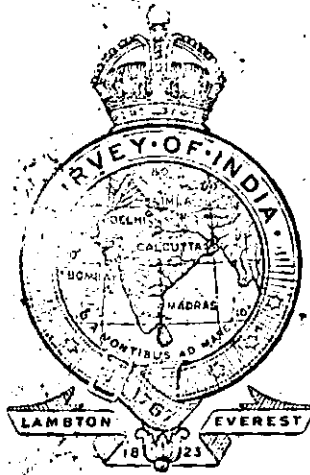


**SURVEY OF INDIA
GENERAL REPORT**

1924 TO 1925



**From 1st October 1924
To 30th September 1925**

**PUBLISHED BY ORDER OF
Colonel Commandant E. A. TANDY, R.E.,
SURVEYOR GENERAL OF INDIA.**

**Printed and Litho. Office,
India,
L.A.**

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Survey of India Office, Calcutta, 1925.

KHAN BAHADUR SHER JANG.

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Survey of India,
CALCUTTA,
1926.

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- (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.

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SURVEY OF INDIA

GENERAL REPORT

1924 TO 1925

From 1st October 1924

To 30th September 1925

INTRODUCTION AND SUMMARY.

1. **Annual Reports.**—Commencing from the present year, Annual Reports are 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 therefore only gives brief abstracts of the above, (*vide* Abstracts IV and V in the Table of Contents on opposite page) 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 is only one *Index map*, at the end, showing the progress of modern topographical surveys and compilation. 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 map*.

2. **General.** Colonel Commandant E. A. Tandy, B.E., filled the post of Surveyor General throughout the survey year under report. The total area of new surveys of all kinds was 44,317 square miles, which is nearly equal to the total area of England.

INTRODUCTION AND SUMMARY.

3. *The total cost* of the Department for the past financial year ending 31st March 1925, as compared with that of previous years, was as follows:—

| | 1922-23. | 1923-24. | 1924-25. | REMARKS. |
|-----------------------------|------------|------------|------------|--------------------------------|
| | <i>Rs.</i> | <i>Rs.</i> | <i>Rs.</i> | |
| Gross actual cost ... | 54,30,867 | 51,14,799 | 53,07,436* | * These figures are not final. |
| Deduct receipts and credits | 25,20,447 | 21,15,470 | 22,37,299* | |
| Net actual charges ... | 29,10,420 | 29,99,329 | 30,70,137* | |

4. *Policy.*—The Department is steadily developing the policy of arranging for all possible co-operation with the local surveys carried out by Provinces and States, and in connection with engineering projects, &c. The demands for assistance or co-operation in these respects are growing rapidly and are putting our resources to a very considerable strain; but there is no doubt that this policy saves much waste and reduplication of work, which would otherwise arise from various survey organizations working in water-tight compartments. It also helps to raise the general standard of local surveys in accordance with the requirements of a better educated population. This kind of co-operation, combined with provincial devolution and other modern delights, however beneficial to the country, involves a heavy increase in the difficulties of survey administration.

5. *Organization.*—The three enormous Survey Circles, into which India was divided before the War, were much too large to allow of the survey administration maintaining that close touch with Provinces and States, and with local developments of all kinds, which the above policy requires. Burma was therefore detached from the Eastern Circle in 1922 to form a separate Circle, with most excellent results.

This however still left the Northern and Southern Circles as large and unwieldy as ever. In addition, modern mobilisation and frontier survey requirements now demand a more intimate touch with the North-West Frontier and with Army Headquarters than is at all possible to a Northern Circle Directorate stationed at Mussoorie. It has therefore been decided, with effect from the 1st October 1925, to rearrange the present Northern and Southern Circles into three Circles, namely the *Frontier Circle*, *Central Circle* and *Southern Circle*, with headquarters respectively at Simla, Mussoorie, and Bangalore. The area of the

Frontier Circle will correspond roughly with that of the Northern and Western Commands, which at present form part of the Northern Circle, while the Central Circle will include the balance of the present Northern Circle together with the Central Provinces, which it will take over from the Southern Circle. The Frontier Circle will itself be divided into two 'Divisions.' The Deputy Director Northern Divn. will recess with 'A' Survey Company at Murrée, the summer headquarters of the Northern Command, and the Deputy Director Western Divn. will recess with 'E' Survey Company at Quetta, the headquarters of the Western Command. It is hoped to maintain Air-Survey Sections with both Survey Companies. This improved organization should greatly assist in the further development of the policy indicated in para. (4), while enabling us to bring our survey mobilisation arrangements more into line with modern requirements.

6. *Guide maps.*—There is a growing demand for a handy series of maps showing up-to-date information for motorists, and for general use, and this will be emphasised when we have aircraft of various kinds working over the country. None of our present series of maps are well suited to these purposes, and the arrangements by which they are supposed to be kept corrected to date are very inadequate and unsatisfactory. The nucleus of No. 12 Party in Shillong has therefore been employed during the year in experimenting with a new series of "guide maps" on a scale of 10 miles to one inch, and it is hoped that samples may soon be ready for general criticism and the orders of Government. In view of the fact that over about half of India our latest surveys are from 20 to 100 years old, up-to-date information is only obtainable by the cordial co-operation of the local officials in the various Provinces and States. It is hoped that the smaller Survey Circles referred to in para. (5) above, will assist us in eliciting the necessary local assistance; but small permanent offices would have to be maintained in each Circle for the purpose and a considerable effort will be needed at the outset.

7. *Notable events of the Survey year* were as follows:—

(a) Khan Sahib Afraz Gul Khan of the Survey of India was attached to the Netherlands Exploration Party under Mr. P. C. Visser, which left Srinagar for Hunza in April. Reports received from Mr. Visser indicate that K. S. Afraz Gul has done excellent work in the survey of these difficult regions, and has mapped some important areas which are at present shown blank on our maps, *vide* para. (106).

(b) *International Congresses.*—It is to be regretted that the arrangements for delegates from the Survey of India to the

International Geodetic Union at Madrid, in 1924, fell through at the last moment, though Colonel Sir Gerald Lenox-Conyngham, F. R. S., kindly acted on our behalf. He reports that Japan had four delegates and Siam two, and that several are necessary if all sections are to be attended. A resolution was passed pressing the urgency of gravity observations in the Himālayas.

The International Geographical Congress at Cairo, last April, was attended by over 400 delegates from other countries. Lt.-Colonel C. P. Gunter, O.B.E., R.E., who represented the Survey of India, has prepared a most interesting report. The Survey of Egypt is producing very excellent work, as a result of the enlightened personal support which it receives from H. M. King Fuad, who is himself a distinguished Honorary Member of the Royal Geographical Society in London.

(c) *Officers on leave* have done much useful work in studying modern developments of various kinds. The late Lt.-Colonel H. McC. Cowie, R.E., made a very satisfactory comparison of our Indian pendulums with the standard at Kew, and he and Dr. J. de Graaff Hunter, Sc.D., M.A., F.Inst.P., inspected Dr. Vening Meinesz's pendulum apparatus for submarine determinations of gravity. Dr. Hunter officer also attended the International Union of Astronomy at Cambridge in July; and went into many details of chronometry and wireless longitudes, both in London and with the head of the Geodetic Branch of the French Military Surveys in Paris. Lt.-Colonel R. H. Phillimore, D.S.O., R.E., also collaborated in this connection and has supplied useful notes as a result of his visit to the offices of the Ordnance Survey at Southampton.

(d) *Air Survey*.—Major C. G. Lewis, R.E., completed the mapping of the Irrawaddy delta, referred to in last year's Report, and has prepared a valuable account. Captain O. Slater, M.C., R.E., has made some progress with the air-survey of inaccessible areas on the N. W. Frontier, and has begun experimental work in connection with cadastral maps based on air-surveys in Peshāwar and Attock districts, in collaboration with the Royal Air Force; but the work of the latter was much hampered owing to military requirements. Progress on these lines must remain difficult until the R. A. F. becomes able to allot certain units definitely for this special work.

(e) *Military Co-operation*.—Lt.-Colonel M. O'C. Tandy, D.S.O., O.B.E., R.E., was on special duty throughout the winter, in the Northern and Western Commands, studying the questions of Frontier Surveys and survey mobilisation, with a view to the establishment of the Frontier Circle referred to in para. (5). Incidentally he gave many lectures on surveys and maps at various military stations, including two at the Quetta Staff

College. Lt.-Colonel C. P. Gunter has carried on this Frontier Survey work in Simla during the summer.

Other Directors have also delivered survey lectures at a variety of military stations, and short survey courses have been given to officers of the Royal Artillery. One or two Artillery Practice camps were also visited by Survey officers, as opportunity arose.

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

Class I officers:—Lt.-Colonel H. McC. Cowie, R.E., and Mr. H. H. B. Hanby died. The following retired:—Lt.-Colonel G. A. Beazeley, D.S.O., R.E., and Messrs. J. A. Freeman, E. C. J. Bond, Rai Bahadur Jagdamba Prasad and Rai Sahib Hanuman Prasad. Lieut. H. A. Bazley, R.E., reverted to the Home Establishment.

Messrs. C. E. C. French, C. C. Byrne, Rai Sahib Dhani Ram Verma and Mr. W. G. Jarbo were confirmed as Deputy Superintendents and Mr. B. M. Berrill and Rai Sahib Pramadaranjan Ray were promoted temporarily from the Class II Service.

Lieuts. G. F. Heaney, G. H. Osmaston and G. Bomford, Royal Engineers, rejoined from military duty, and Lieuts. J. B. P. Angwin and D. R. Crone, Royal Engineers, were appointed to the Department.

Class II officers:—Mr. P. Williams retired.

A competitive examination for the recruitment of probationers to the Class II Service was held at the various Survey headquarters, 64 candidates being nominated to sit for the examination by the Selection Boards.

Upper Subordinate officers:—Khan Bahadur Sher Jang and B. V. Narayana Rao retired and Mr. Sadik Ali was transferred to the Technical Establishment, Photo.-Litho. Office. Mr. Nabadad Khan died and Mr. Sasadhhar Mukarjee was discharged. Four Lower Subordinates were promoted and 14 probationers were appointed, 4 of whom were discharged.

Awards—Conductor W. Smith, Head Draftsman, Army Section No. 6 Drawing Office, was promoted Assistant Commissary with the rank of Lieutenant from 16th November 1924. He was made a Member of the Order of the British Empire in the Birthday Honours in June 1925.

The title of Rai Sahib was conferred on Mr. Sashi Bhusan Mitra, Head Supervisor, Mathematical Instrument Office, in the Birthday Honours in June 1925.

Mr. R. E. Saubolle, Extra Assistant Superintendent, a Corporal in the Simla Rifles, was awarded the Volunteer Decoration for long service.

I. ABSTRACT OF SURVEYS IN EACH PROVINCE AND STATE.

(For Abstract of Forest and Cantonment Surveys, see Part III, page 14)

9. Northern Circle.

Kashmir State.—Gravity and Astronomical latitude operations (p. 15). Exploration survey, *Hunza State* (p. 43).

North-west Frontier Province.—Riverain surveys, Dera Ismail Khān & Peshāwar districts, (p. 26). Settlement and Boundary surveys, Peshāwar district, (p. 28). Revision Cantonment surveys, Bannu, Risalpur, (p. 41).

Punjab.—Riverain surveys, Attock, Jhang and Miānwāli districts, (p. 26). Tahsil Boundary survey, Shekhūpura (p. 26). Four-inch survey of Lahore and environs, (p. 26). Large-scale surveys of Lahore City and Municipal area, (p. 27). Settlement survey, Attock district, (p. 28). Rectangulation, Ferozepore district (p. 27) and Four-inch survey, Ferozepore, Montgomery and Multān districts, for Sutlej Valley Irrigation project, (p. 25). Tertiary levelling for same project, (p. 42). Revision Cantonment surveys, Campbellpore, Murree, and 8 Galis, (p. 41). Revision Survey, Simla, (p. 22). Gravity determinations, (p. 15).

Punjab States. Bahawalpur.—Rectangulation for the Sutlej Irrigation project, (p. 27). Geodetic levelling (p. 16).

Delhi Province.—No work.

Rājputāna.—*Jaipur State.* Survey of Jaipur city and environs, (p. 24).—*Kotah State.* Topographical surveys, (p. 24).—Geodetic levelling, (p. 16).

Sind.—Geodetic levelling, (p. 16).

Baluchistān.—No work.

United Provinces.—Topographical surveys, Allahābād, Bāndā, Fatehpur, Partābgarh and Rāe Bareli districts, (p. 23), Jhānsi and Jālaun districts, (p. 24). Boundary demarcation for the Court of Wards, Gorakhpur, (p. 23). Forest surveys, (pp. 23 and 24).

Central India.—*Baghelkhand Agency.* Topographical surveys, Baraundā, Chaube Jāgirs and Rewah States, (p. 23). *Bundelkhand Agency.*—Topographical surveys, Ajaigarh and Charkāri States, (p. 23), Bijnā, Datiā, Orchhā and Samthar States, (p. 24).

Indore State, topographical surveys, (p. 24).

Gwalior State and *Khaniādhāna State* of *Gwalior Residency*, topographical surveys, (p. 24).

10. Southern Circle.

Central Provinces.—Two-inch survey, *Seoni district*, for *Seoni Court of Wards*, (p. 30). Forest surveys, (p. 30).

Bastar State.—Four-inch boundary surveys, (p. 30).

Bombay.—Topographical surveys, *Ahmadnagar*, *Bombay City*, *Bombay Suburban*, *Kolāba*, *Nāsik* and *Thāna* districts (p. 31). Forest surveys, (p. 32).

Bombay States.—*Jawhār State*, topographical surveys, (p. 31).

Hyderābād State.—Topographical surveys, *Warangal district* (p. 30).

Mysore State.—Topographical surveys, *Hassan*, *Kadūr*, *Mysore* and *Tumkūr* districts, (p. 31). Three-inch surveys of *Bangalore* and *Seringapatam*, (p. 31). Boundary between *Mysore State* and *South Kanara district* of *Madras*, (p. 31).

Coorg.—Topographical surveys, (p. 31).

Madras.—Topographical surveys, *Guntūr*, *Kistna* and *Upper Godāvāri* districts, (p. 30), *Coimbatore district*, (p. 31). Boundary survey between *South Kanara district* and *Mysore State*, (p. 31).

11. Eastern Circle.

Assam.—Topographical surveys, *Sadiyā Frontier Tract*, (p. 34). Tea-garden surveys, (p. 35). Astronomical latitude operations, (p. 15). Forest surveys, (p. 35).

Bengal.—Four-inch surveys in *Rāniganj coalfield*, *Bānkurā*, *Birbhūm*, *Burdwān* districts, (p. 33). Astronomical latitude operations (p. 15). Geodetic levelling, (p. 16). Secondary levelling for *Calcutta Corporation*, (p. 43). Secondary levelling for *East Indian Railway*, (p. 43).

Bihār and Orissa.—Topographical surveys in *Angul district*, in *Athmallik*, *Bāmra*, *Dhenkānāl*, *Hindol*, *Keonjhar*, *Mayūrbhanj*, *Pāl Laharā*, *Rairākhōl* and *Tālcher States*, (p. 34). Four-inch surveys in *Rāniganj coalfield*, *Mānbhūm* and *Santāl Parganae* districts (p. 33). Geodetic levelling, (p. 16).

Sikkim and Bhutān.—No work.

Andaman Islands.—No work.

12. Burma Circle.

Boundary survey between Maymyo sub-division and Hsipaw State, (p. 36). Topographical surveys, Amherst district, (p. 37), Kyaukpyu, Sandoway and Thayetmyo districts, (p. 36). Yenangyaung Oil-fields survey, (p. 39). Secondary levelling for P. W. D. (Irrigation), (p. 42). Tertiary levelling for Burma Oil Company, Yenangyaung, (p. 42). Forest surveys, (p. 37).

II.—ABSTRACT OF TOPOGRAPHICAL WORK.

13. 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 one-inch scale 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 490,000 square miles may possibly be surveyed on the half-inch 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. | Northern Circle. | Southern Circle. | Eastern Circle. | Burma Circle. | TOTALS. |
|-----------------------|--|-------------------|-------------------|-------------------|-------------------|-------------------|
| | | <i>Sq. miles.</i> | <i>Sq. miles.</i> | <i>Sq. miles.</i> | <i>Sq. miles.</i> | <i>Sq. miles.</i> |
| 1905-18 | Mostly 2-inch and 1-inch. | 150,356 | 80,810 | 27,551 | 57,042 | 315,259 |
| 1918-14 | Mostly 1-inch and $\frac{1}{2}$ -inch. | 25,052 | 15,844 | 7,291 | 7,599 | 55,786 |
| 1914-15 | ditto. | 12,334 | 19,286 | 2,448 | 2,608 | 36,676 |
| 1915-16 | ditto. | 8,168 | 17,248 | 2,279 | 4,652 | 32,347 |
| 1916-17 | ditto. | 11,689 | 11,838 | 8,580 | 6,168 | 38,275 |
| 1917-18 | ditto. | 4,202 | 12,181 | 8,598 | 4,800 | 29,781 |
| 1918-19 | ditto. | 509 | 7,263 | 1,764 | 4,412 | 13,948 |
| 1919-20 | ditto. | 9,145 | 11,891 | 4,811 | 5,117 | 31,064 |
| 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 | 20,828 | 9,144 | 5,482 | 61,653 |
| 1923-24 | ditto. | 18,544 | 28,160 | 11,868 | 7,606 | 66,178 |
| 1924-25 | ditto. | 12,095 | 21,765 | 4,544 | 5,913 | 44,317 |
| Areas completed ... | | 304,232 | 281,975 | 89,587 | 122,413 | 798,207 |
| Balance remaining ... | | 445,768 | 260,825 | 173,338 | 143,462 | 1,023,393 |
| Total programme ... | | 750,000 | 542,800 | 262,925 | 265,875 | 1,821,600 |

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1924-25.

| PARTY AND LOCALITY. | | 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. | |
| Character of Country. | Scale and Class of Survey. | Sq. miles. | | Rs. | Rs. per sq. mile. | |
| NORTHERN CIRCLE. | | | | | | |
| No. 1 Party—United Provinces and Central India. | | | | | | |
| <i>Cultivated plains, congested with villages, and low hills densely wooded.</i> | One-inch Revision Survey ... | 3,227 | 3,227 | 94,788 | 29.4 | |
| No. 2 Party—Central India, Gwalior, Rājputāna and United Provinces. | | | | | | |
| <i>Jungle-clad hills, undulating forests and cultivated plains.</i> | Half-inch Original Survey ... | 6,850 | 8,868 | 1,41,151 (a) | 16.0 | (a) Includes Rs. 22,276 cost of training Class II probationers and soldier surveyors, etc., and Rs. 3,962 payable by the Jaipur State Durbar. |
| <i>Jungle-clad hills and cultivated plains.</i> | One-inch Resurvey ... | 2,018 | | | | |
| TOTALS, NORTHERN CIRCLE:— | | 12,095 sq. m. | | Rs. 2,35,889 | Cost-rate 19.5 | |

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1924-25.

| PARTY AND LOCALITY. | | 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. | |
| | | | | | | SOUTHERN CIRCLE. |
| No. 5 Party—Central Provinces. | | | | | | |
| <i>Jungle-clad hills and plain.</i> | Four-inch Original Survey ... | 19 | 85 | 24,581 (b) | 288·6 (b) | (b) Excludes mapping of 4-inch. |
| | Two-inch Revision Survey ... | 66 | | | | |
| No. 6 Party—Hyderabad, Madras and Central Provinces. | | | | | | |
| <i>Partly highly cultivated plains and partly forest-clad hills.</i> | Half-inch Original Survey ... | 3,027 | 9,530 (c) | 98,464 (c) | 10·3 | (c) Area and cost of Bastar Boundary survey is excluded. |
| | Half-inch Revision Survey ... | 291 | | | | |
| | One-inch Original Survey ... | 6,088 | | | | |
| | One-inch Revision Survey ... | 144 | | | | |
| No. 7 Party—Mysore State. | | | | | | |
| <i>Mostly open undulating plateau with some densely wooded hill areas.</i> | One-inch Revision Survey ... | 7,532 | 7,532 (d) | 1,22,065 (d) | 16·2 | (d) Excludes area and cost of 77 square miles of special large scale survey and revision, and of Mysore-South Kanara Boundary survey. |
| No. 8 Party—Bombay and Jachär State. | | | | | | |
| <i>Thickly populated coastal areas and heavily wooded hills of the Western Ghäts.</i> | One-inch Revision Survey ... | 4,618 | 4,618 (e) | 71,189 (e) | 15·4 | (e) Excludes area and cost of special forest maps. |
| TOTALS, SOUTHERN CIRCLE:— | | 21,765 sq. m. | | Rs. 3,16,249 | Cost-rate 14·5 | |

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1924-25.

| PARTY AND LOCALITY. | | OUT-TURNS OF PLANE-TABLING. | | COSTS OF SURVEY INCLUDING MAPPING. | | REMARKS. |
|--|--|---|--------------------------------|------------------------------------|-------------|---|
| | | Area on each Scale of each Class. | Totals of areas on all Scales. | Total Costs. | Cost-rates. | |
| | | | | | | |
| No. 4 Party—Bengal, Bihar & Orissa.—(Rāniganj coalfields.) | | EASTERN CIRCLE. | | | | |
| <i>Generally open, undulating country cut up by the Ajay, Dāmodar and Barākar rivers with steep jungle-covered hills in the south-western portion and a fringe of coppice jungle on the remaining three sides.</i> | Four-inch Original Survey with 10-foot contours. | 60 | 446 | 85,604 | 191·9 | (f) Includes Rs. 1,846 cost of levelling in advance from last year and excludes Rs. 18,463 cost of triangulation, etc., in advance for survey next year. Total cost of party for this year is Rs. 1,03,220. |
| | Four-inch Supplementary Survey with 10-foot contours. | 386 | | | | |
| No. 9 Party—Bihar & Orissa. | Wooded hills and high ground, open and wooded undulating plains. | One-inch Original Survey ... | 2,774 | 2,774 | 1,17,545 | 42·3 |
| Sadiyā Frontier Detachment—Assam. | Low densely wooded plains intersected by the Brahmaputra, Dibāng, Sisacri and Dihūng rivers and bordered by high mountains to the north. | One-inch Original Survey ... | 1,254 } 70 } | 1,324 | 1,06,465 | 80·4 |
| | One-inch Revision Survey ... | | | | | |
| No. 12 Party—Assam. | <i>This party did not take the field but was employed on drawing of 10-mile guide maps of Eastern Circle.</i> | ... | ..... | ..... | 42,640 | (h) Includes Rs. 963 cost of 10-mile mapping done by Sadiyā Frontier Detachment. |
| TOTALS, EASTERN CIRCLE:— | | 4,544 sq. m. Rs. 3,09,614* Cost-rate 68·1 | | | | |

*Excludes cost of No. 13 Party.

Table II.—OUT-TURNS of PLANE-TABLING and COSTS of Topographical Surveys, 1924-25.

| PARTY AND LOCALITY. | | 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. | |
| Character of Country. | Scale and Class of Survey. | Sq. miles. | | Rs. | Rs. per sq. mile. | |
| No. 10 Party—Upper and Lower Burma. | | | | | | BURMA CIRCLE. |
| Densely wooded hills | ... Half-inch Original Survey | 289 | } 3,308 | 1,92,535 (d) | 58·2 | (d) Includes Rs. 558 cost of mapping forest surveys debitable to the Forest Department, Burma. |
| Wooded hills, creeks, islands, and mangrove swamps. | ... One-inch Original Survey | 3,069 | | | | |
| No. 11 Party—Lower Burma. | | | | | | |
| High and low ground densely wooded with evergreen forest and numerous outcrops of rock. | One-inch Original Survey | 1,819 | } 2,224 | 2,00,051 (e) | 89·9 | (e) Includes Rs. 10,898 debitable to the Forest Department, Burma. |
| Cultivated areas, low hills and plains thickly wooded and swamps. | One-inch Supplementary Survey | 384 | | | | |
| High hills densely wooded | ... Two-inch Original Survey | 61 | | | | |
| Low hills densely wooded | ... Four-inch Original Survey | 10 | | | | |
| No. 21 (Burma Forest) Party—Lower and Upper Burma. | | | | | | |
| Densely wooded hills and plains | Four-inch Original Survey | 381 | 381 | 1,71,208 (k) | 449·3 (k) | (k) The whole cost is debitable to the Forest Department, Burma. |
| TOTALS, BURMA CIRCLE:— | | 5,913 sq. m. | | Rs. 5,63,794 | | Cost-rate 95·3 |
| GRAND TOTALS:— | | 44,317 sq. m. | | Rs. 14,25,546 | | Cost-rate 32·2 |

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

14. Forest Surveys.

United Provinces.—*Western Forest Circle.* Bāndā Forest Divn., (p. 23).—*Eastern Forest Circle.* Jhānsi Forest Divn., (p. 24).

Central Provinces.—*Southern Forest Circle.* Chānda Forest Divn., (p. 30).

Bombay.—*Northern and Eastern Forest Circles.* East Thāna Forest Divn., (p. 32). Kolāba Forest Divn., (p. 32).

Assam.—*Eastern Forest Circle* Sadiyā Forest Divn., (p. 35).

Burma.—*Sittang Forest Circle.* North Toungoo Forest Divn., South Toungoo Forest Divn., Shwegyin Forest Divn., North Pegu Forest Divn., (p. 38).

Central Forest Circle.—*Pyinmanā Forest Divn.*, (p. 39).

Hlaing Forest Circle.—*Tharrawaddy Forest Divn.*, *Prome Forest Divn.*, *Allanmyo Forest Divn.*, (p. 39).

Tenasserim Forest Circle.—*Thaungyin Forest Divn.*, (p. 37).

15. Cantonment and City Surveys, etc.

Northern Circle.—*Bannu, Campbellpore, Ferozepore, the Galis, Murree Depôt, Rawalpindi, Risalpur*, (p. 41). *Simla*, (p. 22).

Southern Circle.—*Bangalore, Seringapatam*, (p. 31).

16. Special Surveys.

Hunzu.—*Netherlands Expedition*, (p. 43).

Bengal, Bihar & Orissa.—*Rāniganj Coalfield Survey*, (p. 33).

Assam.—*Large-scale surveys of tea gardens*, (p. 35).

Burma. *Yenangyaung.*—*Large scale surveys of oil-fields*, (p. 39).

Punjab.—*Sutlej Valley Irrigation Project*, (p. 25).

Lahore and Environs survey, (p. 26).

Lahore Town survey, (p. 27).

Artillery practice camp, (p. 32).

IV.—ABSTRACT OF GEODETIC OPERATIONS.

DIRECTOR:—Lt.-Colonel R. H. Thomas, D.S.O., R.E.

17. Organization.—The following parties and offices were administered by the Director Geodetic Branch:—

Nos. 13, 14, 15, 16, 17, 18 and 19 Parties, the Computing and Tidal Office, the Publication and Stores Office, No. 2 Drawing Office and the Forest Map Office.

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

18. Deflection and Gravity observations.—(Nos. 13 and 14 Parties). Astronomical latitudes were observed at eleven stations in Assam, three in Eastern Bengal and fourteen in Kashmir. Of those in Assam, three were in the Surmā valley, seven in the Brahmaputra valley and one in the Khāsi and Jaintiā hills. The Assam and Bengal results show that the Hayford theory of uniform isostatic compensation is very imperfectly realised in this area. The computation of the astrolabe observations in Kashmir is in hand.

Pendulum observations were made at various places in the Punjab and in Kashmir. For time observations in the gravity work the large pattern prismatic astrolabe was used for the first time in India.

19. Triangulation.—Primary triangulation has not yet been resumed since the War.

20. Tidal Operations.—Self-registering tide gauges were operated at Aden, Basrah, Karāchi, Bombay, Madras, Kidderpore, Rangoon, Moulmein, Bassein and Port Blair. Readings of time and height of high and low tide were made at Bhāvnagar, Chittagong and Akyab by the Port Officers concerned, the results being sent to Dehra Dūn.

Weekly charts of the tidal curves registered on the automatic recorder at Margil were received from Basrah and hourly readings from these charts were utilized to derive fresh constants for the computation of tide-tables for the Port of Basrah.

Moulmein and Port Blair observations were finally closed down during the year.

Tidal predictions for the 1926 and 1927 tide-tables for Basrah and the Indian ports were completed by March 1925. Advance printed copies of tide-tables for 17 ports for 1926 were sent to the Admiralty by the end of that month.

21. *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 :—

- (a) *Sind.*—Karāchi-Hyderabad-Sukkur.
- (b) *Rājputāna and Bahāwalpur State.*—Govardhanlā-Bhutta Shaikh (near Khānpur).
- (c) *Sind and Rājputāna.*—Hyderabad-Barmer.
- (d) *Bengal.*—Howrah-Rāniganj-Dinājpur.
- (e) *Bengal, Bihār & Orissa.*—Midnapore-Jaleswar.

Total 1,115 miles.

Details of secondary and tertiary levelling for various purposes are given in Part X of this report, (p. 41).

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

23. *Computing Office.*—Special mention may be made here of the computations in connection with Dr. Hunter's investigation of the Figure of the Earth, and of those in connection with the computations of rectangular coordinates for the military authorities. Numerous other computations both departmental and extra-departmental were carried out, about 225 requisitions being complied with. 34 Degree Sheet Triangulation Pamphlets (including some of the Mesopotamian Triangulation) were compiled, and 48 pamphlets printed off. Magnetic and Meteorological observations were taken throughout the year. The Omori Seismograph recorded 7 earthquakes between 1st October 1924 and 30th September 1925. Sun photographs were taken on 243 days between 1st October 1924 and 30th June 1925.

24. The taking of Solar photographs, which was started in 1878 at the instance of Sir Norman Lockyer for purposes of scientific investigation, was discontinued from 30th June 1925, and the Solar observatory abolished after consultation with the Director of the Science Museum, 5 Kensington, as its upkeep necessitated expenditure which could be more profitably spent on work in which the Survey of India was more directly interested, and as moreover a better-equipped observatory for this purpose had been established at Kodaikānal.

25. Full details of the work of the Publication and Stores Office, No. 2 Drawing Office and Forest Map Office are now given in the Map Publication and Office Work Report, only a brief summary being given in Abstract V of this report.

V.—ABSTRACT OF MAP PUBLICATION AND OFFICE WORK.

26. 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 half year ending 31st March 1925.

27. The Mathematical Instrument Office has always reported in accordance with the financial year, and not the survey year; so its report, which is also included in the Map Publication and Office Work Report, is for a full year up to 31st March 1925. 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 out-turn from the workshops shows very little change. The workshop profit was Rs. 46,607 against Rs. 43,313 in 1923-24, and that of the Store was Rs. 10,878 against Rs. 26,348, in the previous year.

| | 1922-23 | 1923-24. | 1924-25. |
|---|--------------------------|---------------------------|---------------------------|
| | <i>Rs.</i> | <i>Rs.</i> | <i>Rs.</i> |
| 1. Total value of stores issued to Public Offices as shown in the Profit and Loss statements. | 6,25,953 | 4,46,569 | 3,75,024 |
| 2. Value of repairs to instruments received from Public Offices for repairs, and returned in serviceable condition. | 1,70,010 | 1,56,682 | 1,28,931 |
| 3. Value of instruments received from Government Offices as no longer required. | 83,933 | 54,824 | 51,875 |
| 4. Book value of the stock of instruments, &c., in Serviceable Store. | 5,75,844 | 5,14,985 | 3,25,685 |
| 5. Book value of the stock of instruments, &c., in Repairable Store. | 1,26,616 | 1,11,113 | 1,04,859 |
| 6. Total value of work done in the Workshop. | 4,89,329 | 3,92,072 | 3,82,467 |
| 7. Value of instruments manufactured in the Workshop for Serviceable Store. | 1,68,588 | 1,14,677 | 1,42,616 |
| 8. Value of instruments purchased locally. | 22,840 | 13,034 | 35,356 |
| 9. Value of instruments and materials obtained from England through the Director General, India Store Department. | 2,20,650 | 1,47,723 | 95,750 |
| 10. Average No. of employees and their pay including pension contribution. | { No. 554 Rs.1,88,009 | { No. 402 Rs. 1,57,280 | { No. 386 Rs. 1,52,168 |

28. Publications.—The publications of the Department for the half 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.

| Class of maps. | Scale. | New Publications. | New Editions and Reprints. | Number of sheets printed. | Value. |
|--------------------------------------|-------------|-------------------|----------------------------|---------------------------|-----------------|
| GENERAL MAPS. | | | | | Rs. |
| Maps of India | Various | ... | 2 | 8,040 | 4,580 |
| GEOGRAPHICAL MAPS. | | | | | |
| Map of India | 1"=82 miles | ... | ... | ... | ... |
| Southern Asia Series | 1:2,000,000 | ... | ... | ... | ... |
| India and Adjacent Countries Series. | 1:1,000,000 | 2 | ... | 1,000 | 1,500 |
| La Carte Internationale du Monde. | 1:1,000,000 | ... | ... | ... | ... |
| TOPOGRAPHICAL MAPS. | | | | | |
| Quarter-inch, (Modern) | 1"=4 miles | 22 | 10 | 12,800 | 19,702 |
| Do. (Prely.) | 1"=4 miles | 2 | 2 | 2,650 | 5,881 |
| Do. (Provl.) | 1"=4 miles | ... | 2 | 400 | 600 |
| Half-inch, (Modern) | 1"=2 miles | 83 | 8 | 14,700 | 48,994 |
| Do. (Prely.) | 1"=2 miles | ... | ... | ... | ... |
| One-inch, (Modern) | 1"=1 mile | 59 | 22 | 31,095 | 47,994 |
| Do. (Prely.) | 1"=1 mile | 9 | 1 | 2,500 | 3,750 |
| Do. (Provl.) | 1"=1 mile | 1 | ... | 240 | 360 |
| Old Style sheets | Various | ... | 15 | 1,660 | 2,127 |
| SPECIAL MAPS. | | | | | |
| District Maps | 1"=4 miles | ... | ... | ... | ... |
| Administration Report Maps | 1"=8 miles | ... | ... | ... | ... |
| Provincial Maps | Various | 1 | 1 | 562 | 1,888 |
| Plans of Cities and Cantonments | Various | 1 | ... | 1,120 | 3,920 |
| Index Maps | Various | ... | 78 | 180,975 | 17,686 |
| Miscellaneous Maps | Various | 7 | 12 | 28,928 | 18,988 |
| Total ... .. | ..... | 137 | 153 | 276,670 | 1,67,340 |
| Extra-departmental. | | | | | |
| Maps | Various | 79 | 15 | 47,958 | 19,867 |
| Plans and Diagrams | Various | 174 | 6 | 28,390 | 4,582 |
| Illustrations ... .. | ..... | 118 | ... | 54,559 | 11,229 |
| Miscellaneous ... .. | ..... | 32 | 16 | 60,570 | 5,248 |
| Total ... .. | ..... | 403 | 37 | 191,472 | 40,876 |
| Grand Total ... .. | ..... | 540 | 190 | 468,142 | 2,08,216 |

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

| Class of maps. | Scale. | New publica-tions. | Reprints and New Editions. | Number of sheets printed. | Value. |
|----------------------------|---------|--------------------|----------------------------|---------------------------|---------------|
| <i>Departmental.</i> | | | | | Rs. |
| Cantonment Maps ... | Various | 1 | 9 | 8,570 | 17,810 |
| Forest Maps ... | " | 28 | 17 | 2,711 | 3,761 |
| Miscellaneous ... | " | 1 | 2 | 2,600 | 610 |
| Total ... | ... | 25 | 28 | 13,881 | 22,181 |
| <i>Extra-departmental.</i> | | | | | |
| Maps ... | Various | 15 | 6 | 9,785 | 4,692 |
| Plans & diagrams ... | " | 6 | 4 | 26,569 | 2,085 |
| Charts ... | 4" | 345 | ... | 172,500 | 26,220 |
| Total ... | ... | 366 | 10 | 208,854 | 32,947 |
| Grand Total ... | ... | 391 | 38 | 222,735 | 55,128 |
| Various ... | Various | 60 | 12 | 12,700 | 86,800 |

Notes.

29. *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.

30. *Dehra Dūn.*—Ten Cantonment and forty Forest maps were published during the period under report, and a large amount of extra-departmental work was done. For the Sutlej Valley Irrigation Project of the Punjab Government 345 special contoured spot-level charts were published. These were reproduced in the Vandyke Section and caused a great increase of work in that section, the out-turn of negatives being 124 in November and the average monthly out-turn being 90 negatives. The correcting of these negatives threw a great deal of work on the Zinc Correcting Section which had some difficulty in keeping up with it.

The out-turn of the litho. machine increased from 29,000 pulls and 16,500 copies printed in October to 65,000 pulls and 37,200 copies printed in March, the out-turn for March being the highest reached during the last three years.

Table II.—Letterpress Publications.

(a) PUBLISHED AT CALCUTTA.

1. Survey of India General Report, 1923-24. Price Rs. 2 or 3s. 6d. (475 copies).
2. Hand-book of Topography, Chapter VII, Third Edition, 1924. Price Annas 8. (500 copies).
3. Notes on the Organisation, Methods and Processes of the Photo-Litho. Office, Calcutta, Third Edition, 1924. (350 copies).
4. Catalogue of maps published by the Survey of India, 1924. Price Re. 1. (Printed by Litho.). (3,000 copies).
5. Catalogue of maps of Burma, 1925. Price Annas 8 (750 copies).
6. Office Manual (Map Record & Issue Office), 2nd Edition, 1924. (100 copies).
7. Correction to the Hand-book of Topography, Chapter I, No. 27. (750 copies).
8. Corrections to the Hand-book of Topography, Chapter VI, Nos. 129, 130, 131, 132, 133, 139, 140, 143 & 147. (650 copies each).
9. Correction to the Hand-book of Topography, Chapter X, No. 18. (600 copies).

(b) In Hand at Calcutta.

1. Hand-book of Topography, Chapter V.
2. Hand-book of Topography, Chapter VIII.
3. Hand-book of Topography, Chapter XI.
4. Correction to the Hand-book of Topography, Chapter I.
5. Appendix XI to Hand-book of Topography, Chapter VI.

(c) PUBLISHED AT DEHRA DŪN.

1. Tide-tables for 1926 for the 14 ports included in the Admiralty tide-tables. (18,230 copies).
2. New data for levelling pamphlets 57, 47 and 66. (550 copies).
3. Eight Triangulation pamphlets. (800 copies).

(d) In Hand at Dehra Dūn.

1. Records of the Survey of India, (Magnetic Survey).
2. Tidal Chapter of the Hand-book of Trigonometrical Instructions.
3. Levelling pamphlet 44.
4. Hand-book of Topography, Chapter IX.
5. Report on Irrawaddy Delta Air Survey by Major Lewis.
6. Bhutan and Tibet Survey (Captain Meade).
7. Synopsis of Cantonment Surveys.
8. Forest Map Office Record Book.
9. Corrections to Routes in Western Himalaya, Vol. I.

Table III.—Publication of Modern Topographical Maps.

| Years of publication. | NUMBER OF SHEETS PUBLISHED. | | |
|---|-----------------------------|-------------------|------------------|
| | One-inch Sheets. | Half-inch Sheets. | "Degree" Sheets. |
| 1924-25 (Half-year) | 59 | 38 | 6 |
| Previous years | 2,098 | 507 | 119 |
| Total published | 2,157 | 540 | 125 |
| Number of Sheets in India | 6,218 | 1,630 | 450 |

31. **Map Issues.**—The following Tables show the number of maps issued during the half-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. | 110,278 | 1,11,794 | 89,898 | 54,542 | 25,924 | 86,595 | 176,100 | 2,02,981 |
| Extra-departmental. | 174,989 | 40,828 | 23,325 | 8,270 | 6,720 | 940 | 205,084 | 49,588 |
| Total ... | 285,267 | 1,52,122 | 63,223 | 62,812 | 32,644 | 37,535 | 381,134 | 2,52,469 |

Table IV (b).—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 Dūn (F. M. O.). | 1,816 | 2,341 | 588 | 1,174 | 1,868 | 4,905 | 4,022 | 8,420 |
| Northern Circle | ..... | ..... | 14 | 26 | ..... | ..... | 14 | 26 |
| Southern Circle | ..... | ..... | 1,675 | 8,288 | ..... | ..... | 1,675 | 8,288 |
| Total ... | 1,616 | 2,341 | 2,227 | 4,438 | 1,868 | 4,905 | 6,711 | 11,684 |

32. **Map Record and Issue Office, Calcutta.**—During the half-year ending 31st March 1925, sales both to the public and to Government Officials again showed a steady increase.

The re-organization of the Record room continued; up to date, the steel fire-proof rack construction completed and in hand was:—

Map Record Section.—5,230 fixed racks constructed and 1,344 in hand, against 5,810 modern maps published to date.

Original Section.—560 almirahs under construction with shelves on rollers, accommodating altogether 6,720 fair originals, against 5,212 modern fair originals received to date for storage.

VI.—SURVEY REPORTS, NORTHERN CIRCLE.

DIRECTOR:—Lieut.-Colonel L. C. Thuillier, I.A.

33. Summary.—The following parties, detachments, etc., were administered by the Northern Circle during the year:—

Nos. 1, 2, 3, 20*, 22, 23 Parties, No. 3 Drawing Office, the Settlement Survey Detachment and the Nepal Survey Detachment. No. 3 Party did not take the field, but the post of Officer in charge was held by Major J. D. Campbell, D.S.O., R.E., who acted as Assistant Director, Punjab Surveys, for the co-ordination of the various parties and detachments doing special work for the Punjab Government. No. 20 Party, which reverted to the control of the Director Geodetic Branch during the year, was able to take up special survey work for the Sutlej Valley Irrigation Project, owing to the very small amount of Cantonment work in hand. (p. 25).

34. Simla Surveys.—During the winter two surveyors were sent to Simla to take up the revision of the survey on scale 125 feet to one inch. The work was supervised by the Officer in charge No. 6 Drawing Office and the new guide map on the 8-inch scale is now under publication.

35. Training.—Of the 60 pupils entertained last year and employed on 4-inch work in No. 20 Party, 8 have been discharged for unsatisfactory work.

9 of these pupils were sent to No. 22 Party at Lahore for large scale surveys in April and the remainder employed during recess in No. 23 Party and No. 3 Drawing Office.

20 new pupils have been entertained during the year for employment in No. 20 Party.

Of the nine soldier surveyors who were receiving instruction in No. 2 Party, three have been reverted to their regiments, as they were not likely to turn out good surveyors.

36. Party Reports.—Particulars of the work done by Nos. 1, 2, 20*, 22 and 23 Parties and that of the Settlement Survey Detachment are given below. The work of No. 20 Party (Cantonment Section) is briefly described in Part X, p. 41.

*To 15th June 1925. Sutlej Valley four-inch survey only.

- 37. No. 1 Party, Topographical Surveys.**—This party surveyed a total area of 3,227 square miles on the 1-inch scale. This includes 2,901 square miles in the Allahābād, Bāndā, Fatehpur, Partābgarh and Rāe Bareli districts of the United Provinces and 326 square miles in the Indian States of Baraundā (104 square miles), Chaube Jāgirs (109 square miles) and Rewah (106 square miles) of the Baghelkhand Agency, and Ajaigarh (1 square mile) and Charkhāri (6 square miles) of the Bundelkhand Agency of Central India. In addition, an area of 539 square miles was triangulated in the Bāndā district and Rewah State to supply data for the detail survey.
- PERSONNEL.**
- Class I Officer.*
- Mr. M. C. Petters, in charge from 8th October 1924 and from 9th November 1924 to 17th May 1925.
- Class II Officers.*
- Mr. J. C. C. Lears, in charge from 18th May 1925.
- Major C. H. Tresham, in charge from 9th October 1924 to 8th November 1924.
- Mr. O. D. Jackson.
- „ Moqimuddin.
- Upper Subordinate Service.*
- 1 Officer.
- Lower Subordinate Service.*
- 30 Surveyors, etc.

38. Forest Surveys.—In the Bāndā Forest Divn., of the Western Forest Circle, United Provinces, an area of 57 square miles of reserved and unclassed forests, for which four-inch sheets already existed, was revised on the one-inch scale, during the work outlined above.

39. Nature of Country.—The country surveyed in the northern portion consists mainly of well cultivated plains with numerous lakes, marshes and mango groves, and intersected by several rivers, the principal of which are the Ganges and Jumna. The southern portion of the area consists of low isolated hills, cultivated plains and part of the plateau and northern slopes of the Kaimur range; it is densely wooded and covered with a very thorny undergrowth.

40. Boundary demarcation for the Court of Wards, Gorakhpur.—As a result of compromises effected in 1905-07 and 1914-16, which included the transfer of ownership of land on payment, the parties concerned wished the boundary lines, which had been drawn in court on badly distorted tracings, to be marked on the ground. The Collector in charge, Court of Wards, Gorakhpur, asked for the services of an officer to carry out the demarcation and guaranteed payment. An officer was accordingly deputed for the work and the necessary demarcation was completed in January-February 1925.

41. No. 2 Party. Topographical Surveys.—This party sur-

PERSONNEL.

Class I Officer.

Bt.-Lieut.-Colonel S. W. S. Hamilton,
D.S.O., R.E., in charge to 13th January 1925
and from 14th February 1925 to 6th April 1925
and from 16th July 1925.

Class II Officers.

Mr. P. A. T. Kenny, O.B.E., in charge
from 14th January 1925 to 13th February 1925
and from 7th April 1925 to 15th July 1925.

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

„ F. B. Kitson,

„ M. A. Chowdhury, B.A.

„ S. E. Gupta, B.A., (on probation).

„ J. C. Berry do.

„ T. M. C. Alexander do.

„ M. N. A. Hashmi, B.A. do.

Upper Subordinate Service.

5 Officers.

Lower Subordinate Service.

46 Surveyors, etc.

Gwalior Residency; in the Datiā, Orchhā and Samthar States of the Bundelkhand Agency and in the Indore State in Central India.

An area of 4,874 square miles was triangulated in advance for detail survey on the half-inch scale in the Jhānsi district of the United Provinces, in the Kotah and Tonk States in Rājputāna, in the Gwalior State, and in the Bhopāl Agency of Central India.

42. Forest Surveys.—In the Jhānsi Forest Divn., Eastern Forest Circle, U.P., the survey of 31 square miles of reserved forest is included in the above details.

43. Nature of Country.—The country surveyed consisted partly of open cultivated plains, partly of low rocky ridges covered with dense thorn jungle, and partly of undulating forest land. There was also a great deal of intricate broken ground, deeply cleft, along the banks of the Betwā and Sind rivers, and their tributaries.

44. Training.—Nine soldier surveyors and one temporary traverser joined for training during the year and received instruction in drawing in the recess and in plane-tabling during the field season 1924-25.

45. Jaipur City Survey.—At the request of the Jaipur State Durbar, the party undertook the traverse of Jaipur City and Environs for a survey on the scale of 64 inches to 1 mile. Two traversers

veyed a total area of 8,868 square miles on the one-inch and half-inch scales. This includes 2,018 square miles on the one-inch scale in the Jhānsi district of the United Provinces; in the Gwalior State, and in the Khaniādhāna State of the Gwalior Residency; and in the Bijnā, Datiā, Orchhā and Samthar States of the Bundelkhand Agency in Central India. It also includes 6,850 square miles on the half-inch scale in the Jālaun and Jhānsi districts of the United Provinces; in the Kotah State in Rājputāna in the Gwalior State, and in the Khaniādhāna State of the

and two computers were employed, commencing work on 1st February 1925. The traverse was completed on 13th May 1925, and altogether 1,899 stations were fixed and 84.7 linear miles of main and minor traverses run and computed in the field. Plot charts were prepared during the recess in 1925 and sent to the Jaipur Durbar who will complete the detail survey by private agency.

46. No. 20 Party (4-inch Section).*—*Sutlej Valley four-inch*

PERSONNEL.

Class I Officer.

Mr. C. E. C. French, in charge.

Class II Officers.

Mr. O. N. Pushong.

„ J. H. Johnson.

„ G. A. Norman.

„ D. C. Puri.

Upper Subordinate Service.

3 Officers,

Lower Subordinate Service.

90 Surveyors, etc.

and pupils.

survey.—In September 1924 a considerable addition, comprising 6 officers and 90 surveyors, was made to the party for employment on 4-inch topographical survey for the Sutlej Valley Irrigation Project. The area for survey included portions of Multān, Montgomery and Ferozepore districts, and fragments of Bahāwalpur State which projected over the north bank of the Sutlej,—a

country consisting principally of sterile waste, relieved by scattered villages and patches of scrub jungle, usually in the depressions and channels of the old bed of the Beās. The strip of country along the bank of the Sutlej is well cultivated, but nowhere well provided with roads or means of communication.

An aggregate area of 4,395.6 square miles was surveyed on the 4-inch scale during the season; the topographical details being fixed by measurements or intersection from neighbouring stones of the rectangulation survey. The question of accurate boundaries often presented difficulties, especially in the *Nili-bār*, or wilderness. Information obtained from the villagers or patwāri, often disagreed with that indicated by the *masāvi* or forest plan; and, where evidences of habitation had disappeared, the location of a former claim was often well nigh impossible.

Published sheets were produced in black by photography from original plane-table sections, names being either hand-printed or typed. 100 out of 283 sheets were submitted to press before the party's return to recess and the remainder by the end of July.

For the work of the Cantonment Section of this party, see p. 41.

* Transferred to No. 23 Party from 16th June 1925, on transfer of No. 20 Party to Geodetic Branch.

47. No. 22 (Riverain) Party.—*Traverses*—The party continued

PERSONNEL.
Class I Officer.

Mr. Dhani Ram Verma, R.S., in charge.
Upper Subordinate Service.

6 Officers.

Lower Subordinate Service.

38 Surveyors, traversers, etc., (excluding
42 purely temporary men).

the work of traversing and laying down base-lines. 686 linear and 689 square miles of main circuits along the Indus river in Attock, Peshāwar, Miānwāli and Dera Ismail Khān districts and along the Jhelum river in Jhelum district and 3,841 linear miles and 736 square miles of minor traverses in the Indus riverain tracts in Attock and Miānwāli districts and in the Chenāb and Jhelum riverain tracts in Jhang district were executed. 1,038 theodolite stations of the former and 16,630 of the latter in 246 villages were fixed. The corners of 327 squares in 918 square miles were demarcated with permanent mark-stones on the left bank of the Indus river in Attock district, on both banks of the same river in Miānwāli and Dera Ismail Khān districts, and along the Chenāb and Jhelum rivers in Jhang district. These are to serve as bases for future survey and demarcation of boundaries and fields in the river beds. 172 plotted and 79 boundary *masāvis* (settlement mapping sheets) on the scale of 1/1980, 2,308 plotted and 592 boundary *masāvis* on the scale of 1/2640, and 37 four-inch sheets were traced and supplied to the Settlement Officers of Attock, Miānwāli and Jhang districts. Besides these, 302 miscellaneous traces were prepared, and all the traverse stations marked during the field season were plotted on 46 four-inch sheets.

48. Boundary Survey.—This work consisted in a plane-table survey of the boundaries of the newly constituted tahsils of Shekhūpura district. For this the original field sheets of the area topographically surveyed in the years 1910-12 were used. 257 linear miles of the new boundaries were surveyed by interpolation and measurement from the surrounding detail and from the village trijunction pillars shown on the original field sheets. The work was commenced on the 11th September 1924 and finished on 11th December 1924.

49. Lahore & Environs Survey.—This was undertaken at the request of the Chief of the General Staff, Army Head Quarters, India. It comprised revision of the existing 4-inch maps of the area and their extension to include the adjoining rural area, besides the revision of the Town Guide Map on the scale of 16 inches to 1 mile. The area of the 4-inch revision survey and original survey carried out was 43 and 85 square miles respectively; that of the 16-inch revision was 2.3 square miles. The original survey was based on a theodolite traverse connected

with the Lahore Town traverse executed in 1920-21. 121 linear miles were traversed and 307 theodolite stations were fixed for the purpose. The data of the Lahore Town traverse was also utilised in the revision survey.

50. *Lahore Town Survey*.—This was undertaken at the request of the Chairman of the Punjab Town Improvement Trust, who required maps of Lahore,

- (a) on the scale of 1 inch to 100 feet for the city proper and congested areas outside the old city walls,
- (b) on the scale of 1 inch to 330 feet for the rest of the municipal area and for important areas outside the municipal boundary, excluding portions on the north, east and west.

The survey was carried out in the hot weather from 1st May to 20th September 1925. 2.20 square miles on the scale of 1 inch to 100 feet and 27.94 square miles on the scale of 1 inch to 330 feet were surveyed.

The work was based on the Lahore Town traverse executed by the party in 1921. The missing traverse stations numbering 1,960 were relaid and 16.93 linear miles of supplementary traversing with theodolite were carried out and 325 stations were fixed in the new congested areas.

51. No. 23 (Punjab Rectangulation) Party.—*Sutlej Valley*

PERSONNEL.*

Class I Officers.

Mr. E. C. J. Bond, V.D., in charge up to 12th April 1925.

Major J. D. Campbell, D.S.O., R.E., in charge from 13th April 1925.

Class II Officers.

Mr. C. West from 30th October 1924 to 14th June 1925.

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

„ F. W. Smith.

„ Abdul Karim, B.A., from 12th March 1925.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

15 Traversers, etc., (excluding 84 purely temporary men).

Irrigation Project.—During the year the party was employed on rectangulation in connection with the Punjab Government's Sutlej Valley Project in the Ferozepore district and in Bahawalpur State.

A total area of 3707.34 square miles was rectangulated, 23,727 rectangles of 100 acres each were laid out, and 23,092 corner stones of 100-acre rectangles were embedded.

The country under rectangulation in the Ferozepore district lies on the south bank of the Sutlej river and is well cultivated and fed by inundation canals. That in Bahawalpur State lies on the south bank of the Panjnad and Indus rivers, and consists partly of well cultivated land, interspersed with heavy jungle, and partly of open desert areas.

In recess the party was employed on the compilation of *masâvis* of the area rectangulated.

* Excludes personnel of 4-inch Section transferred from No. 20 Party on 16th June 1925.

As it was found that contour sheets prepared in Dehra Dūn from spot levels alone were unsatisfactory, compilation of revised contour sheets was also undertaken and completed during recess, with the aid of the detail on the 4-inch sheets.

52. Settlement Survey Detachment.—The detachment conti-

PERSONNEL.

Class II Officers.

- Mr. Maya Das Puri, B.S., in charge.
 " Abdul Karim, B.A., up to 31st
 December 1924.
 " Prafulla Kumar Ghosh, B.Sc., F.R.
 G.S., from 10th October 1924 to
 31st August 1925.
 " Mahammad Najamuddin, B.A., from
 1st June 1925.

Upper Subordinate Service.

7 Officers.

Lower Subordinate Service.

- 16 Surveyors, Traversers, etc. (excluding 66
 purely temporary men).

strength of the detachment was considerably increased by entertaining and training new hands locally.

Special arrangements were made for the protection of men working along the frontier border.

53. District Boundary Survey.—At the request of the Settlement Officer, Peshāwar, the survey of the district boundary adjoining the independent tribes, and the internal village boundaries, generally running along the ridges of high hills, was undertaken on the scale of 24 inches to a mile during March, April and May.

54. Arrāwali Post.—As asked by the Military Works Department about 2 square miles near Arrāwali Post were plane-tabled for the Commanding Royal Engineer, Kohāt, on the scale of 16 inches to a mile showing topographical detail, clinometric heights, and form contours at intervals of 20 feet in height during February.

55. Out-turn.—The following work was completed for the Settlement Officers:—

Peshāwar:—3,014 linear miles were traversed in 600 square miles (21 in Chārsadda, 108 in Mardān and 471 in Swābi) of 142 villages, and 10,043 theodolite stations laid out on the ground. 35 square miles were triangulated and 87 stations were fixed with theodolite. 92.10 linear miles of the district boundary and 77.68 linear miles of village boundary were surveyed on the scale of 24 inches to a mile. 987 square miles were computed and plotted; and 4,331 plotted *musāvis* (settlement mapping sheets) and 55 riverain compiled boundary *masāvis* on the scale of 24 inches to a mile, and 435 four-inch village indexes and their traces

nued the work of traversing, triangulating, and completing the work done last year in districts Peshāwar (tahsils Chārsadda, Mardān, and Swābi) and Attock (tahsils Attock and Pindi Gheb) for the Settlement Officers.

The Government of India sanctioned the traversing of the whole of the Peshāwar district and so the

were supplied to the Settlement Officer. Besides these 1,511 miscellaneous traces were prepared and all the work done during the year was plotted on 79 four-inch sheets. The boundary maps of 242 villages were reduced by pentagraph to the one-inch scale and compiled on 16 one-inch topographical sheets. The 24-inch surveyed boundaries were transferred on 192 patwāries *masāvis*. The areas of 80 villages were taken out by planimeter and graphically from the settlement maps.

Attock:—2 square miles were experimentally triangulated in villages Kohāla and Kohāli of the Pindi Gheb *tahsil* during November for the detail survey on the scale of 16 inches to a mile. 14 stations were fixed with theodolite and 89 by plane-table intersection along village boundaries and in cultivated bits, and 4 plotted *masāvis* showing the points were supplied to the Settlement Officer. 225 square miles of 8 villages in the same *tahsil* were triangulated and 676 stations fixed with theodolite for the aero-photo survey on the scale of 16 inches to a mile and 226 plotted *masāvis* of 8 villages were supplied. 7.98 linear miles were traversed in 0.76 square mile of village Kamālpur Saidān in the *Attock tahsil*, 26 stations fixed with theodolite; 4 plotted *masāvis* on the scale of 24 inches to a mile, and one four-inch index were supplied to the Settlement Officer for the detail survey.

The stations of two villages Bura and Qāziābād of the *Attock tahsil* traversed last year, were first whitewashed with a circular ring 3 feet wide and 15 feet in diameter; and then marked on the photographs by fixing them from the nearest detail for the aero-photo survey for Settlement purposes.

56. *Nature of Country*.—The ground in the Peshāwar district consisted of intricate high hills along the frontier border while internally it was open, flat, highly fertile, and well irrigated. In the *Attock* district it was generally undulating, broken, hilly, and poorly cultivated.

VII.—SURVEY REPORTS, SOUTHERN CIRCLE.

DIRECTOR { Lt.-Col. C. M. Browne, C.M.G., D.S.O., R.E., up to 10th November 1924.
 Lt.-Col. G. A. Beazley, D.S.O., R.E., from 11th November 1924 to 11th May 1925.
 Lt.-Col. M. O'C. Tandy, D. S. O., O. B. E., R. E., from 12th May 1925.

57. Summary.—The parties, etc., administered by the Southern Circle during the year were Nos. 5, 6, 7 and 8 Parties, and No. 4 Drawing Office.

The Officer in charge of No. 5 Party, in addition to his normal duties, acted as technical adviser on survey matters to the Government of the Central Provinces, and administered their revenue, town and other local surveys.

58. Recess Work.—8 sheets on the one-inch scale were submitted for publication to the circle office before the 30th September 1925. The remaining 68 sheets surveyed on the one-inch and half-inch scales during the year will be submitted before the parties take the field, so that there will be no arrears of fair-mapping in party offices.

59. No. 5 Party.—Forest Surveys.—This party carried out forest surveys on the four-inch scale of an area of 19 square miles in the Chānda Forest Divn. of the Central Provinces.

PERSONNEL.
Class I Officers.
 Major F. B. Scott, I.A., in charge to 27th November 1924.
 Major H. E. Roome, M.C., R.E., in charge from 28th November 1924.

Class II Officers.
 Mr. J. H. S. Wilson.
 „ N. N. Chuckerbutty.

Upper Subordinate Service.
 1 Officer.

Lower Subordinate Service.
 12 Surveyors, etc.

The boundaries of eleven extensions comprising 90 linear miles in the Bālāghāt Forest Divn. were traversed and an area of 3,840 square miles in the Seoni, Mandlā, Bālāghāt, Bhan-

dāra and Chānda districts was triangulated.

60. Seonī Court of Wards.—An area of 76 square miles of special survey for the Court of Wards on the two-inch scale in the Seoni district was also undertaken.

61. Nature of Country.—The country surveyed consists of jungle-clad hills and plain.

62. No. 6 Party.—Topographical Surveys.—This party completed an area of 3,027 square miles of original and 291 of revision half-inch survey, and 6,068 square miles of original and 144 square miles of revision one-inch survey in the Upper Godāvāri, Kistna and Guntūr districts of Madras and Warangal district of Hyderābād. Six square miles of original four-inch survey in connection with the boundary delimitation of Bastar State (Central

PERSONNEL.
Class I Officers.
 Major R. S. Wauchopo, O.B.E., I.A., in charge from 5th December 1924.
 Lieut. G. Bomford, R.E.

Class II Officers.
 Mr. E. A. Meyer, in charge up to 4th December 1924.
 Mr. A. F. Murphy.
 „ E. N. Natesan, B.A.
 „ Muhammad Najamuddin, B.A.
 „ C. P. E. Davenport.

Upper Subordinate Service.
 4 Officers.

Lower Subordinate Service.
 50 Surveyors, etc.

Provinces) and Madras were also carried out. An area of 12,853 square miles of triangulation was completed in the Chānda district of Central Provinces and Nirmal, Karimnagar and Warangal districts of Hyderābād; 105 linear miles of theodolite traversing were carried out.

63. Nature of Country.—The country under survey varied from flat highly cultivated and populated areas to dense forest-clad hills.

64. No. 7 Party.—*Topographical Surveys.*—This party surveyed

PERSONNEL.
Class I Officer.
 Major H. T. Morsehead, D.S.O., R.E., in charge.
Class II Officers.
 Mr. V. W. Morton.
 " J. C. St. C. Pollett.
 " N. S. Harihara Iyer.
Upper Subordinate Service.
 3 Officers.
Lower Subordinate Service.
 40 Surveyors, etc.

an area of 7,525 square miles in the Hassan, Kadūr, Mysore and Tumkūr districts of Mysore State on the one-inch scale, also one square mile of Coorg and 6 square miles of Coimbatore district of Madras on the same scale. The party also triangulated an area of 3,200 square miles in the Bellary district of

Madras and in the Raichūr district of Hyderābād.

65. Station Surveys.—Surveys of 69 square miles of the city and civil and military station of Bangalore and 8 square miles of the island of Seringapatam were executed on the three-inch scale with a view to the publication of guide maps.

66. Nature of Country.—The country surveyed mostly consisted of open undulating plateau averaging slightly under 3,000 ft. in elevation; but densely wooded hills rising to 6,000 ft. were met in the western portion of Kadūr district.

67. Mysore-Madras Boundary.—In connection with the delimitation of the Mysore and Madras (South Kanara district) boundary, a strip of country about 130 miles long and 40 chains wide was surveyed on the scale of four inches to one mile.

68. No. 8 Party.—*Topographical Surveys.*—This party surveyed

PERSONNEL.
Class I Officer.
 Captain L. H. Jackson, I.A., in charge.
Class II Officers.
 Mr. M. Mahadeva Mudaliar, M.A.
 " B. T. Wyatt.
 " Srinivasa Rao Kalkar, B.Sc.
Upper Subordinate Service.
 4 Officers.
Lower Subordinate Service.
 32 Surveyors, etc.

an area of 4,618 square miles on the one-inch scale. Of this area, 290 square miles fell in Jawhār State, and the balance of 4,328 square miles in Ahmadnagar, Kolāba, Nāsik, Thāna, Bombay City and Bombay Suburban districts. With the excep-

tion of the densely populated plains of the coast, the country surveyed consisted of the heavily wooded heights and foothills of the Western Ghāts.

An area of 3,669 square miles was triangulated in advance for detail survey on the one-inch scale in the districts of Ahmadnagar and Sholapur, and in Hyderābād, Mirāj (Senior), and Mirāj (Junior) States.

69. *Forest Surveys.*—At the instance of the Chief Conservator of Forests, Bombay, the party also surveyed 4·6 square miles in the newly afforested areas in Mokhāda Path of the East Thāna Forest Divn., on the four-inch scale; and 209·7 acres of Reserved Forests on the eight-inch scale in the Karjat Tāluka of Kolāba Forest Divn.

70. *Artillery Practice Grounds.*—At the request of the military authorities, points were fixed on the artillery practice grounds at Rājankunti.

VIII.—SURVEY REPORTS, EASTERN CIRCLE.

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

71. 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 Jhālukkbari. Also in his capacity as technical adviser on survey matters to the Government of Bengal, he visited the Bengal Survey Office at Alipore and the Bengal Traverse Party in the field.

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

Six more pupils were entertained in April 1925; they were attached for training in field and recess work to No. 5 Drawing Office; two each have now been posted to Nos. 4 and 9 Parties and two to the Sadiyā Frontier Detachment for further training in the field.

Two Upper Subordinate officers of No. 4 Party received training in triangulation, traversing and computations.

73. Recess Work.—22 sheets (including 8 of tea gardens) were partly and 16 wholly surveyed by the two parties and the detachment and with the exception of No. 9 Party's sheets, all should be mapped before the next field season starts.

74. No. 4 Party.—*Rāniganj Coalfield Survey.*—This party com-

PERSONNEL.

Class I Officer.

Mr. C. C. Byrne, in charge.

Class II Officers.

Mr. J. McCracken, M.B.E.

Lieut. C. S. McInnes.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

31 Surveyors, etc.

pleted the survey on the four-inch scale of the remaining 446 out of a total of 856 square miles of the Rāniganj coalfield. The survey of 386 square miles was based on reductions of the sixteen-inch cadastral

surveys, the remaining 60 square miles being original work.

75. Nature of Country.—The area lay in two detached portions separated by last year's work. The country in the western portion in the Mānbhūm and Bānkurā districts is fringed along its south-westerly border by steep jungle-covered hills and is broken towards the north by the Dāmodar and Barākar rivers and their feeders. In the eastern portion in the Santāl Parganas, Birbhūm, Burdwān and Bānkurā districts, the country is open on the whole, though cut up by the Ajay and

IX.—SURVEY REPORTS, BURMA CIRCLE.

DIRECTOR { Lt.-Col. R. H. Phillimore, D.S.O., R.E., to 10th December 1924.
Lt.-Col. E. T. Rich, C.I.E., R.E., from 11th December 1924.

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

85. Training.—At the beginning of the year 16 pupils were under training, of whom 6 were attached during the winter to No. 7 Drawing Office for instruction in surveying at Maymyo and the remainder were attached to parties.

Of these 16 pupils, three were discharged in the spring as unlikely to become useful surveyors; the remaining 13 are very promising.

In addition, 17 new pupils were enlisted during the summer and were attached to No. 7 Drawing Office for instruction in drawing.

86. Irrawaddy Delta.—Major Lewis completed the maps resulting from the air survey of the Irrawaddy delta of the previous year. A full report has been published by the Burma Forest Party.

Hsipaw Boundary.—At the request of the Commissioner, North-east Frontier Divn., one upper subordinate officer and one surveyor of No. 7 Drawing Office were deputed to survey the boundary between Hsipaw State and the Maymyo sub-division of the Mandalay district. The cost was met by the Government of Burma.

87. No. 10 Party.—*Topographical Surveys.* This party sur-

PERSONNEL.
Class I Officer.
Captain G. Lennox, I.A., in charge.
Class II Officers.
Mr. S. S. McA'F. Fielding.
" F. J. Grice.
Captain F. E. R. Calvert.
Upper Subordinate Service.
4 Officers.
Lower Subordinate Service.
30 Surveyors, etc.

veyed an area of 239 square miles on the half-inch scale in the tribal area between the Mali Hka, and Nmai Hka branches of the Irrawaddy, known as "The Triangle," and 3,069 square miles on the one-inch scale in the Thayetmyo, Kyaukpyu and Sandoway districts of Burma.

Supplementary triangulation for topographical surveys was carried out over an area of 2,932 square miles in the Sandoway, Henzada, Bassein and Myaungmya districts of Burma.

88. Nature of Country.—The country surveyed on the half-inch scale consists of steep jungle covered hills and on the one-inch scale it includes the large islands of Ramree and Cheduba, many smaller hilly islands, creeks and mangrove swamps fringing an indented coast line, with further inland the well wooded ridges of the Arakan Yoma.

The population is sparse in the hills, where communication is by paths. The coast and larger islands are more thickly populated and here communication is almost entirely by water.

89. No. 11 Party.—*Topographical and forest surveys* were continued in Lower Burma in the Amherst district. The total area surveyed on all scales was 2,224 square miles, comprising 1,819 square miles of original and 334 square miles of supplementary surveys on the one-inch scale; 61 square miles of Reserved Forests on the two-inch scale, and 10 square miles on the four-inch scale. An area of 3,808 square miles of original and supplementary triangulation was carried out in the Amherst and Thaton districts for next season's detail survey, and 5 linear miles of forest boundary were traversed by chain and theodolite.

90. Tenasserim Forest Circle.—The forest surveys summarised above are as follows:—

In the *Thaungyin Forest Divn.*, an area of 61 square miles of the Ta-ók Reserved Forests was surveyed on the two-inch scale; and 6.63 square miles of the Gawle and Kyaukket Extensions, and 3.44 square miles of unclassified forest land were surveyed on the four-inch scale. In addition, in the course of one-inch topographical operations, the old four-inch forest sheets of the Gawle, Ónkarein, Mēgala, Balēdo and Kyaukket Reserved Forests were brought up to date, and their external boundaries resurveyed on the four-inch scale.

91. Nature of Country.—The whole of the area surveyed is covered with dense evergreen forest, and is a mass of irregular broken hills and low valleys with the exception of the well defined Dawna range. Some of the peaks along the main watershed rise to over 5,000 feet in elevation. In the extreme south-east, a very conspicuous feature of the landscape is the great profusion of massive out-crops of limestone many hundred feet in height.

92. No. 21 (Burma Forest) Party.—*General.* This party surveyed an area of 381 square miles of Reserved Forests on the four-inch scale in the Thayetmyo, Prome, Tharrawaddy, Pegu, Toungoo and Yamethin districts of Burma.

790.5 linear miles of forest boundary theodolite traverses, 28.1 linear miles of boundary surveys on the four-inch scale and 22.9 linear miles of boundary surveys on the two-inch scale were also completed.

PERSONNEL.

Class I Officers.

Mr. H. W. Biggie, in charge to 31st May 1925.

Mr. S. S. McA'Fee Fielding, in charge from 1st June 1925.

Class II Officers.

Lieut. L. B. Fitz-Gibbon.

Mr. T. F. Kitchen.

„ H. M. Critchell.

Upper Subordinate Service.

3 Officers.

Lower Subordinate Service.

35 Surveyors, etc.

The details of this work are given below.

93. The country surveyed consists of densely wooded hills and plains with few communications.

94. *SITTANG FOREST CIRCLE*.—In the *North Toungoo Forest Divn.* an area of 121·26* square miles was surveyed on the four-inch scale in the following reserves:—Tônbo, Pyônchaung Extension, Padē, Karengaung, Gwethe Extension, Samo, Ye-e-myaung, Saing Extension No. II and West Swa Extensions I and II. An area of 28·99 square miles of unclassified forest and cultivation lying between or adjoining the reserves was also surveyed to show villages and communications. 14·34 linear miles of boundary traversing and 1·20 linear miles of connection traversing were carried out in West Swa Extension II.

In the *South Toungoo Forest Divn.* an area of 44·4 square miles was surveyed on the four-inch scale in the Myayabinkyaw and Nyaungchidauk reserves. An area of 0·5 square mile containing the village of Nyaungchidauk and adjoining cultivation was also surveyed to show the approaches to the reserve of that name. The external boundary of the Pauktaw reserve, 21·0 linear miles in length, was added by plane-table to a four-inch plot of the theodolite traversing done along that boundary in 1923-24.

In the *Shwegyin Forest Divn.* an area of 80·20 square miles was surveyed on the four-inch scale in the following reserves:—Chaungma-ngē East and West Blocks, Taunggyi, Yaukthawa and Pada Extension. An area of 7·3 square miles of unclassified forest and cultivation lying between or adjoining the reserves was also surveyed to show villages and communications.

In the *North Pegu Forest Divn.* 56·86 linear miles of boundary traversing and 4·82 linear miles of interior and connection traversing were carried out in the following reserves:—Yēnwē Extension I, Wami, Myogyauung (east boundary only), and Kawliya (east boundary only). An area of 2 square miles in the Myogyauung reserve was surveyed on the four-inch scale to complete the survey of the reserve, the remaining portion having been surveyed on that scale in seasons 1897-98, before the area was notified as a reserve, and 0·8 square mile of unclassified forest adjoining was also surveyed on the same scale. The east boundary of this reserve, 7·10 linear miles in length was added by plane-table to blue prints of the old four-inch field sections. The east boundary of the Kawliya reserve and the boundaries of its six exclusions, 22·91 linear miles in length, were added by plane-table to blue prints of the old two-inch surveys carried out in seasons 1898-01, before the area was notified as a reserve.

* This includes 0·16 square mile of 16-inch scale survey.

95. CENTRAL FOREST CIRCLE.—In the *Pyinmanā Forest Divn.* an area of 55·34 square miles was surveyed on the four-inch scale in the following reserves :—Pyinmanā Fuel, Lower Sinthe, Yeni Extension II, Minbyin Extension I and Mehaw Extension. The detail survey of the Mehaw Extension is based on a plane-table traverse of its boundary, connected with triangulated points, the number of linear miles of boundary survey being 8·24. An area of 4·91 square miles of unclassed forest and cultivation lying between or adjoining the reserves was also surveyed to show villages and communications. 241·73 linear miles of boundary traversing and 75·43 linear miles of interior and connection traversing were carried out in the following reserves :—Mancho, Yezin, Byingyē, Natma, Nyaunggaing, Hlwabôn, Kôgwe and Hlwazin.

96. HLAING FOREST CIRCLE.—In the *Tharrawaddy Forest Divn.* an area of 32·11 square miles was surveyed in the Teinhmyôk, Kyinichaung, Nyaungbinzia, Kenni and Thewa reserves. An area of 3·12 square miles of unclassed forest and cultivation lying between or adjoining the reserves was also surveyed to show villages and communications.

In the *Prome Forest Divn.*—242·69 linear miles of boundary traversing and 34·23 linear miles of interior and connection traversing were carried out in the following reserves :—Prome Teak Plantation, Tônyē East and West Extensions, Shwekyundaw, Padinbin, Zibinhla, Sēdaing, Sēdaing Extension, Byama-in, Pauktaw Extension, Sinmizwē Extension, Nyaungbindet East Extension, Myebye, Gonbalē, Gonbalē East and North Extensions, Ôlészwē, Chaungzauk North Extension, Kayineik, Kayineik North Extension, Wettaung, Wettaung Extension and Kyatkôn.

In the *Allanmyo Forest Divn.*—102·56 linear miles of boundary traversing and 16·66 linear miles of interior and connection traversing were carried out in the following reserves :—East Yoma Extension II, III and IV, Shazibo, Hmunsa and Pyalo.

97. Yenangyaung Survey Detachment. *Oil-field Survey.*—At the request of the Burma Oil Company, Ltd., a large scale survey of the Yenangyaung oil-fields in the Magwe district of Burma was undertaken by one Upper Subordinate officer and four surveyors from the Burma Circle assisted by a levelling detachment of one Upper Subordinate officer and a leveller from the Geodetic Branch (see p. 42). With the object of increasing the accuracy of the ground work, the area was covered by air-photography carried out by the Air Survey Company, Ltd., from Rangoon.

The work was begun in October and completed in May. The area of $5\frac{1}{2}$ square miles was surveyed on the scale of 24 inches to 1 mile with spirit-levelled contours at 10 feet intervals. The whole cost was paid by the Burma Oil Company, Ltd.

X.—MISCELLANEOUS SURVEY REPORTS.

98. Cantonment Surveys, etc.—During the year the Cantonment Section of No. 20 Party

PERSONNEL.

Class I Officer.

Mr. C. E. C. French, in charge.

Upper Subordinate Service.

1 Officer.

Lower Subordinate Service.

21 Surveyors, etc.

1. Clifden.
2. Ghariāl & Flats.
3. Upper & Lower Topa.
4. Kuldanna.
5. Chāngia Gali.
6. Khaira Gali.
7. Bāriān.
8. Khanspur & Ghora Dakka.

completed the revision surveys of Bannu, Campbellpore, Risālpur, Murree Depôt and eight* *Galis* on the 16-inch scale, and the bāzārs of Rāwalpindi on the 64-inch scale. The revision surveys of Rāwalpindi and Ferozepore are nearing completion.

81·09 linear miles of traversing

and 124·81 miles of levelling have been completed at a cost of Rs. 70·04 and Rs. 21·29 respectively per mile.

The fair-drawings of Deolāli, Sitāpur, Muttra, Bareilly, Agra, Naini-Tāl Minor Cantonment, Gorakhpur Notified Area, Sargodha Remount Depôt, Pathānkot Rest camp, and also the bāzār plans of Sitāpur, Muttra, Bareilly and Agra have been completed and submitted for publication.

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

- | | | |
|---------------------------|---------------|-----------------------|
| Twelve-inch revision, | 4,100 acres, | @ Re. 0.90 per acre. |
| Sixteen-inch revision, | 20,184 acres, | @ Re. 0.82 per acre. |
| Sixteen-inch original, | 741 acres, | @ Re. 0.82 per acre. |
| Sixty-four-inch revision, | 189·88 acres, | @ Rs. 21·76 per acre. |

The total areas fair-mapped, with cost-rates are as follows:—

- | | | |
|---------------------|------------------|----------------------------|
| 11,520 acres on the | six-inch | scale @ Re. 0.28 per acre. |
| 4,835 acres on the | twelve-inch | scale @ Re. 0.20 per acre. |
| 18,313 acres on the | sixteen-inch | scale @ Re. 0.37 per acre. |
| 66 acres on the | forty-eight-inch | scale @ Rs. 7.43 per acre. |
| 272 acres on the | sixty-four-inch | scale @ Rs. 5.52 per acre. |

99. Commercial Levelling.—Besides the geodetic levelling

PERSONNEL.

Class I Officer.

Major A. H. Gwyn, I.A., in charge.

Class II Officers.

Mr. N. R. Mazumdar.

„ D. N. Banerji, L.C.E.

Upper Subordinate Service.

4 Officers.

Lower Subordinate Service.

19 Computers, etc.

71 purely temporary Levellers.

referred to on p. 16, No. 17 Party carried out the following:—

- (a) Tertiary levelling for the Sutlej Valley Irrigation Project.
- (b) Tertiary levelling in the Yenang-yaung oil-field.
- (c) Secondary levelling for the Public Works Department (Irrigation), Burma.

(d) Secondary levelling for the Calcutta Corporation.

(e) Secondary levelling for the Chief Engineer, East Indian Railway.

100. *Sutlej Valley Irrigation Project*.—Tertiary levelling for this project covered 4,900 square miles, in the Multān, Montgomery, Lahore and Ferozepore districts and the Bahāwalpur State, all in the Punjab.

The blocks comprised in the area were:—

I', J', K', N', O', R', B'', C'', D'', S', T'.
 Y'', V'', Z, F', A', C', G', H', Z'.
 C'', D'', E'', F'', Z''.
 I'', J'', K'', N'', O'', P'', R''.
 T'', W'', S''.

The country surveyed lies in the flat lands of the valley of the Sutlej river, and in the higher land to the south which merges into the great desert of Rājputāna. In the latter area there are stretches of bare *pat*, with expanses and ridges (most of which are under 25 feet high) of sand; much of the sandy area is covered with fairly open scrub.

101. *Yenangyaung oil-field*.—Tertiary levelling in the Magwe district, in Burma, covered an area of 6 square miles. It was carried out for the Burma Oil Company, Ltd., in connection with the topographical survey of the same area.

The ground is very much broken up with small *nalas* and strewn with oil wells.

102. *The Public Works Department (Irrigation), Burma*.—Secondary levelling in the Shwebo, Tharrawaddy, Insein and Pegu districts of Burma was carried out for this department along the following lines which all lay in flat alluvial country:—

| | | | |
|---|-----|-----|----------|
| 89 D-Tangon to Shwebo | ... | ... | 65 miles |
| 89 E-Kabo to Myittaw | ... | ... | 92 " |
| 89 F-Okshitkan to Paukan | ... | ... | 78 " |
| 90 E-Thonze to Rangoon | ... | ... | 110 " |
| 88 D-Pegu to Zenzaungbim | ... | ... | 5 " |
| 88 E-Myitkyo to Okpo | ... | ... | 7 " |
| 88 F-EBM at R. D. 25 of Yenwe embankment to Uaw | ... | ... | 10 " |

Total ... 367 miles,

103. Calcutta Corporation.—In connection with the city drainage (Bidyādhari river), in the 24-Parganas district in Bengal, secondary levelling was carried out on the following lines :—

| | | | |
|--------------------------|-----|-----|------------|
| Calcutta to Nārāyanpur | ... | ... | 59 miles. |
| Nārāyanpur to Nārāyanpur | ... | ... | 91 „ |
| Total | | | 150 miles. |

The lines lay in the flat inundation lands to the east of Calcutta, and along the banks of the Bidyādhari, Piāli and Mātla rivers.

104. Chief Engineer, East Indian Railway.—Secondary levelling was carried out on the following lines in the Howrah, Hooghly and Burdwān districts in Bengal and the Mānbhūm and Hazāribāgh districts of Bihār and Orissa :—

| | | | |
|--|-----|-----|------------|
| Howrah to Uttarpāra | ... | ... | 13 miles. |
| Branch lines from existing lines of levels to | | | |
| Seorāphuli, Bāndel, Pandua, Saktigarh, | | | |
| Burdwān, Khāna, Galsi, Mānkur, Pānāgarh, | | | |
| Durgāpur, Rāniganj, Kālipāhari, Asansol and | | | |
| Churulia railway stations, amounting in all to | | 50 | „ |
| Barākar to Hazāribāgh Road Station and to a | | | |
| connection with existing lines of levels at | | | |
| Bagodar | ... | ... | 105 „ |
| Total | | | 168 miles. |

The lines lay in the thickly settled areas in Lower Bengal, the more open tract along the Dāmodar river, and in higher land in the Bihār and Orissa districts.

105. Recess Work.—The computations of the current season's work were all finished, and the results in manuscript form were sent to the various officers for whom the work was done, and to the press for inclusion in the levelling pamphlets. There are no arrears.

106. The Netherlands Expedition, 1925.—Mr. Ph. C. Visser, Attaché to the Dutch Legation at Stockholm, accompanied by Mrs. Visser and Baron Harinxma, explored the main tributaries of the Hunza river. Khan Sahib Afraz Gul Khan of the Survey of India was attached to him as topographer.

After reaching Gilgit on 16th May, the party established a base camp in the Hunza valley at Pasu twelve days later. The Pasu glacier (14½ miles long) was first explored and mapped, but snow storms prevented

access to the Batura at this time of year. An entry was then forced into the Khūnjerāb gorge and the whole valley explored and surveyed to its glacier sources on the Pāmīr watershed. From the upper basin of the Khūnjerāb a pass was made over the range to the south, and the Ghujerāb, which was previously totally unexplored, was entered. Owing to the volume of flood water, the lower Ghujerāb gorge could not be penetrated but the whole of the upper reaches and tributaries were surveyed, as far as the watershed of the Yārkanḍ river basin.

Two passes were forced into the Shingshāl valley, the glaciers of which were now explored for the first time. The discovery of three large glaciers here, — the Virjerāb (24 miles), the Khurdopīn (26 miles), and the Yāzghil (18 miles) — was unexpected. These glaciers, together with the Malungatti, were ascended and surveyed. The first two of these appear to take their rise in the great glacier basin of the Biafo, lying athwart the Karakoram axis, first discovered by Godwin Austen in 1861. Khan Sahib Afraz Gul Khan's survey, which emanated from stations of the Indo-Russian triangulation of 1913, was here connected to fixed points of the Survey of India, a small adjustment only being necessary.

On returning to his base at Pasu, Mr. Visser led his party up the Batura glacier. The whole of this with all its branches was also surveyed by Khan Sahib Afraz Gul Khan for the first time. The Batura glacier is 36 miles long, and therefore equal to the fifth longest outside Polar regions.* Practicable passes were noted into the Lupghar tributary of the Chapursān to the north and into the Tutu Uns glacier on the west, but bad weather and lack of supplies forced a retreat.

Before closing work, the party visited Nagir, ascended the Hispar glacier to the junction of the Lak or Kunyang glacier, and effected a topographical connection with the survey of the Shingshāl glaciers. This last connection is valuable, as it enables the earlier surveys of Sir Martin Conway (1892) and of Mrs. Bullock Workman (1908) to be co-ordinated.

*As far as we know at present the lengths of the six longest glaciers outside Polar regions are as follows:—

| | | | | |
|----------|--------------|-----|-----|-----------|
| Siachen | (Karakoram) | ... | ... | 45 miles. |
| Inylchek | (Tian Shan) | ... | ... | 44 miles. |
| Hispar | (Karakoram) | ... | ... | 38 miles. |
| Biafo | (Karakoram) | ... | ... | 37 miles. |
| Baltoro | (Karakoram) | ... | ... | 36 miles. |
| Batura | (Hindu Kush) | ... | ... | 36 miles. |

No other glaciers are known as yet to exceed 30 miles in length outside Polar regions.

The total out-turn of the Khan Sahib's survey on the half-inch scale was 2,580 square miles. The country is excessively difficult—probably as difficult as any in the world. Sheer precipices of 10,000 feet wall the gorges in some parts, and the rivers race below in flood. In the main valleys mud and rock avalanches constitute formidable dangers, and the party records one snow avalanche that lasted almost continuously for fourteen hours.

In addition to the survey work of the expedition, the party observed the direction and pace of upper air currents, as indicated by the movement of cirrus clouds, collected zoological and botanical specimens, and remeasured the snouts of certain glaciers which had previously been marked by the late Sir Henry Hayden of the Geological Survey of India.

The Surveyor General has conveyed his hearty congratulations and sincere thanks to all members of the Netherlands Expedition for their success in making this valuable contribution to Himalayan geography in the face of very great physical difficulties and considerable danger. The leader of the Expedition has expressed his very high appreciation of the energy, courage, and skill, displayed by Khan Sahib Afraz Gul, and has strongly recommended him for any special promotion or reward which may be considered suitable.

APPENDIX.

THE SERVICES OF KHAN BAHADUR SHER JANG.

By the retirement of Khan Bahadur Sher Jang on 15th June 1925 the Department has lost a most distinguished officer of the Upper Subordinate Service, who has been employed almost continuously, during his service of over 30 years in the Department, either on or beyond the Frontiers of India.

Sher Jang enlisted in Cook's Rifles in 1887. After taking part in the 1st and 2nd Mirānzai Expeditions of 1890-91 and accompanying the Kurram Column in 1892-93, he joined the Survey of India as a Soldier-Surveyor in 1895. From 1895 to 1899 he served on the N. W. Frontier, taking part in the Waziristān Expedition of 1894-95, in the Tochi, Tirāh and Mohmand Expeditions of 1897-98, and in Dir and Chitrāl in 1899, when he was granted the title of Khan Sahib. From 1899 to 1901 he served with Captain Crookshank in Persia, visiting Bandar Abbās, Kermān, Shirāz and Būshire, and surveying an area of about 53,000 square miles. In 1901-02 he was attached to the Abyssinian Boundary Commission and was awarded the title of Khan Bahadur at the early age of 32. In 1903-04 he accompanied the Tibet Mission, being mentioned in despatches, and in 1905-06 served under the Foreign Department in the Persian Gulf, visiting Būshire, Muhammareh, Basrah and the Masqūt frontier. He returned to South Persia in 1907-08 where he surveyed an area of some 25,000 square miles and travelled as far north as the frontier by Herāt. He was employed on the Baluchistān-Afghān frontier in 1909 and with the Afghān Mission in 1910, when he was awarded the McGregor Memorial Medal. He served with the Abor Expedition in 1911-12, when he was again mentioned in despatches, and with the Turco-Persian Boundary Commission in 1913-14, for which he was awarded decorations by the Persian and Turkish Governments.

When the Great War broke out in 1914, Khan Bahadur Sher Jang was engaged on survey work with this Commission in the neighbourhood of Urūmieh. He brought the survey personnel back through Persia by way of Miāneh, Tehrān, Qum, Isfahān, and Shirāz, to Būshire. After a short period of service in India, Sher Jang returned to Persia, and in 1916-17 was with the party surveying the road alignment between Bandar Abbās and Kermān. In 1917-18, he

served in Waziristān and on the Mahsūd frontier, and towards the end of the latter year proceeded again to Mesopotamia. Owing to his intimate knowledge of conditions in Persian Kurdistān, he was now employed under the Political authorities on an important diplomatic mission.

At this time the tribes of Central Kurdistān were in an appalling condition of destitution, as the result of the war, and their chieftains were seeking the protection of the British. In the north, Sayyid Taha, who was in a position to control the tribes under British administration, had been invited to meet the Political Officer; but, being influenced by Turkish propaganda, had so far remained aloof. Khan Bahadur Sher Jang received orders to go to Urūmieh, and to negotiate with Sayyid Taha. He left Rowandūz with four Indian khalasis on 9th March 1919, forced a way over the snow-bound Guru-i-Shaikh pass on the Persian frontier, traversed the desolate Lāhijān country, and reached Urūmieh after much hardship on 20th March. Sayyid Taha was six stages away at Chahari, and owing to the attitude of the Persian Governor, Sher Jang was unable to leave Urūmieh. He wrote a letter to the Sayyid, persuading the latter to visit him in Urūmieh, and they met five days later. All through the night of the 25th March, the two men discussed the situation, and at last as dawn was breaking, Sher Jang won his case and prevailed upon Sayyid Taha to accompany him back to Baghdād. The success of this mission had a large share in maintaining tranquillity in the Rowandūz district during the subsequent rising of Shaikh Mahmud in Southern Kurdistān.

During this rebellion, Sher Jang served as a political officer in the Sulaimāni area. In 1920-21 he was appointed representative of Iraq in the re-settlement of the Iraq-Persian frontier, which had been disturbed by war conditions. His work in this connection was highly appreciated by the Right Hon. Mr. Winston Churchill, Secretary of State for the Colonies, in his despatch dated 21st September 1921. He returned to Persia in 1923 with a detachment of the Survey of India which was employed in survey work for the Anglo-Persian Oil Company.

The Khan Bahadur was promoted to the Upper Subordinate Service on 1st August 1909. He is in possession of 12 war medals and decorations, with 8 clasps; he has been awarded honoraria for his services on several occasions, and has received an assignment of land revenue from the Government of India. In 1902 the Royal Geographical Society

awarded him a Sword of Honour (the Back Memorial) in recognition of his valuable services to geography, and in 1916 he was awarded the Kaiser-i-Hind medal (2nd class). During the visit of H. R. H. the Prince of Wales to India in 1922, Sher Jang had the honour of being personally presented to His Royal Highness, who evinced a keen interest in his services.

Khan Bahadur Sher Jang's unfailing tact and courtesy endeared him to all with whom he came in contact, and it was largely these qualities in conjunction with his energy and resource in hazardous situations which rendered his work so successful and his services so valuable, politically and professionally, in the turbulent countries where so much of his life was passed.

There was also another fine side of Sher Jang's character which was only realised by those who knew him well, namely his compassion for the weak. When he was on sick leave at the end of 1918, the virulent epidemic of influenza was ravaging the homes in his country. Sher Jang devoted his three months hard-earned rest to nursing the sick and burying the dead; and he has recorded in a letter, that he "regarded this duty greater than his active service". On another occasion, in Urūmieh in 1919, when he was by no means in a pleasant situation himself, he exercised all his personal influence in urging the protection of the hapless Christian women and children, whose lives were at that time threatened by fanatical Kurds.

It is not easy to summarise such varied services in a brief note of appreciation. Sher Jang succeeded in winning the admiration and affection of all officers with whom he served, both in the Survey of India and outside it, and he carries with him the best wishes of all ranks of the Department on his retirement.

SURVEY OF INDIA GENERAL REPORT

1924 TO 1925



**From 1st October 1924
To 30th September 1925**

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