Project Profile

BASIC INFORMATION

Project Title	132kV Overhead Pole Line and Underground Cable from the existing Po Lam Substation to the existing Tui Min Hoi Substation - Circuit No 2
Purpose and nature of the Project	At the moment, the electricity supply to Sai Kung Town is mainly from two 33kV primary substations at Tui Min Hoi and Wong Chuk Wan. They are in-fed by a single 132kV and a single 33kV overhead pole lines respectively. In order to cater for the load growth in Sai Kung Town, including the supply to the High Islands Pumping Station, a new 132kV infeed to Sai Kung Town is necessary to be established. This profile is confined to the proposed 132kV overhead transmission pole line and underground cable to deliver electricity from the **existing** Po Lam substation in Tseung Kwan O to the **existing** Tui Min Hoi substation in Sai Kung Town. This proposed project is not only cater for the load growth in but also maintain a secure supply to Sai Kung Area.
Name of Project proponent	CLP Power
Location and scale of project and history of site	The proposed route commences from Tseung Kwan O, run along the ridges to Pak Kong Village in Sai Kung. The two ends of the route are linked to the existing substations by the underground cables. Besides connecting the overhead pole line to the substations, underground cables with outer diameter of about 68mm - 71mm are also installed for crossing the Clear Water Bay Road at Pik Uk and the cultivation at Ho Chung. The route length of the proposed overhead pole line and underground cable are about 6.5 km and 5km respectively. The detail of the proposed route is shown on the 1:10000 scale route maps Drg. No. 16340/RF1158-02 in Attachment 1. The overhead pole line will consist of bare aluminium conductors supported on tubular steel poles of average span of 180m. It will have approximately 30% single pole supports and 70% H-pole Supports similar to those as shown on Drg. Nos.: T GEN 51520 D E33 3000 01 I, T GEN 51520 D E33 3001 01 I and T GEN 51520 D E33 3002 01 I in Attachment 2. More than 1,000 poles (single and H-poles) of the same design of this project were installed in the previous years for supplying electricity to Kowloon, New Territories and Lantau Island. So far, no failure incident has been reported.

Number and types of designated projects to be covered by the project profile	Only one project which need to come across the country park and draft outline zoning plans is covered in this application. 132kV Overhead Pole Line and Underground Cable from the existing Po Lam substation to the existing Tui Min Hoi substation - Circuit No.2
Name and telephone number of contact person(s)	

OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

Project planning and implementation

The project is planned in-house and consultant will be employed to conduct an EIA study of the project after the EIA study brief is available. The project will be implemented by both the in-house and the contractor resources.

Provisional project time schedules

Outline programme for the project is as follows:

1	**Approval from Country and Marine Parks Authority**	**5 Nov 1997**
2	**Partial route approval from District Lands Office / Sai Kung**	**31 Mar 1998**
3	Tree survey and tree felling permit application	May 1998 - Aug 1998
4	Application for an EIA Study Brief	May 1998 - Jun 1998
5	Re-apply for route approval of the remaining section to DLO/SK	Jul 1998 - Sep 1998
6	Tendering and issuing of purchase order for the EIA study	Jul 1998 - Sep 1998
7	EIA study	Oct 1998 - Nov 1998
8	Submission of EIA Report	Dec 1998 - Apr 1999
9	Site route survey(control, alignment profile & site pegging)	Jan 1999 - Sep 2000
10	Application for approval from Town Planning Board	May 1999 - Jul 1999
11	Application for Environmental Permit	May 1999 - Jun 1999
12	Pole erection and conductor stringing	Jul 1999 - Jan 2001
13	Commissioning test	Jan 2001- Feb 2001
14	Circuit completion and operation	Feb 2001

Interactions with broader programme requirements or other projects

This project is scheduled in line with the electricity demand forecast in Sai Kung area including the future supply to the High Islands Pumping Station.

POSSIBLE IMPACTS ON THE ENVIRONMENT

Based on the previous experience, no any significant environmental impacts were recorded due to the routing of 132kV overhead pole lines and underground cables. Whilst, some possible environmental impacts worth to be concerned are listed as the followings.

- Dust may be generated during the excavation and trenching work for the overhead pole lines and underground cables.
- Limited tree trimming and/or felling to keep a minimum clearance of 2.8 meter between tree canopy and the conductors for safety reasons.
- Unsightly visual appearance due to the construction of single & H-poles and overhanging of conductors, at a minimum of 6.7 meter above ground.
- Depending on the rarity and ecological importance of the species within the proposed route, the possible ecological impact can not be determined at this stage.

MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

Ma On Shan Country Park (The Country and Marine Parks Authority has no objection to the two overhead pole lines cross the Ma On Shan Country Park)

Conservation Area of the following Draft Outline Zoning Plans: -

1. Tseng Lan Shue OZP no. S/SK-TLS/2
2. Ho Chung OZP No. S/SK-HC/1
3. Pak Kong and Sha Kok Mei OZP no S/SK-PK/1

ENVIRONMENTAL PROTECTION MEASURES TO BE INCORPORATED IN THE DESIGN AND ANY FURTHER ENVIRONMENTAL IMPLICATIONS

- Hand-dig method is applied for the excavation of footings (1.2m x 1.2m x 2.95m depth) for overhead pole lines and trenching (1.05m width with 1.2m-1.6m depth) for underground cables unless rock breaking is unavoidable. Dust emission can be reduced through this practice.

- Work area/site will be restored with proper re-vegetation.

- Pole will be painted with antique color on the original hot dip galvanized dull gray colour surface if required (It was requested by AFD in some previous projects).

- Any environmental protection measures which are recommended in the EIA report will be followed.

- Any tree trimming and felling will notify AFD and acquire their prior approval.

- The Country and Marine Parks Authority has no objection to the proposed 132kV overhead line from Po Lam Substation to Tui Min Hoi Substation (Poles no. 43 and 44) within Ma On Shan Park. (Letter from the AFD is attached in the Attachment 5)

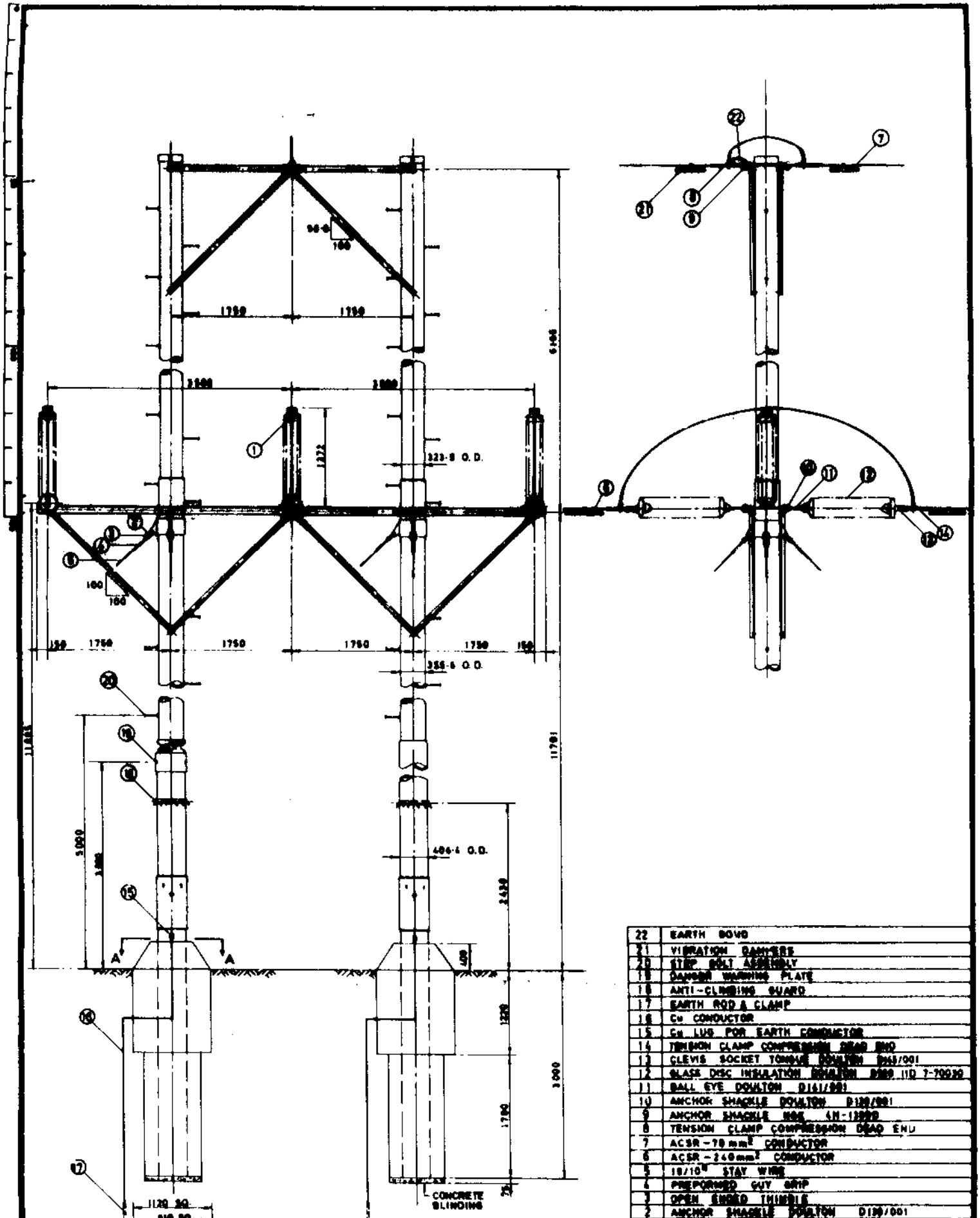
- Regarding the concerns of EMF due to the overhead pole line, studies of CLP's overhead pole lines have revealed that both calculated and measured EMF are well within the guideline limits adopted by the International Radiation Protection Association (IRPA) and stipulated in Hong Kong Planning Standards and Guidelines (HKPSG). Report of the "Electric and Magnetic Measurements" is enclosed in the Attachment 4.

- The route for the circuit no.2 starting from the overhead pole line A29 to A56 will be quite similar to the existing circuit no.1. A minimum separating distance of not less than 20 meter will be kept between circuit no.1 and no.2 (see Attachment 1 and 1.1). Under such minimum separating distance, the cumulative effects of EMF, due to the existing circuit no. 1 and proposed circuit no. 2, is insignificant.

Attachment 2

Elevation plans of pole structures

Drawing Nos.	Pole Description
T GEN 51520 D E33 3000 01 A I	D60 Angle/Terminal "H" Pole
T GEN 51520 D E33 3001 01 A I	D30 Angle "H" Pole
T GEN 51520 D E33 3002 01 A I	Intermediate Single Pole
T GEN 51520 D E33 3003 01 - I	D60 "H" Pole with Cable Sealing Structure



PLAN A—A

22	EARTH BOND
21	VIBRATION DAMPERS
20	STEP BOLT ASSEMBLY
19	DANGER WARNING PLATE
18	ANTI-CLIMBING GUARD
17	EARTH ROD & CLAMP
16	Cu CONDUCTOR
15	Cu LUG FOR EARTH CONDUCTOR
14	TENSION CLAMP COMPRESSION DEAD END
13	CLEVIS SOCKET TONGUE DOVETON D161/001
12	GLASS DISC INSULATION DOVETON D289 (ID 7-70039
11	BALL EYE DOVETON D161/001
10	ANCHOR SHACKLE DOVETON D120/001
9	ANCHOR SHACKLE MFR. 4M-13999
8	TENSION CLAMP COMPRESSION DEAD END
7	ACSR – 78 mm² CONDUCTOR
6	ACSR – 260mm² CONDUCTOR
5	10/10" STAY WIRE
4	PREFORMED GUY GRIP
3	OPEN SWORD THIMBLE
2	ANCHOR SHACKLE DOVETON D130/001
1	POLE INSULATOR MFR. BASSEDA

CHINA LIGHT & POWER CO., LTD.

CONTRACTOR:

CONTR. DRG. NO.

DRAWN: S. C. T. DATE: 2-10-89

CHECKED: P. V. L./Y. M. S. APPROVED:

SCALE: 1:50 SHEET NO. OF 1

TRANSMISSION PROJECTS

REVISIONS

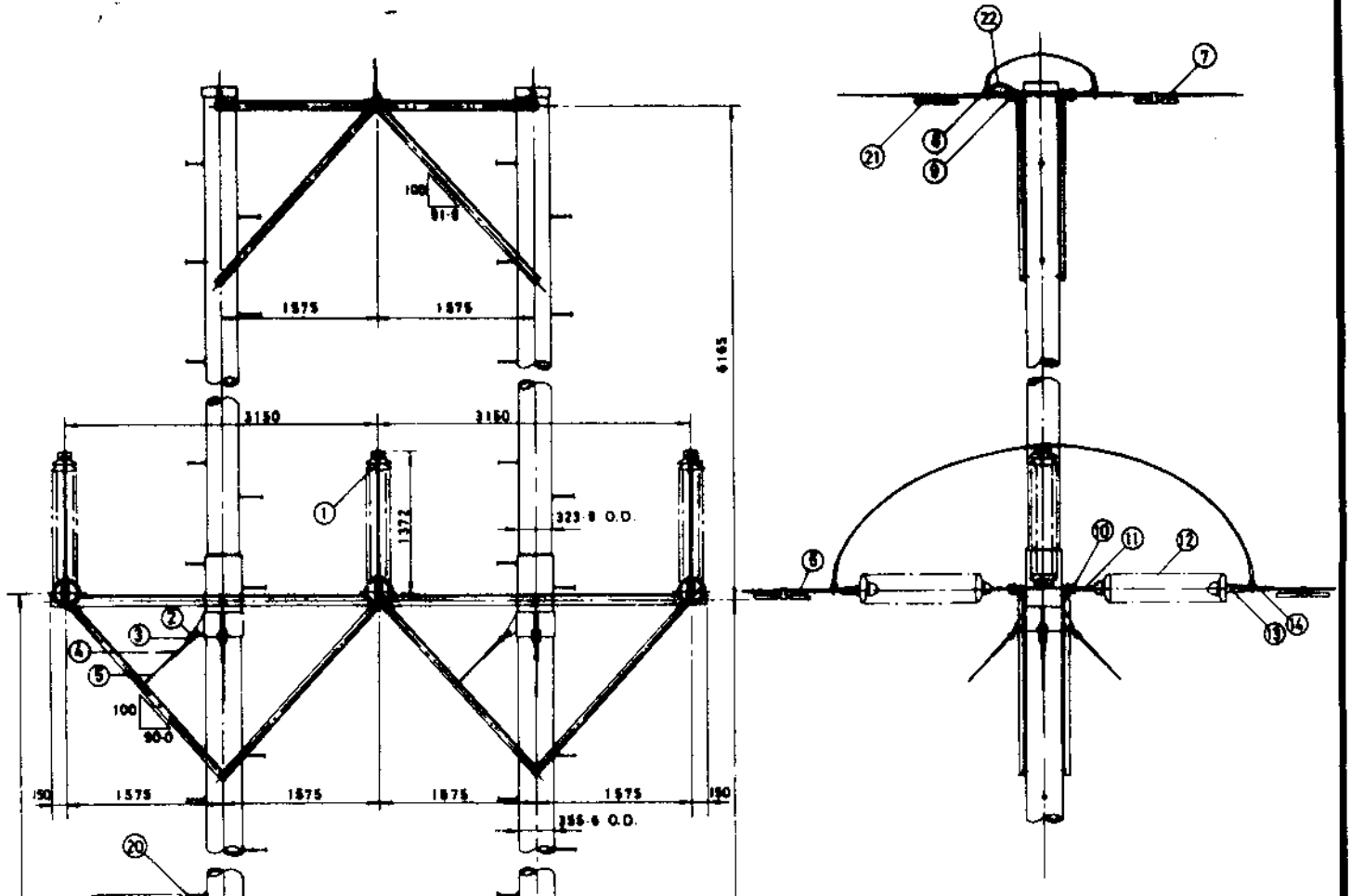
REV.											
	A	B	C	D	E	F	G	H	J	K	L

TITLE:

D60 ANGLE / TERMINAL 'H' POLE

CONTRACT NO.

DRG. NO. 0 000 00000 0 000 0000 00 A 0



PLAN A—A

22	EARTH BOND
21	VIBRATION DAMPERS
20	STEP BOLT ASSEMBLY
19	DANGER WARNING PLATE
18	ANTI-CLIMBING GUARD
17	EARTH ROD & CLAMP
16	Cu CONDUCTOR
15	Cu LUG FOR EARTH CONDUCTOR
14	TENSION CLAMP COMPRESSION DEAD END
13	CLEVIS SOCKET TONGUE DOULTON D143/001
12	GLASS DISC INSULATION DOULTON BSEN 120 7-70030
11	BALL EYE DOULTON D141/001
10	ANCHOR SHACKLE DOULTON D139/001
9	ANCHOR SHACKLE M95 4M-1390D
8	TENSION CLAMP COMPRESSION DEAD END
7	ACSR – 70 mm² CONDUCTOR
6	ACSR – 240 mm² CONDUCTOR
5	19/10 STAY WIRE
4	PREFORMED GUY GRIP
3	OPEN ENDED THIMBLE
2	ANCHOR SHACKLE DOULTON D138/001
1	POST INSULATOR M95 DA88656A

CHINA LIGHT & POWER CO., LTD.

CONTRACTOR:

CONTR. ORG. NO.

DRAWN: B. C. T. DATE: 3-12-87

CHECKED: P. Y. L./Y. N. S. APPROVED:

SCALE: 1:50 SHEET NO. 1

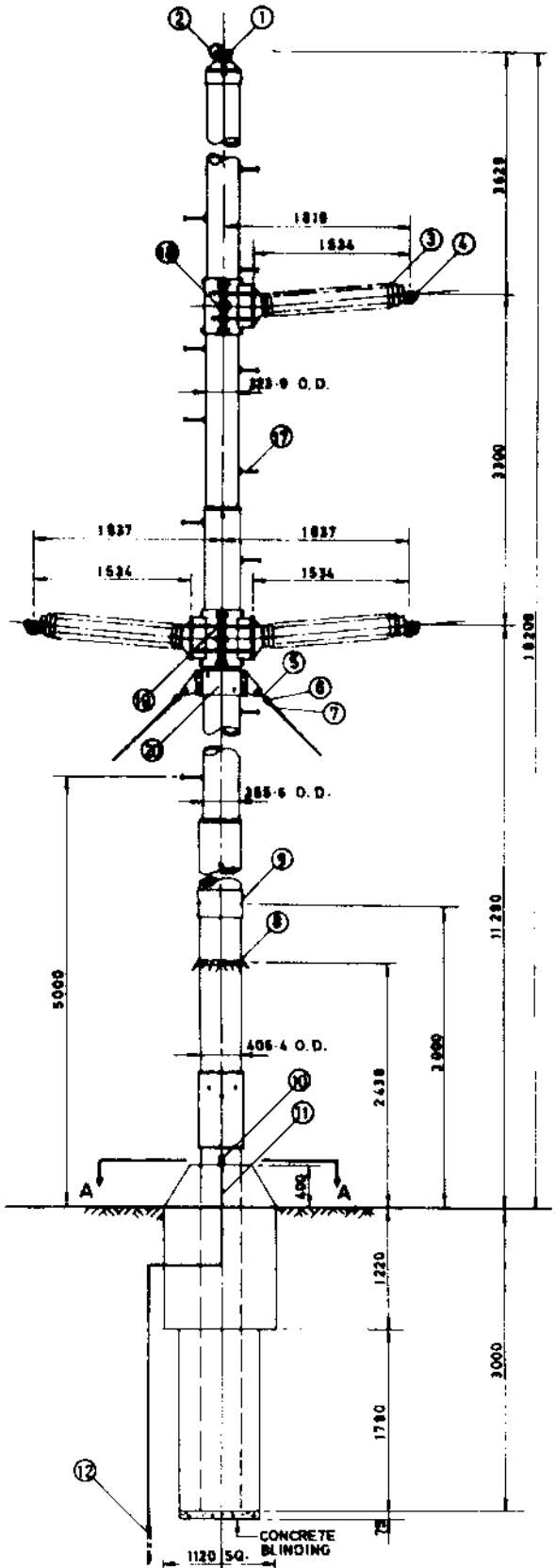
TRANSMISSION PROJECTS

TITLE:

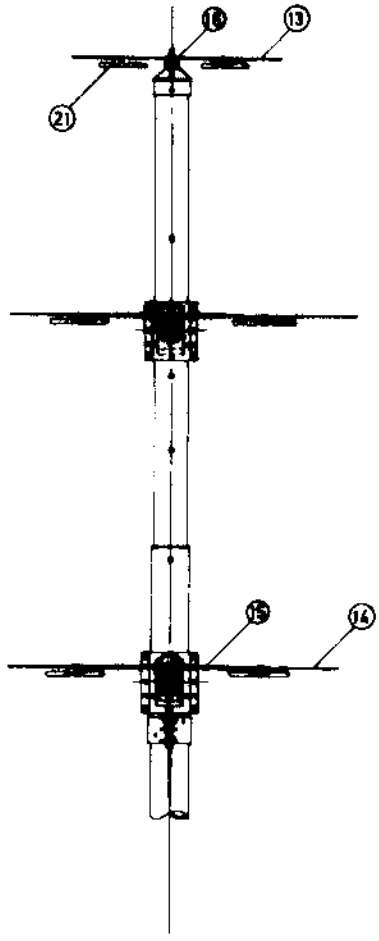
D30 ANGLE 'H' POLE

CONTRACT NO.

DRAWING NO. D30 0000 0000 0 300 0000 00 A 1



PLAN A—A



21	VIBRATION DAMPERS
20	STAY CLAMP ASSEMBLY
19	LINE POST INSULATOR SUPPORT (DOUBLE)
18	LINE POST INSULATOR SUPPORT (SINGLE)
17	STEP BOLT ASSEMBLY
16	AL. LINE TAP
15	PREFORMED LINE GUARD
14	ACSR-240mm² CONDUCTOR
13	ACSR-70 mm² CONDUCTOR
12	EARTH ROD & CLAMP
11	Cu CONDUCTOR
10	Cu LUG FOR EARTH CONDUCTOR
9	DANGER WARNING PLATE
8	ANTI-CLIMBING GUARD
7	PREFORMED GUY GRIP
6	OPEN ENDED THIMBLE
5	ANCHOR SHACKLE DOULTON D139/001
4	TOP CLAMP 1N-1170AU
3	LINE POST INSULATOR NGK DA85705G
2	EARTH BOND
1	EARTH WIRE HOLDER

CHINA LIGHT & POWER CO., LTD.

REVS.

CONTRACTOR :

CONTR. DRG. NO.

DRAWN : S. C. T. | DATE : 4-12-87

CHECKED : P. Y. L. / Y. N. S. | APPROVED :

SCALE : 1 : 50 | SHEET 1 OF 1

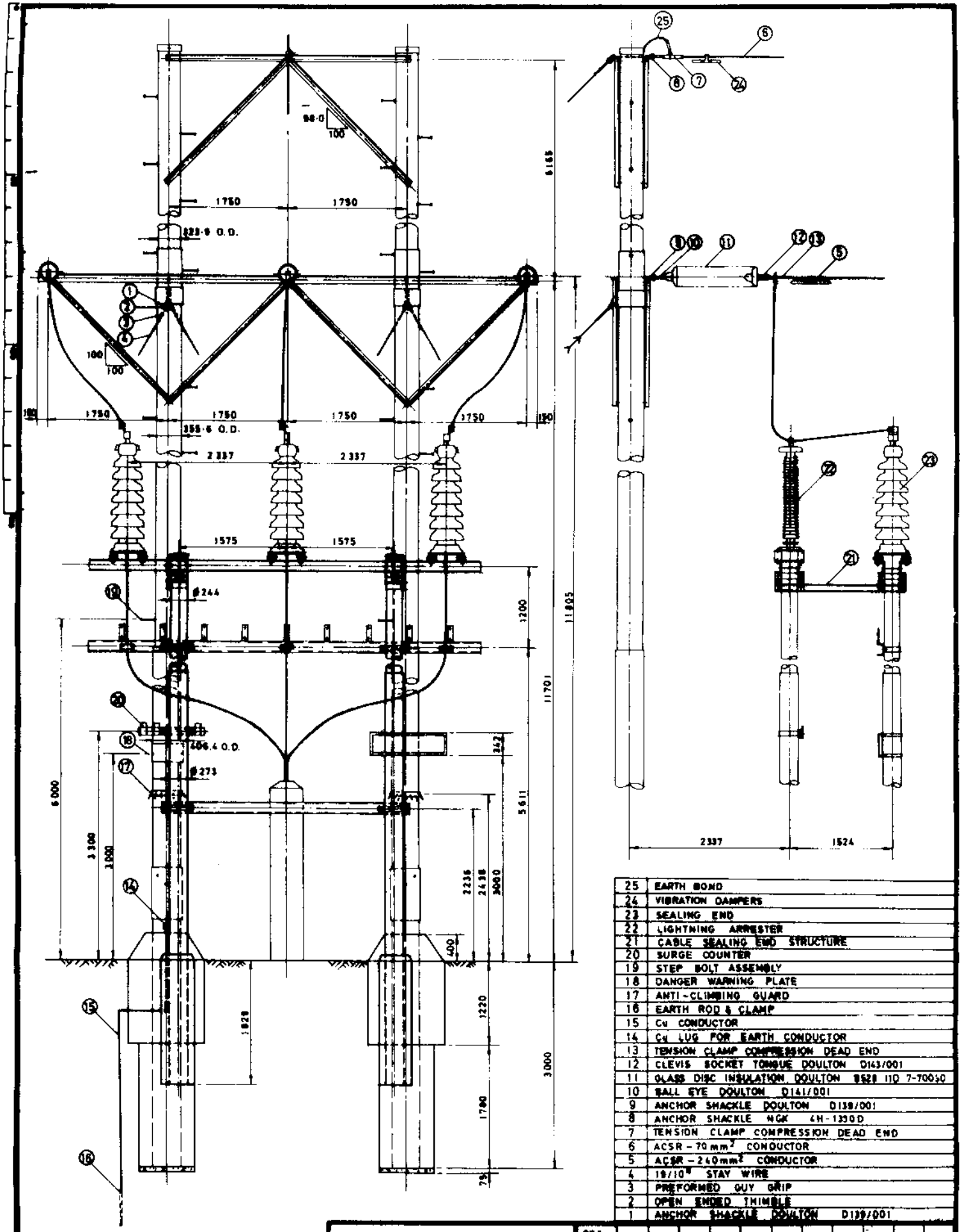
TRANSMISSION PROJECTS

TITLE :

INTERMEDIATE SINGLE POLE

PROJECT NO. | CONTRACT NO.

DRG. NO. TGEN/S1520/DE33/3002/01/A/1



25	EARTH BOND
24	VIBRATION DAMPERS
23	SEALING END
22	LIGHTNING ARRESTER
21	CABLE SEALING END STRUCTURE
20	SURGE COUNTER
19	STEP BOLT ASSEMBLY
18	DANGER WARNING PLATE
17	ANTI-CLIMBING GUARD
16	EARTH ROD & CLAMP
15	Cu CONDUCTOR
14	Cu LUG FOR EARTH CONDUCTOR
13	TENSION CLAMP COMPRESSION DEAD END
12	CLEVIS SOCKET TONGUE DOULTON D143/001
11	GLASS DISC INSULATION DOULTON B52B 11D 7-700±0
10	BALL EYE DOULTON D141/001
9	ANCHOR SHACKLE DOULTON D139/001
8	ANCHOR SHACKLE NGK 4H-1330D
7	TENSION CLAMP COMPRESSION DEAD END
6	ACSR - 70 mm² CONDUCTOR
5	ACSR - 240 mm² CONDUCTOR
4	19/10 STAY WIRE
3	PREFORMED GUY GRIP
2	OPEN ENDED THIMBLE
1	ANCHOR SHACKLE DOULTON D139/001

CHINA LIGHT & POWER CO., LTD

REVS. A B C D E F G H I J K L

CONTRACTOR:

CONTR. DRG. NO.

DRAWN: S. C. T. DATE: 1-2-80

CHECKED: P.Y.L./Y.N.S. APPROVED:

SCALE: 1:50 SHEET 1 IN SET 1

TRANSMISSION PROJECTS ON

TITLE:

D60 'H' POLE WITH CABLE SEALING STRUCTURE

PROJECT NO. CONTRACT NO.

DRG. NO. T G E N 5 1 5 2 0 D E 3 3 3 0 0 3 0 1 - 1

Attachment 4

1. A statement on "Electric and Magnetic Fields Associated with CLP Overhead Lines" reflecting CLP's attitude towards EMF issue.

2. A paper on "Electric and Magnetic Measurements" reflecting current status of EMF values on CLP transmission systems.

Attachment 4 - (1)

Electric and Magnetic Fields Associated with CLP Overhead Lines

1. In a modern society that depends on electricity, electromagnetic fields (EMF) are a fact of life.

   When electricity is used, electric fields are produced by the voltage in a conductor. Magnetic fields are produced by the current or flow of electricity in a conductor.

   Electric and magnetic fields are produced by virtually all consumer appliances, computer terminals, wiring in homes and offices and power lines.

2. China Light & Power (CLP) are committed to providing electricity in a way that protects the health and safety of customers and employees. The existence of EMF associated with the overhead lines does not compromise this commitment.

   Over the past few decades, the issue of possible health effects of EMF has generated a number of studies and reports. The weight of the evidence from those studies indicates that no changes to CLP's present power delivery methods are warranted.

   Studies of CLP's overhead lines in relation to EMF revealed that both the calculated and measured values are well within the guideline limits (5kV/m for electric field exposure and 1000 milligauss for magnetic field exposure) issued by the International Radiation Protection Association, as part of the World Health Organisation Environmental Health Criteria Programme and recommended for adoption by the Hong Kong Government. CLP have agreed to adopt the guideline limits in total for both existing and future circuits, in recognition of some concern by certain members of the public, although independent and authoritative review panels and government inquires have found no concrete scientific evidence that there is a health hazard from power lines.

3. At this stage of development there are over 150 studies underway world-wide covering the effects of electric and magnetic fields. CLP will continue to monitor the situation and ensure that any concerns raised are fully considered in the light of the data available from qualified scientific research parties and the subsequent reviews and overall assessments as compiled by recognised research bodies, government and state authorities.

ELECTRIC AND MAGNETIC FIELD MEASUREMENTS

W.A. el Arculli[1], D.K.Y. Leung[2], Dr. T.C. Cheng[3]
[1]Dip.E.E., C.Eng., M.I.E.E., M.I.E.Aust., M.H.K.I.E.
[2]B.Sc(Eng.), M.Sc., MBA, C.Eng., M.I.E.E.
[1]Senior Transmission Projects Engineer
[2]Electronics & Electrical Services Engineer
[3]Lloyd Hunt Professor & Director of Electric Power Program
[1,2]China Light & Power Company, Limited
[3]University of Southern California

ABSTRACT

Over the past few decades the issue of possible health effects from electric and magnetic fields has generated a large number of studies and reports world-wide. In 1990, the International Radiation Protection Association (IRPA) produced interim guidelines covering limits of exposure to power frequency electric and magnetic fields, as part of the World Health Organization Health Criteria Programme. These guidelines were recommended for adoption by the Hong Kong Government and the two local power companies have accepted the recommendation. This paper summarizes the measurements carried out on the transmission and distribution systems of China Light & Power Co., Ltd. with respect to such fields and compares them with the IRPA interim guidelines and also results obtained from other studies. The measurements are also compared against theoretical predications which enable the electric and magnetic fields to be calculated with reasonable accuracy before the circuits and plant are installed.

INTRODUCTION

In an attempt to allay public concerns regarding the possible effects of electric and magnetic fields on human health, China Light & Power carried out numerous measurements in the system during the past four years for comparison against the IRPA guidelines which are summarized in Table 1. The measurements were carried out with portable instruments which responded only to the alternating current electric and magnetic fields, e.g. EMDEX II LINDA System of Enertech Consultants (USA) and HI-3604 system of Holaday Industries, Inc. (USA). The corresponding voltage and current measurements were taken at the respective substations.

The strength of an electric field, measured in kV/metre, increases as the voltage is increased but decreases rapidly with increasing distance from the source. The magnetic field strength, measured in millitesla, increases as the current is increased but also decreases rapidly with increasing distance.

MEASUREMENTS AND FINDINGS

The test results are summarized in Tables 2, 3 and 4 for overhead lines, underground cables and switchboards respectively.

Overhead Lines

The strengths of the electric and magnetic fields in the vicinity of overhead lines depend on the complex geometry of the line configuration, height of the conductors above ground level, voltage and current. The electric field strengths can be distorted by nearby earthed objects, such as tall trees and structures, which effectively establish a screening effect thereby reducing the electric field strength near ground level.

The measurements shown in Table 2 were carried out with the instruments held under the overhead line conductors at a "standard" height of one metre above ground level.

Among the four overhead lines measured, the 400kV line was found to have the strongest electric field strength of 1.35kV/metre where the ground clearance was 27.5 metres. The maximum magnetic field strength or magnetic flux density measured was 0.004 millitesla under the 400kV line. Stronger electric and magnetic field strengths will be measured if the ground clearance is reduced. However, ground clearances of the lines are designed with due attention paid to ensure they stay above the statutory height limits.

Underground Cables

Of the four cable circuits measured, only the 400kV circuit comprised single-core cables laid horizontally with the remainder comprising three-core cables. All measurements were taken at a height of one metre above ground level.

The combination of the earthed cable sheaths and the soil above the cables reduced the electric field strength to below 0.01 kV/metre in all cases. The highest magnetic flux density was 0.0052 millitesla for the 400kV circuit as shown in Table 3. The very low magnetic flux density encountered for the remaining cables was mainly due to the cancelling effect of the three phases in close proximity inside each three-core cable.

Metalclad Switchboards

Table 4 shows the measurements taken around the switchboards at a height of one metre above floor level and 0.5 metre away from the panels.

The screening effect of the earthed metallic enclosures of the four switchboards reduced the electric field strength to below 0.01 kV/metre. The highest magnetic flux density around the switchboards was 0.068 millitesla, which was measured at the panel carrying the highest load current of 920A.

COMPARISON WITH THEORETICAL PREDICTIONS AND OTHER STUDIES

Figure 1 provides a comparison between the actual measurements and the theoretical predictions of the electric field strengths of the 400kV overhead line. The results are generally consistent with the differences mainly caused by the screening effect of the vegetation within the overhead line corridor.

Figure 2 compares the actual measurements of the magnetic flux density above the 33kV cable with the theoretical predictions. As indicated in the section for Underground Cables, the close proximity of the three phases in the three-core cable accounts for the low magnetic flux density.

The measurements summarized in Tables 2 to 4 inclusive and the theoretical predictions are comparable to the findings of other organizations such as the National Radiological Protection Board of the U.K., the Hongkong Electric Company and other utilities.

CONFIRMATION OF THE IRPA INTERIM GUIDELINES

In May 1993, the International Commission on Non-Ionising Radiation Protection, which is the successor to the former International Non-Ionising Radiation Committee of the International Radiation Protection Association (IRPA), confirmed the interim guidelines produced by the IRPA in 1990 and such guidelines are still applicable.

CONCLUSIONS

Owing to the screening effect, equipment with earthed metallic enclosures would limit the spread of electric fields. In the case of overhead lines the electric field strength is a function of the voltage and the height of conductors above ground level. The electric field strength diminishes rapidly over distance.

The magnetic flux density produced by a conductor is basically current dependent and, similar to electric fields, diminishes over distance. Ferrous material enveloping a current-carrying conductor would affect the field pattern and reduce the intensity of the magnetic field.

The electric and magnetic field strengths measured under the overhead lines, over the underground cables and around the metalclad switchboards were well within the IRPA guidelines for occupational exposure and the general public.

Table 1 : IRPA LIMITS OF EXPOSURE TO 50/60Hz ELECTRIC AND MAGNETIC FIELDS

Exposure Characteristics	Electric Field Strength kV/m (rms)	Magnetic Flux Density Millitesla (rms)
Occupational		
Whole working day	10	0.5
Up to 2 hrs. per working day	30	5
General Public		
Up to 24 hrs. per day	5	0.1
Few hrs. per day	10	1

Table 2 : ELECTRIC AND MAGNETIC FIELD MEASUREMENTS - OVERHEAD LINES

Circuit	System Voltage	Current	Height of Bottom Conductor	Electric Field Strength, kV/m(rms)	Magnetic Flux Density, Millitesla(rms)
Castle Peak - Yuen Long Double Circuit	400kV	1162A	27.5m	1.35	0.004
Fanling - Luohu	132kV	402A	9.7m	0.65	0.004
Hammer Hill - Pak Kong	33kV	80A	8.0m	0.28	0.003
Kowloon Peak S/S - Kowloon Peak	11kV	15A	7.0m	0.06	0.003

Table 3 : ELECTRIC AND MAGNETIC FIELD MEASUREMENTS - UNDERGROUND CABLES

Circuit	System Voltage	Current	Cable Depth Below Ground	Electric Field Strength, kV/m(rms	Magnetic Flux Density, Millitesla(rms)
Tai Wan - Tsz Wan Shan No.1	400kV	390A	1m	<0.01	0.0052
Fanling - Chunfeng	132kV	380A	1m	<0.01	0.0003
Kwai Chung 'A' - Tsing Lung Tau No.2	33kV	160A	1m	<0.01	0.00038
Hoi Shing Road - Princess Alexandra Community Centre	11kV	160A	0.75m	<0.01	0.00016

Table 4 : ELECTRIC AND MAGNETIC FIELD MEASUREMENTS - METALCLAD SWITCHBOARDS

Substation	System Voltage	Current of panel where max.magnetic flux density was measured	Electric Field Strength kV/m (rms)	Magnetic Flux Density Millitesla(rms)
Tsz Wan Shan	400kV	700A	<0.01	0.059
Tuen Mun	132kV	500A	<0.01	0.047
Tuen Mun	33kV	500A	<0.01	0.052
Tuen Mun	11kV	920A	<0.01	0.068

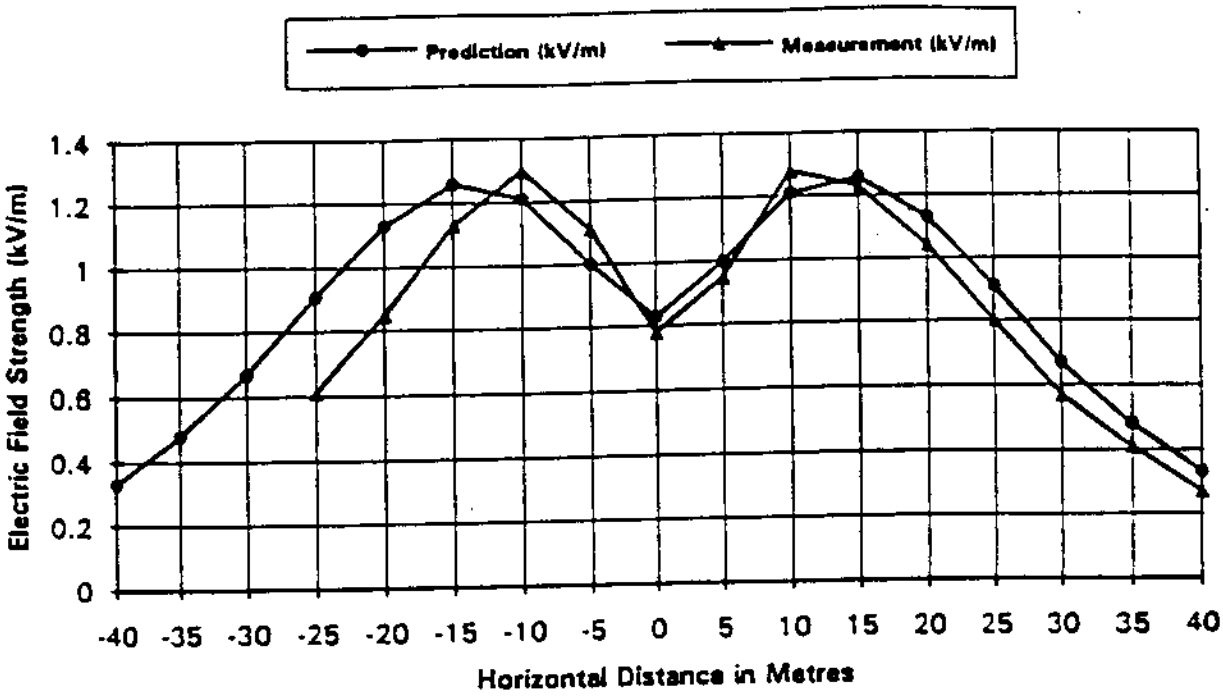


Fig. 1 400kV Overhead Line Electric Fields - Measurements Vs. Theoretical Predictions

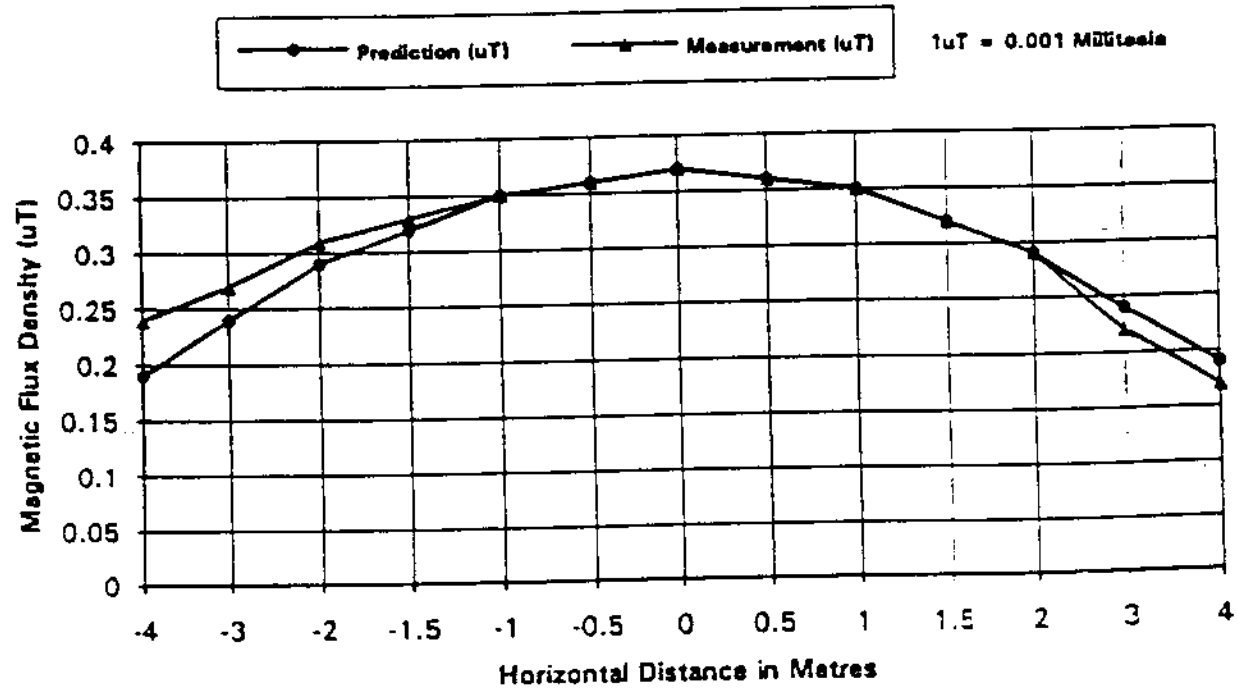


Fig. 2 33kV Cable Magnetic Fields - Measurements Vs. Theoretical Predictions

(Attachment 1, 1.1 and 3 are not available at this web site, but are available at all other locations indicated in the advertisement notice.)