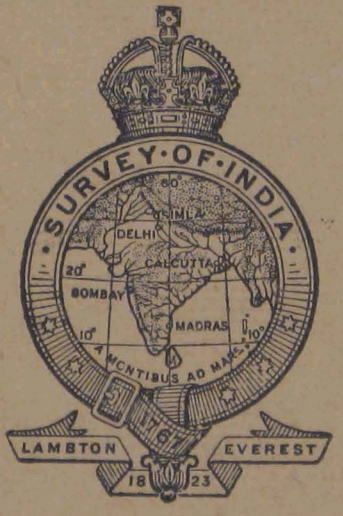
SURVEY OF INDIA

GENERAL REPORT

1935



From 1st October 1934
To 30th September 1935

PUBLISHED BY ORDER OF

BRIGADIER H. J. COUCHMAN, D.S.O., M.C.

SURVEYOR GENERAL OF INDIA.

Printed at the Photo.-Litho. Office,
Survey of India,
CALCUTTA,
1935.

Price One Rupee Eight Annas or Two Shillings and Six Pence.

Rāmgarh Hill, Surguja State, C. P.

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Original water colour by Capt. R. H. Sams, R.E.

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NOTICES

I. Work done by the Survey of India.

II. How to obtain maps and other publications.

III. List of Agents for the sale of maps.

I. WORK DONE BY THE SURVEY OF INDIA

APPLICATION FOR SURVEYS OF ANY KIND, whether for private or Government purposes, should be made to the following officers:

The Director,	Frontier Circle,	*Survey of India,	Simla.	(*Tel.* "*Surfrontier*").
,, ,,	Geodetic Branch, *	,,	,, Dehra Dūn.	(*Tel.* "*Surtrig*").
,, ,,	Eastern Circle, *	,,	,, Shillong.	(*Tel.* "*Sureast*".
,, O. C.	No. 6 (South India) Party, *	,,	,, Bangalore.	(*Tel.* "*Surfield* (*Six*").
,, ,,	No. 10 (Burma) Party, *	,,	,, Maymyo.	(*Tel.* "*Surfield Ten*").

FOREST AND CANTONMENT SURVEYS, LEVELLING, TRIANGULATION AND TIDE-TABLES. Advice in regard to these, and on scientific questions, is obtainable from the *Director, Geodetic Branch, Survey of India, Dehra Dūn*, who undertakes a good deal of levelling and similar work for municipalities and engineering projects, on payment. (*Telegrams* "*Surtrig*").

MAPS AND ILLUSTRATIONS can be printed by the *Director, Map Publication*, Survey of India, 13 Wood Street, Calcutta, for Government Departments only, and special maps can also sometimes be prepared, on payment.

THE MATHEMATICAL INSTRUMENT OFFICE, Survey of India, 15 Wood Street, Calcutta, is a well equipped Government Factory which supplies, manufactures and repairs all kinds of Surveying Drawing, Optical, Meteorological and Medical instruments. It also manufactures special instruments for experimental purposes and receives back surplus instruments on valuation, from all Government Departments, whether Imperial or Provincial.

The Price List, Rules and Regulations and Forms for Indents, Repairs and Deposits are supplied gratis on application. (*Telegrams* "*Surinst*").

GENERAL ENQUIRIES should be addressed to the Assistant Surveyor General, 13 Wood Street, Calcutta. (*Telegrams* "*Surveys*"), as the Surveyor General of India is on tour during most of the year.

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* *Provinces and States in each Survey Circle.*

1. FRONTIER Circle
Kashmir and Jammu
N. W. F. Province
Baluchistān
Punjab
Punjab States
Bikaner State
Sind

2. GEODETIC Branch
United Provinces
Central India
Gwalior
Ajmer-Merwāra
Delhi
E. Rājputāna States
W. Rājputāna States
Baroda
Bombay (Northern Division).
States of Western India.

3. No. 6 (South India) Party.
Madras
Madras States
Hyderābād
Mysore and Coorg
Bombay (Southern Division).

4. EASTERN Circle
Central Provinces (including Berār).
Bihār and Orissa
Bengal
Assam and Sikkim.
Eastern States.

5. No. 10 (Burma) Party.
Burma.

II. HOW TO OBTAIN MAPS AND OTHER PUBLICATIONS

SURVEY OF INDIA MAPS are obtainable from the Map Office, 13 Wood Street, Calcutta (*Tel.* "*Surmaps*"). Also to some extent from the Agents detailed below and from the Directors of Survey Circles. A MAP CATALOGUE, which itself forms a useful atlas of India and surrounding countries, can be obtained for *Re. 1/-* (*post free*).

FOREST AND CANTONMENT MAPS are obtainable from the Map Office, Survey of India, Dehra Dūn. (*Tel.* "*Surtrig*").

GEOLOGICAL MAPS are prepared by and can be obtained from the Director, Geological Survey, Calcutta.

SURVEY PUBLICATIONS OTHER THAN MAPS, as outlined below, are obtainable through the Director, Geodetic Branch, Survey of India, Dehra Dūn, who will supply a full *Catalogue gratis* on application. The Catalogue is also included in the Annual Geodetic Report.

(*a*) *Trigonometrical data.* Triangulation pamphlets, each covering one square degree, giving descriptions, positions, and heights of triangulated points and other data, with chart. Levelling pamphlets, each covering $4° \times 4°$, giving descriptions and heights of Bench marks, with chart.

(*b*) *Tidal Predictions*, published annually in advance as *Tide-Tables of the Indian Ocean.* These tables contain predictions for 41 Indian and Burmese ports, and for 28 other ports in various parts of the world.

(*c*) *Geodetic works of Reference*—The G.T.S. series of twenty-one large quarto volumes describing in detail the geodetic operations of the Great Trigonometrical Survey from 1800. Detailed accounts are given of the Base-line measurements, of the reduction of the Geodetic Triangulation treated in five portions, of the early Pendulum observations, of Telegraphic Longitude and Astronomical Latitude operations, of Tidal observations, and of Levelling of high precision.

(*d*) *Historical, and General Reports*, including the "Memoirs on Indian Surveys" by Sir Clements Markham and C.E.D. Black: also Annual Reports, Narrative Reports, Record Volumes, and the annual Geodetic Reports.

(*e*) *Miscellaneous.* Papers on Geodesy, Exploration, etc. including a "Sketch of the Geography and Geology of the Himālaya Mountains and Tibet" (in 4 parts) revised in 1933.

III. LIST OF AGENTS FOR THE SALE OF MAPS

OUT OF INDIA.

England.	1.	Secy. to the High Commissioner for India. (Genl. Deptt.), India House, Aldwych, London, W. C. 2.
	2.	Sifton Praed & Co. Ltd., The Map House, 67 St. James's Street, London, S. W. 1.
America.	3.	C. S. Hammond & Co., 30 Church St., Hudson Terminal, New York, and 75 State St., Boston, Mass.
Germany.	4.	Dietrich Reimer, Berlin, S. W. 48.
China.	5.	The French Book Stores, Grand Hotel de Pekin, Peiping.

INDIA.

Āgra.	1.	English Book Depot, Tāj Road.
	2.	Indian Army Book Depot, Dayāl Bāgh.
Ajmer.	3.	Rajputana Book House.
Allahābād.	4.	North India Christian Tract and Book Society.
Ambāla.	5.	Ram Chander & Sons.
	6.	English Book Depot, Ambāla Cantonment.
Bangalore.	7.	Raja Gopal Photo. Zinco. and Printing Works, Fort Bangalore.
Bareilly.	8.	London Book Depot.
Baroda.	9.	B. Parikh & Co., Māndvi Road.
Bombay.	10.	Thacker & Co.
	11.	D. B. Taraporevala Sons & Co.
	12.	King & Co., 213-215 Badri Mahal, Hornby Road.
Calcutta.	13.	W. Newman & Co., 3 Old Court House Street.
	14.	Automobile Association of Bengal, 40 Chowringhee.
	15.	City Map Agency, Govt. Book Depot, 8 Hastings St.
	16.	Oxford Book & Stationery Co., 17, Park St.
	17.	Thacker Spink & Co., 3 Esplanade East.
	18.	The Good Companions, Chowringhee.
Cawnpore.	19.	Advani Brothers.
Darjeeling.	20.	Oxford Book & Stationery Co.
Delhi.	21.	Oxford Book & Stationery Co., Kashmīr Gate.
	22.	Ramesh Book Depot and Stationery Mart.
	23.	J. M. Jaina & Brothers, Mori Gate.
	24.	Bhawani & Sons, Connaught Place, New Delhi.
	25.	Oxford Book & Stationery Co., Connaught Place, New Delhi.
Dum-Dum.	26.	Indian Air Survey & Transport Ltd.
Ferozepore.	27.	English Book Depot, Wazir Ali Buildings.
Indore.	28.	The Manager, Dak Bungalow, Indore.
	29.	The Proprietor, Central India High Class Athletic Depot.
Jhānsi.	30.	English Book Depot.
Karāchi.	31.	Aero Stores, Napier Road.
Kasauli.	32.	Ram Chander & Sons.
Kashmīr.	33.	Cockburns Agency, Srīnagar.
	34.	D. G. Smith & Co., Srīnagar.
Lahore.	35.	Punjab Religious Book Society, Anārkali.
	36.	Standard Book Depot.
	37.	Oxford Book & Stationery Co.
Lucknow.	38.	Lucknow Publishing House, The Mall.
Madras.	39.	Higginbothams Ltd.

(Continued Overleaf)

III. LIST OF AGENTS FOR THE SALE OF MAPS—(*Concld.*)

INDIA.—(*Concld.*)

Meerut.	40.	Oxford Book & Stationery Co.
Murree.	41.	J. Ray & Sons, The Mall.
Mussoorie.	42.	The Mussoorie Book Society.
Muzaffarpur.	43.	Burman & Co.
Nāgpur.	44.	Superintendent, Govt. Printing, Book Depot.
Ootacamund.	45.	Higginbothams Ltd.
Patna City.	46.	K. P. Saxena & Co., Diwan Mohalla.
Peshāwar.	47.	Faqir Chand Marwah, Peshāwar Cantonment.
	48.	J. Ray & Sons, Arbab Road.
	49.	Sham Lal & Sons.
	50.	London Book Co. (India).
Poona.	51.	The International Book Service, Deccan Gymkhana Colony.
Quetta.	52.	Standard Book Stall, Club Corner. (Temporarily closed).
Rangoon.	53.	The Curator, Government Book Depot, Burma.
Rāwalpindi.	54.	J. Ray & Sons, 43 K & L, Edwardes Road.
Simla.	55.	Oxford Book & Stationery Co.

PREFACE

THE HISTORY AND WORK OF THE SURVEY OF INDIA.

The first authoritative map of India was published by D'Anville in 1752, when the exploration of the then unknown India was still largely in French hands. It had been compiled from routes of solitary travellers and rough charts of the coast.

The Survey of India may be said to have been founded in 1767—ten years after the battle of Plassey—when Lord Clive formally appointed Major James Rennell the first Surveyor General of Bengal, at that time the most important of the East India Company's possessions, though there were earlier settlements in Madras and Bombay.

Rennell's maps were originally military reconnaissances and latterly chained surveys based on astronomically fixed points, and do not pretend to the accuracy of modern maps of India based on the rigid system of triangulation commenced at Madras in 1802 and since extended over and beyond India. Even now however the *relative* accuracy of these old maps makes them valuable in legal disputes, as for instance in proving that the holding of a Bengal landowner was a river area at the time of the Permanent Settlement of 1793, so that he is debarred from its benefits.

From these beginnings, this department has gradually become primarily responsible for all topographical surveys, explorations and the maintenance of geographical maps of the greater part of Southern Asia, and also for geodetic work.

Geodesy means the investigation of the size, shape and structure of the earth, and the geodetic work of the department consists of primary (or geodetic) triangulation, latitude, longitude and gravity determinations. From these the exact "figure" of the earth is obtained, whereby points fixed by triangulation can be accurately located on its curved surface. This system of fixed points holds together all topographical and revenue surveys, and the existence of such a system from the early days of the department has avoided the embarrassments caused in other countries where isolated topographical surveys have been started without a rigid framework, with the inevitable result that they could not be fitted together.

A geodetic framework is therefore essential in any large survey, but there are a number of other activities, all of these ultimately utilitarian, which can be suitably combined with it and the following are some of those which have been carried out in India:

Precise levelling for the determination of heights;

Tidal predictions and publication of Tide Tables for forty-one ports between Suez and Singapore;

The Magnetic survey;

Observation of the direction and force of gravity;

Astronomical observations to determine latitude, longitude and time;

Seismographic and meteorological observations at Dehra Dūn.

CONTENTS.

ILLUSTRATIONS.

GLOSSARY.

Scales are referred to as follows:—

(*i*) by their representative fraction, *e.g.* "1/25,000",

(*ii*) *for scales which are multiples of 1/1,000,000*—"1/M scale", "1/6M scale" &c., which mean "1/1,000,000 scale", "1/6,000,000 scale" &c.,

(*iii*) *for scales smaller than 4 miles to one inch*—"50-mile scale", "8-mile scale" &c., which mean "scale of 50 miles to one inch" "scale of 8 miles to one inch" &c.,

(*iv*) *for scales of and larger than 4 miles to one inch*—"¼-inch scale", "½-inch scale", "4-inch scale", "16-inch scale" &c., which mean "scale of ¼ inch to one mile" &c., &c.

Serial numbering of Survey of India maps.

Sheets 65, 78 &c. are sheets on the 1/M scale;

Sheets 65 K, 78 F &c. are ¼-inch sheets;

Sheets 65 K/N.W., 78 F/S.E., &c. are ½-inch sheets;

Sheets 65 K/1, 78 F/16 &c. are 1-inch sheets.

The system of numbering is fully explained in the Indexes at the end of this report.

Abbreviations.—U. S. S. denotes Upper Subordinate Service.

L. S. S. denotes Lower Subordinate Service.

U. S. Officer denotes Upper Subordinate Officer.

L. S. Officer denotes Lower Subordinate Officer.

P. L. O. denotes Photo.-Litho. Office (Calcutta).

P. Z. Section denotes Photo.-Zinco Section (Dehra Dūn).

D. O. denotes Drawing Office.

F. O. U. O. denotes "For Official Use Only".

SURVEY OF INDIA

GENERAL REPORT

1935

From 1st October 1934

To 30th September 1935

INTRODUCTION AND SUMMARY.

1. Annual Reports are now published in two separate volumes namely:—

The *Geodetic Report.*
The *General Report.*

These reports cover the survey year, which ends on 30th September, except that *Part 4* (Map Publication and Office Work) of the latter is for the financial year, which ends on 31st March.

The *Geodetic Report* contains full details of all scientific work.

The *General Report* includes an abstract of the *Geodetic Report* (in *Part 2*), and full details of the survey operations of the ordinary field units (*Part 3*) as well as drawing, map publication and instrument manufacture (*Part 4*). Abstracts II and IV (*vide* Table of Contents) summarize the detailed reports of *Part 3* and enable the reader to select those which are of special interest to him.

The progress of "*modern*" (*i.e.* since 1905) topographical surveys made by this Department, and compilations made from our own or other material, is illustrated in *Index A* at the end of this report, while *Index B* indicates the obsolescence of modern surveys. The remaining indexes show all the standard maps which have been published up to date on the various scales. It will be seen from *Index C* that the areas within the Indian Empire which are blank on *Index A* are actually almost entirely covered by topographical maps. These maps are however from old material based on the old longitude of 1815, which was over 2 miles out, and are drawn in the old style; they are consequently excluded from *Index A*.

2. General.—Brigadier H. J. Couchman, D.S.O., M.C., held the post of Surveyor General throughout the year. Colonel S. W. S. Hamilton, D.S.O., officiated from 7th June, while Brigadier Couchman was on leave.

The post of Assistant Surveyor General was filled by Major H. R. C. Meade, I.A., up to the date of his death on 3rd December 1934 and thereafter by Lt.-Colonel E. O. Wheeler, M.C., R.E., except for a short period immediately after Major Meade's death during which it was filled by Lt.-Colonel F. J. M. King, R.E.

3. The total cost of the Department for the year ending 31st March 1935, as compared with that of previous years, was as follows:—

	1932-33	1933-34	1934-35	REMARKS.
	Rs.	*Rs.*	*Rs.*	
Gross actual cost ...	36,10,206(*a*)	34,25,357(*b*)	33,50,661†	(*a*) Including Rs. 1,21,330 for English Charges (High Commissioner) on Stores, and loss or gain by exchange. (*b*) Including Rs. 1,08,290 for do. do.
Deduct recoveries ...	14,08,175	12,55,341	10,45,885†	
Nett actual charges ...	22,02,031	21,70,016	22,54,776†	†These figures are not final.
Total area of survey of all kinds completed during the year.	Square miles.	Square miles.	Square miles.	
	43,683*	42,216*	51,678*	* *Vide* page 16.

4. Organisation. No. 23 (Irrigation Surveys) Party was disbanded from 1st April 1935 when its work was placed in abeyance.

The Photo. Zinco Section which was shown in the General Report for 1931-32 as transferred to the Computing and Tidal Party, is now directly under the orders of the Director, Geodetic Branch.

An Assistant Head Engraver was recruited from England and assumed charge of his duties from 20th October.

A revised scale of pay has been sanctioned, with effect from the 1st October 1934, for the existing members of the Upper Supervising Staff of the Workshop Establishment of the Mathematical Instrument Office.

5. Notable events of the Survey year.

Some interesting relics of Colonel Sir George Everest, C.B., F.R.S., have very kindly been donated by his family, and have been lodged in the offices of the Survey of India at Dehra Dūn, where Sir George spent the last ten years of his service.

Quetta Earthquake.—

A severe earthquake occurred at Quetta at about 3 A.M. on the 31st May, resulting in the death of 4 lower subordinates of 'E' Company.

Considering the severity of the earthquake and the heavy losses sustained by the civil population in the city, the personnel of 'E' Company were fortunate in escaping with so few casualties.

The office building was severely shaken and the walls cracked in many places. Plant and machinery were not seriously damaged, and were able to be used to print many urgent maps required by the various local authorities.

Levelling near Hardinge Bridge for the Eastern Bengal Railway.—

At the request of the Eastern Bengal Railway a detachment of No. 15 Party carried out some 3,700 linear miles of levelling in the vicinity of the Hardinge Bridge. 256 bench marks, 1,508 *pakka* points, and 15,569 spot heights were fixed (para. 115).

The results for the area west of the railway line from Calcutta to Darjeeling were supplied to the Railway at the end of February and for the area to the east of that line, about the middle of June.

Traverse by Hunter Short Base in the Great Indian Desert.—

Framework for detail surveys of 8,450 square miles in sheets 40 I and M, consisting largely of a desert of wind-blown sand, was provided by means of traverse, utilizing the Hunter Short Base for the measurement of distances.

Four main East-West lines, each about 120 miles long, approximately parallel and about 15 miles apart, were run between G. T. meridional triangulation series on either flank (para. 71).

Boundary Survey.—

At the request of the Agent to the Governor-General, Eastern States, a part of the boundary between the Srīnagar and Rāmpur Tappas of Surguja State was demarcated, on payment. This boundary had been in dispute since 1869. (para. 93).

Exploration.—

An account by Captain F. Kingdon Ward of his exploration in south-east Tibet has appeared in the Journal of the Royal Geographical Society for November, 1934.

Surveyor Muhammad Akram was deputed during April to accompany the Visser Himālayan Expedition, 1935, to the Karakoram. Khan Sahib Afraz Gul Khan, a retired Class II Officer, also joined the expedition to assist in its survey work.

Surveyor Muhammad Ayub Khan was again deputed for a period of about 2 years from 1st July to accompany Sir Aurel Stein in his Persian expedition.

The results of the reconnaissance surveys carried out in 1933-34 by Surveyor Muhammad Ayub Khan, who accompanied Sir Aurel Stein in connection with his explorations in south-west Persia, have been incorporated in 1/M Sheet No. 17 (SHĪRĀZ).

Exercises and Manoeuvres.—

Major T. M. M. Penney, R.E., Officer Commanding, 'E' Company took part in the Western Command Exercise, 1934, in the capacity of Deputy Director of Surveys.

An air survey exercise was carried out near Nowshera by No. 18 Party during February, which was attended by certain R. A. officers of the Northern Command, by the Commandant School of Artillery in India and by Lt.-Colonel O. Slater, M.C., R.E., Officer Commanding, 'A' Company.

Extracts from the report on this exercise, by Captain D. R. Crone, R.E., Officer in Charge, No. 18 Party, will be published in due course.

Air Survey.—

At the request of the Calcutta Corporation the survey of 14 square miles was undertaken in connection with the Kulti Outfall scheme (para. 80).

At the request of the Commissioner and the Municipal Board, Nāgpur, the survey of about 30 square miles in and about Nāgpur City and Civil Station has been undertaken using a combination of air and ground survey methods (para. 93).

Deputation of Officers.—

During the year, 1st Class Surveyor Muhammad Khan and Muhammad Ayub Khan were deputed respectively to accompany the Visser Expedition, 1935, to the Karakoram and Sir Aurel Stein's Persian Expedition, 1935.

Lectures.—

The students of the Senior Division of the Staff College attended a lecture and demonstration in the office of 'E' Company at Quetta on the 29th October.

Adventures and Casualties.—

The Surveyor General deeply regrets to record the following deaths:—

Mr. L. F. Everest, M.A., L.L.D., (Cantab.), Barrister-at-Law, the eldest son and last lineal descendant of the late Colonel Sir George Everest, C.B., F.R.S., who died in London on the 1st April in his 82nd year.

Major H. R. C. Meade, I.A., Assistant Surveyor General, who was killed in an aeroplane accident at Birati, near Dum Dum, on 3rd December.

Mr. N. N. Banarji, M.A., B.L., Registrar, who died in Calcutta on the 8th June after a brief illness.

Mr. O. C. Ollenbach, late Deputy Superintendent (Class I), who died at Mussoorie on the 6th July.

Mr. H. P. D. Morton, late Superintendent, who died at Southampton on the 7th November.

Mr. R. P. Ray, B.A., late Extra Assistant Superintendent, who died at Dehra Dūn on the 12th July.

Captain J. O'C. Fitzpatrick, late Extra Assistant Superintendent, who died at Gloucester on the 2nd November.

Rai Sahib Narendra Nath Mukherji, late Head Assistant, Surveyor General's Office, who died at Calcutta on the 22nd February.

Mr. Abdul Majid, late Sub-Assistant Superintendent, who died at Dehra Dūn on the 27th October.

Mr. Abdul Ghafur, late Sub-Assistant Superintendent, who died at Bangalore on the 12th August.

Mr. Kadir Baksh, late Head Assistant, Geodetic Branch Office, who died at Dehra Dūn on the 18th November.

18 Lower Subordinates and 11 inferior servants died during the year under report.

Distinguished visitors.—

His Excellency Sir Harry Haig, K.C.S.I., C.I.E., I.C.S., Governor of the United Provinces, visited the Geodetic Branch Office at Dehra Dūn on the 11th April.

The Hon'ble Sir Kunwar Jagdish Prasad, Kt., C.S.I., C.I.E., O.B.E., Hon'ble Member, Education Health and Lands visited the Survey of India Offices in Calcutta on the 13th February.

The 5th term Gentlemen Cadets of the Indian Military Academy visited the Geodetic Branch Offices on the 31st May.

6. Appreciations and Awards.

Their Majesties' Silver Jubilee medals were awarded to 59 officers and subordinates of the Department.

His Excellency the Viceroy and Governor-General has been pleased to confer the title of Rai Sahib, as a personal distinction, upon Mr. Raj Bahadur Mathur, B.A., Extra Assistant Superintendent, Survey of India.

The following is an extract from the Report by the G. O. C. in C. Western Command on training carried out in the Western Command during the individual training period 1934:—

'E' Survey Company.

"'E' Survey Company co-operated during the year both with Staffs and R. A. and did valuable work. I much appreciate the way in which this unit assists training in every way possible, and the response they give invariably to all requests for their assistance."

The Superintendent, Government Fruit Research Station, Chaubattia, Rānikhet, has written to the Director, Geodetic Branch expressing his appreciation of the satisfactory manner in which the survey of the Government Gardens was done by No. 20 Detachment.

Mathematical Instrument Office.—

Among other special manufactures were the following:—

An improved and more robust type of clinometer has been evolved by the Mathematical Instrument Office and is under test. Fixed instead of folding vanes are utilized, and improvements have been made in the levelling arrangements.

One Pilot gauge was made up and supplied to the Principal, Bengal Engineering College, Sibpur.

One new Hunter Short Base apparatus complete was made and supplied to the Director Geodetic Branch.

Five 36-inch duralumin tree calipers, with cases, were made and supplied to various Forest Officers.

In an Essay Review of the work of the Calcutta School of Tropical Medicine the following paragraph appears:—

"In this connection one must pay special tribute to the work of the Mathematical Instrument Office of the Survey of India. This Department ever since the School started has been of invaluable assistance in repairing instruments, devising new apparatus, and tackling laboratory problems. The Superintendent may almost be included as an honorary member of the staff of the School".

7. Personnel.—Casualties, retirements, promotions and other changes were as follows:—

Class I Officers.—Messrs. V. W. Morton, E. A. Meyer and P. Simpson, granted leave preparatory to retirement.

Dr. J. de Graaff Hunter, C.I.E., M.A., Sc.D., F.R.S., F.Inst.P. and Lt.-Colonel A. H. Gwyn, I.A., retired.

Majors L. H. Jackson, I.A., and E. A. Glennie, D.S.O., R.E., promoted to be Lt.-Colonels.

Captains G. F. Heaney, R.E., and G. H. Osmaston, M.C., R.E., promoted to be Majors.

Lieutenant R. H. Sams, B.Sc., R.E., promoted to be Captain.

Major H. R. C. Meade, I.A., killed in an aeroplane accident.

General Central Services Class I.—Mr. S. Woodhouse, Superintendent, Mathematical Instrument Office, granted leave preparatory to retirement.

Class II Officers.—Rai Sahib A. K. Mitra, retired.

Miscellaneous appointments,—General Central Services Class II.—

Mr. R. C. Malcolm, appointed to officiate as Superintendent, Mathematical Instrument Office.

Mr. J. B. Chorlton, invalided.

Mr. F. E. Selfe, appointed Assistant Head Engraver.

Mr. N. N. Banarji, M.A., B.L., Registrar, died.

Mr. G. M. Dhara, appointed to officiate as Registrar.

Upper Subordinate Officers.—Messrs. L. D. Joshi, Jagannath, Muhammad Siddik and L. M. Ganguli retired.

II. ABSTRACT OF SURVEYS IN EACH PROVINCE AND STATE.

8. The prime duties of the Survey of India are geodetic, topographical and geographical, but the department is also developing co-operation with local survey agencies, with a view to mutual economy, and is now doing a considerable amount of miscellaneous outside work on payment, besides advising and assisting Provincial Governments with local and settlement surveys as required.

The following abstract shows the nature and *locale* of the field operations actually carried out by the department during the past year, grouped under the following sub-heads:

Air Surveys.	Geodetic.
Boundary Surveys.	Levelling.
Cadastral Surveys.	Miscellaneous.
Cantonment and City Surveys.	Railway Surveys.
Correction Surveys.	Riverain Surveys.
Exploration.	Special Surveys.
Forest Surveys.	Topographical Surveys.
Framework.	Training.

If a province or state is not mentioned, no work has been done there during the year under report.

9. Ajmer-Merwāra.

Framework. Traversing and levelling for Cantonment surveys of Nasirābād (p. 41).

Geodetic. Latitude at 4 stations (p. 12).
Longitude at 4 stations (p. 12).

10. Assam.

Geodetic. Primary triangulation on the south side of the Assam valley from Gauhāti to the Nāga Hills (p. 13).

Topographical surveys in Lushai Hills district (p. 47), and in Manipur State (p. 47).

11. Baluchistān.

Framework. Triangulation in Sibi district and Kalāt State (p. 35). Traversing in Zhob district (p. 35).

Geodetic. Latitude at 32 stations (p. 12).
Longitude at 32 stations (p. 12).

Topographical surveys in Sibi and Zhob districts and Kalāt State (p. 35).

12. Baroda.

Framework. Original and revision triangulation in the district of Kadi (p. 39).

Geodetic. Gravity at 2 stations (p. 12).

13. Bengal.

Air survey Kulti Outfall area, Calcutta (p. 42).

Cantonment surveys. Re survey of Barrackpore Cantonment and Ishapore Ordnance Factory Lands (p. 40).

Framework. Triangulation and traverse in Chittagong district and Chittagong Hill Tracts (p. 47).

Levelling. Precise levelling from Dināj pur to Purnea. Revision of precise levelling from Chittagong to Akyab (p. 14). Secondary and tertiary levelling in Pābna and adjoining districts in connection with the protection of the Hardinge Bridge (p. 53).

Topographical surveys in Chittagong Hill Tracts (p. 47) and in Chittagong district (p. 52).

14. Berar.

Levelling. High precision levelling from Akola to Thānegaon, of the new geodetic level net (p. 13).

15. Bihar and Orissa.

Correction surveys in Puri district (p. 50).

Framework. Triangulation and traverse in Angul, Bhāgalpur, Darbhanga, Monghyr, Muzaffarpur, Patna, Purnea, Sambalpur, and Santāl Parganas districts (pp. 44, 46).

Geodetic. Latitude at 25 stations (p. 12).
Longitude at 16 stations (p. 12).
Gravimetric observations (Gravity gradient) at 61 stations (p. 12).
Magnetic observations at 29 stations (p. 13).

Levelling. Precise levelling from Bagaha to Ghāzīpur, (being a portion of the line Bagaha to Sironj) and from Dināj pur to Purnea, in connection with disturbances caused by the earthquake of 15th January 1934 (p. 14).

Topographical surveys in Darbhanga, Gaya, Monghyr, Muzaffarpur, Patna, Sambalpur and Sāran districts (pp. 43, 45).

16. Bombay.

Geodetic. Gravity at 3 stations (p. 12).

Levelling High precision levelling from Bombay to Surat, part of the new geodetic level net (p. 13).

17. Burma.

Framework. Triangulation and traverse in Akyab district and the Arakan Hill Tracts (p. 47).
Triangulation and traverse in Kyaukse, Mandalay, Meiktila, Sagaing and Yamethin districts and the Northern and Southern Shan States. Supplementary triangulation in Akyab district (p. 52).

Levelling. Revision of precise levelling from Chittagong to Akyab (p. 14).

Topographical surveys in Akyab, Minbu and Pakokku districts and the Arakan Hill Tracts (p. 52) and in Chin Hills district (pp. 47, 52).

18. Central India.

Framework. Revision triangulation in the Mālwa Agency and in Indore and Jaora States (p. 39).

Geodetic. Latitude at 11 stations (p. 12).

Topographical surveys in Indore, Khilchipur, and Rājgarh States (p. 38).

19. Central Provinces.

Air survey. Traverse and postpointing in Nāgpur (p. 46).

Framework. Traversing and levelling for Cantonment survey of Jubbulpore (p. 40); triangulation and traverse in Bilāspur and Raipur districts (p. 46).

Geodetic. Latitude at 14 stations (p. 12).
Levelling. High precision levelling from Akola to Thānegaon, portion of the line Dhūlia to Nāgpur, of the new geodetic level net (p. 13).
Topographical surveys in Bilāspur and Raipur districts (p. 46).

20. Eastern States.

Correction surveys in Nayāgarh State (p. 50).
Framework. Triangulation and traverse in Baudh, Gāngpur, Kālāhandi, Patna, Raigarh, Rairākhol, Sakti, Sārangarh and Sonepur States (p. 46).
Triangulation in Bastar and Kālāhandi States (p. 50).
Miscellaneous. Demarcation of the boundary between Srīnagar and Rāmpur tappas of Surguja State (p. 47).
Topographical surveys in Raigarh, Sakti and Sārangarh States (p. 46).

21. Gwalior.

Framework. Revision triangulation in Gwalior State (p. 39).
Geodetic. Latitude at 5 stations (p. 12).
Longitude at 5 stations (p. 12).
Topographical surveys in Gwalior State (p. 38).

22. Hyderābād.

Geodetic. Latitude at 8 stations (p. 12).

23. Madras.

Framework. Triangulation in Vizagapatam district (p. 50) and in Ganjām district (pp. 46, 50).
Topographical surveys in Ganjām and Vizagapatam districts (p. 50).

24. N. W. F. Province.

Air surveys in Tirāh and Mohmand Tribal territory, North Wazīristān Agency, Khyber Agency and in Peshāwar and Kohāt districts (p. 36).

25. Punjab.

Correction surveys in Amritsar, Hoshiārpur, Jullundur and Ludhiāna districts (p. 32).
Framework. Triangulation and traversing in Dera Ghāzi Khān district (p. 32).
Settlement traverse in Kāngra district (p. 33).
Topographical surveys in Amritsar, Ferozepore, Jullundur, Kāngra, Montgomery, Multān and Muzaffargarh districts (p. 31).

26. Punjab States.

Correction surveys in Kapūrthala State (p. 32).
Framework. Triangulation and traversing in Bahāwalpur State (p. 32).
Topographical surveys in Bahāwalpur, Chamba, Faridkot, Kalsia and Mandi States (p. 31).

27. Rājputāna.

Framework. Triangulation in Bikaner State (p. 32).
Original and revision triangulation in Bikaner, Dūngarpur, Jaisalmer, Jhālawār, Jodhpur, Udaipur, Pālanpur, Partābgarh and Tonk States. (p. 39).
Geodetic. Latitude at 22 stations (p. 12).
Longitude at 21 stations (p. 12).
Gravity at 12 stations (p. 12).

Topographical surveys in Bīkaner State (p. 31), and in Jhālawār, Jodhpur, Kotah, Udaipur, Pālanpur, Sirohi and Tonk States (p. 38).

28. Sind.

Framework. Triangulation in Upper Sind Frontier district (p. 35).
Original and revision triangulation in Thar Pārkar district (p. 39).
Traverse by Hunter Short Base in Sukkur district (p. 39).

Geodetic. Latitude at 7 stations (p. 12).
Longitude at 7 stations (p. 12).
Gravity at 1 station (p. 12).

Topographical surveys in Upper Sind Frontier district (p. 35).

29. States of Western India.

Framework. Original and revision triangulation in the Sabar Kāntha (formerly Banās Kāntha) Agency (p. 39).

Geodetic. Gravity at 15 stations (p. 12).

Levelling. High precision levelling from Lakhpat (Cutch) to Buhāra part of the new geodetic level net (p. 13).

30. United Provinces.

Cantonment surveys. Re-survey of Bareilly, Dehra Dūn and Naini Tāl Cantonments and Sahāranpur Remount Depôt (p. 40).

Framework. Traversing for survey of Chaubattia Government Orchard (p. 40).

Geodetic. Latitude at 24 stations (p. 12).
Longitude at 22 stations (p. 12).

Levelling. Precise levelling from Bagaha to Ghāzīpur, (being a portion of line Bagaha to Sironj) in connection with disturbances caused by the earthquake of 15th January 1934 (p. 14).

Special surveys. Original survey of the Chaubattia Government Orchard on the 32-inch scale (p. 40).

Topographical surveys in Ballia district (p. 43).

PART 2.—GEODETIC WORK.

III.—ABSTRACT OF GEODETIC OPERATIONS.

DIRECTOR:—{Lt.-Colonel C. M. Thompson, I.A., to 20-10-34.
{Colonel C. G. Lewis, O.B.E., from 21-10-34.

31. General.—Besides geodetic work, the Director, Geodetic Branch, administers at Dehra Dūn *No. 2 Drawing Office*, the *Forest Map Office*, a *Printing Section* and a *Photo.-Zinco. Section*, whose work is reported in Part 4 of this report, and also the following survey operations, which are reported in other parts of the General Report:—

Levelling carried out in aid of special engineering projects, (para. 115).

Topographical Survey carried out by No. 1 Party (paras. 69-72).

Cantonment Surveys (paras. 73-77).

The *Training School* was closed during the year under report.

32. Geodetic.—Purely geodetic operations include miscellaneous computations and research, preparation and publication of records, observatory work (astronomical, magnetic, seismological and meteorological), the measurement of geodetic bases, principal triangulation, geodetic levelling, precise latitudes, longitudes, azimuths, gravity determinations in all parts of India, and prediction of tides at 41 eastern ports between Suez and Singapore.

These operations are fully described in the annual Geodetic Report of the Survey of India. The following is a brief abstract of the geodetic operations described in the Geodetic Report of 1935, which contains complete index maps and detailed results.

33. Observatory Section.—Bi-weekly time observations werie continued with the shutter and motor transits and a record of the longitude of Dehra Dūn maintained by the reception of wireless time signals from Bordeaux and Rugby.

Shortt Clock No. 34 was in use throughout.

The usual magnetic, seismographic and meteorological observations were undertaken and various instruments adjusted, cleaned and repaired.

34. Computing Section.—The Computing Section has been largely employed on computations connected with field observations for latitude and longitude (see para. 36 below). The adjustment of minor triangulation in 1/M 29 and 30 has been completed and that of Persian sheets is in hand.

Hypsometric heights from observations by Mr. G. Sheriff in the Himālayan regions of Assam and Bhutān have been computed.

The computations of Poona base extension and Padag base extension triangulations were completed.

Geodetic Report 1934 and Handbook of Topography Chapters II and VII, have been edited and printed at Dehra Dūn.

Two Indian triangulation pamphlets and addenda to 3 others have been compiled and printed. One secondary levelling pamphlet has been reproduced by gestetner.

35. Tidal Section.—The tide-tables of the Indian Ocean for 1935 for 69 ports were prepared and published in October 1934, and advance predictions for 14 ports for 1936 were despatched in October 1934 to the hydrographic departments of the U. K., United States and Japan for inclusion in their tide-tables.

Automatic registrations were continued at Aden, Karāchi, Bombay, Colombo, Trincomalee (up to 15th January 1934), Dublat (up to 31st March 1934), Kidderpore and Rangoon. In addition, observations of high and low water on tide-poles during daylight only were continued at Bhāvnagar, Chāndbāli (up to 31st March 1935), Chittagong and Akyab. The tidal observatories at Rangoon (May 1934) and Bombay (May & July 1934) were inspected by the port authorities.

36. Latitude and Longitude.—(No. 14 Party).—Observations for latitude and longitude were made along 3 different series, running east and west and connecting the work done in previous years and extending from the Burma-Siam to the Perso-Baluchistān frontier. The first series consisting of 39 stations, at 2 of which Geodetic values only were determined, was observed by Capt. Bomford, R.E. and extended from the Perso-Baluchistān frontier to Reti in Sind.

The second series of 57 stations, observed by Rai Sahib R. B. Mathur, B.A., was continued from near Rānchi in Bihār and Orissa to Ajmer where it joined the meridional series along longitude 75° observed in 1930-31; the third series of 11 stations, also by Rai Sahib Mathur, was observed along latitude 28° starting east of Ratangarh from a station of the 75° meridional series and extending westwards to join up near Uperthal H. S. in Jaisalmer State with the work done by Lt.-Col. E. A. Glennie, D.S.O., R.E. in 1930-31. The personal equations of the observers were determined by comparative observations at Dehra Dūn before and after the field work and in the second and third series, by an additional check at the Fyzābād Longitude station. These observations extend the section of the geoid westwards from Rānchi to the extreme west of India.

Observations for latitude were made at 34 stations in a north-south alignment along the great meridional arc from near Hyderābād (Deccan) to Dholpur State, thus connecting the geoidal section of last year and that of 1930-31. The system of work and the instruments used were the same as in the previous year.

The observers were Mr. B. L. Gulatee, M.A. and Computer J. B. Mathur for 26 and 8 stations respectively.

Latitude was also determined at 11 stations by Computer J. B. Mathur along the western flank of the Hurilaong meridional series, which lies near the disturbed area of the Bihār earthquake.

37. Gravity Observations.—(No. 14 Party).—Observations to determine the force of gravity were made at 8 stations in Rājputāna and Ajmer-Merwāra, 3 in Bikaner State, 3 in Bombay Presidency, 1 in Sind, 2 in Baroda State, 3 in Cutch State, 2 in Gujrāt States Agency and 10 in States of Western India. The observer was Mr. M. N. A. Hashmie, B.A.

Observations with an Oertling Gradiometer to determine the gravity gradient were made at 61 stations. The work consisted of a single traverse line running south from the Nepāl boundary about 4 miles east of Raxaul past Motihāri to Chāpra on the Ganges, thus passing through

A primary Triangulation Station in the Nāgā Hills, Assam.

A typical village in the Nāgā Hills, Assam.

"Jhum" cultivation in Assam.

a part of the Bihār earthquake area close to the epicentral tract. The observer was Mr. M. N. A. Hashmie, B.A.

The observations were undertaken to ascertain whether geophysical methods would give any positive indication of any fault or other geological structure in the bed rock underlying the alluvium in the epicentral region.

38. Magnetic Observations.—(No. 14 Party).—Observations for magnetic declination, dip and horizontal force were made by Mr. Shyam Narain, B.Sc. at 29 stations on a line running due south from near Raxaul past Motihāri to Kesariya. This was an attempt to obtain, by a geophysical method, positive information of any geological structure underlying the alluvium associated with the earthquake.

39. Triangulation.—(No. 15 Party).—During the season 1934-35 primary triangulation on the south side of the Assam Valley was carried out to replace the major portion of the Assam Valley Triangulation of 1867-78 (Series No. 55), the old work being of insufficient accuracy for extension.

The new series started from stations of the Assam Longitudinal series west of Gauhāti and extended eastwards through the Mikir Hills to the Nāga Hills series about Golāghāt, utilizing most of the old stations of the original Assam Valley series. Thence a new series was observed running north-east through administered Nāga territory as far as the Nāmtiāli base (measured in 1933-34).

In all, observations were made at 30 stations using a Wild precision theodolite throughout, the average triangular closing error being 0″·48.

The observations at the starting stations west of Gauhāti disclosed considerable differences when compared with angular values of the original work, indicating either a shift of one or more station marks or more probably a general movement due to seismic action. Further observations will be extended westwards next season in order to effect a satisfactory junction with the old series and to determine if possible the cause of the disturbance of the stations.

40. Levelling.—(No. 15 Party).—*High Precision.*—Out of the total length of 15,800* miles of levelling of high precision required for the new geodetic level net of India, 272 miles were completed during 1934-35, making a total of 9,055* miles completed up to date.

During 1934-35, 428 miles of single levelling on the high precision system were carried out as follows:—

In fore direction only.			
In the Central Provinces.—Akola-Thānegaon		...	118 miles.
In back direction only.			
In the Bombay Presidency etc.—			
Bombay-Surat	170 miles	...	234 ,,
Buhāra-Unhia Tar, Lakhpat-Nakhtarāna Mota.	64 ,,		
In both directions.			
In the Bombay Presidency etc.—			
Lakhpat-Unhia Tar	38 ,,	...	76 ,,
	Total	...	428 miles.

*Line 101A Sukkur to Hyderābād has been treated as secondary having been excluded *vide* Geodetic Report Vol. VII page 100.

Precise Levelling.—The line of precise levelling Chittagong-Magwe executed in 1932-33 for the Indo-Burma connection, revealed that Mean Water Level at Akyab was 4·73 feet below Mean Water Level at Chittagong and that Amherst was 0·84 feet above Mean Water Level at Akyab. The latter discrepancy of 0·84 feet, being reasonable, was adjusted between Minbu and Akyab. An error of 3 feet or so was however suspected between Chittagong and Akyab and this portion was therefore relevelled by single levelling; as expected, an error of 2·4 feet was found about 60 miles north of Akyab.

Precise levelling from Dināj̄pur to Purnea 92 miles and from Bagaha to Ghāzīpur 163 miles (the latter to be eventually extended to Sironj) were executed to determine how the bench marks at Bagaha and Purnea had been affected by the earthquake of 15th January 1934. Neither Dināj̄pur on the alluvium of Bengal, nor Sironj on the stable plateau of Central India are likely to have been affected by the earthquake.

Reports of secondary and tertiary levelling will be found under part IX of this report (p. 53).

PART 3.—TOPOGRAPHICAL WORK.

IV.—ABSTRACT OF TOPOGRAPHICAL WORK.

41. The following tables indicate the progress achieved to date in the topographical survey programme assigned to the Department in 1905 and give details of the work done in the year under report.

Table A shows the area of survey completed on various scales since 1905, as well as the approximate balance which remains to complete the contoured topographical survey of India. The figures which were entered in the report for 1930-31 were found on re-examination to be inaccurate, and to be incapable of calculation by 5 year periods for separate scales; consolidated figures from 1905 to 1930 are therefore given.

Table B shows the area revised during the year under report.

Table C shows in detail the survey operations carried out during the year under report, together with their cost rates. While every attempt is made to calculate the cost rates accurately, it is extremely difficult to allocate "overhead charges" fairly to the various classes of work, and rates of pay etc., will vary with the locality; the cost rates shown in the table must therefore be considered to be approximate. For this reason, a column showing "out-turn" is included in the table, which those familiar with survey organization will find very useful in estimating costs in subsequent years.

The cost, shown for mapping and computations are those incurred in the party etc., offices only, except where otherwise stated; publication charges, if required, may be ascertained from the Director, Map Publication, at Calcutta.

42. Progress. In the second page of the preface to this report will be found a brief outline of the scope of the topographical surveys of the department. The hopes expressed in 1905—that modern maps on the 1-inch scale would be available for the entire Indian Empire within 25 years—are still far from realization in 1935, just over half the total area of India having been completed on that scale. In 1913, when it was realized that for various reasons it would be impossible to complete the 1-inch surveys in the time allotted, a scheme for the reduction of the scale of survey in the less populous areas was sanctioned by the Secretary of State.

In spite of the reductions in scale however, only two thirds of the country is as yet covered by modern maps. The tendency to revert to the 1-inch scale in special circumstances, such as in areas of more than ordinary military, geological or engineering importance, the necessity which frequently arises to resurvey on the 1-inch scale areas already surveyed on smaller scales, as they grow in importance, the necessity for the comparatively frequent revision of existing surveys in the more populous areas and lastly but by no means least important, the recent urgent necessity for economy; all these factors have conspired to delay still further the completion of the programme even as amended in 1913.

Original surveys since 1931, the year of retrenchment, have been carried out at the rate of about 39,000 sq. miles per annum; on this basis, some 16 years are still required to complete the programme.

The present position of the mapping of India is shown in the first two *Index Maps* at the end of this volume.

Table A.—Progress of Topographical Surveys since 1905.

Survey years.	1-inch and larger scales.	¾ and ½-inch scales.	⅜ and ¼-inch scales.	TOTALS.
	Sq. miles.	*Sq. miles.*	*Sq. miles.*	*Sq. miles.*
1905-30 ...	861,723	156,125	17,986	1,035,834
1930-34 ...	113,545	45,019	7,943	166,507
1934-35	**19,434**	**29,753**	.....	**49,187**
Totals to 1935 ...	**994,702**	**230,897**	**25,929**	**1,251,528**
Balance remaining	*approximately 300,000*	*approximately 220,000*	*approximately 110,000*	*633,159*
Total programme				**1,884,687**

Table B.—*Revision and Resurvey of above work during the year.*

1934-35 ...	**2,491**	**Nil**	**Nil**	**2,491**

TABLE C.—Areas, out-turns and cost rates of Surveys, Computation and Mapping.

Party.	Class of work.		Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
						Field work.	Mapping or computations.	Total.	
				Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**FRONTIER CIRCLE.**
'A' Company.—									
Flat cultivated plains and sandy desert.	½-inch & 1-inch.	**Triangulation**	39 L, O & P, 44 H & 45 E.	580	119	7·2	1·8	**9·0**	
	1-inch	**Traverse** ...	39 L ...	80 L. miles.	89 L. miles.	7·8	1·9	**9·7**	
Narrow valleys, terraced and cultivated spurs and high wooded mountains rising to 12,000 feet (measurement by subtense bar).	.....	**Settlement Traverse.**	52 D ...	100 L. miles.	14 L. miles.	61·0	30·0	**91·0**	
Flat cultivated plains and sandy desert (rectangulated).	**½-inch**	Original survey...	44 C & G ...	6,228	117	4·2	1·8	**6·0**	
	1-inch	Original survey...	44 C & H & 45 E	1,789	56	8·1	7·0	**15·1**	
	1-inch	Supplementary survey.	39 N ...	257	49	5·5	7·0	**12·5**	
Flat cultivated plains and sandy desert.	**1-inch**	Re-survey ...	44 C ...	344	56	8·1	7·0	**15·1**	
Medium and high hills rising to 15,000 feet with open cultivated valleys.	**1-inch**	Re-survey ...	52 D ...	90	30	9·6	7·0	**16·6**	
	1½-inch	Re-survey ...	52 D ...	168	(a)	(a)	(a)	(a)	(a) Being training area, no out-turn has been shown.
Flat cultivated plains ...	**1-inch**	Revision survey	44 J, M & N ...	767	72	8·3	7·0	**15·3**	
	1-inch	Correction survey	44 M ...	6 sheets	.....	266·0 per sheet	0·4 per sheet	**266·4 per sheet**	

TABLE C.—Areas, out-turns and cost rates of Surveys, Computation and Mapping.

Party	Class of work.		Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
						Field work.	Mapping or computations.	Total.	
				Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**FRONTIER CIRCLE.—** *Contd.*
'E' Company.—									
Dead flat plain, partly desert and partly irrigated.	.....	**Triangulation**	39 D ...	262	95	10·9	(*b*)	(*b*)	(*b*) Completed cost-rate is not possible to give in any of these sheets as some sheets were surveyed in previous years and drawn in this year and others are not yet completed and distribution of charges is made in accordance with classes of survey, it not being possible to distribute charges sheet by sheet.
Fairly flat cantonment area	.....	**Traverse** ...	39 E ...	12 L. miles.	12 L. miles.	8·3	(*b*)	(*b*)	
Dead flat plain, partly desert and partly irrigated.	**1-inch**	Accessory ground work for air survey compilation.	39 D ...	262	104	3·1	(*b*)	(*b*)	
Fairly flat cantonment area	**16-inch**	Re-survey ...	39 E ...	3	411 acres	744	(*b*)	(*b*)	
Fair Mapping ...	**¾-inch**	Original survey	35 I ...	.....	.....	.....	(*b*)	(*b*)	
	1½-inch	Original air survey compilation.	39 D ...	.....	.....	.....	.....	.....	
	16-inch	Re-survey ...	Quetta Civil station, Quetta Cantt.	.....	.....	.....	.....	.....	
	1½-inch	Correction survey	34 J, N & O ...	.....	.....	.....	.....	.....	
	2-inch	Correction survey	34 J ...	.....	.....	.....	.....	.....	
	1/50,000	Compilation ...	Sheet No. 1 Chaman.	.....	.....	.....	.....	.....	
	1-inch	Correction survey	34 J, K, N & O	.....	.....	.....	.....	.....	

TABLE C.—Areas, out-turns and cost rates of Surveys, Computation and Mapping.

Party.	Class of work.		Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
						Field work.	Mapping or computations.	Total.	
				Sq. m.	Sq. m.	Rs. (Air survey compilation).	Rs.	Rs.	**FRONTIER CIRCLE.—** *Contd.*
No. 18 (Air Survey) Party.—									
Tirāh. Steep partly wooded mountains (3,000-8,000 ft.).	**1½-inch**	Original air survey	38 K & O ...	113	.....	31·1	.....	.....	
Mohmand and Bājaur. Medium hills with open cultivated valleys.	**1½-inch**	Original air survey	38 N ...	137	.....	25·7	.....	.....	
Wazīristān. Steep wooded mountains (3,000-10,000 feet).	**1½-inch**	Original air survey	38 H ...	138	.....	40·3	.....	.....	
Tīrāh. Steep hills (3,000-6,000 feet).	**1½-inch**	Revision air survey	38 K & O ...	105	.....	22·0	.....	.....	
Mohmand and Bājaur. Medium hills with open cultivated valleys.	**1½-inch**	Revision air survey	38 N ...	192	.....	18·3	.....	.....	
Khyber. Medium rocky hills.	**1/25,000**	Revision air survey	38 N ...	86	.....	35·7	.....	.....	
Kohāt district. Low hills and open valleys.	**1½-inch**	Ground revision	38 O ...	250	.....	1·3	.....	.....	
Peshāwar district. Flat cultivated plain.	**1½-inch**	Ground revision	38 N ...	400	.....	1·0	.....	.....	
Fair mapping ...	**1½-inch**	.....	38 K, N & O	996	.....	.....	11·8	.....	The areas mapped include old ground surveys and new surveys from air photos.

TABLE C.—Areas, out-turns and cost rates of Surveys, Computation and Mapping.

Party.	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
			Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**FRONTIER CIRCLE.—** *Concld.*
No. 6 Drawing Office.—								
Map examination ...	**1-inch** Sheets ...	.....	.....	.....	.....	·22	.....	Excludes T. A. of Major G. H. Osmaston, M.C., R.E., from Simla to Shillong and back in connection with triangulation work to be carried out by No. 15 Party.
Ditto	**½-inch** Sheets ...	.....	.....	.....	.....	·07	.....	
Ditto	**16-inch** Cantonment maps	.....	.....	.....	.....	4·19	.....	
Ditto	**16-inch** Quetta Civil Station.	.....	.....	.....	.....	12·66	.....	
Ditto	**1-inch** Special map ...	.....	.....	.....	.....	·33	.....	
Colour Patterns ...	**1-inch** Sheets ...	.....	.....	.....	.....	·25		
Ditto	**¼-inch** Sheets ...	.....	.....	.....	.....	·03		
Ditto	**3-inch** Guide Map ...	.....	.....	.....	.....	6·72		
Ditto	**1/25,000** Guide Map ...	.....	.....	.....	.....	1·83		

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party.	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
No. 1 Party.—			Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**GEODETIC BRANCH.**
55% Sand hills; 40% undulating sandy areas, lightly scrub-covered; 5% kankar hills.	¼-inch **Traverse** ... (by Hunter Short Base).	40 I & M ...	494 linear miles.	103 linear miles.	28·7 per linear mile	3·6	**32·3**	No. 2 D. O. costs for examination and preparation of colour patterns of this unit:—Rs. 2,639/-cost rate per 1-inch and ½-inch sheets:—Rs. 165 & Rs. 212 respectively.
80% Sand hills; 20% isolated rocky hills and small patches of open plains.	½-inch **Triangulation**	40 K ...	1,741	614	2·3	·4	**2·7**	
30% Sand hills; 25% open arid plains and isolated rocky hills; 45% open undulating country and low sand hills.	½-inch **Triangulation** (Revision).	40 K, L & P and 45 A, B, E, F & I.	23,187	2,567	·4	.....	**·4**	
50% Lightly-wooded Arāvalli hills; 40% broken ground; 10% flat country interspersed with hills.	½-inch **Triangulation** (Revision).	45 L & P ...	4,342	1,649	·5	.....	**·5**	

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party.	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
No. 1 Party.—*Concld.*			Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**GEODETIC BRANCH.—*Contd.***
65% Open environs of Udaipur city; 20% hills; 15% suburbs and congested town.	**4-inch** Original survey ...	45 H ...	31	2·0	342·7	70·9	**413·6**	By Upper and Lower Subordinates under training.
60% Intricate lightly wooded hills rising to 4,500 feet; 40% open cultivated valleys and plains.	**1½-inch** Original survey ...	45 H ...	557	10·0	36·9	7·8	**44·7**	By personnel mostly under training.
75% Intricate, wooded Arāvalli hills; 25% open cultivated valleys and plains.	**¾-inch** Original survey ...	45 H ...	764	23·8	14·8	(*a*)	.....	By surveyors under training. (*a*) Mapping not yet taken up.
70% Open arid plains; 20% isolated rocky hills; 10% sand hills.	**½-inch** Original survey ...	45 C & D ...	4,308	87·5	5·5	2·1	**7·6**	
50% Open jungle; 50% forest-clad slopes of easy hills (some traversing necessary).	**⅓-inch** Original survey ...	54 D ...	4,334	55·8	6·8	1·7	**8·5**	

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
No. 20 (Cantonments) Detachment.—			Acres.	Acres.	Rs.	Rs.	Rs.	**GEODETIC BRANCH.—** *Contd.*
Cantonments (Plains). 60% open and 40% congested.	16-inch **Traverse** ...	45 J, 55 M...	11,946	1,210·8	1·0	0·3	**1·3**	Nasīrābād and Jubbulpore Cantonments. Excludes 9·4 L.M. traversing done for change of boundaries of Jhānsi, Delhi and Lansdowne Cantonments.
Cantonments (Hills). About 70% terraced area and 30% heavily wooded.	32-inch **Traverse** ...	53 O ...	166	108·3	1·9	0·9	**2·8**	Chaubattia Government Orchard (Fruit Research Station).
Cantonments (Plains). Congested areas.	64-inch **Traverse** ...	45 J, 55 M...	292	74·2	3·5	0·1	**3·6**	Nasīrābād and Jubbulpore Cantonment Bāzārs.
Cantonments (Hills). Steep and intricate hills, interspersed with nālās.	64-inch **Traverse** ...	53 O ...	8	40·0	16·0	1·5	**17·5**	Naini Tāl Cantonment Bāzār.
Cantonments (Plains). Average congestion.	16-inch **Levelling** ...	45 J, 55 M...	12,270	6,135·0	0·1	.....	**0·1**	Nasīrābād and Jubbulpore Cantonments.

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party.	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
No. 20 (Cantonments) Detachment.—*Concld.*			Acres.	Acres.	Rs.	Rs.	Rs.	**GEODETIC BRANCH.—*Concld.***
Cantonments (Plains). 60% open and 40% congested.	**16-inch** Re-survey ...	53 G, J, P & 79 B.	13,123	177·7	2·1	1·5	**3·6**	Sahāranpur Remount Depôt, Dehra Dūn, Bareilly and Barrackpore Cantonments and Ishapore Factory Lands.
Cantonments (Hills). Steep and intricate hills, heavily wooded and interspersed with nālās.	**16-inch** Re-survey ...	53 O ...	709	84·7	4·6	3·0	**7·6**	Naini Tāl Cantonment.
Cantonments (Hills). About 70% terraced area and 30% heavily wooded.	**32-inch** Original survey ...	53 O ...	166	21·5	27·0	4·8*	**31·8**	Chaubattia Government Orchard (Fruit Research Station). *Drawn on 128″ scale.
Cantonments (Hills). Congested hilly area, interspersed with deep nālās having numerous falls.	**64-inch** Original survey ...	53 O ...	8	3·7	37·3	10·5	**47·8**	Naini Tāl Cantonment Bāzār.
Cantonments (Plains). 60% open and 40% congested.	**64-inch** Re-survey ...	53 J, P & 79 B	129	9·8	19·1	12·9	**32·0**	Dehra Dūn, Bareilly and Barrackpore Cantonment Bāzārs.

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party.	Class of work.		Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
						Field work.	Mapping or computations.	Total.	
EASTERN CIRCLE OFFICE.—				Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**EASTERN CIRCLE.**
20% very congested city area, 10% less congested urban area and 70% open area.	16-inch	**Traverse for air surveys.**	79 B ...	53 linear miles.	53·0 linear miles.	15·2 per	7·8 linear	**23·0** mile.	Kulti outfall scheme, near Calcutta.
Ditto.	**16-inch**	Survey on rectifications (air photography).	79 B ...	3·2 sq. m. (2,048 acres).	768 acres.	564·3	221·5	**785·8**	Ditto.
No 4 Party.—									
Low jungle covered hills ...	1-inch	**Triangulation**	72 K ...	675	439·3	1·7	0·4	**2·1**	
Plains, mostly open and cultivated.	1-inch	**Traverse ...**	72 G, K & O ...	6,310 (2,241 L. miles).	252·4 (84·8 L. miles).	2·7	1·1	**3·8**	
Plains, mostly open and cultivated. Surveyed by resection from auxiliary points fixed from traverse control.	**1-inch**	Original Survey	72 C & G ...	2,680	28·5	12·8	8·1[a]	**20·9**	(a) The total cost of mapping and colour patterns in No. 5 Drawing Office was Rs. 487.
Ditto.	**1-inch**	Supplementary Survey.	72 G ...	2,422	35·0	13·2	8·1[a]	**21·3**	

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party.	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
No. 5 Party.—			Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**EASTERN CIRCLE.—** *Contd.*
80% Rocky hills clad with mixed jungle, 20% rocky hills with less jungle, and more scattered.	1-inch **Triangulation**	64 L, O & P ...	5,476	211	4·9	3·6	**8·5**	
40% Undulating jungle, 60% cultivated plains with fairly abundant tree growth. Average length of traverse lines throughout the area 52·5 chains.	1-inch **Traverse** ...	64 O ...	443* linear miles.	76 linear miles.	2·7	1·0	**3·7**	
25% very congested city area, 10% less congested urban area, 65% open area.	16-inch **Traverse for Air Survey.**	55 O ...	62† linear miles.	23‡ linear miles.	17·6	1·8	**19·4**	
90% dense jungle, 10% open cultivated area.	..... **Boundary demarcation and traverse.**	64 I & J ...	58§ linear miles.	20 linear miles.	84·6	3·9(a)	**88·5**	
40% open cultivated plains, 25% cultivated plains with fairly abundant tree growth. 35% undulating jungle with frequent hills.‖	**1-inch** Original survey ...	64 K ...	4,429	32¶*	12·0	10·5(a)	**22·5**	

* About 1,100 square miles.

† About 32 square miles. Cost rate figures include a short series of triangulation to connect with G. T. triangulation.

‡ Includes postpointing at 20 chains maximum interval.

§ No area can be given as this was purely boundary traverse. Includes demarcation.

‖ Partly assisted by reduction from 4-inch forest surveys made prior to 1905.

¶ Excludes Officers & men under training.

* Includes days lost through sickness which is a frequent concomitant of work in this area.

(a) The total cost of mapping and colour patterns in No. 5 Drawing Office was Rs. 305.

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party.	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
No. 12 Party.—			Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**EASTERN CIRCLE.—** *Concld.*
Hills up to 4,000 feet mostly densely wooded and sparsely populated.	½-inch **Triangulation**	84 C ...	3,746	232·8	4·34	1·04	**5·38**	
60% Flat jungle-clad country with intricate nālās and small hills. 40% cultivation.	1-inch **Traverse** ...	84 B ...	378	30·66 Linear miles.	10·98	3·11	**14·09**	
80% Parallel ranges of dense jungle clad hills up to 7,000 feet divided by deep nālās. Survey largely by plane table resection and facilitated by "jhūm" cultivation. 20% low extremely heavily wooded hills where absence of "jhūm" necessitated much plane-table traverse.	**½-inch** Original survey ...	84 A, B & E ...	5,879(a)	39·5(b) / 47·2(c)	14·09	3·82(d)	**17·91**	(a) Includes 414 sq. miles for mapping during recess 1936 and 50 sq. miles by 2 surveyors under training. (b) Outturn for surveyors not working on blue prints. (c) Outturn for surveyors in 84 A/NE & SE working on blue prints.
Compiled mapping ...	**½-inch** Sheets ...	79 M & 84 A ...	4,363 (4 shts.)*	.....	.....	1·96	**1·96**	*Includes 1 sheet containing 45% ½-inch original survey.

(d) The total cost of mapping and colour patterns in No. 5 Drawing Office was Rs. 367.

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party.	Class of Work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
No. 6 (South India) Party.—			Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**INDEPENDENT PARTIES.**
Hilly country with peaks up to 4,000 feet and deep valleys; often heavily wooded. Sparsely inhabited by hill tribes, and very unhealthy.	1-inch **Triangulation**	65 I & M ...	6,734	300·0	2·47	0·36	**2·83**	
Hilly country with peaks up to 3,000 feet and small cultivated areas in valleys.	**1-inch** Correction survey	74 A ...	54	90·0	5·07	8·73*	**13·80**	*Includes cost of colour patterns.
Reserved Forests about 50% flat sal jungle and 50% hilly.	**1-inch** Supplementary survey.	74 A ...	392	28·7	15·91	8·73*	**24·64**	
40% cultivated plains with isolated hills up to 1,500 feet. 60% hilly country with peaks rising to 4,000 feet; some dense jungle and some cultivated areas, mostly temporary; little traversing necessary.	**1-inch** Original survey ...	74 A & B ...	4,483	19·3	23·61	8·73*	**32·34**	

TABLE C.—Areas, out-turns and cost rates of Surveys, Computations and Mapping.

Party.	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
No. 6 (South India) Party.—*Concld.*			Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**INDEPENDENT PARTIES.—*Contd.***
	½-inch Compiled mapping	65 & 74 ...	10 shts.	.....	.....	2·02*	**2·02**	
	¼-inch Compiled mapping	65 ...	1 sht.	.....	.....	0·50*	**0·5**	*Includes cost of colour patterns.
No. 10 (Burma) Party.								
Mainly wooded hills from 4,000 to 6,000 feet high and flat cultivated land in the valley of the Irrawaddy River.	1-inch **Triangulation**	93 B, C & D ...	6,116	350	3·70	2·05	**5·75**	
Low intricate wooded hills and open cultivated plains.	1-inch **Triangulation (Supplementary).**	84 H ...	200	462	2·68	.....	**2·68**	
Flat cultivated country ...	1-inch **Traverse** ...	93 B, C & D ...	119† linear miles.	38 linear miles.	22·19	5·74	**27·93**	†It is not possible to give the area in square miles as the traverse work was carried out to supplement points in the area triangulated.

TABLE C.—Areas out-turns and Cost rates of Surveys, Computations and Mapping.

Party.	Class of work.	Sheet Nos.	Areas in sq. miles (or acres) of each description of work.	Out-turn of field work per man per month.	Cost rate per Sq. M. (or Acre) of each description of work, excluding pupils and men under training.			Remarks.
					Field work.	Mapping or computations.	Total.	
			Sq. m.	Sq. m.	Rs.	Rs.	Rs.	**INDEPENDENT PARTIES.—Concld.**
No. 10 (Burma) Party.—*Concld.*								
Steep hills rising to over 10,000 feet partly open and partly wooded. Communications poor.	½-inch Original survey ...	84 F, G & H ...	8,241	102·0	9·65	2·79	**12·44**	
Low densely wooded ridges with flat cultivated land between.	1-inch Original survey ...	84 D & H ...	1,985	28·2	23·69	8·64	**32·33**	
Fair drawing	1-inch Compiled mapping	96 J & M ...	816	.....	.....	4·09	**4·09**	
Ditto	½-inch ditto	84 I & 94 C ...	3,320	.....	.....	1·80	**1·80**	
Ditto	¼-inch ditto	83 L & N, 92 J	12,861	.....	.....	0·56	**0·56**	Total Cost of Office Copy corrections & miscellaneous work Rs. 15,652.
	Preparation of Colour Patterns.	.....	16 shts.	.....	.....	137·87 per sheet.	**137·87 per sheet.**	

V.—SURVEY REPORTS, FRONTIER CIRCLE.

DIRECTORS:—{Colonel S. W. Sackville Hamilton. D.S.O., to 6-6-35.
{Lt.-Colonel C. M. Thompson, I.A., from 7-6-35.

43. Summary.—The units administered by the Frontier Circle were 'A' and 'E' Companies, No. 18 Party. No. 6 Drawing Office and No. 23 Party up to its disbandment on 1st April.

44. Training.—Two Class I Officers on probation received training in air survey.

Eleven soldier surveyors were under training in 'A' Company during the field season, of whom two reverted to their regiments.

45. Special.—The Officer Commanding, 'E' Survey Company, took part in the Western Command Exercise held around Quetta between 22nd and 24th October 1934. During the year the Staff College senior students visited his office for brief lectures, and demonstrations of map making and reproduction.

'E' Survey Company was severely affected by the disastrous Quetta Earthquake which occurred on 31st May. Four members of the Company lost their lives in the city and the office building was rendered unsafe for further occupation.

46. Areas Surveyed.—

580 sq. miles of triangulation.
80 linear miles of traversing.
12 linear miles of cantonment boundary traverse.
100 linear miles of settlement traverse.
6,228 sq. miles of ½-inch original survey.
1,790 sq. miles of 1-inch original survey.
262 sq. miles of 1-inch original survey (triangulated and photographed from the air).
168 sq. miles of 1½-inch resurvey.
3 sq. miles of 16-inch resurvey.
434 sq. miles of 1-inch resurvey.
257 sq. miles of 1-inch supplementary survey.
767 sq. miles of 1-inch revision survey.
1-inch correction surveys of 6 sheets.

By No. 18 (Air Survey) Party.—

388 sq. miles compiled (original survey).
383 sq. miles compiled (revision survey).

'A' Survey Company.

Officer Commanding.—{Mr. W. H. Strong. M.B.E., to 1-1-35.
{Lt.-Colonel O. Slater, M.C., R.E., from 2-1-35 to 3-8-35.
{Lieut. C. A. Biddle, R.E., from 4-8-35.

47. General.—The party continued surveys in Ferozepore, Jullundur, Kāngra, Montgomery, Multān and Muzaffargarh districts and in Bahāwalpur, Chamba, Faridkot, Kalsia, and Mandi States of the Punjab and in Bikaner State of Rājputāna.

In addition, correction surveys were carried out in Amritsar, Hoshiārpur, Jullundur and Ludhiāna districts and in Kapūrthala State of the Punjab.

Triangulation and traverse for next season's survey were carried out in Dera Ghāzi Khān district and Bahāwalpur State of the Punjab. A small area in the neighbourhood of Bīkaner City was also triangulated to provide a framework for a special survey of that city. This survey was completed during the year under report.

Towards the end of the field season a traverse camp was formed for fixing points for a settlement survey shortly to be undertaken in the Kāngra district of the Punjab.

Field headquarters opened at Ferozepore Cantonment on 16th October and closed on 15th April.

48. Personnel.—The average strength of the Company during the year was one Class I, 3 Class II, 6 U. S. Officers, 28 surveyors, 1 traverser, 1 draftsman, 6 computers, 3 clerks and 13 soldier surveyors.

Messrs. O. D. Jackson (Class II) and Muzaffar Husain (U. S. S.) joined 'A' Company from No. 23 Party and No. 18 Party respectively in October and Mr. E. R. Wilson, B.A. (Class II) in December.

Mr. Mohd. Najamuddin, B.A. (Class II) was transferred to 'E' Company in December and Messrs. W. H. Strong, M.B.E. (Class II) and Muzaffar Husain (U. S. S.) to No. 6 Drawing Office in January and June respectively.

49. Areas Surveyed.—

580 sq. miles of triangulation.
80 linear miles of traversing.
100 linear miles of settlement traverse.
6,228 sq. miles of ½-inch original survey.
1,789 sq. miles of 1-inch original survey.
168 sq. miles of 1½-inch resurvey.
434 sq. miles of 1-inch resurvey.
257 sq. miles of 1-inch supplementary survey.
767 sq. miles of 1-inch revision survey.
6 sheets of 1-inch correction surveys.

50. Field work was organised as follows:—

Camp (1) under Rai Sahib Chuni Lal Kapur with Mr. I. K. Ponnappa and 10 surveyors completed 1,037 square miles of ½-inch original survey, 1,725 square miles of 1-inch original survey, 344 square miles of 1-inch re-survey and 257 square miles of 1-inch supplementary survey in sheets 39 N and 44 C and G.

Camp (2) under Mr. O. D. Jackson with Mr. Muzaffar Husain and 10 surveyors completed 5,191 square miles of ½-inch original survey in sheets 44 C and G.

Camp (3) under Mr. Sardar Khan, assisted by Mr. Mohd. Akbar was organised for training in the Kāngra valley and in parts of Chamba and Mandi states. One surveyor and 6 second year soldier surveyors completed **258** square miles of 1- and 1½-inch resurvey in sheet [redacted] 52 D. Five first year soldier surveyors and one computer received instruction and did independent work in the same area.

Camp (4) under Mr. Mohd. Najamuddin, B.A. succeeded by Mr. E. R. Wilson, B.A. with 3 surveyors completed 767 square miles of revision

survey in sheets 44 J, M and N, together with 6 sheets of correction surveys in sheet 44 M. The basis of the revision survey was 4-inch survey done by No. 23 Party during season 1931-32 for the Punjab Irrigation Department. A drawing section of 6 surveyors and 1 draftsman also formed part of the camp and completed 4 sheets of mapping left over from recess.

Triangulation.—Mr. Bashirullah Khan completed 580 square miles of triangulation in all. Of this, 80 square miles in sheets 44 H and 45 E, was for a special survey of Bikaner city; and the remainder, in sheet 39 P, for surveys to be carried out next field season.

Traversing.—The north west corner of sheet 39 L, which falls in next season's survey area, required supplementary triangulation. Owing to excessive tree growth it was found cheaper to traverse the area and Mr. Bashirullah Khan completed 80 linear miles of traverse in this area.

Special surveys.—An area of 64 square miles of 1-inch original survey round Bikaner city in sheets 44 H and 45 E was completed by 2 surveyors supervised by Mr. Muzaffar Husain. This survey is for a special map with contours at 10 feet intervals required on payment by Bikaner State.

At the request of the Punjab Government a traverse camp of 3 traversers and 3 computers was formed towards the end of the field season to undertake the traverse for settlement purposes of 30 small villages in the Kāngra district. This work was supervised by Rai Sahib Chuni Lal Kapur and 100 linear miles of traverse, together with its computations and plotting, was completed during the month of August.

Description of Country.—In the neighbourhood of the Sutlej the country is thickly populated and intensively cultivated. In addition to numerous wells there is now a rectangular net work of field distributaries fed by canals controlled at their head works by the various barrages across the Sutlej itself. The alignments of the old inundation canals are marked by high banks which wind apparently haphazard across the country or have been realigned to form modern canals. South of this the country is desert in process of reclamation. Large areas of sand dunes, mostly sparsely covered with shrubs but a few sterile and shifting, are interspersed with areas of *pat* now canalised and cultivated. The banks of the old *taubas* are fast disappearing as the water supply now depends chiefly on deep tanks supplied from canals. In out of the way places the old and bitter wells are still in use, but near the canals the wells are gradually becoming sweeter. There are no signs of the actual bed of the old Hakra or Ghaggar river; but the area through which it flowed is marked now by a broad canalised and cultivated rift between sand hills, which in the south rise to two hundred feet above the plain. The whole area except for some of the larger dune areas has been rectangulated and this formed the basis of the survey.

51. Recess Duties.—Including arrears the Company had a total of 27 sheets to be mapped during the recess. Of these 23 sheets were completed by four drawing sections. The remainder will be completed during the coming field season.

Computations. Owing to the formation of the traverse camp mentioned above the computation section during most of the recess was

reduced to Mr. Saiyid Irshad Ahmad, B.A., and 1 computer. All the computation work for the coming field season was completed by the end of recess.

'E' Survey Company.

Officer Commanding.—Major T. M. M. Penney, R.E.

52. General.—Due to the accumulation of arrears of mapping the Company did not take the field as a whole during the year under report but was concentrated in Quetta on fair drawing, both during the field season and during recess.

Some survey work was done however both as departmental and extra departmental jobs.

In liaison with the R. A. F. and as training in air survey for both the R. A. F. and this unit, one 1-inch sheet was photographed, triangulated, and had its detail checked on the ground. Corrections to the Quetta Cantonment map were verified on the ground and the fair sheets brought up to date. An extra departmental spot level survey was carried out in the neighbourhood of Pishin. The Fort Sandeman Cantonment was re-surveyed on behalf of No. 20 (Cantonments) Detachment. One or two other small surveys were carried out as paid for works, while numerous small jobs, such as fixing bearing pickets for the Royal Artillery and range taking for range finder testing ranges, were undertaken for the Army.

The Officer Commanding took part in the capacity of Deputy Director of Surveys in the Western Command Exercise, while a selected number of surveyors and computers carried out a small triangulation exercise with signallers kindly lent by the 2nd Indian Divisional Signals.

One surveyor went on deputation with Dr. Visser's 1935 Himālayan expedition.

53. Quetta Earthquake.—The Company was severely affected by the disastrous earthquake which occurred in the early hours of 31st May. The office building being situated in the 50% zone was very severely shaken and will require complete reconstruction on earthquake-proof lines. Practically the whole of the personnel were living in the 100% zone in the city, and suffered very great loss both in relatives and personal property. Fortunately, only four men of the Company lost their lives while one was severely injured.

The survivors of all families were evacuated from Quetta, and the whole Company lived and worked in tents throughout the remainder of the recess season.

The emergent demands of the Civil and Military authorities for surveys and maps, arising out of the earthquake, caused extra departmental work to be greatly increased. A special rectangulation survey was carried out to assist in siting the temporary Quetta City, special maps and plans for the Earthquake Claims Commissioner were drawn and reproduced and special skeleton plans of the Cantonment for the Quetta Cantonment Reconstruction Committee were prepared. Demands for large scale maps of Quetta Cantonment, and Civil area, and of the surrounding country including all adjacent villages, were heavy during the first few days after the disaster. These were met immediately, though

the press room was severely shaken and not really safe for work, in view of recurring shocks. To refute current rumours that the earthquake had altered the position and heights of the surrounding hills, and to enable an up-to-date report on triangulation stations and bench marks to be submitted, a special re-triangulation of the adjoining hills was carried out, and the levels of bench marks in the city area were checked.

54. Personnel.—The average strength during the year was 2 Class I officers, 2 Class II, 3 Upper Subordinate officers and 19 Lower Subordinates (excluding 3 clerks, 2 computers and 15 reproduction section personnel).

One clerk, one computer, one surveyor and one member of the Reproduction Section were killed in the earthquake.

Lieut. J. S. O. Jelly proceeded on leave for 3 months from 2nd January. Mr. H. M. Critchell proceeded on 4 months leave from 12th November prior to transfer to No. 6 Drawing Office.

Mr. Chowdhury Mohd. Aslam proceeded on three months sick leave from 7th June due to injuries received in the earthquake.

55. Areas surveyed.—262 square miles round Jacobābād were triangulated, and photographed from the air, and visited on the ground for classification of detail, and the air survey map compiled. 3 square miles on the 16-inch scale were resurveyed in Fort Sandeman Cantonment and 12 linear miles of cantonment boundary traversed.

An area of one square mile was rectangulated and surveyed on the 32 inch scale near the Murree Brewery on the outskirts of Quetta, to assist in laying out the temporary Quetta City area.

56. Field Work.—Apart from the work mentioned above no field work was done. The ground work for the air survey of the Jacobābād area in 39 D/7 was carried out by Mr. Khushal Khan (U. S. S.) and 2 surveyors during January and February, while the Fort Sandeman work was done by Mr. Chiragh Shah (U. S. S.) and 2 surveyors during April, May and June.

Nature of country surveyed.—Dead flat plain, partly desert and partly irrigated round Jacobābād, and ordinary fairly flat cantonment area at Fort Sandeman.

57. Office Work.—The normal drawing work was divided into two sections. *No. (1) Section* under Mr. Najamuddin consisted on an average of 9 draftsmen. *No. (2) Section* was under Mr. Critchell assisted by Mr. Vidya Dhar Chopra who took over the section on Mr. H. M. Critchell's proceeding on leave until Mr. Chowdhury Muhammad Aslam joined on 15th April. The section consisted on an average of 9 draftsmen. 17 Fair sheets of arrears mapping were completed between the two sections throughout the year.

A large number of special maps and plans were drawn to meet requirements due to the earthquake, especially large scale plans of the various city wards for use in connections with salvage operations in Quetta City.

Lieut. J. S. O. Jelly generally supervised the computing section, the air survey work and the reproduction section, and was available for experimental work and miscellaneous jobs required by the Army

and for military training. His services were also lent to the military authorities during the week following the earthquake to assist in supervising the many engineering jobs urgently required at that time.

58. Reproduction Section.—This section under Litho-draftsman Shahabuddin was employed on miscellaneous work throughout the year, the largest single job being the printing of 98 sets of *deh* maps for the Irrigation Department.

The section was very fully employed from the day of the earthquake onwards in printing the various special maps and plans referred to above. When the earthquake occurred revised 16-inch maps of the Quetta Cantonment and Civil Station, as well as the new 1/25,000 Guide map, were under publication in Dehra Dūn and Calcutta; no published copies on these scales were available. To meet the immediate demand for large scale maps, the Reproduction Section were able to use preliminary plates which had been made in Quetta before the material for the 16-inch and 1/25,000 maps had been sent for publication; they were thereby able to meet all demands made by the Civil and Military authorities.

59. Military Training.—Senior surveyors were given a short course in triangulation and traverse, rapid 1/25,000 scale plane-tabling and advanced triangulation with signallers.

No. 18 (Air Survey) Party.

Officer in charge.—{Captain D. R. Crone, R.E., to 13-3-35.
{Lieut. R. C. N. Jenney, R.E., from 14-3-35.

60. General.—Recess and field headquarters remained at Murree and Risālpur respectively, the latter opening on 20th October and closing on 6th May.

61. Personnel.—The average strength of the party was 2 Class I, 2 Class II, 3 U. S. officers and 17 Lower Subordinates (excluding clerks and reproduction personnel).

Mr. E. R. Wilson, B.A., joined the Party on 1st October for training, was transferred to 'A' Company on 7th December, and transferred back to No. 18 Party on 20th May.

Mr. N. D. Joshi, B.A., joined the Party for training on 28th November.

62. Areas Surveyed.—

388 square miles compiled (original survey).
383 square miles compiled (revision survey).

63. Field work.—No. 1 Wing Station, R. A. F., Kohāt, supplied oblique photographs with the F/8 camera of 129 linear flying miles in tribal territory in sheet 38 K & H for height determination.

No. 2 Wing Station, R. A. F. Risālpur supplied oblique photographs with the F/8 camera of 112 linear flying miles in sheet 38 N for height determination.

Experimental work with the 20-inch lens and infra-red filter was continued, but difficulties were encountered owing to vibration, resulting in a blurred image.

A modified mounting for the F/8 camera for use with the Ross 6-inch E. M. I. lens was designed by No. 2 Wing Station, R. A. F. Risālpur.

64. Compilation.—The compilation of a special map for Northern Command was completed in January. For the method of reproduction see page 70 para. 131.

The remaining compilation carried out was for the greater part the completion for contours of the previous year's outline compilations, by the method of survey from oblique photographs.

205 square miles were compiled for detail only from air photos taken in previous years.

Fair mapping.—583 square miles compiled from air photos in previous years have been fair mapped during the year under report.

65. Photographic Equipment and Instruments.—A Wild air camera with its accessories was purchased by the Department.

One model of the Zeiss folding mirror stereoscope with tracing stereometer attachment was received during the year. This instrument proved most useful for the examination of photographs by the officer in charge and section officer.

66. Training.—Lieuts. C. A. Biddle, R.E., and D. E. O. Thackwell, R.E., were trained in methods of air survey during recess.

67. Nowshera Air Survey Exercise.—This exercise was carried out in January-February 1935. The primary object was the rapid production of 1/50,000 standard maps and a 1/25,000 battle map. Incidental objects were to test the Indian oblique method of fixing spot heights under active service conditions and to ascertain the value to the R. A. of copies, on the 1/25,000 scale, of the air survey compilation during the making of the 1/50,000 standard map. Extracts from this report will be published in due course.

68. Reproduction Section.—For details of the work of the reproduction section see page 70.

VI.—SURVEY REPORTS, GEODETIC BRANCH.

No. 1 Party.

Officer in charge.—Captain H. W. Wright, R.E.

69. General.—The party carried out operations in the Punjab States, Rājputāna and Central India Agencies, Gwalior, the Bombay Presidency, the States of Western India and in Baroda in sheets 40 I, K, L, M, P, 45 A, B, C, D, E, F, H, I, L, P and 54 D.

At the end of August a small Camp took the field for high mountain surveys in sheets 53 I, J, M and N. The area, which is to be surveyed on ¾-inch scale for ½-inch maps, comprised the uppermost part of the Bhāgirathi basin north of the Bandarpūnch, Gangotri, Kedārnāth and Badrināth massifs as far as the Tibetan Border.

This work will be described in the General Report for 1936-37.

Both Jodhpur and Tonk States contributed at the full rates for surveys carried out for them.

The officer in charge continued personal negotiations for contributions to surveys with the administrations of Indian States and his proposals have already been accepted by one state and have received promises in others.

The field headquarters of the party by permission of H. H. the Mahārāna of Mewār continued to be at Udaipur (Udaipur or Mewār State) throughout the season from 15th October 1934 to 14th April 1935; on the conclusion of field work, all equipment was moved to Jodhpur, the future headquarters.

Personnel.—The field strength of the party was 1 Class I, 5 Class II, 2 Class II probationers, 6 Upper Subordinate Officers and 39 Lower Subordinates.

70. Areas surveyed.—

4-inch original survey ...	...	31	square miles.
1½-inch original survey ...	...	557	,, ,,
¾-inch original survey ...	...	764	,, ,,
½-inch original survey ...	...	8,642	,, ,,

71. Field work was organised as follows:—

Camp (1).—Mr. A. A. Graham (Class II) with 12 surveyors completed the original survey of 4,308 square miles on the ½-inch scale in the states of Jodhpur. Pālanpur and Sirohi in sheets 45 C and D.

The area is typical of the arid flat country which largely comprises Jodhpur State, interspersed however with isolated groups of bold rocky mountains, and tending to desert conditions on the west.

Camp (2).—Mr. J. B. Lal (Class II) assisted by Mr. B. B. Kuttappa (U. S. S.), and 12 surveyors completed 4,334 square miles of ½-inch original surveys in the states of Indore, Khilchipur, Rājgarh, Jhālawār, Kotah, Tonk and Gwalior in sheet 54 D; the country is undulating intersected by steeply-banked big rivers and includes extensive areas of jungle-clad hills.

Camp (3).—Mr. J. C. Ross (Class II), with 2 Class II probationers, 1 U. S. S. officer and 10 surveyors completed 764 square miles of ¾-inch and 317 square miles of 1½-inch original surveys in the states of Jodhpur, Udaipur and Sirohi in sheet 45 H.

The camp consisted mostly of personnel under training; the area is in the wildest tracts of the little known Arāvalli mountains.

Camp (4).—Mr. M. W. Kalappa (U. S. S.), with 3 U. S. S. officers and one lower subordinate under training completed 31 square miles of 4-inch original surveys for the preparation of the Udaipur Guide Map, and 240 square miles on the 1½-inch scale in the neighbourhood of Udaipur in sheet 45 H.

Triangulation.—Mr. T. M. C. Alexander (Class II), completed 1,741 square miles of original triangulation in sheet 40 K and 9,063 square miles of revision of old triangulation in sheets 40 K, L and P in Kadi (Baroda) and Thar Pārkar (Sind) and in the states of Jodhpur and Pālanpur and the Sabar Kāntha Agency.

1st Class Surveyor Najmul Husain and Inter Class Surveyor R. K. Saxena completed 14,124 square miles of triangulation revision in sheets 45 A, B, E, F and I in the states of Bīkaner, Jaisalmer and Jodhpur.

These framework officers carried out their work in a semi-desert country of which the predominant feature was sand formations and in which water was scarce.

Inter Class Surveyor R. K. Saxena also completed 4,342 square miles of revision of old triangulation in sheets 45 L and P in the states of Dūngarpur, Gwalior, Indore, Jhālawār, Udaipur, Partābgarh and Tonk and in the Mālwa Agency.

Traverse by Hunter Short Base.—Mr. M. M. Mudaliar (Class II), accompanied by 2 computers, provided framework for detail surveys of 8,453 square miles in the heart of the Great Indian Desert in sheets 40 I and M in Sukkur District (Sind) and in the states of Bahāwalpur, Jaisalmer and Jodhpur.

The area consisted largely of a desert of windblown sand, which although covered with low coarse vegetation, provided very few identifiable points, thus making triangulation both difficult and uneconomical.

Framework was therefore provided by traversing east and west lines between two flanking Great Trigonometrical series.

Four main traverse lines, each about 120 miles long, approximately parallel and about 15 miles apart, were run by subtense measurements of a 4, 5 or 6 chain Hunter Short Base set up 2, 3 or 4 miles respectively from each (Wild) theodolite Station.

Computations of each day's observations were carried out nightly.

Conditions in this desert area were particularly arduous and special arrangements had to be made for food, water and fuel. Of the 19 camels employed, 8 died of exhaustion due to lack of adequate fodder and water.

72. Recess duties.—Fair mapping was completed by 3 main sections under Messrs. T. M. C. Alexander, Jugal Behari Lal and P. C. Sen Gupta, the latter assisting in the fair mapping supervised by Messrs. J. C. Ross and M. W. Kalappa.

Framework computations were dealt with by a section under Mr. I. D. Suri (U.S.S.).

No. 20 (Cantonments) Detachment.

Officer in charge.—{ Mr. O. N. Pushong, to 9-4-35.
,, A. A. Graham, from 10-4-35.

73. General.—The detachment surveyed cantonments and their bāzārs on the 16-inch and 64-inch scales respectively, in accordance with the programme approved by the Engineer-in-Chief and the Army Department.

A special survey on the 32-inch scale, at Chaubattia, was completed for the Deputy Director, Government Gardens; and a theodolite survey of 10·14 miles of the re-aligned boundary of Nepāl adjoining Bahraich District was carried out for the Government of the United Provinces.

The field season commenced on the 10th October 1934 and closed on the 15th April 1935, field headquarters remaining at Dehra Dūn.

Personnel.—The field strength was 2 U. S. officers and 32 Lower Subordinates, including 4 draftsmen and 3 computers employed at field headquarters; one traverser was temporarily transferred to No. 5 Party at the beginning of March for about 2 months.

74. Areas surveyed.—

16-inch re-survey.

Bareilly Cantonment	...	4,944·5 acres.
Barrackpore ,,	...	1,262·5 ,,
Dehra Dūn ,,	...	3,696·1 ,,
Ishapore Ordnance Factory Lands	...	575·6 ,,
Naini Tāl Cantonment	...	709·3 ,,
Sahāranpur Remount Depôt	...	2,644·0 ,,
Total	...	13,832·0 ,,

The above areas include overlaps.

32-inch original survey.

Chaubattia Government Orchard	...	166·3 acres.

64-inch original survey.

Naini Tāl Cantonment Bāzār	...	8·0 acres.

64-inch re-survey.

Bareilly Cantonment Bāzārs	...	65·4 acres.
Barrackpore ,, ,,	...	59·8 ,,
Dehra Dūn ,, ,,	...	4·0 ,,
Total	...	129·2 ,,

75. Field work was arranged as follows:—

Camp (1), under Mr. J. A. Cabral with 4 surveyors and 2 traversers, completed the detail survey of Barrackpore and Ishapore, and the advance traversing and levelling of Jubbulpore.

Camp (2), under Mr Bakhshi Harnam Singh with 9 surveyors and 2 traversers, completed the detail survey of Bareilly, Naini Tāl, Sahāranpur and Chaubattia Government Orchard, and the advance traversing and levelling of Nasīrābād.

Camp (3), under the officer in charge assisted by Surveyor A. Francis with 4 surveyors, completed the detail survey of Dehra Dūn.

The survey of topographical features in the open and hilly areas of Cantonments was carried out in much greater detail than in the previous surveys; this was facilitated by theodolite traverses having been run along all main nālās.

76. Traversing and Levelling.—

9·8 linear miles of traversing was completed for the survey of Chaubattia Government Orchard.

244·5 linear miles of traversing and 55·6 linear miles of levelling were completed for next season's survey of Jubbulpore and Nasīrābād.

9·4 linear miles were traversed in connection with changes of cantonment boundaries in Delhi, Jhānsi and Lansdowne.

At the request of the Officer Commanding the station, 28 points were fixed at Dehra Dūn for the training of range takers.

77. Recess duties.—Fair mapping was divided into two sections under Messrs. J. A. Cabral and Bakhshi Harnam Singh.

A section of 4 draftsmen, under the supervision of the officer in charge was employed throughout the field season to deal with arrears of mapping.

35 sheets on the 16-inch scale of Allahābād, Barrackpore, Fyzābād, Bareilly and Shāhjahānpur Cantonments, Sahāranpur Remount Depôt, Ishapore Ordnance Factory Lands, and 5 sheets on the 64-inch scale of Bareilly, Dehra Dūn and Naini Tāl bāzārs were completed and sent for publication.

The computations of the traversing and levelling carried out in the field season were also completed during recess.

VII.—SURVEY REPORTS, EASTERN CIRCLE.

DIRECTOR:—{Major L. H. Jackson, I.A., to 11-11-34.
{Colonel J. D. Campbell, D.S.O., from 12-11-34.

78. Summary. The units administered by the Eastern Circle were Nos. 4, 5 and 12 Parties, and No. 5 Drawing Office.

The Director, Eastern Circle, also acted as technical adviser to the Government of Assam, and on the request of the C. P. Government, inspected the survey work in that province.

79. Areas surveyed.—

5,879 sq. miles of ½-inch original survey.
7,109 sq. miles of 1-inch original survey.
2,422 sq. miles of 1-inch supplementary survey.

80. Air Survey.—The control for the air survey of Nāgpur City and its environs is described in No. 5 Party's report (p. 46).

The air survey was also carried out of a strip of country east of Calcutta in connection with the outfall scheme. The method adopted was first to photograph a strip 20 miles long by 1 mile wide and provide a contact mosaic for post-pointing of control and subsequently, rectified prints for field work on 16-inch scale. With the aid of these prints, the Outfall Engineer was able to lay out his line on the ground, and detail survey mainly consisting of inking up detail on photos, was thus confined to astrip 600 feet wide on either side. The field work was completed by Mr. Mathur (U. S. S.) and 1 surveyor and the tracing and reproduction of the finished map were completed during recess.

81. Training.—In addition to two Class I Officers under training, 5 probationers of Class II Service joined the Circle during the field season for training.

No pupils were recruited during the year under report.

82. Special.—The Director, Eastern Circle, inspected No. 6 (S.I.) Independent Party in the field.

No. 4 Party.

Officer in charge.—{Mr. D. K. Rennick, M.B.E., to 17-3-35.
{Mr. J. McCraken, M.B.E., from 18-3-35.

83. General.—The party continued surveys on the 1-inch scale in Bihār and Orissa and the United Provinces in sheets 72 C and G.

The field headquarters opened at Patna on 16th November 1934 and closed on 15th April 1935 on completion of field work.

84. Personnel.—The field strength of the party was 1 Class I, 8 Class II (3 under training) and 4 Upper Subordinate officers, 37 surveyors, 4 computers, 3 clerks and 1 store-keeper.

Mr. D. K. Rennick, M.B.E., (Class I) proceeded on 8 months leave out of India from 18th March.

Mr. J. McCraken, M.B.E., (Class II) joined the party in the field on 18th March.

Mr. J. L. Sahgal (Class II) proceeded on leave from 3rd April to 7th May.

Mr. U. D. Mamgain, B.Sc., (U. S. S.) was temporarily transferred to No. 5 Party from 26th March and rejoined on 18th June.

Mr. S. B. P. Mathur, B.Sc., (U. S. S.) was temporarily transferred for duty on the Calcutta outfall scheme from 1st February to 31st May, and Messrs. N. L. Gupta, C.E., M. Alauddin, B.Sc. and L. J. Bagnall, B.Sc. (Class II Probationers) joined the Party in November for training.

85. Area surveyed.—

2,680 square miles of 1-inch original survey.
2,422 square miles of 1-inch supplementary survey.
675 square miles of triangulation for subsequent 1-inch detail survey.
2,106 linear miles of theodolite traverse for subsequent 1-inch detail survey.

135 linear miles of theodolite traverse was carried out in December 1934 and January 1935 for detail survey in the same season.

The triangulation was connected to minor topographical triangulation and the traverse adjusted to G. T. triangulation.

86. Field Work.—The detail survey and the advance triangulation and traverse carried out were distributed and organised as follows:—

Camp (1).—Mr. J. L. Sahgal, (Class II) with 8 surveyors completed the 1-inch supplementary survey of 1,077 square miles in sheet 72 G, in the Gaya and Patna districts of Bihār and Orissa. This survey was carried out on blue prints of the compiled preliminary sheets. The detail was found accurate and was of great assistance to surveyors in the field.

Camp (2).—Mr. F. M. Hawley, (Class II), with Mr. L. J. Bagnall, B.Sc., (Class II) under training and 10 surveyors completed the 1-inch original survey of 1,340 square miles in sheets 72 C and 72 G in Ballia district of the United Provinces and in the Muzaffarpur and Sāran districts of Bihār and Orissa. This survey was carried out on blue prints of the compiled preliminary sheets. Except for a few main features and village names the detail on the blue prints was found inaccurate and of very little assistance to surveyors in the field.

Camp (3).—Mr. M. M. Ganapathy, B.A., (Class II) with Mr. J. R. Chibbar (U. S. S.) as assistant, Mr. N. L. Gupta, C.E., (Class II) under training and 10 surveyors completed 268 square miles of 1-inch original survey and 1,077 square miles of 1-inch supplementary survey in sheet 72 G in the Darbhanga, Gaya, Monghyr and Patna districts of Bihār and Orissa. The supplementary survey was carried out on blue prints of the compiled preliminary sheets; the detail, except for changes in the north bank of the Ganges River was found accurate and was of great assistance to surveyors in the field. The original survey was also carried out on blue prints of the compiled preliminary sheets but owing to considerable changes in the topography the detail on the blue prints was of little or no assistance to surveyors in the field.

Mr. N. L. Gupta, C.E., (Class II) contracted lymphangitis in January and proceeded on leave; he was however able to return and continue his training before the end of the season.

Towards the end of January, Mr. M. M. Ganapathy, B.A., (Class II) made over charge of *Camp (3)* to Mr. J. R. Chibbar (U. S. S.) and

took over charge of *Camp* (*5*) (Triangulation and Traverse) for the remainder of the season.

Camp (*4*).—Mr. Abdul Ahad, B.Sc., (Class II) with Mr. Md. Alauddin, B.Sc., (Class II) under training and 9 surveyors completed 268 square miles of 1-inch supplementary survey and 1,072 square miles of 1-inch original survey in sheet 72 G in the Darbhanga, Muzaffarpur and Patna districts of Bihār and Orissa. The supplementary survey was carried out on blue prints of the compiled preliminary sheets. There have been considerable changes north of the Ganges River, and the detail on the blue prints was in consequence found to be of very little assistance to the surveyors in the field. The detail south of the Ganges River was found accurate. The original survey was carried out on blue prints of the compiled preliminary sheets. Except for village names and a few main features there have been considerable changes, and, the detail on the blue prints was found to be of very little assistance to surveyors in the field.

Towards the end of February, six surveyors were transferred to this camp from *Camps* (*1*), (*2*) and (*3*) to help complete the 1-inch original surveys in 62 G/9, 10 and 13 where conditions were more difficult owing to the area being heavily congested with village sites densely surrounded by trees and fruit gardens.

Camp (*5*).—Mr. U. D. Mamgain, B.Sc., (U. S. S.) with Messrs. S. B. P. Mathur, B.Sc., (U. S. S.) and A. P. Datta, B.Sc., (U. S. S.) 5 traversers and 4 computers completed 2,241 linear miles of theodolite traverse covering an area of 6,310 square miles in 72 G and 72 K & O in the Bhāgalpur, Darbhanga, Monghyr, Muzaffarpur, Patna, Purnea and Santāl Parganas districts of Bihār and Orissa; Mr. U. D. Mamgain, B.Sc., (U. S. S.) also completed triangulation for 1-inch surveys covering an area of 675 square miles in sheet 72 K in Monghyr district.

Mr. M. M. Ganapathy, B.A., (Class II) took over charge of *Camp* (*5*) on 8th February from Mr. U. D. Mamgain, B.Sc., (U. S. S.), who was then employed on theodolite traverse for the remainder of the season.

87. Description of Country.—The area lies in the Gangetic plain with two main tributaries, the Gogra and Gandak Rivers meeting the Ganges near Chāpra and Hājīpur respectively. Large areas are liable to floods during the rains and remain inundated till about the end of January. The general nature of the country is flat open plain, densely populated. In the area of triangulation however, the hills rise from 150 to 1,600 feet and are fairly well wooded, with sparse population.

Road and railway communications are good with several metalled roads and numerous roads and cart tracks motorable in the dry season.

The country surveyed falls within the earthquake area of January 1934. Except for a few ruined houses still unrepaired there is no evidence of the damage done.

88. Miscellaneous.—*Health.*—The health of the party was generally very satisfactory. At the beginning of the season most of the men were inoculated against cholera. In February, plague was prevalent in the area north of the Ganges River. Advantage however was taken

of the Public Health Depots in the Districts to have the men inoculated against plague, and there were no casualties.

Weather.—Weather conditions were favourable throughout the field season except during March and April when they were somewhat trying owing to high winds accompanied by sand and dust.

Khamal.—At the close of the field season the field headquarters of the Party was removed from Patna to Bhāgalpur in the area for survey in 1935-36.

89. Recess duties.—The fair mapping was divided into four sections in charge of Messrs. J. L. Sahgal, F. M. Hawley, M. M. Ganapathy, B.A., and Abdul Ahad, B.Sc., (Class II).

The computing section was in charge of Mr. U. D. Mamgain, B.Sc., (U. S. S.).

All surveys were fair-mapped and all computations completed by the end of recess.

No. 5 Party.

Officer in charge.— Captain I. H. R. Wilson, R.E., to 31-10-34.
Captain J. B. P. Angwin, R.E., from 1-11-34.

90. General.—Topographical survey on the scale of 1 inch to 1 mile was continued in the Raipur and Bilāspur districts of the Central Provinces, the Sambalpur district of Bihār and Orissa and in the Eastern States Agency. The whole of sheet 64 K was surveyed.

Triangulation for topographical survey was carried out in 64 L, O & P and traverse in 64 O. A length of some 58 miles of boundary between the Srinagar and Rāmpur tappas of Surguja State was demarcated and traversed. Traverse and postpointing of contact prints for the Air Survey of Nāgpur City was carried out.

Field headquarters was at Raipur, at which the field season opened on 25th October 1934 and closed on 3rd May 1935.

91. Personnel.—The field strength consisted of the officer in charge, 2 R. E. subalterns on probation, 5 class II officers, 2 class II officers on probation, 5 Upper Subordinate officers, 22 surveyors, 2 traversers, 1 computer, 3 clerks and 1 storekeeper.

92. Areas surveyed.—

4,429 square miles of 1-inch original survey.
5,476 square miles of triangulation for 1-inch survey.
443 linear miles of traverse covering about 1,100 square miles for 1-inch survey.
58 linear miles of traverse for boundary demarcation.
62 linear miles of traverse covering about 32 square miles for 16-inch air survey.

93. Field work.—The 16 sheets of 64 K were divided up between 3 Camps as follows:—

Camp (1).—Mr. R. N. Hastir (Class II), with 1 U. S. officer and 7 surveyors carried out the original survey of 1,385 square miles in sheet 64 K, falling in Raipur, Bilāspur and Sambalpur districts and Sārangarh State.

The country varies between medium jungle clad hills and partly cultivated, partly jungled plains. The southern portion of the area is

traversed by the Great Eastern Road and also contains some convenient dry-weather motor roads.

Camp headquarters was first at Saraipāli and later at Bilaigarh and Seorīnārāyan.

Work in this camp was delayed owing to fever and did not finish until May 10th.

Camp (2).—Mr. C. T. Hurley (Class II) with Mr. G. H. Khan (Class II), two Class II probationers and 6 surveyors carried out the original survey of 1,387 square miles in sheet 64 K, falling in Raipur and Sambalpur districts. Mr. H. H. Phillips (Class II probationer) carried out 24 miles of supplementary traverse in 64 K/4.

At the end of February one man was withdrawn for the Nāgpur Air Survey traverse and near the end of the season one man was sent to assist *Camp (1).*

The country is partly densely wooded with medium hills and partly open, gently undulating plains.

The Great Eastern Road, several minor motorable roads and the Raipur-Vizianagram branch of the Bengal-Nāgpur Railway run through the area.

Camp headquarters was at Mahāsamund throughout the season.

Camp (3).—Mr. M. A. Khan (Class II) assisted by Mr. K. C. Gosain (Class II) and 10 surveyors, including 4 under training, carried out the original survey of 1,657 square miles in sheet 64 K falling in Raipur and Bilāspur districts and Raigarh and Sakti States. The area is mainly gently undulating plains about half open and half covered with patches of jungle and thickly wooded cultivation. The Main Bengal-Nāgpur Railway line and some minor motorable roads run through the west of the area. In the east communications are poor.

Camp headquarters was first at Baloda Bāzār and later at Chāmpa on the Bengal-Nāgpur Railway in sheet 64 J/12.

Triangulation.—Lt. D. E. O. Thackwell, R.E., and Messrs. I. H. Naquvi and G. S. Sidhu (U. S. S.) triangulated 5,476 square miles in sheets 64 L, O & P, in the Angul and Sambalpur districts of Bihār and Orissa, the Bilāspur, and Raipur districts of the Central Provinces and the Ganjām district of Madras, and in Baudh, Gāngpur, Kālāhandi, Patna, Rairākhol, Raigarh, Sakti, Sārangarh and Sonepur States, for detail survey in subsequent seasons. Lt. C. A. Biddle, R.E., and Messrs. N. C. Naug and A. R. Khan (U. S. S.) assisted in the reconnaissance for this triangulation but were unable to complete their work owing to malaria. The country is mainly medium wooded hills, with indifferent communications. The triangulation in 64 O completes a connecting link between the Bilāspur and Sambalpur geodetic meridional series.

Traverse.—443 linear miles, covering about 1,100 square miles were traversed in sheet 64 O in Bilāspur and Sambalpur districts and in Patna, Sārangarh and Sonepur States. The country is mainly gently undulating and open, with patches of jungle.

Nāgpur Air Survey.—Traverser Amar Singh with Traverser Nand Kishore Sharma, temporarily transferred from the Geodetic Branch, traversed 62 linear miles covering about 32 square miles in and about Nāgpur City and Civil Station, and connected this traverse

by triangulation with Geodetic framework. 250 natural objects were fixed by this traverse and "postpointed" on contact prints of air photos supplied by the Indian Air Survey and Transport Ltd. 50 "independent lines" were also measured and their ends postpointed.

Surguja State.—At the request of the Agent to the Governor-General, Eastern States, Lieut. R. H. Sams, B.Sc., R.E. was deputed to demarcate part of the boundary between Srinagar and Rāmpur tappas of Surguja State, which had been in dispute since 1869. Lieut. Sams demarcated this boundary to the satisfaction of both parties to the dispute, and commenced the theodolite traverse. On his departure at the end of December to take over charge of No. 12 Party the traverse was taken over by Lieut. C. A. Biddle, R.E., who completed it.

94. Miscellaneous.—There was a good deal of sickness in the party; as a result general closing of the field was delayed until May 3rd and part of *Camp (1)* did not finish work until May 10th. Weather was good until the latter part of the season when the heat was mitigated only by severe storms which did considerable damage to tents.

95. Recess duties.—There were five fair mapping sections in charge respectively of Messrs. C. T. Hurley, M. A. Khan, K. C. Gosain, G. H. Khan and R. N. Hastir (all Class II) and the 16 sheets surveyed were completed. Mr. G. H. Khan assisted by Mr. G. S. Sidhu, (U. S. S.) also had charge of the computations. The computations of the Nāgpur traverse were completed and sent to the Air Survey Company by the end of May and the remaining computations were completed by the end of recess.

No. 12 Party.

Officer in charge.—{Lt.-Colonel E. O. Wheeler, M.C., R.E., to 30-12-34.
{Lieut. (Captain) R. H. Sams, B.Sc., R.E., from 31-12-34.

96. General.—The survey operations of the party for this season were carried on the ½-inch scale in the Lushai Hills district and Manipur State of Assam, the Chin Hills district of Burma and Chittagong Hill Tracts of Bengal, in sheets 84 A, B and E.

Triangulation and traverse for future survey were carried out in the Chittagong district and Chittagong Hill Tracts of Bengal and in the Arakan Hill Tracts and Akyab district of Burma, in sheets 84 B and C.

The field headquarters of the party opened at Rāngāmāti on the 6th November 1934 and closed on 16th April 1935.

Personnel.—The strength of the party was 1 Class I, 3 Class II, 5 Upper Subordinate officers and 38 Lower Subordinates including 31 surveyors.

97. Areas surveyed.—

5,879 square miles of ½-inch original survey in sheets 84 A, B and E.

3,746 square miles of triangulation for ½-inch survey in sheet 84 C.

378 square miles of traversing in sheet 84 B.

The triangulation was connected to the Burma Coast G. T. Series, and the traverse with previous triangulation carried out by the party.

98. Field work was organised as follows.—

Camp (1) under Mr. F. J. Grice (Class II), with Mr. G. C. Aggarwala (U. S. S.) up to end of January, and 10 surveyors completed 2,184 square miles of original survey on the ½-inch scale in sheet 84 E.

Camp (2) under Mr. J. C. Berry (Class II) with Mr. O. P. Anand (U. S. S.) and 11 surveyors completed 1,664 square miles of original survey on the ½-inch scale in sheets 84 A and B.

Camp (3) under Mr. K. L. Dhawan (Class II), with Mr. G. C. Aggarwala (U. S. S.) from end of January, and 10 surveyors completed 1,636 square miles on the ½-inch scale in 84 A/NE and SE up to the end of January. The camp was then transferred to 84 A/SW where an area of 414 square miles of original survey on the ½-inch scale was completed. Blue prints of the outline only, from old style Assam 1-inch sheets surveyed in 1899-1901, were utilised in sheets 84 A/NE and SE, and were of considerable help in the survey of these sheets.

Triangulation.—Messrs. Hari Singh and S. K. Guha (both U. S. S.) and surveyor S. N. Sharma completed the triangulation for ½-inch survey of 3,746 square miles in sheet 84 C.

Traverse.—In the flat and wooded area of sheet 84 B, the previous triangulation was supplemented by traversing, with the object also of testing the possibility of using the existing revenue surveys of this area for revision survey on the 1-inch scale next season.

Traversing of 169 linear miles was carried out for the control of detail survey on the 1-inch scale of 378 square miles in sheets 84 B/2, 3 and 4.

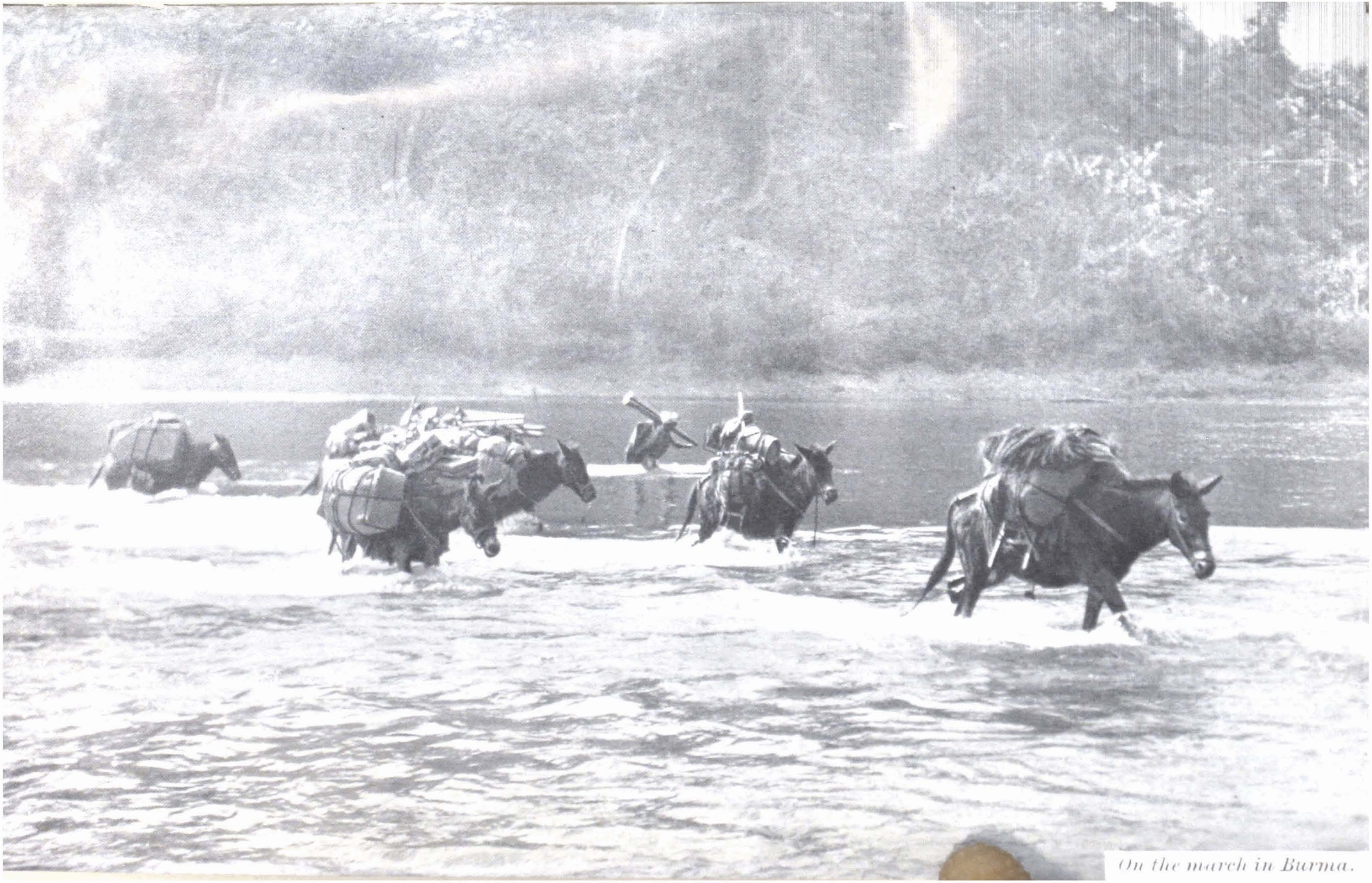
99. Description of Country.—The area surveyed in *Camps (1)* and *(2)* and that surveyed in *Camp (3)* up to the end of January fell mainly in the Lushai Hills of Assam, a small portion in the east being in the Chin Hills of Burma.

The area consists mostly of steep hills and deep valleys. The general formation of the ridges, which are a distinct feature due to their regularity, runs mainly north and south.

The whole area is covered with dense jungle and communications are therefore limited. The main communication, mule tracks and footpaths, follow the crests of the ridges, thereby connecting the villages, which the Lushais almost always locate on a hill top. This custom, formerly a defensive measure against tribal raids, is still maintained, as water is always obtainable from springs near the crests of the ridges and the malaria ridden jungles in the lower valleys are avoided.

Cultivation is carried out mainly by the system of *jhūming*, which consists of disforesting patches of hill side for planting crops. This fact added greatly to the speed of survey in *Camps (1)* and *(3)*, where *jhūm* cultivation was extensive. The area of *Camp (2)* in the Lungleh subdivision, and the second area taken up by *Camp (3)*, contained fewer *jhūms* due to there being few villages, and the features were not so bold, and more intricate. The difficulty of obtaining fixings by resection and the necessity for considerable plane-table traversing in heavy jungle made progress in this area much slower.

Party headquarters at Rāngāmāti, Chittagong Hill Tracts.



On the march in Burma.

100. Miscellaneous.—

Health.—On the whole there was little sickness in the party, due to the healthy climate of the Lushai Hills during the winter months, and the freedom from disease and malaria among the Lushais.

Mr. N. C. Roy (U. S. S.) fell sick with enteric and a computer employed in traversing contracted pneumonia, both at the commencement of the field season, and were invalided from the area. One khalasi died of pneumonia. There were no other casualties or sickness of a serious nature.

Weather.—Throughout the season the weather remained very fair. The haze due to *jhūm* burning hampered the triangulation towards the latter part of the season. Occasional sharp storms occurred towards the end of the season but due to an early return to recess the worst of these were avoided.

Fauna.—Game of any sort is now comparatively rare in the Lushai Hills, due to the inhabitants themselves being keen on *shikar*, and lately having acquired considerable quantities of sporting arms. Pheasant, jungle fowl and imperial pigeon were seen.

Sambhur, barking deer, wild bear, bison, panther, tiger and elephant still exist however and are more numerous towards the south and sparsely populated areas of the district.

101. Recess Duties.—The party was organised in three drawing sections under Messrs. F. J. Grice, J. C. Berry and K. L. Dhawan (all Class II).

The five sheets on the $\frac{1}{2}$-inch scale surveyed during the field season as well as four sheets on the $\frac{1}{2}$-inch scale compiled from their component 1-inch sheets surveyed in seasons 1932-33 and 1933-34 were fair-mapped.

The computations for the triangulation and traverse carried out during the field season were completed by the end of recess.

VIII.—SURVEY REPORTS, INDEPENDENT PARTIES.

102. Nos. 6 (South India) and 10 (Burma) Independent Parties were administered directly by the Surveyor General. Their mapping and survey areas were approximately the same as those of the former Southern and Burma Circles respectively, abolished in 1932.

No. 6 (South India) Party.

Officer in charge.— { Major W. J. Norman, M.C., R.E., to 3-8-35.
Mr. B T. Wyatt, V.D., from 4-8-35.

103. General.—The party continued the 1-inch survey of the Ganjām and Vizagapatam Districts of Madras. A small area of correction survey was carried out in Nayāgarh State of the Eastern States Agency and Puri District of Bihār and Orissa. The area surveyed by this party now joins up on the East Coast with that surveyed by the Eastern Circle.

Triangulation in advance for subsequent survey on the 1-inch scale was carried out in the Ganjām and Vizagapatam Districts of Madras and in Bastar and Kālahandi States of the Eastern States Agency.

Field head-quarters opened at Gopālpur on 20th November 1934 and closed on 11th May 1935.

In addition to the field work, a permanent drawing section was employed on compiled mapping and colour patterns in Bangalore.

The party was inspected in recess by the Surveyor General and in the field by the Director, Eastern Circle.

104. Personnel.—The strength of the party was 1 Class I, 5 Class II, 8 Upper Subordinate officers and 63 Lower Subordinates.

Mr. Drake (Class II) proceeded on leave in April.

105. Areas surveyed.—

4,483 square miles of 1-inch original survey.
392 square miles of 1-inch supplementary survey.
54 square miles of 1-inch correction survey.
6,734 square miles of triangulation for subsequent 1-inch survey.

106. Field work was organized as follows:—

Camp (1).—Mr. Nangia (Class II) with 7 to 8 surveyors completed 1,119 square miles in sheets 74 A/1, 5, 9 & 13.

Camp (2).—Mr. Wyatt, V.D., (Class II) with 12 surveyors completed 1,120 square miles in sheets 74 A/2, 6, 10 & 14. Owing to the late return from leave of Mr. Wyatt, this camp was divided at the start of the field season between Mr. Thomas (Class II) and Mr. Muthanna (U. S. S.).

Camp (3).—Mr. Drake, D.C.M., (Class II) with 8 to 12 surveyors completed 1,107 square miles in sheets 74 A/3, 7, 11 & 15. When Mr. Drake went on leave in April, Mr. Thomas took charge of this camp.

Camp (4).—Mr. Nair (Class II) with 7 to 8 surveyors surveyed 901 square miles in sheets 74 A/4, 8, 12 & 16.

Camp (5).—Mr. Azim, I.D.S.M., (U. S. S.) with 5 to 8 surveyors completed 682 square miles in sheets 74 B/1, 5 & 9.

Triangulation.—Messrs. Murti Rao, Mustafa, Shamanna, Fernandez, Faruquie (U. S. S.) and Surveyor Narasinga Rao triangulated 6,734 square miles in sheets 65 I & M.

107. The health of the party was again bad and during the latter half of the field season nearly all its members suffered from recurring attacks of malaria fever. It is possible to avoid infection by living in a mosquito-net room in a bungalow between sunset and sunrise, but this being impracticable for the members of a survey party it is nearly impossible to prevent the spread of the fever. The use of *Atebrin* and *Plasmoquine* has helped surveyors to recover quickly from attacks and has possibly reduced somewhat the incidence of the disease.

108. Recess duties.—The nineteen 1-inch sheets of the current programme were mapped during the recess by five sections under Messrs. Wyatt, Nangia, Nair, Thomas and Azim.

The permanent drawing section under Mr. Natesan (Class II) was employed at Bangalore throughout the year on ½-inch and ¼-inch compiled mapping and colour patterns, of which there are now no arrears. An effort is being made to complete both the ½-inch and ¼-inch compiled mapping within one year of the completion of the 1-inch original mapping, which has been successful in the case of 65 O. This constitutes a saving of 3 or 4 years over the time normally taken, and it is hoped that the improvement may be maintained.

No. 10 (Burma) Party.

Officer in charge.—{Mr. J. McCraken, M.B.E., to 31-10-34.
Lt.-Col. F. B. Scott, I.A., from 1-11-34.

109. General.—The party continued surveys on the 1-inch and ½-inch scales in Upper Burma, Assam and Bengal. The field headquarters opened at Pakokku on 19th November and closed on 4th April.

110. Personnel.—The field strength was one Class I, 3 Class II and 5 U. S. officers and 40 Lower Subordinates.

In addition a Drawing Section consisting of 10 draftsmen and 1 computer, in charge of one Class II officer, remained in Maymyo to carry on the compiled mapping of the party.

Mr. C. S. McInnes, (Class II) was posted to the Party on return from leave from the 25th October.

Mr. J. McCraken, M.B.E., (Class II) was transferred to No. 5 Drawing Office, Shillong on the 23rd December.

111. Areas surveyed.—

6,116 square miles of triangulation for 1-inch detail survey;
200 square miles of supplementary triangulation for 1-inch detail survey;
119 linear miles of traversing;
8,241 square miles of ½-inch original survey;
1,985 square miles of 1-inch original survey;

112. Field work was organised as follows:—

Camp (1).—Mr. F. W. Smith (Class II) with 9 surveyors completed the ½-inch original survey of 3,308 square miles in sheets 84 F/SW & SE and 84 G/NW, in the Chin Hills district and the Arakan Hill Tracts of Burma and the Lushai Hills district of Assam. The country surveyed consists of steep hills rising to 8,000 feet above sea-level, partly open and partly wooded. Communications are poor.

Camp (2).—Mr. C. P. E. Davenport (Class II), with 8 surveyors completed the ½-inch original survey of 3,323 square miles in sheets 84 G/NE, SW & SE in the Akyab, Chin Hills and Pakokku districts and the Arakan Hill Tracts of Burma. The country surveyed consists of steep hills rising to over 10,000 feet above sea-level, partly open and partly wooded. Communications are poor.

Camp (3).—Mr. D. N. Saha (Class II), with 11 surveyors completed the 1-inch original survey of 1,429 square miles in sheets 84 D/1, 5, 6, 9, 10, 13 and 14 in the Akyab district of Burma and the Chittagong district of Bengal. The country surveyed consists of low densely wooded ridges with flat cultivated land between them. Communications are good.

Camp (4).—Mr. A. K. Sen Gupta (U. S. S.) with 9 surveyors completed the 1-inch original survey of 556 square miles in sheets 84 H/1 and 2 and ½-inch original survey of 1,609 square miles in sheets 84 H/NW & NE, in the Akyab, Chin Hills and Minbu districts and the Arakan Hill Tracts of Burma. The country surveyed on the 1-inch scale consists of low intricate wooded hills and open cultivated plains. Communications are good. The ½-inch area consists of densely wooded hills rising to nearly 6,000 feet above sea-level. Communications are poor.

Triangulation.—Messrs. Khan Muhammad, H. K. Kar, A. K. Talapatra, and surveyor Iqbal Muhammad completed the triangulation of 6,116 square miles in sheets 93 B/4, 93 C and 93 D/NW & NE, in the Kyaukse, Mandalay, Meiktila, Sagaing and Yamethin districts and the Northern and Southern Shan States.

Mr. Sen Gupta completed the supplementary triangulation of 200 square miles in the Akyab district.

113. Recess duties.—Fair mapping was divided into two sections under Mr. F. W. Smith assisted by Mr. D. N. Saha and Mr. C. P. E. Davenport assisted by Mr. A. K. Sen Gupta, and the computing section was in charge of Mr. Davenport assisted by Mr. Khan Muhammad. All surveys were fair mapped on the appropriate scales during the year. The Drawing Section, under Mr. C. S. McInnes, carried out compiled mapping throughout the year.

IX.—MISCELLANEOUS SURVEY REPORTS.

No. 15 Party (Triangulation and Levelling).

Officer in charge.—{Captain G. Bomford, R.E., up to 28-10-34.
Major G. H. Osmaston, M.C., R.E., from 29-10-34.

114. Other work done by this party is described in paras. 39 and 40.

115. *Levelling for the protection of the Hardinge Bridge.*—364 miles of secondary, 311 miles of double tertiary, and 3,056 miles of single tertiary levelling were carried out by this party for the Eastern Bengal Railway in Pābna and adjoining districts.

The work was paid for by the Railway Department.

PART 4.—MAP PUBLICATION AND OFFICE WORK.

From 1st April 1934 to 31st March 1935.

X.—INTRODUCTION AND PERSONNEL.

116. Index maps C to G, at the end of this Report, form the most important adjunct to *Part 4*, as they show the progress of publication to date for all standard series of modern maps, excluding transfrontier work.

117. Letter press.—Apart from *Sections X* (Introduction) and *XIV* (the annual report of the Mathematical Instrument Office), *Part 4* is divided into three main Sections:—

Section XI shows all publications and map issues for the year.

Section XII shows all the fair drawing, whether completed for publication or still in hand, carried out by the various drawing offices and field parties.

Section XIII describes the work of the printing and miscellaneous offices, excluding that of the Computing and Tidal Party, whose work is of a geodetic character and is published in full in the annual Geodetic Report.

118. Personnel.—

Calcutta. Director, Map Publication.

Lt.-Col. F. J. M. King, R.E.

Chief Draftsman—Mr. Amar Krishna Mitra, R.S., to 11-6-34 and from 24-10-34 to 3-2-35.
,, ,, ,, F. H. Grant, from 12-6-34 to 23-10-34 and from 4-2-35.

No. 1 Drawing Office.

O.C. Mr. L. Williams, M.B.E., to 3-2-35.
,, ,, Amar Krishna Mitra, R.S., from 4-2-35.
II ,, F. H. Grant, to 11-6-34 and from 24-10-34 to 3-2-35.
,, ,, P. C. Mitra, B.A., from 1-10-34.
,, ,, J. C. St. C. Pollett, V.D.
,, ,, A. F. Murphy.
,, ,, Dhirendra Nath Banarji, L.C.E.
,, ,, Bhupendra Nath Saha, M.SC.
,, ,, Abdul Rashid Quraishi, B.A., to 31-10-34.
U.S. ,, Kodandera Ganapathy Mandanna.
,, ,, Girija Sonker Bagchi.
,, ,, Atul Chandra Maulick.
,, ,, Suresh Chandra Chatterjee, B.SC., from 1-5-34.
,, ,, Nirmal Chandra Sen, B.COM.

Engraving Office.

Mr. A. R. J. Dalziel, Head Engraver.
,, F. E. Selfe, *Asstt.* ,, ,, from 21-10-34.

Photo.-Litho. Office.

O.C. Major G. W. Gemmell, I.A., to 10-10-34.
,, Captain G. F. Heaney, R.E., from 11-10-34.

Managers & Assistant Managers.

Mr. S. Colquhoun, Manager, Litho.
,, L. H. Mordue, Offg. Manager, Photo. to 26-10-34.
,, F. R. Vandyke, ,, Photo. from 27-10-34.
,, K. L. Dev, *Asstt.* ,, Litho. to 26-10-34.
,, L. H. Mordue, ,, ,, Litho. from 27-10-34.
,, L. J. Vallis, Offg. ,, ,, Photo. to 26-10-34.
,, K. L. Dev, ,, ,, Photo. from 27-10-34.

Map Record and Issue Office.

O.C. Mr. E. A. Meyer, to 4-2-35 and from 5-3-35.
,, ,, F. H. Grant, from 5-2-35 to 4-3-35.

Mathematical Instrument Office.

Mr. S. Woodhouse, Superintendent in charge.
,, R. C. Malcolm, F.R.M.S., F.R.MET. SOC., Asstt. Supdt.
,, A. Lacamp, Asstt. Supdt.

Dehra Dūn. Director, Geodetic Branch.

Col. C. G. Lewis, O.B.E., to 21-6-34 and from 21-10-34.

Lt.-Col. C. M. Thompson, I.A., from 22-6-34 to 20-10-34.

No. 2 Drawing Office.

O.C. Mr. V. W. Morton.
II ,, Moquimuddin Ansari, B.A.
,, ,, N. S. Harihara Iyer.
U.S. ,, A. A. S. Matlub Ahmad. from 7-6-34 to 15-9-34.
,, ,, Abdul Ghani Qureshi.
,, ,, N. M. Bopaiah, from 23-2-34 to 31-12-34.

Forest Map Office.

C.D. Mr. F. C. Pilcher.
U.S. ,, B. B. Shome, from 11-4-34.

Computing & Tidal Party.

O.C. Captain G. Bomford, R.E., to 12-10-34 and from 14-12-34.
,, Lt.-Col. E. A. Glennie, D.S.O., R.E., from 13-10-34 to 13-12-34.

Photo.-Zinco. Section.

Mr. S. C. Aratoon.

Letterpress Printing Section.

Mr. H. H. Williams.

Simla. Director, Frontier Circle.

Colonel S. W. Sackville Hamilton, D.S.O.

No. 6 Drawing Office.

O.C. Lt.-Col. C. M. Thompson, I.A., to 26-4-34 and from 25-10-34.
,, Lieut. R. H. Sams, B.Sc., R.E., from 27-4-34 to 3-10-34.
,, Col. S. W. Sackville Hamilton, D.S.O., from 4-10-34 to 24-10-34.

SURVEY SECTION.

II Mr. Duni Chand Puri.
,, ,, W. H. Strong, M.B.E., from 8-1-35 to 10-2-35.
,, ,, Chowdhuri Mohd. Aslam, B.A.
,, ,, B. N. Murthy, B.Sc., from 24-9-34.
U.S. ,, H. Narasimha Murti Rao, B.A., to 21-10-34.
,, ,, Ghulam Hasan.
,, ,, Lalbir Singh, C.H., to 24-9-34.

ARMY SECTION.

Captain T. A. Whitmarsh.

Shillong. Director, Eastern Circle.

Colonel J. D. Campbell, D.S.O., to 5-5-34 and from 12-11-34.

Lt.-Col. C. M. Thompson, I.A., from 6-5-34 to 14-6-34.

Major L. H. Jackson, I.A., from 15-6-34 to 11-11-34.

No. 5 Drawing Office.

O.C. Mr. P. Simpson, to 1-1-35 and again from 14-3-35.
,, ,, J. McCraken, M.B.E., from 2-1-35 to 13-3-35.
II ,, P. C. Mitra, B.A., to 30-9-34.
,, ,, B. T. Wyatt, V.D., to 15-7-34.
,, ,, A. R. Quraishi, B.A., from 1-11-34.
U.S. ,, P. C. Sen Gupta, B.Sc., to 13-12-34.
,, ,, Janam Raj Chibbar, to 23-9-34.
,, ,, Muhammad Muzaffar Shah.

Bangalore. No. 6 (South India) Party.

O.C. Major W. J. Norman, M.C., R.E.
II Mr. A. J. A. Drake, D.C.M.
,, ,, B. T. Wyatt, V.D., from 17-1-35.
,, ,, E. N. Natesan, B.A.
,, ,, M. D. Nangia, B.A.
,, ,, M. R. Nair, B.A.
,, ,, P. A. Thomas, from 20-8-34.
U.S. ,, H. Narasimha Murti Rao, B.A., from 22-10-34.
,, ,, Mohabat Lal Kohli, from 2-12-34.
,, ,, Muhammad Abdul Azim, I.D.S.M.
,, ,, K. B. Muthanna.
,, ,, Muhammad Mustafa.
,, ,, A. Shamanna.
,, ,, C. H. Fernandez.
,, ,, Mohd. Amir Faruquie, B.A.

Maymyo. No. 10 (Burma) Party.

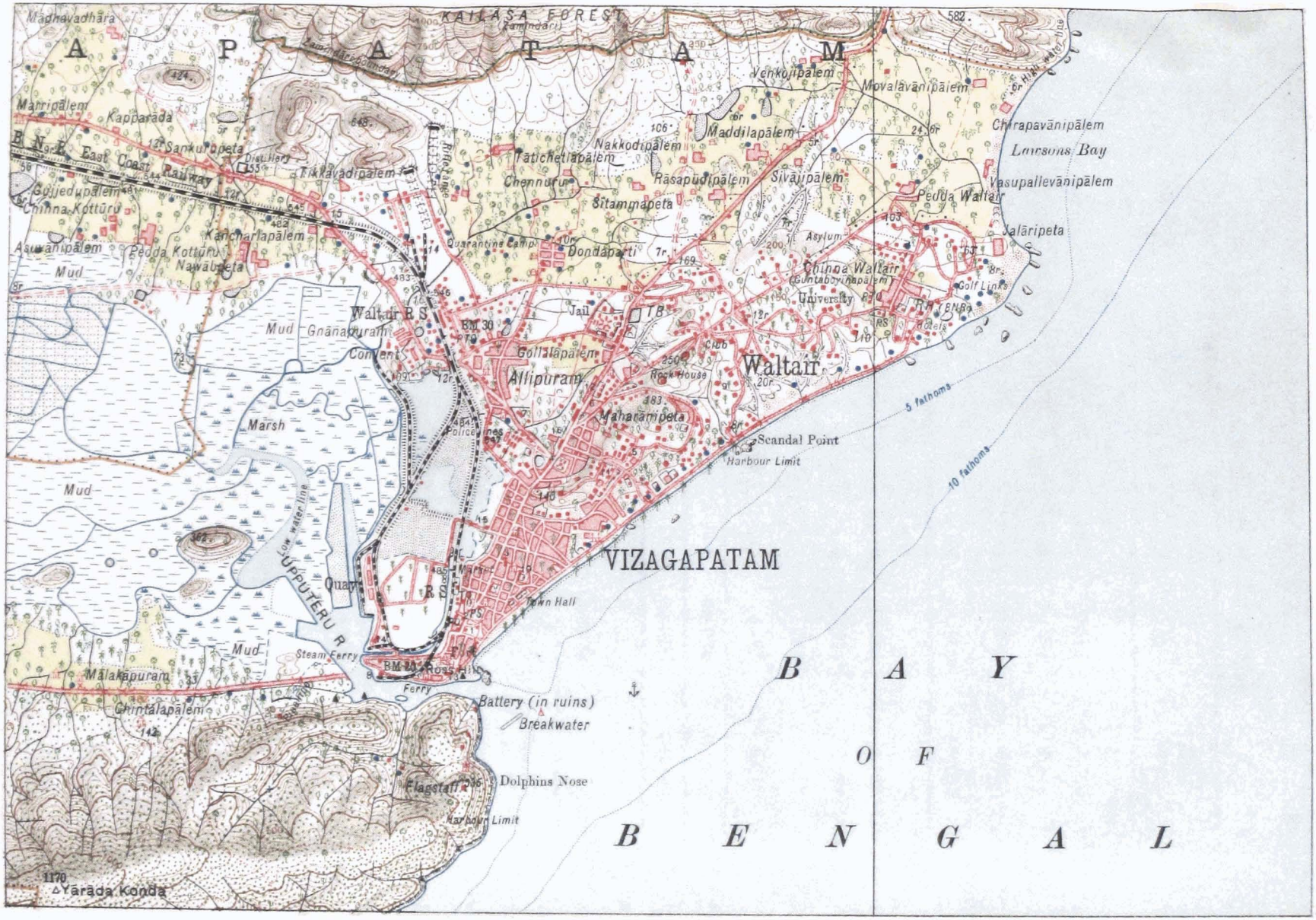
O.C. Lt.-Col. F. B. Scott, I.A., from 1-11-34.
,, Major L. H. Jackson, I.A., to 2-6-34.
,, Mr. J. McCraken, M.B.E., from 3-6-34 to 31-10-34.
II ,, J. McCraken, M.B.E., to 22-12-34.
,, ,, F. W. Smith.
,, ,, C. S. McInnes, from 25-10-34.
,, ,, C. P. E. Davenport.
,, ,, D. N. Saha.
U.S. ,, Khan Muhammad, C.H.
,, ,, A. K. Sen Gupta.
,, ,, H. K. Kar.
,, ,, A. K. Talapatra.
,, ,, U. On Ba.

XI.—PUBLICATIONS AND ISSUES.

119. Publications.—The publications of the Department for the year are shown in the following three tables, of which Table I shows map publications at the various presses, Table II shows the progress made in publication of modern topographical maps, and Table III shows the more important letterpress publications.

Table I *(a)*—Maps published at Calcutta, during the year 1934-35.

Class of maps.	Scale.	New publications.	Revised editions, new editions and reprints.	Number of copies printed.	Value. Rs.
		Departmental.			
GENERAL MAPS.					
Maps of India	Various	1	4	8,788	10,009
GEOGRAPHICAL MAPS.					
Southern Asia Series ...	1:2 million	3	...	1,820	3,640
India and Adjacent Countries Series	1:1 million	2	14	8,390	13,054
Carte Internationale du Monde	1:1 million	...	3	970	1,940
TOPOGRAPHICAL MAPS.					
Quarter-inch, Modern ...	1″= 4 miles	19	35	29,605	45,905
,, (Prely.) ...	Ditto	...	3	1,065	1,660
,, (Provl.) ...	Ditto	...	8	2,066	2,184
Half-inch, Modern ...	1″=2 miles	46	27	41,519	84,595
One-inch, Modern ...	1″=1 mile	119	91	127,988	1,98,126
,, (Prely.) ...	Ditto	3	6	3,974	6,245
,, (Provl.) ...	Ditto	...	4	1,863	2,116
Old style maps	Various	...	9	1,622	2,518
SPECIAL MAPS.					
Manœuvre and Radius maps ...	Various	1	5	4,952	11,475
Provincial maps	Ditto	...	4	2,135	5,278
City & Town Guide maps ...	Ditto	2	3	5,098	15,372
Index maps	Ditto	1	88	52,744	5,789
Miscellaneous maps ...	Ditto	27	15	29,054	6,217
Total ...	.....	**224**	**319**	**323,653**	**4,16,103**
		Extra-departmental.			
Maps	Various	120	18	95,588	22,275
Plans and diagrams ...	Ditto	61	2	37,600	2,652
Illustrations	.....	145	2	60,240	8,756
Miscellaneous	.....	26	17	78,785	4,378
Total ...	.....	**352**	**39**	**272,208**	**38,061**
Grand Total ...	.....	**576**	**358**	**595,861**	**4,54,164**



Portion of 1-inch Sheet, 1935.

Table I *(b)*—Maps published at Dehra Dun.

Class of maps.	Scale.	New publications.	Reprints and new editions.	Number of copies printed.	Value. Rs.
		Departmental.			
Cantonment maps ...	Various	23	6	5,677	4,530
Forest maps ...	,,	...	30	1,650	2,698
Miscellaneous ...	,,	59	16	26,732	8,309
Total ...	...	**82**	**52**	**34,059**	**15,532**
		Extra-departmental.			
Maps	Various	106	2	19,031	18,518
Plans and diagrams ...	,,	13	4	5,385	1,329
Charts	,,	1	1	250	114
Forest maps ...	,,	38	...	2,128	6,371
Total ...	...	**158**	**7**	**26,794**	**21,332**
Grand Total ...	...	**240**	**59**	**60,853**	**36,864**

Table I *(c)*—Maps published at Quetta.

Class of maps.	Scale.	New publications.	Reprints and new editions.	Number of copies printed.	Value. Rs.
		Departmental.			
Maps	Various	85	9	817	2,684
Plans and diagrams ...	,,	8	...	21	27
Charts / Forms	,,	15	7	5,033	471
Total ...	...	**108**	**16**	**5,871**	**3,182**
		Extra-departmental.			
Maps	Various	17	11	4,901	1,550
Plans and diagrams ...	,,	84	4	2,170	632
Charts / Forms	,,	11	2	1,993	723
Total ...	...	**112**	**17**	**9,064**	**2,905**
Grand Total ...	...	**220**	**33**	**14,935**	**6,087**

Table I *(d)*—Maps published at Murree and Risalpur Cantonment.

Class of maps.	Scale.	New publications.	Reprints and new editions.	Number of copies printed.	Value. Rs.
	Departmental.				
Maps	Various	...	...	1,639	3,811
Plans and diagrams ...	,,	...	...	157	170
Charts / Forms	,,	...	...	6,859	358
Total ...	...	...	...	**8,655**	**4,339**
	Extra-departmental.				
Maps	Various	...	...	1,932	654
Plans and diagrams ...	,,	...	...	2,116	249
Total ...	...	...	...	**4,048**	**903**
Grand Total ...	...	...	...	**12,703**	**5,242**

Table II.—Abstract of Modern Topographical Maps.

	One-inch maps.	Half-inch maps.	Quarter-inch maps.
Topographical maps published in 1934-35	119	46	19
Do. do. published in previous years	3,449	987	829
Total published ...	**3,568**	**1,033**	**348**
Number of sheets in India ...	**6,218**	**1,630**	**450**

NOTES.—

Calcutta.—In addition to the work shown in Table I(*a*), 103,254 copies of 320 maps were gridded during the year.

Dehra Dūn.—In addition to the work shown in Table I(*b*), 3,543 prints of 639 originals, consisting of plane-table sections, triangulation charts and pamphlets, and forest maps were printed.

Table III.—Letterpress publications.

(a) PUBLISHED AT CALCUTTA.

1. **General Report** of the Survey of India, 1933-34. (450).*
2. Confidential Supplement to the Survey of India General Report, 1933-34. (125).
3. Survey of India Notes,—issued monthly. (2 550).
4. List of Maps Published,—issued monthly. (4,400).

* Numbers in brackets after each item denote the number of copies printed.

Table III *(Concld.)*.

(a) PUBLISHED AT CALCUTTA.—*Concld.*

5. List of F. O. U. O. Maps Published,—issued quarterly. (2,000).
6. Government of India and Circular Orders. (1,750).
7. Addenda and Corrigenda to Regulations on the Subject of Language Examinations applicable to the Officers of the Survey of India, 1914. (250).
8. Alphabetical Index to Names for the 1933 Edition of the Calcutta-Howrah Guide Map. (1,500).
9. Correction slips to Handbooks of Topography, Border Specimen, Map Catalogue, &c. (21,674).
10. Miscellaneous. (3,272).
11. Calendars for 1935. (1,650).

(b) In hand at Calcutta.

1. *Handbook of Topography Chapter V (4th Edition).*
2. *Ditto ditto Chapter VI (7th Edition).*
3. *Index to Annual Reports of the Survey of India, 1904-05 to 1926-27 compiled by Lt.-Col. A. H. Gwyn, I.A.*
4. *Correction slips to Handbooks of Topography, Conventional Signs, &c.*
5. *Miscellaneous.*

(c) PUBLISHED AT DEHRA DŪN.

1. Geodetic Report, 1933. (350).*
2. Levelling Pamphlet No. 40. (100).
3. Addenda to Levelling Pamphlets 45 and 53. (365).
4. Addenda to Triangulation Pamphlets. (960).
5. Addendum to Auxiliary Tables V. (200).
6. Tide Tables for the Indian Ocean, 1935. (1,400).
7. Tide Tables, Hooghly River, 1935. (150).
8. Do. Hooghly River (Signals, lights, &c.), 1935. (800).
9. Do. Rangoon, 1935. (850).
10. Do. Bombay, 1935. (900).
11. Record Volume No. XXV (Surveys in Swāt, Chitrāl and Gilgit) and its Supplement. (310).
12. Handbook of Topography Chapter VII, Transfrontier Reconnaissance. (330).
13. Secondary Levelling Pamphlets, gestetnered. (210).
14. Triangulation Pamphlets. (700).
15. Annual Provision and Maintenance Returns of 312 districts. (7,800).
16. Lists of Bench Marks. (14).
17. Correction slips to Handbooks and Pamphlets, &c. (6,475).
18. Miscellaneous. (255,363).

(d) In hand at Dehra Dūn.

1. *Geodetic Report, 1934. (350).*
2. *Tide Tables for the Indian Ocean, 1936. (1,200).*
3. *Handbook of Topography Chapter II (Constitution and Organisation of a Survey Party). (330).*
4. *Addenda to Levelling Pamphlet 93. (120).*
5. *Annual Provision and Maintenance Returns of 12 districts. (300).*
6. *Triangulation Pamphlets. (300).*
7. *Lists of Bench Marks. (2).*

120. Map Issues.—From Table IV below it will be seen that the total sales by the entire Department during the year were 445,617 copies, valued at Rs. 2,29,865, as against 570,331 copies valued at Rs. 2,36,324 sold during the previous year.

*Numbers in brackets after each item denote the number of copies printed.

The Map Record and Issue Office's total departmental sales were 129,745 copies valued at Rs. 1,45,567. This represents a decrease of 746 copies on the previous year's figures.

The total number of extra-departmental maps issued by the Map Record and Issue Office was 265,815 or 117,451 copies less than last year. Of this number, Government Departments, including the Army and the Royal Air Force, purchased 153,460 copies less than last year. The sales of these maps to the general public, however, increased by 36,009 copies.

The number of maps transferred to the High Commissioner for India and the Circle Offices for stock and issue were 44,803 copies, value Rs. 65,328.

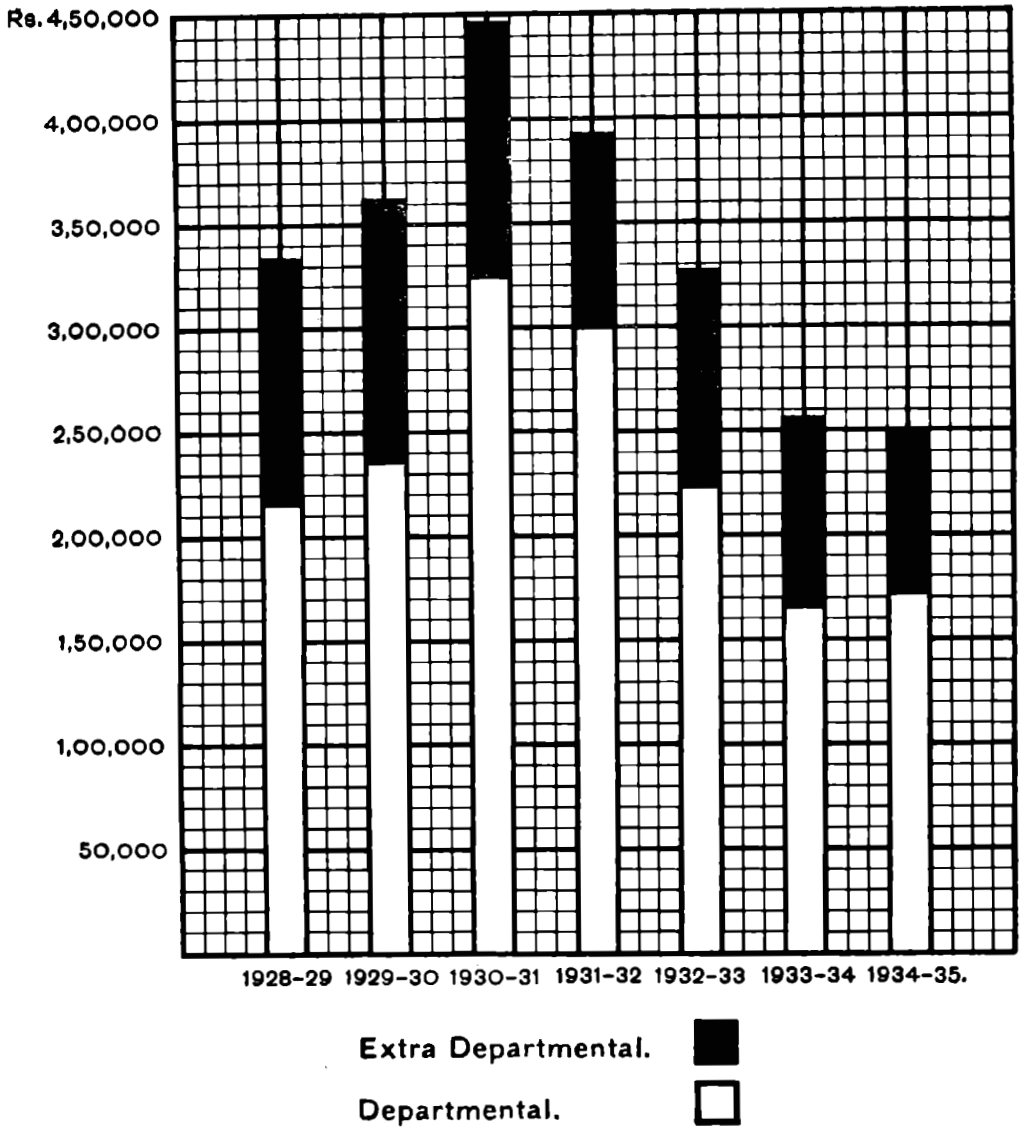
Table IV.—Maps issued by Survey units.

D=Departmental. X=Extra-departmental.		SALES.								FREE ISSUES.
		Government Officials.		Army and Royal Air Force.		Public.		Total.		
		Number of copies.	Sale Value. Rs.	Number of copies.	Sale Value. Rs.	Number of copies.	Sale Value. Rs.	Number of copies.	Sale Value. Rs.	Number of copies.
Calcutta	D*	22,025	27,402	75,930	75,131	31,790	43,034	129,745	1,45,567	14,469
	X	152,828	22,419	14,786	4,664	98,201	10,346	265,815	37,429	2,408
Dehra Dūn	D	3,121	7,023	8,345	5,033	799	1,342	12,265	13,398	7,376
	X	18,721	14,094	849	650	5,550	6,182	25,120	20,926	97
Simla	D	148	278	.....	.....	231	406	379	684	684
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Murree or Ferozepore ("A" Company)	D	4	9	98	142	13	22	115	173	.....
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Quetta ("E" Company)	D	485	747	3,936	4,872	71	108	4,492	5,727	96
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Risalpur Cantonment (No. 18 Party)	D	.....	.....	.....	.....	.....	.....	.....	.....	8,658
	X	.....	.....	4,048	903	.....	.....	4,048	903	.....
Bangalore	D	760	1,269	768	814	728	1,126	2,256	3,209	193
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shillong	D	202	351	50	47	132	282	384	650	2,294
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Maymyo	D	116	208	549	489	333	502	998	1,199	659
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Totals	...	198,410	73,800	109,359	92,745	137,848	63,320	445,617	2,29,865	38,921

In addition to above, 44,803 copies of maps, value Rs. 65,328, were issued by the Map Office, Calcutta, to the High Commissioner for India, and the Survey Circles and Parties, for stock and sale.

PROGRESS OF MAP SALES

1928—35.



The above diagram represents the aggregate sales of the whole Department.

121. Map Record and Issue Office.—The volume of work in the Map Record and Issue Office has remained constant. Against 15,423 letters received in 1932 and 15,414, in 1933, 15,434 were received in 1934.

Excluding the value of maps held by the Circle Offices, the approximate value of the Map Record and Issue Office stock on 31-3-35, including those stocked in the Branch Office, Calcutta, was Rs. 34,93,601.

The physical verification of stock carried out at frequent intervals throughout the year by the Officer in Charge is now recorded in a "Stock Verification Register". This register was opened in January 1934 and reveals discrepancies averaging only to a decimal point.

All receipts were brought to account at Catalogue prices. No revaluation took place of stocks already in hand.

21,921 superseded copies of 194 different maps were removed from stock, of which 1,973 copies were sold at a nominal value to the Bengal and the Bihār and Orissa Drawing Offices for departmental use; the remaining copies were scrapped.

As in past years, the Army still continues to top the list of purchasers. From a classification of issues, it is found that the percentages of departmental sales roughly work out as below :—

ARMY	...	...	...	58½ %
PUBLIC	...	...	...	24½ %
OTHER GOVT. DEPTS.		...	...	17 %

Table V. Stock of Maps. This table gives the stock of maps as it stood on 31st March 1935.

Class of maps.	CALCUTTA.				DEHRA DÜN.		SHILLONG.		SIMLA.		FEROZEPORE AND MURREE.		QUETTA.		MAYMYO.		BANGALORE.		
	M. R. I. O.		BRANCH AGENCY.																
	Number of copies in stock.	Present Face Value Rs.	Number of copies in stock.	Present Face Value Rs.	Number of copies in stock.	Present Face Value Rs.	Number of copies in stock.	Present Face Value Rs.	Number of copies in stock.	Present Face Value Rs.	Number of copies in stock.	Present Face Value Rs.	Number of copies in stock.	Present Face Value Rs.	Number of copies in stock.	Present Face Value Rs.	Number of copies in stock.	Present Face Value Rs.	Nu co in
[Southern Asia Series ...	10,397	19,255	19	36	160	320	...	...	54	108	39	83	62	124	...	...	33	67	1
India and Adjacent Countries ...	36,021	58,031	211	346	1,594	2,652	128	192	347	539	144	216	317	475	316	474	454	770	8
Carte Internationale du Monde	3,341	6,943	10	20	121	242	50	100	42	84	12	35	18	36	...	...	47	141	
-inch maps	10,803	31,763	...	...	7,804	16,044	351	623	...	...	...	...	...	...	...	...	...	...	1
inch maps	1,298,341	19,54,380	4,223	6,180	51,240	76,718	25,062	37,143	3,993	6,010	3,825	5,737	2,933	3,450	22,690	33,316	4,911	7,542	1,41
-inch maps	400,335	7,97,654	1,002	1,968	12,354	24,374	6,084	11,967	607	1,219	989	1,972	880	1,760	3,857	7,528	1,401	2,913	42
ter-inch maps	267,697	3,93,146	656	862	7,609	11,105	3,028	4,506	1,138	1,728	871	1,265	1,485	2,228	2,348	3,301	515	720	28
ral maps of India ...	18,048	33,194	78	154	407	512	67	205	68	155	18	56	23	60	3	36	120	234	1
incial and District maps of India	6,154	19,703	23	89	304	761	635	1,045	39	138	11	32	...	...	6	9	63	313	
onment and Town maps (Special d Guide).	53,216	1,32,825	50	119	11,902	23,963	411	855	287	1,713	825	1,250	33	128	113	341	437	966	6
euvre and Radius maps ...	5,939	12,519	10	27	128	281	...	...	14	31	110	193	...	...	181	312	...	...	
ellaneous maps	78,532	34,188	79	150	6,491	7,295	172	128	504	844	17	56	62	124	...	...	31	30	8
TOTALS ...	2,188,824	34,93,601	6,361	9,951	100,114	1,64,267	35,988	56,764	7,093	12,569	6,861	10,895	5,813	8,385	29,514	45,317	8,012	13,696	2,38

XII.—WORK OF DRAWING OFFICES.

122. Tables VI to VIII give an abstract of new maps, reprints and new editions completed for publication, as well as those in hand during the year, for the whole department.

123. No. 1 Drawing Office, Calcutta.—The revised edition of the 32-mile map of India and Adjacent Countries, with details and lettering in bold characters, is making progress. A revised edition of the 50-mile Road Map of India, in an improved form, has been taken in hand.

The new style Province Maps of the Punjab and of the U. P. and Delhi on 1/M scale have been published.

Engraving Office:—New and up to date plant and methods for carrying out erasures and corrections on copper plates have been introduced in the Engraving Office during the year under report.

After cleaning, the plate is silvered with a solution of nitrate of silver. Erasures to be made are then cut out to the depth of the engraving and painted round with bitumen or varnish after which the edges and the back of the plate are coated with wax.

The plate after being cleaned with dilute nitric acid is suspended in a vat of copper sulphate at a distance of about 5 to 6 inches from a pure copper anode and a direct electric current is passed from the anode to the plate.

The energy is supplied by a motor generator which delivers up to 100 amperes at a voltage up to 6.

After about 14 hours running the erasures will have become filled with copper; the plate is then handed to an engraver, who scrapes off the surplus deposit and the plate is then ready for engraving the corrections.

124. No. 2 Drawing Office, Dehra Dūn.—With the object of providing more work for the Photo.-Zinco. Office in Dehra Dūn and of relieving the pressure in No. 1 Drawing Office and the Photo.-Litho. Office in Calcutta, all work in connection with the re-issue of Persia sheets falling in 1/M sheets Nos. 9 and 10 has been transferred to the Geodetic Branch. A new section called the Re-issue Section was created to deal with these sheets.

The 8-mile map of Nepāl mentioned in the report for 1933-34 is still under publication.

Original survey records prior to 1905 beyond the limit of regular survey were received from the Directors Frontier Circle and Eastern Circle and utilized for completion of the 1/M record of exploration surveys.

125. Forest Map Office, Dehra Dūn.—This office, which is maintained by contribution from all Provincial Governments except Assam and Bihār and Orissa, continues to meet all demands from these Governments for forest maps. Its main work is the fair drawing of working plans and new editions for various forest officers and the

upkeep of their office copies. In addition 15 sheets comprising 4-inch enlargements and ½-inch working plans were prepared for the Jawhār and Kashmīr States.

126. Map Record and Business Section, Dehra Dūn.—This section continues to be responsible for the storage, despatch and sales of publications and forms, and the collection of bills for all supplies and extra-departmental work carried out by the Geodetic Branch. It stores all originals of departmental maps published in the Geodetic Branch and of cantonment and forest maps with their published prints, and carries a stock of Survey of India maps for issue within the department and for sale to the public.

127. No. 6 Drawing Office, Simla.

Survey Section.—

(*1*) The examination of party sheets has been particularly heavy this year owing to parties continuing drawing in the winter to complete arrears of mapping.

(*2*) The following work was done in addition to that reported in Tables VI to VIII:—

Indexes.—A large number of miscellaneous indexes were prepared.

General.—(*a*) Frontier Circle records received from parties were arranged and indexed.

(*b*) New registers of triangulation and traverse data are under preparation to facilitate cross references between angle books, charts and volumes.

(*c*) On urgent requisition, 52 one-inch sheets (51 old style and 1 new style) with the corners of the main rectangles marked thereon from the rectangulation data by No. 24 Party in seasons 1926-30 were supplied to the Executive Engineer, Development & Research Division, Irrigation Branch, Karāchi, Sind.

(*d*) The fair originals of sheets 43 C/5, 43 D and Simla Panorama map were corrected and submitted to the Director, Map Publication.

(*e*) The fair originals of Quetta Civil Station corrected by O. C. 'E' Company were examined and submitted to D. G. B.

(*f*) Some drawing and typing of additional information relating to their work was carried out on maps supplied to certain Government departments for conference purposes, etc.

Army Section.—

(*1*) During the past year, the Army Section was employed in the compilation, drawing and reproduction of maps, plans and diagrams for the Army and the various Government departments.

(*2*) As was to be expected, the installation of the new machine printing presses has resulted in a vast increase in output. Full advantage of the machine printing has been taken by all departments of the Government of India, and the draftsmen have been hard pressed to keep pace with the increased demands.

Table VI.—New maps.

Figures in italics denote work in hand.

	TOPOGRAPHICAL.								GEOGRAPHICAL.										GENERAL AND SPECIAL.												ACCESSORY.						MISCELLANEOUS.					
	1-inch.		½-inch.		¼-inch.		⅛-inch.		1/M. Helio.		1/M. Engraved.		Carte Internationale. Helio.		Carte Internationale. Engraved.		1/2 M. Helio.		1/2 M. Engraved.		Guide Map.		District.		Province.		India.		Forest.		Cantonment.		Gridding.		Shading.		Colour Patterns.		Indexes.		Charts.		Various.		Ne
No. 1 Drawing Office including Engraving Office.	6	*2*	...	...	...	*4*	...	...	1(*a*)	3(*a*)	2(*a*)	13(*a*)	...	...	...	10(*b*)	...	2(*c*)	...	2(*c*)	...	...	...	...	2(*d*)	6(*e*)	...	3(*f*)	...	...	...	...	96	...	187	58	93	6	7	...	...	...	13(*g*)	8	3
No. 2 Drawing Office ...	...	5(*h*)	...	...	*1*	*11*	...	3(*i*)	3(*j*)	5(*k*)	...	...	...	...	...	...	...	2	...	...	1 (*l*)	2(*m*)	...	...	...	...	...	...	...	...	...	2	...	...	...	25	...	49	...	19	...	291	1(*n*)	
Geodetic Branch Parties ...	6	5	6	9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6 (*o*)	10(*p*)	...	...	...	...	...	...	...	...	...	...	...	...	
No. 5 Drawing Office ...	...	...	6	*21*	4	7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	2(*q*)	...	5	*1*	...	...	60	*11*	...	...	...	...	...	...	1
Eastern Circle Parties ...	45	*1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
No. 6 Drawing Office ...	...	...	2	5	...	*1*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11	*6*	...	...	39	*16*	...	...	...	...	...	...	1
Frontier Circle Parties ...	20	7	...	4	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
No. 6 (S. I.) Party ...	20	...	13	4	6	*2*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2(*r*)	...	...	...	...	...	...	...	...	5	...	...	...	52	*20*	...	...	...	...	...	...	
No. 10 (Burma) Party ...	6	...	10	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	19	...	...	...	...	...	...	...	
Forest Map Office ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20	...	...	...	...	...	...	...	...	...	...	...	...	...	15	3	1
Total ...	103	*20*	37	*45*	12	*25*	...	*3*	2	*8*	...	*13*	...	...	...	*10*	...	*4*	...	*2*	2	*4*	...	...	2	*6*	...	*3*	20	...	8	*10*	121	*7*	187	*58*	288	*53*	56	...	19	...	319	*12*	9
Total to date ...	**3,696**		**1,082**		**359**		.....		**56**		**27**		**1**		**19**		**1**		**16**		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		
Total for India ...	**6,218**		**1,630**		**450**		.....		**104**				**41**				**22**				.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		.....		

References.

Scales:—*x*-**inch** means *x* inches to 1 mile.

x-**mile** „ 1 inch to *x* miles.

1/M means 1 : 1 million or 1·014 inches to 16 miles.

1/2M „ 1 : 2 „ „ „ „ 32 „

(*a*) Revised editions.
(*b*) Includes five revised editions.
(*c*) „ one „ „
(*d*) Punjab, U. P. & Delhi.
(*e*) Baluchistān, Bengal, Burma, Hyderābād, Kashmīr and Jammu, and Mysore & Coorg.
(*f*) 32-mile, 128-mile India and 67 mile Railway map of India (engraved edition).
(*g*) Includes Tape edition index for Calcutta & Howrah Guide map, scale 3″=1 mile.
(*h*) New editions from two-inch surveys.
(*i*) Special Nepāl maps.
(*j*) Includes one revised edition.
(*k*) Includes four revised editions.
(*l*) Delhi Guide map.
(*m*) Lucknow and Bombay Guide maps.
(*n*) Revised edition, Himlāyas & Central Asia, Scale 1/2½M.
(*o*) 64-inch, two sheets and 16-inch, four sheets.
(*p*) 16-inch, ten sheets.
(*q*) 16-inch Shillong Cant., 32-inch Shillong Cant., (Jhalupāra).
(*r*) Gulbarga and Warangal Guide map.

Table VII.—Miscellaneous.

No. 1 Drawing Office—

Original brought up to date and lodged in M. R. I. O.	1
Originals and E. O. plates corrected against press order proof	47
Mosaics (congregated rough maps prepared for photography)	42
Grid originals scrutinized and corrected	58
Grid cutting lines on originals drawn or checked ...	99
Shaded originals corrected and emphasized ...	34
Miscellaneous cases	177
Originals from circles and parties corrected against D. M. P's. scrutiny	300
Published maps corrected by hand	4,230

No. 2 Drawing Office—

Mosaics (congregated rough maps prepared for photography)	27
Exploration Krab file (rough indexes prepared) ...	10
„ „ „ (fair „ „) ...	42
Party sheets examined, corrected and submitted for publication	15
Grid cutting points on mosaics and originals drawn and checked	19
Plane-tables projected and plotted for exploration work	3

Forest Map Office—

Standard indexes completed	23
Sheets coloured for indents	702
Areas extracted, sheets	32
Originals corrected	30
Sheets passed for publication	61

No. 6 Drawing Office—

One inch sheets examined	34
Quarter inch sheets examined	1
Guide map examined	1

No. 10 (Burma) Party—

Map mounting (booklets)	362
„ „ (plain)	18
Sheets projected for mosaics	17

Table VIII.—Re-issues.

Reprints—No changes in map. New editions—Slight alterations. Revised editions—Considerable changes.

	MODERN MAPS INCLUDING PRELIMINARY EDITIONS.								OLD-STYLE, INCLUDING PROVISIONAL ISSUES.			GENERAL AND SPECIAL.					
	TOPOGRAPHICAL.				GEOGRAPHICAL.								RAILWAY.	FOREST.	CANTONMENT.		
	2-inch.	1-inch.	½-inch.	¼-inch.	1/M. Helio.	1/M. Engraved.	1/M. Carte Internationale.	1/2 M.	1-inch.	½-inch.	¼-inch.	Various.	67 & 80-mile.	2-inch & 4-inch.	12-inch.	16-inch.	64-inch.
No. 1 Drawing Office—																	
Reprints	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
New editions	...	53	11	15	1	...	1	...	10	...	4	6	2	...	...	...	...
Revised „	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
No. 2 Drawing Office—																	
New editions	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Revised „	...	2	...	5	...	...	...	...	...	...	...	...	...	...	...	...	...
No. 5 Drawing Office—																	
New editions	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Revised „	...	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
No. 6 Drawing Office & Frontier Circle Parties—																	
New editions	...	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Revised „	...	14	3	2	...	...	...	...	...	...	...	1	...	...	...	...	...
No. 6 (S. I.) Party—																	
New editions	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Revised „	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
No. 10 (Burma) Party—																	
New editions	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Revised „	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Forest Map Office & No. 20 (Cantonment) Detachment—																	
Reprints	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	22	...
New editions	...	...	...	...	...	...	...	...	...	...	...	...	...	30	...	4	...
Revised „	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	29	8
Totals ...	...	**81**	**15**	**22**	**2**	...	**1**	...	**10**	...	**4**	**7**	**2**	**30**	...	**55**	**8**

XIII.—PRINTING AND MISCELLANEOUS.

128. The Photo.-Litho. Office, Calcutta.—During the year there has been a noticeable decrease in the amount of work both departmental and extra-departmental passing through the office. Efforts are now being made to attract more work from other Government departments. Owing to the reduction in the size of the Survey Department in recent years, this office is in a position to undertake more extra-departmental work than formerly.

An average of three out of four rotary offset and seven out of nine flat-bed printing machines were in continuous working, and the twenty handpresses were fully occupied. In the Type Printing Section the six letter-press machines were almost continuously in use.

Experiments have been carried out with a view to reducing the time taken to prepare drawing blue prints from plane table sections, for survey parties, and have met with a great measure of success. Hitherto the normal method involved the preparation of a "mosaic" using black prints pulled on a hand-press, from lithographic zinc plates of individual planetable sections. The method was lengthy and costly, and the quality of blue print was not good. The only alternative was the method of direct lithographic combination of the work on two or more zinc plates which however could be used only in a small percentage of cases, and even then had serious defects.

The new methods involve the use of "Correctostat" and "Ozalid" papers, products which have recently come on to the market. These papers are used for taking contact prints from the negatives of individual planetable sections, and are then put down in mosaic form on a projection of the sheet on zinc or glass. The time taken to produce a drawing blue print has now been reduced from an average of over four weeks to one week, and there has been a marked improvement in both the quality and accuracy of the blue prints. All mosaicing is now done in the Photo.-Litho. Office instead of being sent out to a drawing office as hitherto. This has resulted in a saving of time and clerical work, and has relieved drawing offices of work which often was difficult to deal with expeditiously without interference with normal routine.

COST AND OUT-TURN OF PHOTO.-LITHO. OFFICE.

Expenditure.	Value of out-turn at office rates.	Negatives prepared.	Zinc plates prepared.	Maps printed.		Impressions pulled.
				Departmental.	Extra-departmental.	
Rs.	Rs.					
2,80,123	3,32,806	4,381	6,089	733	1,541	3,183,978

INDEPENDENT OUT-TURN OF THE PROCESS ENGRAVING AND TYPE PRINTING SECTIONS.

PROCESS ENGRAVING SECTION.					TYPE PRINTING SECTION.		
HALF-TONE WORK.		LINE WORK.		PHOTO-GRAVURES.			
Blocks prepared.	Impressions pulled.	Blocks prepared.	Impressions pulled.	Plates prepared.	Items or pages published.	Copies printed.	Impressions pulled.
287	48,475	15+2 Stereos.	39,865	1	1,821	9,63,840	1,800,603

129. OUT-TURN OF ENGRAVING OFFICE COPPER PLATE PRINTING SECTION.

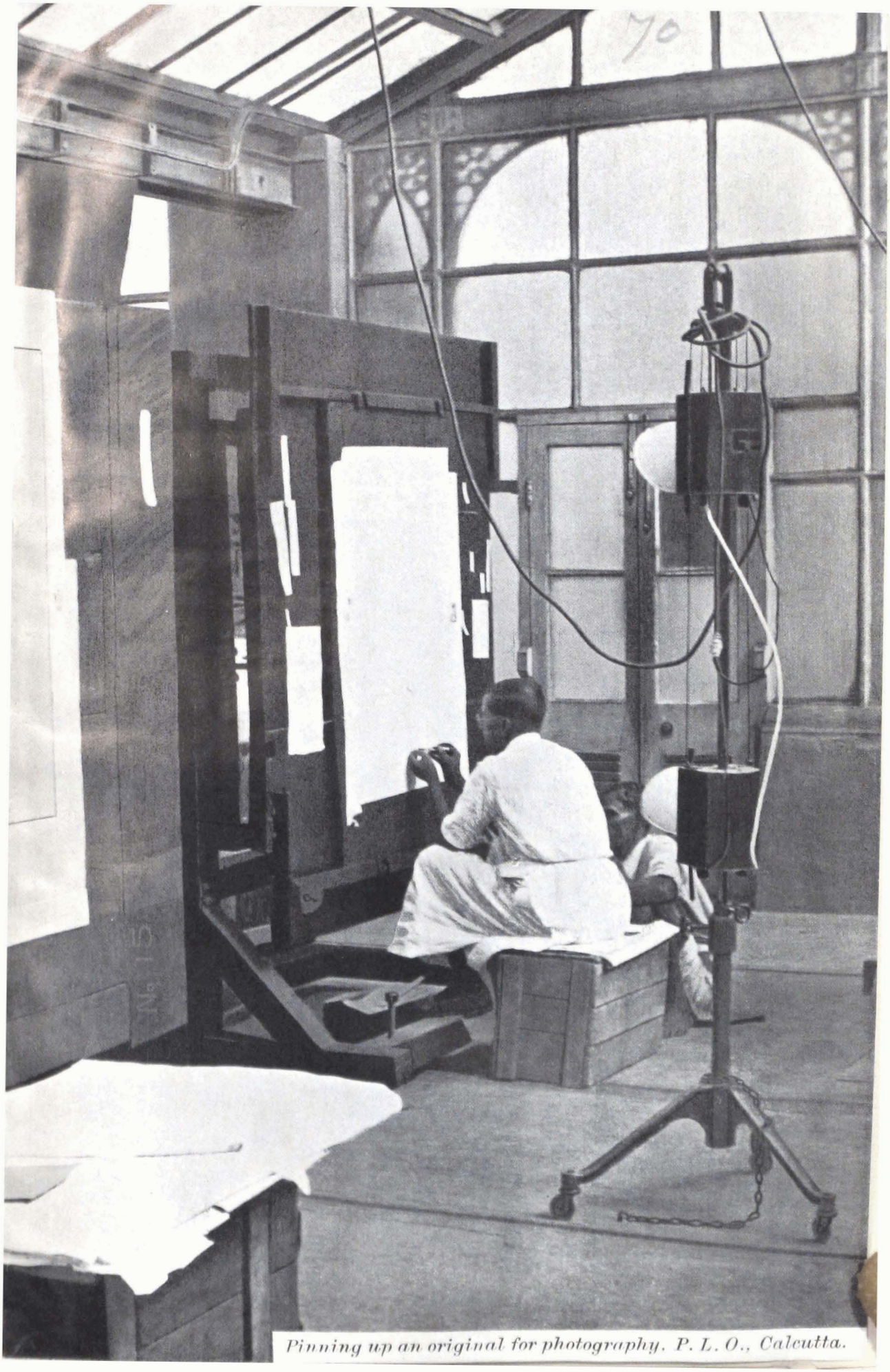
IMPRESSIONS PULLED.				
Photogravures.	Chromo Paper.	Transfer.	Miscellaneous.	Total.
602	512	241	5,391 Including 1,150 commission forms.	6,746

130. Photo.-Zinco.-Section, Dehra Dūn.—The printing plant of this section consisting of one rotary and two flat-bed machines (only one of which is in operation at a time), an offset press and 3 hand-presses, was in continuous operation during the year, printing cantonment and forest maps, diagrams and the Bhakra Dam Project sheets, as well as indexes and charts for the Geodetic Report, as shown in Table I.(*b*). In addition to the above the Lucknow Guide map and the "Lay-out plan of New Delhi" were printed in colours.

The old Zeiss Protar lens and prism were replaced by a new Apochromat Tessar F. 9 lens and prism at a cost of £ 210 (excluding Rs. 858 on freight and import duty). This lens gives much improved negatives using considerably shorter exposures than with the previous lens.

131. No. 18 (Air Survey) Party, Murree and Risalpur.—The Reproduction Section was employed on miscellaneous work throughout the year.

One special map was printed for Head-quarters, Northern Command, which was perpared direct from an air survey compilation. The outline original was first completed for typing and accessory work on a bromide print from a contact film negative taken from the compilation, when the outline had been completely surveyed. The contour original was completed for typing on a bromide print, from a duffed contact film negative taken from the finally completed compilation. The reduction of the bromide originals was done by photography at Dehra Dūn, as the camera



Pinning up an original for photography. P. L. O., Calcutta.

in No. 18 Party was not large enough. The final map in two colours is very satisfactory, and the elimination of fair drawing greatly reduced the time and cost, besides ensuring more faithful reproduction of the survey.

This method of reproducing maps in two colours direct from the survey has been further developed to eliminate the duffing which is carried out at present, by means of a black bank-post paper print of the outline, registered carefully with the combined film negative. The new method is more satisfactory than the two-colour process reported in the 1934 report, and has been standardized for hasty map production in the Party. One special map was produced by this method for Headquarters, Peshawar District.

The Party has been re-equipped with a process camera, to take film or plate negatives up to 23 × 21 inches, to match the Furnival portable hand presses in use in the Party.

132. 'E' Company, Quetta.—The Reproduction Section was employed throughout the year mostly on extra-departmental work.

A paper cutting machine, and a double royal hand press were received and set up during the year.

Improvements were made in the Photo Section, the lighting being improved and a long focus lens being installed which is capable of dealing with full size blue prints.

There are now in the Company one offset rotary printing machine, one duplicating press, 4 hand presses and 2 portable presses.

Reproduction of originals received :—

In one colour	...	...	...	208
In two colours	...	...	...	19
In three ,,	...	...	...	22
In four ,,	...	...	...	3
		TOTAL	...	252
Vandyke and helio plates prepared		...	...	334
Prints pulled	...	...	...	14,846

XIV.—MATHEMATICAL INSTRUMENT OFFICE.

133. During the year under review the total value of repairs carried out and the sale of instruments, have shown an increase on the previous year.

Owing to the decision of the military authorities to discontinue employing the M. I. O. for repair work, considerable retrenchment of staff was unfortunately necessary. This involved the discharge of 62 men. The savings thus effected in the cost of establishment amount to Rs. 22,572 per annum. An additional saving is expected owing to the Superintendent proceeding on leave for 28 months from 4th April 1935, preparatory to retirement.

Repairs and manufactures during the year covered the usual wide range associated with the M. I. O. The principal items are as follows:—

Repairs for Public Departments:—

Theodolites.
Levels.
Sextants.
Quintants.
Clinometers.
Abney levels.
Plane-tables.
Drawing boards.
T-Squares.
Plane-table stands.
Theodolite and level stands.
Drawing instruments.
Pantographs.
Sight rules.
Parallel rules.
Levelling staves.
Ghat tracers.
Hypsometers.
Raingauges.
Survey umbrellas.
Sphygmomanometers.
Microscopes.

Repairs to Army Optical and other instruments included:—

60 Rangefinders.
50 Dial sights.
54 Telescopes.
36 Directors.
530 Binoculars.
160 Monoculars.
180 Liquid compasses.
80 Watches.

Manufactures for Public Departments included the following:—

Steel Band chains.
Subtense bars.
Measuring rods.
Levelling staves.
Survey umbrellas.
Sight rules.
Water bottles.
Surveying flags.
Canvas holdalls.
Drawing boards.
Plane-tables.
T-Squares.
Mule trunks.
Ink rollers.
Ferro-printing frames.
Zinc washing tubs.
Canvas covers.
Set squares.
Drawing instruments.
Protractors.
Leather tape cases.
Plotting scales.
Aluminium gauge plates.
Head stereoscopes.
Wind vanes.
Copy, Imperial Yard.
Sounding quintants.

Manufactures for Director of Contracts, Simla.

A large number of spare parts and smaller apparatus for the Army were made up and supplied, on tender, to the Director of Contracts, Simla. In connection with this work numerous experiments were carried out with a view to perfecting the radium painting of luminous components.

In the Optical Department considerable progress was made in the renovation of prisms and lenses. During the year under review, the following were re-worked, polished and figured:—

2,300 Prism surfaces.

350 Plano-convex lenses and object glasses.

1,031 Object glasses rebalsamed.

In the Optical Department manufactures extended to:—

500 Prisms.	250 Rangefinder moderating glasses.
421 Lenses.	162 Reflecting mirrors.
940 Compass glasses.	136 Spirit bubbles.
564 Theodolite and level diaphragms.	308 Thermometers.
605 Binocular graticules.	148 Pocket Sikes hydrometers.

Instruments adjusted and tested in the Optical Department were as follows:—

71 Head stereoscopes.	40 Planimeters.
260 Thermometers.	35 Sphygmomanometers.
70 Microscopes.	12 Ophthalmoscopes.
30 Barometers.	41 Hydrometers.
40 Hygrometers.	30 Microscope objectives.

In addition, 370 glass jars were graduated for the Excise Department.

Special manufactures to design were completed as follows:—

8 Ampoule fillers (7 for the Director, Bacteriophage Laboratory, Bankipore and 1 for the School of Tropical Medicine, Calcutta).

4 Polarity indicator magnets for the Superintendent, Gun and Shell Factory, Cossipore.

1 Pilot gauge for the Principal, Bengal Engineering College, Shibpur.

1 Hunter short base apparatus for the D. G. B., Dehra Dūn.

5 Duralumin tree calipers for the Divl. Forest Officer, Dhārwār, the Silviculturist, Assam, and the Provincial Silviculturist, Ootacamund.

Six new pattern survey clinometers were made up and issued to Directors and O. C's. Nos. 6 and 10 Parties for test and report after the field season with a view to further improvement in design.

The following officers visited the M. I. O. on the 12th April to discuss with D. M. P. and S. M. I. O. certain matters relating to the supply of Army repair work:—

1. Lt. General Sir H. E. ap Rhys Pryce, K.C.B., C.M.G., D.S.O., Master General of the Ordnance.
2. Bt. Lt.-Col. J. N. Thomas, D.S.O., M.C., R.A., Asstt. Master General of the Ordnance.
3. Lt.-Col. R. Crofton, M.C., I.A.O.C., Asstt. Director of Artillery.
4. The Inspector of Guns, Cossipore.
5. The Asstt. Inspector of Guns, Hastings.

Messrs A. K. Chanda, B.Sc., and Kali Charan, M.A., officers of the Indian Audit and Accounts Services were deputed to the M. I. O. in July by the Auditor General for the purpose of studying the methods of accounting.

Army surplus and obsolescent stores were sold on behalf of the Director of Contracts, Simla, and a sum of Rs. 1,778 was realised. Surplus and obsolescent stores and scrap materials belonging to the M. I. O. were disposed of, and a sum of Rs. 13,173 was realised.

Fire drill and the inspection of fire appliances were carried out monthly during the year.

134. The following comparative table shows the slight increase in the demands on this office for the supply of instruments, and also for the total value of repairs.

	1932-33.	1933-34.	1934-35
	Rs.	*Rs.*	*Rs.*
1. Total value of stores issued ...	1,39,422	1,93,785	2,01,410
2. „ „ „ repairs carried out to orders	2,49,705	1,80,648	1,39,119
3. „ „ „ instruments &c. returned to stores	23,154	14,208	5,814
4. *Book value of stock in—*			
(*a*) Serviceable store	4,07,531	3,66,279	3,30,666
(*b*) Repairable „	1,59,494	1,62,064	1,56,899
(*c*) Material „	1,80,725	1,65,131	1,48,387
5. *Value of new instruments—*			
(*a*) Manufactured in workshop ...	44,105	72,048	76,561
(*b*) Purchased locally	18,264	39,737	44,611
(*c*) Imported through the Stores Department, London ...	8,410	8,211	9,650
6. Total value of work done in the workshop	3,52,141	2,89,707	2,62,216
7. Value obtained by sale of obsolescent and condemned stores ...	3,350	4,919	13,136
8. *Employees—*			
(*a*) Average numbers in workshop ...	424	399	383
(*b*) Cost of employees in workshop including pension contribution	1,55,898	1,47,506	1,49,829

INDEX MAPS

MODERN TOPOGRAPHICAL SURVEYS AND COMPILATION

on scales ranging from 4 inches to 1 mile to $\frac{1}{8}$ inch to 1 mile.

N. B. The index shows all topographical work brought on to the true longitude since 1905. Previous topographical work, in the blank areas was about two miles out of position, being based on the old longitude of 1815.

SYSTEM OF NUMBERING SHEETS.

THE $\frac{1}{M}$ SERIES forms the basis of numbering for sheets on all scales. It consists of sheets 4° × 4° on the scale of 1:1,000,000, whose numbers are shown on the Index thus:— 55

QUARTER-INCH SHEETS—Each $\frac{1}{M}$ sheet is divided into 16 sheets of scale quarter-inch to one mile, lettered A–P as shown on the Index. The name of each quarter-inch sheet is therefore written thus: 55 K

HALF-INCH SHEETS—Each $\frac{1}{4}$ inch sheet is divided into four half-inch sheets, named respectively N.W., N.E., S.W., S.E. The name of a half-inch sheet thus takes the form:— ..... $55\frac{K}{N.E.}$

N.W.	N.E.
S.W.	S.E.

ONE-INCH SHEETS—Each $\frac{1}{4}$ inch sheet is divided into 16 one-inch sheets, numbered from 1–16 as here shown. The name of a one-inch sheet thus takes the form ..... $55\frac{K}{12}$

1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16

BRITISH ISLES
on same scale.

MODERN TOPOGRAPHY

up to 30th September 1935.

REFERENCES.

MODERN SURVEYS (since 1905).
Scale 1 inch to 1 mile, and over
" about $\frac{1}{2}$ inch to 1 mile
" $\frac{1}{4}$ inch to 1 mile, and less

MODERN COMPILATION (since 1905).
Scale 1 inch to 1 mile, and over
" about $\frac{1}{2}$ inch to 1 mile
" $\frac{1}{4}$ inch to 1 mile, and less

CURRENT SURVEYS are further distinguished by marks as follows

	Scale 1	$\frac{1}{2}$	$\frac{1}{4}$	larger
Surveyed last season 1934–35	○	+	·	::
Proposed for survey in 1935–36	○	+	·	::

(with red initials or numbers to indicate the unit concerned)

REFERENCES.

Unsurveyed or surveyed prior to 1905

Surveyed or revised 1905-06 to 1914-15

" " 1915-16 to 1924-25

" " 1925-26 to 1934-35

Surveys outside the Indian Empire have not been shown.

64° E. of Greenwich.

REG. NO. 3269 D'33—525.

HELIO. S. I. O. CALCUTTA

1 inch and ½ inch scales. SURVEY OF INDIA on scales of ONE-INCH and HALF-INCH to one mile.

MODERN MAPS, shown in bright colours, are based on the true longitude adopted in 1905.
OLD MAPS, shown in purple and green were about 2 miles out of position, being based on the longitude of 1815.

SYSTEM OF NUMBERING SHEETS.

THE $\frac{1}{M}$ SERIES forms the basis of numbering for sheets on all scales. It consists of sheets 4° × 4° on the scale of 1:1,000,000, whose numbers are shown on the Index thus:—..... 55

QUARTER-INCH SHEETS—Each $\frac{1}{M}$ sheet is divided into 16 sheets of scale quarter-inch to one mile, lettered A–P as shown on the Index. The name of each quarter-inch sheet is therefore written thus: 55 K

HALF-INCH SHEETS—Each $\frac{1}{4}$ inch sheet is divided into four half-inch sheets, named respectively N.W., N.E., S.W., S.E. The name of a half-inch sheet thus takes the form:—..... $55_{N.E.}^{K}$

N.W.	N.E.
S.W.	S.E.

ONE-INCH SHEETS—Each $\frac{1}{4}$ inch sheet is divided into 16 one-inch sheets, numbered from 1–16 as here shown. The name of a one-inch sheet thus takes the form:—..... 55_{12}^{K}

1	5	9	13
2	6	10	14
3	7	11	15
4	8	12	16

PUBLICATIONS up to 31st March 1935.
on ONE-INCH and HALF-INCH scales.

REFERENCES.

MODERN MAPS (since 1905).
Scale 1 inch to 1 mile only
" ½ inch " " only
Published on both scales

OLD MAPS (previous to 1905).
Scale 1 inch to 1 mile
" ½ inch " "

NEW MAPS (including revised editions).
Published during the financial year 1934-35, one-inch • half-inch +
In hand, to be published by the end of 1935, do • do +

Scale 1:12 Million.

Miles 100 0 100 200 300 400 500 600 700 800 900 Miles

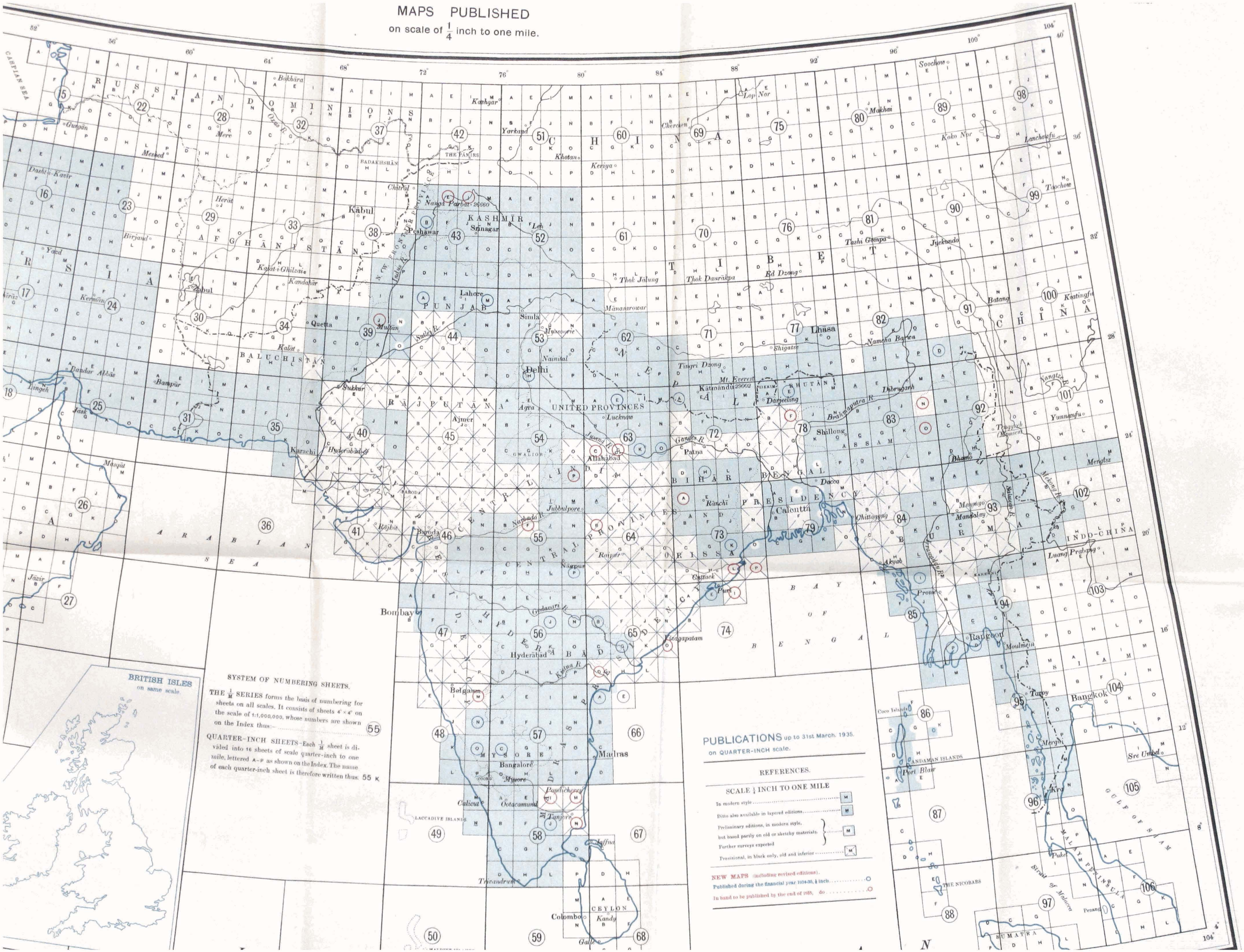
Compiled by Lieut.-Col. H. L. Crouchman, D.S.O., M.C., Surveyor General of India, 1935.

Reg. No. 1875. D. 25. 525.

Helio. S. I. O. Calcutta.

MAPS PUBLISHED

on scale of $\frac{1}{4}$ inch to one mile.

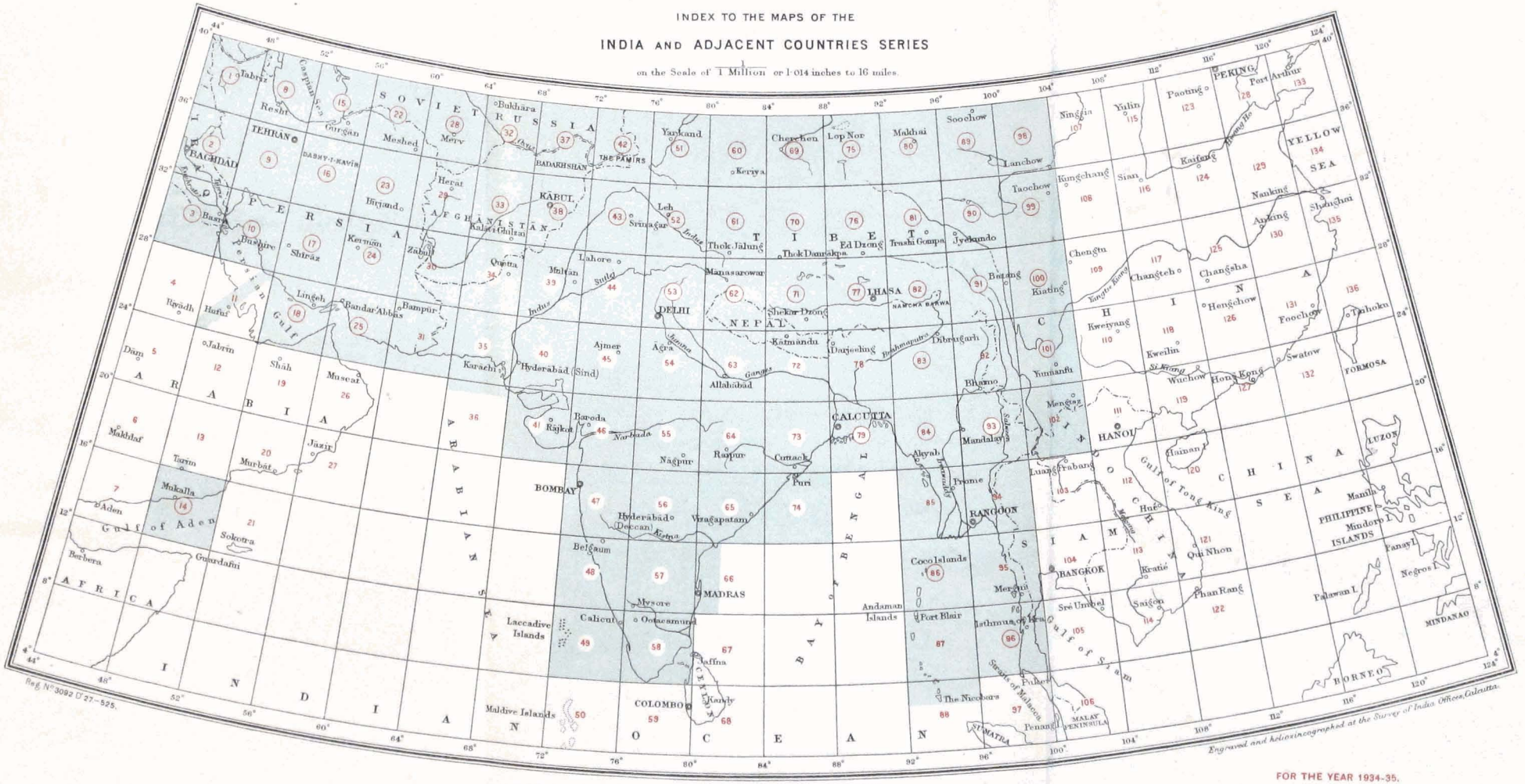


INDEX E

INDEX TO THE MAPS OF THE

INDIA AND ADJACENT COUNTRIES SERIES

on the Scale of 1 Million or 1·014 inches to 16 miles.



Reg. No. 3092 D 27—525.

Published under the direction of Brigadier H.J. Couchman, D.S.O., M.C., *Surveyor General of India*, 1935.

Scale of Index 1/30 Million

Miles 200 0 200 400 600 800 Miles.

Engraved and heliozincographed at the Survey of India Offices, Calcutta.

FOR THE YEAR 1934-35.

REFERENCE — Helio Engd.

Maps published. Political Edition only

" " Political & Layered Editions

" In hand

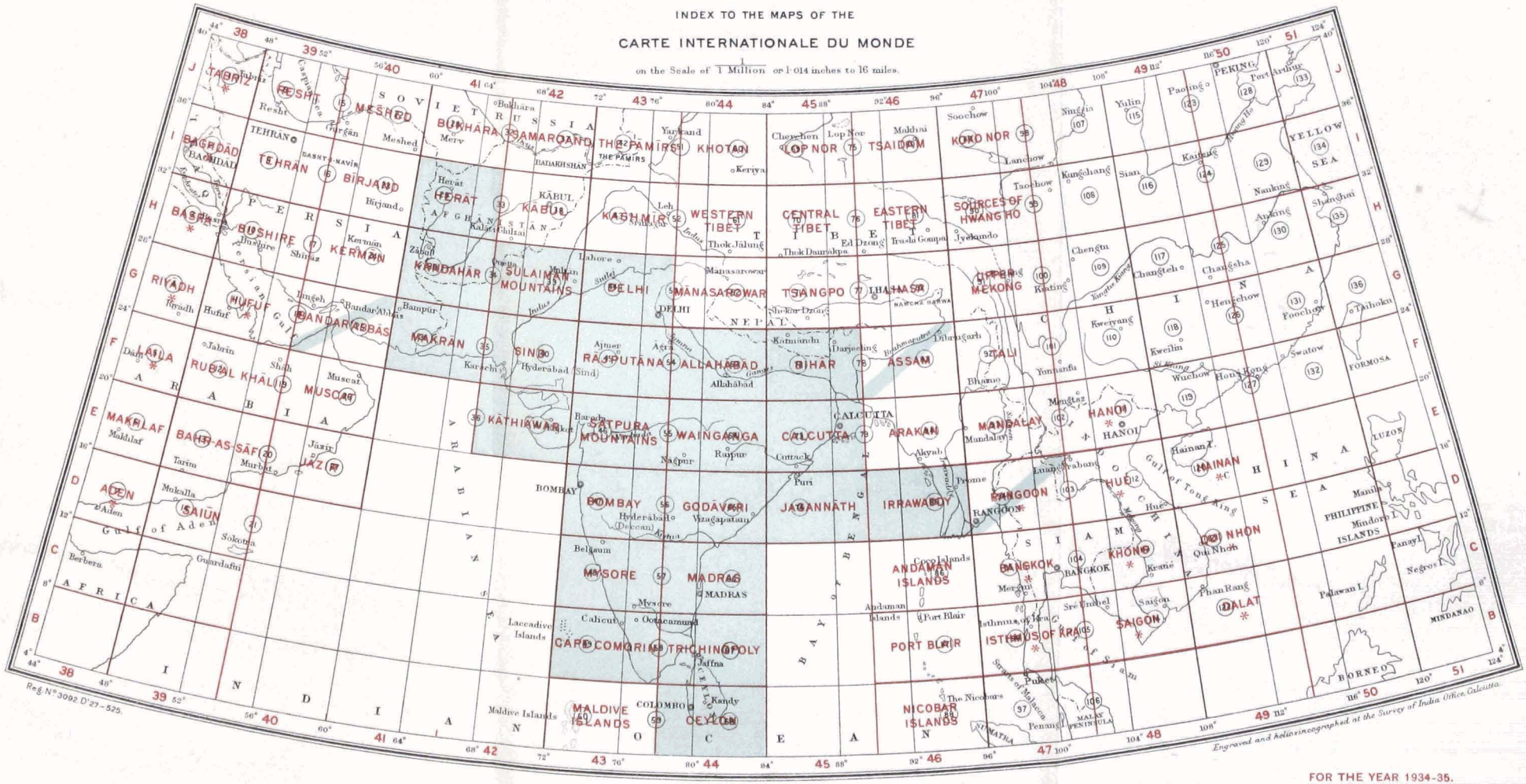
Sheets published during the financial year 1934-35:—87 & 88, 102; Rev. edn. 29, 52 and 84.

INDEX F

INDEX TO THE MAPS OF THE

CARTE INTERNATIONALE DU MONDE

on the Scale of 1 Million or 1·014 inches to 16 miles.



Reg. N° 3092. D'27-525.

Published under the direction of Brigadier H.J. Couchman, D.S.O., M.C., *Surveyor General of India,*
1935.

Scale of Index $\frac{1}{30\ \text{Million}}$

Miles 200 0 200 400 600 800 Miles

Engraved and heliorinecographed at the Survey of India Office, Calcutta.

FOR THE YEAR 1934-35.

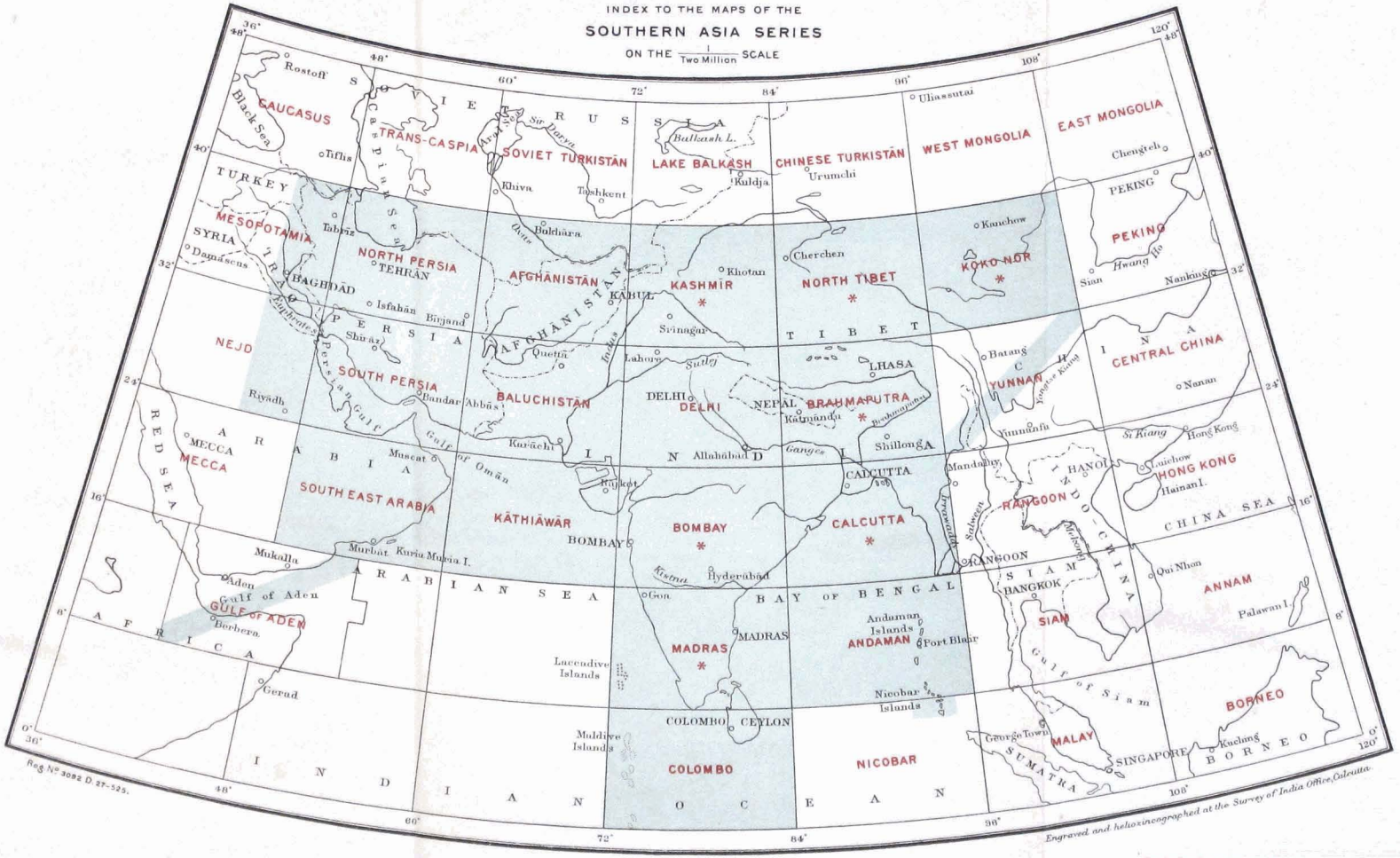
REFERENCE

Maps published

" in hand

" published by other countries *

INDEX G



Published under the direction of Brigadier H. J. Couchman, D.S.O., M.C., *Surveyor General of India,*
1935.

Scale of Index $\frac{1}{40 \text{ Million}}$

Miles 200 0 200 400 600 800 1000 Miles

FOR THE YEAR 1934-35.

REFERENCE

	Helio	Engd
Maps published (Political & Layered Edn.)		*
" in hand		

Maps published during the financial year 1934-35:—Delhi, South East Arabia.