

HC-49

SURVEY OF INDIA GENERAL REPORT

1925 TO 1926



From 1st October 1925
To 30th September 1926.

PUBLISHED BY ORDER OF
Colonel C. P. GUNTER, O.B.E., R.E.,
Offg. SURVEYOR GENERAL OF INDIA.

Printed at the Photo.-Litho. Office,
Survey of India,
CALCUTTA,
1926.

Price One Rupee or One Shilling and Nine Pence.

HC-49

13232



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Survey of India Office, Calcutta, 1913

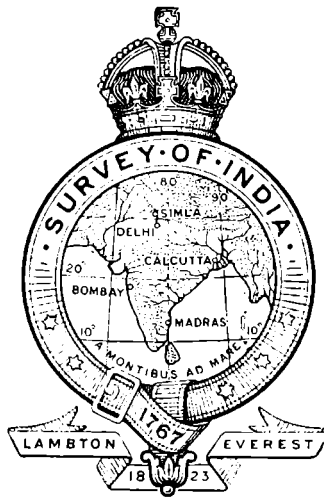
COLONEL VALENTINE BLACKER, C. B.
THE FIRST SURVEYOR GENERAL OF INDIA, 1823-1826.
(Died in Calcutta, 1826. Vide Appendix.)

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LIST OF PROVINCES AND STATES IN EACH CIRCLE.

Director, Frontier Circle, headquarters Simla, (telegrams "Surfrontier")—N.W. Frontier Province, Baluchistān, Kashmīr, Punjab, Punjab States, Delhi, Bikaner and States of Western Rājputāna, Sind and Cutch.

Director, Central Circle, headquarters Mussoorie, (telegrams "Surcent")—United Provinces, Central Provinces, Central India Agency, Gwalior State, Baroda State, Ajmer and Eastern Rājputāna, Northern Division Bombay Presidency, States of Western India (less Cutch).

Director, Southern Circle, headquarters Bangalore, (telegrams "Sursouth")—Bombay Presidency (less Northern Division and Sind), Hyderābād and Mysore States, Coorg, Madras Presidency and Madras States.

Director, Eastern Circle, headquarters Shillong, (telegrams "Sureast")—Bihār and Orissa, Bengal Presidency, Assam and Sikkim.

Director, Burma Circle, headquarters Maymyo, (telegrams "Surburma")—Burma, the Andaman and Nicobar Islands.

HOW WE CAN HELP YOU.

Surveys of every kind can be carried out for private firms as well as for all Government Departments on application to the following Survey Directors:—

The Director, Frontier Circle, Survey of India,
Simla. (*Telegrams "Surfrontier"*).

The Director, Central Circle, Survey of India,
Mussoorie (*Telegrams "Surcent"*).

The Director, Southern Circle, Survey of India,
Bangalore. (*Telegrams "Sursouth"*).

The Director, Eastern Circle, Survey of India,
Shillong. (*Telegrams "Sureast"*).

The Director, Burma Circle, Survey of India,
Maymyo. (*Telegrams "Surburma"*).

Triangulation, Levelling, Cantonment Surveys, Tide Tables. Advice in regard to these, and on scientific questions, is obtainable from the *Director, Geodetic Branch, Survey of India, Dehra Dūn*, who also undertakes a good deal of levelling and similar work 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. (*Telegrams "Surpub"*).

The Mathematical Instrument Office, Survey of India, 15 Wood Street, Calcutta, supplies and repairs all kinds of optical and surveying instruments, and takes back surplus instruments, on valuation, from all government departments, whether Imperial or Provincial. (*Telegrams "Surinst"*).

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

HOW TO OBTAIN MAPS AND OTHER SURVEY PUBLICATIONS.

Maps. The Map Record and Issue Office, Survey of India, 13 Wood Street, Calcutta, (*Telegrams "Surmaps"*) can supply maps, on a great variety of scales, for all parts of India and most of Southern Asia. These are also obtainable to some extent, from the Agents detailed on page v and from the Directors of Circles detailed in the notice on page ii.

A Catalogue of Maps, showing Survey of India maps available for all Southern Asia, and itself forming a useful atlas of the Indian Empire, is obtainable from the above, at the cost of *One Rupee only*.

Forest Maps are obtainable only from the Forest Map Office, Survey of India, Dehra Dûn. (*Telegrams "Surforest"*).

Geological Maps are obtainable from the Director, Geological Survey of India, Calcutta.

Publications. An abstract of professional publications, other than maps, is given overleaf, and a complete list of these is obtainable *gratis*, from the Director, Geodetic Branch, Survey of India, Dehra Dûn. (*Telegrams "Surtrig"*).

ABSTRACT OF PUBLICATIONS.

Survey of India Publications other than maps may be divided into—

- (A) **Historical and General Reports**
- (B) **Geodetic works of reference**
- (C) **Catalogues, Instructional handbooks, etc.**
- (D) **Miscellaneous papers.**

Historical and General Reports include the Memoirs by Sir Clements Markham and by C. E. D. Black, the Annual General Reports, Narrative Reports, Records Volumes, etc.

Geodetic works of reference comprise Everest's Great Arc Books, the G. T. S. Volumes, Triangulation and Levelling Pamphlets, and Tide Tables for various ports between Suez and Singapore.

The G. T. S. Volumes form a series of nineteen volumes, describing in detail the various operations of the Great Trigonometrical Survey. Detailed accounts are given of Base-line measurements, of the reduction of Principal Triangulation with each main figure treated separately, of Telegraphic Longitude and Astronomical Latitude operations and of Levelling of high precision.

Catalogues, Instructional handbooks, etc., comprise Departmental Orders, Catalogues and Lists. Tables and Star Charts, Manuals, Handbooks, etc.

Miscellaneous papers include various unclassified papers on Geography, Geodesy, Exploration, etc., and other professional and departmental papers and forms.

A complete catalogue of all the above may be had gratis on application to the Director, Geodetic Branch, Survey of India, Dehra Dūn.

AGENTS FOR THE SALE OF INDIAN OFFICIAL PUBLICATIONS.

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- A. CONSTABLE & Co., 10, Orange Street,
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Bond Street, W.
- HENRY S. KING & Co., 65, Cornhill, E.C.
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- MARTINUS NIJHOFF, The Hague - Holland.
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FRIEDLANDER & SOHN, Berlin } Germany.

FOR MAPS ONLY.

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SURVEY OF INDIA

GENERAL REPORT

1925 TO 1926

From 1st October 1925

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INTRODUCTION AND SUMMARY.

1. **Annual Reports.**—Annual Reports are now published in three separate volumes as follows:—

General Report.

Geodetic Report.

Map Publication and Office Work Report.

The first two are for the survey year ending 30th September but the last is for the financial year up to 31st March.

The Map Publication Report contains all the index maps showing the progress of map publication on all scales, with reports on publication and issue, printing and drawing, and of such offices as the Mathematical Instrument Office, which have to conform with the financial year.

The Geodetic Report includes full details of all scientific work.

This General Report only gives brief abstracts of the above (*vide* Abstracts IV and V in the Table of contents) and is confined to reporting the survey operations of the ordinary field parties and detachments. The first three Abstracts (*vide* Table of contents) summarise these reports and enable the reader to look up such portions as may concern him. There are three index maps at the end, showing the progress of modern topographical surveys, compilation and publication. Maps of sorts are of course available for all parts of the Indian Empire, but some are very old, and all previous to 1905 were based on the old longitude of 1815, (which was over 2 miles out), and are excluded from the index maps.

2. **General.** Colonel Commandant E. A. Tandy, R.E., the Surveyor General, proceeded on 8 months and 3 days leave from the 15th March 1926. Colonel C. P. Gunter, O.B.E., R.E., was appointed Officiating Surveyor General during his absence on leave.

The total area of new surveys of all kinds completed during the year was 42,489 square miles.

3. *The total cost of the Department for the past financial year ending 31st March 1926, as compared with that of previous years, was as follows:—*

	1923-24.	1924-25.	1925-26.	REMARKS.
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>	
Gross actual cost ...	51,14,799	53,66,784	53,37,235*	* These figures are not final.
Deduct receipts and credits	21,15,470	22,27,138	21,82,240*	
Net actual charges ...	29,99,329	31,39,646	31,54,995*	

4. *Organization.—Formation of Frontier Circle.*—Under the orders of the Government of India, a new circle of the Survey of India designated the Frontier Circle and comprising roughly the area of the Northern and Western Commands of the Army was constituted with effect from the forenoon of 1st October 1925 with head-quarters at Simla. Colonel C. P. Gunter, O.B.E., R.E., who held the temporary post of Director Frontier Surveys from 27th April 1925, was appointed Director Frontier Circle. The following survey units were placed under the administrative control of the Director Frontier Circle:—Nos. 2, 3 (now E and A Companies), 18 and 19 Parties, No. 6 Drawing Office (Simla), the Settlement Survey Detachment from 1st October 1925, and No. 23 Party from 1st July 1926. No. 19 Party was temporarily transferred to the administrative control of the Director Geodetic Branch with effect from 12th April 1926.

As a result of the formation of the Frontier Circle, it was considered desirable, when redistributing the circle areas, to make them correspond with administrative boundaries and to notify them in order that survey records may be stored in the proper circle head-quarters and that civil administrations may know which Director to address on survey matters. The Survey of India was accordingly divided into five circles from 1st April 1926, as shown in the index maps at the end of the book.

A list of provinces and states comprised in each circle is given in Notice No. 1.

5. *Notable events of the survey year* were as follows:—

(a) The Netherlands Exploration Party under Mr. P. C. Visser, which was exploring in Hunza Valley, as mentioned in last year's report, and to which Khan Sahib Afraz Gul Khan of the Survey of India was

attached, closed work in October 1926. The total area surveyed by the Khan Sahib was 2,580 sq. miles on the scale $\frac{1}{2}$ " = 1 mile.

(b) Surveyor Torabaz Khan was deputed to accompany Sir Aurel Stéin in his archæological expedition to the Upper Swāt Valley.

(c) Under the orders of the Government of India a party consisting of three Upper Subordinate officers and nine surveyors under Mr. J. McCracken, M.B.E., was deputed to foreign service to carry out survey work on behalf of the Turkish Petroleum Co., Ltd., Baghdād. The party sailed from Bombay on the 23rd October 1925 and returned to India in July 1926. The manager of the company has expressed high commendation of the behaviour and conduct of the party, which is reported to have been exemplary. Mr. Sajawal Khan's local experience and influence proved of great value to the party.

(d) The assistance rendered by Messrs. K. K. Das, B.A., and H. C. Banerjea, B.A., in a gravity survey with the Eotvos torsion balance in Assam was greatly appreciated by Dr. Pakar, the Hungarian scientist of the Burma Oil Co., Ltd.

(e) A lecture was delivered at Poona in May 1926, on "Survey and Maps", to the Intelligence Class by Lt.-Col. C. M. Browne, C.M.G., D.S.O., R.E.

(f) *Air survey.*—The Government of Burma (Ministry of Forests) has conveyed its thanks to Major C. G. Lewis, R.E., for his work while in charge of the Aero-photo party that was responsible for the survey of the Irrawaddy Delta in the following terms—"The Ministry realises how much the success of this work was due to the efficiency of ground control in featureless country for which Major Lewis was responsible and later to his skill in interpreting the results of the photography".

(g) With a view to study the latest processes in aero-photo work, Major C. G. Lewis, R.E., was given permission while on leave in England to visit firms in England and Switzerland as well as the Swiss Federal Topographical offices.

6. Personnel.—Casualties, retirements, recruitments, and awards were as follows:—

Class I officers.—Lt.-Col. H. J. Couchman, D.S.O., M.C., R.E., was transferred temporarily to the Security Printing, Nāsik, as Deputy Master from 28th April 1926.

Mr. S. S. McA.F. Fielding was temporarily promoted from Class II to Class I service.

Lieuts. H. W. Wright, R.E., and I. M. Cadell, R.E., were appointed to the Department.

Mr. Behari Lal Gulatee, B.A., (Cantab), Assistant Research Officer, Irrigation Department, Punjab, was appointed on probation as Asstt. Mathematical Adviser outside the Class I cadre.

Class II officers.—Messrs. G. J. S. Rae and J. H. S. Wilson retired.

Seven candidates were appointed to Class II service on the result of the examination referred to in last year's report.

Mr. H. H. Creed was transferred to the Bengal Survey Department for a period of 5 years.

Upper Subordinate officers.—Messrs. Muhammad Khan, Shaikh Muhammad Salik and Shaikh Subhan retired.

Mr. Paras Ram died. Four Lower Subordinates were promoted to the Upper Subordinate service and three Upper Subordinate probationers were discharged.

Awards.—Major K. Mason, M.C., R.E., was awarded the "Cuthbert Peek Grant" of the Royal Geographical Society to assist him in further explorations of the Himālayas.

Khan Sahib Afraz Gul Khan received the award of the "Back Grant" of the Royal Geographical Society for his surveys in Central Asia and Hunza.

The following honours were conferred during the year:—

Khan Bahadur	... Khan Sahib Saiyid Zille Hasnain, Extra Assistant Superintendent, Survey of India, (Retired).
Rai Sahib	... Mr. Chuni Lal Kapur, Extra Assis- tant Superintendent. Mr. Sarada Charan Chakrabarti, Head Assistant, Map Publication Office.
Khan Sahib	... Mr. Abdul Latif Khan, Sub-Assis- tant Superintendent.

I.—ABSTRACT OF SURVEYS IN EACH PROVINCE AND STATE.

(For Abstract of Forest and Cantonment Surveys, see Part III, page 13).

7. Central Circle.

Punjab.—Riverain surveys, Jhelum, Mianwāli, Lyallpur, Montgomery and Shekhūpura districts, (p. 28). Boundary survey, Ambāla district and Sirmūr State, (p. 29). Rect-angulation, Ferozepore district, (p. 30) and four inch survey, Ferozepore, Lahore, Montgomery and Muzaffargarh districts for Sutlej Valley Irrigation Project, (p. 29).

United Provinces.—Topographical surveys, Jhānsi district, (p. 27), Bāndā, Cawnpore, Fatehpur and Hamirpur districts, (p. 26). Four inch contoured survey, Morādābād and Sahāranpur districts for East Indian Railway, (p. 25). Forest Boundary demarcation, Bahraich and Kheri districts, (p. 25). Large scale survey, Muttra City, (p. 29).

Central India.—*Baghelkhand Agency*. Topographical surveys, Baraundā State and Chaube Jāgirs, (p. 26).

Bundelkhand Agency.—Topographical surveys, Ajaigarh, Baoni, Beri, Charkhāri, Chhatarpur and Gaurihar States, (p. 26), Orchhā State, (p. 28).

Central Provinces.—Topographical surveys, Bālāghāt, Bhandāra, Mandlā and Seoni districts, (p. 27). Forest surveys, (p. 27). Cantonment survey of Pachmarhi, (p. 48).

Gwalior State.—Topographical surveys, (p. 28).

8. Frontier Circle.

North-West Frontier Province.—Revision topographical surveys, Peshāwar and Hazāra districts and topographical surveys, Swāt and Buner, (pp. 31, 32). Air survey for cadastral maps, Peshāwar district, (p. 34). Air survey of river Indus, (p. 34). Settlement survey, Peshāwar district, (p. 36).

Punjab.—Revision topographical surveys, Attock and Rāwalpindi districts, (p. 31). Air survey for cadastral maps, Attock district, (pp. 34, 36). Air survey of river Indus, (p. 34). Settlement survey, Attock district, (p. 36).

Sind.—Topographical surveys, Hyderābād and Karāchi districts, (pp. 33). Mosaic of river Indus, Hyderābād district, (p. 34).

Baluchistān.—Topographical surveys, Las Bela State, (p. 33).

9. Southern Circle.

Central Provinces.—Topographical surveys, Chānda district and Bastar State, (p. 37).

Bombay.—Topographical surveys, Ahmadnagar, Sholāpur, Thāna, Kolāba, Poona and Ratnāgiri districts, (p. 38).
Forest surveys, (p. 39).

Bōmbay States.—Topographical surveys, Bhor, Janjira, Sāngli, Mirāj (Senior) and Mirāj (Junior) States, (p. 38).

Hyderābād State.—Topographical surveys, Warangal, Karimnagar, Adilābād, Raichūr, Bhir and Osmānābād districts, (pp. 37, 38).

Madras.—Topographical surveys, East Godāvāri, Anantapur, Bellary, Cuddapah and Kurnool districts, (pp. 37, 38).
Four inch survey, Salem and Coimbatore districts, for Cauvery (Mettūr) project, (p. 38).

10. Eastern Circle.

Assam.—Topographical surveys, Sadiyā Frontier Tract, Lakhimpur district and tribal area, (p. 42). Forest surveys, (p. 42).

Bihār and Orissa.—Topographical surveys, Hazāribāgh, Singhbhūm, Mānbhūm and Cuttack districts, Keonjhar, Dhenkānāl, Saraikelā and Mayūrbhanj States, (pp. 40, 41),
Four inch surveys, Jharia coalfield, Mānbhūm and Hazāribāgh districts, (p. 41). Forest Surveys, (p. 41).

11. Burma Circle.

Topographical surveys, Sandoway, Henzada, Bassein and Myaungnya districts and tribal area known as "The Triangle", (p. 44). Amherst and Thaton districts, (p. 45).
Maymyo Guide Map, (p. 44). Moulmein Guide Map, (p. 45). Forest surveys, (pp. 44 to 47).

II.—ABSTRACT OF TOPOGRAPHICAL WORK.

12. The following two tables show respectively the progress of the topographical programme assigned to the Department in 1905 and the out-turns and cost-rates of different parties during the year under report. In 1913 the Secretary of State sanctioned a scheme for the reduction of the scale of survey of certain sparsely populated areas of India. This will greatly reduce the area of survey on the scale 1 inch = 1 mile and consequently accelerate the rate of progress of topographical surveys shown in Table I below. In order to give a better idea of what work actually lies before the Department, it may be remarked that of the area remaining for survey about 489,000 square miles may possibly be surveyed on the scale $\frac{1}{2}$ inch = 1 mile or smaller scales. There is however at present a tendency to revert to the larger scale in many areas, owing to the pressing requirements of geologists and engineers, and to the military demand for maps on a larger scale.

Table I.—Progress of Topographical Surveys since 1905.

Survey year.	Scales of survey.	Central Circle.	Frontier Circle.	Southern Circle.	Eastern Circle.	Burma Circle.	TOTALS.
1905-14	Mostly 1 & $\frac{1}{2}$ inch = 1 mile.	Sq. miles. 175,408	Sq. miles. Areas included under Central Circle.	Sq. miles. 96,154	Sq. miles. 34,842	Sq. miles. 64,641	Sq. miles. 371,045
1914-15	ditto.	12,334		19,286	2,448	2,608	36,676
1915-16	ditto.	8,168		17,243	2,279	4,652	32,342
1916-17	ditto.	11,689		11,338	3,560	6,163	32,750
1917-18	ditto.	4,202		12,181	3,596	4,800	24,779
1918-19	ditto.	509		7,263	1,764	4,412	13,948
1919-20	ditto.	9,145		11,891	4,311	5,117	30,464
1920-21	ditto.	14,411		14,275	5,766	5,509	39,961
1921-22	ditto.	11,528		21,596	5,970	5,510	44,604
1922-23	ditto.	26,199		20,823	9,144	5,482	61,648
1923-24	ditto.	18,544	28,160	11,363	7,606	65,673	
1924-25	ditto.	12,095	21,765	4,544	5,913	44,317	
Completed up to 1924-25.		304,232*		281,975	89,587	122,413	798,207
†As redistributed 1925-26.		213,774	172,382	200,051	89,587	122,413	798,207
1925-26	ditto.	11,621	4,906	14,137	6,029	5,796	42,489
Areas completed		225,395	177,288	214,188	95,616	128,209	840,696
Balance remaining		212,605	354,327	129,362	189,619	137,666	1,023,579
Total programme		438,000	531,615	343,550	285,235	265,875	1,864,275‡

* Detailed areas shown under Central Circle up to 1924-25 were surveyed under the Northern Circle.

† The Northern and Southern Circles having been re-arranged as Central, Frontier and Southern, the total areas surveyed up to 1924-25 are given as now redistributed, the details for each year being left undisturbed.

‡ Advantage has been taken of the opportunity afforded by the re-arrangement of the Circles to calculate more accurately the area covered by the programme. The total arrived at is 1,864,275 square miles as against 1,821,600 sq. miles shown in previous reports.

Table II. . . . OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1925-26.

PARTY AND LOCALITY. Character of country. Scale and class of survey.	OUT-TURNS OF PLANE-TABLING		COSTS OF SURVEY INCLUDING MAPPING		REMARKS.
	Areas on each scale of each class.	Totals of areas on all scales.	Total costs.	Cost-rates.	
	Sq. miles.		Rs.	Rs. per sq. mile.	
CENTRAL CIRCLE.					
No. 1 Party—United Provinces and Central India.					
<i>Cultivated plains, congested with villages, and low hills densely wooded.</i>	... 536	3,222	67,874	21.1	
... One inch Resurvey One inch Revision survey	2,686				
No. 5 Party—Central Provinces.					
<i>Jungle-clad hills and cultivated plains.</i>	2,175	2,847	51,168	17.9	
... One inch Original survey One inch Supplementary survey Four inch Original survey	671 1				
Jhansi Survey Detachment—United Provinces, Central India and Gwalior State.					
<i>Dense jungle-clad hills; undulating plains, partly cultivated and partly covered with thorny scrub.</i>	1,562	2,751	95,259	34.6	
... One inch Original survey One inch Resurvey One inch Revision survey	185 1,004				
TOTALS, CENTRAL CIRCLE:— 8,820† sq. m. Rs. 2,14,301 Cost-rate 24.3					

† In Table I, an area of 192 square miles, previously surveyed, is excluded, and an area of 2,993 square miles surveyed by No. 6 Party of the Southern Circle but falling in the area of the Central Circle is included.

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1925-26.

PARTY AND LOCALITY. Character of country. Scale and class of survey	OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARKS.
	Areas on each scale of each class.	Totals of areas on all scales.	Total costs.	Cost-rates.	
	Sq. miles.		Rs.	Rs. per sq. mile.	
FRONTIER CIRCLE.					
A. Survey Company—North-West Frontier Province and Punjab.					
Medium hills, bare in foot hills and wooded in higher hills.	One inch	Original survey ...	774		
Cultivated plains and low hills partly wooded.	One and a half inch	Original survey ...	70	(a) 2,807	(a) Excludes 774 sq. miles surveyed in hot weather 1926, of which fair-mapping has not commenced.
	One and a half inch	Resurvey ...	485	(b) 1,07,958	(b) Excludes Rs. 8,000 cost of fair-drawing No. 18 Party's work, Rs. 1,455 cost of exploration, Rs. 34,064 cost of advance triangulation, Rs. 398 miscellaneous Army Dept. work, Rs. 296 debitable to Murree Municipality and Rs. 22,429 cost of work in Buner, not yet fair-mapped.
	One and a half inch	Revision survey ...	2,252		
E. Survey Company—Baluchistan (Las Bela State) and Sind Province.					
Open desert, low hills and coast line.	One and a half inch	Original survey ...	300		
Open desert, low hills and coast line.	Two inch	Resurvey ...	727	(c) 1,84,856	(c) Includes Rs. 76,924 cost of training probationers, etc.
Open desert, scrub covered low hills and coast line.	One and a half inch	Resurvey ...	1,072		
TOTALS, FRONTIER CIRCLE:—			4,906 sq. m.	Rs. 2,92,809	Cost-rate 59.7

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1925-26.

PARTY AND LOCALITY.	Character of country.	Scale and class of survey.	OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARKS.	
			Areas on each scale of each class.	Totals of areas on all scales.	Total costs.	Cost-rates.		
								sq. miles.	Rs. per sq. mile.
SOUTHERN CIRCLE.								
No. 6 Party — <i>Central Provinces, Hyderabad State and Madras.</i>								
<i>Dense forest-clad hills with few open patches of cultivated areas near the main rivers like the Godavari, Indravati and Prān-hita.</i>			5,020 512 1,134	6,666	1,53,503	23.0		
No. 7 Party — <i>Hyderabad State and Madras.</i>								
<i>Open plains of "black cotton" soil, with intricate rocky outcrops.</i>			4,598 1,152 69	5,809	(a) 78,684	(b) 13.7	(a) Excludes Rs. 505 recovered from Army funds and Rs. 24,000 recoverable from Government of Madras. (b) 69 square miles surveyed for Government of Madras excluded in calculating cost rate.	
No. 8 Party — <i>Bombay and Hyderabad State.</i>								
<i>Thickly populated coastal areas heavily wooded hills, and undulating plains mostly under cultivation.</i>			5,328 49 1,633 47 2	7,059	(c) & (d) 1,40,342	19.8	(c) Includes Rs. 11,486 debit to Forest Department, Bombay. (d) Excludes cost of 4-inch and 8-inch mapping.	
TOTALS, SOUTHERN CIRCLE:—					19,534† sq. m.	Rs. 3,72,729	Cost-rate 19.0	

† Area of 14,137 square miles shown in Table I, excludes 1,134, 1,152, 47 & 2 square miles previously surveyed, and 69 square miles, which is a special contribution work for the Government of Madras, and 2,393 square miles of the Central Circle area surveyed by No. 6 Party.

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1925-26.

PARTY AND LOCALITY. Character of country. Scale and class of survey.		OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARKS.
		Areas on each scale of each class.	Totals of areas on all scales.	Total costs.	Cost-rates.	
		Sq. miles.		Rs.	Rs. per sq. mile.	
No. 4 Party—Bihār and Orissa.—(Jharū coalfield.)						EASTERN CIRCLE. (a) Excludes Rs. 17,496 cost of triangulation done in advance for next year and includes Rs. 12,308 out of Rs. 18,462 cost of triangulation done last year, leaving a balance of Rs. 6,164 to be adjusted in a subsequent report. (b) Includes Rs. 34,972 cost of triangulation, etc., in advance from last year and excludes Rs. 22,672 cost of triangulation etc., in advances for survey next year. 1,484 sq. miles were also mapped in addition to 2,676 sq. miles surveyed during the year.
Undulating country, cut up by the Dāmotar and Jamunā rivers, congested with buildings, both new and disused colliery workings and many lines of rail-ways.	Four inch Supplementary survey with 10-foot contours.	249	699	1,10,450 (a)	158·0	
Steep wooded hills surrounded by cultivated undulating country.	One inch Original survey One inch Supplementary survey	109 341				
No. 9 Party—Bihār & Orissa.						
High wooded hills, open and cultivated undulating country dotted with low scrub-covered hills.	One inch Original survey One inch Supplementary survey	1,805 949	2,754	1,12,119	40·7	
Sadiyā Frontier Detachment—Assam.						
High hills and low plains, all densely wooded plains intersected by the Lohit, Dihing and Tirāp rivers.	One inch Original survey Half inch Original survey	1,913 663	2,576	1,84,779 (b)	71·7	
No. 12 Party—Assam.						
This party did not take the field but was employed on drawing of 10-mile Guide Maps of Eastern Circle.	...					
TOTALS, EASTERN CIRCLE:—		6,029 sq. m.		Rs. 4,07,348			Cost-rate 67·5

Table II.—OUT-TURNS OF PLANE-TABLING and COSTS of Topographical Surveys, 1925-26.

PARTY AND LOCALITY.		OUT-TURNS OF PLANE-TABLING.		COSTS OF SURVEY INCLUDING MAPPING.		REMARKS.	
Character of country.	Scale and class of survey.	Areas on each scale of each class.	Totals of areas on all scales.	Total costs.	Cost-rates.		
		Sq. miles.	Rs.	Rs.	Rs. per sq. mile.		
No. 10 Party—Burma.							
Wooded hills	...	338				BURMA CIRCLE. (a) Includes 25 sq. miles special forest survey. (b) 18 sq. miles special forest survey. (c) 25 sq. miles special forest survey. (d) 128 sq. miles special forest survey. (e) 260 sq. miles special forest survey. (f) Includes Rs. 9,522 debitabie to the Forest Department, Burma. (g) Includes Rs. 28,908 debitabie to the Forest Department, Burma. (h) The whole cost is debitabie to the Forest Department, Burma.	
Densely wooded hills, creeks, islands, and mangrove swamps.	Half inch Original survey	...					
Open cultivated plains, creeks and low hills.	One inch Original survey	...					
High densely wooded hills and open cultivated plains, intersected by creeks.	One inch Revision survey	344					
Densely wooded hills	One inch Supplementary survey	462					
Thickly populated wooded plateaus and wooded hills.	Two inch Original survey	86 ^(a)					
	Four inch Original survey	18 ^(b)					
No. 11 Party—Burma.							
High hills with evergreen forest and well wooded low ground varied with hills and scattered cultivation.	One inch Original survey	627					
Cultivated areas, thickly wooded low hills and plains.	One inch Supplementary survey	1,781					
Low hills and undulating ground thickly wooded.	Four inch Original survey	116					
Montsein Guide Map	Four inch Original survey	25 ^(c)					
No. 21 (Burma Forest) Party.							
Densely wooded hills and plains	Two inch Original survey	128 ^(d)					
	Four inch Original survey	260 ^(e)					
			3,315	2,18,601 (f)	65.9		
			2,549	1,68,891 (g)	66.3		
			388	1,85,304 (h)	477.6		
TOTALS, BURMA CIRCLE:—† 6,252 sq. m. Rs. 5,72,796 Cost-rate 91.6							
GRAND TOTALS:— 45,541 sq. m. Rs. 18,59,983 Cost-rate 40.8							

† In table I, 466 square miles of special forest surveys, as shown in Remarks column, are excluded.

III.—ABSTRACT OF FOREST, CANTONMENT, AND OTHER SPECIAL SURVEYS.

13. Forest Surveys.

United Provinces.—*Eastern Forest Circle.* Jhānsi Forest Divn., (p. 28). Bahraich Forest Divn., (p. 25).

Central Provinces.—*Northern Forest Circle.* Mandlā Forest Divn., Seoni Forest Divn., (p. 27).

Southern Forest Circle.—Bālāghāt Forest Divn., Bhandāra Forest Divn., (p. 27).

Sind.—*Sind Forest Circle.* Hyderābād and Karāchi Forest Divns., (p. 33).

Bombay.—*Northern and Central Forest Circles.* West Nāsik Forest Divn., (p. 39), Poona Forest Divn., (p. 39), Kolāba Forest Divn., (p. 39).

Assam.—*Eastern Forest Circle.* Sadiyā Forest Divn., (p. 42). Sibsāgar Forest Divn., (p. 42).

Bihār and Orissa.—Chaibāsa Forest Divn., (p. 41).

Burma.—*Delta Forest Circle.* Henzada-Ma-ubin Forest Divn., Bassein Forest Divn., (p. 44).

Federated Shan States Forest Circle.—*Northern Shan States Forest Divn.,* (p. 44).

Tenasserim Forest Circle.—Thaton Forest Divn., (p. 45). Thaugyin Forest Divn., (p. 45).

Hlaing Forest Circle.—Allanmyo Forest Divn., Prome Forest Divn., (p. 46).

Sittang Forest Circle.—North Toungoo Forest Divn., North Pegu Forest Divn., (p. 46).

Central Forest Circle.—Magwe Forest Divn., Pyinmanā Forest Divn., Yamethin Forest Divn., Meiktila Forest Divn., (pp. 46-47).

14. Cantonment and City Surveys, etc.

Geodetic Branch.—Campbellpore, Ferozepore, the Galis in Murree hills, Rāwalpindi, Quetta, Loralai, Fort Sandeman, Chaman, Lahore, Multān, (p. 48).

Central Circle.—Muttra, (p. 29). Pachmarhi, (p. 48).

Burma Circle.—Maymyo Guide Map, (p. 44), Moulmein Guide Map, (p. 45).

15. Special Surveys.

Punjab.—Riverain surveys, (p. 28).

Sutlej Valley Irrigation Project, (p. 29).

Ambāla-Sirmūr Boundary, (p. 29).

Punjab-United Provinces Boundary demarcation, (p. 28).

Central India.—Bhopāl surveys, (p. 49).

United Provinces.—Survey for railway flood protection, (p. 25).

Hyderābād State.—Survey of Sarangapalli-Tekmatla coalfield, (p. 37).

Revision survey on the scale $1\frac{1}{2}$ inches = 1 mile of the country around Secunderābād for the military authorities, (p. 37).

Madras.—Survey of the Kistna Valley at Siddeswaram, (p. 37). Cauvery Mettūr survey, (p. 38).

Bombay.—Fixing points for 16th Field Brigade, Royal Artillery, Kirkee, (p. 39).

Sind.—Mohenjo-daro ruins. (p. 49).

Mysore.—Fixing points for 12th Field Brigade, Royal Artillery at Hoskote and Bangalore, (p. 39).

Bihār & Orissa.—Jharia coalfield survey, (p. 41).

IV.—ABSTRACT OF GEODETIC OPERATIONS.

DIRECTOR { Lt.-Colonel R. H. Thomas, D.S.O., R.E., from 1-10-25 to 27-11-25.
| Lt.-Colonel M. O'C. Tandy, D.S.O., O.B.E., R.E., from 28-11-25.

16. Organization.—The Bhopāl Survey Detachment was transferred from the administrative control of the Director Central Circle, to that of the Director Geodetic Branch. No. 13 Party was transferred from the administrative control of the Director Geodetic Branch, to that of the Director Map Publication. No. 19 Party, which was transferred to the administrative control of the Director Frontier Circle, has been re-transferred temporarily to the control of the Director Geodetic Branch.

The designation of the Superintendent of the Trigonometrical Survey has been changed to the Director, Geodetic Branch.

The following parties and offices were administered by the Director, Geodetic Branch:—

Nos. 13, 14, 15, 16, 17, 19 and 20 Parties, Bhopāl Survey Detachment, Survey Training School, Computing and Tidal Party, No. 2 Drawing Office and the Forest Map Office.

The work of No. 20 Party (Cantonment Section) is briefly described in part X (p. 48).

Full details of the following geodetic operations are being published in the Annual Report of the Geodetic Branch.

17. Deflection and gravity observations.—(Nos. 13 and 14 Parties). These parties did not take the field during 1925-26. The computation of observations made in Kashmir during the previous year was completed, except the computation of the Hayford anomalies. Preparations were made for the International Longitude Observations at Dehra Dūn in 1926.

18. Triangulation.—(No. 15 Party). In November 1925 Principal Triangulation was commenced in Lower Burma, to supply reliable fixed points round Rangoon on which to base a new large scale map of that town, proposed by the Local Government, and to assist the topographical survey of the area.

Previous triangulation in the area consisted of some minor work done in 1875. Many of the stations had disappeared and those remaining were not sufficiently reliable to be used.

The new series breaks off southwards from the Burma Coast Series 80 miles north of Rangoon and runs through the Government Reserved Forests of the Pegu Yoma hills. The reconnoitring and building of the

stations were completed as far as Rangoon, and the observations were started in February 1926, but, after the first two stations had been observed, thick haze made further work impossible.

19. Tidal operations.—Self-registering tide-gauges were operated at Aden, Basrah, Karāchi, Bombay, Madras, Kidderpore, Rangoon and Bassein.

Readings of the actual times and heights of high and low waters, taken on tide-poles during daylight only, were made at Bhāvnagar, Chittagong and Akyab under the supervision of the local Port Officers concerned, the results being sent to Dehra Dūn regularly every month.

Weekly charts of the tidal curves registered on the automatic tide-recorder at Ma'qil were received from Basrah each month, but these observations have not been reduced by the harmonic analysis method, as the values of the tidal constants deduced from the past nine years have been deemed sufficient.

The preparation and publication of the 1927 tide tables for Basrah and the Indian ports is expected to be completed early in October 1926.

Advance manuscript and printed copies of tide tables for 17 ports for 1927 were sent to the Admiralty by the end of March 1926 for inclusion in the Admiralty tide tables. The running off of the tidal curves for 1928 tide tables has been completed.

The tidal observatories at Bassein, Rangoon and Kidderpore were inspected in February 1926.

At the request of the Deputy Conservator to the Commissioners of the Port of Calcutta, an inspection of their automatic tide-gauge at Phuldobi was made in March 1926, with the object of seeing whether the registrations of the tidal curves which had been recorded at this site for the past nine years, and which are still being continued, could be utilised for the preparation of the tide tables for Phuldobi. An estimate as to the probable cost and time for the reduction of these observations by the harmonic analysis method, and the computations of data for the preparation of tide tables for 1930 was prepared and submitted to the Commissioners of the Port of Calcutta, who, owing to retrenchment, have unfortunately not been able to sanction the expenditure.

20. Levelling.—Work for the new geodetic level net of India was continued according to the programme laid down. The following lines of geodetic levelling were run:—

In the 'back' direction only—

(a) *Sind.*—Karāchi-Kotri.

(b) *Sind and Rājputāna*.—Kotri-Barmer.

(c) *Bengal, Bihār & Orissa*.—Midnapore-Rāniganj.

(d) *Bengal, Bihār and Orissa*.—Rāniganj-Dinājpur.

In the 'fore' direction only—

(e) *United Provinces*.—Muttra-Cawnpore.

(f) *United Provinces*.—Cawnpore-Benares.

Total 1,167 miles.

Details of secondary and tertiary levelling for various purposes are given in Part X of this report, (p. 50).

21. No comparator or base-line work was undertaken during the year.

22. *Computing Office*.—Dr. J. deGraaff Hunter, M.A., Sc.D., F. Inst. P., has re-written the article on 'Geodesy' for a new issue of the Encyclopædia Britannica, XIth edition, additional volumes. The original article was written jointly by Col. Sir G. P. Lenox-Conyngham, Kt., R.E., F.R.S., and Dr. Hunter.

A magnetic storm of exceptionally great intensity—the greatest since 1913—was recorded at Dehra Dūn Magnetic Observatory. The disturbance commenced at 21 hrs. 24 mts. on 26th January 1926, reaching an amplitude of 00374 C. G. S. units.

Numerous computations, both departmental and non-departmental, were carried out, about 120 requisitions being complied with. Twenty-eight degree sheet triangulation pamphlets (including 5 Mesopotamian sheets) were compiled and six were printed. Forty have been reprinted.

Magnetic and meteorological observations were taken throughout the year. The Omori seismograph recorded 27 earthquakes during the year ending 30th September 1926, of which 2 were major and 25 minor. In addition to the regular time observations, preparations for a more precise time service have been in hand, for which a Riefler clock and two other old clocks have been installed in the Hennessey Observatory. Wireless apparatus has been set up for reception of time signal from Annapolis, Bordeaux and Honolulu in connection with the International Longitude scheme which will be carried out in October and November 1926. Arrangements have been perfected in the Hunter Observatory for precise time observations in the same connection.

23. A brief summary of the work of the Publication and Stores Office, No. 2 Drawing Office and Forest Map Office, is given in Abstract V of this report.

V.—ABSTRACT OF MAP PUBLICATION AND OFFICE WORK.

24. Full reports of the work of the printing offices at Calcutta, Dehra Dūn, &c., and of the drawing offices at all branch and circle headquarters, with *indexes* showing the progress and present state of map publication on various scales, have been published separately in the *Map Publication and Office Work Report*, from which the following tables are abstracted to show the net result of all this work in the form of Publications and Issues, for the financial year ending 31st March 1926.

25. The **Mathematical Instrument Office** has always reported in accordance with the financial year, and not the survey year; so its report, which is abstracted from the Map Publication and Office Work Report, is also for the financial year ending 31st March 1926. This report describes various interesting developments in connection with instruments for medical research and the Army, as well as for surveying, &c. The following table shows a slight decrease in gross demands on this office for the supply of instruments, while the value of the outturn from the workshops shows very little change.

3. During the year from 1st April 1925 to 31st March 1926, the demands on this office for supply and repair of instruments show an increase, compared with the previous year (*vide* items 1 and 2 in the statement below).

	1923-24.	1924-25.	1925-26.
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
1. Total value of stores issued, as shown in the Profit and Loss statements.	4,46,559	3,75,024	4,20,340
2. Value of repairs to instruments received for repairs, and returned in serviceable condition.	1,56,682	1,28,931	1,34,008
3. Value of instruments received, as no longer required.	54,824	51,875	51,045
4. Book value of the stock of instruments, &c., in Serviceable Store.	5,14,985	3,25,685	2,55,474
5. Book value of the stock of instruments, &c., in Repairable Store.	1,11,113	1,04,559	81,527
6. Total value of work done in the workshop.	3,92,072	3,82,467	4,31,269
7. Value of instruments manufactured in the workshop for Serviceable Store.	1,14,677	1,42,616	1,75,874
8. Value of instruments purchased locally.	13,034	35,356	43,326
9. Value of instruments and materials obtained from England through the Director General, India Store Department.	1,47,723	95,750	92,003
10. Average number of employees and their pay including pension contribution.	{ No. 402 Rs. 1,57,280	{ No. 386 Rs. 1,52,166	{ No. 412 Rs. 1,60,659

26. Publications.—The publications of the Department for the year are shown in the following 3 tables, of which Table I shows map publications, Table II letterpress publications, and Table III an abstract of the publication of modern topographical maps to date.

Table I (a)—Maps published at Calcutta, during the year 1925-26.

Class of maps.	Scale.	NUMBER OF DIFFERENT MAPS OF EACH CLASS RECEIVED.		Number of sheets printed.	Value.
		New publications.	New editions and reprints.		
GENERAL MAPS.		<i>Departmental.</i>			Rs.
Maps of India	Various	...	6	8,750	9,021
GEOGRAPHICAL MAPS.					
Map of India	1"=32miles	...	...	...	...
Southern Asia series ...	1:2,000,000	...	1	250	750
India and Adjacent Countries series.	1:1,000,000	5	25	11,835	19,004
La Carte Internationale du Monde.	1:1,000,000	...	1	350	350
TOPOGRAPHICAL MAPS.					
Quarter inch, (Modern) ...	1"=4 miles	24	47	28,640	43,756
Do. (Prely.) ...	1"=4 miles	3	6	2,500	4,040
Do. (Provl.) ...	1"=4 miles	...	51	12,340	18,280
Half inch, (Modern) ...	1"=2 miles	69	28	37,265	1,12,973
Do. (Prely.) ...	1"=2 miles	...	...	...	...
Do. (Provl.) ...	1"=2 miles	2	...	400	500
One inch, (Modern) ...	1"=1 mile	127	169	195,795	325,386
Do. (Prely.) ...	1"=1 mile	7	5	4,210	6,361
Do. (Provl.) ...	1"=1 mile	...	...	...	...
Old style sheets ...	Various	...	26	8,375	5,643
SPECIAL MAPS.					
District maps ...	1"=4 miles	...	...	...	...
Administration report maps ...	1"=8 miles	...	3	275	102
Provincial maps ...	Various	3	4	5,475	17,269
Plans of Cities and Cantonments	Various	1	1	1,050	3,000
Index maps ...	Various	1	1	650	318
Miscellaneous maps ...	Various	50	36	47,064	17,915
Total ...	.....	292	410	360,224	5,84,668
		<i>Extra-departmental.</i>			
Maps ...	Various	145	52	175,676	38,370
Plans and diagrams ...	Various	317	12	141,026	18,249
Illustrations ...	.....	162	1	57,719	13,149
Miscellaneous ...	.....	102	32	299,793	16,410
Total ...	.....	726	97	674,214	81,178
Grand Total ...	.....	1,018	507	1,034,438	6,65,846

Table I (b)—Maps published at Dehra Dūn.

Class of maps.	Scale.	New publications.	Reprints and new editions.	Number of sheets printed.	Value.
<i>Departmental.</i>					<i>Rs. as. p.</i>
Cantonment maps ...	Various	44	62	14,674	29,348 0 0
Forest maps ...	"	57	46	10,623	12,656 4 0
Miscellaneous ...	"	9	2	4,767	3,231 13 3
Total ...	...	110	110	30,064	45,236 1 3
<i>Extra-departmental.</i>					
Maps ...	Various	565	21	170,147	25,748 9 8
Plans & diagrams ...	"	43	...	30,119	1,368 1 0
Charts ...	4" = 1 mile	324	...	116,125	9,110 1 0
Total ...	...	932	21	316,391	36,226 11 8
Grand Total ...	...	1,042	131	346,455	81,462 12 11

Notes.

27. Calcutta.—Map publication was considerably delayed by the heavy work of surprinting minute meshes for the Army Department on a very large number of maps already published. As these maps were trimmed and also in many cases folded, the surprinting could only be effected in hand-presses, and registration was difficult and often imperfect. This work left insufficient hand-presses for ordinary proof work.

28. Dehra Dūn.—In addition to the work shown in Table I(b) above, 66,063 prints of 972 originals, consisting of plane-table sections, triangulation charts and pamphlets, and forest maps were printed free of charge.

In June 1925, the outturn of negatives reached a record of 287 negatives, and in October 1925, the outturn of the printing machines reached a record of 55,764 prints, representing 86,186 pulls.

Table II.—Letterpress publications.*(a)* PUBLISHED AT CALCUTTA.

1. Survey of India General Report, 1924-25. Price Re. 1 or 1s. 9d. (475 copies).
2. Survey of India Map Publication and Office Work Report, 1924-25. Price Re. 1 or 1s. 9d. (475 copies).
3. Confidential Supplement to the Survey of India General Report, 1923-24.
4. Confidential Supplement to the Survey of India General Report, 1924-25.
5. Government of India Orders Nos. 814 to 819.
6. Survey Notes—from February 1925 to February 1926 (350 copies for each month).
7. Circular Order No. 293, reprint (300 copies).
8. Booklet for Conventional Signs for use on P. T. Sections (1,000 copies).
9. Catalogue of Maps, Confidential (150 copies).
10. Sections 1 to 4 of the Hand-book of Topography, Chapter VIII (600 copies).
11. Correction No. 28, to the Hand-book of Topography, Chapter I, 1921 (600 copies).
12. Correction No. 2, to the Hand-book of Topography, Chapter II, 1923 (600 copies).
13. Corrections Nos. 1 and 2, to the Hand-book of Topography, Chapter IV, 1924 (600 copies each).
14. Corrections Nos. 134 to 138, 141, 142, 144, 145 and 146, to the Hand-book of Topography, Chapter VI, 1922 (650 copies each).
15. Corrections Nos. 16, 17 and 19 to the Hand-book of Topography, Chapter X, 1919 (600 copies each).
16. Corrections No. 14, to Border Specimen for Topographical Maps, January 1920, (1,000 copies).
17. Corrections Nos. 15 & 16, to Type-Table for Topographical Maps, December 1920, (1,000 copies each).
18. List of published maps for record in the office of the High Commissioner for India, General Department, Record Branch, London and for sale to the public for the quarters ending 31st December 1924, 31st March, 30th June, 30th September and 31st December 1925 (50 copies for each quarter).
19. List of published maps, "For Official Use Only", for record in the office of the High Commissioner for India, General Department, Record Branch, London and not for sale to the public for the quarters ending 31st December 1924, 31st March, 30th June, 30th September and 31st December 1925 (10 copies for each quarter).
20. Map publication lists—From February 1925, to February 1926 (800 copies each month).
21. Instructions for applicants for appointment as Class II officers (300 copies).
22. Rules to be observed in the examination of candidates for the Class II service of the Survey of India (200 copies).
23. Rules for the guidance of officers conducting the Class II service examination (100 copies).
24. Appendices, tables on title-pages etc., for the Memorandum by the Surveyor General on the pay of Class II officers (200 copies).
25. Rules for the appointment of store keepers in field parties (200 copies).
26. Addenda and corrigenda to regulations on the subject of Language Examinations etc. 10th and 11th lists of corrections (400 copies each).
27. Calendar for 1926 (3,000 copies).

Table II (a)—(Concl'd.).

28. Rules and regulations of the M. I. O. (5,000 copies).
29. Account rules of the M. I. O. (30 copies).
30. Annual indent for D. O. (15 copies).
31. Annual indent for E. O. (15 copies).
32. Photo.-Litho. Office annual indent (15 copies).
33. M. I. O. annual indent and supplementary indent (15 copies each).

(b) In Hand at Calcutta.

1. *Government of India Orders—Re changes in nomenclature of Class I officers.*
2. *Government of India Orders—Re date from which sanctions accorded by the Secretary of State in Council should take effect.*
3. *Hand-book of Topography, Chapter V.*
4. " " " VIII (from Section V).
5. " " " XI.
6. *Correction Nos. 163 to 178, to the Hand-book of Topography, Chapter VI (1922).*
7. *Correction No. 17, to Type Table for Topographical Maps (1920).*
8. *List of names for the Simla Guide Map.*
9. *List of names for the Bangalore Guide Map.*
10. *P. L. O. annual indent.*

(c) PUBLISHED AT DEHRA DŪN.

1. Records of the Survey of India, Vol. XX. The War Record 1914—20 (720 copies).
2. Hand-book of Topography Chapter IX (660 copies).
3. 13 Triangulation Pamphlets and Addenda to 1/M sheet 61 (1,400 copies).
4. Additional tables (Traverse) to Auxilliary Tables Part III (500 copies).
5. Tide Tables for Indian ports for 1926 (5,190 copies).
6. New data for Levelling Pamphlets, 53, 57, 79 (650 copies).
7. Additions and corrections No. 2, to Routes in the Western Himālaya, Kashmir &c. Vol. 1 of January 1926 (500 copies).
8. 69 correction slips to Forest Map Catalogue (10,350 copies).
9. Forest Map Office Record book (50 copies).
10. Professional forms (129,873 copies).
11. Miscellaneous (181,009 copies).

(d) In Hand at Dehra Dūn.

1. *Records of the Survey of India, Vol. XIX. The Magnetic Survey of India.*
2. *Records of the Survey of India, Vol. XXI. (1) Air Survey in the Irrawaddy delta by Major C. G. Lewis, R.E., and (2) Narrative Report of Bhutān and South Tibet Survey Detachment by Captain H. R. C. Meade, I.A.*
3. *Government of India and Circular Orders (Administrative) from January 1919 to 31st December 1924.*
4. *Professional Paper No. 20—Reconnaissance Survey from Aircraft by Lt. Colonel G. A. Beazeley, D.S.O., R.E.*
5. *Auxiliary Tables Part I. Fifth edition (reprint).*
6. *The Tides—Part V of the Hand-book of Trigonometrical Instructions.*
7. *Levelling of Precision—Part VI of the Hand-book of Trigonometrical Instructions.*
8. *Levelling Pamphlet 44 (revised and extended). Addenda to Pamphlets 41 & 46.*
9. *Wasiristān Air Survey.*
10. *List of Cantonments and Military Stations.*

Table III.—Publication of modern topographical maps.

Years of publication.	NUMBER OF SHEETS PUBLISHED.		
	One inch sheets.	Half inch sheets.	Quarter inch or Degree sheets.
1925-26	127	69	27
Previous years	2,157	540	125
Total published ...	2,284	609	152
Number of sheets in India ...	6,218	1,630	450

Map issues.—The following tables show the number of maps issued during the year.

Table IV (a).—Map issues, Calcutta.

	ON BOOK TRANSFER (TO GOVERNMENT OFFICIALS).		ON CASH PAYMENT.		FREE ISSUES.		TOTAL.	
	Number of copies.	Value. Rs.	Number of copies.	Value. Rs.	Number of copies.	Value. Rs.	Number of copies.	Value. Rs.
Departmental.	61,347	87,673	63,869	91,556	29,551	48,639	154,767	2,27,868
Extra-departmental.	898,376	84,727	68,982	26,659	2,761	3,147	970,121	1,14,533
Total ...	959,725	1,72,400	132,851	118,215	32,312	51,786	1,124,888	3,42,401

Table IV —Map issues, Dehra Dūn & Circles.

BRANCH OR CIRCLE.	ON BOOK TRANSFER (TO GOVERNMENT OFFICIALS).		ON CASH PAYMENT.		FREE ISSUES.		TOTAL.	
	Number of copies.	Value. Rs.	Number of copies.	Value. Rs.	Number of copies.	Value. Rs.	Number of copies.	Value. Rs.
Dehra (F. M. O.).	14,290	13,798	2,183	3,425	4,545	8,519	21,018	25,742
Dūn (No. 2 D. O.)	1,540	2,281	1,018	2,040	3,706	10,473	6,264	14,794
Central Circle ...	.....	.....	164	317	.....	.....	164	317
Southern Circle ...	426	813	1,939	3,244	.....	.....	2,365	4,057
Eastern Circle ...	.....	.....	133	271	.....	.....	133	271
Burma Circle ...	.....	.....	57	154	.....	.....	57	154
Total ...	16,256	16,892	5,494	9,451	8,251	18,992	30,001	45,335

29. Map Record and Issue Office, Calcutta.—During the year under review, the issues of departmental publications on book debit to government officials were less than those for recent years; other issues were generally the same. The decrease is mainly due to the fact that from 1921 to 1925 large new issues were made to the Army for mobilization purposes, as their old stocks were out of date; this demand has now practically ceased.

Sales to the general public have remained much the same, but the number of demands and enquiries has increased by over one thousand and is now 11,500. The publication of modern surveys in the neighbourhood of Bombay should lead to increases; especially if a suitable selling agency is established there.

The total number of shelves constructed to date in the map store-rooms is 6,750, as against about 10,000 required for the full survey programme, as at present foreseen.

In the "original" record room an additional 40 shelves were completed, bringing the total to 600. These will accomodate nearly all the fair originals of the present survey programme.

VI.—SURVEY REPORTS, CENTRAL CIRCLE.

DIRECTOR { Lt.-Col. L. C. Thuillier, I.A., to 2nd November 1925.
 Major V. R. Cotter, I.A., from 3rd November 1925 to 27th November 1925.
 Lt.-Col. R. H. Thomas, D.S.O., R.E., from 28th November 1925 to 9th
 March 1926.
 Lt.-Col. R. H. Phillimore, D.S.O., R.E., from 10th March 1926.

30. Summary.—The designation of Northern Circle was changed to Central Circle from April 1st 1926. Nos. 1 and 22 Parties, the Jhānsi Survey Detachment and No. 3 Drawing Office were administered by this circle throughout the year. No. 23 Party was transferred to the Frontier Circle from 1st July 1926, and No. 5 Party was transferred from Southern Circle on April 1st, 1926. A small Railway Survey Detachment was formed for the field season only, under Rai Sahib Nanak Chand Puri.

The officer in charge of No. 5 Party in addition to his normal duties, acted as Assistant Director of Surveys, Central Provinces, and administered the revenue, town, and other surveys of that province.

31. One Upper Subordinate officer from No. 3 Drawing office was deputed to lay down a forest boundary between Bahraich Forest Division and Kheri district. The work occupied six weeks, and the cost was debited to the Forest Department.

32. Training.—11 pupil surveyors and 2 soldier surveyors made satisfactory progress in one inch topographical survey.

47 pupil surveyors were employed on 4 inch survey in No. 23 Party and on conclusion of the work of the Sutlej Valley Project in June 1926, 46 were distributed among other units.

33. Railway Survey Detachment.—*Special surveys.*—At the request of the Chief Engineer, East Indian Railway, an area of 56 square miles was surveyed on the scale 4 inches = 1 mile, with contours at 2 feet vertical interval, at the points where the Solāni and Rāmgangā rivers caused serious breaches of the railway near Laksar and Morādābād during the floods of September 1924.

The Solāni river area lay in Sabāranpur district; the Rāmgangā area lay in Morādābād district.

Work lasted from November to April; no fair mapping was required.

The whole cost was borne by the East Indian Railway.

34. No. 1 Party.—*Topographical surveys.*—This party surveyed

PERSONNEL.

Class I Officer.

Major R. Foster, I.A., in charge from 26th October 1925.

Class II Officers.

Mr. P. A. T. Kenny, O.B.E., in charge from 16th July 1925 to 25th October 1925.

Mr. A. M. Talati, L.C.E.

Major C. H. Tresham.

Mr. Seth Ram Gupta,
(on probation).

Upper Subordinate Service.

2 Officers.

Lower Subordinate Service.

43 Surveyors, etc.

an area of 2,660 square miles on the scale 1 inch = 1 mile in Bāndā, Cawnpore, Fatehpur, and Hamirpur districts of the United Provinces, 560 square miles in Ajaigarh, Baoni, Beri, Charkhāri, Chhatarpur, and Gaurihār States of the Bundelkhand Agency and a small area of the Baghelkhand Agency of Central India; a total of 3,222 square miles.

35. Nature of country.—The country surveyed on the scale 1 inch = 1 mile consisted of cultivated plains in Cawnpore, Fatehpur, Hamirpur and the north of Bāndā district, flat and covered with numerous swamps and groves of trees in the two former districts, much more open and slightly undulating in the rest of the area. In the south of Bāndā district and the Indian states the country rises and is covered with numerous isolated rocky outcrops finally touching, in the south, the forest clad plateau of the Bindhāchal range of the Vindhya.

36. Triangulation.—An area of 6,834 square miles was triangulated in advance in Palāmau and part of Rānchi and Hazāribāgh districts of the Bihār and Orissa Province and Sargujā State of the Central Provinces.

37. Training.—Two soldier surveyors, 3 draftsmen and 8 pupil surveyors joined the party and underwent a course of instruction in surveying in the field. After 2 months training they were entrusted with the survey of a portion of the area.

38. Boundary demarcation.—One surveyor, during December 1925, was deputed to demarcate the boundary between the villages of Amchauli and Galauli in the Bāndā tahsil of Bāndā district, at the request of the Munsif of Bāndā, for the purpose of settling a dispute in a case pending in his court, the cost of the work being paid by the litigants.

A small estate in Naini Tāl was surveyed by one surveyor on the scale 1 inch = 40 feet, the cost of survey being met by the owner.

39. No. 5 Party.—*Topographical surveys.*—This party sur-

PERSONNEL.

Class I Officers.

Major H. E. Roome, M.C., R.E., in charge.

Class II Officers.

Mr. N. N. Chuckerbutty, L.C.E.

,, A. F. Murphy.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

20 Surveyors, etc.

veyed a total area of 2,846 square miles on the scale 1 inch = 1 mile in the Bālāghāt, Bhandāra, Mandlā and Seoni districts of the Central Provinces. In addition, an area of 4,457 square miles was triangulated in the Bhandāra, Chānda, Nāgpur and Wardhā districts.

40. Forest surveys.—In the Bālāghāt, Bhandāra, Mandlā and Seoni Forest Divisions of the Northern and Southern Forest Circles, Central Provinces, an area of 671 square miles of reserved forests, for which four inch sheets already existed, was revised on the scale 1 inch = 1 mile, during the work outlined above. In addition, in the Mandlā Forest Division an area of 1·2 square miles of reserved forest was surveyed on the scale 4 inches = 1 mile.

41. Nature of country.—The country surveyed in the northern and southern portions consists mainly of densely wooded plains and hills interspersed with cultivation, while the central sector comprised well cultivated plains generally covered with trees and containing numerous small tanks. The principal river is the Waingangā. The western half of the area is intersected with irrigation channels, fed from the Waingangā River and certain large lakes.

42. Boundary survey for the Central Provinces Government.—One surveyor was deputed to accompany the Central Provinces Boundary Officer and to map 83 linear miles of boundary between Raipur district, Central Provinces and Patnā State.

43. Pachmarhī Guide Map.—At the request of the Central Provinces Government, an area of 6 square miles was surveyed on the scale 4 inches = 1 mile.

44. Field of firing map.—At the request of the Small Arms School, Pachmarhī, two maps of their field of firing areas were prepared on the scale 16 inches = 1 mile.

45. Jhānsi Survey Detachment.—*Topographical surveys.*—

PERSONNEL.

Class II Officers.

Mr. P. A. T. Kenny, O.B.E., in charge from 28th October 1925.

Mr. J. C. C. Lears, in charge from 1st to 27th October 1925.

Mr. O. D. Jackson.

,, M. N. A. Hashmi, B.A., (on probation).

Lower Subordinate Service.

20 Surveyors, etc.

This Detachment was formed on 1st October 1925 to carry on topographical surveys in the United Provinces and Central India, in the neighbourhood of Jhānsi, and surveyed an area of 2,752 square

miles on the scale 1 inch = 1 mile. This includes 1,074 square miles in the Jhānsi district of the United Provinces, 810 square miles in the Gwalior State, 854 square miles in the Orchhā State of the Bundelkhand Agency of Central India, and 14 square miles in the Khaniādhana State of the Gwalior Residency of Central India.

550 square miles of the above area was triangulated during the field season for supplementary heights.

46. Forest surveys.—In the Jhānsi Forest Division, Eastern Forest Circle, U. P., an area of 25 square miles of reserved forests, for which four inch sheets already existed, was revised on the scale 1 inch = 1 mile during the work outlined above.

47. Nature of country.—The country surveyed consisted of dense jungle-clad hills and undulating plains, partly cultivated and partly covered with thorny scrub.

48. Training.—Three pupils and one draftsman joined for training and received instruction in planetabling during the field season 1925-26 and in drawing during the recess of 1926.

49. No. 22 (Riverain) Party.—*Traverses.*—This party

PERSONNEL.
Class I Officer.

Mr. Dhani Ram Verma, R.S., in charge.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

37 Surveyors, traversers, etc., (excluding 46 purely temporary men and 11 pupils).

continued the work of traversing and laying down base-lines. 297 linear and 285 square miles of main-circuits along the Rāvi river in Lyallpur, Shekhūpura and Montgomery districts and 3,698 linear miles and 768 square miles of minor traverses in the Indus riverain tract in Miānwāli district and in the Jhelum riverain tract in Jhelum district were executed. 509 theodolite stations of the former and 17,783 of the latter in 238 villages were fixed. 339 corners of 114 base-lines in 904 square miles were demarcated with permanent mark-stones on both banks of the Indus river in Miānwāli district and Jhelum river in Jhelum district and Kashmīr State to serve as bases for future survey and demarcation of boundaries and fields in the bed of the rivers. 2,618 plotted and 639 boundary *musāvis* (settlement mapping sheets) on the scale of 1/2640 and 37 four inch sheets were traced and supplied to the Settlement Officer, Miānwāli and the Deputy Commissioner Jhelum district. Besides these, 477 miscellaneous traces were prepared, and all the traverse stations marked during the field season were plotted on 43 four inch sheets.

50. Punjab-U. P. boundary demarcation.—This was undertaken for the Punjab and U. P. Governments. It comprised original survey on the scale 4 inches = 1 mile of the villages of Gurgaon district in the

Punjab and Bulandshahr district in the United Provinces along the Jumna river, proposed for transfer from one province to the other, and demarcation of the new inter-provincial boundary with stone pillars.

For this purpose boundaries of villages were traversed and main-circuits were run along both banks of the river; in all 447 linear miles were traversed and 2,021 stations were fixed. 46 square miles were surveyed on scale of 4 inches = 1 mile. 288 stone pillars were erected on the new inter-provincial boundary. 8 four inch plot-sheets of traverses were prepared for future use.

51. Ambāla-Sirmūr boundary survey.—This was undertaken for the Deputy Commissioner, Ambāla district. The work consisted in traversing the boundaries of villages Jhanda, Sālepur and Thaska of Ambāla district, the northern portions coinciding with the boundary of Sirmūr State in dispute and plotting the boundaries on *musāvis* on the same scale as that of the settlement *musāvis* of the district. 19 linear miles were traversed and 137 stations were fixed. 30 boundary plots were prepared and supplied to the Deputy Commissioner, Ambāla.

52. Muttra Nuzūl land survey.—This was undertaken for the Municipal Board, Muttra (U. P.). It comprised revision of the existing property map of the Sadar Bāzār on the scale 64 inches = 1 mile. For this purpose main and minor traverses were carried out. In all 11 linear miles were traversed and 446 stations were fixed. Each individual property was measured and its superficial contents were worked out, the total area surveyed was 70 acres. A special map with a schedule of the properties surveyed and their areas in acres was prepared to enable the municipal board to prepare the *khasra* and to work out encroachments on municipal land.

53. No. 23 Party.—*Sutlej Valley Irrigation Project.*—During the year the party was employed on 4 inch topographical survey of the area commanded by the Sutlej Valley Irrigation Project in the Montgomery, Lahore and Ferozepore districts, in continuation of the area surveyed by No. 20 Party in 1924-25. A small area round the Panjnad weir sites in district Muzaffargarh, commanded by the same project, was also traversed and surveyed on the scale 4 inches = 1 mile. The party also rectangulated a small strip along the

PERSONNEL.

Class I Officer.

Major J. D. Campbell, D.S.O., R.E., in charge, excluding a month from 4th January 1926.

Class II Officers.

Mr. H. B. Simons, from 28th December 1925 in charge from 4th January 1926 to 3rd February; 1926.

Mr. O. N. Pushong.

„ J. H. Johnson.

Captain J. O'C. Fitzpatrick from 6th October 1925 to 22nd February 1926.

Mr. Duni Chand Puri.

Upper Subordinate Service.

2 Officers.

Lower Subordinate Service.

66 Surveyors, etc., and pupils (excluding 73 purely temporary men).

Bikaner canal, being an extension of the area previously rectangulated by the party in the Ferozepore district.

A total area of 2,423.85 square miles was surveyed, 37.84 linear miles traversed, and 145 square miles rectangulated into 25-acre rectangles.

The country surveyed lies on either bank of the Sutlej River and consists partly of populated country, cultivated and watered by inundation canals, and partly of desert with open scrub jungle and some sand hills.

Published sheets were reproduced in black by photography from the original plane-table sections. A small drawing section was formed during the field season to deal with typing, etc. 66 plane-table sections were submitted for publication during the field season and the remainder early in recess.

VII.—SURVEY REPORTS, FRONTIER CIRCLE.

DIRECTOR:— { Lt.-Col. C. P. Gunter, O.B.E., R.E., from 1-10-25 to 14-3-26.
 { Lt.-Col. R. H. Thomas, D.S.O., R.E., from 15-3-26.

54. Summary.—The following units were administered by the Frontier Circle during the year:—A and E Companies, Nos. 18 and 19 Parties, No. 6 Drawing Office (Simla), and Settlement Survey Detachment. No. 19 Party was temporarily transferred to the control of the Director Geodetic Branch from 12th April 1926. No. 23 Party was transferred from the Central to the Frontier Circle from 1st July 1926. Its report appears under the Central Circle.

55. Training.—Two Class II probationers, nine Upper Subordinate probationers, eleven pupil surveyors, eleven soldier surveyors and two purely temporary traversers commenced or continued their training in field and recess work in A and E Companies during the year. Three Upper Subordinate probationers were discharged as unlikely to become efficient officers and two soldier surveyors reverted to their units at the termination of first period of their extra training.

56. Party reports.—Particulars of the work done by the field units of the circle are given below.

57. A. Survey Company.—*Topographical surveys.*—This Com-

PERSONNEL.

Class I Officers.

Lt.-Col. R. H. Phillimore, D.S.O., R.E.,
 in charge from 12th November 1925 to 2nd
 March 1926.

Captain W. J. Norman, M.C., R.E., in
 charge to 11th November 1925 and from 3rd
 March 1926.

Captain G. F. Heaney, R.E., (on proba-
 tion).

Lieut J. B. P. Angwin, R.E.

Class II Officers.

Mr. A. A. Graham.

„ F. W. Smith.

„ C. M. Aslam, B.A.

„ T. M. C. Alexander, (on probation).

Upper Subordinate Service.

2 Officers.

Lower Subordinate Service.

24 Surveyors, etc.

company surveyed a total area of 3,607 square miles on the scales 1 inch and $1\frac{1}{2}$ inches = 1 mile. This includes 800 square miles on the scale 1 inch = 1 mile and 70 square miles on the scale $1\frac{1}{2}$ inches = 1 mile original survey in Swāt and Buner, 2,270 square miles on the scale $1\frac{1}{2}$ inches = 1 mile revision survey in Peshāwar and Hazāra districts in the North-west Frontier Province: 467 square miles of revision survey or re-survey in the Attock and Rāwalpindi districts in the Punjab.

An area of 1,550 square miles has been triangulated in advance for

detail surveys on the scales $\frac{1}{2}$ inch and $1\frac{1}{2}$ inches = 1 mile in Hazāra district and tribal territory in the North-west Frontier Province.

58. Rāwalpindi four inch Guide Map.—Triangulation in advance of 100 square miles has been carried out for a four inch Guide Map of Rāwalpindi and environs.

59. *Nature of country.*—The country surveyed comprises highly cultivated plains, arid plains, bare foot-hills and medium hills partly wooded.

60. *Training.*—Six soldier surveyors and seven pupil surveyors joined for training during the year and received instruction in plane-tableing on the scale $1\frac{1}{2}$ inches = 1 mile during the cold weather and on the scale 4 inches = 1 mile in the hills during the hot weather. In addition they received instruction in drawing, plotting and projection.

61. *Air survey of Waziristān.*—The compilation made from air-photos by No. 18 Party has been incorporated in sheets 38 H/13,15, 38L/1,2,3,5,6 and these sheets have been redrawn.

62. *Survey in Buner and Swāt.*—This year's work included the revision of sheets 43 B/2,7,11 as the Upper and Lower Swāt canals have been constructed since the original survey. These sheets have never been completely surveyed, the portion of Buner included in them being omitted. Buner which lies to the north of Peshāwar district and between the Indus and the Swāt rivers together with the Swāt Valley above Chakdarra has hitherto, like the remainder of tribal territory, been closed to the surveyor. During the last few years the Miān Gul has extended and consolidated his position and has now firmly established himself as ruler of all Swāt and Buner. While survey work was being carried out in Peshāwar district, the political authorities were asked if the survey could be extended into Buner. This the Miān Gul consented to allow and he also gave permission for the survey of a considerably larger area comprising most of sheets 43 B/5, 6, 9, 10, 13. It was considered advisable that the work should be done at once. Mr. C. M. Aslam therefore commenced triangulation in February and the detail survey was commenced in the middle of May.

Likewise, taking advantage of the present political situation, Sir Aurel Stein, K.C.I.E., obtained permission to enter the Miān Gul's dominions to carry on archæological research. As he was entering unknown country, a surveyor, Torabāz Khān, was sent with him. He was able to survey Upper Swāt on the scale $\frac{1}{2}$ inch = 1 mile.

63. *Co-operation with the Royal Artillery.*—In November 1925 Lieut. G. F. Heaney, R.E., attended the R. A. Practice Camp at Akora and studied the survey methods used by battery officers.

Captain W. J. Norman, M.C., R.E., attended manœuvres with the R. A. Survey Section in November 1925.

In January 1926 Colonel C. P. Gunter, O.B.E., R.E., Director, Frontier Circle and Lt.-Colonel R. H. Phillimore, D.S.O., R.E., attended a conference with the Major General Commanding the Royal Artillery at Akora.

In February 1926 Lt.-Colonel R. H. Phillimore, D.S.O., R.E., visited Kākul and inspected the R. A. Survey Section at work.

64. E. Survey Company.—*Topographical surveys.*—This

PERSONNEL.

Class I Officers.

Bt.-Lieut.-Col. S. W. S. Hamilton, D.S.O., R.E., in charge to 31st April 1926.

Major E. O. Wheeler, M.C., R.E., in charge from 9th April 1926.

Lieut. G. Bomford, R.E. (on probation).

„ D. R. Crone, R.E. (on probation).

Class II Officers.

Mr. A. J. A. Drake, D.C.M.

„ Abdul Karim, B.A.

„ J. C. Berry, (on probation).

„ M. R. Nair, B.A. (on probation).

Upper Subordinate Service.

11 Officers (9 on probation).

Lower Subordinate Service.

22 Surveyors, etc.

company surveyed an area of 281 square miles in Las Bela State in Baluchistān, 784 square miles in the Karāchi district and 307 square miles in the Hyderābād district of the Sind province on the scale $1\frac{1}{2}$ inches = 1 mile; and 61 square miles in Las Bela State and 666 square miles in the Karāchi district on the scale 2 inches = 1 mile.

1,050 square miles of triangulation and 328 square miles of traversing, covering a total area of 1,378 square

miles, were carried out in Las Bela State and Hyderābād and Karāchi districts, and computed in advance of the detail survey. An area of 370 square miles was triangulated, 900 square miles reconnoitred for triangulation and 270 square miles traversed in advance for next season's detail survey, in Karāchi district.

65. Forest surveys.—In the Hyderābād and Karāchi Forest Divisions of the Sind Forest Circle, an area of some 81 square miles of reserved forests, for which 1 inch, and in some cases, 2 inch old style topographical maps existed, was resurveyed on the scale $1\frac{1}{2}$ inches = 1 mile during the course of the topographical surveys.

66. Nature of country.—The country surveyed included the cities of Karāchi and Hyderābād (Sind) and the southern extremities of the Pab and Kirthar ranges of hills on either side of the Hab river.

Otherwise the country consisted of plains with occasional low undulating hills, open, waterless and devoid of trees or cultivation around Karāchi and on the right bank of the river Indus, while that on the left bank, being a canal area, was mostly covered with trees and thick vegetation.

67. Training.—Two Class II officers, nine Upper Subordinate officers, four pupil surveyors, five soldier surveyors and two purely temporary traversers commenced or continued their training in field and recess work during the year.

68. No. 18 (Air Survey) Party.—*Cadastral surveys.*—The

PERSONNEL.

Class I Officers.

Captain O. Slater, M.C., R.E., in charge,
up to 16-11-25.

Captain W. J. Norman, M.C., R.E., in
charge up to 23-2-26

Captain G. F. Heaney, R.E., in charge
from 1-3-26.

Class II Officers.

Nil

Upper Subordinate Service.

1 Officer.

Lower Subordinate Service.

7 Surveyors, etc.

experimental work in connection with the construction of cadastral maps based on air-photographs, referred to in last year's report, has been continued and the following large scale Settlement Surveys have been carried out.

An area of 14 square miles in the Swābi *tahsīl* of Peshāwar district was photographed by the Royal Air Force and *musāvis* on the scale 24 inches = 1 mile, showing boundaries of field and other detail required in Settlement Surveys, were prepared for the Settlement Officer, Peshāwar district. The country was nearly all cultivated and fairly level and therefore suitable for air survey.

An area of 140 square miles in the Pindi Gheb *tahsīl* of Attock district was photographed and *musāvis* on the scale 16 inches = 1 mile were prepared for the Settlement Officer Campbellpore. The area was not very heavily cultivated. From the experience gained in these two surveys improved methods and organization have been evolved, which should be of considerable value if more of this work is to be undertaken in the future.

69. Surveys of the river Indus.—An area of 200 square miles astride the river Indus above and below the town of Dera Ismāil Khān was photographed and mapped on the scale 4 inches = 1 mile for the Irrigation Department N. W. F. P.

A mosaic, on the scale 3 inches = 1 mile, of 20 miles of the river Indus south of Hyderābād (Sind) was constructed for the Chief Engineer in Sind.

70. Surveys on the Frontier.—The air survey of inaccessible parts of the North Western Frontier, also referred to in last year's report, was continued and gaps, covering an area of about 45 square miles in the existing compilations of Waziristān on the scale 1½ inches = 1 mile, were filled in, in co-operation with the Royal Air Force.

71. Settlement Survey Detachment.—The detachment continued the work of triangulation,

PERSONNEL.

Class II Officers.

Mr. Maya Das Puri, R.S., in charge.

„ Mahamud Najamuddin, B.A.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

31 Surveyors, etc. (excluding 62 purely temporary men).

traversing, and frontier boundary survey in the Peshāwar district (*tahsīls* Mardān, Swābi, and Nowshera), and that of supplementing

points and post-pointing in the Pindi Gheb *tahsīl* of the Attock district.

72. Indus survey.—At the special request of the Settlement Officer, Peshāwar, the survey of the Indus river towards Peshāwar, on the scale 24 inches = 1 mile was undertaken showing *belās* (wooded and grassy islands), main channels and supplementary points fixed by plane-table intersection for the use of *patwāris* for demarcating boundaries in the bed of the river. 44·8 square miles of the river facing the Attock and the Hazāra districts up to village Jahāngira of the Swābi *tahsīl* were surveyed. For the portion falling opposite the Hazāra district, 10 linear miles of road running along the river and several *pakka* points were also surveyed on the same scale to serve as references for the future demarcation of the district boundary in the bed of the river. 116 surveyed *musāvis* (settlement mapping sheets) and a congregated compiled map on the scale 4 inches = 1 mile were supplied to the Settlement authorities.

73. Frontier boundary survey.—In continuation of the work done last year, 45 linear miles of the frontier boundary (*tahsīls* Mardān and Swābi) and a few alterations made by the Settlement Officer in the Chārsadda frontier boundary, 52 linear miles of internal village boundaries in the Swābi *tahsīl*, and about 300 acres of scattered cultivation in Mardān were surveyed on the scale 24 inches = 1 mile.

74. Nowshera Hills boundary survey.—As arranged by the Settlement Officer, Peshāwar, the survey of village boundaries in the Nowshera hills was taken up at the end of January, when a portion of the Nowshera triangulation had been completed on the scale 12 inches = 1 mile. 335 linear miles of boundaries of 56 villages in 305 square miles, were surveyed: and 121 surveyed and 625 plotted *musāvis* were supplied to the Extra Assistant Settlement Officer, Nowshera. Much trouble was experienced in this part, as it was mostly barren and dangerous; moreover the local officials found great difficulty in pointing out boundaries on the ground owing to defective maps of the last settlement.

Five Lower Subordinate officers were given preliminary instruction in plane-tabling on the scale 12 inches = 1 mile for over a month during March and April with a view to utilizing their services next field season for surveying boundaries and cultivation in the Nowshera hills.

75. Out-turn.—In addition to the above, the following work was completed for the Settlement Officers:—

Peshāwar:— 2,191·7 linear miles were traversed in 702 square miles of 164 villages in the Nowshera *tahsīl* and 8,163 theodolite stations laid out on the ground. 44½ square miles of the Nowshera hills and 1 square

mile of the *Mardān* frontier disputed boundary were triangulated, and 393 stations and 982 intersected points laid out.

703 square miles were computed and plotted, also 2,029 plotted *musāvis*, 102 riverain compiled boundary *musāvis* on the scale 24 inches = 1 mile and 239 four inch indexes and their traces were supplied to the Settlement Officer.

Besides these, 1,008 miscellaneous traces were prepared, and all the work done during the year plotted on four inch sheets.

87 four inch indexes of 104 villages were reduced by pentagraph to the scale 1 inch = 1 mile, and boundaries compiled on 8 one inch topographical sheets of the *Nowshera tahsīl*.

The area of 377 villages (209 in *Chārsadda*, and 168 in *Mardān*) containing 884 square miles was extracted by planimeter and graphically from the twentyfour inch settlement survey *musāvis*.

407 *musāvis* of 43 villages (14 in *Chārsadda*, and 29 in *Mardān*) were traced on paper for experimental use by the *patwāris*.

450 twentyfour inch *musāvis* of 32 villages in *Mardān*, were reduced by pentagraph to the scale 4 inches = 1 mile, 32 four inch indexes prepared and the rectangles of 4,000 *musāvis* corrected.

5 congregated maps *viz.*, two of *Chārsadda* and two of *Mardān tahsīl*, showing assessment circles and detail (scale $\frac{1}{4}$ inch = 1 mile), and one of *Mardān tahsīl*, showing frontier boundary and detail (scale 4 inches = 1 mile) were compiled for the Settlement Officer.

102 reductions on the scale $1\frac{1}{2}$ inches = 1 mile, showing boundaries and detail, were prepared for A Company.

Attock.—2,039 points were supplemented by plane-table intersection in 95.9 square miles of 7 villages on 120 *musāvis* on the scale 16 inches = 1 mile for surveying detail; also 1,763 points were post marked on 110 sixteen-inch *musāvis*; and photographs in 140 square miles for compiling the revenue maps from the aero-photo survey and 71 sixteen inch *musāvis* compiled and supplied to the Settlement Officer.

76. *Nature of country*.—The ground in the *Mardān* and the *Swābi* frontier was generally hilly. The *Indus* riverain area was sandy, shrubby, and contained many very valuable wooded islands. The major portion of the *Nowshera tahsīl* was barren, hilly and contained scattered patches of cultivation, while parts along the *Kābul* river were very fertile and well irrigated. The *Pindi Gheb* area was undulating, broken, hilly and poorly cultivated.

VIII.—SURVEY REPORTS, SOUTHERN CIRCLE.

DIRECTOR:—
 ♦ Lt.-Col. M. O'C. Tandy, D.S.O., O.B.E., R.E., from 12th May 1925 to 15th November 1925.
 Lt.-Col. L. C. Thuillier, I.A., from 16th November 1925 to 18th April 1926.
 Lt.-Col. C. M. Browne, C.M.G., D.S.O., R.E., from 19th April 1926.

77. Summary.—The parties, etc., administered by the Southern Circle during the year were Nos. 6, 7 and 8 Parties and No. 4 Drawing Office. No. 5 Party, which was under the administrative control of the Director Southern Circle during the year, was transferred to that of the Director Central Circle from 1st April 1926.

78. Recess work.—32 sheets on the scale $1\frac{1}{2}$ inches = 1 mile were submitted by parties to the Circle Office before the 30th September 1926, of these 8 sheets have been despatched for publication. The remaining 32 sheets surveyed on the scale 1 inch = 1 mile and 11 sheets of the Hyderābād special forest survey will be submitted to the Circle Office by parties before taking the field.

Besides the above 4 special sheets of the Mettūr Project on the scale 4 inches = 1 mile were received in the Circle Office from No. 7 Party and published copies of these 4 inch sheets were prepared in No. 4 Drawing Office.

79. No. 6 Party.—*Topographical surveys.*—This party completed an area of 5,020 square miles of original and 512 square miles of revision survey on the scale 1 inch = 1 mile in Chānda district and Bastar State of Central Provinces, Warangal, Karimnagar and Adilābād districts of Hyderābād and East Godāvāri district of Madras.

80. An area of 5,062 square miles of triangulation was completed in Karimnagar, Nizāmābād, Adilābād, Nānder and Medak districts of Hyderābād.

81. Special survey of Sarangapalli—Tekmatla coal field for the Hyderābād government and of the Kistna Valley at Siddeswaram for the Irrigation department, Madras, and revision survey on the scale $1\frac{1}{2}$ inches = 1 mile of the country around Secunderābād for the military authorities were also executed.

82. Nature of country.—The country under survey consists of dense forest clad hills with few open patches of cultivated areas near main rivers, like the Godāvāri, Indrāvati and Prānhita.

83. No. 7 Party.—*Topographical surveys.*—This party surveyed

PERSONNEL.

Class I Officers.

Major H. T. Morhead, D.S.O., R.E., in charge.

Lieut. G. Bonford, R.E., from 25th June to 7th October 1925.

Class II Officers.

Mr. V. W. Morton, from 17th October 1925.

Mr. J. C. St. C. Pollett.

.. N. S. Harihara Iyer.

Upper Subordinate Service.

6 Officers.

Lower Subordinate Service.

27 Draftsmen, etc.

Training Section.

15 Surveyors, etc., and pupils.

an area of 5,740 square miles in the Anantapur, Bellary, Cuddapah and Kurnool districts of Madras, and the Raichūr district of Hyderābād. This includes the supplementary survey on the scale 1 inch = 1 mile of an area of 1,152 square miles which had been previously surveyed on the scale $\frac{1}{2}$ inch = 1 mile in season 1923-24.

The country surveyed consisted mostly of open plains of "black cotton" soil, but intricate rocky outcrops occurred in several sheets.

Cauvery (Mettūr) survey.—At the request of the Chief Engineer for Irrigation, Madras, a detailed survey was carried out on the scale 4 inches = 1 mile of an area of 69 square miles in the Salem and Coimbatore districts, comprising the site of the proposed dam and of the proposed flooded area, in connection with the Cauvery (Mettūr) Project.

Training.—Five second-year, and ten first-year pupils received instruction during the year.

84. No. 8 Party.—*Topographical surveys.*—This party surveyed

PERSONNEL.

Class I Officer.

Major L. H. Jackson, I.A., in charge.

Class II Officers.

Mr. J. H. S. Wilson.

.. M. Mahadeva Mudaliar, M.A., up to 18th October 1925.

Mr. B. T. Wyatt.

.. M. S. Ganesa Aiyar.

.. Srinivasa Rao Kelkar, B. Sc.

Upper Subordinate Service.

2 Officers.

Lower Subordinate Service.

42 Surveyors etc.

on the scale 1 inch = 1 mile, 4,764 square miles in Ahmadnagar, Sholāpur, Thāna, Kolāba, Poona and Ratnāgiri districts, 242 square miles in Bhor State, 322 square miles in Janjira State, 23 square miles in Sāngli State, 18 square miles in Mirāj (Senior) State, and 7 square miles in Mirāj (Junior) State in Bombay, and 1,633 square miles in Bhir and Osmānābād districts in Hyderābād

State. With the exception of the densely populated plains of the coast and the heavily wooded heights and foot hills of portions of the Western Ghāts, the country surveyed consisted of undulating plains mostly under cultivation.

51 linear miles of traversing were completed, and an area of 4,654 square miles was triangulated in advance for detail survey on the scale 1 inch = 1 mile in the Nilgiri, Coimbatore, Madura, Trichinopoly and Salem districts in Madras.

85. *Forest surveys.—Bombay Presidency, Northern and Central Circles.*

At the request of the Chief Conservator of Forests Bombay, an area of 30,076 acres (46·99 square miles) in the *West Nāsik* and *Poona Forest Divisions* was surveyed on the scale 4 inches = 1 mile, and in the *Kolāba Forest Division* an area of 1,223 acres (1·91 square miles) was surveyed on the scale 8 inches = 1 mile.

86. *Co-operation with the Royal Artillery.*—Points for the 12th and 16th Field Brigades were fixed at Kirkee, Hoskote and Bangalore.

IX.—SURVEY REPORTS, EASTERN CIRCLE.

DIRECTOR:—Colonel A. A. McHarg, D.S.O., R.E.

87. Summary.—The parties, etc., administered by the Eastern Circle, were Nos. 4, 9, 12 Parties, No. 5 Drawing Office, and the Sadiyā Frontier Detachment. No. 12 Party did not take the field.

In addition to his duties in the Imperial Department, the Director, as Director of Surveys, Assam, held administrative charge of the Assam Survey Department including the Assam Traverse Party, the Drawing and Reproducing Offices at Shillong and the Assam Survey School at Jhālukbāri and, in his capacity as technical adviser on survey matters to the Government of Bengal, visited the Bengal Survey Office at Alipore, the Survey School at Mainamati near Comilla and the Bengal Traverse Party in the field.

88. Training.—All the pupils, attached for training to parties in the field, appear to be promising and likely to become useful surveyors.

Four new pupils, entertained in April 1926, were attached, for training in field and recess work, to No. 5 Drawing Office.

89. Recess work.—12 whole sheets on the scale 1 inch = 1 mile and parts of 21 sheets (3 on the half inch, 10 on the one inch and 8 on the 4 inches = 1 mile scales) were surveyed; of these, 2 old partly drawn one inch sheets have been completely fair-mapped and the new half inch work incorporated on another sheet; all the remaining sheets should be mapped by the time the parties next take the field.

90. No. 4 Party.—*Topographical surveys.*—This party surveyed

PERSONNEL.

Class I Officer.

Mr. C. C. Byrne, in charge.

Class II Officers.

Mr. C. O. Picard.

Lieut. C. S. Melnes.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

25 Surveyors, etc.

areas of 109 and 341 square miles of original and supplementary survey respectively, on the scale 1 inch = 1 mile, in the Hazāribāgh and Mānbhūm districts of Bihār and Orissa.

The party, in addition, triangulated an area of 3,090 square miles in the Hazāribāgh and Mānbhūm districts of Bihār and Orissa and the Bānkurā district of Bengal and completed in the field the computing of the triangulated area originally allotted for survey. This however, owing to the long time taken in surveying the coalfield due to its intricate nature had eventually to be left over for next field season; it also completed the levelling required for the four inch survey besides making numerous connections with colliery companies' private bench-marks.

91. Jharia coalfield survey.—The party also surveyed on the scale 4 inches = 1 mile an area of 249 square miles comprising the Jharia coalfield in the Hazāribāgh and Mānbhūm districts of Bihār and Orissa.

Both supplementary one inch and four inch surveys were based on one and four inch reductions respectively of the sixteen inch cadastral surveys.

92. Nature of country.—The country surveyed, consisted of an open undulating cultivated plateau, averaging about 700 feet in elevation, drained by the Dāmodar river and its tributary the Jamuniā, dotted in the north-west by several isolated wooded hills amongst which stands out preeminently the bold forest-clad Parasnāth hill and crescent-shaped ridge, the ends of which point north-west and north-east. The summit of this hill (sacred to the Jains) is dotted with numerous small white shrines and temples, the most prominent capping the precipitous western peak (4,569 feet) of the hill, which, on clear days is visible from a distance of many miles. At the south-east end of the ridge lies the recently constructed Rājdhaha reservoir, furnishing the water supply for the important railway centre of Dhānbāid and the Jharia coalfield area, in the northern part of the Mānbhūm district. The greater portion of this area is very sparsely wooded and is covered with both old and new collieries with adjacent scattered patches of terraced rice cultivation, as well as by an intricate net-work of railways and is well provided with good motorable roads, in some places lined with trees.

93. No. 9 Party.—*Topographical surveys.*—This party surveyed

PERSONNEL.

Class I Officer.

Mr. H. M. Berrill, in charge.

Class II Officers.

Mr. Madras Mahadeva Mudaliar, M.A., from 20th October 1925.

Mr. Bhupendra Nath Saha, M.Sc.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

30 Surveyors, etc.

an area of 2,754 square miles on the scale 1 inch = 1 mile in the Cuttack, Mānbhūm and Singhbhūm districts and the Dhenkānāl, Keonjhar, Mayūrbhanj and Saraikelā Feudatory States of Bihār and Orissa; it also triangulated and traversed areas of 3,224 and 636 square miles, respectively, for one inch survey in the Mānbhūm and Singhbhūm districts

and the Mayūrbhanj, Keonjhar and Nilgiri States of Bihār and Orissa and the Bānkurā and Midnapore districts of Bengal.

94. Forest surveys.—Areas of 4 and 437 square miles, both included in the above, were surveyed on the scale 1 inch = 1 mile in the Kolhān protected forest blocks and the Barābhūm reserved forest of the Chai-bāsa Division and in the state forests of Dhenkānāl, Keonjhar, Mayurbhanj and Saraikelā Feudatory States of Bihār and Orissa respectively.

95. Nature of country.—The area surveyed lay in two detached portions, the smaller south-west portion includes the country, north of the Brāhmani river, where the Cuttack district and the Keonjhar and Dhenkānāl states meet, and consists mostly of high rocky precipitous jungle-covered hills rising to 3,460 feet; the larger north-east portion takes in the valley of the Subarnarekhā in the Singhbhūm district and the upper valleys of the Kadkai and Burhābalang with the northern fringe of the Simlāpāl hills, which are covered principally with *sāl* forest, rising to about 3,100 feet in the Mayūrbhanj state.

96. Sadiyā Frontier Detachment.—*Topographical surveys.*—

PERSONNAL.

Class II Officers.

Major J. H. Williams, in charge.

Mr. E. M. Kenny, from 1st December 1925 to 25th January 1926.

Mr. D. K. Rennick, M. B. E.

„ R. C. Hanson.

„ H. H. Creed.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

29 Surveyors, etc.

This detachment completed the survey on the scale 1 inch = 1 mile of the remaining area of 1,913 square miles, lying partly in the plains, partly along the adjacent foot-hills in the Nāgā Tribal territory and the Sadiyā Frontier tract and partly in the mountainous area, up to the Pātkai range; 663 square miles were also

surveyed on the scale $\frac{1}{2}$ inch = 1 mile in Nāgā Tribal territory and the Sadiyā Frontier tract of Assam. The Local Government provided Assam Military Police escorts for the protection of those surveyors working in Tribal territory and the adjacent country of the Sadiyā Frontier tract.

The detachment also triangulated an area of 1,870 square miles in the Gāro Hills and Khāsi Hills and the Goālpāra and Kāmṛūp districts of Assam and carried out 272 linear miles of traversing, as far north as the frontier of Bhutān, for next year's one inch survey, over an area of 862 square miles in the Goālpāra and Kāmṛūp districts.

97. Forest surveys.—138 square miles in the Nāmsai, Nāmphuk and parts of the Manabum and Paya protected forests and part of Dum Dumā reserved forest in the Sadiyā Forest Division and part of Dilli reserved forest of the Sibsāgar Forest Division of the Eastern Forest Circle, Assam, surveyed on the scale 1 inch = 1 mile, are included in the above details.

98. With the exception therefore, of the uninhabited upper reaches of the Dihing river (known, higher up, as the Diyun) in the Sadiyā Frontier tract, practically the whole of the north-east frontier bordering on this tract has now been covered by modern surveys, the 1 inch = 1 mile scale surveys having been connected to the quarter inch exploration surveys of the north east frontier, carried out in the years 1911-12 and 1913, and the half inch work to the south east, along the Pātkai range, having been connected to work on the same scale brought up from the Burma side.

99. *Nature of country.*—The country surveyed comprised roughly a 40 miles square in the densely wooded evergreen plains' portion of the Luhit valley south of the Luhit river, a small area of steep wooded foot-hills north of the same river, a fringe of equally steep wooded foot-hills along the eastern border and the triangular strip of forest-clad mountainous country in the south, rising from a height of about 600 feet in the plains at the Dihing river to the Pātakai Bum. The latter varies in height from 4,124 feet at the Pangsau Pass on the very rarely used foot-path, leading from Sadiyā to the Hukawng valley, to over 8,200 feet, at the south-westerly corner of the Sadiyā Frontier tract, the height of this range on the railway-surveyed route from Assam to Burma being 3,080 feet.

The few villages lying in the plains are scattered along the Tengapāni river and its tributary the Te-eng as well as up the Noa Dihing; almost all of these villages are inhabited by Hkamtis and Singphos. The only paths existing follow the general run of these minor rivers, and lateral communications, until the foot-hills are reached, are non-existent. From the Luhit river a little used Mishmi foot-path skirts the foot of the hills as far as the Te-eng river, then branches off in a south-easterly direction and eventually leads to Putao in Burma.

Wild elephants are common in the lower hills and plains. In the dry early months of the year almost all except the larger streams dry up and water becomes very scarce, but, once the rains set in, most of these streams become unfordable. Rations and transport for all the squads had to be imported and, except for one or two months during the cold weather, working conditions, owing to the prevalence of leeches and obnoxious insects, were extremely unpleasant.

X.—SURVEY REPORTS, BURMA CIRCLE.

DIRECTOR :—Lt.-Col. E. T. Rich, C.I.E., R.E.

100. Summary.—The parties, etc., administered by the Burma Circle were Nos. 10, 11, 21 Parties, and No. 7 Drawing Office.

101. Training.—At the beginning of the year 30 pupils were under training.

Of these 30 pupils, 8 were discharged in the spring as unlikely to become useful surveyors; the remaining 22 are promising.

In addition, 7 new pupils were enlisted during the summer and were attached to No. 7 Drawing Office for instruction in drawing.

102. No. 10 Party.—*Topographical surveys.*—This party sur-

PERSONNEL.

Class I Officer.

Captain G. Lennox, I.A., in charge.

Class II Officers.

Mr. G. A. Norman, M.B.E.

„ F. J. Grice.

Captain F. E. R. Calvert.

Upper Subordinate Service.

6 Officers.

Lower Subordinate Service.

30 Surveyors, etc.

vayed a total area of 3,315 square miles comprising 338 square miles on the scale $\frac{1}{2}$ inch = 1 mile in the tribal area between the Mali Hka and 'Nmai Hka branches of the Irrawaddy, known as "The Triangle", 2,873 square miles on the scale 1 inch = 1 mile in the Sandoway. Henzada, Bassein and Myaungmya

districts of Burma and 104 square miles of forest and guide map surveys on the scales 2 & 4 inches = 1 mile.

Triangulation and traverse was also carried out over an area of 3,270 square miles in the Bassein and Myaungmya districts of Burma.

103. Forest surveys.—These consisted of 86 square miles in the Henzada—Ma-ubin Forest Divn. of the *Delta Forest Circle* on the scale 2 inches = 1 mile and 8 square miles on the scale 4 inches = 1 mile in the Northern Shan States Forest Divn. of the *Federated Shan States Forest Circle*.

104. Guide Maps.—An area of 10 square miles was surveyed on the scale 4 inches = 1 mile for the Maymyo Guide Map.

105. Nature of country.—The forest survey areas and country surveyed on the scale $\frac{1}{2}$ inch = 1 mile consist of thick jungle-covered hills. The area surveyed on the scale 1 inch = 1 mile includes the steep densely wooded hills of the Arakan Yoma, the broken western coast line of Burma and the well cultivated plains north of Bassein. Communication in the hills is by paths and on the coast and plains by rivers and creeks.

106. No. 11 Party.—*Topographical surveys.* This party sur-

PERSONNEL.

Class I Officers.

Mr. J. O. Greiff, in charge to 26th October 1925.

Major L. G. Crosthwait, I. A., in charge from 27th October 1925.

Class II Officers.

Mr. P. Simpson.

„ G. E. R. Cooper.

„ A. V. Dickson.

Lower Subordinate Service.

26 Surveyors, etc.

veyed an area of 2,549 square miles on the scales 1 & 4 inches = 1 mile in the Amherst and Thaton districts of Burma.

Triangulation was carried out over an area of 1,640 square miles in the Pegu, Salween. Thaton and Toungoo districts of Burma.

107. Forest surveys.—The following reserved forests of the *Tenasserim Forest Circle* totalling 116 square miles, were surveyed on the scale 4 inches = 1 mile:—

Thaton Forest Division.—Gyochaung, Hlaingbwe, Kyonpago, Mēlaung, Mitharaung and Tilôn Reserved Forests.

Thaungyin Forest Division.—Ta-u-kē Reserved Forest.

108. Guide Maps.—The town of Moulmein and environs, comprising an area of 25 square miles, was surveyed on the scale 4 inches = 1 mile.

109. Nature of country.—The country surveyed which lies between the Gulf of Martaban and the Siamese frontier consists partly of cultivated plains along the sea coast and Salween river, partly of low undulating forest, and partly of the Dawna range rising to over 6,800 feet and covered with evergreen forest.

110. No. 21 (Burma Forest) Party.—This party surveyed an

PERSONNEL.

Class I Officers.

Mr. S. S. McA'Fee Fielding, in charge to 26th October 1925.

Mr. J. O. Greiff, in charge from 27th October 1925.

Class II Officers.

Lieut. L. B. Fitz-Gibbon.

Mr. H. M. Critchell.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

35 Surveyors, etc.

area of 260 square miles of reserved and unclassified forests on the scale 4 inches = 1 mile in the Thayetmyo, Prome, Pegu, Toungoo, and Yamethin districts of Burma, and an area of 128 square miles of reserved forests on the scale 2 inches = 1 mile in the Yamethin district. 645 linear miles of forest boundary theodolite traverses, 3 linear miles of boundary

surveys by plane-table on the scale 8 inches = 1 mile, and 75 linear miles of boundary surveys by plane-table on the scale 4 inches = 1 mile, were also completed.

The details of this work are given below.

111. Nature of country.—The country surveyed consists of densely wooded hills and plains with good communications, but a great scarcity of water, which had in many instances to be obtained from some distance outside the area.

112. *Hlaing Forest Circle.*—In the *Allanmyo Forest Divn.* an area of 55 square miles was surveyed on the scale 4 inches = 1 mile in the following reserves:—Shazibo, Hmunsa, East Yoma Extensions II, III, and IV, and Pyalo.

In the *Prome Forest Divn.* an area of 98 square miles was surveyed on the scale 4 inches = 1 mile in the following reserves:—Tônyē East and West Extension, Kyatkôn, Wettaung and Extension, Kayineik and North Extensions, Olēzwē, Gonbalē and North and East Extensions, Sinmizwe Extension, Nyaungbindet East Extension, Pauktaw Extension, Byama-in, Myebya, Sēdaing and Extension, Zibinhla, Padinbin and Shwekyundaw. 14 linear miles of plane-table traversing on the scale 4 inches = 1 mile were done of the external boundary of the Sinmizwe and north boundary of the Tônyē reserves, and 7 linear miles of theodolite connection traversing in the Myebya and Nyaungbindet Extension reserves. The Prome Teak Plantation reserve of 0.1 square mile was surveyed on the scale 16 inches = 1 mile.

113. *Sittang Forest Circle.*—In the *North Pegu Forest Divn.* an area of 11 square miles was surveyed on the scale 4 inches = 1 mile in the Yēnwē and Wami reserves, and the boundaries of four exclusions on the scale 8 inches = 1 mile, 3 linear miles in length, were added by plane-table traverse to the old survey of the Kawliya reserve.

In the *North Toungoo Forest Divn.* an area of 1 square mile on the scale 4 inches = 1 mile was surveyed in the West Swa Extension II.

114. *Central Forest Circle.*—In the *Pyinmanā Forest Divn.* an area of 37 square miles was surveyed on the scale 2 inch = 1 mile in the Nancho reserve, and 26 linear miles of the west boundary was surveyed by plane-table on the scale 4 inches = 1 mile.

In the *Yamethin Forest Divn.* an area of 86 square miles was surveyed on the scale 4 inches = 1 mile in the following reserves:—Hlwazin, Kôgwe, and Hlwabôn and an area of 9 square miles of unclassed forest between the Hlwazin and Kôgwe reserves was also surveyed on the same scale to show villages and communications. In the Yezin reserve an area of 91 square miles was surveyed on the scale 2 inches = 1 mile and 35 linear miles of the west boundary were surveyed by plane-table on the scale 4 inches = 1 mile 36 linear miles of interior and connection traversing was carried out in the Byingyē, Natma and Nyaunggaing reserves.

In the *Magwe Forest Divn.* 225 linear miles of boundary traversing and 50 linear miles of interior and connection traversing were carried out in the following reserves:—Myindē, Myothit, Kyaukmigyaung West Extension, Sitha, Yabe West Extensions I and II and Gyogyaung.

In the *Meiktila Forest Divn.* 239 linear miles of boundary traversing and 88 linear miles of interior and connection traversing were carried out in the following reserves:—Meiktila Fuel, Popa Hill and Extension, Pyetkaywetaung, Taunggyegôn, Sindaung, and Kubyin; Extensions, I and II.

XI.—MISCELLANEOUS SURVEY REPORTS.

114. Cantonment Surveys, etc.—No. 5 Party brought the existing 64-inch scale map of Pachmarhi Cantonment up to date.

115. No. 20 Party.—This party continued field work throughout the year and completed the

PERSONNEL.

Class I Officers.

Mr. C. E. C. French, in charge to 6th November 1925.

Mr. M. C. Petters, in charge from 7th November 1925.

Upper Subordinate Service.

1 Officer.

Lower Subordinate Service.

24 Surveyors, etc.

out the year and completed the surveys of Rāwalpindi, Quetta with R. A. F. extension, Loralai, Fort Sandeman, Chaman and the military areas of Sunny Bank, Dungā Gali and the Military Dairy Farm in the Murree hills on the 16-inch scale, Ferozepore on the 12-inch scale, and

the bāzārs of Kuldana (Murree hills) and Campbellpore on the 64-inch scale. The revision surveys of Lahore and Multān cantonments were also commenced during the year. In addition 64·49 linear miles of traversing and 11·64 miles of levelling to supply data for the detail survey were completed at a cost of Rs. 59·70 and Rs. 44·59 respectively, per mile.

The fair maps of Chaklāla, Mona Remount Depôt, Kohāt, Campbell-

- *1. Bāriān.
- 2. Khairā Gali.
- 3. Ghora Dakka and Khanpur.
- 4. Chāngla Gali.
- 5. Cliffden and Murree.
- 6. Dungā Gali.
- 7. Kuldana, Sunny Bank & Military Dairy Farm.
- 8. Ghariāl and Topa.

pore, Bannu, Risālpur and eight * *Galis* in Murree, also the bāzār plans of Kohāt, Campbellpore and Rāwalpindi, or a total of 42 sheets, have been completed and despatched for publication.

The out-turns and cost-rates of the various classes of survey are as follows:—

Twelve-inch revision,	1,805	acres @ Rs. 0·79 per acre.
Sixteen-inch original,	1,989	acres @ Rs. 2·26 per acre.
Sixteen-inch revision,	20,000	acres @ Rs. 1·62 per acre.
Sixtyfour-inch original,	2·04	acres @ Rs. 37·47 per acre.
Sixtyfour-inch revision,	62	acres @ Rs. 18·99 per acre.

The total areas fair-mapped with cost-rates work out as follows:—

905 acres on the twelve-inch	@ Rs. 0·49 per acre.
19,065 acres on the sixteen-inch	@ Rs. 0·60 per acre.
241 acres on the sixtyfour-inch	@ Rs. 9·27 per acre.

The section of No. 2 Drawing Office responsible for embodying on the originals and office copies of cantonment maps the changes notified annually by the Military Engineering Service was transferred to No. 20

Party on 6th April 1926, and all work connected therewith will in future be carried out by this party.

At the request of the Director General of Archæology in India, a surveyor was deputed to carry out the detail survey of the site of the ancient ruins at Mohenjo-daro in Lārkhāna district in Sind on the scale of 100 feet to an inch. An area of 394·17 acres was accordingly surveyed in detail with the necessary traversing and levelling required for the frame work. The expenditure of Rs. 1296-14-0 is debitable to the Archæological Department.

116. Bhopāl survey.—During the year the detachment continued the work of traversing village boundaries and the interior sub-demarkations for the cadastral survey of the Bhopāl State on the scale 16 inches = 1 mile.

Except five computers and traversers lent by the Survey of India Department, all other hands, 68 in number, were entertained and many of them were trained as in previous years. The work was based on G. T. and topographical triangulation stations existing in and around the area traversed.

In all 6,307·8 linear miles of main and sub-circuit traverses were run and 43,300 theodolite stations were laid out in an area of 2,194·4 square miles, along the boundaries and interior of 1,051 villages. 5,645 theodolite stations around village trijunctions were demarcated by monolith pillars 2 feet by 6 inches to serve as bases for future survey and demarcation of fields and boundaries. Origin co-ordinates of the stations marked with stones falling in 1,051 villages were reduced and copied. 2,435 *musāvis*, (settlement maps) on the scales 16 and 4 inches = 1 mile were plotted. The area of 8 main-circuits, 81 sub-circuits, and 1,051 villages was computed by universal theorem and that of the villages by planimeter as well and compared *inter se*. 124 four inch sheets were reduced on the scale 1 inch = 1 mile by pentagraph. 40 miscellaneous traces were prepared.

117. Cadastral survey.—In the middle of September 1925, the Settlement Officer in charge of this party having resigned, the Officer in charge was asked by the Revenue Member to take charge of it in addition to his own duties.

The programme consisted of cadastral survey on the scale 16 inches = 1 mile and preliminary record-writing (both field and recess) of eleven tahsils, an area of about 2,900 square miles. The field work had to be commenced on 1st October 1925, and the strength sanctioned for it was 2 assistant settlement officers, 4 head inspectors, 16 inspectors,

and 173 amins, but on account of the incomplete arrangements made by the outgoing officer, neither the full number of amins nor the instruments necessary for the work were forthcoming at the end of September 1925. Accordingly, though the field work was started on the due date, only two camps could then be formed to take the field instead of four as proposed. The two assistant settlement officers were entertained in November and December 1925, and gradually, as the amins arrived, the two remaining camps were also formed by the end of December 1925.

The field operations continued till the middle of July 1926, and an area of about 2,100 square miles was surveyed on the scale 16 inches = 1 mile. The record-writing of 973 villages of tahsils Sehore, Ichhāwar, Jāwar, Ashta, Durāhā, Nasrullaganj, Bilqisganj, Goharganj and Diwānganj was completed in the field. The detail survey was checked by 3,322 linear miles of *partāl*, of which the check by the superior agency amounted to 498 linear miles. 23 per cent of the quadri-lateral lines, on which the detail survey was based, were also checked on the ground. Besides this, about eight villages in each tahsil, except in Nasrullaganj and Durāhā tahsils, were checked by the Secretary, Revenue Department, in the field.

The area under traverse survey was mostly hilly and covered with thick forests but in parts it consisted of well cultivated plains. The nature of the ground under cadastral survey was undulating and interspersed with isolated hillocks covered with jungle. The Vindhya Chal Range bounded the area on the south.

The office work of the Traverse Detachment and field and office work of the Cadastral Survey Party was inspected by the Director Geodetic Branch from 16th to 19th March 1926.

118. Commercial levelling.—Besides the geodetic levelling

PERSONNEL.

Class I Officers.

Major A. H. Gwyn, I.A., in charge up to 31st March 1926.

Major V. R. Cotter, I.A., in charge from 1st April 1926.

Class II Officers.

Mr. N. R. Masumdar.

„ J. L. Sahgal.

Upper Subordinate Service.
7 Officers.

Lower Subordinate Service.

22 Computers, etc.

64 purely temporary Levellers, etc.

referred to on p. 16 and the work of the Sutlej Valley Irrigation Project referred to in the next paragraph No. 17 Party carried out the following:—

(a) Secondary levelling for the Chief Engineer, E.I.R., in Bengal, Bihār and Orissa, and the United

Provinces, mainly along the railway line.

(i) Barākar—Allahābād.

(ii) Mughal Sarai—Hāzāribāgh.

119. Sutlej Valley Levelling.—The following was done including the completion of all levelling work for this project :—

(a) Secondary levelling—

(1) In Sind ...	...	...	69	miles.
(2) Near Panjnad Weir Site		...	59	,,
(3) In Haveli Project	...	...	132	,,

(b) Tertiary levelling—

For Sutlej Valley Irrigation Project ... 3,852 Sq. ,,

The country was less favourable for economical work than during the previous year owing to, (a) lack of water in some parts, (b) high sand hills in the desert areas, (c) a number of overflow channels in the watered areas which had to be constantly crossed and re-crossed.

APPENDIX.

THE CENTENARY OF THE DEATH OF COL. VALENTINE BLACKER, C.B.

A photogravure of Col. Valentine Blacker, C.B., the first Surveyor General of India 1823-1826 forms the frontispiece to this report. The 4th of February 1926*, the centenary of this officer's death, was suitably commemorated by the Surveyor General, who, with a few senior officers visited Col. Valentine Blacker's grave in the Park Street Cemetery, Calcutta, and placed a wreath thereon. The great topographer Major James Rennell, who was Surveyor General of Bengal from 1764 to 1777, claims to have been accorded the title of Surveyor General of India in 1767, but this title does not seem to have been regularly accorded to any of his successors and was only permanently established when Col. Valentine Blacker became the first Surveyor General in 1823. ✓

This year is also memorable in the annals of the Survey as being that in which Col. Lambton, the first founder and Superintendent of the Great Trigonometrical Survey, died at the age of 70, when still working in the field and was succeeded by Lieut. Everest who afterwards became Col. Sir George Everest and Surveyor General of India. It was thus in 1823 that the title of Surveyor General became permanently established, and that the officer, who was to organize the great framework of the Trigonometrical Survey on its present lines, assumed the office of Superintendent. Col. Valentine Blacker is believed to have fully appreciated the value of a proper basis of triangulation of a high order of accuracy for the whole Survey of India, as is shown by an able paper of his on the subject which was reprinted by Major General Sir Andrew Waugh.

Sir Andrew Waugh speaks of Col. Valentine Blacker as, with the exception of Everest, the ablest and most scientific man that ever presided over the department.

* The date of Col. Valentine Blacker's death was the 4th of February 1826, as is authenticated by the records of the Park St. Cemetery in Calcutta, where he is buried and by the inscription on his monument. His death is said to have been due to an accident. The Dictionary of Indian Biography by C. E. Buckland, C.I.E., 1906, and the Dictionary of National Biography by Leslie Stephen and Sidney Lee, 1908, give the date of his birth as October 19, 1778 which is possibly correct, but give the year of his death wrongly as 1823. Markham, in his memoir on the Indian Surveys states that Col. Valentine Blacker died of fever in 1827, but this statement also appears incorrect, both as regards the year and cause of his death.

The revenue surveys in the N. W. F. Province were commenced under his auspices. The authorship of a lithographed pamphlet entitled "Construction of a graticule for a general Atlas of India" is attributed to Col. Blacker by Markham, and, though the actual name of the author does not appear on the pamphlet, nor the date of its production, it appears from an old letter of Major General Waugh's that this is correct.

The projection that he suggested was a polyconic one and differed from that actually adopted by the geographer at the India Office, London, for the Atlas of India.

The calculations for Col. Valentine Blacker's projection were most carefully made and tabulated in a more convenient form for use than was actually the case with the Atlas projection. Moreover his central meridian and parallel (20° latitude 80° longitude) were more symmetrically placed than the central parallel and meridian ($24\frac{1}{2}^{\circ}$ latitude $76\frac{1}{2}^{\circ}$ longitude) of the Atlas.

The polyconic projection was thus Col. Blacker's gift to India, though his exact projection was afterwards modified by General Walker. In 1906 the Survey Committee abandoned the Atlas sheet projection, which was defective, and brought the $\frac{1}{4}$ inch = 1 mile maps on to the polyconic system. It may be thought that Col. Blacker had the assistance of mathematical specialists in dealing with map projections, but this was not the case. The East India Company's officers, Lambton chosen from the Infantry, Everest from the Artillery, and Blacker from the Cavalry had to be their own specialists.

The following record of the services of Col. Blacker has been compiled from such biographies as are available, supplemented by information obtained from a relative.

Lieut.-Col. Valentine Blacker (1778 to 1826), historian of the Mahratta war of 1817—1819, served in the Madras Cavalry in 1798, and as cornet with a troop of the Nizam's contingent in the Mysore campaign of 1799. The next year he was employed as A.D.C. to Col. Stevenson in the Wynaad and then served with his regiment in the south of Madras under Col. Agnew, when he was thanked in despatches for surprising the enemy and successfully charging them with his troop. He then joined the Quartermaster General's department (Madras), rising to be Quartermaster General in 1810 at the age of 32. In 1815 he served with the army of reserve under Lt.-Gen. Sir Thomas Hislop and in 1817 under the same commander with the army of the Deccan at the battle of Mahidpur and other operations of that year. His services at Mahidpur and the reconnaissance made by him before the battle were

specially brought to the notice of the Governor General. On returning to Europe in 1821, he was thanked in general orders by the Commander in Chief of the Madras Army for his eminent and scientific services as Quartermaster General of the Army of Fort St. George during a period of ten years.

His distinguished career in Madras appears also to have been commemorated by the application of his name to Blacker's Garden, a residence in that city.

He was then appointed Surveyor General of India, when he executed a complete map of Hindustān, still preserved by his family at Elm Park, Co. Armagh. Besides introducing the polyconic projection into Indian mapping, he initiated the first explorations of the Dihang and Dibang.

Syed Mohsin, the celebrated mathematical instrument maker, was first trained under Col. Blacker, who took him to Calcutta from Arcot. Col. Blacker was appointed a C.B. in 1818 and died at Calcutta on the 4th February 1826 as the result of an accident.

His monument bears the following inscription :—

Epitaph (on the front).

Beneath are deposited the remains of Lieut.-Colonel Valentine Blacker, Companion of the Bath, of the Light Cavalry, on the establishment of Fort Saint George.

During ten years Quartermaster General of the Madras Army and subsequently Surveyor General of India.

Ob iv February MDCCCXXVI Act. XL.

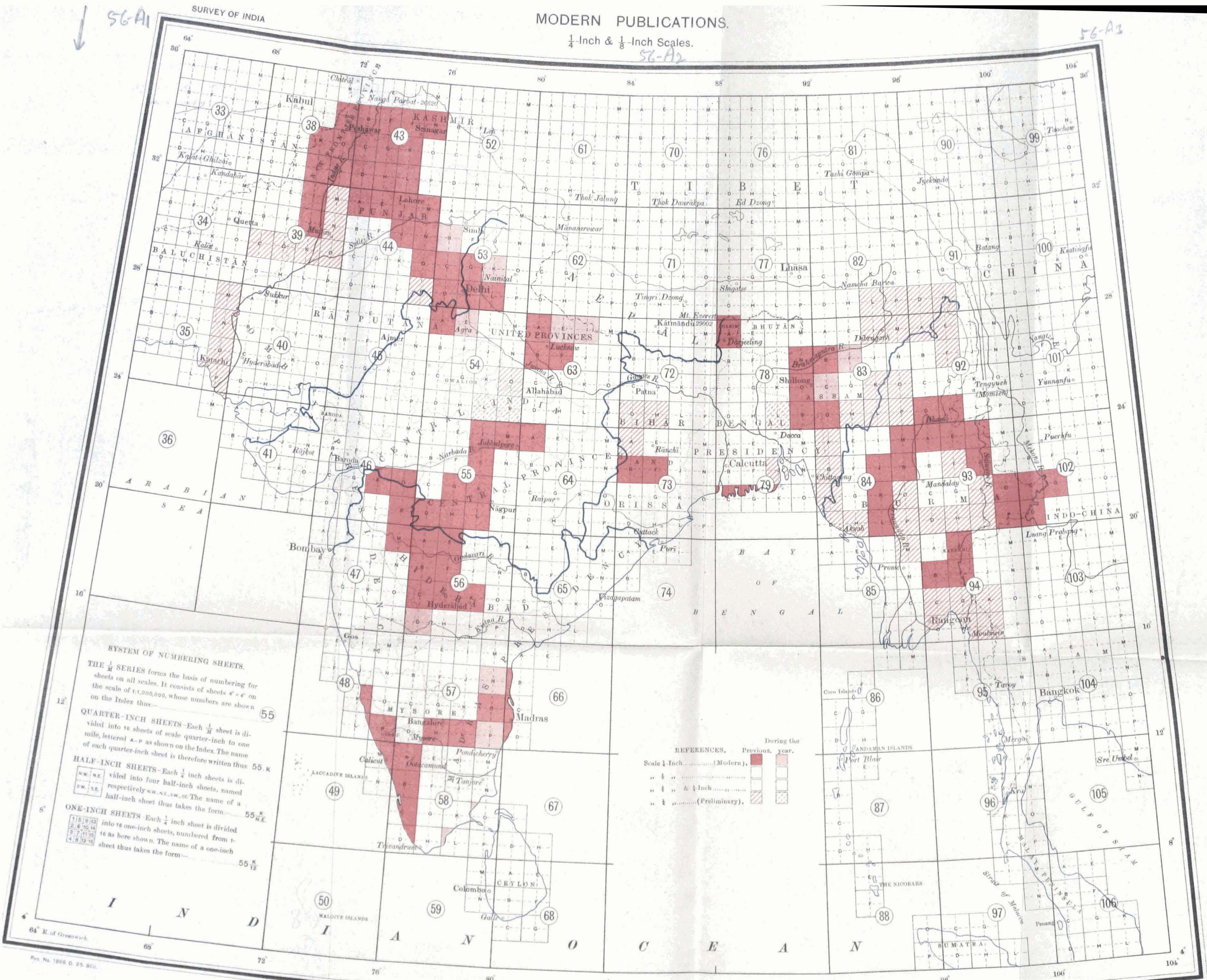
(On the opposite side).

Lieut. Col. Blacker was an officer distinguished alike for professional ability, for public zeal, for private worth and for manliness of character. In testimony thereof his friends and comrades have caused this monument to be erected to his memory.

56-A1

56-A3

56-A2



SYSTEM OF NUMBERING SHEETS.

THE 1/4" SERIES forms the basis of numbering for sheets on all scales. It consists of sheets 4" x 4" on the scale of 1:1,000,000, whose numbers are shown on the Index thus:—

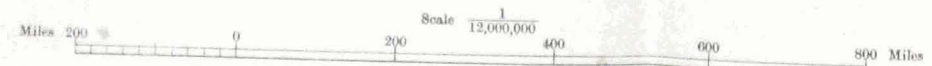
QUARTER-INCH SHEETS—Each 1/4" sheet is divided into 16 sheets of scale quarter-inch to one mile, lettered A-P as shown on the Index. The name of each quarter-inch sheet is therefore written thus: 55.K

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ONE-INCH SHEETS—Each 1/4" sheet is divided into 16 one-inch sheets, numbered from 1 to 16 as here shown. The name of a one-inch sheet thus takes the form:— 55.K.12

REFERENCES.

Scale	During the Previous year.
1/4" (Modern)	[Red box]
1/8" (Modern)	[Light red box]
1/4" (Preliminary)	[Hatched box]
1/8" (Preliminary)	[Light hatched box]



56-B1

56-B3

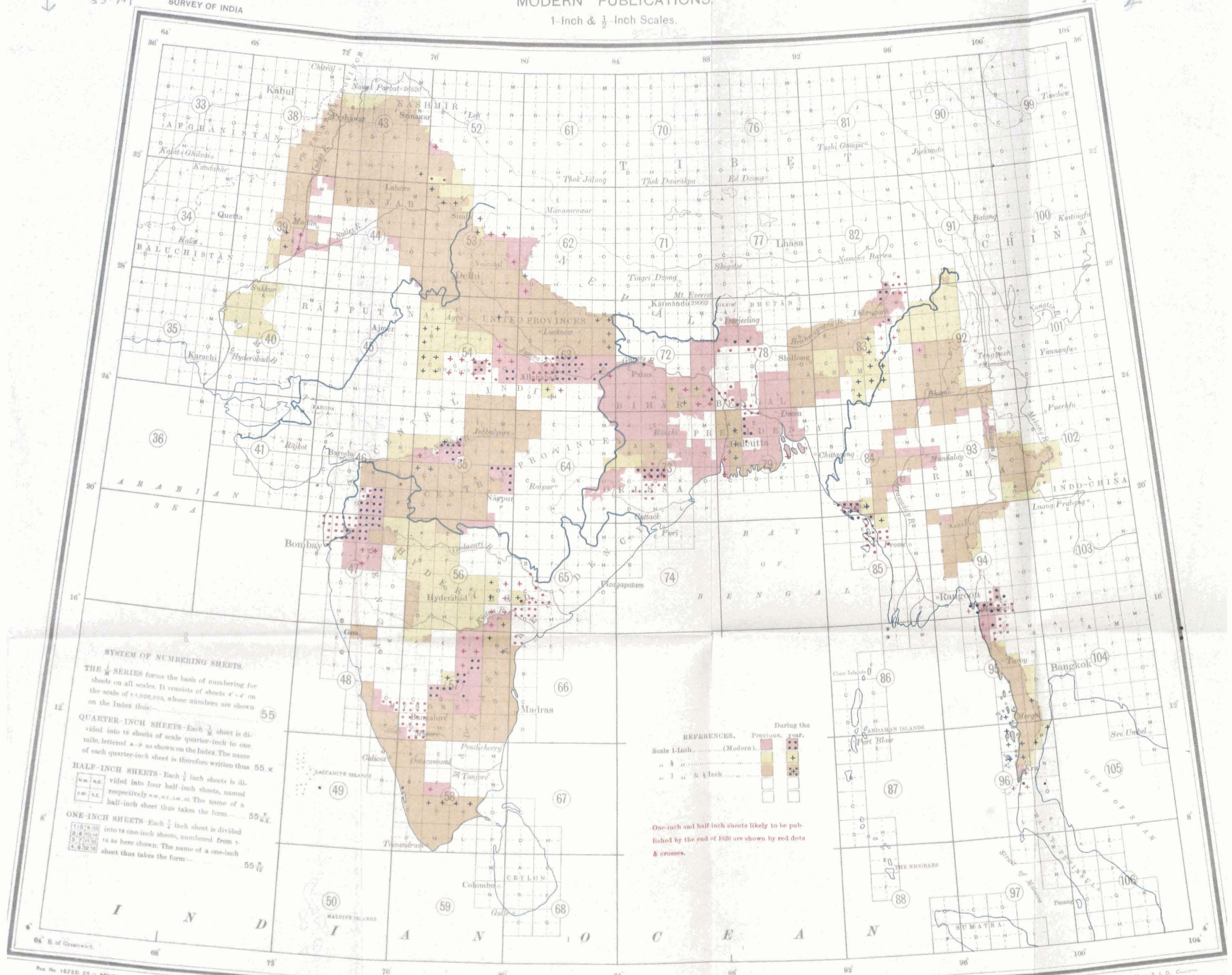
55-A1

SURVEY OF INDIA

MODERN PUBLICATIONS

1-Inch & 1/2-Inch Scales.

55-A2



SYSTEM OF NUMBERING SHEETS.

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

QUARTER-INCH SHEETS—Each $\frac{1}{4}$ 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., S.W., S.E., N.E. The name of a half-inch sheet thus takes the form: 55.K.N.E.

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

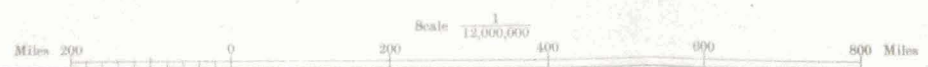
REFERENCES.

Scale	Previous year	During the year
Scale 1-Inch..... (Modern)	+	+
" 1/2 " & 1/4 Inch.....	+	+
" 1 " & 1/2 Inch.....	+	+

One-inch and half-inch sheets likely to be published by the end of 1924 are shown by red dots & crosses.

55-B1

Published under the direction of Colonel Commandant E. A. Tandy, R.E., Surveyor General of India, 1925.



Map S. I. O. 50000

55-B2

58-A1

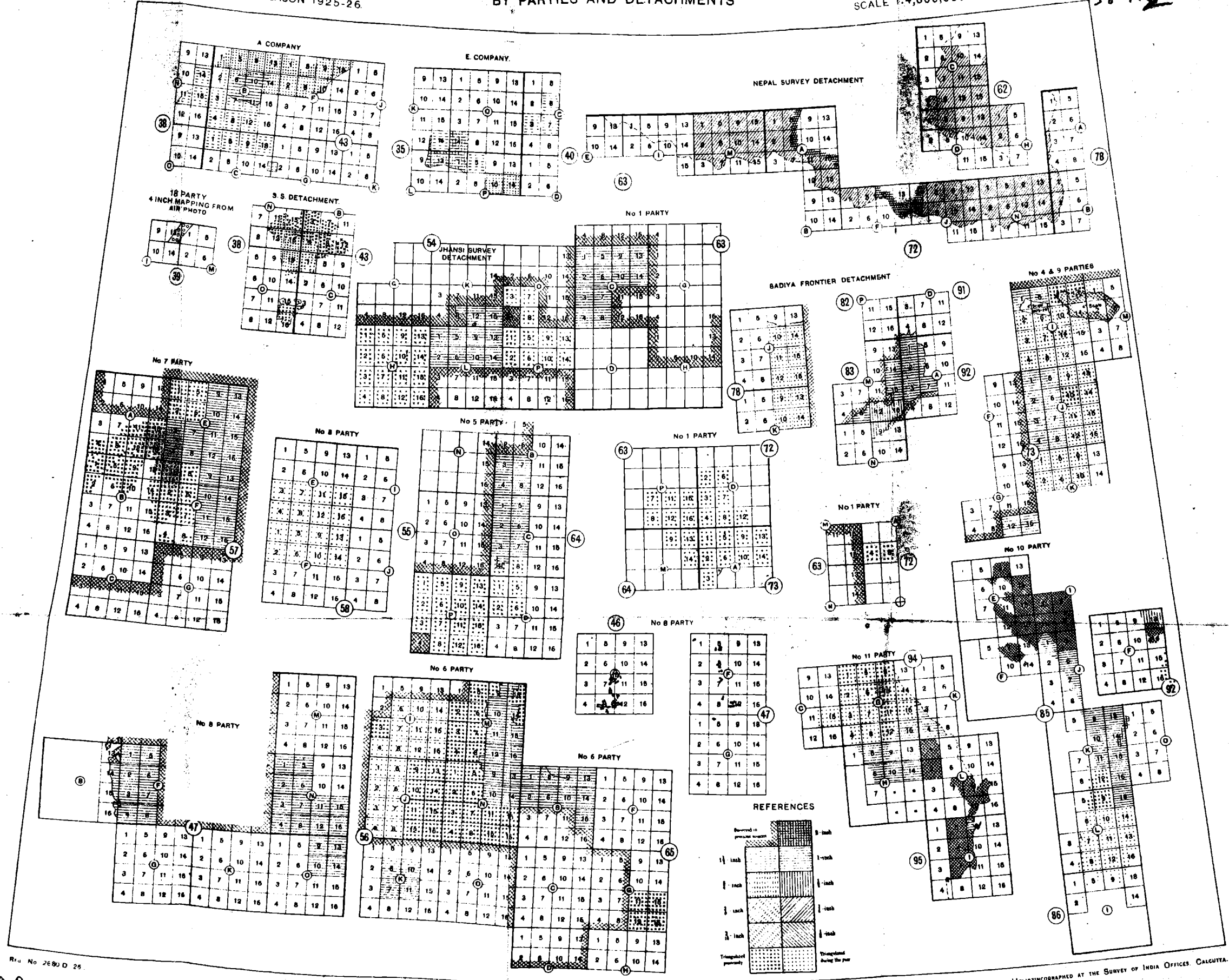
INDEX SHOWING SURVEYS BY PARTIES AND DETACHMENTS

MODERN TOPOGRAPHICAL SURVEYS AND COMPILATION,
on 4-inch or larger scales.

SEASON 1925-26.

SCALE 1:4,000,000.

58-A2



18 PARTY
4 INCH MAPPING FROM
AIR PHOTO

S.S. DETACHMENT

No 1 PARTY

JHANSI SURVEY
DETACHMENT

BADIYA FRONTIER DETACHMENT

No 4 & 9 PARTIES

No 7 PARTY

No 8 PARTY

No 5 PARTY

No 1 PARTY

No 1 PARTY

No 10 PARTY

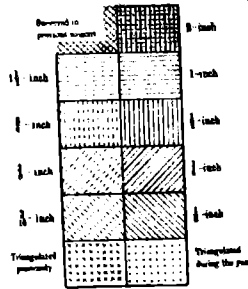
No 8 PARTY

No 6 PARTY

No 6 PARTY

No 11 PARTY

REFERENCES



R.F. No 2690 D 25

58-B1