

SURVEY OF INDIA GENERAL REPORT

1941



From 1st October 1940
To 30th September 1941

PUBLISHED BY ORDER OF
THE SURVEYOR GENERAL OF INDIA.

Printed at the Photo.-Litho. Office,
Survey of India,
CALCUTTA,
1941.

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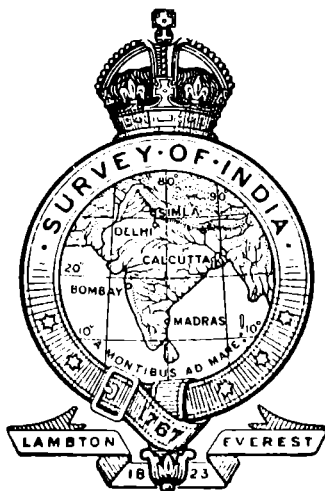
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P R E F A C E

In order to save labour and paper some index maps, tabular statements and other material usually included in the General Report have been omitted from this Report for 1941.

The index map which is included at the end of the volume shows areas covered by modern topographical surveys and compilation. The index maps which have been omitted normally illustrate the position as regards the publication of maps on different scales. In so far as the progress made in any one year represents only a small fraction of the mapping of the whole of India, the present position is approximately shown by the index maps included in the Report for 1939, to which reference may be made.

Recent General Reports have also contained a brief History of the Department (in the Preface) and Notices regarding its work and publications. Reference may be made to the 1939 Report for these also.

CONTENTS.

	PAGE.
PART 1. GENERAL.	
I. INTRODUCTION and SUMMARY	1
PART 2. GEODETIC WORK.	
II. ABSTRACT OF GEODETIC OPERATIONS	7
PART 3. TOPOGRAPHICAL WORK.	
III. ABSTRACT OF TOPOGRAPHICAL WORK (with Tables A and B) ...	9
IV. SURVEY REPORTS. FRONTIER CIRCLE—	
Office of Assistant Director, Frontier Circle (Frontier)	11
‘A & E’ Survey Company (now Party)	11
No. 18 (Air Survey) Party	13
No. 19 Party	14
V. SURVEY REPORTS. GEODETIC BRANCH—	
No. 20 (Cantonments) Detachment	16
VI. SURVEY REPORTS. EASTERN CIRCLE—	
Summary	18
No. 1 Party	18
No. ‘4 & 12’ Party	20
No. 5 Party	22
Lahore Survey Detachment	23
No. 6 (South India) Detachment	25
VII. SURVEY REPORTS. INDEPENDENT PARTY—	
Burma Survey Party	27
VIII. SURVEY REPORTS. MISCELLANEOUS	30
PART 4. MAP PUBLICATION AND MATHEMATICAL INSTRUMENT OFFICE.	
IX. MAP PUBLICATION (with Tables I, II and III)	31
X. MATHEMATICAL INSTRUMENT OFFICE	39
INDEX MAP.—Modern topographical surveys and compilation	At end

GLOSSARY.

Scales are referred to as follows:—

- (i) for scales which are multiples of 1/1,000,000—"1/M scale", "1/6M scale" &c., which mean "1/1,000,000 scale", "1/6,000,000 scale" &c.,
- (ii) for scales smaller than 4 miles to one inch—"50-mile scale", "8-mile scale" &c., which mean "scale of 50 miles to one inch", "scale of 8 miles to one inch" &c.,
- (iii) for scales of and larger than 4 miles to one inch—"½-inch scale", "¼-inch scale", "4-inch scale", "16-inch scale" &c., which mean "scale of ½-inch to one mile" &c., &c.
- (iv) Other scales, by their representative fraction, e.g. "1/25,000".

Serial numbering of Survey of India maps.

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

Sheets 65 K, 78 F &c. are ½-inch sheets;

Sheets 65 K/N.W., 78 F/S.E. &c. are ¼-inch sheets;

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

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

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

L. S. S. denotes Lower Subordinate Service.

U. S. Officer denotes Upper Subordinate Officer.

L. S. Officer denotes Lower Subordinate Officer.

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

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

D O. denotes Drawing Office.

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

SURVEY OF INDIA

GENERAL REPORT

1941

From 1st October 1940

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INTRODUCTION AND SUMMARY.

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

The Geodetic Report.

The General Report.

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

The *Geodetic Reports* contain full details of all scientific work, but are being held in abeyance during the war.

The *General Report* includes an abstract of the *Geodetic Report* (in *Part 2*), and full details of the survey operations of the ordinary field units (*Part 3*) as well as map publication, and instrument manufacture (*Part 4*).

2. General.—BRIGADIER SIR CLINTON GRESHAM LEWIS, O.B.E., held the post of Surveyor General up to 20th April 1941 when he proceeded on leave preparatory to retirement, and was succeeded by BRIGADIER E. O. WHEELER, M.C.

The post of Assistant Surveyor General was held by MAJOR G. BOMFORD, R.E., up to 15th June 1941, and thereafter by Mr. O. N. PUSHONG.

The post of Additional Assistant Surveyor General was held by RAI SAHIB DIWAN CHAND VERMA, from 6th November 1940, when it was created.

3. The total cost of the Department for the year ending 31st March 1941, as compared with that of previous years, was as follows:—

	1938-39	1939-40	1940-41
	<i>Rs.</i>	<i>Rs.</i>	<i>Rs.</i>
Gross actual cost	38,17,092(a)	36,58,967(b)	41,84,571(c)
Deduct recoveries	14,82,043	15,01,621	18,60,525
Nett actual charges	23,85,049	21,57,346	23,24,046
	Square miles.	Square miles.	Square miles.
Total area of surveys of all kinds completed during the year.	23,558	18,513	11,099*

(a) Including (1) Rs. 96,173 for English Charges (High Commissioner) on Stores, and loss or gain by exchange, and (2) Rs. 2,15,944 for sterling overseas pay and leave salary &c., paid in England.

(b) Including Rs. 55,079 for (1) and Rs. 2,11,047 for (2) above.

(c) Including Rs. 89,948 for (1) and Rs. 93,600 for (2) above.

* *Vide* page 10.

4. Noteworthy events.—

Organization.—The Government of India sanctioned the creation of a temporary post of Assistant Director, Frontier Circle (Frontier) and the formation of a new unit designated No. 19 Party with effect from 5th January 1941. With the creation of these posts, the Frontier Circle units at Risālpur and Murree were re-organized as follows:—

- (i) The Assistant Director, Frontier Circle (Frontier) to control and be responsible for the general organization and technical work of the offices located there.
- (ii) 'A & E' Company (now Party) to deal with ground survey.
- (iii) No. 18 Party to deal with air survey and photography.
- (iv) No. 19 Party to carry out all map reproduction, frontier map maintenance.

The Government of India sanctioned the formation of a temporary special training unit designated No. 2 Party to conduct the training of soldier surveyors with its headquarters at Abbottābād with effect from 1st March 1941.

The Mathematical Instrument Office was transferred to the control of the Supply Department for the duration of the war with effect from 1st May 1941.

"E" Company was amalgamated with "A" Company with effect from 11th September 1940. The combined unit 'A & E' Company was re-designated 'A/E' Party with effect from 15th September 1941 for the duration of the war, the 'Officer Commanding' the unit being also re-designated 'Officer in charge'.

No. 4 Party was amalgamated with No. 12 Party with effect from 1st October 1940, the combined unit being designated No. '4 & 12' Party.

No. 6 (S. I.) Party was reduced to the status of a detachment and designated No. 6 (S. I.) Detachment with effect from 26th April 1941. The Detachment was transferred from the administrative control of the Surveyor General to that of the Director, Eastern Circle with effect from 1st July 1941.

Nos. 1 and 14 Parties were transferred from the administrative control of the Director, Geodetic Branch to that of the Director, Eastern Circle with effect from 1st November 1940 and 1st June 1941 respectively.

The Lahore Survey Detachment was transferred from the administrative control of the Director, Frontier Circle to that of the Director, Eastern Circle with effect from 1st November 1940. The Detachment was disbanded from the afternoon of 30th September 1941.

The headquarters of the Eastern Circle together with No. 5 Drawing Office and No. 5 Party and those of No. '4 & 12' Party were transferred for the duration of the war from Shillong to Dehra Dūn, the former with effect from 12th October 1940 and the latter from 12th April 1941.

The Office of the Stores Officer, Surveys under the Director, Map Publication was transferred to the administrative control of the Director, Frontier Circle with headquarters at Simla from 1st April 1941 and subsequently at Dehra Dūn from 1st August 1941 and his designation changed to Assistant Director, Frontier Circle (Stores).

The unit designated the 'Imperial Standard Mapping Section' under the Director, Map Publication was abolished from 1st March 1941 and the personnel borne on the strength of the establishment were transferred to the Fluctuating Establishment of No. 1 Drawing Office from the same date.

The Survey of India buildings in the 'Bonnie Brae Estate' at Shillong have been temporarily transferred to the Defence Department for use as a Military Hospital.

Temporary posts.—The following temporary posts were sanctioned during the year in connection with the war:—

- (i) An Assistant Director, Frontier Circle.
- (ii) An Assistant Director of Surveys in Burma.
- (iii) An Assistant Director, Map Publication.
- (iv) A Stores Officer, Surveys.
- (v) Two posts of Superintendent held by the Assistant Surveyor General and the Officer in Charge, No. 2 Party.
- (vi) An Additional Assistant Surveyor General.
- (vii) An Officer in Charge, Photo.-Litho. Office.
- (viii) An Additional Head Draftsman, No. 1 Drawing Office.
- (ix) An Additional temporary Assistant Superintendent, Mathematical Instrument Office.

5. Awards.—

His Majesty the King, Emperor of India was graciously pleased to confer the honour of Knighthood on BRIGADIER SIR CLINTON GRESHAM LEWIS, O.B.E.

His Majesty the King, Emperor of India was graciously pleased to make the following appointments:—

MAJOR D. R. CRONE, R.E., to be an officer of the Most Excellent Order of the British Empire.

MR. S. COLQUHOUN to be a member of the Most Excellent Order of the British Empire.

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

Class I Officers.—BRIGADIER SIR CLINTON GRESHAM LEWIS, O.B.E. was granted extension of service for 9 months with effect from 25th November 1940 on expiry of which he retired.

COLONEL E. O. WHEELER, M.C., confirmed as Surveyor General and promoted to Brigadier.

LT.-COLONEL T. M. M. PENNEY, confirmed as Director and promoted to Colonel.

LT.-COLONEL (A/COLONEL) W. J. NORMAN, M.C., died.

MAJORS G. H. OSMASTON, M.C., R.E. and G. BOMFORD, R.E., promoted to Acting Lt.-Colonel, CAPTAIN C. A. K. WILSON, R.E., to Acting Major and 2ND LIEUTS. P. G. MOTT, R.E. and H. M. RIMMER, R.E., to Acting Lieut.

CAPTAIN R. H. SAMS, R.E., promoted to Major and LIEUTS. R. C. A. EDGE, R.E. and L. H. WILLIAMS, R.E., to Captain.

MAJOR G. W. GEMMELL, I.A. who was temporarily reverted to military duty, was retransferred to civil duty.

MAJOR I. H. R. WILSON, R.E., continued to function in his civil appointment as Survey Training Officer in addition to his duties as Officer Commanding, Survey Depot.

CAPTAINS C. A. BIDDLE, R.E. and D. E. O. THACKWELL, R.E., promoted to Superintendent.

CAPTAIN D. E. O. THACKWELL, R.E., placed on special duty in Burma Survey Party.

MR. F. H. GRANT retired and was re-employed as Assistant Director, Map Publication.

MR. C. S. McINNES, granted leave preparatory to retirement.

MESSRS. F. J. GRICE and MOQUIMUDDIN ANSARI promoted to Superintendent.

CAPTAINS D. M. CLEMENTI, R.E., R. T. L. ROGERS, R.E. and L. H. WILLIAMS, R.E., confirmed as Assistant Superintendent.

CAPTAIN R. C. A. EDGE, R.E. who was holding a "Short-term" appointment was appointed permanently in the Department.

The following officers temporarily reverted to military duty:—

A/LT.-COLONELS G. H. OSMASTON, M.C., R.E. and G. BOMFORD, R.E., MAJORS I. H. R. WILSON, R.E. and R. H. SAMS, R.E., A/MAJOR C. A. K. WILSON, R.E. and A/LIEUT. H. M. RIMMER, R.E.

The following officers were re-employed in the temporary posts of Superintendent:—COLONEL O. H. B. TRENCHARD and MESSRS. C. H. TRESHAM, V.D., M. M. MUDALIAR and O. N. PUSHONG.

2ND LIEUT. H. M. RIMMER, R.E. and LIEUT. J. S. PAINTAL, I.E., joined the Department as Assistant Superintendent, on probation.

2ND LIEUTS. E. J. DANIEL, I.E. and R. MUIR, I.E. were attached to the Geodetic Branch for training.

The following officers of the Class II Service were appointed to officiate as Superintendent in the Class I Service:—

MESSRS. N. N. CHUCKERBUTTY, L.C.E., A. F. MURPHY, D. N. BANERJEE, L.C.E., D. C. PURI, N. S. HARIHARA IYER and K. S. MUHAMMAD HASAN.

General Central Service (Class I).—RAI SAHIB DIWAN CHAND VERMA was appointed to the temporary post of Additional Assistant Surveyor General and MR. S. COLQUHOUN, M.B.E., to the temporary post of Officer in charge, Photo.-Litho. Office.

Class II Officers.—MR. J. C. ST. C. POLLETT, V.D., was granted leave preparatory to retirement.

The following officers of the Upper Subordinate Service were appointed to officiate in the Class II Service:—

MESSRS. J. A. CABRAL, G. C. AGGARWALA, U. D. MAMGAIN, C.H., M. W. KALAPPA and O. P. ANAND.

MESSRS. M. A. GANAPATHY and J. C. SIKKA were appointed to the Class II Service, on probation.

MESSRS. H. C. W. STOTESBURY and P. C. MITRA, were re-employed in the temporary posts of Extra Assistant Superintendent.

The following officers have been granted Emergency Commissions:—

MESSRS. M. N. A. HASHMIE, P. A. THOMAS, A. AHAD, M. A. KHAN, J. C. ROSS, P. S. SHINGHAL, H. H. PHILLIPS, K. A. SHEIKH and U. D. MAMGAIN, C.H.

General Central Service (Class II).—MR. F. H. MURRAY, appointed on probation, as Assistant Superintendent, Mathematical Instrument Office.

MR. K. W. SMITH, appointed to the additional temporary post of Assistant Superintendent, Mathematical Instrument Office.

MR. H. G. PHILLIPS, confirmed as Assistant Manager, Photo.-Litho. Office.

Upper Subordinate Officers.—MESSRS. SARDAR KHAN, C.H. and MUHAMMAD FAIZUL HASAN retired.

MR. MUHAMMAD MUSTAFA, granted leave preparatory to retirement.

MESSRS. AMAR SINGH, GOVIND PRASAD and SULTAN MAHMUD, promoted from the Lower Subordinate Service to the Upper Subordinate Service.

Four officers were appointed to the Upper Subordinate Service, on probation.

MR. P. R. KUTTY KURUP died.

The following officers of the Upper Subordinate Service and Lower Subordinate Service &c. have been granted Viceroy's Commissions:—

Upper Subordinate Service Officers:—

MESSRS. A. C. MAULICK, N. C. SEN, N. M. BOPAIAH, ABDUL RASHID KHAN, MUZAFFAR HUSAIN, C.H., A. SHAMANNA, M. Z. A. QURESHI, A. P. DATTA, J. B. MATHUR, N. N. DHAWAN, JAGAN NATH and A. N. RAMANATHAN.

Lower Subordinates:—

Surveyors—NAZIR AHMAD, RAHMAT MUHAMMAD, S. ABDUL WAHAB, SHAIKH MOHD. FAKHRUDDIN, AUTAR SINGH I, MUHAMMAD AKRAM, HARI DUTT, SUKOMAL DAS GUPTA, UDAI SINGH, GAJAI SINGH II, KUNDAN SINGH, M. ABDUR RAUF, J. D. SATYANATHAN, HARI SINGH, JAI PRAKASH, K. SHAIK IBRAHIM, RAM SINGH NEGEE, V. E. G. PAUL, NATHI RAM, GAGAN SINGH THAPA, CHAIT RAM, E. TEWTABY, ABDUL HAMID, KESHOR SINGH, R. BALAKRISHNAN, LASHKARI KHAN, SYED MANZUR HASAN, B. S. TOMAR, MOHAR SINGH, JOEL RYNTATHIANG, N. A. QURESHI, ZAHURULLAH KHAN, HAKIM SINGH, BARKAT ALI KHAN, CHET SINGH, ABDUL RAHIM, JOGINDAR SINGH, MADHWA NAND, SARWAR KHAN, ABDUL RAHMAN II, KHURSHAID ALI KHAN, MAHAMMAD NAZIR, RAZAI HASNAIN, FAHIM- UDDIN, ALI HASAN, and MOHAMMAD ALAM.

Draftsmen—BHAGWAN SINGH, ASHARFI LAL, SAIYID ALI ASBAT, S. K. MALLICK, ABDUL HAKIM, MUHAMMAD ABDUL QAYUM, NARAIN SINGH, MUHAMMAD ASGHAR, S. R. ARUNACHALAM, AZMAT ALI, FAKIR CHAND, P. N. SEN GUPTA, TAFAZZUL HUSAIN II, ABDUS SATTAR, KASHI PRASAD GANGULI, PREM SINGH and MUHAMMAD ISHAK KHAN.

Computers—INDU MOHAN SAKLANI, S. C. GHOSH, S. N. ROY, H. C. GUPTA, P. R. S. NAYYAR, N. K. SUBRAMANIAN, J. C. BHATTACHARJI, T. B. SWAMI- NATHAN, and N. K. BASU.

Traverser—GOKUL CHAND.

Clerks—K. G. NANDA, SUDHIRENDRA DAS GUPTA, J. C. TALAPATRA, B. C. CHAKRABARTI, D. N. HALDAR, B. K. DAS, WAHED HASAN KHAN, GIAN CHAND AURORA, HANS RAJ JUNEJA, V. N. PARASHAR, H. L. NANDA, MOHD. M. HUSAIN, SYED ZAHURUL HASAN ZAIDI and T. MOORE.

Photographer—P. D. SANTHANKAR.

Litho Machine Printer—C. M. K. PILLAI.

Litho Draftsman—R. G. PATANKAR.

PART 2.—GEODETTIC WORK.

II.—ABSTRACT OF GEODETTIC OPERATIONS.

DIRECTOR :— { Colonel E. A. Glennie, D.S.O., to 11-4-41.
 ,, O. Slater, M.C., from 12-4-41.

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

Cantonment Surveys (paras. 38—42).

Training School (paras. 83—85).

8. Geodetic.—Purely geodetic operations include miscellaneous computations and research, preparation and publication of records, observatory work (astronomical, magnetic, seismological and meteorological), the measurement of geodetic bases, principal triangulation, geodetic levelling, precise latitudes, longitudes, azimuths, gravity determinations in all parts of India and Burma and prediction of tides at 39 ports between Suez and Singapore.

These operations are normally fully described in the annual Geodetic Reports of the Survey of India which contain complete index maps and detailed results, but during the war no Geodetic Reports will be published. The following is a brief abstract of the geodetic operations whose detailed description is thus unavoidably deferred.

9. Observatory Section.—The usual magnetic, seismological and meteorological observations have been carried on. The analysis of the previous year's latitude variation programme has not yet been undertaken.

10. Computing Section.—The claims of more urgent work have considerably curtailed the normal activities of this section. No further progress has been made with "complete data" triangulation pamphlets, and part I (Graticules of Maps) of Auxiliary Tables is still incomplete. Levelling pamphlets 53 and an addendum to 54 were however printed during the year, and a secondary levelling pamphlet No. 70 was produced by gestetner.

All necessary forms for computation by rotary machine were revised and printed during the year, and many forms for logarithmic computation in grid terms were brought up to date. These forms, with worked examples and instructions, were included in a volume "Supplement to Handbook of Topography Chapter VIII" which was produced for the first time. Consequent on the reduction in size of the 1941 Nautical Almanac, it was necessary to draw new star charts, and a booklet for latitudes 0°, 15°, 30°, 45° was prepared and published. Chapters V and VII of the Handbook of Topography were reprinted during the year.

11. Tidal Section.—The tide-tables of the Indian Ocean and the pamphlets for Bombay and Rangoon were prepared and published in September 1941. In the past, two editions of the Hooghly River pamphlet have been produced; one sold by the Commissioner for the Port of Calcutta, and a smaller edition sold departmentally. As this arrangement was uneconomical, it has been decided to discontinue the smaller edition, and to supply an improved edition to the Port Commissioners.

Automatic tidal registrations were continued at Aden, Karāchi, Bombay, Vizagapatam, Dublat, Calcutta and Rangoon. In addition, tide-pole readings of high and low water, during daylight only, were continued at Bhāvnagar, Chittagong and Akyab.

12. Magnetic Observations.—(No. 14 Party).—A programme of observations with vertical force variometers was carried out in Bihār and the east United Provinces, in order to investigate further the magnetic anomalies that had been found in the section lines observed in 1934-35 and 1936-37. Except for experimental work round Dehra Dūn, this was the first occasion on which these instruments had been used in the field. The work was started by Mr. Shyam Narain (Asstt. Magnetic Observer) and was completed by Mr. Rustam Khan (U. S. S. probationer), each assisted by one computer. Transport was by hired motor lorry; as all the area was accessible by road and observations take little time, the investigation could be in considerable detail, 684 stations being occupied during the season of $3\frac{1}{2}$ months. Results have not yet been fully analysed, but it appears that the areas of high anomaly are more local than was previously supposed.

13. Geodetic Traverse.—(No. 15 Party).—On account of financial stringency the geodetic traverse could not be taken up in 1940-41.

14. High Precision Levelling.—(No. 15 Party).—Out of the total length of 15,800 miles of levelling of high precision required for the new Geodetic level net of India, 176 miles were completed during 1940-41, by levelling in the back direction (i) Pithora to Raipur, (ii) Sambalpur to Sohela and (iii) Jagatpur (Cuttack) to Bhadrakh, making a total of 10,854 miles completed to date.

PART 3.—TOPOGRAPHICAL WORK.

III.—ABSTRACT OF TOPOGRAPHICAL WORK.

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

Table A shows the area of survey completed on various scales since 1905, as well as the approximate balance which remains to complete the contoured topographical survey of India.

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

16. The terms Original Survey, Resurvey, Revision and Supplementary Survey have been in use hitherto to describe surveys with reference to the state of surveys already existing in the area and also to indicate the technical method employed. This combination of classifications has been found unsatisfactory and dual sets of terms have now been introduced as follows:—

- (i) Broad classification of surveys in relation to existing surveys and to the reorganisation of 1905.
 - (a) Surveys executed prior to 1905-06 are termed *Old Surveys*.
 - (b) Surveys in areas which have not been surveyed since 1905 are termed *New Surveys*.
 - (c) Surveys in areas which have been surveyed since 1905 are termed *Revision Surveys*.
 - (d) The survey of particular items of detail or relief which have changed or come into existence since the previous survey, is termed *Verification*. This is distinct from Revision Survey in that it does not purport to bring up to date the whole area of a map.
- (ii) Nomenclature for describing technical methods of survey irrespective of the classification detailed in sub-para. (i) above.
 - (a) *Original Survey*. Survey carried out on blank paper without making use of any previous work (which may or may not exist).
 - (b) *Blue-print Survey*. Survey carried out with the assistance of previous work which is printed, or hand-transferred, in blue on the plane-table section.
 - (c) *Colour-print Survey*. Survey carried out by the correction of previous work which is printed in colour on the plane-table section.

NOTE.—These terms are used in the technical parts of this report, *viz.* in Table C (not published this year) and in "Survey Reports" Sec. IV *et seq.*

Table A.—Progress of Topographical Surveys in India since 1905.

Survey years.	1-inch and larger scales.	$\frac{3}{4}$ and $\frac{1}{2}$ -inch scales.	$\frac{3}{8}$ and $\frac{1}{4}$ -inch scales.	TOTALS.
	<i>Sq. miles.</i>	<i>Sq. miles.</i>	<i>Sq. miles.</i>	<i>Sq. miles.</i>
1905—35	848,629	189,084	25,929	1,063,642
1935—40	57,979	58,851	19,868	136,698
1940-41	2,370	.....	.....	2,370
Totals to 1941 ...	908,978	247,935	45,797	1,202,710
<i>Balance</i>	<i>approximately.</i> 160,000	<i>approximately.</i> 160,000	<i>approximately.</i> 100,000	420,305
Total programme ...	.....	.....	.....	1,623,015

Progress of Topographical Surveys in Burma since 1905.

1905—35	146,208	41,634	.....	187,842
1935—40	16,793	2,379	.....	19,172
1940-41	4,899	.....	.....	4,899
Totals to 1941 ...	167,900	44,013	.....	211,913
<i>Balance</i> ... ..	.....	.....	.....	49,807
Total programme ...	.....	.....	.....	261,720

Table B.—Revision of above work during the year.

India 1940-41 ...	2,811	.....	411	3,222
Burma 1940-41 ...	608	.....	.....	608

IV.—SURVEY REPORTS, FRONTIER CIRCLE.

DIRECTOR :— { Lt.-Colonel T. M. M. Penney to 8-10-40 in addition to his own duties
as Assistant Director (Civil).
Colonel E. O. Wheeler, M.C., from 9-10-40 to 18-4-41.
„ E. A. Glennie, D.S.O., from 19-4-41.

Assistant Director (Civil).— { Lt.-Colonel T. M. M. Penney to 3-1-41.
Mr. C. H. Tresham, V.D., from 4-1-41.

Assistant Director (Military).— { Major G. F. Heaney, R.E. to 31-7-41.
Colonel E. A. Glennie, D.S.O., from 1-8-41 in addition to
his own duties as Director, Frontier Circle.

Assistant Director (Stores).—Colonel O. H. B. Trenchard, from 1-4-41.

17. The units administered by the Frontier Circle were:—Office of the A. D. F. C. (F), 'A & E' Company (now Party), Nos. 2, 18 and 19 Parties, No. 6 Drawing Office and Survey Training Centre. The Lahore Survey Detachment was transferred from the administrative control of the Director, Frontier Circle, to that of the Director, Eastern Circle from 1st November 1940. The report of this unit appears under the Eastern Circle.

The Director, Frontier Circle acted as Director of Surveys at General Headquarters in addition to his civil duties.

Office of the Assistant Director, Frontier Circle (Frontier).

Assistant Director.—Major D. R. Crone, O.B.E., R.E., from 5-1-41.

18. The assistant directorate to control the technical work of 'A & E' Company (now Party), Nos. 18 and 19 Parties and subsequently of No. 2 Party, was formed under the orders of the Government of India from 5th January 1941.

The average strength was 1 Upper Subordinate officer, 2 clerks and 3 surveyors.

'A & E' Survey Company.*

Officer Commanding.— { Captain D. E. O. Thackwell, R.E., to 10-3-41.
„ Ganbhir Singh, I.A., from 11-3-41.

19. **General**.—The Company (now Party) carried out revision survey and training of soldier surveyors in Attock district of the Punjab; verification of changes in the Loralai and Zhob districts of Baluchistān and Dera Ismail Khān district of N. W. F. P.; and framework in Mardān and Peshāwar districts of N. W. F. P. and Attock district of the Punjab.

Field headquarters remained at Risālpur Cantonment from 14th October 1940 to 9th May 1941.

20. **Personnel**.—The average strength of the Company (now Party) during the year was 2 Class I, 2 Class II, 3 Upper Subordinate officers and 25 Lower Subordinates (excluding 3 clerks, 1 storekeeper clerk and 3 computers).

* Redesignated 'A/E' Party from 15-9-41.

8 pupil draftsmen joined the Company in June for training in fair-mapping, 4 of whom resigned subsequently.

Captain R. S. Kalha, I.A., was transferred to No. 18 Party in June. R. S. C. L. Kapur, (Class II) was transferred to No. 18 Party during December, but rejoined this unit in May. He was subsequently transferred to the Eastern Circle in September.

Mr. Chowdhury Muhammad Aslam (Class II) and Mr. Sardar Khan (U. S. S.) together with five surveyor instructors, were transferred to No. 2 Party in April. On transfer from the Lahore Survey Detachment Mr. Amar Singh (U. S. S.) joined this unit in June. Mr. Bashirullah Khan (U. S. S.) was transferred from No. 19 Party to this unit in September.

21. Areas surveyed.—

560 square miles of triangulation.

56 square miles of 1/25,000 original survey (revision).

259 square miles of 1/50,000 original survey (revision).

Areas for inclusion in Table B.

Revision survey.—1-inch and larger scales:—315 square miles.

22. Field work was organized as follows:—

Camp (1) under Captain R. S. Kalha, I.A., completed 56 square miles of 1/25,000 and 259 square miles of 1/50,000 original survey (revision) in Attock district in sheet 43 C. The camp consisted of 6 soldier surveyors under 1st and 2nd periods of training.

Camp (2) under Mr. Chowdhury Muhammad Aslam (Class II), assisted by Mr. Sardar Khan (U. S. S.) and 3 surveyor instructors, was responsible for the training of 17 soldier surveyors under 1st period of training.

Camp (3).—*Triangulation.*—Captain Gambhir Singh, I.A., completed the triangulation of 560 square miles in Peshāwar and Mardān districts of N. W. F. P. and Attock district of the Punjab in sheet 43 C.

The area in camps (1), (2) and (3) consisted of low hills and plains.

Verification Surveys.—One surveyor was employed in October and November 1940 for the verification of changes in districts Loralai and Zhob of Baluchistān and Dera Ismail Khān of N. W. F. P. in sheets 39 B, E and F. The surveyor worked on blue prints of the post 1905 survey, except in the case of sheet 39 F where printed sheets of the latest edition were used.

One surveyor was employed in April and May for the verification of changes in the Dera Ismail Khān district of N. W. F. P. in sheet 38 L. The survey was carried out on grey prints of the post 1905 surveys.

23. Office work.

—The office work was organized as follows during the field season:—

Section I.—Mr. R. N. Hastir (Class II) with 4 Lower Subordinates for the maintenance of 'A' Company area, *viz.* Punjab, Punjab States, Kashmir and Jammu and parts of N. W. F. P. and Rājputāna.

Section II.—Mr. V. D. Chopra (U. S. S.) and 3 Lower Subordinates for the maintenance of 'E' Company area, *viz.* Baluchistān and Sind and Khairpur State of the Punjab States.

Both the above mentioned sections had to collect and compare office copies of the different drawing sections and to prepare one final office

copy for each sheet of the unit, and also a separate verification guide showing information received from extra-departmental sources, but incorporated on the various editions of that sheet without verification on the ground, and also such information which may be received in future but may require verification on the ground.

Section III.—Mr. Muhammad Akbar (U. S. S.) with 9 surveyors and draftsmen carried out the fair mapping of $\frac{1}{4}$ -inch, $\frac{1}{2}$ -inch and 1-inch sheets, and also corrected the old originals against office copies and ground verification surveys. R. S. Chuni Lal Kapur (Class II) was in charge of this section for a month prior to his transfer to No. 18 Party.

24. During the recess on the re-transfer of R. S. Chuni Lal Kapur (Class II) to this Company, the office work was re-organized as follows:—

Section I.—R. S. Chuni Lal Kapur (Class II) assisted by Mr. Amar Singh (U. S. S.) and 2 Lower Subordinates for the maintenance of the entire area of N. W. F. P.

Section II.—Mr. V. D. Chopra (U. S. S.) with 2 Lower Subordinates for the maintenance of the remaining Frontier Circle area.

Both the above mentioned sections carried on the preparation of office copies and verification guides of their respective areas.

Section III.—Mr. R. N. Hastir (Class II) assisted by Mr. Muhammad Akbar (U. S. S.) with 7 Lower Subordinates carried on the fair mapping of the Company. Originals of 5 $\frac{1}{4}$ -inch, 2 $\frac{1}{2}$ -inch, 11 1-inch and 3 1/25,000 sheets were drawn or corrected and submitted for publication.

25. The computation section, consisting of 3 computers, was mainly employed during the field season on the adjustment of topo. triangulation data for grid pamphlets, but subsequently during the recess the adjustment work was given up and the computers completed computations of the triangulation carried out by Captain Gambhir Singh, I.A., mentioned in para. 22.

No. 18 (Air Survey) Party.

Officer in charge.— $\left\{ \begin{array}{l} \text{Major D. R. Crone, O.B.E., R.E., to 22-12-40.} \\ \text{Captain C. A. K. Wilson, R.E., from 23-12-40 to 4-1-41.} \\ \text{,, R. C. A. Edge, R.E., from 5-1-41 to 26-5-41.} \\ \text{,, R. S. Kalba, I.A., from 27-5-41 to 11-9-41.} \\ \text{Khan Sahib Muhammad Hasan from 12-9-41.} \end{array} \right.$

26. General.—Recess and field headquarters remained at Murree and Risālpur respectively, the latter opening on 26th October 1940 and closing on 9th May 1941.

27. Personnel.—The average strength of the Party was 3 Class I, 9 Class II, 7 Upper Subordinate officers and 44 Lower Subordinates (excluding clerks). In addition to this 17 soldier surveyors under 1st period of training, joined the Party in the middle of May 1941. The drawing and reproduction section personnel were transferred to the newly formed No. 19 Party in January 1941.

28. Areas surveyed.—

101 square miles compiled (1-inch original survey).

473 square miles compiled (1-inch revision survey).

204 square miles compiled (1-inch revision detail only).

*Areas for inclusion in Tables A and B.**New survey.*—1-inch scale:—101 square miles.*Revision survey.*—1-inch scale:—473 square miles.**29. Field work.**—

375 square miles of vertical photography.

9 linear miles of oblique photography.

Nos. 20 and 28 Squadrons, R. A. F. and No. 1 Squadron, I. A. F. supplied 375 square miles of vertical photography in Jhelum, Kāngra, Attock and Kohāt districts, Khyber Agency and tribal territory (Sheets 43 G and H, 38 O and 52 D).

I. A. F. Detachment, Miransbāh supplied 9 linear miles of oblique photography in North Waziristān Agency (Sheet 38 L).

Large scale survey and field contouring was carried out for the Northern Command in Jhelum district under Mr. K. A. Sheikh (Class II) and Mr. Govind Prasad (U. S. S.) in Kāngra district under Mr. G. E. Bower (Class II Probationer) and in Rāwalpindi district under Mr. J. A. F. Dalal (Class II Probationer).

In addition to the above, special levelling, &c., was carried out for the Defence Department in Kohāt district under Captain R. S. Kalha, I.A., and later Mr. U. D. Mangain (Class II *offg.*) and in Khyber Agency by Mr. N. N. Dhawan (U. S. S.) and Surveyor Husain Khan.

30. Compilation.—Compilation was carried out in sheets 34 J, 38 K, L and N, 43 G and H and 52 D under Captain R. C. A. Edge, R.E., and later under Mr. E. R. Wilson (Class II) assisted by Messrs. J. C. Ross (Class II), O. P. Anand (Class II *offg.*), N. C. Sen (U. S. S.) and B. B. Kuttappa (U. S. S.).

Compilation in sheets 34 J, 38 L, 35 P and 47 E was carried out in the course of training under K. S. Muhammad Hasan (Class II) and Mr. E. R. Wilson (Class II) assisted by Messrs. N. D. Joshi (Class II), N. C. Sen (U. S. S.), B. B. Kuttappa (U. S. S.) and Govind Prasad (U. S. S.).

31. Training.—During the year 1 Class I, 5 Class II, 3 Upper Subordinate officers and an average of 14 Lower Subordinates and 17 Soldier Surveyors under 1st period of training, were under training in air survey. 4 Class I officers from the Federated Malaya States were also trained in air survey.

32. Office and reproduction work.—For detail of work see report of No. 19 Party on pages 14-15 and 32-33.

No. 19 Party.

Officer in charge.— $\left\{ \begin{array}{l} \text{Captain C. A. K. Wilson, R.E., to 2-7-41.} \\ \text{Major D. R. Crone, O.B.E., R.E., from 3-7-41 to 7-7-41.} \\ \text{Captain R. C. A. Edge, R.E., from 8-7-41.} \end{array} \right.$

33. General.—The Party was formed on the 5th January 1941.

Field headquarters were at Risālpur and closed on the 9th May 1941.

34. Personnel.—The average strength of the Party was 1 Class I, 1 Class II and 1 Upper Subordinate officers, 1 Technical Assistant and 31 Lower Subordinates excluding clerks.

35. Office Work.—3 draftsmen were employed under Mr. Bashirullah Khan (U. S. S.) throughout the year on fair mapping and miscellaneous work.

36. Training.—5 Lower Subordinates were recruited and trained during the year (1 Photographer, 1 Litho. Draftsman, 2 Negative Retouchers and 1 Zinc Corrector).

8 Lower Subordinates were recruited and are under training; 7 as Negative Retouchers and Zinc Correctors and 1 as Machine Feeder.

12 inferior servants are under training with a view to promotion to third division posts (7 as Hand Press Printers, 2 as Helio & Vandyke Operators, 2 as Negative Retouchers and Zinc Correctors and 1 as Guillotine Operator).

37. Reproduction Work.—For detail of the work. see pages 32 and 33.

V.—SURVEY REPORTS, GEODETIC BRANCH.

No. 20 (Cantonments) Detachment.

Officer in Charge.—{ Mr. Moquimuddin Ansari, to 21-1-41.
,, E. N. Natesan from 22-1-41.

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

The field season commenced on the 14th October 1940 and closed on the 31st March 1941, field headquarters remaining at Dehra Dūn.

Personnel.—The field strength, excluding the officer in charge, was 2 U. S. officers and 30 Lower Subordinates, including 4 draftsmen, 2 surveyors, 3 computers, 1 traverser and 3 clerks employed at field headquarters.

39. Areas Surveyed.—

<i>16-inch revision survey.</i>			
Lahore Cantonment	...	...	9,096 acres. (includes overlap).
<i>64-inch revision survey.</i>			
Lahore Cantonment Bāzārs	...	...	153·2 acres.
Jhānsi Sadr Bāzār	...	...	48·4 ,,

40. Field work was organized as follows:—

Camp (1) with headquarters at Dehra Dūn under Mr. Bakhshi Harnam Singh (U. S. S.) with 1 surveyor and 3 traversers completed the detail survey of Jhānsi Sadr Bāzār and advance traversing and levelling of Agra and Ambāla Cantonments. A few cases of boundary disputes between the Revenue and Military authorities were settled on the spot and fresh boundary pillars constructed and traversed.

Camp (2) with headquarters at Lahore Cantonment under Mr. A. Francis (U. S. S.) with 13 surveyors, including 1 pupil under training, completed the detail survey of Lahore Cantonment and its Bāzārs and resiting of a number of boundary pillars in Murree Cantonment.

41. Traversing and Levelling.—280·3 linear miles of traversing and 71·7 linear miles of levelling were completed for next season's survey in Agra and Ambāla Cantonments. 1·7 linear miles of boundary traversing were also carried out for Murree Cantonment at the special request of the Cantonment Authority.

42. Recess duties.—Fair mapping was carried out by two sections during the recess under Messrs. Bakhshi Harnam Singh (U. S. S.) and A. Francis (U. S. S.) respectively, the former also supervised the computation section and the latter was responsible for dealing with boundary changes and notifications.

A section of 4 draftsmen, 2 surveyors, 3 computers and 1 traverser, under the supervision of the officer in charge, assisted by Mr. Bakhshi Harnam Singh, was employed throughout the field season to deal with the arrears of mapping and computation of the advance frame work.

27 sheets on the 16-inch scale of *Bannu, *Cherāt, *Dalhousie, *Dera Ismail Khān, *Jhelum and *Jullundur Cantonments and 6 sheets on the 64-inch scale of Jhānsi, Jullundur and Lahore Cantonment Bāzārs were completed and sent for publication, while 8 sheets on the 16-inch scale of Lahore Cantonment of the current season's work were partially completed.

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

* Arrears mapping.

VI.—SURVEY REPORTS, EASTERN CIRCLE.

DIRECTOR.—Colonel L. H. Jackson, I.A.

43. Summary.—On the conclusion of the last survey year, the Eastern Circle had under its administrative control Nos. 4, 5 and 12 Parties and No. 5 Drawing Office.

During the year under report, Nos. 4 and 12 Parties were amalgamated as No. '4 & 12' Party and the administrative control of Nos. 1 and 14 (Geophysical) Parties, and No. 6 (S. I.) and the Lahore Survey Detachments was transferred to the Circle.

The headquarters of the Circle with those of Nos. 5 and '4 & 12' Parties and No. 5 Drawing Office were transferred from Shillong to Dehra Dūn for the duration of the war and the office buildings at Shillong with the exception of some rooms reserved for survey records were made over to the Defence Department for use as a Military Hospital.

The status of No. 6 (S. I.) Party was reduced to that of a Detachment and most of its personnel were transferred to Dehra Dūn for war mapping.

Owing to war commitments, the normal activities of the Department were suspended.

No. 1 Party.

Officer in charge.— { Major G. H. Osmaston, M.C., R.E., to 1-1-41.
 { Captain R. A. Gardiner, R.E., from 2-1-41.

44. General.—Due to the war the normal field programme was almost entirely suspended. The Party carried out the following special surveys:—

- (a) Riverain survey in Gurgaon district, at the request of the Punjab Government.
- (b) A military training map, on the 1-inch scale in Gwalior State, at the request of the Darbar in sheet 54 J.
- (c) Demarcation of a small boundary dispute between the Gwalior State and the Datia State, Central India, at the request of the Resident at Gwalior.
- (d) Control for settlement survey in the Kurram Valley in sheets 38 G and 38 K at the request of the Revenue and Divisional Commissioner, N. W. F. P.
- (e) Survey of firing ranges in Delhi Cantonment.
- (f) Revision of the 3-inch Delhi Guide Map.

Items (a) to (e) were done on payment.

Contributions were received during the year towards the cost of topographical surveys in their territories from the States of Jodhpur (Mārwar), Gwalior, Jaora, Ratlām and Partābgarh.

The party headquarters remained at Dehra Dūn throughout the year. The personnel who did not take the field were wholly employed on mapping.

45. Personnel.—The average strength of the Party during the year was 1 Class I, 2 Class II, 3 Upper Subordinate officers, and 48 Lower Subordinates including 11 pupil draftsmen and 4 clerks.

In addition to the above, 2 Class I probationers (Lieut. Anant Singh, I.E. and Lieut. A. D. Verma, I.E.) and 6 Class II and 3 Upper Subordinate probationers were posted to the Party for training. One of the Upper Subordinate probationers died before taking the field.

46. Areas surveyed.—

512 square miles of minor triangulation for 1-inch surveys.

91 linear miles of theodolite traverse for 1-inch surveys.

338 linear miles of theodolite traverse for 16-inch revenue settlement surveys.

11.5 linear miles of theodolite traverse for boundary demarcation.

21.5 linear miles of plane-table traverse for boundary demarcation.

431 square miles of 1-inch original survey.

41 square miles of 3-inch blue-print survey.

Areas for inclusion in Table B.

Revision survey.—1-inch and larger scale:—560 square miles.

47. Field work was organized as follows:—

Camp (1).—Mr. M. A. Faruque (U. S. S.) with 3 traversers, 2 computers and 2 draftsmen completed the work of providing a framework for the preparation of 16-inch settlement maps of 33 villages of Palwal tahsil of Gurgaon district in the Punjab covering an area of 90 square miles in sheets 53 H and 54 E.

Camp (2).—Mr. T. M. C. Alexander (Class II) with 2 Class I, 5 Class II and 2 Upper Subordinate probationers, and 2 first class surveyors employed as instructors for most of the time, completed 444 square miles of survey in the Gwalior State in sheet 54 J for a military training map for the Gwalior State. Of this area the towns of Lashkar and Gwalior covering about 13 square miles were surveyed on the 3-inch scale and the remainder on the 1-inch scale. On the transfer of Mr. Alexander to Kurram Settlement Survey Camp on 24th March Lieut. Anant Singh, I.E., took over charge of the camp. The camp headquarters were at Morar.

Camp (3).—Mr. P. K. Jain (Class II probationer) completed 512 square miles of minor triangulation supplemented by 91 linear miles of theodolite traversing for future 1-inch surveys in Mirzāpur district of the United Provinces in sheet 63 L.

Delhi Guide Map.—Surveyor Harnam Singh completed the revision of an area of 28 square miles on the 3-inch scale for the Delhi Guide Map in sheet 53 H

Boundary demarcation.—Mr. M. A. Faruque (U. S. S.) carried out the demarcation of disputed portions of the boundary about 12 miles in length between the Gwalior State (Gwalior) and the Datia State, Bundelkhand Agency, Central India, during February and March.

Kurram Settlement Survey.—Triangulation for the settlement survey of the Kurram Valley covering about 110 square miles in sheets 38 G and K was taken in hand in April. A full report will be given next year.

Survey of Firing Ranges.—Messrs S. Q. Hasan and S. M. S. K. Mudaliar (both Class II probationers) were sent under urgent military request to help site and survey new range areas near Delhi; the work was completed in about 1 month.

Verification Survey.—Because of the war work, no verification survey was carried out.

48. Recess duties.—

About half the personnel of the Party remained at party headquarters, Dehra Dūn, throughout the year, employed on mapping. The work carried out included typing of war sheets for No. 1 Indian Field Survey Company, 1/50,000 mapping, Mārwar Map, Gwalior Military Training Map and arrears of $\frac{1}{2}$ -inch sheets.

No. 4 & 12 Party.

Officer in charge.—{ Mr. A. J. A. Drake, D.C.M., to 31-7-41.
,, D. C. Puri, from 1-8-41.

49. General.—Due to war commitments and consequent financial restrictions Nos. 4 and 12 Parties were amalgamated and designated No. '4 & 12' Party.

Normal field operations were suspended, but colour-print survey on the $\frac{1}{4}$ -inch scale in the Bālipāra Frontier Tract of Assam was carried out in sheets 83 E and F and in addition the following special work on payment:—

- (a) Fixing of range points at Shillong in the Khāsi and Jaintia Hills district of Assam for the Defence Department.
- (b) Survey of boundaries of holdings on the 16-inch scale at the Happy Valley Cantonment, Shillong, in the Khāsi and Jaintia Hills district of Assam for the Defence Department.
- (c) River crossing of the Brahmaputra and tertiary levelling in the Cāchār, Goālpāra, Kāmṛūp, Nowgong, Sibsāgar and Sylhet districts of Assam in sheets 78 F, J, N, O, P and 83 B, C, D, F, I, J for the Public Works Department, Assam.
- (d) A boundary survey on the 4-inch scale was carried out in the Jessore district of Bengal in sheet 79 F at the request of the Munsif of the 3rd Court, Jessore, to settle a land dispute.

The party headquarters remained in Shillong up to the 11th of April and were thereafter transferred to Dehra Dūn.

50. Personnel.—The average strength of the party was 1 Class I, 3 Class II, and 3 Upper Subordinate officers and 30 Lower Subordinates.

51. Areas surveyed.—

411 square miles of $\frac{1}{4}$ -inch colour-print survey (Exploratory).

Areas for inclusion in Table B.

Revision Survey.—1-inch and larger scales:—2·3 square miles.
 $\frac{1}{4}$ -inch scale:—411 square miles.

52. Field work was organized as follows:—

Dafla and Mīri Hills.—Surveyor K. S. Loverwell accompanied the Political Officer, Bālipāra Frontier Tract on his tour of the area and carried out exploratory survey of 411 square miles on the $\frac{1}{4}$ -inch scale in sheets 83 E and F. A print of the published sheet was utilised for plane-tabling.

Assam Levelling.—A river crossing was necessary to connect a line of levels from the Gauhāti Standard Bench Mark with the one at Dhubri along the north bank of the Brahmaputra River. This was carried out by Messrs P. K. Chowdhury and A. P. Datta (both U. S. S.) who used Zeiss model II levels and committee pattern staves. The distance of the crossing was 49 chains.

Three methods were employed *e.g.* Reciprocal, Target and Vertical angles. The results of the two observers were good.

Thereafter computers S. N. Basu and A. C. Chakrabatti completed 621 linear miles of tertiary levelling in the Assam and Surma Valleys for the P. W. D., Assam.

Boundaries of Holdings.—One surveyor completed this in three days on the existing plane-tables of the 16-inch Happy Valley survey, Shillong. Only a few holdings previously pegged out by the owners were surveyed.

Jessore Land Dispute.—Mr. A. P. Datta (U. S. S) carried out 6·6 linear miles of prismatic compass traversing, 10·6 linear miles of theodolite traversing and a detailed boundary survey plot on the 4-inch scale in connection with a land dispute in the vicinity of villages Bābupur and Silimpur in the Jessore district of Bengal. A comparative map on the 16-inch scale was compiled at Shillong for comparison with the cadastral survey maps.

Training Camp.—A training camp under Mr. O. D. Jackson (Class II) was opened early in December at Unisaw village about 12 miles from Shillong. 2 unclassified surveyors and 4 pupils were trained in hill plane-tabling on the 2-inch scale. The camp was closed at the end of March.

Triangulation, Traversing and Levelling:—

- (a) 621 linear miles of tertiary levelling in the Assam and Surma Valleys for the P. W. D., Assam.
- (b) The fixing of the range point at Shillong was done by intersection from 3 trigonometrical stations. Two of these were old stations of the Shillong Guide Map survey and one a new station. The stations were not more than 2 miles apart and the actual field work took 3 days.

53. Description of country.—

Dafla and Mīri Hills.—The area in 83 F consists of low foot hills thickly wooded. Wild elephants and other games are to be found here. Communications are not good. In sheet 83 E the area consists of high hills covered with dense mixed forest, sparsely populated, and communications are not good.

Assam Levelling.—Low cultivated plains subject to flooding particularly bordering on the Brahmaputra River and low lying areas. Communications good.

Jessore Land Dispute.—Low cultivated plains with marshy land.

54. Recess duties.—The party was organized for recess into 4 main sections:—

Section I.—under Mr. O. D. Jackson (Class II) assisted part time by Mr. R. L. Ghei (Class II) and Mr. R. R. Sahai (U. S. S.) mapping Burma farmed re-issues, sheet 79 N and the Shillong Guide Map and Happy Valley Cantonment 16-inch traces.

Section II.—under Mr. Mohammad Alauddin (Class II) assisted part time by Mr. R. L. Ghei (Class II) mapping Burma farmed re-issues and sheet 64 H.

Section III.—under Mr. A. G. Qureshi (U. S. S.) mapping Burma farmed re-issues and sheet 64 O/N. E.

Section IV.—under Mr. H. H. Phillips (Class II) assisted by Messrs. Mohabat Ali and Muzaffar Husain (both U. S. S.) dealt with maintenance and sale of maps.

On transfer of the unit to Dehra Dūn the sections were reorganized as follows:—

Section I.—under Mr. Mohammad Alauddin (Class II) assisted by Mr. R. L. Ghei (Class II) and Mr. R. R. Sahai (U. S. S.) mapping of Burma farmed re-issues and sheet 79 A/8.

Section II.—under Mr. H. H. Phillips (Class II) assisted by Mr. P. K. Chowdhury (U. S. S.) mapping of sheet No. 79 N, special Dafla map, sheets Nos. 64 O/N.E. and 64 H and collection of information for maintenance.

Three $\frac{1}{4}$ -inch, eleven $\frac{1}{2}$ -inch and four old style 1-inch Burma re-issues were submitted for publication.

No. 5 Party.

Officer in charge.— $\left\{ \begin{array}{l} \text{Major R. H. Sams, R.E., to 29-1-41 and from 1-4-41 to 20-4-41.} \\ \text{Mr. F. J. Grice, from 30-1-41 to 31-3-41, 21-4-41 to 12-5-41 and from 3-9-41} \\ \text{to 24-9-41.} \\ \text{,, N. S. Harihara Iyer, from 13-5-41 to 28-5-41.} \\ \text{,, D. C. Puri, from 29-5-41 to 31-7-41.} \\ \text{,, A. J. A. Drake, D.C.M., from 1-8-41 to 2-9-41 and from 25-9-41.} \end{array} \right.$

55. General.—Due to mobilisation the party did not take the field.

56. Personnel.—The average strength of the party excluding the officer in charge was 2 Class II and 2 Upper Subordinate officers and 21 Lower Subordinates.

57. Field work.—4 surveyors were employed for about 2½ months on survey of 'prisoners of war camp' at Rāngarh Cantonment in sheet 73 E on the 32-inch scale and surveyed an area of about 8 square miles under the supervision of the Officer in charge, Railway Survey Section, Rāngarh.

One surveyor was employed for about a week on survey of site plan at Mauza Telpura (Dehra Dūn) in sheet 53 J for the Army Headquarters,

Meerut district and surveyed an area of about $\frac{1}{2}$ square mile on the 6-inch scale under the supervision of Mr. L. J. Bagnall (Class II).

58. Recess duties.—The fair mapping of four $\frac{1}{2}$ -inch Sikkim sheets Nos. 78 A/N.W. & 77 D/S.W., 78 A/S.W. & 72 M/S.E., 78 A/N.E. & 77 D/S.E. and 78 A/S.E. was completed in the first 3 months under Mr. A. Ahad (Class II) assisted by Mr. N. L. Gupta (Class II) and for the rest of the season most of the personnel were employed on war mapping on 1/50,000 scale. The drawing of the Shillong Guide Map and preparation of colour patterns were carried on when there was no war mapping in hand.

Lahore Survey Detachment.

Officer in charge.— { Mr. D. C. Puri, to 21-5-41.
 ,, M. R. Nair, from 22-5-41.

59. General.—The original programme of the unit so far as field work was concerned was completed by the first week of April 1941. The Administrator of Lahore Municipality, asked for a further survey of old *ābādīs* of Bāghbānpura-cum-Bhogiwāl and Ichhra estates, which though omitted from the original programme by the Settlement Department, was required by the municipality for planning purposes. This was taken in hand on 15th March and completed by 9th June.

Insertion of boundaries and completion of sheets are in hand.

60. Personnel and distribution of duties.—The average strength excluding the officer in charge, was 1 Class II, 5 Upper Subordinate officers and 39 Lower Subordinates including clerks.

The following changes occurred during the year:—

Messrs. K. B. Muthanna and I. K. Ponnappa (both U. S. S.) were transferred to the Survey Training Centre and Mr. Manawar Khan (U. S. S.) to No. 18 Party.

Mr. N. D. Joshi (Class II) was transferred to this unit on 11th August 1940 and transferred to No. 18 Party from 11th December.

Messrs. Sheikh Alauddin, M. L. Kohli and J. R. Chibbar (all U. S. S.) were transferred to this unit on 1st August and 22nd September 1940 and 15th January 1941 respectively.

Messrs. M. R. Nair and N. D. Joshi (both Class II) were in charge of the field camps consisting of 12 Lower Subordinates. Mr. Manawar Khan and later Mr. M. L. Kohli with 17 plotters and draftsmen dealt with plotting and drawing.

Mr. Saiyid Irshad Ahmad (U. S. S.) with 7 computers computed the computation by 15th April and was transferred back to Dehra Dūn.

61. Field work.—

Control.—Triangulation was all completed during the previous year. 126·155 linear miles of traverse with 2,092 stations were completed during the year, making a total of 332·064 linear miles and 3,931 marks of main traverse and 677·860 linear miles and 12,979 stations of detail traverse. The whole traverse was completed by March.

62. Detail Survey (Offsetting).—An area of 913 acres for the 40-foot scale and 4,539 acres for the 100-foot scale was completed during the year, making a total of 5,816 acres for the 40-foot scale and 13,991 acres for the 100-foot scale.

63. Plotting and inking up detail.—All plotting from offsets and inking up after verification on the ground was completed during the year.

11 original sections were completed for typing and insertion of boundaries from information supplied by the Settlement Department.

64. Check measurements.—Checking and verification of all plotted work was carried out by camp officers by direct measurements on the ground, *pari passu* with the plotting. In summer months the camp officers were hard put to it to keep pace with the plotting.

65. Boundaries and limits of holdings.—362 final traces on tracing cloth were submitted to the Settlement Department for insertion of boundaries. 118 traces were received back during the year and settlement work is in progress in all other estates and is in various stages of completion. It is estimated that the final completion of originals for publication after insertion of boundaries, as received from the Settlement Department, will take over a year, and depends entirely on the speed with which the traces are received back from the Settlement Department.

66. Averages.—The following averages have been calculated from total figures of the whole programme now completed and will be a useful guide for estimating any similar works in future:—

Triangulation.—Total number of 330 stations have been fixed in an area of 20,000 acres making an average of about one station per 60 acres.

Traversing.—Average number of traverse stations per 100 acres is 85. (In congested area the number may be up to about 250 stations per 100 acres).

Average length in linear miles of traverse per 100 acres is 5.0 miles.

Average number of stations completed per man per month is 113. (In congested area the number will be about 100 stations and in semi-congested area about 130 stations per month).

Average linear miles of traverse per man per month are 7.2 linear miles.

Offsetting.—Average out-turn per man per month is 91 acres. (In congested areas the average will be about 30 acres only while in open areas it may be about 150 to 200 acres).

Number of offsets per acre is 17.06.

Average number of offsets per man per day is 68.

67. Amritsar district—Kapūrthala State boundary disputes.—At the request of the Chief Secretary to the Punjab Government certain missing boundary pillars, along a disputed length of riverain boundary on the Beās River between Jalālābād village (Amritsar district) and Kapūrthala State in sheet 44 M, were fixed by this detachment in February 1941. The work was carried out by traverser Dial Singh. The method adopted was to run two traverses between two sets of base

line marks and from near stations of this traverse to peg out the missing boundary pillars with the help of distances and bearings supplied by the office. Unfortunately no computed values of co-ordinates of these missing boundary pillars were available from old records, and their co-ordinates were taken from the index map on the scale of 1 inch to 200 karams or 1,000 feet. A further check on the accuracy of these co-ordinates was provided by a comparison of the computed direct distances from these co-ordinates with direct distances given on the index map. These co-ordinates of boundary pillars taken from the index map were used for computing their distances and bearings, which data were used by the traverser to fix their positions on the ground. 8.3 linear miles of traverse, consisting of 29 stations including base line stations, were run, and 10 boundary marks were fixed. The cost of the survey was Rs. 300.

The results of the survey have been communicated to both the Punjab and Kapūrthala State Governments.

No. 6 (South India) Party (now Detachment).

Officer in charge.— $\left\{ \begin{array}{l} \text{Mr. N. S. Harihara Iyer, from 29-8-40 to 1-1-41 and from 8-2-41 to 25-4-41.} \\ \text{,, J. C. St. C. Pollett, v.d., from 2-1-41 to 7-2-41.} \\ \text{,, B. N. Murthy, B.Sc., from 26-4-41.} \end{array} \right.$

68. General.—The Party which has been reduced to the status of a detachment from the afternoon of 25th April completed its programme of 1-inch topographical surveys in Bombay, Kolhāpur and Deccan States. Field work commenced in the middle of October.

In addition to the above, revision survey was carried out by 10 surveyors in the Chingleput, Coimbatore, Madras, Malabar and Nilgiri districts of Madras Presidency and in the Mysore district of Mysore State. Work commenced towards the end of October and continued till the end of July. Owing to unprecedented weather conditions in Malabar one sheet near Calicut had to be left incomplete. The party (now detachment) was administered throughout the season from Bangalore. The officer in charge made tours of inspection in the months of January, February, April, May, June and July.

69. Personnel.—The strength of the party (now detachment) was 1 Class I, 3 Class II and 3 U. S. S. officers, of whom two were promoted to Class II Service from 1st October 1940 and 50 Lower Subordinates including 4 clerks. One Class I, 2 Class II and 3 U. S. S. officers and 24 surveyors, 3 draftsmen and 2 clerks were transferred to the Eastern Circle, 14 surveyors and 1 draftsman were transferred to Frontier Circle and 3 surveyors were transferred to Burma Survey Party during the year under report. 12 pupil surveyors were entertained on probation in August 1940 and 6 were selected. 12 pupil draftsmen were entertained on probation in March 1941 and 8 retained. Of these 1 pupil draftsman and 1 pupil surveyor were transferred to the Eastern Circle. The present strength consists of 1 Class II officer, in charge of the Detachment, 3 surveyors-draftsmen, 12 pupils and 2 clerks.

70. Areas surveyed.—

53 square miles of 2-inch blue-print revision survey (enlarged modern 1-inch).

1,381 square miles of 1-inch blue-print revision survey (modern 1-inch).

29 square miles of 1½-inch blue-print revision survey (reduction of 5-inch cadastral).

2,269 square miles of 1-inch blue-print new survey (old 1-inch).

Areas for inclusion in Tables A and B.

New Survey.—1-inch scale:—2,269 square miles.

Revision Survey.—1-inch and larger scales:—1,463 square miles.

71. Field work was organized as follows:—

Camp (I).—Mr. M. A. Azim (U. S. S.) and 12 surveyors carried out the 1-inch blue-print new survey of 2,269 square miles of Poona and Sātāra districts of Bombay, of Kolhāpur State and of the Deccan States in sheets 47 K and O.

Mr. J. A. Cabral (Class II offg.) and 10 surveyors started blue-print revision survey of 1,463 square miles on 2-inch, 1½-inch and 1-inch scales in the districts of Chingleput, Coimbatore, Madras Malabar and Nilgiri districts of Madras Presidency and in the Mysore district of Mysore State. The survey was completed, excepting for a small portion in Malabar district which had to be left unsurveyed owing to unfavourable weather conditions, under the direct supervision of the officer in charge of the party (now detachment) as Mr. Cabral was transferred during the course of the field season to the Eastern Circle.

72. Description of country.—The country covered by the 1-inch original survey in Bombay, Kolhāpur and the Deccan States is open undulating plains, partly black cotton soil under cultivation and partly barren and sterile country with a lot of stone and rock outcrops. The country covered by the 1-inch and larger scale survey is of distinct types. In sheet 66 C it is flat and not very open, in sheet 58 A it is covered by high and wooded hills and in sheet 49 M it is hilly and partly cultivated and partly wooded. The coastal area is covered by dense cocoanut plantations. In sheet 57 D the country is undulating and open excepting for patches of wooded areas. The country presented no serious difficulties technical or otherwise except that rapid progress was not possible in the flat covered areas.

The Bhima, Mān, Nira, Yerla, Cauvery and Cheliyār Rivers pass through the area.

The roads from (i) Pandharpur to Miraj, (ii) Pandharpur to Sholāpur, (iii) Ootacamund to Mettupālaiyam, (iv) Madras to Bangalore, (v) Calicut to Madras and (vi) Mysore to Cannanore pass through this area.

A dam across the Cauvery River at Krishnarājasāgara offers facilities for irrigation over large areas; otherwise irrigation is dependent mainly on rain fall.

73. Recess duties.—There were no sub-sections as in previous years for fair-mapping, preparation of prof. fs and colour patterns, etc.

The entire work was done under the direct orders of the officer in charge.

VII.—SURVEY REPORTS, INDEPENDENT PARTY.

74. The Burma Survey Party is administered directly by the Surveyor General. Its mapping and survey areas are approximately the same as those of the former Burma Circle, abolished in 1932.

Burma Survey Party.

Officer in charge.— { Major H. W. Wright, R.E., to 31-5-41.
Mr. A. F. Murphy, from 1-6-41.

75. General.—The organization and activities of the party underwent considerable modification during the year. The diminished party and the Drawing Section together continued the increased rate of the last year's out-turn of topographical surveys and maintenance duties.

During May a small reproduction section with light equipment was received from India and set up in Maymyo: this was subsequently expanded and the building of a permanent reproduction office was begun.

The installation of reproduction equipment in Maymyo and the use of the Government press in Rangoon enabled a beginning to be made in the production of topographical maps wholly within Burma.

In continuation of the policy of making Burma surveys self-supporting the 1 Class II and 1 Upper Subordinate Burman probationers who in the previous year had received training in India, underwent further instruction in the field and office under party arrangements.

76. Personnel.—The average strength of sections was as detailed below:—

At headquarters, Maymyo.—

Office of the Officer in charge.—1 Class I officer and 5 clerks.

Drawing Section.—2 Class II officers, 2 U. S. S. officers, 5 surveyors, 19 draftsmen, 1 computer and 1 clerk.

Military Surveys Training Sub-unit.—1 Class I officer, 1 Class II officer, 1 U. S. S. officer, 3 surveyors and 1 computer.

Reproduction Section.—1 photographer, 1 helioman and 2 hand-pressmen.

Field Sections.—

Framework and Detail Surveys.—1 Class II officer, 3 U. S. S. officers, 1 Class II and 1 U. S. S. Burman probationers, 25 surveyors, 2 computers and 6 pupils.

Verification Surveys.—7 surveyors.

77. Field out-turn.—

Primary programme.—

Framework.

244 linear miles of theodolite traverse.

Detail surveys.

- 803 square miles of 1-inch original survey.
- 291 square miles of 1½-inch original survey for publication on 1-inch scale.
- 3,789 square miles of 1-inch blue-print survey.
- 14 square miles of special 1-inch original survey for Forest Department.
- 2 square miles of special 4-inch original survey for Forest Department.

*Maintenance programme.—**Framework.*

- 92 linear miles of theodolite traverse.

Detail surveys.

- 608 square miles of 1-inch blue-print surveys.
- 5,924 linear miles of verification surveys.

Areas for inclusion in Tables A and B.

New survey.—1-inch and larger scales:—4,899 square miles.

Revision survey.—1-inch scale:—608 square miles.

78. Field work.—

Mr. F. M. Hawley (Class II), Mr. A. K. Talapatra and U On Ba, A.T.M. (both U. S. S.) were in charge of field sections totalling 25 surveyors and 2 computers; U Ba Han, Mr. V. W. H. Raphael, Mr. E. Thwin and 6 pupils were also under instruction.

For the primary programme, surveys in the area of eighteen 1-inch sheets were completed in sheets 84 N, 85 N and 93 B in Lower Chindwin, Katha, Mandalay, Prome, Sagaing, Shwebo, Tharrawaddy and Thayetmyo districts and in the Nothern and Southern Shan States. Detailed areas are given in the previous paragraph.

The framework for primary surveys consisted of 244 linear miles of theodolite traverse in sheet 84 N in Lower Chindwin, Sagaing and Shwebo districts.

For the maintenance programme an area of 608 square miles of 1-inch blue-print surveys was completed in sheets 84 N and 85 N in Prome and Shwebo districts, the framework consisting of 92 linear miles of theodolite traverse.

The special surveys of 16 square miles on the 1-inch and 4-inch scales in the primary programme was to provide Forest maps in parts of Dawle Extension, Taungnyo Yoma Sattha Extension, Thapan Extensions Nos. I and II and Taungnyo reserved forests in Prome and Tharrawaddy districts.

13 surveyors, including 6 part time from the field sections mentioned above, verified 5,924 linear miles of roads, railways, canals and changes in the course of important rivers. These operations were conducted over an extensive area of Burma and the Shan States.

79. Description of country.—In the Shan States most of the area surveyed was open low hills intersected by densely wooded ravines. In Upper Burma it varied from irrigated plains, thickly populated, open and intersected by high scrub hedges to low hills, open and

densely forested. In Lower Burma the country was equally divided between open cultivated plains and densely wooded low hills.

80 Air Survey Training.—During recess an air survey training section was formed of 2 officers and 8 surveyors for full time training in survey from vertical air photographs. Three more officers did a part time course in addition to their other duties.

81. Rapid Fair-Mapping.—Experiments were carried out during recess in various rapid fair-mapping methods on the sheets surveyed by the party during the field season. For all sheets fair drawing was done in black and white inks on transparent traces.

One sheet was prepared in black and brown by the Vandyke process throughout, as this process alone could be completely carried out in Burma during a period when equipment for photographic work was not available at the outset. The finish of the maps thus produced was certainly below that of the normal Survey of India procedure, but some months in time were saved by not sending the field plane-table sections to Calcutta for photography and production of drawing blue prints. As the maps had to be prepared as expeditiously as possible, the time factor was considered to be of more importance than finish.

82. Work at headquarters.—The field section completed the fair drawing of 10 sheets. Owing to the emergent demand for maps of other areas the completion of drawing and final examination of 4 other primary sheets had to be deferred.

The Drawing Section under Mr. A. F. Murphy (Class II) assisted by Messrs. F. M. Hawley (October, 1940) and C. T. Hurley (from November, 1940) (both Class II) and Messrs. H. K. Kar and Muhammad Mustafa (both U. S. S.) was primarily engaged in the re-issue of a heavy programme of emergent demand maps on various scales. All such maps were gridded and, besides incorporating the material from verification surveys, included additions and corrections collected by the issue of 49 sets of maps covering Burma to the local authorities. As a consequence the normal work of the section, such as compiling geographical and topographical sheets, the re-issue of large scale maps for the Forest Department, etc. was restricted.

The stock and sale of Burma maps continued to be the divided responsibility of the Curator, Government Book Depot, Rangoon and the Officer in charge, Burma Survey Party, Maymyo.

VIII.—MISCELLANEOUS SURVEY REPORTS.

Training School, Dehra Dūn.

Officer in charge.— { Mr. N. N. Chuckerbutty to 28-4-41.
 ,, Mahammad Najamuddin from 29-4-41.

83. One officer of the Corps of Royal Engineers, 2nd Lieut. H. M. Rimmer and one officer of the Corps of Indian Engineers, Lieut. J. S. Paintal joined the Class I Service. 2nd Lieuts. E. J. Daniel and R. Muir of the Corps of Indian Engineers joined the Survey Training School in April. After a short training here, 2nd Lieut. H. M. Rimmer, R.E., was transferred to No. 18 Party. The other three officers are receiving the usual course of instruction.

84. Two Class II Service and four Upper Subordinate Service probationers were appointed in January 1941 and are receiving the usual course of instruction. The U. S. S. probationer who was on leave on medical certificate from March 1940 has since rejoined and continued his course.

85. On completion of the course of training the Bhutanese pupil surveyor returned to Bhutan in April 1941.

PART 4.—MAP PUBLICATION AND MATHEMATICAL INSTRUMENT OFFICE.

From 1st April 1940 to 31st March 1941.

IX.—MAP PUBLICATION.

86. Map Policy.—All maps except the 1/M and smaller scales are now, for the period of the war at least, being normally printed in black and brown only.

Some sheets, such as in Burma where there are very large areas of cultivation, are being printed also with a yellow tint, and similarly sheets with important water features retain their blue printing.

This, combined with the shortage of paper and foil, has put a stop to the drawing of separate detail originals and it seems that, as a result of the experience gained from the hastily-embarked-on experiment, separate detail originals are never again likely to be used. It will however probably be desirable to have separate name originals in future, as many of which as possible should be engraved.

87. The Photo.-Litho. Office, Calcutta.—The following presses were in use in the Photo.-Litho. Office:—

Lithographic Printing Machines.

Two Mann "Standard" Single Colour Double Demy Rotary Offset machines with "chain delivery".

One Mann "Standard" Single Colour Double Demy Rotary Offset machines with "shooting delivery".

One Ratcliffe Quad Demy Flatbed machine.

Two Mann Quad Crown Flatbed machines.

Two Furnival Double Demy Flatbed machines.

Two Mann Double Demy Flatbed machines.

One Ratcliffe Double Demy Flatbed machine.

Lithographic Proving Presses.

One Mann Quad Crown Offset Proving and Duplicating Press (Power driven).

One Mann Double Demy Offset Proving and Duplicating Press (Power driven).

One Hoe Quad Demy Proving Press.

One Greig & Sons Quad Demy Proving Press.

Two Hoe Double Imperial Proving Presses.

One Furnival Double Imperial Proving Press (Power driven).

Four Hoe Double Elephant Proving Presses.

Three Furnival Double Elephant Proving Presses (Power driven).

Two Greig & Sons Imperial Proving Presses.

Three Furnival Imperial Proving Presses (one Power driven).

One Ratcliffe Imperial Proving Press.

Letterpress Printing Machines.

- One Payne and Dawson Double Royal Wharfedale machine.
- One Linotype & Machinery Double Crown "Centurette" machine.
- One Dawson & Sons Double Demy Wharfedale machine.
- One Payne & Otley Demy Wharfedale machine.
- One Rockstorch & Scheinder Foolscap "Victoria" Platen
- One Walker Bros. Foolscap "Laurate" Platen.
- One Chandler & Price Foolscap Platen.
- One Furnival & Co. Crown Folio Platen.
- One Ruling machine.

88. Photo.-Zinco. Section, Dehra Dūn.—The following Printing Machines and Presses were in use in the Photo.-Zinco. Office:—

- One Flatbed Litho Printing Machine Quad Demy size, printing capacity 43" × 30".
- One Flatbed Litho Printing Machine Double Crown size, printing capacity 30" × 20".
- One Rotary Offset Printing Machine Double Demy size, printing capacity 33" × 23".
- One Offset Duplicating Proving Press, Double Demy size, printing capacity 33" × 23".
- Three Litho Hand Presses, Flatbed, Double Imperial size, printing capacity 43" × 33".
- One Litho Hand Press, Flatbed, Double Elephant size, printing capacity 42" × 27".
- One Litho Hand Press, Flatbed, Double Royal size, printing capacity 40" × 30".

The last two presses have been converted to Offset "Duplicating Proving Presses" as an experimental measure.

89. No. 18 (Air Survey) Party, and No. 19 Party, Murree and Risālpur.—The Reproduction Section and plant were moved into the new offices on Broadway at the beginning of the cold weather. The Double Demi Rotary Offset machine press, which was mounted on a sleeper crib in the previous year, was transferred to a G. M. C. trailer, on which a specially designed wooden body had been built. A second G. M. C. trailer with a collapsible canvas body was also obtained.

One 22" × 24" portable process camera was manufactured by Messrs. Mehra Bros. of Risālpur.

The Reproduction Section was detached from No. 18 (Air Survey) Party and re-designated No. 19 Party on the 5th January 1941.

The following printing presses were in use:—

- One Double Demy Rotary Offset Machine Press, on trailer.
- One Double Demy Offset Duplicating and Proving Press.
- Five D. E. and D. I. hand presses.
- One Furnival Proving Press for motor drive 41" × 29".
- One Furnival Portable 23" × 21" hand press was used in the Survey Exercise.
- One 15" × 16" Penrose Empire Camera adapted for film and wet plate, and two Furnival portable 23" × 21" hand presses were sent to the Burma Survey Party.

Reproduction of originals received:—

In one colour	...	...	...	692
In two colours	...	...	...	94
In three „	...	...	...	3
In four „	...	...	...	3
In five „	...	...	...	1
Vandyke and helio plates prepared	...	...	...	586
Prints pulled	...	...	...	59,107

90. No. 6 Drawing Office (Army Section), Simla.—The following machines were in use in the Army Section:—

One Ratcliffe Flatbed Machine Press (Power driven) Litho Press for stone or zinc, Quad Crown with motor 4 h.p.

One Ratcliffe Hand Proving Press (Power driven) for stone or zinc, Double Elephant with motor $1\frac{1}{2}$ h.p.

One Ratcliffe Hand Proving Press (Power driven) for stone or zinc, Quad Crown with motor $1\frac{1}{2}$ h.p.

One Hand Proving Press for stone only by Winston, D.E.

One Hand Proving Press for stone only by Wm. Notting, D.E.

One Treadle Letter Press Machine by Chandler & Price, Foolscap.

One Hand Proving Letter Press Machine, Foolscap. (Special letter-press type, compositors sticks etc.).

One Guillotine 30'' by Dawson Payne & Eltood (one spare blade).

One Graining Machine (Power driven) by Mann, Quad Crown with motor $1\frac{1}{2}$ h.p.

One vacuum Printing Frame, German, maker unknown, Quad Crown.

N.B.—The following arc lamps were also in use in the Army Section:—

Two pairs of Arc Lamps standards each with 2 lamps. German, maker unknown. Each lamp supposed to be of 3,450 candle power.

Table I(a)—Maps published at Calcutta, during the year 1940-41.

Class of maps.	Scale.	New publica- tions.	Revised editions, new edi- tions and reprints.	Number of copies printed.	Value. Rs.
<i>Departmental.</i>					
GENERAL MAPS.					
Maps of India	Various	1	9	16,479	22,122
GEOGRAPHICAL MAPS.					
Southern Asia Series	1:2 million	...	...	...	...
India and Adjacent Countries Series	1:1 million	...	32	17,083	27,012
Carte Internationale du Monde	..	...	18	3,463	6,662
TOPOGRAPHICAL MAPS.					
Quarter-inch, Modern	1"=4 miles	10	85	42,393	50,926
" (Prely.) ... ..	..	...	2	300	469
" (Provl.) ... ..	..	1	3	1,047	1,047
Half-inch, Modern	1"=2 miles	9	13	9,378	13,360
" (Prely.) ... ..	..	2	...	105	80
One-inch, Modern	1"=1 mile	44	184	108,332	1,32,248
Old style maps	Various	...	12	2,430	3,737
SPECIAL MAPS.					
Provincial maps	Various	...	7	3,949	6,649
City & Town Guide maps ... ..	..	...	5	1,785	3,630
Index maps ... ..	..	...	32	12,421	1,229
Miscellaneous maps ... ..	..	14	64	67,315	4,688
Total ... ..	.....	81	466	286,480	2,73,859
<i>Extra-departmental.</i>					
Manœuvre and Radius maps	Various	1	14	11,161	19,653
Other maps * ... ..	..	209	63	125,248	22,926
Plans and diagrams ... ..	..	293	1	152,239	6,757
Illustrations ... ..	..	240	1	35,830	7,280
Miscellaneous ... ..	..	33	18	540,468	9,964
Total ... ..	.....	776	97	864,946	66,580
<i>Maps published for the Govt. of Burma.</i>					
General & Geographical maps	Various	3	11	5,080	6,644
Topographical maps ... ..	..	21	56	48,566	37,694
Special maps ... ..	..	4	2	504	893
Total for Burma ... ..	.....	28	69	54,150	45,231
Total Extra-departmental	.....	804	166	919,096	1,11,811
Grand Total ... ..	.....	885	632	1,205,576	3,85,670

NOTES.—*Calcutta.*—In addition to the work shown in Table I(a), 24,832 copies of 199 maps were gridded during the year.

* Excludes 50,950 copies of 25 maps supplied to the Army ex-India.

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

Class of maps.	Scale.	New publications.	Reprints and new editions.	Number of copies printed.	Value. Rs.
<i>Departmental.</i>					
Cantonment maps ...	Various	2	27	3,460	1,873
Forest maps ...	4"=1 mile	...	22	1,474	1,364
Miscellaneous ...	Various	76	72	80,497	19,873
Total ...	...	78	121	85,431	23,110
<i>Extra-departmental.</i>					
Maps ...	Various	32	19	8,450	5,836
Plans and diagrams ...	"	20	42	15,930	3,611
Charts ...	"	36	4	16,152	4,277
Forest maps ...	"	9	...	9,782	5,221
Total ...	...	97	65	50,314	18,945
Burma maps (Cantonment & Forest) ...	...	...	...	...	...
Total Extra-departmental ...	...	97	65	50,314	18,945
Grand Total ...	...	175	186	135,745	42,055

NOTES.—*Dehra Dūn.*—In addition to the work shown in Table I(b) above, 6,301 prints of 861 originals, consisting of plane-table sections, triangulation charts and forest maps, &c. were printed. 49 bromide prints, 4 Ferrogalic negatives, 110 Ferrogalic cloth and paper prints were also prepared.

Table I (c)—Maps published at Murree and Risalpur.

Class of maps.	Scale.	New publications.	Reprints and new editions.	Number of copies printed.	Value. Rs.
<i>Departmental.</i>					
Maps ...	Various	...	...	20,271	11,478
Plans and diagrams ...	"	...	...	276	196
Charts } including panoramas	"	...	...	13,175	1,583
Forms }					
Total ...	...	...	...	33,722	13,252
<i>Extra-departmental.</i>					
Maps ...	Various	...	...	4,495	5,910
Plans and diagrams ...	"	...	...	654	212
Charts } including panoramas	"	...	...	2,800	82
Forms }					
Total ...	...	...	...	7,449	6,204
Grand Total ...	...	...	...	41,171	19,456

Table II.—Abstract of Modern Topographical and Geographical Maps.

	INDIA.						BURMA.					
	1°	½°	¼°	1/M		1/2 M	1°	½°	¼°	1/M		1/2 M
				I. & A. C.	Carte Internationale.					I. & A. C.	Carte Internationale.	
Published maps.												
Primary	3,324	243	23	.....	.....	.....	633	25	.....	.....	.....	.....
Compiled	.....	757	296	75*	26	15	.....	161	54	8*	4	2
Remaining (Approx.)												
Primary	776	120	7	.....	.....	.....	237	.....	.....	.....	.....	.....
Compiled	.....	300	105	.....	15	5	.....	74	18	.....	2	.....
Totals (Approx.)	4,100	1,420	431	.....	41	20	870	260	72	.....	6	2
Transfrontier	.....	.....	151	.....	.....	.....	.....	.....	4	.....	.....	.....
Grand total (Approx.)	4,100	1,420	582	.....	41	20	870	260	76	.....	6	2

* This series has been abandoned and no new sheets will be taken up.

91. Map Issues.—It will be seen from Table III below that the total sale by the entire department during the year 1940-41 was 1,124,996† copies, value Rs. 3,04,485 as against 594,211 copies, value Rs. 2,40,238 sold during the previous year.

The Map Record and Issue Office's total sale of departmental maps was 184,460 copies, value Rs. 1,72,696 as against 148,542 copies, value Rs. 1,54,333 sold during the previous year. For the increase in the number of copies issued, there has been no proportionate increase in the value, owing to the prices of certain maps being reduced as a result of a change in the map policy (see para. 86) and to the bulk of the supply of maps being made at concession rates to the army who purchased roughly 66,000 copies more this year.

The total number of extra-departmental maps issued by the Map Record and Issue Office was 957,446 copies, value Rs. 1,22,100.

The number of copies transferred to the High Commissioner for India, London and the Circle Offices for stock and issue was 34,007 copies, value Rs. 50,267.

† This excludes the supplies made to the Army ex-India.

Table III.—Maps issued by Survey units.

D=Departmental. X=Extra-departmental.	SALES.								FREE ISSUES Number of copies.	
	GOVERNMENT OFFICIALS.		ARMY AND ROYAL AIR FORCE.		PUBLIC.		TOTAL.			
	Number of copies.	Sale Value. Rs.	Number of copies.	Sale Value. Rs.	Number of copies.	Sale Value. Rs.	Number of copies.	Sale Value. Rs.		
Calcutta	D	20,888	21,602	141,840	122,089	21,732	29,005	184,460*	172,696*	12,949
	X	581,611	24,160	223,216	23,658	52,519	6,659	857,346	54,477	2,647
Dehra Dūn	D	1,789	1,841	48,310	29,197	490	758	6,089	6,677	7,489
	X	20,365	6,742	4,931	2,714	227	99	25,523	9,555	.....
Simla	D	113	194	84	92	313	476	510	762	943
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Murree and Risālpur ('A & E' Company)	D	114	177	2	3	7	11	123	191	1,243
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Murree and Risālpur (No. 19 Party)	D	65	104	1,051	787	.....	.....	1,116	891	2,832
	X	277	185	7,016	5,955	156	64	7,449	6,204	.....
Karāchi ('E' Company)	D	139	210	97	78	158	217	394	505	106
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Bangalore	D	27	37	801	1,058	3,396	4,641	4,224	5,736	291
	X	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shillong	D	366	600	179	273	264	587	809	1,460	896
	X	45	100	.....	.....	.....	.....	45	100	.....
Totals (excluding Burma maps).		625,799	55,952	427,527	1,85,904	79,262	42,517	1,088,088	2,59,254	29,396
Calcutta, (Burma maps) X		36,908(a)	45,231	.....	.....	.....	.....	36,908	45,231	.....
Grand Total	...	662,707	1,01,183	427,527	1,85,904	79,262	42,517	1,124,996	3,04,485	29,396

* Excludes 34,007 copies of maps, value Rs. 50,267 issued by the Map Office, Calcutta to the High Commissioner for India and the Survey Circles and Parties, for stock and sale.

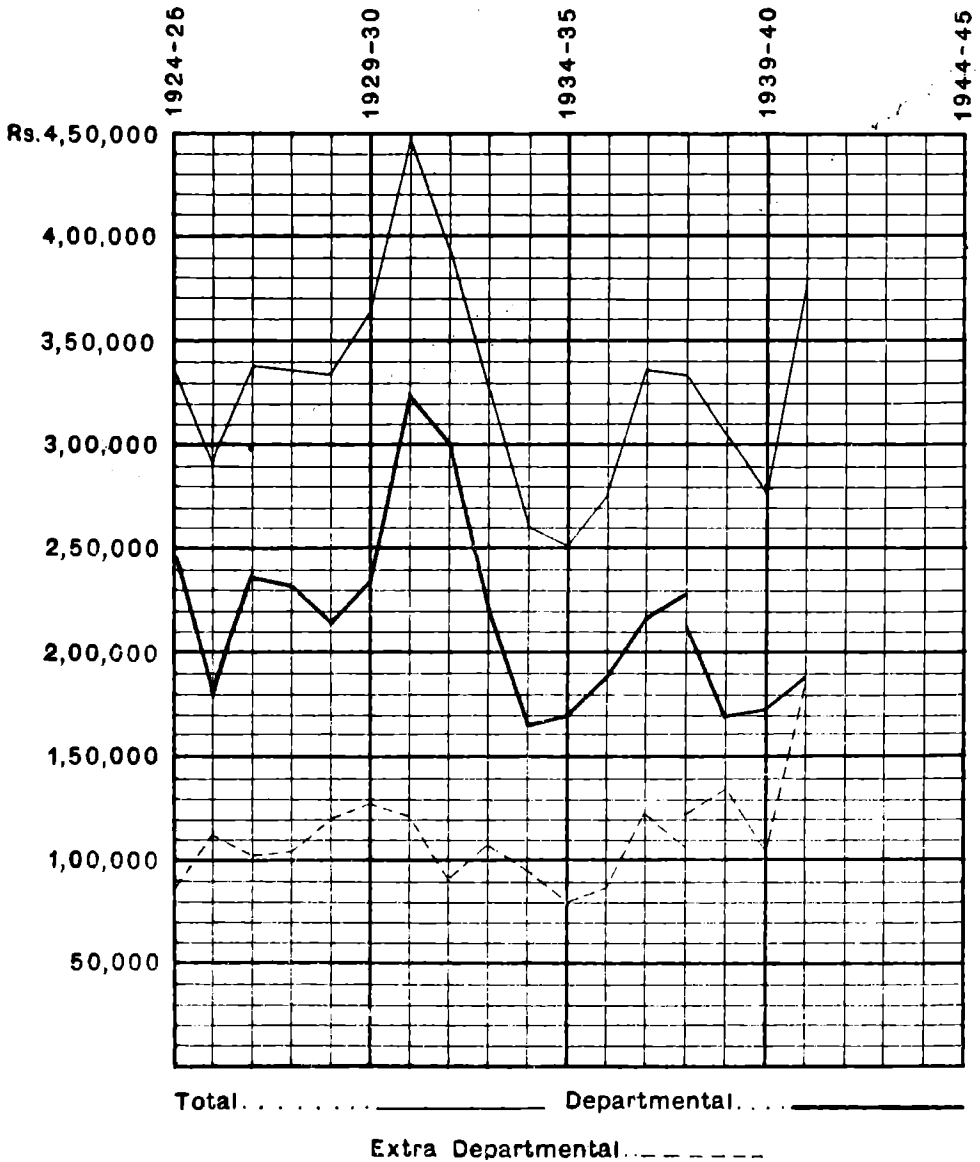
Note 1.—In this table the figures in the sale-value columns exclude the cost of mounting in various linen-backed styles.

Note 2.—In addition to this, 50,950 copies of ex-India maps were also issued to the Army during the year.

(a) In addition to above, 11,196 copies were supplied to the Army in Burma and 1,046 copies to Military Commands ex-India.

PROGRESS OF MAP SALES

1924-41.



NOTE:—The break in Departmental and Extra Departmental graphs after the year 1937-38 indicates the change over of Burma maps from Departmental to Extra Departmental.

The above graph represents the aggregate sales of the whole Department. These figures include the cost of maps supplied in various linen-backed styles.

Since 1939 prices of some maps have been reduced owing to publication in black and brown and, therefore, sale figures after 1939 represent about 40% more copies sold than for a corresponding sale figure in previous years.

X.—MATHEMATICAL INSTRUMENT OFFICE.

92. Manufactures, Repairs and Issues.—The year under review shows an increase of Rs. 2,47,887 on sales and Rs. 1,99,433 on work done compared with the previous year.

93. Distribution of transactions.—The value of invoices covering transactions with various Government Departments etc. during the year is as follows:—

	Rs.
1. P. W. Departments	1,02,734
2. Survey of India	1,43,629
3. Defence Department etc.	2,19,768
4. Railways	42,951
5. Forest Departments	12,251
6. Education Departments	27,875
7. Medical Departments	11,383
8. Other Civil Departments, which include Excise, Jails, Meteorological, Judicial, R. I. Marine. Posts & Telegraphs, Geological, Botanical and Archæological Survey Departments etc.	1,07,907
9. Government Officers, Municipalities, Indian States, etc. on cash payment	47,167
TOTAL	7,15,665

The above were spread over Departments of the Central and Provincial Governments in various provinces, and for countries outside India as shown below:—

	Rs.
Punjab	83,920
Bengal	1,17,355

	Rs.
Orissa	5,610
Bombay	37,263
Central Provinces	16,227
United Provinces	19,301
Bihār	16,701
Assam	16,389
Madras	13,752
Burma	13,921
North West Frontier Province	5,962
Sind	4,064
Nepal	445
Andamans	1,214
Survey of India	1,43,629
Defence Department	2,19,768
Aden, Uganda, Bahrein, Malay States	144

Issues by the Serviceable Stores amounted to 61,554 instruments. The Stores Section dealt with 23,108 requisitions from workshops. The Clerical Section received and dealt with 22,136 letters. The Accounts Section dealt with 5,301 invoices, 2,739 bills and vouchers for the local purchase of instruments and materials. The number of contingent bills drawn on the Accountant General, Bengal during the year amounted to 498.

During the year 2,131 instruments have been deposited by various Government Departments as no longer required. Credit afforded by this office for the above instruments returned on deposit amounted to Rs. 14,961-7-0. The instruments deposited will be reconditioned for reissue at reduced prices.

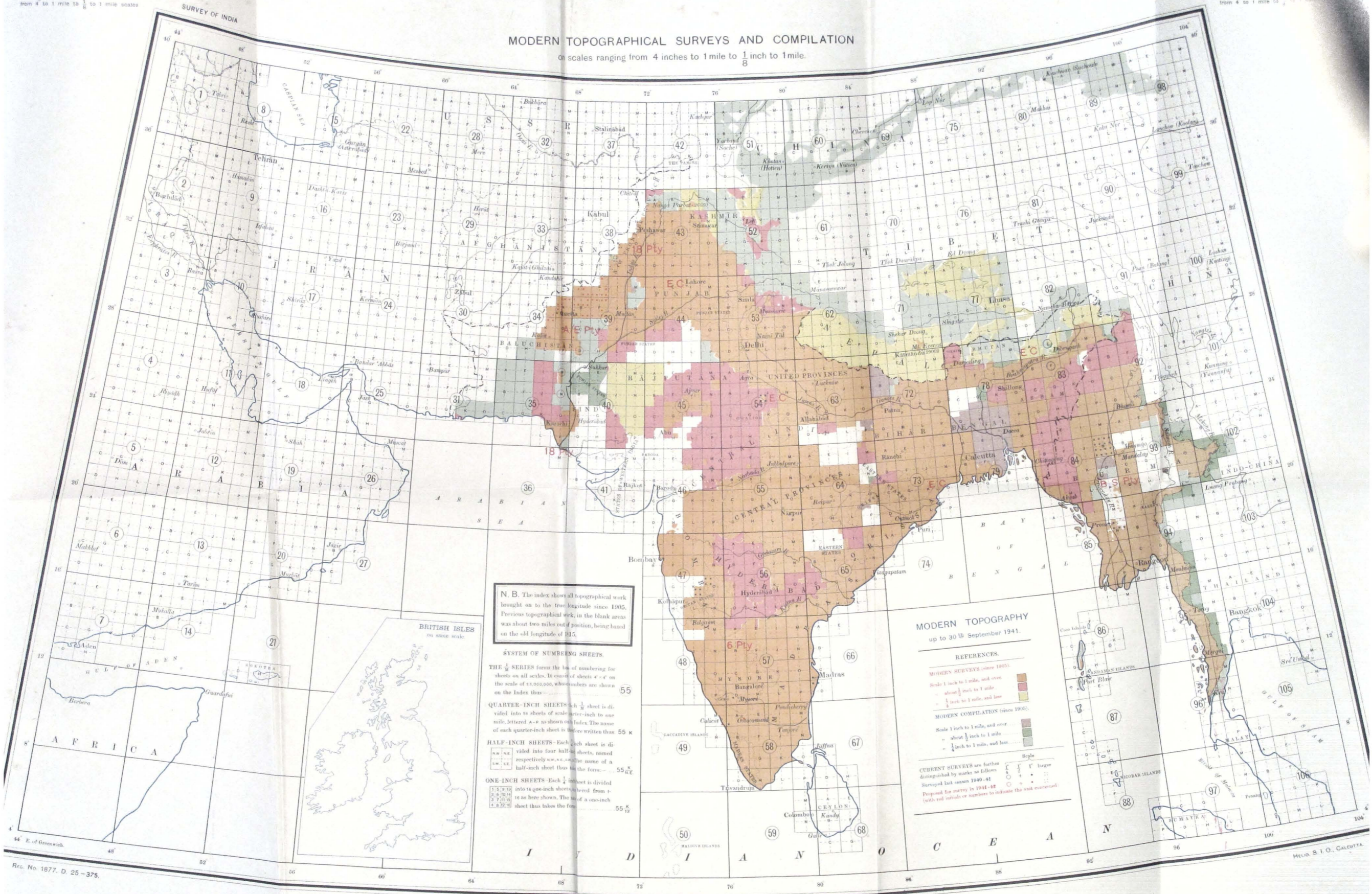
A sum of Rs. 1,666 was realised by the disposal of surplus and obsolescent stores and scrap materials.

94. Summary. The following table shows the value of work done during the last three years.

Sale.	1938-39.	1939-40.	1940-41.
	Rs.	Rs.	Rs.
1. Total value of stores issued ...	3,29,428	3,97,907	6,45,794
<i>Out-turn in Works:—</i>			
2. Total value, manufacture of new instruments and components—	1,86,684	1,66,967	3,61,789
3. „ value of repairs to orders— ...	76,934	79,586	69,871
4. „ value of instruments reconditioned for issue— ...	54,440	60,835	1,01,702
5. „ value of adjustment and cleaning charges	4,366	3,441	4,190
6. „ value of work done in the workshop as per items 2 to 5 above—	3,22,424	3,10,829	5,10,262
7. <i>Book value of stock in—</i>			
(a) Serviceable store	3,06,493	2,69,018	2,75,688
(b) Repairable „	1,32,754	1,30,953	1,05,433
(c) Material „	1,13,315	1,10,637	1,42,909
8. <i>Value of new instruments—</i>			
(a) Purchased locally	78,857	95,514	1,71,844
(b) Imported through the Stores Department, London— ...	49,058	36,978	36,052
9. Value obtained by sale of obsolescent and condemned stores— ...	2,392	2,315	1,666
10. <i>Employees—</i>			
(a) Total number of employees on register on 31st March ...	365	399	754
(b) Cost of employees in workshop	1,41,858	1,42,295	2,22,696

MODERN TOPOGRAPHICAL SURVEYS AND COMPILATION
on scales ranging from 4 inches to 1 mile to 1/8 inch to 1 mile.

SURVEY OF INDIA



N.B. The index shows all topographical work brought on to the true longitude since 1905. Previous topographical work, in the blank areas was about two miles out of position, being based on the old longitude of 815.

SYSTEM OF NUMBERING SHEETS.

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

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

HALF-INCH SHEETS—Each 1/4" sheet is divided into four half-inch sheets, named respectively N.W., N.E., S.W., S.E. The name of a half-inch sheet thus takes the form—

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

MODERN TOPOGRAPHY
up to 30th September 1941.

REFERENCES.

MODERN SURVEYS (since 1905).
Scale 1 inch to 1 mile, and over.
" about 1/2 inch to 1 mile.
" 1/4 inch to 1 mile, and less.

MODERN COMPILATION (since 1905).
Scale 1 inch to 1 mile, and over.
" about 1/2 inch to 1 mile.
" 1/4 inch to 1 mile, and less.

CURRENT SURVEYS are further distinguished by marks as follows:
Surveyed last season 1940-41.
Proposed for survey in 1941-42.
(with red initials or numbers to indicate the unit concerned).

