

SURVEY OF INDIA
GENERAL REPORT
1933



From 1st October 1932
To 30th September 1933

PUBLISHED BY ORDER OF
BRIGADIER H. J. COUCHMAN, D.S.O., M.C.
SURVEYOR GENERAL OF INDIA.

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Survey of India,
CALCUTTA,
1934.
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BRIGADIER ROBERT HENRY THOMAS, C.S.I., D.S.O.
SURVEYOR GENERAL OF INDIA, 1928-33.

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PREFACE

THE HISTORY AND WORK OF THE SURVEY OF INDIA.

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

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

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

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

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

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

Precise levelling for the determination of heights;

Tidal predictions and publication of Tide Tables for fortyone ports between Suez and Singapore;

The Magnetic survey;

Observation of the direction and force of gravity;

Astronomical observations to determine latitude, longitude and time;

Seismographic and meteorological observations at Dehra Dūn.

Indian geodesy has disclosed by far the largest known anomalies of gravitational attraction in the earth's crust, which have recently led to a reconsideration of the whole theory of isostasy.

Topographical Surveys.—In the past this department used to carry out the large scale revenue surveys for most of India, and was still conducting this work for Central and Eastern India and Burma in 1905.

Though revenue survey is primarily a record of individual property boundaries and is unconcerned with the surface features, ground levels and exact geographical position essential to a topographical survey, it was on the whole found economical to carry out both surveys together.

By 1905 however all the Provinces had taken over the revenue surveys, for which they had always paid, and the Survey of India was enabled to concentrate its energies on a complete new series of modern topographical maps in several colours on the 1-inch to 1-mile scale.

This new series had been rendered necessary by the natural demand for more detailed information to be shown on maps, especially as regards the portrayal of hill features by contours, proper classification of communications and—more recently—air traffic requirements.

It was intended that this 1905 survey should be completed in twenty-five years, and then revised periodically every thirty years. Owing however to the war and more recent retrenchments only two thirds of the programme had been completed by 1932, in spite of a reduction of scale for the less important areas.

Although new surveys covering from thirty to sixty thousand square miles—an area comparable to that of England—are carried out every year, the maps of a large part of the country are still over 50 years old, printed mostly in black only, and have hill features shown by roughly sketched form lines or hachures; such changes in town sites, canals and communications as have been embodied in them have not been surveyed on the ground, but entered from outside information.

Owing to the serious financial situation in 1931, the establishment of the department was severely cut down and its annual expenditure halved, in consequence of which the modern survey of India cannot now be completed before 1950.

The obsolescence of the present series of modern maps of India is shown in the second index map at the end of this report.

Large Scale Surveys.—Surveys and records of international, state and provincial boundaries have always formed an important item of topographical work, and in recent years numerous Guide Maps have been published of important cities and military stations where the 1-inch to 1-mile scale is inadequate.

Miscellaneous.—While expending on topographical and geodetic work all funds allotted by Imperial Revenues, the department is prepared to undertake or aid local surveys, on payment by those concerned, such as

Forest and cantonment surveys;

Riverain, irrigation, railway and city surveys;

Surveys of tea gardens and mining areas, with such control levelling as is necessary for these operations.

Administrative assistance is also given, and executive officers lent, in aid of the revenue surveys of various Provinces and States.

The Printing Offices at Calcutta and Dehra Dūn also carry out work for other Government departments, such as special maps, illustrations for Reports and all diagrams for patents.

The Mathematical Instrument Office of this department assists all Government departments, as well as non-officials, by maintaining a high standard of instrumental and optical equipment and by manufacturing and repairing instruments which would otherwise have to be imported from abroad.

Military Requirements and Air Survey.—The department is also responsible for all survey operations required by the army, and is in a position to meet the rapidly increasing complexity of modern military requirements, especially in air survey.

In view of its high military importance, air survey work for civil purposes is receiving all possible encouragement and assistance, and the latest methods of mapping from photographs taken from the ground are being studied experimentally.

The flying and photography for air mapping done by this department are at present carried out by the Royal Air Force or the Indian Air Survey Company, a commercial firm with headquarters at Dum Dum.

Administration is by the Surveyor General under the Education, Health and Lands Department of the Government of India.

The Headquarters Office is at Calcutta under the Assistant Surveyor General, and there are four Directors, one for the Map Publication and other technical offices at Calcutta, and three for three of the five Survey of India Circles into which the country is divided; the other two Circle areas (covering Burma and South India) are administered personally by the Surveyor General.

Of the three Circle Directors, one also administers the Geodetic Branch at Dehra Dūn in addition to his topographical survey Circle.

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4. " " " $\frac{1}{4}$ -inch [redacted] scale	"
5. India and Adjacent Countries Series, 1/M scale	"
6. Carte Internationale, 1/M scale	"
7. Southern Asia Series, 1/2M scale	"

GLOSSARY.

Scales are referred to as follows:—

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

Serial numbering of Survey of India maps. The system of numbering will be evident by a reference to the Indexes at the end of this report, e.g.

- Sheets 65, 78 &c. are sheets on the 1/M scale;
- Sheets 65K, 78F &c. are ¼-inch sheets;
- Sheets 65K/N.W., 78F/S.E., &c. are ½-inch sheets;
- Sheets 65K/1, 78F/16 &c. are 1-inch sheets.

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.

APPENDIX.

The two photographs in Plates II and III show the great improvement in definition obtained by the use of an infra-red plate and filter (Plate II), as compared to one taken with the usual panchromatic plate and orange filter (Plate III).

The photographs were taken from Bāriān, Murree Hills (7,210 ft.) looking north-east across the Jhelum valley and Kashmir. The snow peak in the right centre of the landscape is Nanga Parbat (26,620 ft.), 115 miles distant, and the hill marked Qafir Khān (11,515 ft.) on the watershed forming the horizon, is 31 miles from the camera.

A comparison of the two photographs shows the utility of infra-red photography for ground photo survey.

At present infra-red plates are comparatively slow, their speed being about one-third the speed of a fast panchromatic plate with suitable light filter. This restricts their use in the air, owing to Camera vibration, to subjects requiring brief exposures such as distant mountain ranges.



PLATE II.

Photo. by Capt. D. R. Crane, R.E.

PHOTOGRAPH TAKEN WITH INFRA-RED PLATE AND FILTER
LOOKING NORTH-EAST FROM HILLS ABOVE BARIĀN (MURREE HILLS) ACROSS THE JHELUM VALLEY.

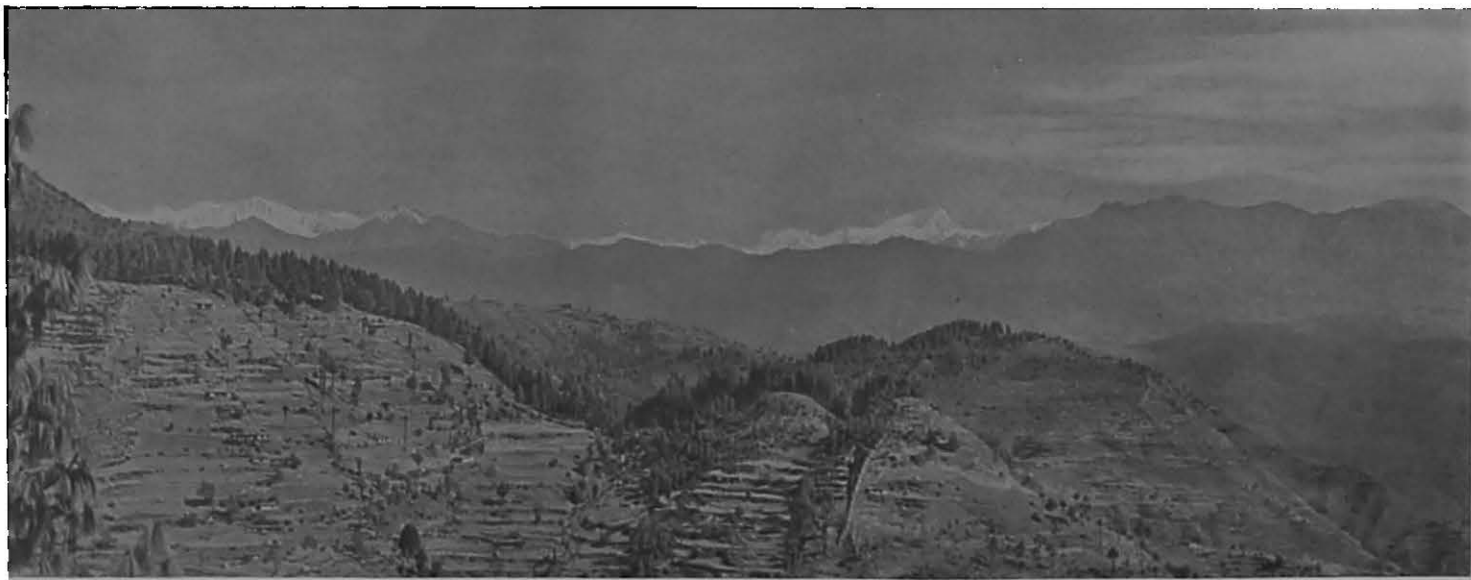


Photo. by Capt. D. R. Crane, U.S.A.

PHOTOGRAPH TAKEN WITH PANCHROMATIC PLATE AND ORANGE FILTER
SAME VIEW AS THAT IN PLATE II.

PLATE III.

Correction to Map Publication & Office Work Report, 1931-32.

Page 13.

Add the following as a fresh sub-para. under "No. 2 & 3 Drawing Offices":—

"The 1-inch sheets reported in hand in Table V included six sheets of air resurvey in the United Provinces, of which the flying and photography was carried out by the Indian Air Survey and Transport Company and the control provided by the Air Survey Traverse Detachment of 1930-31".

Correction to General Report, 1931-32.

Para. 5, page 5, line 25.

Read "1-inch & $\frac{1}{2}$ -inch scales" for "1-inch & 2-inch scales".

Page 11, para. 14.

Read "page 13 of 1931-32 Map Publication Report" for "page 14 of 1931-32 Map Publication Report".

NOTICES

- I. Work done by the Survey of India.
- II. How to obtain maps and other publications.
- III. List of Agents for the sale of maps.

I. WORK DONE BY THE SURVEY OF INDIA

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

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

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

MAPS AND ILLUSTRATIONS can be printed by the *Director, Map Publication, Survey of India, 18 Wood Street, Calcutta*, for Government Departments only, and special maps can also sometimes be prepared, on payment.

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

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

GENERAL ENQUIRIES should be addressed to the Assistant Surveyor General, 18 Wood Street, Calcutta. (Telegrams "Surveys"), as the Surveyor General of India is on tour during most of the year.

* Provinces and States in each Survey Circle.

- | | | |
|--|---|--|
| <p>1. FRONTIER Circle
Kashmir and Jammu
N. W. F. Province
Baluchistan
Punjab and Delhi
Punjab States
Bihar and States of
W. Rājputāna.
Part of Bombay†
Cutch.</p> | <p>2. GEODETIC Branch No. 6 (South India) Party.
United Provinces
Central India
Gwalior
Ajmer-Merwāra
E. Rājputāna States
Baroda
Part of Bombay†
States of Western
India (less Cutch).</p> | <p>3. EASTERN Circle
Central Provinces
(including Berār).
Bihār and Orissa
Bengal Presidency
Assam and Sikkim.
States of Eastern India.</p> |
| <p>5. No. 10 (Burma) Party.
Burma.</p> | | |

† Bombay Presidency—Sind is in the Frontier Circle: Northern Div. is Geodetic Branch, remainder in No. 6 (South India) Party.

II. HOW TO OBTAIN MAPS AND OTHER PUBLICATIONS

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

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

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

SURVEY PUBLICATIONS OTHER THAN MAPS are obtainable through the Director, Geodetic Branch, Survey of India, Dehra Dūn, who will supply *gratis* a full *Catalogue* of the following :

- (a) *Trigonometrical data.* Triangulation pamphlets, each covering one square degree, giving descriptions, positions, and heights of triangulated points and other data, with chart. Levelling pamphlets, each covering $4^{\circ} \times 4^{\circ}$, giving descriptions and heights of Bench-marks, with chart.
- (b) *Tidal Predictions*, published annually in advance as *Tide Tables of the Indian Ocean*. These tables contain predictions for about 40 Indian and Burmese ports, and for about 25 other ports in various parts of the world.
- (c) *Geodetic works of Reference*—The G.T.S. series of twenty-one large quarto volumes describing in detail the geodetic operations of the Great Trigonometrical Survey from 1800. Detailed accounts are given of the Base-line measurements, of the reduction of the Geodetic Triangulation treated in five portions, of the early Pendulum observations, of Telegraphic Longitude and Astronomical Latitude operations, of Tidal observations, and of Levelling of high precision.
- (d) *Historical, and General Reports*, including the "Memoirs on Indian Surveys" by Sir Clements Markham and C.E.D. Black : also Annual Reports, Narrative Reports, Record Volumes, and the annual Geodetic Reports.
- (e) *Miscellaneous.* Papers on Geodesy, Exploration, etc.

(The Catalogue is also included in the Annual Geodetic Report.)

III. LIST OF AGENTS FOR THE SALE OF MAPS

OUT OF INDIA.

- England.* 1. Secretary to the High Commissioner for India-
(General Department), India House, Aldwych,
London, W. C. 2.
2. Sifton Praed & Co. Ltd., The Map House, 67
St. James's Street, London, S. W. 1.
- America.* 3. C. S. Hammond & Co., 30 Church Street,
Hudson Terminal, New York, and 75 State
Street, Boston, Mass.
- Germany.* 4. Dietrich Reimer, Berlin, S. W. 48.

INDIA.

- Agra.* 1. English Book Depot, Taj Road.
2. Indian Army, Book Depot, Dayal Bagh.
- Allahabad.* 3. North India Christian Tract and Book Society.
- Ambala.* 4. Ram Chander & Sons.
- Bangalore.* 5. Higginbothams Ltd.
- Bombay.* 6. Thacker & Co.
7. D. B. Taraporevala Sons & Co.
8. King & Co., 213-215 Badri Mahal, Hornby Road.
- Calcutta.* 9. W. Newman & Co., 3 Old Court House Street.
10. Automobile Association of Bengal, 40 Chowringhee.
11. City Map Agency, Govt. Book Depot, 8 Hastings St.
12. Oxford Book & Stationery Co., 37/39 Park St.
13. Standard Book & Map Agency, Ballygunge.
14. S. K. Khana & Co., B. 45 Municipal Market.
15. Thacker Spink & Co., 3 Esplanade East.
- Cawnpore.* 16. Advani Brothers.
- Dacca.* 17. Provincial Library.
- Darjeeling.* 18. Oxford Book and Stationery Co.
- Delhi.* 19. Oxford Book and Stationery Co., Kashmere Gate.
20. Romesh Book Depot and Stationery Mart.
21. J. M. Jaina & Brothers, Mori Gate.
22. Bhawani & Sons, Connaught Place.
- Ferozepore.* 23. English Book Depot, Wazir Ali Buildings.
- Jhansi.* 24. English Book Depot.
- Karachi.* 25. Hoosenbhoy Karimji & Sons, Napier Road.
26. Keale & Co., Book Corner, Elphinstone Street.
- Kasauli.* 27. Ram Chander & Sons.
- Kashmir.* 28. Cockburns Agency, Srinagar.
29. Bекett & Co., Srinagar.
30. D. G. Smith & Co., Srinagar.
- Lahore.* 31. Punjab Religious Book Society, Anarkali.
32. Standard Book Depot.
33. Oxford Book & Stationery Co.
- Lucknow.* 34. Davy & Co.
- Madras.* 35. Higginbothams Ltd.
- Meerut.* 36. Oxford Book & Stationery Co.
- Murree.* 37. J. Ray & Sons, The Mall.
- Mussoorie.* 38. The Mussoorie Book Society.
39. Davy & Co.
- Muzaffarpur.* 40. Burman & Co.
- Nagpur.* 41. Superintendent, Govt. Printing, Book-Depot.
- Peshawar.* 42. Northern India Book Depot.
43. Sham Lal & Sons.
- Quetta.* 44. Standard Book Stall, Club Corner.
- Rangoon.* 45. The Curator, Government Book Depot, Burma.
- Rawalpindi.* 46. J. Ray & Sons, 43 K & L, Edwardes Road.
- Simla.* 47. Oxford Book & Stationery Co.

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