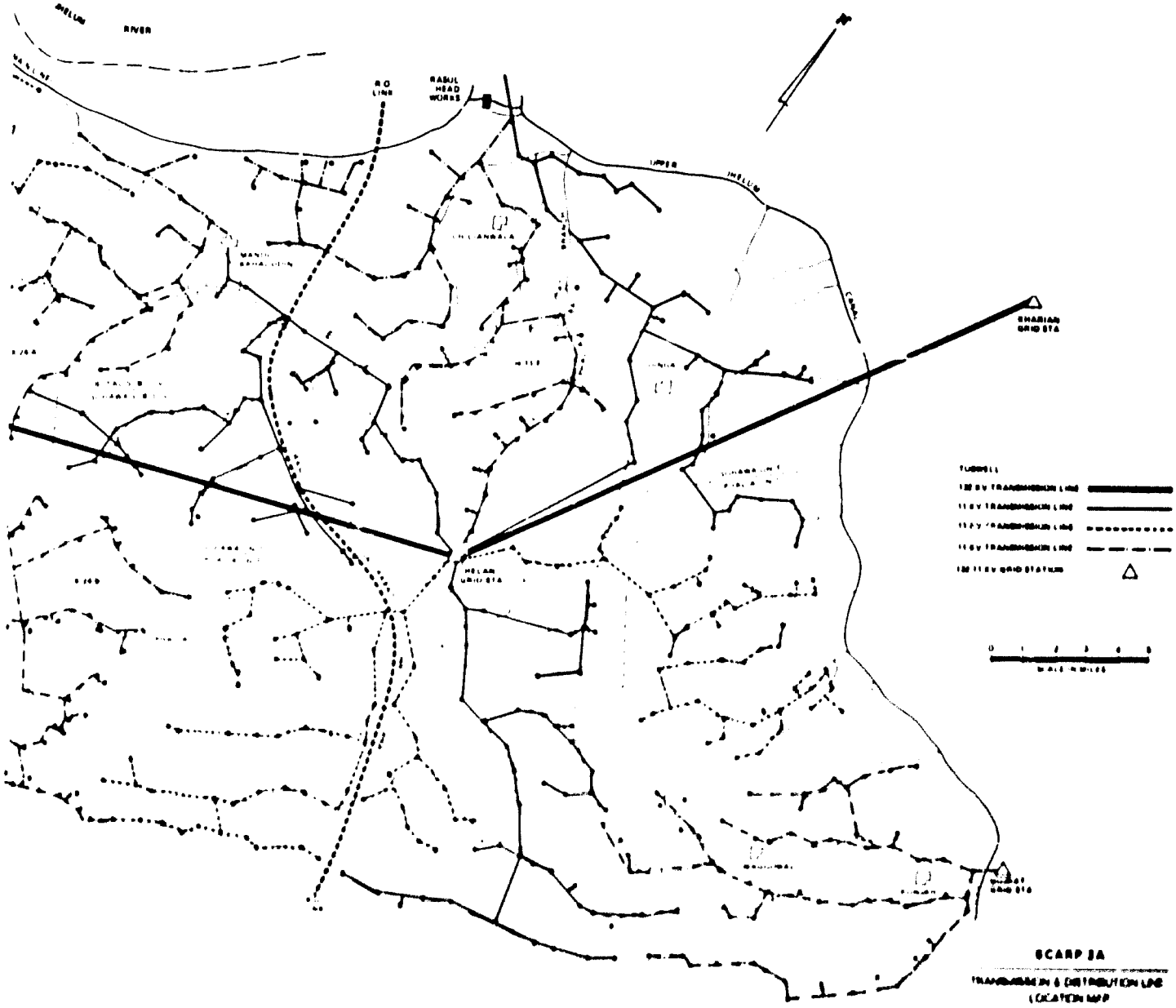
JHELUM
RIVER
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HEAD
WORKS
UPPER
JHELUM
CANAL
SHABIAN
GRID STA
JHELUM
GRID STA
SCARP 3A
TRANSMISSION & DISTRIBUTION LINE
LOCATION MAP

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

SECTION III
HISTORY

During the early part of the 1900's the first irrigation canals were built to supply water to the area known as the Punjab now forming part of West Pakistan. These canals brought large area of land under cultivation.

For the last 70 years ground water tables in the area under irrigation have been steadily rising. This rise in the water table caused principally by leakage from unlined canals and deep perculation of water applied for irrigation, had no adverse effects during the early years of canal irrigations when the water tables were at a depth varying from 80 to 90 feet below the surface.

However, the water tables have gradually risen, to the root zone and in many places above the surface of the land. This action has also brought salts to the surface which had a very adverse effect on the land and in many areas rendered it unfit for cultivation.

This effect was recognized shortly after these irrigations schemes were completed and to offset the effect a Drainage Board was created in 1917 to study the problem and make recommendation as to what remedial action should be taken. The Drainage Board was succeeded by many similar committees and Boards. These Boards were hampered in their work by a lack of funds and nothing constructive could be done until the creation of the West Pakistan Water and power Development Authority in October, 1958. The Authority created a Ground Water and Reclamation Division and this Division completed investigations which had been started by the Irrigation Branch of the public Works Department. The results of these investigations culminated in the publication of a report in January 1959 entitled "Project No. 1, Salinity Control Program in West Pakistan". The implementation of this Project was taken in hand and was linked with two other projects then under construction, these being the West Pakistan High Tension Grid and the West Pakistan Secondary Transmission Project. The latter project provided Secondary Grid Stations to the SCARP 1 area.

Following the successful completion of the Salinity Control and Reclamation Project No. 1 (SCARP 1) the Authority undertook the reclamation of lands lying between the Rivers Chenab and Jhelum known as Chej Doab. The project was designated as SCARP 2 of which the Lower Jhelum Sub Project SCARP 2A forms a major part

Commonwealth Associates Inc., Jackson, Michigan, U.S.A. were retained by the Authority as the Engineer to design and supervise the construction of the electrification part of the Project.

The design and construction supervision of the drains and tubewells was carried out by Tipton & Kalmback Inc. and a report on this part of the project has been prepared by them and does not form part of this closeout report.

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

LOAN IMPLEMENTATION

Article III of the Loan Agreement between the President of Pakistan and the United States of America required the Borrower to fulfill certain conditions before any Letter of Commitment could be issued or any disbursement of the Loan funds made. The conditions precedent are of two categories, the first of which was to be fulfilled prior to establishment of a Letter of Commitment for Engineering Services, and the other which was to be fulfilled prior to the issuance of a Letter of Commitment for anything other than Engineering Services.

The conditions precedent to initial financing (Engineering Services) were fulfilled early in the year; and on August 18, 1964, the Secretary to Government, President's Secretariat, Economic Affairs Division, Government of Pakistan, was notified that pre-conditions to initial financing required by Section 3.1 of the Loan Agreement had been fulfilled to the satisfaction of AID. Letter of Commitment No. 391-H-083-1 to finance the Engineering Services under the West Pakistan Water and Power Development Authority/Commonwealth Associates Inc. Agreement was issued in October, 1964.

The conditions precedent to the issuance of Letters of Commitment or disbursement of Loan funds for other than Engineering Services required the Borrower to submit for approval an Implementation Plan for the project showing project schedules, cost estimates, preliminary plans and major equipment specifications, evidence of construction services, a material procurement plan, site studies, evidence of maintenance capability, evidence of training arrangements for indigenous personnel, and a material control and cost accounting plan.

The Implementation Plan and evidence required by U.S. AID was submitted in June of 1964. The Plan was accepted by U.S. AID, and the Implementation Letter No. 391-H-0550-02 was issued in December 1964 informing the Government of Pakistan that all conditions precedent to financing required under Section 3.02 of the Loan Agreement had been fulfilled, and WAPDA's request for a Letter of Commitment for the supply and commissioning of all mechanical and electrical equipment and materials had been forwarded to AID/Washington. The Letters of Credit were established as the three separate phases of the Construction contracts developed inasmuch as the materials funded under the loan were components of the contracts as Contractor furnished.

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

SECTION V
DESIGN AND ENGINEERING

TRANSMISSION LINES

One tower of each design was tested to destruction and was found to exceed specification requirements.

Six tower types were designed by the Engineer, Commonwealth Associates at their Head Office in Jackson, Michigan and were designated as follows:

1. 8AA Tangent Tower
2. 8BA Light Angle Tower
3. 8CA Medium Angle Tower
4. 8EA Degree Angle Tower
5. 8FA 90 Degree Angle Tower
6. 8FFA Terminal Tower

All steel used in the manufacture of towers was in accordance with the specification of the American Society for Testing Materials (ASTM).

All tower steel was hot dipped galvanized after fabrication in accordance with ASTM specification A 123 58

Bolts and Nuts were in accordance with ASTM specification A394.

ACSR Conductor 795 MCM code name "Cuckoo" and 397.5 MCM code name Brant were selected. The Cuckoo has a two layer aluminum 24/0.1820 and a steel stranding of 7/0.1213.

The Brant has a two layer aluminum stranding 28/0.1287 and a steel stranding of 7/0.0858.

The overhead shield wire was 7/16" extra high strength steel having a stranding of 7/0.145.

The minimum conductor temperature was assumed to be 30°F.

The maximum conductor temperature was assumed to be 150°F.

The maximum final tension with no wind pressure at 60°F was not allowed to exceed 16.40 percent of the ultimate strength of the conductor.

The maximum final tension with no wind pressure on the static wire was not allowed to exceed 16.8 percent of the ultimate strength at 30°F.

Sag and tension was based on a 1180 foot ruling span, a 1200 ft wind span and a 1400 foot weight span.

Sag tables were prepared on the basis of the above noted conditions and supplied to the Contractor and Inspectors.

Horizontal and vertical clearances were based on the 6th Edition of the U.S. National Electric Code and the West Pakistan Water and Power Development Authority standards.

All towers were dressed with 9 unit a single string of insulators for suspension and 9 unit a double string of insulators for all major canal crossings, and abnormally long spans with two conductor clamp in series.

In place where tension insulators were used the string was 11 units long.

Double tension strings were used for railway and main road crossings.

The insulators were rated at 15,000 lbs M and E for suspension and 25,000 lbs M & E for tension.

All conductor hardware was manufactured from high strength heated silicon aluminum alloy with a strength of 25,000 lbs.

Preformed armor rods were used at all conductor suspension points.

Stockbridge Dampers were used on all angle points and in all line tension spans.

All foundations were of the grillage type and a design was provided for each tower type.

11 kV LINES

The 11 kV lines were designed to use WAPDA Standard lattice steel poles and these poles were dressed with an 8 foot wooden crossarm and pin type insulators.

FOUNDATIONS

The contractor submitted 33 designs for foundations and use of which were predicated on the type of pole used and the soil conditions in the area.

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During actual construction the pole/soil conditions indicated that only 9 types of foundations were required.

The foundations were in general 2 foot square by 5 foot deep with 6" extending above grade no reinforcing was required where the soil bearing was reasonable good however, reinforcing was required in waterlogged areas.

Stub angles were installing on the foundation and the poles were erected after the foundations had been cured.

All soil tests were made using a probe type soil tester.

There were twelve types of poles which were designated as follows:

1. Type p-1-20 - for LT lines

2. Type p-1-25 - for LT and some special application on 11 kV

3. Type p-1 30H - for 11 kV lines using 477 MCM and 336 MCM ACSR conductors and at dead end locations.

4. Type p-1-30L - for 11 kV lines using 4/0, 1/0 and No. 3 ACSR conductors.

5. Type p-2 30 - for special angle poles using wood cross arms.

6. Type p 6 30 - for Transformer Installations.

7. Type p 6 p 30 - for Capacitor and line relcoser installations.

8. Type p 1 35 H - Same as p-1 30 H except 5 foot longer.

9. Type p 1 35 L - Same as p 1 30 L except 5 foot longer.

10. Type p 3 35 - Special vertical angle using suspension insulators.

11. Type p t 40 - Special pole for lateral tee off.

The lines were strung with 477 MCM ACSR Code name Pelican, 336.4 MCM ACSR Code name Merlin, 4/0 ACSR Code name Penguin, 1/0 ACSR Code name Raven and No. 3 ACSR Code name Swallow.

These conductors were used according to the line loading and the lines were protected by line recloser and sectionalizing fuses. The sectionalizing fuses were coordinated with the line reclosers.

It was not found necessary to use any line voltage regulators however, capacitors were installed to improve voltage.

3-Phase 11/.4 kV locally manufactured Distribution Transformers were used. They were supplied by Siemens Pakistan Engineering Co.

Three sizes were selected 25 KVA and 75 KVA. These transformers were protected by open type 11 kV fuses. It was not found necessary to protect these transformers by installing Lightning Arrestors since the Isocronic Level is very low in the project.

GRIDSTATIONS

The Gridstations at Sardarpur Noon, Judlathi and Bhamb were designed to be of the rural non attended type with accommodation for the SDOs maintenance and breakdown crews.

The consisted for a 12/16 MVA 132 kV Transformer protected by SMD type fuses on the high side and a S.D.O. type Breaker on the low side. This breaker protected on 11 kV Bus from which the 11 kV lines were taken. These lines were protected by a "W" type recloser which were set for 2 fast and 2 retarded operation to lockout.

The Gridstation was fitted with overload and ground fault protection and the individual lines were metered to record the energy used. A demand meter was also installed to record energy flow from the bus side of the 11 kV O.C.B.

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

MATERIALS PROCUREMENT

The construction contract for the 132 kV lines was awarded to The Imperial Electric Co. of Pakistan as the result of competitive bids which included materials funded under the loan.

Insulators were purchased from A.B. Chance and line hardware from ITT.

Purchasing was performed with the issuance of specifications and tender documents by Commonwealth Associates Inc. and product evaluations, bid comparisons were made and submitted to WAPDA for approval.

The lattice steel structures were fabricated in Pakistan by the Batala Engineering Co. and 181 miles of 795 MCM "Cuckoo" conductor were manufactured in Pakistan by Pakistan Cable Ltd., using aluminum redraw rod supplied by Alcoa. Another 190 miles of the same conductor was purchased from Southwire Cable.

Letter of Commitment for materials were issued following the Contractor selection and inspections, tests, and expediting was undertaken by Commonwealth on behalf of WAPDA.

The Contractor for the 70 miles of 132 kV Gridstations was Greaves Crompton Parkinson Ltd. of Pakistan. The four transformers were purchased from Westinghouse after competitive bidding and furnished by WAPDA.

The Gantrys were manufactured in Pakistan by the Batala Engineering Co.

The Oil Circuit Breakers and other foreign exchange components purchased from General Electric were considered contractor payments received as the U.S. suppliers billings were satisfied.

The construction contractor for the 850 miles of 11 kV distribution systems was the Imperial Electric Co. of Pakistan. All material was contractor furnished with the foreign exchange materials included in the contractor's cost.

The 3600 lattice steel poles were manufactured by the Karachi Shipyard Engineering Works and the 590 distribution transformers were manufactured in Pakistan by Climax Engineering Co. and the S. Muhammed Din Co.

The U.S. purchased materials under the loan consisted of:

281 miles of ACSR Swallow No. 3

591 miles of ACSR Raven No. 1

1215 miles of ACSR Penguin No. 4/0

567 miles of ACSR Merlin 336 Mem.

Hardware and insulators were supplied by A. B. Chance. All U.S. purchased material was shipped in vessels of U.S. flag as further documented in this report.

Some delays were encountered due to a shortage of shipping vessels, the closing of the Suez Canal. Dock facilities and overland transport was often delayed as relief food shipments were given handling priority.

The State of Emergency of December 1965 during the Parkistan India hostilities also contributed to the non availability of overland transport.

Procurement began in March 1967 and was completed in June 1968 as shown in the procurement schedule following in this report. Tests and inspections were conducted on all major material items at vendors plants in the United States and Pakistan by or under the responsible supervision of Commonwealth Associates. Inspections were waived on smaller standard catalogue items and accepted conditionally by Commonwealth and WAPDA on the basis of manufacturers' tests and guarantees.

IMPORTED MA
11 KV DISTR

SER NO.	DESCRIPTION	QUANTITY	INVOICE NUMBER	DATE OF INVOICE	NAME OF SUPPLIER & REMARKS	FAS COST US DOLLAR	FREIGHT COST US DOLLAR	FREIGHT COST RUPEE	I C US
1	ACSR No. 3 "Swallow"	143.182 Miles			Alcoa	Included in Item 4	Included in Item 4		Inc in 4
2	ACSR No. 1/0 "Raven"	371.097 Miles	25329646 25330710 25333038		Alcoa	Included in Item 4	Included in Item 4		Inc in 4
3	ACSR No. 4/0 "Penguin"	625.947 Miles	25333863 25335682		Alcoa	Included in Item 4	Included in Item 4		Inc in 4
4	ACSR No. 336 "Merlin"	286.452 Miles	25338921 25341930		Alcoa	481,879.35	32,258.55		2
5	Conductor Accessories	97%	25343842 25343196 25336309		Alcoa	18,372.95	Included in Item 4		In in
6	ACSR No. 4/0 "Penguin"	339.852 Miles	25353910		Alcoa	131,073.01	8,802.95		5
7	ACSR No. 336 "Merlin" ACSR No. 4/0 "Penguin" ACSR No. 3 "Swallow"	112.975 Miles 251.916 Miles 55.682 Miles	25351307		Alcoa	192,432.09	12,624.09		76
8	Conductor Accessories	3%	25354875		Alcoa	273.65	Included in Item 7		In in
9	ACSR No. 336 "Merlin" ACSR No. 4/0 "Penguin" ACSR No. 1/0 "Raven" ACSR No. 3 "Swallow"	24.442 Miles 34.709 Miles 220.763 Miles 83.523 Miles	25344348		Alcoa	79,205.61	10,013.92		62
10	ACSR No. 336 "Merlin"	116.895 Miles	25346647		Alcoa	61,829.88	Included in Item 9		I i

ORTED MATERIALS FOR
KV DISTRIBUTION LINE

CONTRACTOR - IMPERIAL ELECTRIC CO. LTD.

PAGE

	INSURANCE						ARRIVALS		
COST RUPEE	COST US DOLLAR	COST RUPEE	CIF COST US DOLLARS	NAME OF VESSEL	US FLAG SHIP	LETTER OF CREDIT NO.	E.T.A. KARACHI	ACTUAL ARRIVAL	AT SITE %
	Included in Item 4		Included in Item 4	USS Flying Fish	Yes	NW/580/DLF	6-12-66	24-12-66	100
	Included in Item 4		Included in Item 4	USS Flying Fish	Yes	NW/580/DLF	6-12-66	24-12-66	100
	Included in Item 4		Included in Item 4	USS Flying Fish	Yes	NW/580/DLF	6-12-66	24-12-66	100
	2,014.62		516,152.52	USS Flying Fish	Yes	NW/580/DLF	6-12-66	24-12-66	100
	Included in Item 4		18,372.95	USS Flying Fish	Yes	NW/580/DLF	6-12-66	24-12-66	100
	521.04		140,397.00	USS Green Isle	Yes	NW/580/DLF	2-1-67	18-1-67	100
	765.02		206,094.85	Flying Gull	Yes	NW/580/DLF	16-2-67	5-3-67	100
	Included in Item 7		Included in Item 7	Flying Gull	Yes	NW/580/DLF	16-2-67	5-3-67	100
	639.56		167,173.60	Green Port	Yes	NW/580/DLF	9-3-67	13-3-67	100
	Included in Item 9		Included in Item 9	Green Port	Yes	NW/580/DLF	9-3-67	13-3-67	100

IMPORTED MAT
11 KV DISTRI

SER NO.	DESCRIPTION	QUANTITY	INVOICE NUMBER	DATE OF INVOICE	NAME OF SUPPLIER & REMARKS	FAS COST US DOLLAR	FREIGHT COST US DOLLAR	FREIGHT COST RUPEE	US
11	ACSR No. 336 "Merlin"	29.294 Miles	25345612		Alcoa	15,494.63	Included in Item 9		In in
12	Line Hardware	85%	45837 45838	7-11-66	A. B. Chance	20,449.15	2,131.25		2
13	Line Hardware		38575 38567	6-10-66	A. B. Chance	124,261.54	8,336.37		1,
14	Line Hardware (Service Insulators)	85%	38583	7-10-66	A. B. Chance	267.75	20.08		
15	Line Hardware	85%	5721	15-2-67	A. B. Chance	39,758.80	1,768.33		
16	Line Hardware	50%	P-61438 P-61439 P-61440 P-61441 P-61443	4-11-66	I. T. T. Export Corp.	37,457.91	1,534.42		
17	Line Hardware	30%	P-61442	4-11-66	I. T. T. Export Corp.	30,872.58	424.13		
18	Line Hardware	10%	P-61598	7-11-66	I. T. T. Export Corp.	526.50	66.03		
19	Line Hardware	10%	P-61444	4-11-66	I. T. T. Export Corp.	369.13	21.50		
20	Wooden Cross Arms	45%	P-63532	13-1-67	I. T. T. Export Corp.	37,779.70	5,721.89		
21	Wooden Cross Arms	55%	P-63533	13-1-67	I. T. T. Export Corp.	51,559.20	12,414.24		
22	E.H.S. Galvanized Steel Wire	100,000 Lbs(Gross)	270-00788	15-3-67	US Steel Int. (N.Y.) Inc.	14,981.96	1,811.66		
23	Line Hardware	15%	10158	20-3-67	A. B. Chance	10,232.24	452.42		
24	Spl. Tools & Plant	100%	12455	10-4-67	A. B. Chance	---	---		

MATERIALS FOR
STRIBUTION LINE

CONTRACTOR - IMPERIAL ELECTRIC CO. LTD.

ST EE	INSURANCE COST US DOLLAR	INSURANCE COST RUPEE	CIF COST US DOLLAR	NAME OF VESSEL	US FLAG SHIP	LETTER OF CREDIT NO	ARRIVALS E.T.A. KARACHI	ARRIVALS ACTUAL ARRIVAL	ARRIVALS AT SITE %
	Included in Item 9		Included in Item 9	Green Port	Yes	NW/580/DLF	9-3-67	13-3-67	100
	249.35		22,829.75	USS Steel Director	Yes	NW/580/DLF	20-1-67	23-1-67	100
	1,464.46		134,044.37	USS Steel Scientist	Yes	NW/581/DLF	2-1-67	4-1-67	100
	3.56		291.39	USS Steel Scientist	Yes	NW/581/DLF	2-1-67	4-1-67	100
	461.81		41,988.94	Green Habour	Yes	NW/581/DLF	29-5-67	26-5-67	100
	202.55		39,194.88	USS Steel Navigator	Yes	NW/594/DLF	6-12-66	24-12-66	100
	161.78		31,458.49	USS Flying Hawk	Yes	NW/594/DLF	26-12-66	19-1-67	100
	2.67		595.20	USS President Coolidge	Yes	NW/594/DLF	11-1-67	16-1-67	100
	2.02		392.65	USS Flying Foam	Yes	NW/594/DLF	18-1-67	21-2-67	100
	195.88		43,697.47	President Hayes	Yes	NW/594/DLF	2-3-67	3-3-67	100
	288.06		64,261.50	President Buchanan	Yes	NW/594/DLF	19-3-67	24-3-67	100
	92.51		16,886.13	Flying Hawk	Yes	NW/582/DLF	8-5-67	22-5-67	100
	117.37		10,802.03	Flying Fish	Yes	NW/581/DLF	2-6-67	29-5-67	100
	---		28,245.00	Steel Director	Yes	NW/715/DLF	20-5-67	27-5-67	100

22

IMPORTED MATER
11 KV DISTRIBU

SER NO.	DESCRIPTION	QUANTITY	INVOICE NUMBER	DATE OF INVOICE	NAME OF SUPPLIER & REMARKS	FAS COST US DOLLAR	FREIGHT COST US DOLLAR	FREIGHT COST RUPEE	11 C US
25	Spl. Tools & Plant	100%	16152	7-4-67	Peterson Eng. Co. Inc.	77,223.92	5,612.70		--
26	Spl. Tools & Plant	100%	25319552 25319574	----	Alcoa	1,617.00 132.70	18.00 3.50		--
27	Spl. Tools & Plant	100%	P-67835	9-6-67	I. T. T. Export Corp.	21,610.89	772.32		--
28	Spl. Tools & Plant	100%	P-70848	6-10-67	I. T. T. Export Corp.	566.46	26.45		--
29	Insulators	85%	P-2594	9-11-67	A. B. Chance	56,292.59	9,263.31		68
30	Insulators	85%	P-2597	16-11-67	A. B. Chance	11,031.88	1,653.70		13
31	Insulators	15%	P-2596	16-11-67	A. B. Chance	10,461.25	1,669.77		12

MATERIALS FOR
TRIBUTION LINE

CONTRACTOR - IMPERIAL ELECTRIC CO. LTD.

INSURANCE						ARRIVALS		
COST US DOLLAR	COST RUPEE	CIF COST US DOLLAR	NAME OF VESSEL	US FLAG SHIP	LETTER OF CREDIT NO	E.T.A. KARACHI	ACTUAL ARRIVAL	AT SITE
----		82,846.62	President Adams	Yes	NW/718/ILF	6-6-67	12-6-67	100
----		1,635.00 136.20	Express	Yes	NW/714/ILF	30-6-67	-----	---
----		22,383.21	Steel Navigator	Yes	NW/713/ILF	4-8-67	16-9-67	100
----		592.91	Flying Foam	Yes	NW/713/ILF	22-11-67	----	---
683.77		66,239.67	Flying Gull	Yes	NW/668/ILF	7-1-68	----	---
132.19		12,817.77	Flying Gull	Yes	NW/668/ILF	7-1-68	----	---
126.80		12,257.82	Green Harbour	Yes	NW/668/ILF	21-1-68	----	---

IMPORTED MATER
132 KV TRANSMISSI

							FREIGHT		INS
SER. NO.	DESCRIPTION	QUANTITY	INVOICE NUMBER	DATE OF INVOICE	NAME OF SUPPLIER & REMARKS	FAS COST US DOLLAR	COST US DOLLAR	COST RUPEE	CO US
1	Line Hardware	100%	14788	27-4-67	A. B. Chance	3,920.31	129.07		4
2	E.H.S. Galvanized Steel Wire	100%	270/D1643	26-5-67	U.S. Steel Int. (N.Y.) Inc.	19,821.46	3,443.88		12
3	Conductor Accessories	100%	25326641 25326642 25326643	16-8-67	Alcoa Int. Inc. U.S.A.	7,052.74	108.18		2
4	Insulator Fitting and Conductor Accessories	100%	F-68290	27-6-67	I. T. T. Export Corp. U.S.A.	18,364.31	543.56		1
5	Suspension Insulators	100%	P-9	27-7-67	A. B. Chance U. S. A.	28,119.30	4,825.40		2
6	Line Hardware	100%	42328	14-11-67	A. B. Chance U. S. A.	293.55	26.48		

D MATERIALS

NSMISSION LINE

CONTRACTOR IMPERIAL ELECTRIC CO. LTD.

ST PEE	INSURANCE COST US DOLLAR	INSURANCE COST RUPEE	CIF COST US DOLLAR	NAME OF VESSEL	US FLAG SHIP	LETTER OF CREDIT NO	ARRIVALS E T A. KARACHI	ARRIVALS ACTUAL ARRIVAL	ARRIVALS AT SITE
	44.44		4,093.82	Steel Age	Yes	NW/736/11F	7-7-67	17-8-67	100
	124.76		23,390.10	Steel Age	Yes	NW/738/11F	7-7-67	18-8-67	100
	28.19		7,189.11	Flying Gull	Yes	NW/735/11F	18-8-67	25-8-67	100
	114.57		19,022.44	Flying Gull	Yes	NW/737/11F	18-8-67	25-8-67	100
	261.82		33,306.52	Flying Cloud	Yes	NW/736/11F	25-8-67	15-10-67	100
	3.56		323.59	Steel Rover	Yes	NW/736/11F	19-1-68	25-1-68	100

IMPORTED MATEI
3-132/11 KV GRID

SER. NO.	DESCRIPTION	QUANTITY	INVOICE NUMBER	DATE OF INVOICE	NAME OF SUPPLIER & REMARKS	FAS COST US DOLLARS	FREIGHT COST US DOLLAR	FREIGHT COST RUPEE	INS COST US DO
1	Oil Circuit Breakers	3	D-16020	9-5-67	General Electric Co. New York USA				
2	Meter Cabinets	3	D-12575	21-4-67	General Electric Co. New York USA	10,554.40	801.50		10
3	Potential Transformers	6	D-02973	7-3-67	General Electric Co. New York, USA	1,026.00	Included in Item 10		
4	138 kV Disconnect Switches	3	D-08291		General Electric Co., New York USA				
5	15 kV Disconnect Switches	66	D-08291	28-3-67	General Electric Co., New York USA				
6	Spare Parts & Tools	100%	D-08291	28-3-67	General Electric Co., New York USA	1,059.09			
7	Photo-Cell Units	3	D-01078	27-2-67	General Electric Co., New York USA	30.00			
8	Control Panels	3	D-01078	27-2-67	General Electric Co., New York USA	288.00			
9	11 kV Circuit Reclosers	21	KY-54119	27-12-67	Line Material	45,507.00	932.00		39
10	Current Transformers	63	D-02973	7-3-67	General Electric Co., New York USA	10,962.00	433.50		115
11	Bare Copper Earthing	3 Sets	D-35449-2	22-8-67	General Electric Co., New York USA				
12	Station Transformer 25 KVA	3 Nos	D-19992-1	25-5-67	General Electric Co., New York USA				

MATERIALS
GRID STATION

CONTRACTOR - GREAVE CROMPTON PARKINSON, LTD.

INSURANCE						ARRIVALS		
COST US DOLLAR	COST RUPEE	CIF COST US DOLLAR	NAME OF VESSEL	US FLAG SHIP	LETTER OF CREDIT NO.	E T A KARACHI	ACTUAL ARRIVAL	AT SIT
		14,850.00	Exchequer	Yes	NW/600/11F	6-18-67	8-2-67	100
101.34		11,447.24	Exchequer	Yes	NW/600/11F	6-18-67	8-2-67	100
		10,026.00	Steel Surveyor	Yes	NW/600/11F	6-5-67	7-25-67	100
		10,636.63	Flying Fish	Yes	NW/600/11F	5-18-67	7-8-67	100
		4,244.95	Flying Fish	Yes	NW/600/11F	5-18-67	7-8-67	100
		1,059.09	Flying Fish	Yes	NW/600/11F	5-18-67	7-8-67	100
		30.00	Flying Fish	Yes	NW/600/11F	5-18-67	7-8-67	100
		388.00	Flying Fish	Yes	NW/600/11F	5-18-67	7-8-67	100
398.39		47,1[illegible].14	Flying Fish	Yes	NW/601/11F	18-8-67	25-8-67	100
115.56		11,511.00	Steel Surveyor	Yes	NW/600/11F	6-5-67	6-25-67	100
		697.80	Flying Cloud	Yes	NW/600/11F	3-4-67	6-4-67	100
		1,359.00	Flying Cloud	Yes	NW/600/11F	3-4-67	6-4-67	100

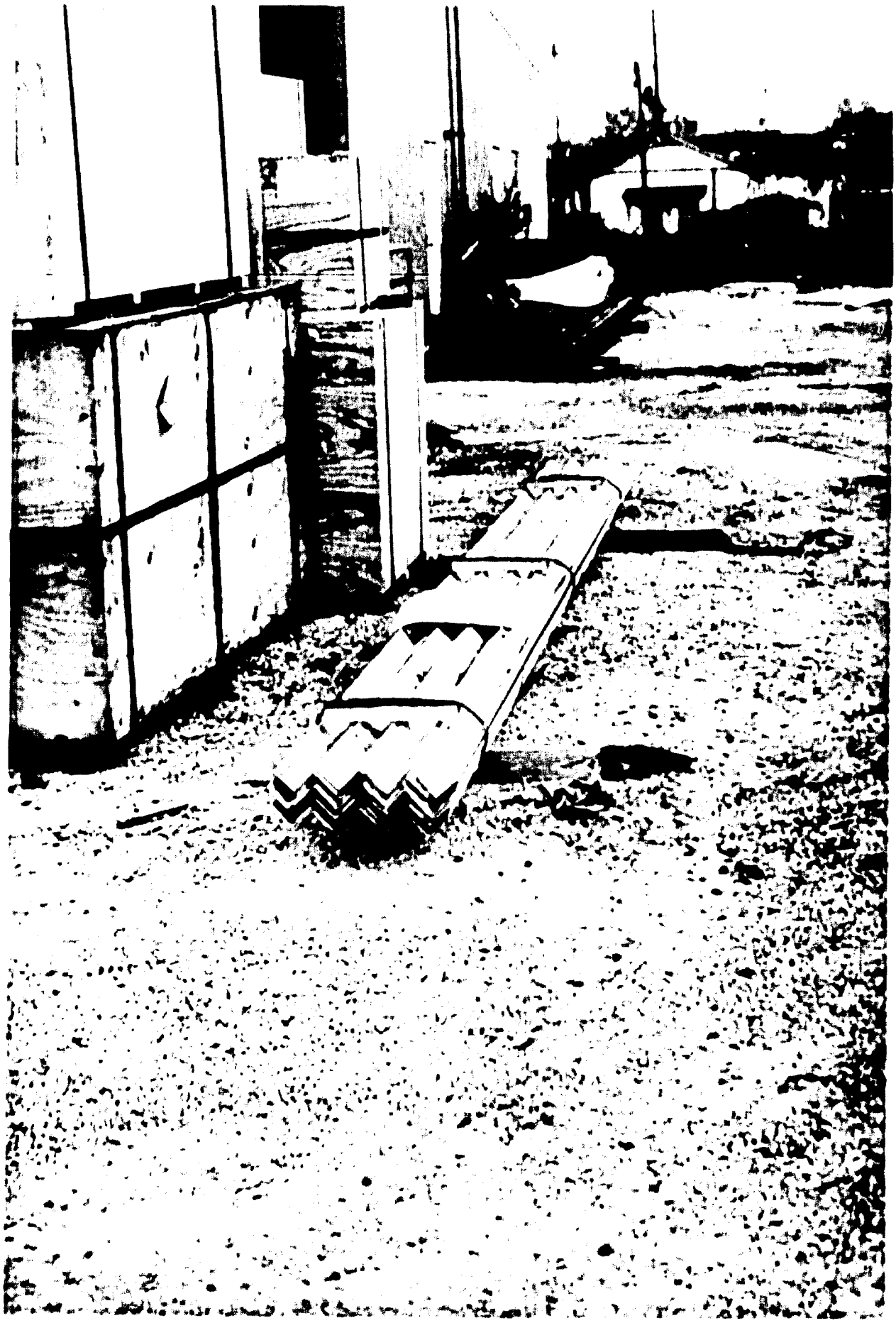
IMPORTED MA
3-132/11 KV GR

							FREIGHT		
SER. NO.	DESCRIPTION	QUANTITY	INVOICE NUMBER	DATE OF INVOICE	NAME OF SUPPLIER & REMARKS	FAS COST US DOLLARS	COST US DOLLAR	COST RUPEE	C US
13	Spare Insulators, 138kV Insulators Bus Clamps Connectors Flexible Terminals		D-433680-1	9-8-67	General Electric Co., New York USA				
14	Lightning Arresters Disconnect Switches & Fuses		D-53339	23-11-67	General Electric Co., New York USA				

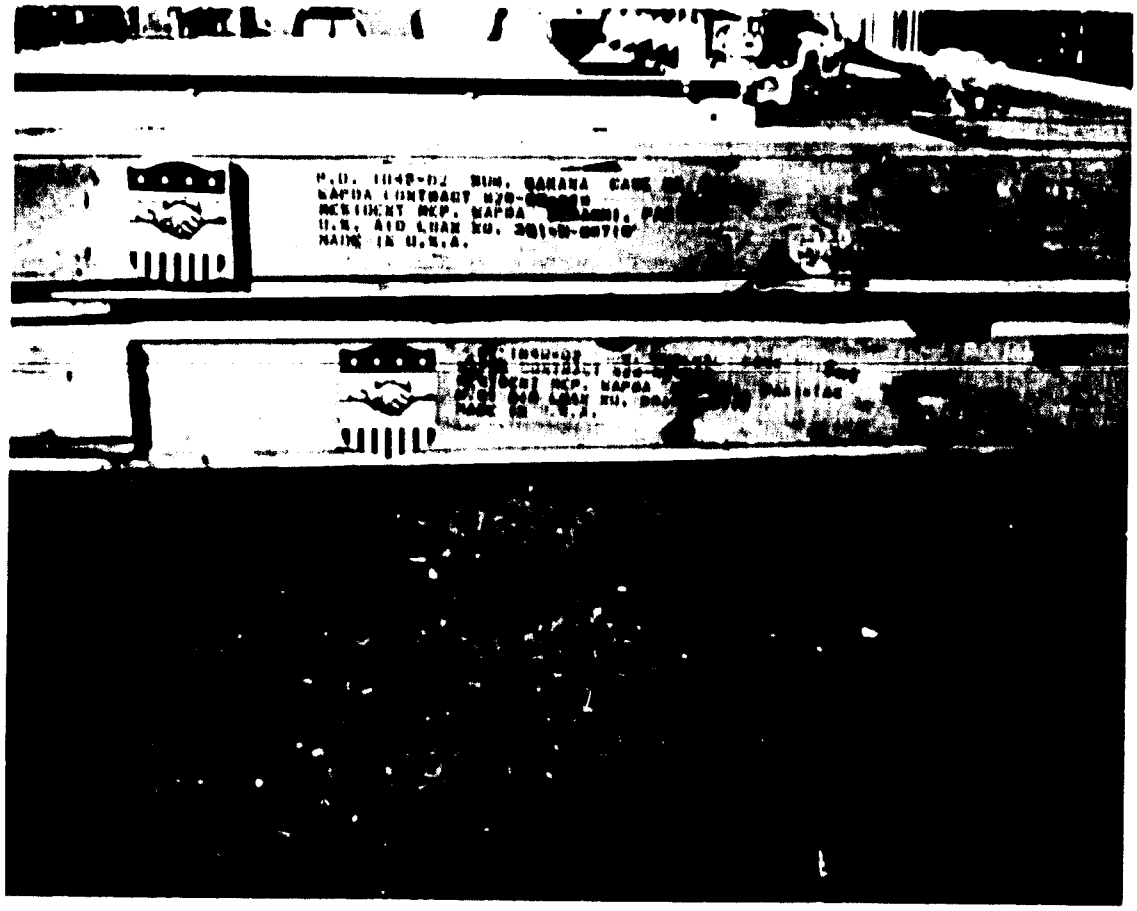
IMPORTED MATERIALS
132/11 KV GRID STATION

CONTRACTOR - GREAVES CROMPTON PARKINSON, LTD.

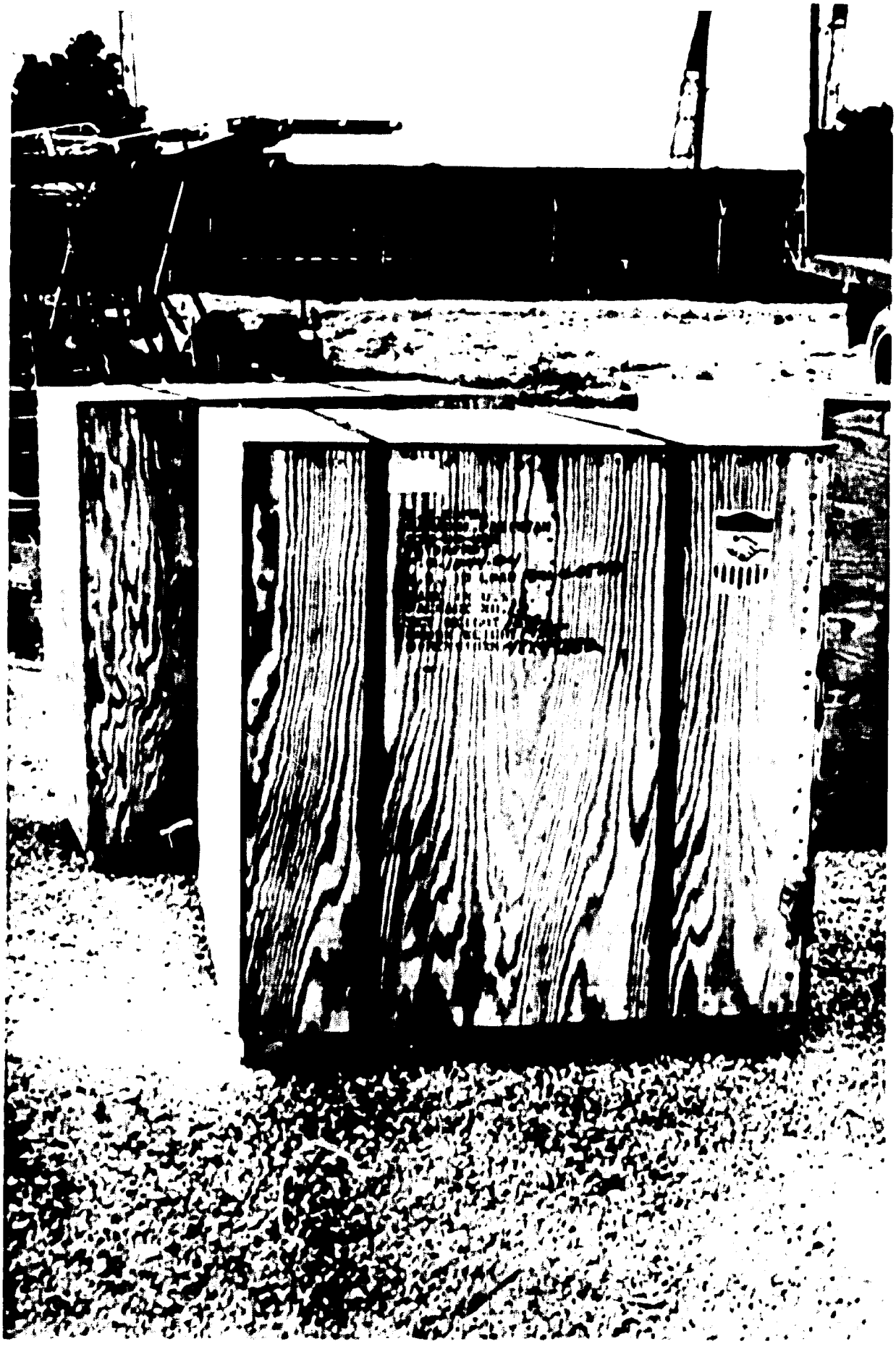
FREIGHT		INSURANCE						ARRIVALS		
ST DOLLAR	COST RUPEE	COST US DOLLAR	COST RUPEE	CIF COST US DOLLAR	NAME OF VESSEL	US FLAG SHIP	LETTER OF CREDIT NO.	E.T.A. KARACHI	ACTUAL ARRIVAL	AT SITE %
				4,125.54	Steel Director	Yes	NW/600/DLF	10-7-67	30-6-67	100
				1,114.95	Steel Fabricator	Yes	NW/600/DLF	8-2-67	7-2-67	100



EXPORT PACKAGING



EXPORT PACKAGING SUBSTATION MATERIALS



INSULATORS EXPORT PACKAGING

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

CONSTRUCTION

Tender documents for the 132 kV transmission line were issued to ten qualified bidders on December 7, 1965. Four bids were submitted and opened on July 16, 1965 from the following responsive tenderers.

The Imperial Electric Co. – Awarded Contract Rs 9,112,890

Greave Crompton Parkinson

Industrial Engineering and Construction Co.

International Industries Ltd.

Construction began in May 1967 and was complete in October 1968

Tender documents for the 132 kV Gridstations were issued to six qualified bidders. Four bids were submitted and opened on December 24, 1965 from the following responsive tenderers:

Greaves Crompton Parkinson – Awarded Contract Rs 1,309,349

Associated Electrical Industries

International Industries Ltd.

The Gustav Hirsch Organization U.S.

Construction began in October 1967 and was completed in September of 1968. Tender documents were issued for the 11 kV distribution system to ten qualified bidders. Four bids were submitted and opened on November 30, 1965 from the following responsive tenderers.

Imperial Electric Co – Contract Awarded Rs 15,899,820

Greaves Crompton Parkinson

Industrial Engineering and Construction C

International Industries Ltd.

Construction began in July 1965 and was completed in September of 1968.

Construction was scheduled to coincide with and parallel the tubewell completions.

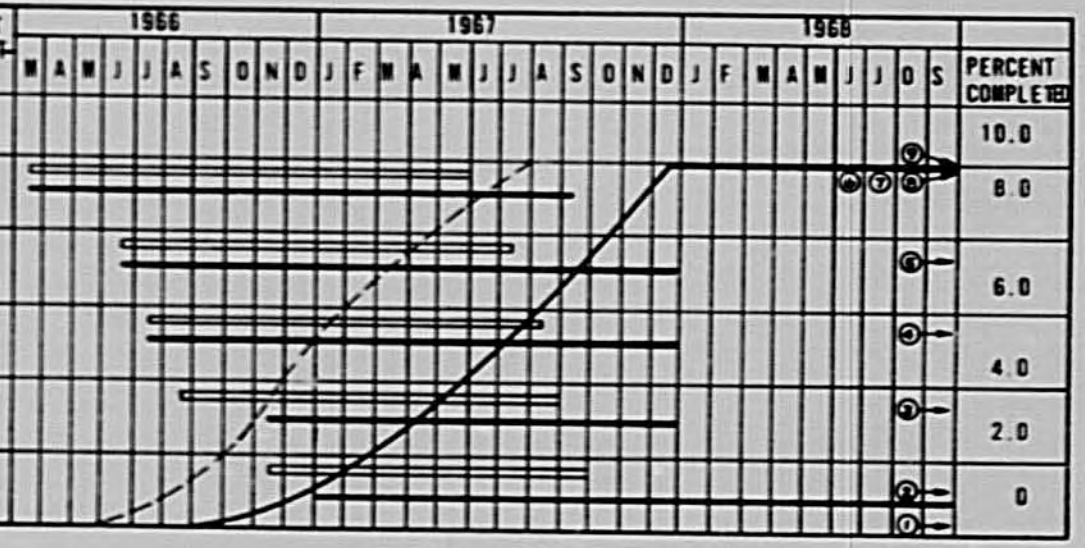
The several phases of the project are detailed in the following progress schedules.

SCARP 2A TUBEWELL ELECTRIFICATION PROJECT

CONSTRUCTION SCHEDULE

11 KV DISTRIBUTION LINE AND SCHEDULE

DESCRIPTION	WITTED %PROJECT	PERCENT COMPLETED	PROJECT %COMPLETED	PERCENT COMPLETED
TOTAL	36.00	100.00	36.00	10.0
STAKING	1.0	1.00	1.00	8.0
FOUNDATION ERECTION	18.0	100	18.00	6.0
POLE ERECTION	6.0	100	6.00	4.0
CONDUCTOR INSTALLATION	10.0	100	10.00	2.0
SERVICE DROP INSTALLATION	1.0	100	1.00	0



REMARKS

1 SEPT. 1966 4.26% COMPLETED
2 DEC. 1966 16.23% COMPLETED
3 MARCH 1967 36.14% COMPLETED
4 JUNE 1967 57.53% COMPLETED
5 SEPT. 1967 79.55% COMPLETED
6 DEC. 1967 99.50% COMPLETED
7 MARCH 1968 99.58% COMPLETED
8 JUNE 1968 99.58% COMPLETED
9 SEPT. 1968 100.00% COMPLETED

ACTUAL PROGRESS
SCHEDULE PROGRESS
REVISED SCHEDULE

COMMONWEALTH ASSOCIATES INC.
JACKSON, MICHIGAN, U.S.A.
LAHORE, WEST PAKISTAN

SCARP – 2A TUBEWELL ELECTRIFICATION PROJECT

CONSTRUCTION SCHEDULE FOR
132-KV TRANSMISSION LINE
THE IMPERIAL ELECTRIC COMPANY

DESCRIPTION	WTTED % OF PROJ.	ITEM % COMP.	PROJ. % COMP.	1967 M	J	J	A	S	O	N	D	1968 J	F	M	A	M	J	J	A	S	O	N	D	% COMPTD
TOTALS	15.60	71.37	15.45																					100
STAKING	0.05	100.00	0.050																					80
FOUNDATION ERECTION	6.40	100.00	6.40																					60
TOWER ERECTION	5.85	100.00	5.85																					40
CONDUCTOR STRINGING	3.00	100.00	3.00																					20
PETTY JOBS AND CLEAN UP	0.30	50.00	0.15																					0

KHARIAN TO HELAN TO BE COMPLETED BY JAN. 31, 1968
HELAN TO KUTHIALA SHEIKHAN TO BE COMPLETED BY MARCH 31, 1968
KUTHIALA SHEIKHAN TO FAQIRIAN TO BE COMPLETED BY MAY 15, 1968

ESTIMATED PROGRESS
SCHEDULED PROGRESS
ACTUAL PROGRESS

REMARKS

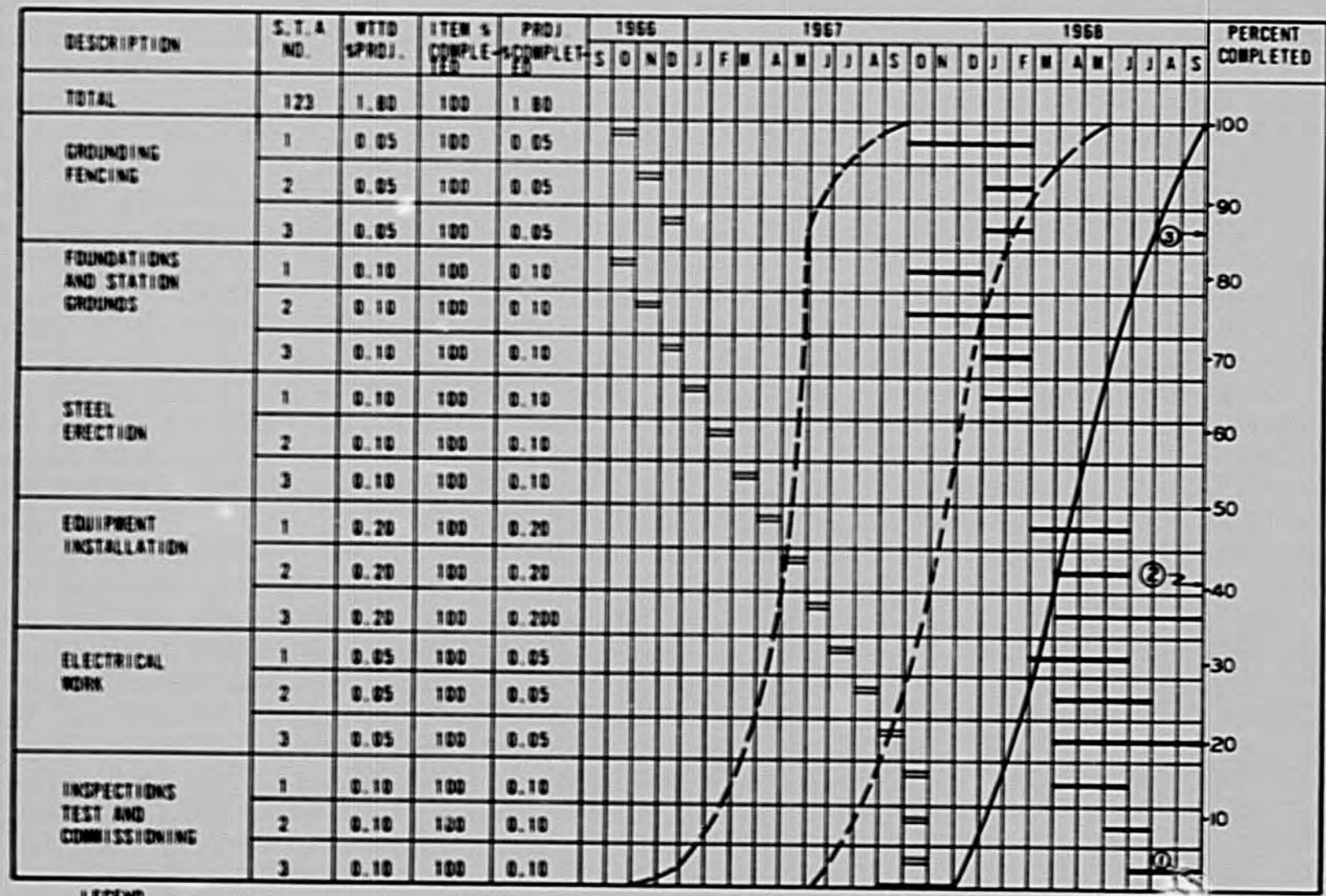
1 JUNE 1967 0224% COMPLETE
2 SEPT. 1967 .160% COMPLETE
3 DEC. 1967 1.64% COMPLETED
4 MAR. 1968 17.40% COMPLETED
5 JUNE 1968 71.37% COMPLETED
6 SEPT. 1968 100.00% COMPLETED

COMMONWEALTH ASSOCIATES INC
JACKSON, MICHIGAN U.S.A.
LAHORE, WEST PAKISTAN

SCARP - 2A TUBEWELL ELECTRIFICATION PROJECT

SUBSTATION CONTRUCTION SCHEDULE

DESCRIPTION	S.T.A NO.	WTTD %PROJ.	ITEM % COMPLETED	PROJ % COMPLETED
TOTAL	123	1.80	100	1.80
GROUNDING FENCING	1	0.05	100	0.05
	2	0.05	100	0.05
	3	0.05	100	0.05
FOUNDATIONS AND STATION GROUNDS	1	0.10	100	0.10
	2	0.10	100	0.10
	3	0.10	100	0.10
STEEL ERECTION	1	0.10	100	0.10
	2	0.10	100	0.10
	3	0.10	100	0.10
EQUIPMENT INSTALLATION	1	0.20	100	0.20
	2	0.20	100	0.20
	3	0.20	100	0.200
ELECTRICAL WORK	1	0.05	100	0.05
	2	0.05	100	0.05
	3	0.05	100	0.05
INSPECTIONS TEST AND COMMISSIONING	1	0.10	100	0.10
	2	0.10	100	0.10
	3	0.10	100	0.10



LEGEND

STN. NO. 1 HELAN SUBSTATION
STN. NO. 2 KUTHIALA SHEIKHAN
STN. NO. 3 HEAD CADIRIAN SUBSTATION

ACTUAL PROGRESS
SCHEDULE PROGRESS
REVISED SCHEDULE

1 DEC. 1967 - 0.1% COMPLETE
2 MAR. 1968 - 41.67% COMPLETE
3 JUNE. 1968 - 86.17% COMPLETE
4 SEPT. 1968 - 100% COMPLETE

COMMONWEALTH ASSOCIATES, INC.
JACKSON, MICHIGAN U.S.A.
LAHORE, WEST PAKISTAN

39

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

TRAINING

A varying body of about forty WAPDA technical personnel was assigned to Commonwealth in the project execution and a training program was inaugurated to assist WAPDA in the development of an engineering department within the power wing. They participated in the preliminary studies of routes of existing lines and power distribution capabilities, projecting loads and their priorities, mapping, planning, design, procurement and construction techniques.

Engineers, surveyors, draftsmen and inspectors assigned to and functioning under the supervision of Commonwealth were directly involved with all of the above phases, participating in seminars, the day-to-day work experience and execution of the plan to its successful completion.

The field supervision, establishment and enforcement of work standards for the contractors contributed toward protecting the integrity of the design as well as developing the concept and techniques of quality control.

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

FINANCIAL AND CONTRACTUAL

A total of four Letters of Committment were issued by AID for the loan portion of the project in the amount of $10,787,000 and were assigned to the following entities of contract and material costs.

Engineering and Consulting Services

A basic agreement between WAPDA and Commonwealth Associates Inc. was made effective on September 1, 1964 for engineering and consulting services and the above Letter of Committment in the amount of $625,000 was established on August 28, 1964 for a term of eighteen months.

On March 1, 1967, the agreement was extended for sixteen months and enhanced in the amount of $341,000.

A second amendatory agreement was made effective on July 1, 1968 extending the contract to its final termination date of December 31, 1968.

	Loan Disbursement U.S. Dollars		Rupee Costs
Engineering and Consulting			
Commonwealth Associates	958,572		2,582,395
WAPDA furnished 132 kV			
power transformers	233,074		
distribution transformers			2,289,524
crossarms			92,800
11 kV Distribution Lines			
Imperial Electric Co.	1,681,789		7,724,857
132 kV Transmission Lines			
Imperial Electric Co.	87,325		2,148,044
132/11 kV Gridstations			
Greaves Crompton Parkinson	108,047		68,164
TOTAL	$3,068,807	Rs	14,905,784

The dollar exchange rate for the project was Rs 4.75 = 1 dollar

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

PERSONNEL

The project contractor for the transmission and distribution lines had an average field force of 500 people of varying skills and disciplines. The field force for the Gridstation contractor averaged twenty five of varying skills.

WAPDA personnel directly assigned to Commonwealth Associates and the project averaged about 80 and included Engineers, surveyors, draftsmen, inspectors, drivers and laborers. This staff participated in the training programs augmenting their day to day duties in the development of an engineering department within WAPDA.

EXPATRIATE PERSONNEL

The project was staffed by six expatriate personnel of Commonwealth Associates to include:

Project Manager
Resident Field Engineer
Administrative Engineer
Field Inspectors

The following Commonwealth personnel were assigned at various times during the course of the project.

W. R. Folck	Project Manager	September 1964	June 1965
D. C. Harker	Project Manager	September 1964	Nov. 1965
T. McCready	Project Manager	September 1964	Dec. 1968
D. L. Nelson	Project Manager	July 1967	March 1972
S. Brok	Project Manager	July 1966	July 1969
R. Leffler	Project Engineer	August 1966	July 1970
P. J. Stary	Resident Field Engr.	August 1968	June 1972
C. J. Stewart	Administrative Engr	August 1964	June 1968
T. J. Plaskota	Substation Engineer	Nov. 1967	Aug. 1972
K. D. Jackson	Resident Field Engr	July 1965	Jan. 1970
R. J. Loughney	Sr. Field Inspector	June 1967	June 1969
D. Garnica	Field Inspector	Feb. 1967	Dec. 1968
S. Maxwell	Field Inspector	Aug. 1964	Oct. 1967
R. E. McCaig	Field Inspector	July 1966	July 1968

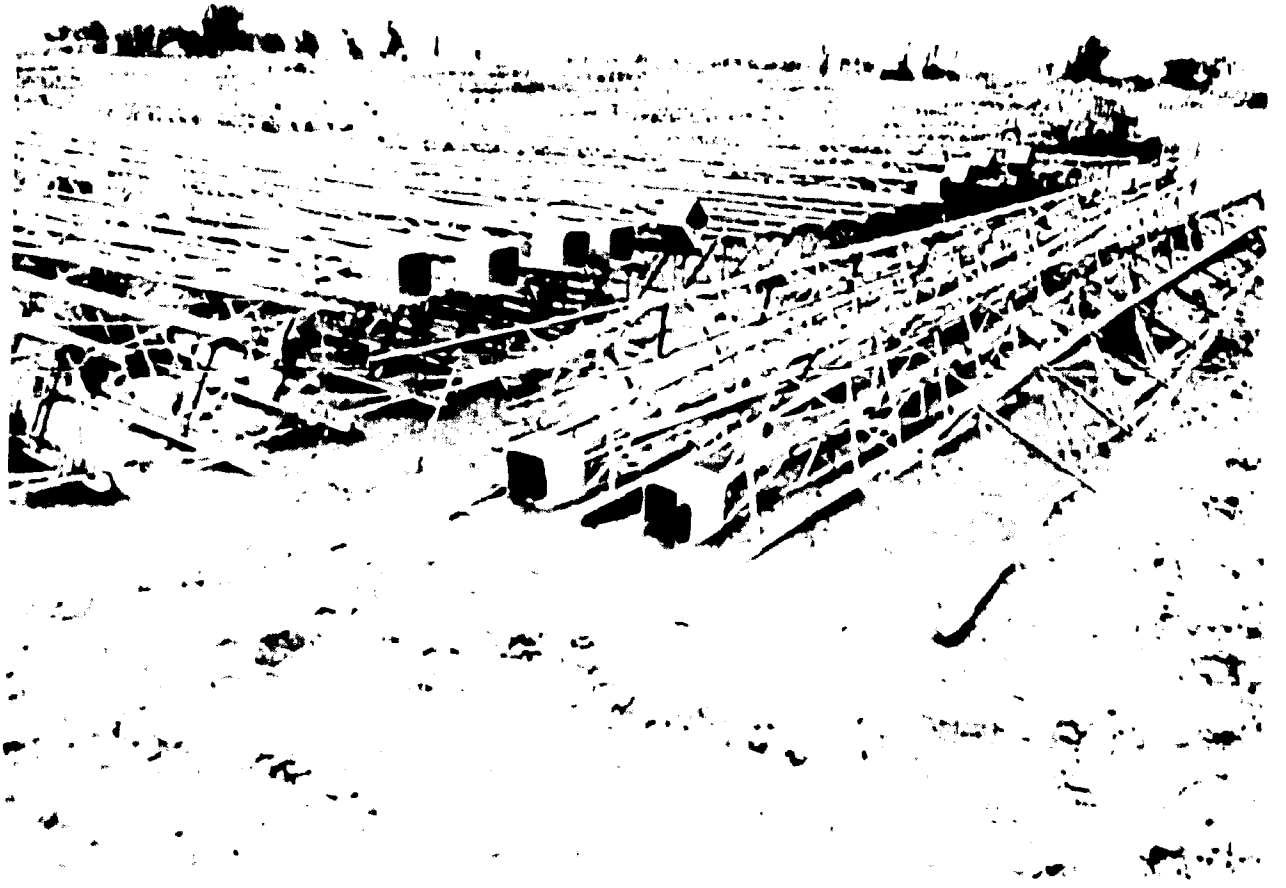
WEST PAKISTAN
WATER & POWER DEVELOPMENT AUTHORITY
SALINITY CONTROL & RECLAMATION PROJECT 2A
IN COOPERATION WITH
THE UNITED STATES OF AMERICA
AGENCY FOR INTERNATIONAL DEVELOPMENT
AID LOAN Nº 391-H-055
CONSULTING ENGINEERS
COMMONWEALTH ASSOCIATES INCORPORATED
LAHORE W. PAKISTAN

THE ABOVE AID SIGN HAS BEEN INSTALLED AT THE IMPERIAL ELECTRIC MATERIAL STORAGE YARD AT MANDI BAHAUDDIN FOR THE SCARP-2A 11-KV DISTRIBUTION LINE CONTRACT.

TYPICAL DUST STORM

IN BACK GROUND MEN WORKING IN DUST STORM

WAPDA SUPPLIED VECHICLES



11 KV STEEL LATTICE POLES

LINE OF ERECTED POLES

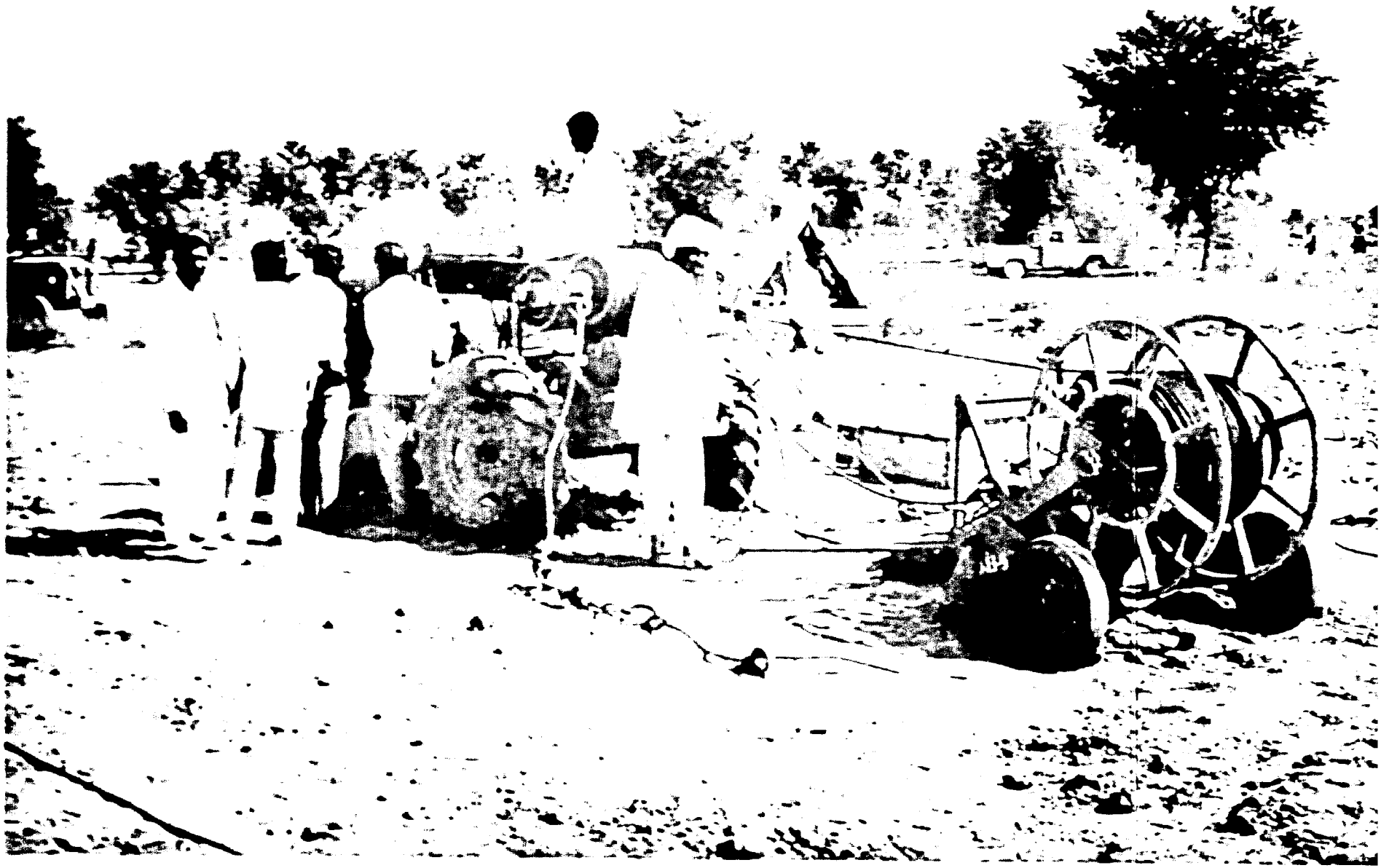
11 KV OIL CIRCUIT RECLOSER
INSTALLATION

FORMING AND PREPARATION REQUIREMENTS FOR POURING CONCRETE FOUNDATIONS ALONG 11-KV DISTRIBUTION CIRCUITS

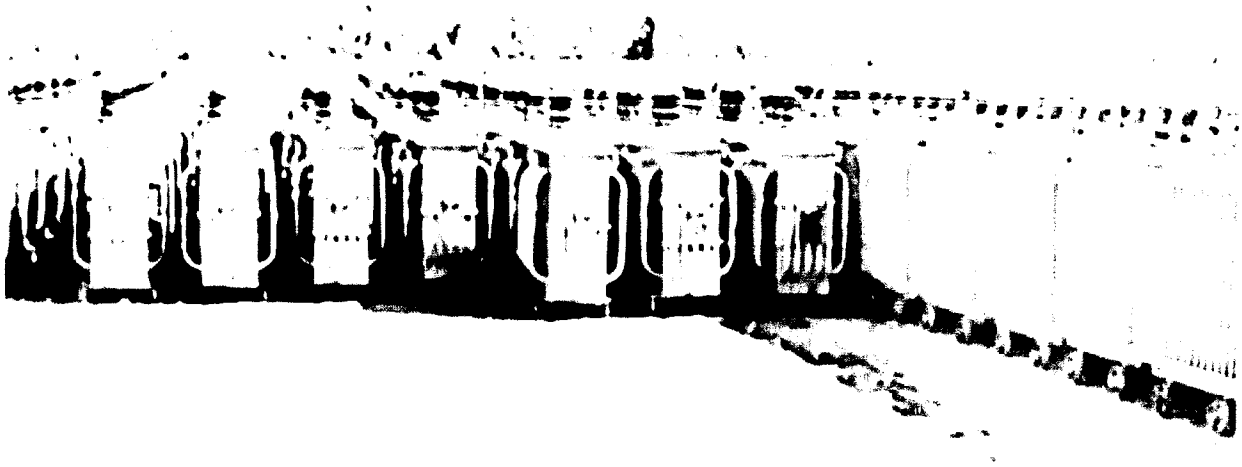
STUB ANGLE DIMENSIONS ARE CHECKED BY CAI AND WAPDA REPRESENTATIVES AFTER EACH FOUNDATION HAS BEEN INSTALLED.

CURING COMPLETED 11 KV POLE FOUNDATION

STRINGING. ON 11 KV POLES



CONTRACTORS CONDUCTOR PULLING EQUIPMENT

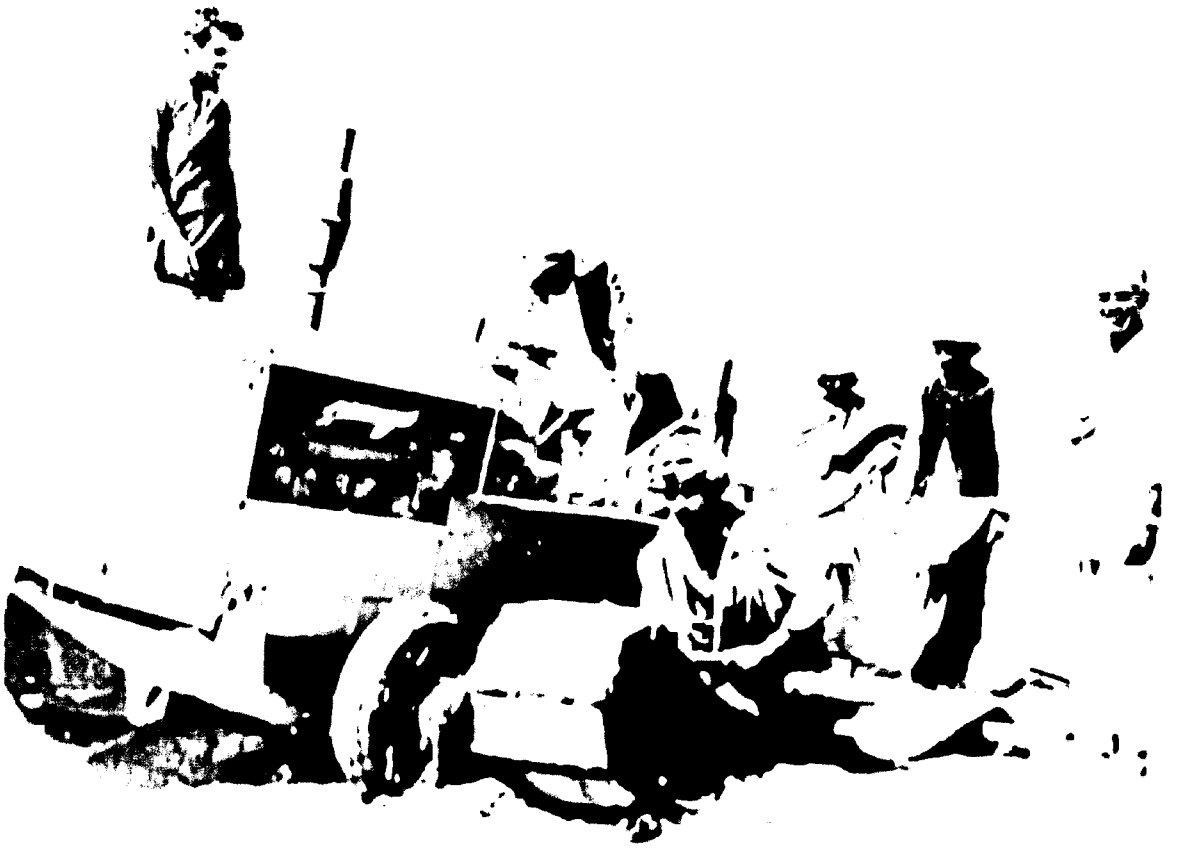


11 KV TRANSFORMERS AT CLIMAX ENGINEERING CO.

11 KV CIRCUIT BREAKER

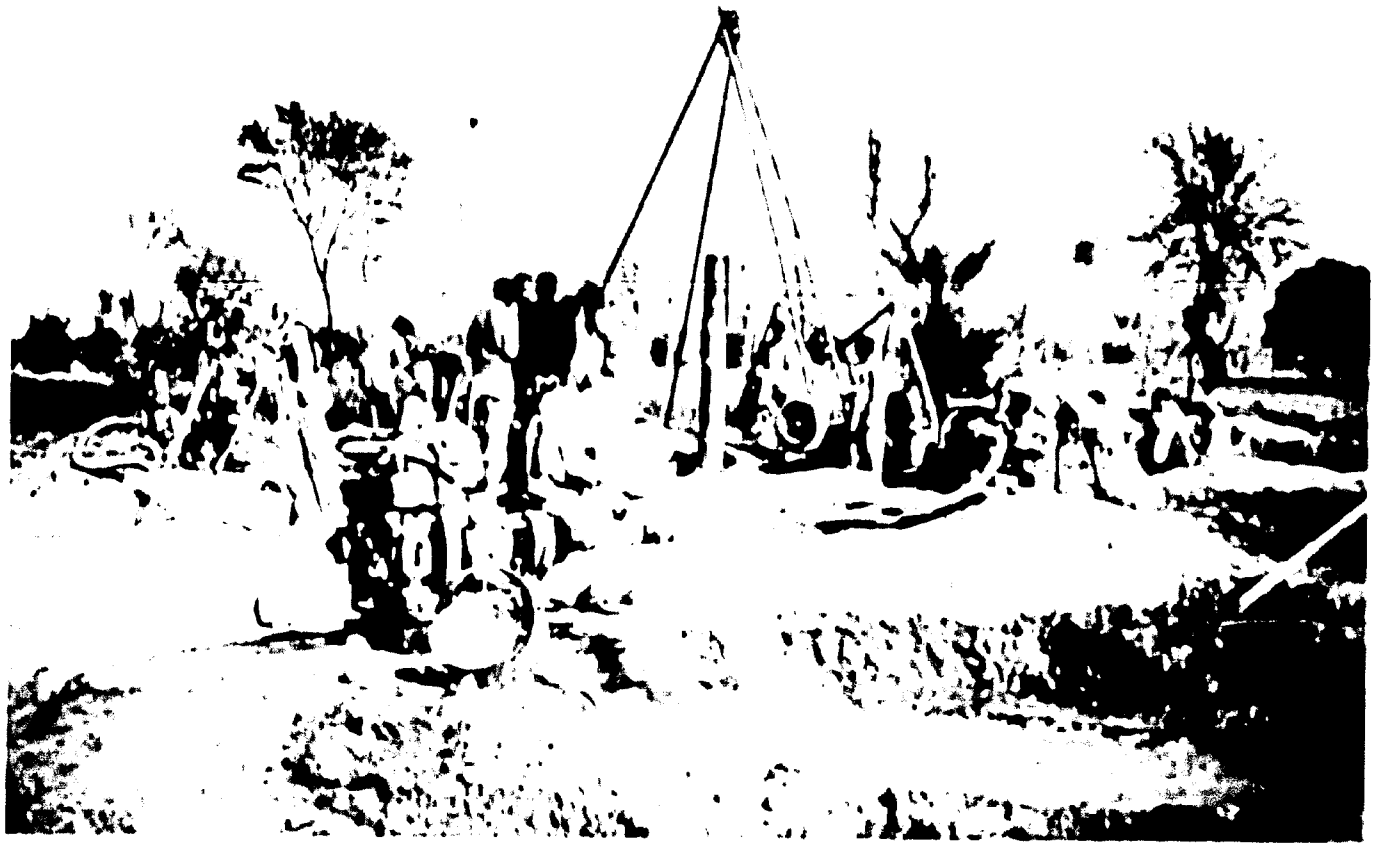
SURVEYING FOR 132 KV TRANSMISSION LINE
TOWER GRILLAGE FOOTINGS

TAKING CONCRETE CYLINDERS FOR STRENGTH TEST.

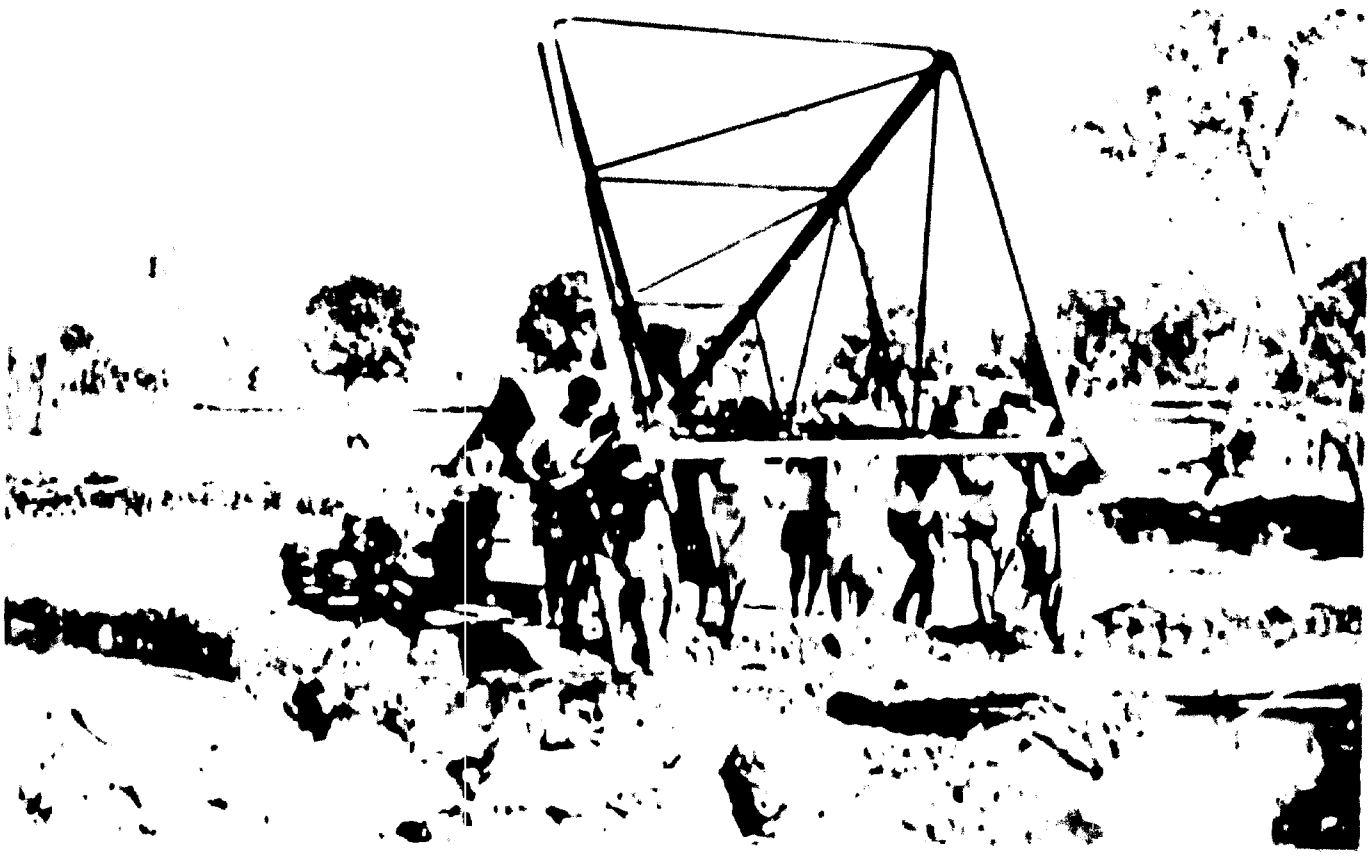


EQUIPMENT BREAKDOWN

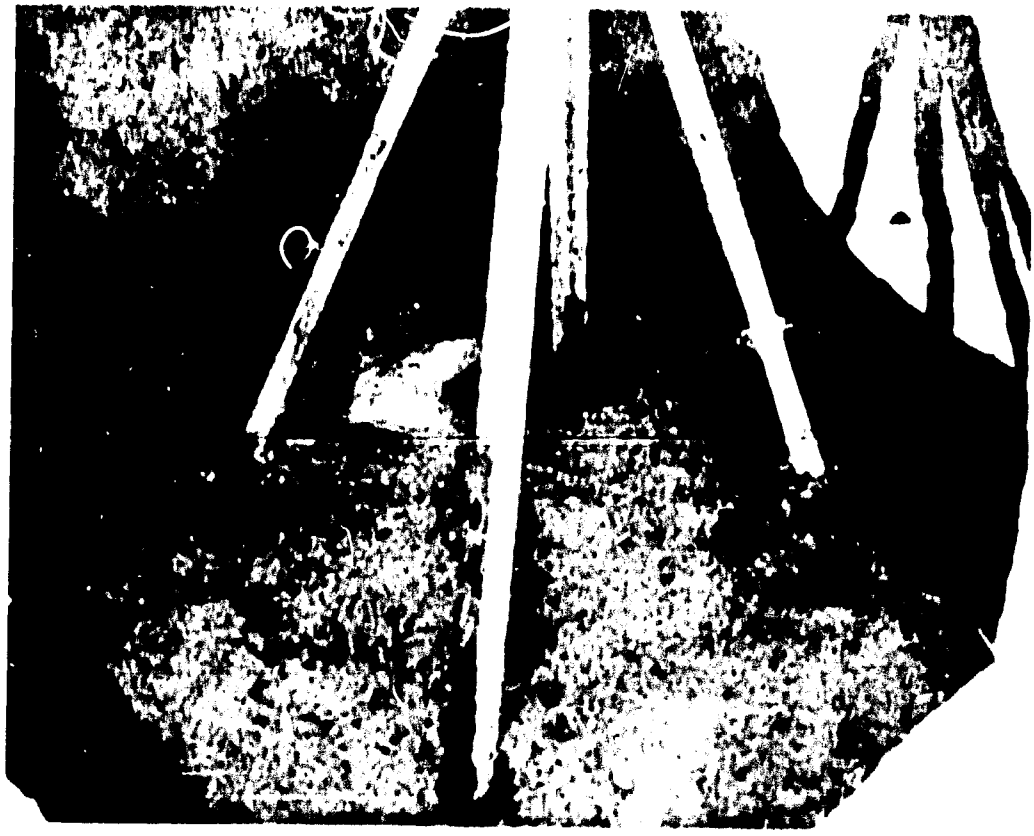
CHARGING MIXER WITH MEASURING BOXES



DE WATERING 132 KV TOWER FOUNDATION
PITS LUDEWALA KUDLATHI T 85 02 CONTRACT

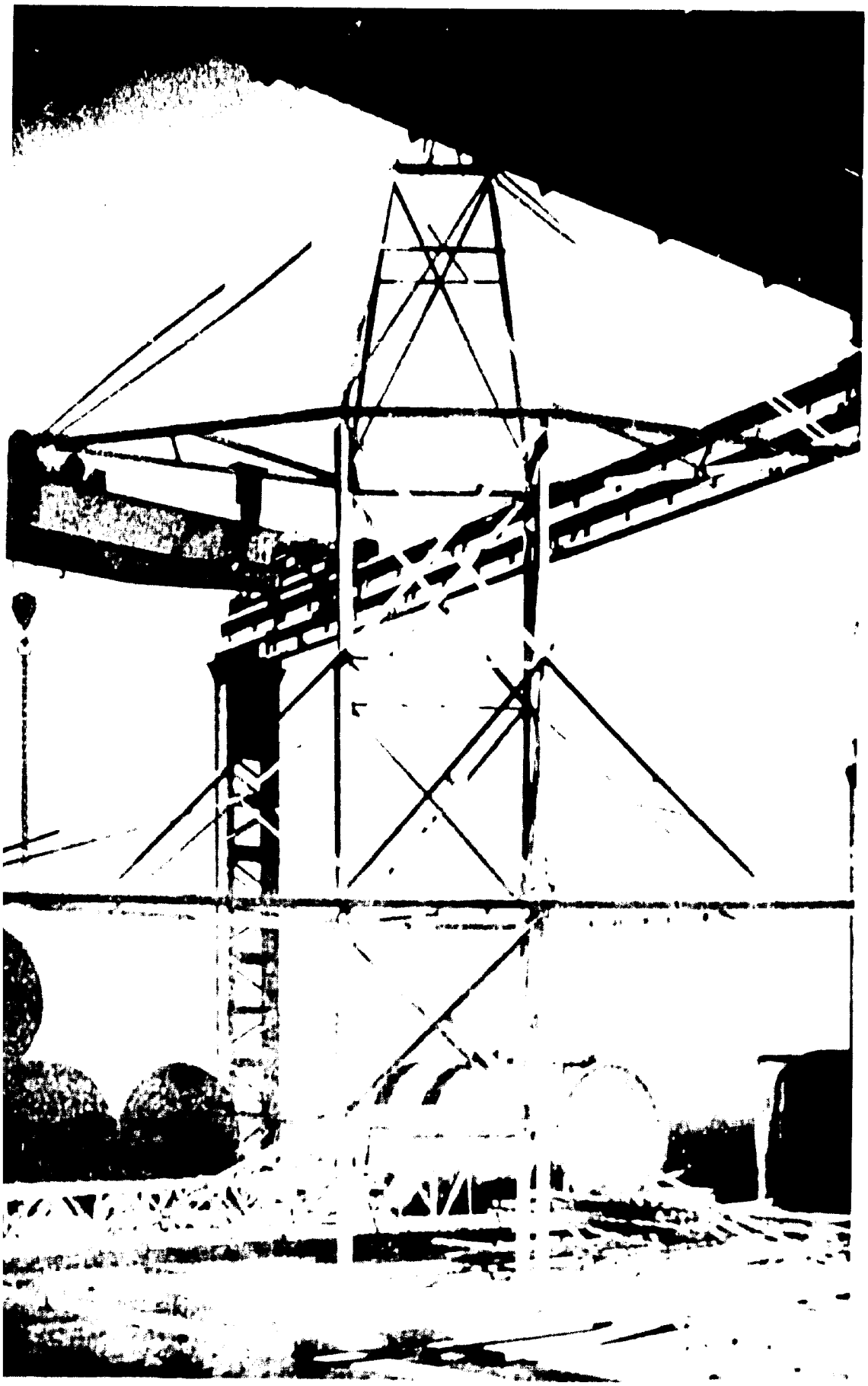


CARRYING GRILLAGE TO BE SET IN DE WATERED PIT



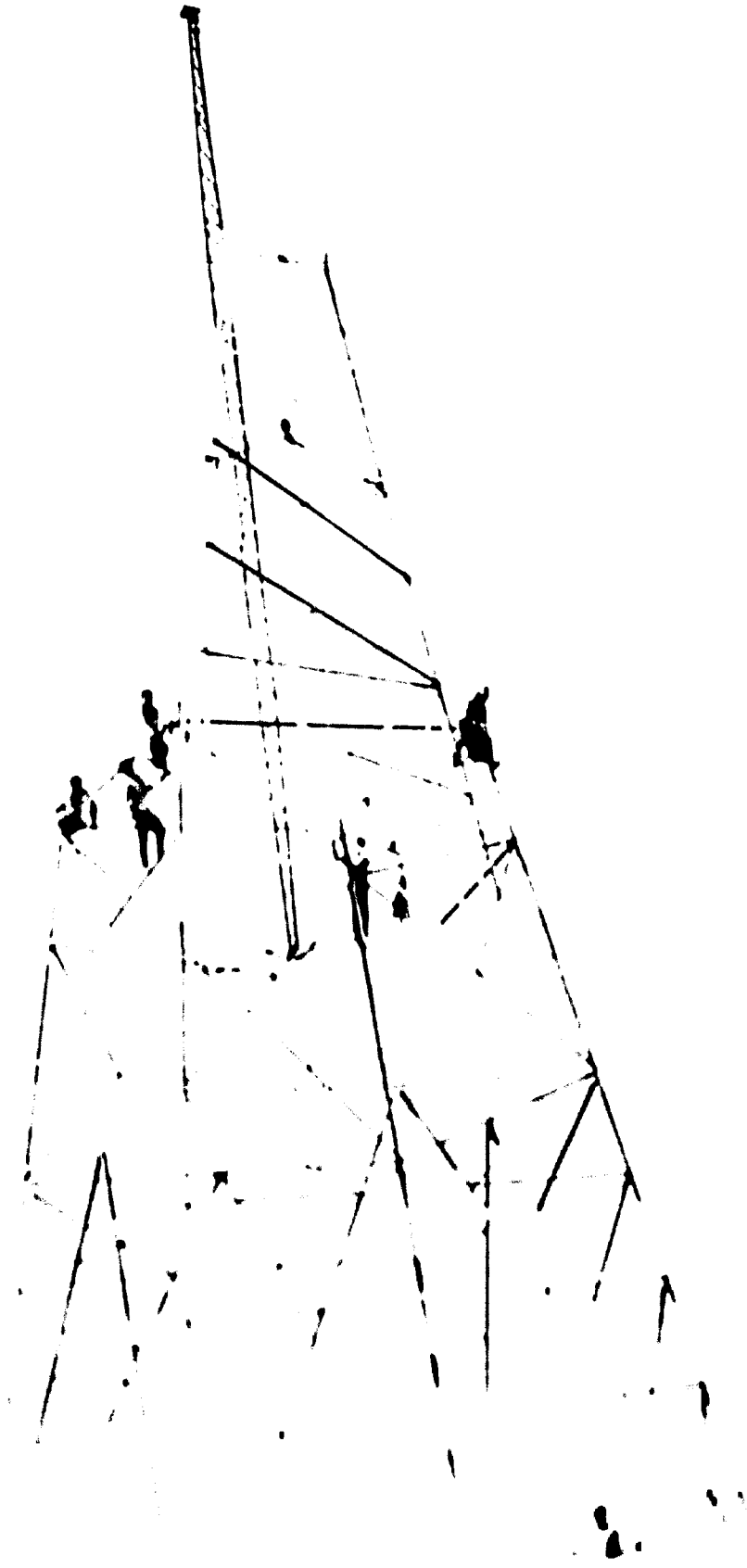
ONE LEG OF THE 132 KV TRANSMISSION LINE TOWER.
GRILLAGE FOOTING AFTER CONCRETING

COMPLETE VIEW OF THE BOTTOM SECTION OF 132 KV
TRANSMISSION LINE TOWER AFTER ERECTION.

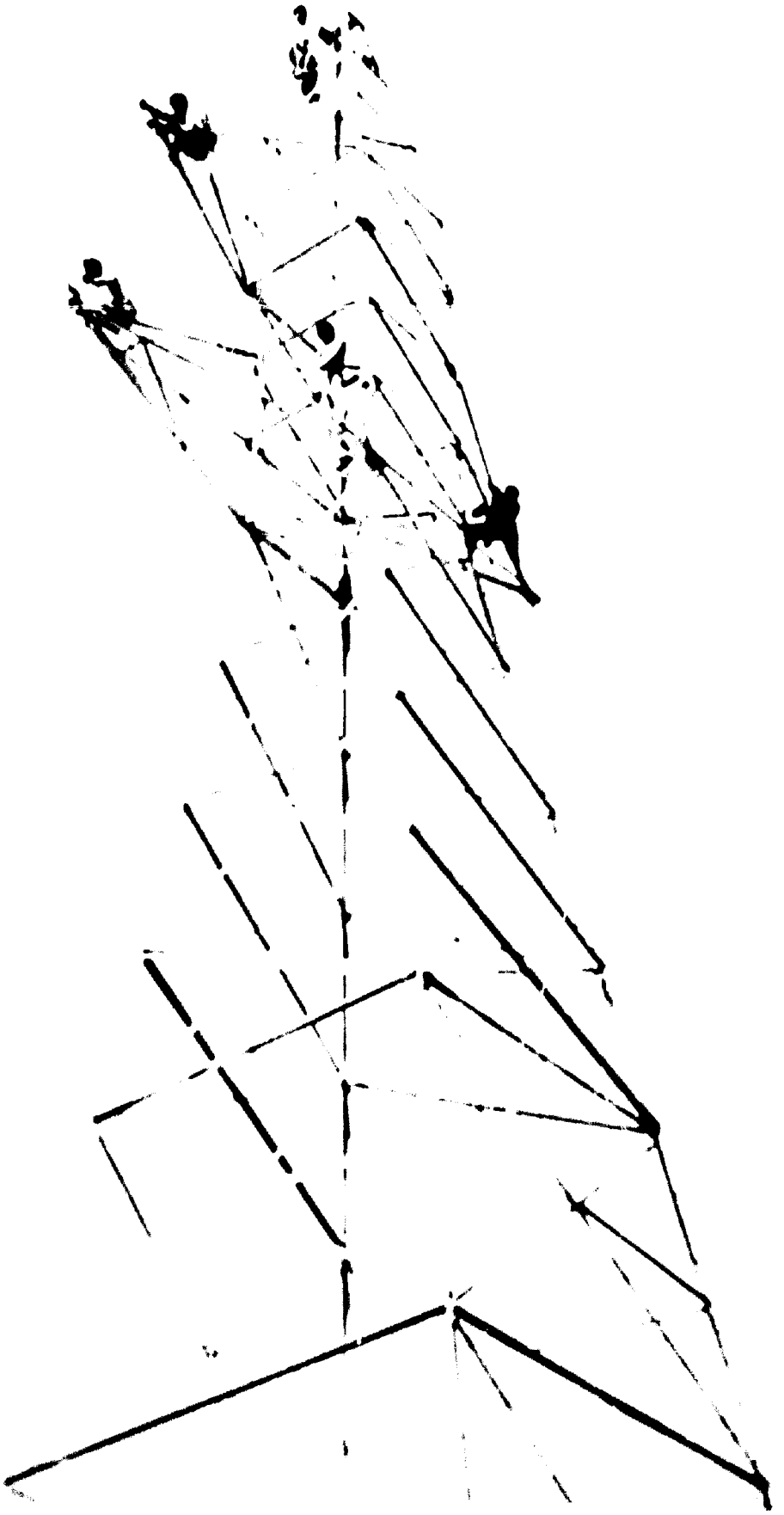


CROSS ARMS OF TYPE BAA TOWER BEING TESTED AT
BATALA ENGINEERING COMPANY

132 KV TOWER STEEL

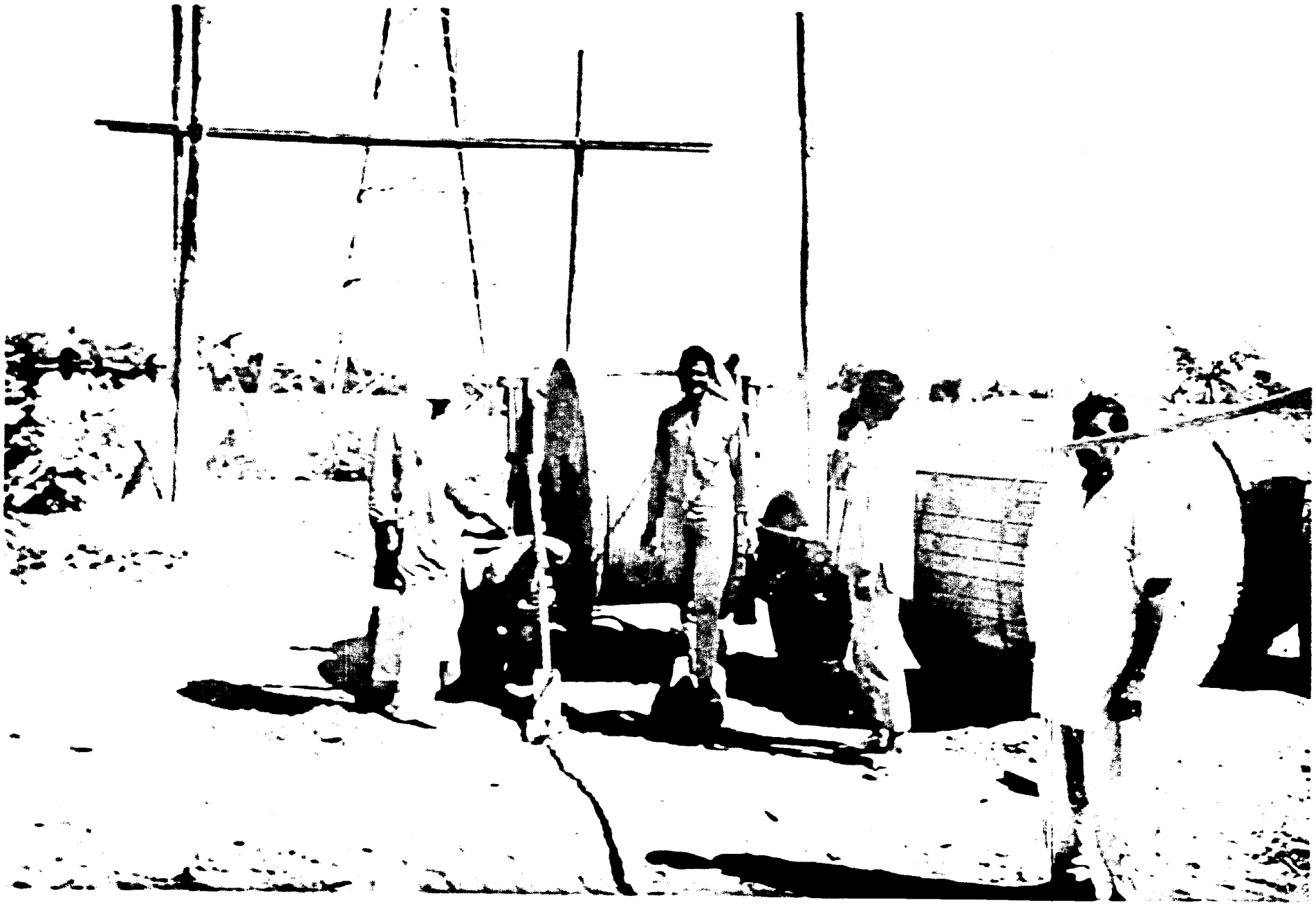


132 KV TOWER ERECTION
WITH GIN POLE

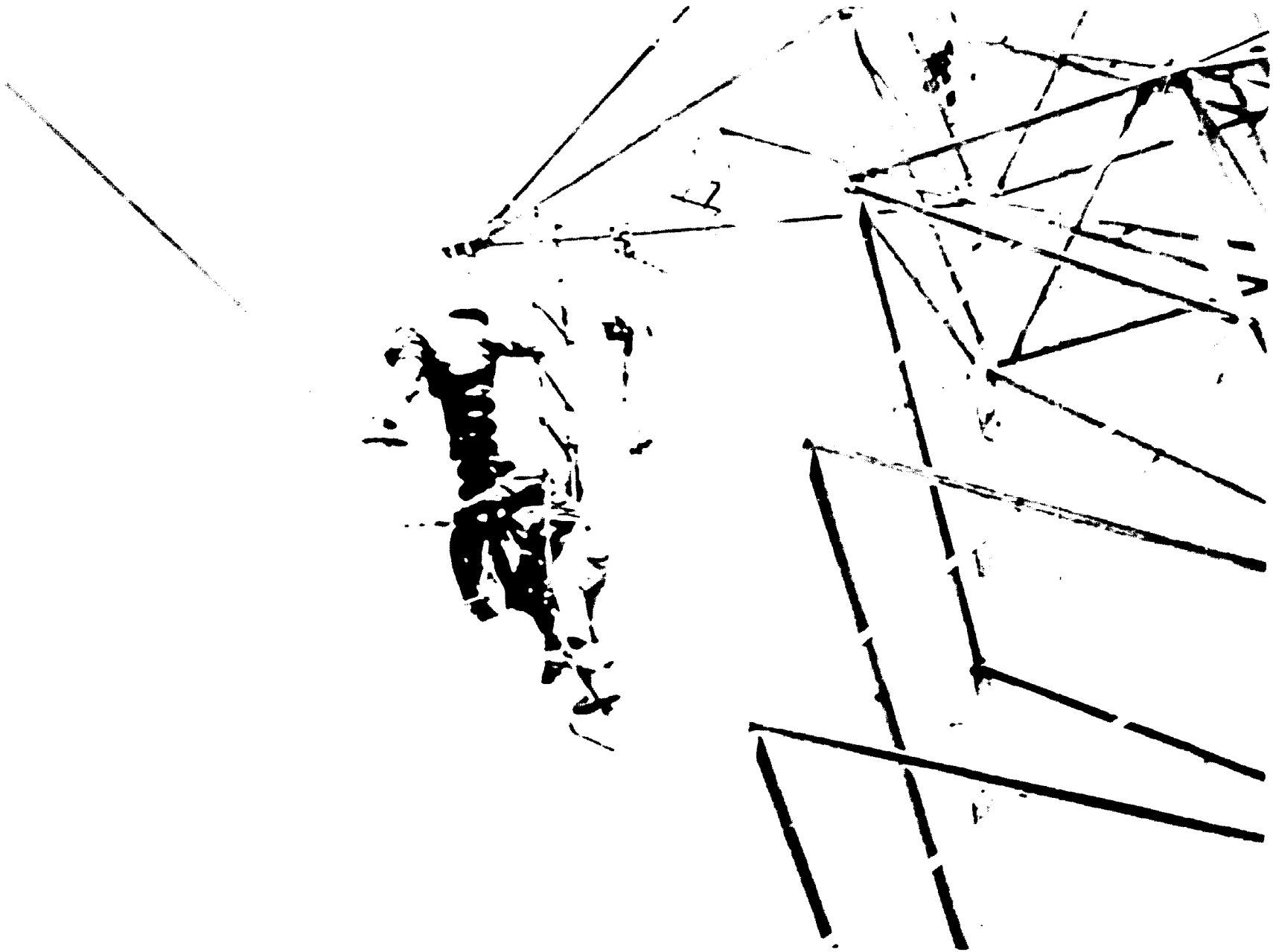


INSPECTION AND
BACK BOLTING

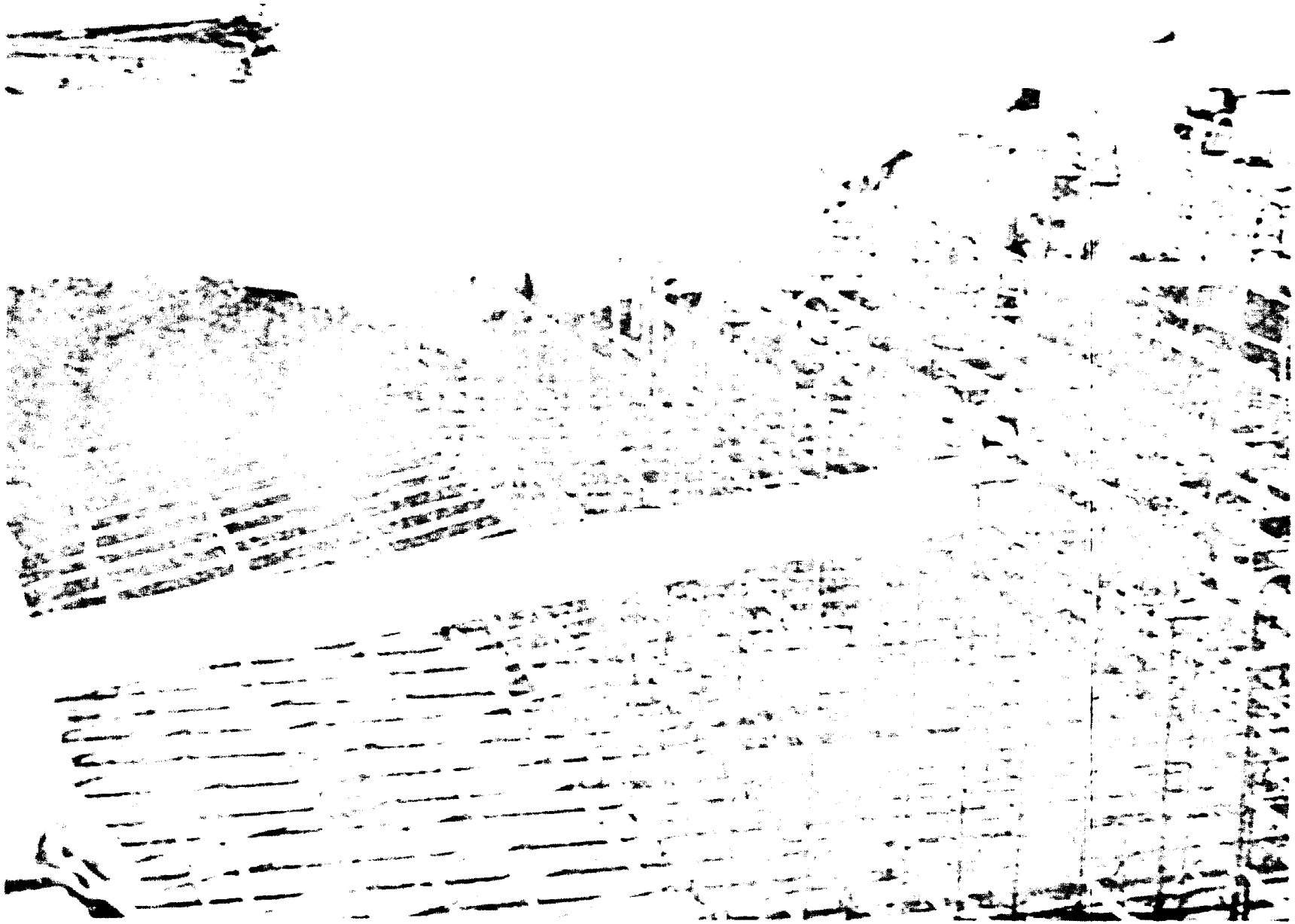
REELS OF ACSR CONDUCTOR ARE DELIVERED FROM THE RAILROAD STATION AT MANDI BAHAUDDIN BY BUFFALO CARTS



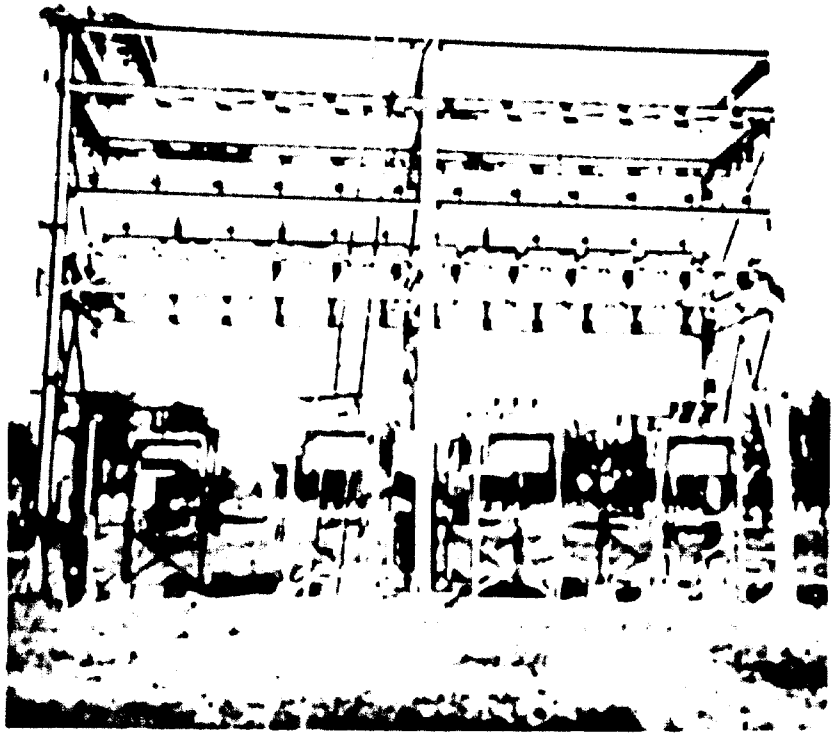
CONDUCTOR STRINGING

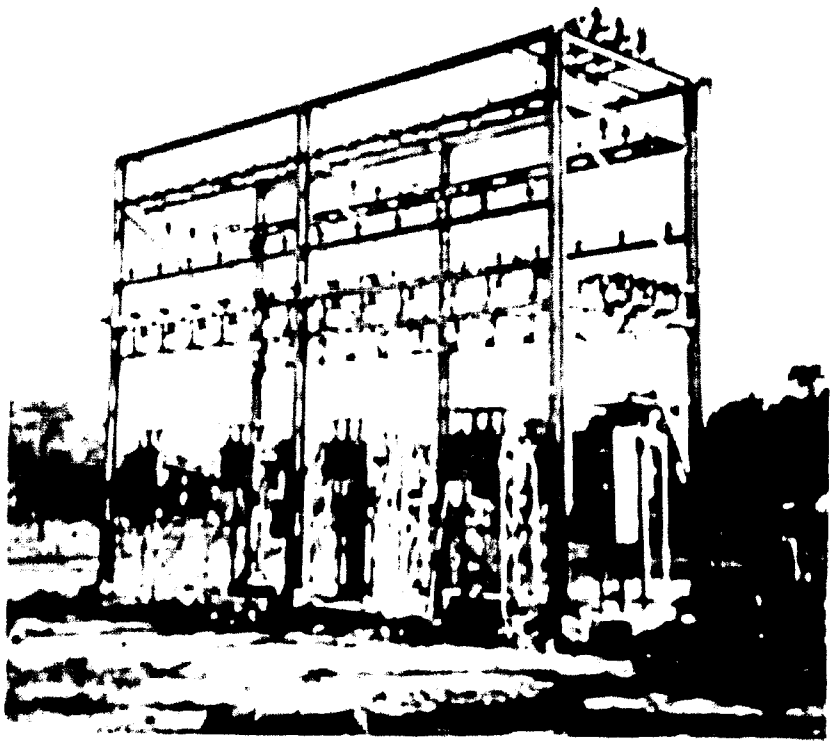


COMMONWEALTH INSPECTOR DEMONSTRATES
CLIPPING OF CONDUCTOR



REINFORCING STEEL FOR 132/11 KV SUBSTATION





GRID STATIONS UNDER CONSTRUCTION

WEST PAKISTAN
WATER AND POWER DEVELOPMENT AUTHORITY
LAHORE, WEST PAKISTAN

ADDITIONAL NOTES

As built drawings for the project consisting of manufacturers details of equipment, gridstation control diagrams, maintenance and operating manuals are available with the West Pakistan Water and Power Development Authority, Lahore, Pakistan and Commonwealth Associates Inc., Jackson, Michigan, U.S.A. Spare parts and materials for electric maintenance and testing equipment, hand tools, guage and meter testing apparatus are available at WAPDA.

All other Project Documents, such as quarterly reports, material specifications, contracts, loan agreements, shipping documents and test reports are also available with the Water and Power Development Authority and Commonwealth Associates.