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1923

Survey of India.

CONSTITUTION AND ORGANISATION
OF A SURVEY PARTY.

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This pamphlet forms Chapter II of the Handbook of
Topography, prepared by Colonel Gordon, I.A.,
in 1911.



DEHRA DUN.
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LIST OF CHAPTERS OF THE
HANDBOOK OF TOPOGRAPHY,
PREPARED BY COLONEL GORDON, I.A.,
IN 1911.

- CHAPTER I. Introductory.**
- .. **II. Constitution and Organisation of a Topographical
 Survey Party.**
- .. **III. Triangulation and its Computations.**
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CHAPTER II.
CONSTITUTION AND ORGANISATION
OF A SURVEY PARTY.

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From paragraph 43, on, the original numbering of the paragraphs has been altered in this reprint.

CHAPTER II.

CONSTITUTION AND ORGANISATION OF A TOPOGRAPHICAL SURVEY PARTY.

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CONSTITUTION & ORGANISATION OF A TOPOGRAPHICAL SURVEY PARTY.

SECTION I.—GENERAL.

1. The constitution of a topographical survey party depends on the nature of the country, the area to be surveyed, and the scale of survey. For most of the Indian Empire a survey party of normal strength, in the field, will ordinarily consist of an officer in charge, four to eight officers of classes I and II and the upper subordinate grade (of whom three or four would be given charge of survey camps and the remainder would be employed on triangulation, or be under training in plane-tableing), thirty to forty surveyors, two clerks and the due proportion of *khalasis* and other menials. In parties where much traversing has to be done, some traversers and computers will also be required.

Constitution of a topographical survey party.

2. Although every effort should be made to recruit the bulk of the menials from the districts in which the work lies, it is always necessary, for the sake of efficiency and economical working, to have a certain number of trained and trustworthy menials on the permanent and temporary strength of a party: these should include a *jamadār*, and a suitable proportion of *tindals*, mates, and heliotroppers. In some parties it will prove economical to enlist a carpenter and blacksmith, and parties working in Burma and Assam may require a proportion of *barkandazes*. Each surveyor also should be allowed to enlist a *khalasi*, preferably one from his own country, to look after his tent and its contents while he is at work, and to assist in cooking his meals, thus allowing the surveyor to devote as much of his time as possible to his field work.

Menials.

3. In some parts of the country it is necessary to obtain the services of a police guard, to bring the pay of the party from the treasury, and to distribute it to the various detached sections. *Tahsil peons* are also sometimes attached to the different officers and surveyors, to assist in procuring transport and supplies; in Burma, it is also usual to have a certain number of interpreters in the field.

Police Guards, Tahsil Peons, and Interpreters.

4. The work of a topographical party in the field may be conveniently divided into two classes, *viz.* (i) triangulation (including previous reconnaissance) or traversing, or both, and (ii) plane-tableing. The general control of the operations is vested in the officer in charge, whose duty is so to apportion the work among his subordinates as to secure the maximum outturn of thoroughly reliable work

Division of work and duties of an officer in charge of a party.

SECTION 1.—GENERAL.

at a minimum cost. The ultimate test, by which the results are judged, is the quality and cost of the finished map and it will be found that officers who display the greatest skill in managing their parties, and in planning and controlling the work of their assistants, will obtain the best results.

The officer in charge of a party should take a leading share in every part of the duties in the field and recess. He should be constantly inspecting the work of each camp, and instructing the officers and men under him; he should, especially, spare no pains in training newly joined officers in the theory, as well as in the practical use of the theodolite and the plane-table. He should circulate the various departmental orders to his officers, and should satisfy himself that they study their handbooks and keep them up to date.

Duties of Camp Officers.

5. A camp officer is responsible for the work entrusted to him. Junior officers should not be placed in charge of camps until they have done at least two field seasons plane-tabling, and one triangulating. Except for the short time he has to attend to the examination of bills and returns from his men, before despatching them to the officer in charge, and to the distribution of their pay, a camp officer should be constantly marching about and visiting the plane-tablers, checking their work, helping them out of difficulties, and training the junior members of his camp, and any soldier surveyors who may be attached to it. He should be a man of tact and resource, and of active habits, punctual in the submission of accounts and returns, and methodical in all matters connected with the management of his camp.

Accuracy and Adeliity of Field work.

6. It cannot be too strongly impressed on all members of the department, that every consideration should give way to the one great and paramount object of turning out good work, which may be thoroughly relied on by the public, and which will be found, on examination in the field, to be as accurate as it appears to be on paper. The public service requires the maximum amount of work of the best description; it expects quantity as well as quality; but quantity without quality is of very questionable value; the outturn should, therefore, on no account be permitted to exceed what can be accomplished with an appropriate degree of fidelity. The surveyor should resist all temptation to gain fictitious credit by departing from the strict line of duty. It may be difficult for him to refrain from injudicious haste, when he knows that some of his brother surveyors are working with greater rapidity than himself and are likely to gain more credit than himself because they happen to have a greater show of work; his duties appertain to his own work only, and if he is careful to make it as good as possible, it will always be a credit to him, and to the department.

 SECTION I.—GENERAL.

7.* Officers and surveyors who, after having been sufficiently trained, submit field work that requires to be revised, render themselves liable to forfeiture of pay during the time occupied in revision.

Officers to forfeit pay if their work has to be revised.

8.* Any person who may submit documents, maps, or plans, for record, containing intentional errors, should be prosecuted by the officer in charge of the party to which the individual belongs, under sections 167 and 218 of the Penal Code.

Penalty for falsification of records.

9. Before taking the field, the officer in charge of a party, besides making himself thoroughly conversant with the details of all the previous survey operations which have taken place in the area allotted to his party, should place himself in communication with the local officials, especially forest officers, and should ascertain the nature of the communications, the resources of the country, as regards transport, supplies, and local labour, and the current rates for the same, as well as the most suitable months for carrying out survey operations, with due regard to climate and health. He should obtain copies of gazetteers and other books containing information about the country and copies of Government notifications of boundaries. He should also obtain maps prepared by local officials and by other departments, such as *musāvis*, *mujhmilis*, tahsil maps showing village and other boundaries, canal maps showing levels, railway maps, and large scale maps of cantonments and municipal towns as well as all departmental maps of the area under survey.

Necessity for obtaining all available information regarding the area for survey.

Much useful information can be obtained from the narrative reports of survey parties which have previously worked in the area, and advantage should be taken of the experience of the triangulators and traversers who have preceded the detail survey. It is sometimes advisable for the officer in charge to make a tour through the country to be surveyed, in the year preceding the detail survey, in order to obtain a personal knowledge of local conditions. The success of the work will depend greatly on the care with which preliminary enquiries have been carried out.

10. The care of the health of such a large body of men is a most important matter, and one which should receive the greatest attention. In some parts of the country, where civil dispensaries are frequent, recourse should be had to them in cases of illness, but, in sparsely populated and out of the way districts, it is necessary to have the services of a Sub-Assistant Surgeon who should be attached to the party. A plentiful supply of fresh medicines should be provided, and each camp officer, and surveyor or traverser, should be supplied with a medicine chest. The pattern known as "District Officer's chest" is most suitable for camp officers and the "D modified" pattern for surveyors and traversers (*vide* para. 35).

Medical arrangements.

* *Vide* General Hand-book paras. 82 and 83.

SECTION I.—GENERAL.

All serious cases of illness should be at once reported to the headquarter camp, and, when there is no Sub-Assistant Surgeon, should be sent to the nearest civil hospital or dispensary. Useful medical hints will be found in "Moore's Family Medicine" and in "Hints to Travellers."

Transport.

11. When permanent transport is attached to a party, officers should see that the animals are properly loaded and cared for, and regularly provided with sufficient fodder of good quality. Elephants especially require great care, and useful information regarding them will be found in Appendix I, as well as in Colonel Evans' book "Elephants and their Diseases" which should be in the possession of every party to which elephants are attached.

Equipment.

12. The efficiency of a party depends to a great extent on its stores, instruments, and tents being complete and in good order. The equipment should be regularly overhauled and checked at the end of every field season; arrangements should be made for the repair of damaged articles; worn out and unserviceable articles should be condemned by a committee, and unnecessary articles should be returned to store.

All members of a party should understand that they are personally responsible for the care and safe custody of all Government property entrusted to their charge.

Guarding stores.

13. Stores and public property should not be kept in a closed tent, with a single sentry outside; such an arrangement is unsafe, and unfair to the man on guard. The most secure method of guarding property is to collect it in an open spot, from which the sentry can have a clear view on all sides; the articles should be raised above the influence of damp ground, and of white ants, by means of wooden trestles, stones, or bricks and protected from the weather. Delicate instruments liable to injury from exposure can be guarded securely if placed in a *shuldāri*, or open *pāl*. When the strength of the guard is insufficient for furnishing a double night sentry, the *khalasis* of the establishment must take their turn on such duty.

The care of Government property.

14. All Government property should be stored in a masonry building, whenever practicable. When left at "*khamāts*" or "godowns," proper arrangements should be made for its safe custody. Every precaution should be taken against damage to, or loss of, Government property by theft, fire in tents or godowns, and in transit by post, boat, or rail.

Carriage of survey instruments in the field.

15. It should be specially noted and impressed on all members of the party that survey instruments, such as theodolites, levels, plane-tables, &c., should, except in very exceptional circumstances, always be carried by the *khalasis* and not on carts, or mules or other animals. Should it be unavoidable to carry theodolites or other delicate instruments in carts, a layer of branches placed under the boxes will be found to be an excellent substitute for springs, and to prevent injury from jolting.

SECTION I.—GENERAL.

16. Members of a topographical survey party have many opportunities of collecting information and statistics about the country under survey, and it is most important that they should avail themselves of such chances, especially in little known districts. The officer in charge of the party should impress upon his officers the great value of information of this kind when intelligently collected and systematised.

*Statistical
and other
information.*

Information regarding discoveries of objects of archæological interest should be reported to the Superintendent of the Circle, who will forward the report to the Local Government or Administration within which the discovery is made.*

Specimens of arms, ornaments, dresses, household utensils, tools, agricultural implements, musical instruments and other articles, illustrative of the state of arts among the aboriginal and other jungle tribes, which may be of use to the Trustees of the Indian Museum, as affording materials for a comparative study of the arts as practised by races in an early stage of social development, can sometimes be collected by members of a survey party: proposals for the formation of such a collection should be made to the Honorary Secretary to the Trustees of the Indian Museum.†

17. Officers in the field must do all in their power to prevent oppression of the villagers by any members of the establishment or by their servants; they will report at once to the officer in charge any circumstances of this nature coming to their notice. If kindly treated and considerately dealt with, the inhabitants will be found willing and ready to afford assistance whenever necessary, and it should be borne in mind that the work will progress more smoothly when good relations have been established with the inhabitants.

*Prevention of
oppression of
villagers.*

Members of a party are granted certain concessions in the matter of tents and travelling allowances, and are, therefore, prohibited from demanding accommodation in houses.

It is the duty of every officer to pay for all supplies received by him at the rates laid down by the authorities, and to see that his subordinates and servants do the same.

In the past it was customary in some districts for villagers to supply water, grass and firewood free, but this was an act of courtesy and could not be enforced. The custom has been legally abolished and it is necessary for officers to ensure that their servants do not attempt to obtain gratuitous labour or supplies.

It is desirable, in order to avoid any chance of unpleasantness, that all members of a party, before moving camp, should obtain an

* See Appendix II.—Rules regarding submission of reports regarding objects of archæological interest.

† See Appendix III.—Collections to be furnished to the Indian Museum illustrating the arts practised by the aboriginal and other jungle races of India.

SECTION I.—GENERAL.

acknowledgment, from the headman of the village from which they have obtained their supplies, that all demands have been settled in full.

Indian States.

18. The above precautions are specially necessary in Indian States. Should it be found that any member of a party working in an Indian State has any cause for complaint, a representation should be made, by the officer in charge of the party, to the political officer.

Presents and gratuities prohibited.

19. Surveyors and others who can be proved to have received, on any pretence whatsoever, any present or gratuity from the inhabitants or authorities of the district in which they may be employed, or from their subordinates, are liable to be summarily dismissed and proscribed. They are also liable to be made over to the civil power for trial.

Further rules on this subject are laid down in the "Government Servants' Conduct Rules."

Trespassing and sporting prohibitions.

20. All members of the Department indulging in sport are warned*—

(a). Against trespassing on standing crops without the consent of the owners.

(b). Against shooting pea-fowl, or other birds or animals which are looked upon as sacred.

(c). Against shooting domestic animals, such as dogs or pigs.

(d). Generally against shooting or fishing in the immediate neighbourhood of villages, temples, or mosques.

Officers in charge of parties should obtain copies of local game laws and regulations for the provinces and states in which their parties are working, and should take precautions for their observance by all members of the establishment.

General Report.

21. Directions regarding the preparation of the General Report and of the annual report of a party for the preparation of the Record Volume are given in the Handbook of General Instructions. The officer in charge of the party should endeavour to make the latter report useful for reference by parties which may work in the same area in the future; he should also include in the report brief notes on any marked physiographical changes that may come under observation.†

Maintenance of maps and charts in the offices of topographical parties and drawing offices.

22. Officers in charge of topographical parties and drawing offices are required to keep one copy of the latest edition of all published topographical and district maps, triangulation and traverse charts, of the province in which they are working, carefully stored in an

* Government of India Order No. 238, dated 5th October 1895. See also General Hand-book, para 80.

† *I*de appendix IV and General Hand-book, para 266 *et seq.*

SECTION I.—GENERAL.

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† *Ide* appendix IV and General Hand-book, para 286 *et seq.*

SECTION I.—GENERAL.

almirah, and arranged in drawers. The sheet number should be stamped on the right hand lower margin of each sheet, where it can be readily seen on pulling out the drawer, and the sheets returned daily to their proper places in the almirah after use. They should be correctly coloured, and kept for reference and not for ordinary office use.

Officers in charge should consider it a duty to make themselves thoroughly conversant with the history and quality of each one of these sheets, noting all information on these points in ink on the backs of the sheets. They will thus be enabled to report at any moment to their administrative officers, as to the needs of the area allotted to their parties in the matter of topographical maps, and to point out where new surveys are required, and over which areas a revision or supplementary survey will suffice. To aid them in attaining this knowledge, and for ready reference, they should prepare index maps, and also keep up a register giving, as far as possible, all the requisite information. It is also desirable that they should acquire a general knowledge of the history and quality of all revenue surveys that have been conducted in the province, whether by Imperial or local agency, so as to be able to judge whether the material thus available can be made use of. They should take every opportunity when in, or going to or from, the field, of roughly examining the work in any of the sheets previously surveyed through which they pass, so as to get as correct an idea as possible of future requirements, and whenever possible should, under the orders of the Superintendent, survey and record on the maps any new roads, canals, or railways, &c. that may have been made since publication, so that should a new edition or reprint of any sheet be required, the new work may be shown on it.

When any work, which has been previously surveyed and fair mapped, is found to be incorrect, a report accompanied by a trace showing the necessary corrections in their proper colours should be submitted to the Circle Superintendent, who will, if the fair map in which the error occurs has been already despatched for publication, forward a copy of the report and trace to the Superintendent, Map Publication, for such action as he may consider necessary.

23. Registers of the receipt and despatch of all fair maps, field sections, computations, &c., should be kept up in every party and office. *Registers of fair maps, &c.*

A separate register of all reserved forest surveys executed by the party is to be maintained, showing the year and scale of survey, date of submission of plane-table sections, method of publication (normal or special), whether 4-inch boundary plots were prepared and, if so, the date of their despatch to the Superintendent of the Circle.

SECTION II.—PREPARATION FOR THE FIELD.

*General
administration
of a topogra-
phical party.*

24. The general administration of a topographical party may be divided into—

Preparation for the field.

Duties in the field.

Preparation for recess.

Duties in recess.

SECTION II.—PREPARATION FOR THE FIELD.

Programmes.

25. The first, and one of the most important preliminaries to a survey, is the preparation of the programme*. On this depends the strength of the party, and the question of transfers of officers and subordinates, which, in the interests of the work, as well as for the convenience of those concerned, it is well to arrange as soon as possible.

The area allotted to each party for a period of years is usually laid down in advance by the Surveyor General, but it is the duty of an officer in charge to draw up each year a detailed programme of the work he proposes to carry out in the following field season and the succeeding one.

In doing this he should endeavour so to lay out the work of his party that, within the limits of the area allotted to it, he shall as far as possible meet the requirements of the Local Government of the Province in which he is working and those of any other authority which have been officially communicated to him. He should bear in mind the importance of keeping the work of his party concentrated so as to facilitate supervision, of completing the survey of whole half-inch and quarter-inch sheet areas at the earliest date and, where old style maps of the area in which his party is working exist on the same scale as those which it is preparing, of completing the re-survey of the whole of the area of each of these maps at once, so as to obviate the necessity of the further maintenance of a stock of them in the Map Publication Office. The programme thus carefully thought out, must be submitted, not later than the 15th of May of each year, to the Circle Superintendent, who will include it in the programme of the Circle, which is required to be submitted to the Surveyor General not later than the 10th June. The Surveyor General then draws up the general programme for the Department for the sanction of the Government of India.

* See appendices V and VI.

SECTION II.—PREPARATION FOR THE FIELD.

The Superintendent of a Circle is required to obtain the approval of the local Governments in his Circle to the programme, in so far as it affects each Government respectively.

This should be done, if possible, before the general programme of the Circle is submitted to the Surveyor General, and, in the covering letter with which the programme is submitted to the Surveyor General, the Superintendent must state which Governments have approved of the proposed programme. The approval of the other Governments should be communicated to the Surveyor General on their receipt by the Superintendent.

26. After he has submitted the programme the officer in charge should, unless there is a chance of any important change, decide on the general plan of operations, selecting the most convenient centres for his headquarter camp, and for the standing camps of the different camps into which the party is divided. It is essential that the headquarters of the party should be conveniently situated as regards a treasury, and post and telegraph offices. The camp headquarters should be selected so as to be in easy communication with the surveyors belonging to it.

General plan of operations.

The work of the various camps should be apportioned so as to secure the maximum outturn of work at a minimum cost. The camp officers should then divide up the areas allotted to them among their surveyors and submit their proposals to the officer in charge for his approval.

In arranging the allotment of plane-tables to surveyors, it should be borne in mind that it is necessary to complete the plane-table sections of several sheets well before the close of the field season, in order that they may be despatched to a reproducing office for the preparation of enlargements and the subsequent supply of blue prints for fair drawing, in time to allow of the drawing being put in hand at once on the return of the party to recess quarters.

27. The most suitable number of surveyors to allot to a camp officer will vary according to the scale, the nature of the country, and the skill and experience of the surveyors. Inexperienced surveyors require the greatest amount of supervision, and this should be taken into account when fixing the strength of the various camps: facility of communication is also an important factor. Under ordinary circumstances a camp officer should be able to exercise sufficient supervision over 8 to 10 surveyors working on the 1-inch scale, and a larger number, say 12 to 15, in the plains. It is not necessary however to have all camps of equal strength.

Strength of camps.

28. The most suitable time for taking the field should then be fixed, but formal permission for closing the recess office need not be

Duration of field season.

SECTION II.—PREPARATION FOR THE FIELD.

applied for until a month before the party is to leave for the field. The field season should last for about six months, but the date of commencing and closing field work varies in different parts of India. In malarious districts little benefit is gained by commencing field work before the middle of November, while in Rajputana, Sind, and in parts of the Punjab and of the United Provinces, out of door work becomes almost impossible after April. In Burma and Assam little in the way of triangulation or reconnaissance can be done during March and April, owing to the dense smoke haze which obscures all distant points. It should therefore be borne in mind that the period of a field season varies with local and climatic conditions, and does not depend on the programme of work, which is merely an approximate estimate of a season's outturn. If a party completes its programme before the time fixed for the close of the field season, it should take up additional work, with, however, the essential proviso that only in very exceptional circumstances and with the sanction of the Administrative officer, should a larger area be surveyed than can be drawn in the recess season.

Strength of
squad.

29. The above arrangements having been settled, the number of *khalasis* required should be calculated. This number varies according to local circumstances, a fair ordinary number being 4 or 5 for each surveyor working in the hills, and 6 or 7 where constant chaining is required, 20 for a triangulator, 10 for a traverser, 10 for a camp officer, 9 for the officer in charge, and about 12 for headquarters. In parts of the country, such as Baluchistan and Burma, where local *khalasis* are not obtainable, it is generally advisable to make a slight increase in the numbers so as to form a reserve.

The permanent and temporary men on leave pay should first be written to and informed when and where they should report themselves; arrangements should then be made to have any extra men who may be required, recruited, either by tindals or by a special recruiting officer.

Warm clothing.

30. If it is deemed necessary to supply the menials with blankets and warm clothing, sanction should be applied for, according to the scale laid down, and arrangements should be made for obtaining the articles.*

Transport.

31. When obtainable locally, transport should be arranged for as required by each officer and surveyor. This is a much cheaper plan than keeping permanent transport, but there are cases where the latter plan is the only one possible; in such cases the sanction of the administrative officer should be obtained and early arrangements

* See Appendix VII and General Hand-book, para 549.

SECTION II.—PREPARATION FOR THE FIELD.

made with the local officials, contractors, commandants of camel and mule corps, or the Indian Army Service corps. In applying for administrative sanction the amounts to be recovered from the travelling allowances of officers of each grade should be mentioned.

32. Early notice of the approach of a survey party must be given to local officials, the position of the headquarters of the officer in charge and of the camp officers being intimated; it is sometimes also advisable to supply an index map showing the distribution of surveyors. The head of each district should be asked to issue orders to all *tahsildars*, *lamhardars* and other minor officials, to render all assistance to the members of the party, and to point out boundaries when required. The request should be worded to make it clear that all supplies and labour will be paid for. Local rates for transport, labour and provisions should be ascertained and permission to use all Government bungalows should be asked for.

Notice to local officials.

In the case of a party working in an Indian state, communications regarding the work should in the first place be made by the Circle Superintendent to the Resident or Political Agent, who should be asked to arrange that the officer in charge of the party be allowed to communicate direct with the state officials on all matters of detail.

33. All data with regard to the area to be surveyed should be obtained early in the recess season.

Data.

The Triangulation Pamphlets and Levelling Pamphlets must be consulted and, if the area has been topographically triangulated, the synopses and, if these are not available, the computations and charts must be obtained from, or through, the administrative officer.

If the area has been traversed instead of being triangulated, application should be made to the Administrative officer for the necessary information.

The results of the precise levelling executed by the Trigonometrical Survey are contained in pamphlets, each pamphlet dealing with the area of one of the sheets of the $\frac{1}{M}$ map. Besides procuring the pamphlets, application should be made to the Trigonometrical Survey Office for particulars of any work that may have been done since their publication.

34. Copies of all available maps of the area for survey, both those of the Survey of India and other special or local maps, should be obtained, and such reductions as may be required should be arranged for in good time.

Existing maps.

35. Arrangements for refitting medicine boxes should be made during the recess, and indents for medicines should be submitted with the countersignature of the Civil Surgeon. The surgical equipment of the party should be examined and checked during the recess.

Indents for medicines, &c.

 SECTION II.—PREPARATION FOR THE FIELD.

When a Sub-Assistant Surgeon is deemed necessary, a requisition for his services should be submitted.

Funds.

36. The usual requisition for funds should be attended to so that no delay on account of want of money may occur.

Instruction of surveyors.

37. If any surveyor has been found not to be sufficiently familiar with the ordinary symbols, the use and adjustment of the clinometer and its computations, the preparation of returns and accounts, &c., he should be given special instruction by his camp officer before taking the field.

Inexperienced triangulators also will require careful instructions in the provisions of Chapter III before they take the field.

Escorts.

38. When a party is working on or near the frontier, where escorts are deemed necessary, early information must be given to the local political officer regarding the localities in which work will be carried on, so that he may make arrangements and fix the strength of the escorts.

Mounting plane-tables.

39. The arrangements for mounting plane-tables differ in different parties and in different parts of India, and it is impossible to lay down hard and fast rules on the subject. Generally speaking it is advisable to bring the plane-tables back to recess quarters and to mount them there. As soon as the rains are over the boards should be exposed to the sun for a fortnight or three weeks before mounting, to get them shrunk as much as possible. The boards should be mounted as long as possible before they are projected and plotted. During the interval they should be kept in a dry place and should be put out on fine days to dry in the sun. If these precautions are taken, a great deal of trouble due to the subsequent contraction of the board and paper is avoided.

Instead of mounted plane-tables (as described above) 6-ply Bristol boards and mounted straw boards are now extensively used by plane-tables—See Chapter V, para 8.

Advance section from recess.

40. When it is not practicable to bring the plane-tables to recess quarters, a couple of suitable men must be sent to the *khamâl*, where the boards are kept, to carry out the work. When the boards are ready and sufficiently dry, an advance section should be despatched to project and plot them; two officers and six surveyors will generally be found sufficient for the purpose and should be able to project and plot about thirty-two boards in a fortnight; if, however, the data consist of traverse points a larger section may be necessary.

Equipment.

41. At the close of every field season instruments, tents, &c., should be examined, and all further requirements should be indented

SECTION II.—PREPARATION FOR THE FIELD.

for and arrangements should be made for the local repair of damaged tents and camp equipment.

The senior officer with the advanced section should have all tents, instruments, &c., taken out of the field *khamāl*, and got ready for issue to the surveyors and camp officers. In certain cases it is convenient to have separate rendezvous for the different sections of a party, in which case arrangements should be made to despatch their equipment in good time, and so avoid delay.

42. It is the most convenient plan to issue stationery and forms to members of a party from recess quarters. The issues should be made in bulk to camp officers. *Stationery and forms.*

43. Before proceeding to the field, reductions of the edges of adjoining fair sheets or traces of the edges of adjoining published sheets, should be obtained; these edges should be transferred in blue on to the plane-tables before the surveyors commence work. Information as to wooded areas in adjoining sheets should also be taken to the field for the adjustment of the current work. *Edges.*

44. Before the survey of any area which includes any portion of the external boundary of India is undertaken, the officer in charge of the party must apply through the Administrative officer to the Superintendent Map Publication for copies of existing maps showing the boundaries, and for a full description of them. As the information required will generally have to be obtained from the Foreign Department, applications must be submitted well in advance of requirements. *External boundary of India.*

In the case of the boundary of an Indian State, or of any Tributary State or Tribal Territory, a full description of the boundary should be obtained by the Superintendent of the Circle from the Local Government concerned. |

Superintendents must see that full information on these points is supplied to the officers in charge of the parties concerned.

45. As any delay, after a party leaves its recess quarters for the field, means extra expense and reduced outturn, it is essential that every possible precaution should be taken to avoid it. All lists of data, equipment, instruments, furniture etc. to be issued to the different camps should be prepared, and the dates by which the different batches of *khalasis* are to reach the Head Quarter camp or other rendezvous must be carefully worked out and arranged for in plenty of time before the party leaves recess quarters. *Importance of avoiding delay in starting field work.*

 SECTION III.—DUTIES IN THE FIELD.

SECTION III.—*DUTIES IN THE FIELD.*

Commencing
work.

46. The officer in charge, having issued his orders and made arrangements for the despatch of each camp or detachment, the members of the party should proceed to their work without delay.

Progress
Reports.

47. As soon as possible, after the parties have taken the field, officers in charge of parties will submit to the Administrative officer, for transmission to the Surveyor General reports in the prescribed form (O. 77) stating the organisation and distribution of the establishment and work of each party, with brief remarks on the commencement of the work. Similar reports, with brief remarks stating in general terms the progress made, should be submitted for transmission to the Surveyor General with the returns for January.

Tours of the
officer in charge.

48. The officer in charge of the party and camp officers should move freely about their respective areas, as constant inspection in the field is essential in order to secure good work, sufficient output, and uniformity of style. It is only by being able to compare the work of individuals that an officer can arrive at a standard of quality and quantity by which the work may be judged.

The officer in charge of a party should be able, after completing his monthly accounts, reports, etc., to devote at least three weeks of each month, and often longer, to touring. During his tours he should have the following objects in view:—

(a) To make himself thoroughly acquainted with the area under survey so as to be able to decide on doubtful points, such as the classification of roads, &c., and the manner of showing on the fair maps the different classes of country.

(b) To inspect as many boards as possible, endeavouring to see each surveyor actually at work at least once during the season.

(c) To inspect the various camps, and to consult with camp officers regarding the progress of the work, the allotment of boards, &c.

(d) To work with and instruct officers and upper subordinates under training, and to satisfy himself that camp officers are imparting instruction in a uniform and satisfactory manner.

(e) Although it is not absolutely essential that an officer in charge should inspect triangulators and traversers in the field, it is desirable that he should arrange to meet each of them, at least once, in the course of the field season.

 SECTION III.—DUTIES IN THE FIELD.

49. The most important duties of a camp officer consist in the testing and examination of the work, and the instruction of the younger and less experienced members of his camp, including soldier surveyors. He should spend several days at a time with backward men, observing their methods of work, and showing them how to overcome difficulties. He should make it a rule to visit each surveyor at least once every month. In some circumstances this will not always be possible and it is more important that a camp officer should make a thorough test of his Surveyors' work, spending two, or more, days with them, if necessary, than that he should make frequent cursory examinations. His duties connected with monthly returns and accounts are not of an arduous nature, and ought not, as a general rule, to occupy him for more than four or five days in a month. It is sometimes a good plan for a camp officer to reserve a small area in the neighbourhood of his camp for survey by himself. This will prevent him from growing rusty in the practice of his profession. In addition to the examination of topographical details, a camp officer should pay particular attention to the verification of boundaries and to the agreement between the work of the various surveyors. He should always include a theodolite in his camp equipment and should be prepared when necessary to carry out such additional triangulation or traversing as may be found necessary. He should, in the course of his inspections, examine cash books, village lists, diaries, and instruments, especially clinometers which should be constantly tested.

Duties of camp officers.

50. Survey officers should make a point of becoming personally acquainted, not only with the district officers, but with officers of other departments such as the Public Works, Canals, Railways and Forests, and should endeavour to interest them in the work.

District officers and other officials.

51. It is important that all officers and subordinates of a party should inform their immediate superiors of any change of address.

Change of address.

52. Whenever the work of any surveyor for the field season has been completed, examined, and the edges adjusted, his equipment should be taken over and his squad paid up and discharged or sent on leave. He himself should then be sent at once to recess quarters, or on leave, as the case may be. Each *khalasi* must be asked at the time of final payment whether he has received his dues in full and any claim he puts forward must be investigated.

Breaking up of establishment.

 SECTION IV.—PREPARATION FOR RECESS.

SECTION IV.—*PREPARATION FOR RECESS.*

*Despatch of
plane-table sec-
tions to Photo.
Office.*

53. As soon as a plane-table section is completed, the dimensions to which it is required to be enlarged, reduced or reproduced should be recorded on form O.143 one copy of which should be pasted on the back of the south-east corner of the plane-table section, another copy being attached to the forwarding letter; in the case of a section on which only a small area has been surveyed the dimensions should only be given for the smallest possible quadrilateral, comprising complete 5' squares of latitude and longitude, that will include the work. The section should then be despatched to the nearest reproducing office. If several plane-table sections are ready at the same time they should be despatched together, but no section should be unnecessarily delayed. By this means some enlargements will be ready by the time the party arrives in recess quarters, and the remainder will arrive in regular succession, thus ensuring the provision of regular work for the recess establishment. The block in the photo. office, which is otherwise apt to occur at the end of a field season, will also be avoided if plane-table sections are despatched promptly whenever they are completed.

Particulars regarding the number of prints required, and their colour, as well as the description of paper on which they should be printed, should in each case be entered on form O.143 referred to above.

*Importance of
starting work
early.*

54. A party which is able to commence work directly on arrival at recess quarters is more likely to complete its fair mapping in good time, than one which is delayed at the start owing to its enlargements not being ready.

*Arrangements
for privilege
leave*

55. During the field season surveyors should be asked whether they intend to apply for leave during the recess. While due consideration should be given to the convenience of individuals, it should be borne in mind that the most convenient time in the interests of the work, for Surveyors who are required for drawing to go on leave, is at the close of the field season, as it is during the latter half of the recess season that the work is heaviest. The grant of leave should not be withheld except for very urgent reasons.

Advance section.

56. An officer should, whenever possible, be sent to recess ahead of the party, to project and plot the fair sheets, to get the office ready, and to give out work to surveyors as they arrive.

SECTION V.—DUTIES IN RECESS.

57. Indents for type for the requirements of the year beginning on the next 1st of April and separate indents for drawing paper for the requirements of the year beginning on the 1st of April of the second year ahead should be submitted by officers in charge of parties and offices so as to reach the Circle Superintendent on the 1st of May annually. The Superintendent will then prepare consolidated indents for his Circle, which should reach the Superintendent of Map Publication not later than the 1st of June annually.

*Indents for type
and drawing
paper.*

58. During the field season the officer in charge of a party should consult with the local forest officers regarding their requirements as to the survey of forest reserves during the next field season and the one following, and should submit proposals to the Circle Superintendent as described in Chapter IX.

Forest survey.

SECTION V.—DUTIES IN RECESS.

59. A party in recess should be divided into a suitable number of drawing and computing sections under experienced officers. Whenever it can be arranged, officers who have held charge of camps in the field should be given charge of the drawing sections which deal with the areas surveyed under them: similarly, surveyors should whenever possible draw the sheets which they themselves have surveyed. The computing section should be placed under the charge of the senior officer employed on this class of work.

Division of work.

The success of the recess work depends, to a very great extent, on the methodical arrangement of the work and on the various members of the establishment being given the work in which they are most proficient.

60. By the end of the first week in June, and again on 1st November, Superintendents of Circles will submit to the Surveyor General reports in the prescribed form (0.83 d) stating the distribution of all the sheets of the circle which have been surveyed but not published. Similar forms (0.83 e) should be submitted for the sheets of the secondary, or compiled mapping (half-inch and quarter-inch) which should show the distribution of all sheets the drawing of which has been begun but which have not been published, and should state the numbers of half-inch and quarter-inch sheets, respectively, which are due to be mapped but which have not yet been put in hand.

*Returns of
distribution
of sheets.*

61. During recess all draftsmen, &c., should be in their places at the hour appointed for opening office, and officers should be careful to set a good example in this respect.

Punctuality.

SECTION V.— DUTIES IN RECESS.

Duties of section officers.

62. It is the duty of the section officers to see that no draftsman is delayed for want of material, and they must therefore arrange that all enlargements, traces of outline and contours, names for typing, &c., are ready as required. They should visit their draftsmen and typers each day and see that their methods and work are satisfactory. They are responsible for the preliminary examination of the map, much of which can be carried out *pari passu* with the execution of the work.

They should arrange to have traces prepared of the edges of all fair sheets (both contour and outline sheets) which adjoin work which has not already been mapped.

Draftsmen.

63. It is sometimes necessary, during part of the recess, to employ two draftsmen concurrently on one sheet (double-banking), and this can usually be arranged by one draftsman commencing work early in the morning and leaving at midday, when he should be relieved by his successor, who will remain on after office hours.

It is not necessary, nor generally advisable, that one draftsman should draw any one sheet from start to finish. The average draftsman can usually draw the drainage with sufficient skill and rapidity, but may not be able to draw roads, boundaries, village sites or ornamentation, altogether satisfactorily. The draftsman therefore who is specially proficient at any class of detail should be given that to do. By a division of labour of this kind, work will be found to progress rapidly and satisfactorily. It is advisable, however, that each contour sheet should be entirely drawn by one draftsman.

Typers.

64. The officer in charge of a party is responsible for training an adequate number of typers. Each skilled typer should have an assistant to fill up the type holders; this arrangement saves time, and it will be found that the assistant, by observing the methods of the typer, will soon become proficient at the work.

Soldier surveyors.

65. Soldier surveyors under their first period of training should not be employed on miscellaneous work, as they are attached to parties for instruction. They must be taught to project plane-tables on any scale from the Auxiliary Tables, to construct latitude, longitude, and diagonal scales, and to plot points. It is very important that this instruction should be carefully carried out, as this class of surveyor will often be employed on exploration work. When submitting reports on soldier surveyors for transmission to the Chief of the Staff, information on these points should invariably be supplied.

Completion of sheets.

66. Sheets should on no account be left in the "almost ready" state, but must be pushed on to completion. Section officers should endeavour to send in fair sheets to the officer in charge in regular

SECTION V.—DUTIES IN RECESS.

succession whenever ready, and not all together at the end of the recess. It will usually be found the best plan to push on the easier sheets, thus leaving more time for the more difficult ones.

67. Officers in charge of parties should also submit each sheet, as soon as it is finished and examined, to the Superintendent, instead of holding it back and submitting all the sheets of his party at the end of the recess.

*Submission of
fair sheets.*

68. The computations should be bound, or temporarily bound, by degree sheets, and dealt with as described in Chapter III, before the party leaves for the field.

Computations.

69. Officers in charge of parties should submit all reports, returns and requisitions punctually on the dates laid down, both in the field and in recess.

*Reports and
returns.*

APPENDICES.

LIST OF APPENDICES.

- I.—Care and treatment of elephants.
- II.—Archæology.
- III.—Indian Museum.
- IV.—Physiographical changes.
- V.—Colours to be used on index maps
- VI.—Submission of programmes.
- VII.—Warm clothing.
- VIII.—Despatching.
- IX.—Tents.

APPENDIX I.

CARE AND TREATMENT OF ELEPHANTS.

In many parts of India and Burma, elephants are almost indispensable for survey parties, and as both the purchase and keep of these animals form a somewhat heavy charge, it is very desirable that executive officers should themselves exercise a careful supervision over their treatment in order to ensure their efficiency.

Necessity of supervision.

It would be impossible to enter here into all the diseases to which elephants are subject, but there are two which are the most frequent cause of temporary disablement, and which are generally preventable by reasonable care. These are injuries to the feet, and sore backs.

Two principal causes of disablement.

Injuries to the feet are very liable to occur in marching over ground from which bushes and small jungle have been cut down, with short sharp stumps left standing in the ground. An elephant treading on these, or even on small sharp pieces of stone, may cripple itself more or less: when such a road has to be traversed, it is a good plan to harden the soles of the feet by the application of a paste, of which the ingredients are known to *mahouts*, and generally used by them for this purpose.

There are two kinds of disease peculiar to the feet of elephants, named *Tawakkh* and *Sarjan*. They are both contracted through neglect and from allowing the animal to stand for many consecutive days on the same *an* without cleaning it. The best treatment is by nitric acid, applied with thin strips of copper which should be dipped into the bottle containing the acid, and rubbed over the wound. The feet must be first well pared and washed; the acid should be applied morning and evening.

Injuries to the feet, and their treatment.

One of the best native remedies for *Sarjan*, is the following:—*Tua* or *Choudara*, one fruit, cut up, powdered, and mixed with one seer of mustard oil; this must be kept on the fire until it burns, and becomes thick and black. The mixture is spread over the wounded surface while it is quite hot. An ordinary paint-brush is the best means of applying it.

Carbolic lotion is useful for dressing wounds on the feet of the elephant, and should be applied on plugs of tow inserted in the wounds after they have been carefully cleaned out, and all proud flesh cut away.

APPENDIX I.

*Sore backs;
their cause and
treatment.*

Sore backs are generally caused by the padding being out of order, in consequence of which the loads press directly on the back, and thus occasion inflammation, and very frequently suppuration to an extent that sometimes requires months to cure. If on the first symptom of a swelling being observed, the place is well fomented and rubbed, a sore back may probably be avoided. But *makhouts*, as a class, are proverbially unobservant and heedless in the performance of their duties; and the chances are that the swelling will not be noticed by them, until it becomes so large that it is impossible to avoid seeing it. The mischief is then done, and suppuration, which must be allowed to take its course, has most probably set in. These suppurating abscesses usually take place a little behind the tips of the shoulder blades. When they are quite ripe they should be opened with a long lancet-shaped knife, four incisions in the lower surface being made—two on either side. It is better to open them thoroughly at first, otherwise the pus is liable to find its way into the surrounding cellular tissue, and an enormous diffused abscess is the result. After the matter has been well pressed out, the cavity should be thoroughly syringed with lukewarm water, twice a day, morning and evening, the cavity being filled between the syringings with tow steeped in carbolic acid lotion of the following strength, *viz.*, 1 oz. of carbolic acid to 10 oz. of water. The wound should be constantly protected by a broad pad of cloth, otherwise its cure will be considerably retarded by the habit elephants have of blowing dust or dirt over their bodies, more particularly when they have sores on any part of them.

*Description and
care of gear.*

In the case of sore backs prevention is easier than cure, and as the *gadhela* or pads are generally the cause, too much attention cannot be given to ensure their being kept in a proper condition. They are very liable to become rotten when exposed to rain, and should therefore be always kept under cover when not in actual use; a single month of monsoon weather is sufficient to destroy them if recklessly exposed to it. The pads and other furniture at present in use for the elephant are as follows:—

- (1) The *namda*, which consists of hair well felted together, is about an inch thick, and two yards square, and has a covering of gunny on the upper side, and one of coarse cloth on the under. The latter comes in immediate contact with the animal's back.
- (2) The *gadhela* placed on the top of the *namda* consists of two bags of gunny filled with bulrushes, a foot thick, and two feet broad, the length being four to five feet, according to the size of the animal. These bags are joined edge to edge at either extremity, the open space between them being intended to receive the spinal ridge of the animal's back-bone.

 APPENDIX I.

- (3) The *vimqali* which is of similar construction to the *gadhela*, but smaller in its dimensions.
- (4) The *jhul*, a coarse cloth consisting of gunny which is thrown over the whole.
- (5) A rope about one inch in diameter by which the above are fixed on the back; one end of this rope is converted into a loop, sufficiently long nearly to surround the body of the animal and the pads. It is tied on the top, then passed singly round the neck, then along the upper sides of the pads, then below the tail and finally tied again at the place of the first knot on the top. The parts which pass under the belly and tail are sheathed with leather, to prevent abrasion of the elephant's skin.

It may be assumed as a principle that sore back and injuries to the feet of elephants are the result of negligence on the part of the attendants, and it is therefore a good rule to enforce that so long as the animals are under treatment for such injuries, half of the attendants' pay should be stopped, unless good cause can be shown, in individual cases, why the rule should not be put in operation. *Stoppage of attendants' pay.*

Elephants are occasionally very useful in pushing down trees; when so occupied pads should be provided to defend the head. If an elephant bruise or injure itself when so employed, and this it is liable to do, it will probably refuse to give assistance again in this way. *Head pads.*

Elephants should not be picketed out in a burning sun; inflammation of the brain and other similar diseases may be caused by such exposure. If shade be not available, a white padded covering should be fastened over the head. *Protection from sun.*

On coming off a march, an elephant should be allowed to cool previously to being washed; negligence in this particular is apt to occasion serious illness. The animal may be allowed to drink water when in a heated state without any untoward effects resulting, but it should not be allowed to throw water over itself. *Precautions against chills.*

Elephants should be watered twice daily; at each time they take about 15 or 16 gallons of water. They prefer river water to all others, and willingly drink that procured by digging holes in the sandy beds of rivers, after it has stood for a few minutes to allow the sediment to sink. Elephants cannot be kept with impunity for more than 24 hours without water. *Watering.*

APPENDIX II.

APPENDIX II.

No. $\frac{1}{58-71}$.

Extract from the Proceedings of the Government of India in the Home Department (Archæology),—dated Simla, the 8th June 1883.

RESOLUTION.

In the Resolution of the 8th November 1882, read above, the

3*. As regards the question of preservation *in situ* as opposed to removal to, and exhibition in a museum, it may be observed that the great majority of the discoveries made by the Archæological Survey of India consist of the remains of buildings, massive pillars or inscribed blocks, which cannot be removed, and should for many other reasons be preserved where they stand. The case is, however, different with isolated figures, not *in situ*, especially if they are the remains of an extinct religion, such as Buddhist figures, which are not unfrequently mutilated by the people, unless they happen to have been adopted by the Brahmans as belonging to Hindoo cults. In regard to such isolated figures, and to others which, although not mutilated, are lying neglected about the country, it appears to the Government of India that these might with propriety be removed to some safe place of deposit, such as the Indian Museum, where they could be seen and studied by all persons who take an interest in Indian Art. The Governor-General in Council desires to make it clear that he is entirely opposed to the removal of any objects which are still *in situ*, such as the monoliths attached to Buddhist stupas and Brahminical temples; but, on the other hand, there seems no sufficient reason why isolated remains, such as a capital which is found lying without a shaft, or stray statues the original site of which is unknown, should not be removed to some museum in order to save them from future injury. To this class also belong the sculptures which have been found scattered about the Buddhist ruins of the ancient Gāndhāra, now occupied by the Yusufzai Afghans, whose custom is believed to be to mutilate such remains unless this is prevented by their prompt removal to a place of safety.

4*. In making the above remarks, the Governor General in Council has not lost sight of the fact that it may be argued that the claim of the Government to objects of archæological value rests upon no sufficient legal or other foundation. The Government has in fact never claimed any indefeasible right of property in such objects, nor could such a right be asserted without legislation. Experience has, however, shown that the arrangements necessary for securing any object worthy of removal to a museum, or for preserving it in any other way, can in most cases be made without difficulty by Local Governments or local officers. This being so, it does not appear necessary to take any legal powers of compulsory acquisition.

thinks that all differences of opinion will be reasonably met by compliance with the following instructions:—

- 1.—All discoveries of objects of archæological interest made by Government officers, (whether belonging to the Archæological Survey or not), should be reported by them to the head of the Local Government or

APPENDIX III.

Administration within which the discovery is made. When such a report is made, it will rest with the Local Government or Administration to issue orders for the preservation of the objects discovered *in situ*, or for their removal to a Provincial or Local Museum, where such exist, in accordance with the general principles set forth in the paragraphs marginally quoted above. Where there is no Local Museum, the object should be sent to the Imperial Museum, if the Trustees, to whom information of the discovery should be conveyed by the Local Government or Administration, should so desire.

II.—Local Governments and Administrations will furnish the Trustees of the Indian Museum with lists of all Museums in the Province and with descriptive catalogues of their contents, and will report to the Archæological Department all fresh discoveries dealt with under the preceding clause.

III.—The Trustees will be at liberty to arrange with Local Governments and Administrations either for the transfer to the Indian Museum of any object the Trustees may require, or for acquiring it by exchange, or for obtaining casts or other impressions of it, any points as to which there is a difference of opinion being referred to the Government of India for final decision. In dealing with such applications from the Trustees, Local Governments and Administrations will not fail to attach due weight to the desirability of completing any particular archæological series to which the Trustees of the Indian Museum may attach importance.

APPENDIX III.

COLLECTIONS TO BE FURNISHED TO THE INDIAN MUSEUM ILLUSTRATING
THE ARTS PRACTISED BY THE ABORIGINAL AND OTHER
JUNGLE RACES OF INDIA.

*From H. F. BLANFORD, Esq., Honorary Secretary to the Trustees of
the Indian Museum, to the Surveyor General of India,—
(No. 586, dated Calcutta, 2nd June 1871).*

The attention of the Trustees has recently been directed to the importance of devoting a section of the Indian Museum to illustrations

APPENDIX III.

of the state of the arts among the aboriginal and other jungle races in India and its dependencies. With this view it is desired to obtain collections of the arms, ornaments, dresses, household utensils, tools, agricultural implements, musical instruments, and indeed all objects that are the products of their own manufacturing skill, and that will serve to illustrate the habits and modes of life of those indigenous races that have remained but little affected by foreign civilization. It is unnecessary to dilate upon the interest that would attach to such a collection, both as leading to a knowledge of the habits of the less known tribes in this part of His Majesty's dominions, and as affording materials for a comparative study of the arts practised by races in an early stage of social development.

It is desired at the same time to bring together a similar collection of the objects found in the ancient burial places frequently associated with stone circles which are known to exist abundantly in Central, Western, and Southern India, and may yet be met with elsewhere. These, as at present known, consist chiefly of pottery, ornaments, and iron weapons. The stone flakes and celts both of the chipped and polished types, and hatchets of copper and perhaps bronze, which have been found in many parts of India, since attention has been prominently directed to such objects, are also desired for this collection.

In order to carry out these objects, I am desired to solicit through you the assistance of the officers in your Department, who, being employed among, or in the neighbourhood of, aboriginal tribes, or in places where ancient cairns and burial places are known to exist, may enjoy facilities for obtaining objects of the kinds enumerated. Objects of the former classes may probably be obtained by purchase for very moderate sums. It is of course not intended that any expense that may be incurred in their purchase or transmission should fall on the officers to whose good offices the Trustees may be indebted for procuring the specimens. Objects of the latter class will probably only be obtainable under conditions where labour is easily and cheaply procurable for the purpose of excavating, and although the Trustees will be willing to purchase objects thus obtained at any moderate cost, they cannot undertake the responsibility of guaranteeing beforehand the cost of exploration.

In conclusion, I am desired to solicit your personal support and co-operation in making known the Trustees' objects to such officers as may be in a position to afford assistance in its practical accomplishment.

 APPENDIX IV.

APPENDIX IV.

PHYSIOGRAPHICAL CHANGES.

Officers are requested to include in their Annual Reports for the Record Volume brief notes on any marked physiographical changes that may come under observation.

*Circular Memo.
No. 1, dated 20th
January 1911.*

(i).—The whole area of loose sand that constitutes the Rājputāna desert is moving *en masse* towards the north-east under the influence of prevailing winds; it will be of interest to ascertain in the course of the new survey to what extent the sand has advanced towards Ajmer and Delhi and Ferozepore since the last survey was made, and whether in its advance it is abandoning areas in Sind and Cutch which it formerly occupied.

(ii).—When sand advances into regions watered by rain, it is carried by streams in to the rivers and by rivers into the sea. Its advance may consequently not here be apparent. But in the struggle for mastery between the sand and the rivers, the courses of the latter are apt to be deflected. The Punjab rivers have been driven northwards and have been forced to combine by advances of sand from Rājputāna; the Ghaggar has been choked and the Jumna has been pushed to the east. It will be of interest to learn whether the rivers are still retiring before the sand or whether they are holding their own.

(iii).—If any considerable area that was formerly cultivated is found now to be desiccated, the change will be worthy of mention in the Record Volume.

(iv).—All rivers that meander over flat alluvial plains are apt to change their courses as their beds get raised by silt. It is of interest to know whether these changes of course are systematic, *i.e.*, always towards one direction, or whether they are oscillatory. Are (for example) the junction-points of the Himālayan rivers, Gogra, Gandak, Kosi, &c., with the Ganges in Bengal all tending to move to the east?

(v).—Changes in the position of coast-lines are always worthy of record, more especially if they appear to be systematic.

(vi).—Very little is as yet known of the rate of growth of the deltas of the rivers of North and South India and Burma. The effect of irrigation schemes upon deltaic growth is a subject of scientific interest.

 APPENDIX V.

APPENDIX V.

 PREPARATION OF INDEX MAPS ATTACHED TO REPORTS AND PROGRAMMES
 FOR SUBMISSION TO THE SURVEYOR GENERAL.

(See plate of colours on opposite page).

1. As a general rule, index maps for submission to the Surveyor General should be prepared on the Circle index maps, but, if these are on too small a scale to explain any particular case satisfactorily, then the index maps on the scale of thirty-two miles to one inch should be used instead. The last mentioned index maps should generally be used by officers in charge of parties when submitting index maps to the Superintendents of their Circles.

2. As a general rule, different scales of survey should not be distinguished on index maps submitted by Superintendents. If it is necessary, in exceptional cases, to distinguish between the different scales of survey, this may be done by drawing one or more diagonal lines across the sheets it is required to distinguish and entering an explanatory footnote on the index map.

3. The following index maps are prepared and submitted by Superintendents of topographical Circles;—

- (i). The index map to illustrate the Programme of Operations, *vide* Appendix VI.

Three copies of this index map will accompany the programme and one copy will be sent by the Superintendent of the Circle to the Superintendent, Map Publication for information.

- (ii). The index map for attachment to the copies recorded in the Surveyor General's office of the "Annual Reports to Local Governments," *vide* para 292 of the General Hand-book.

One copy of this index map will accompany the copies of the annual reports.

- (iii). The index map to illustrate the General Report, *vide* paragraphs 286-288 of the General Hand-book.

Three copies of this index map will accompany the General Report. There will be no separate index map for the Record volume.

4. The colouring of the index maps mentioned in paragraph 3 above, will be as similar as possible to the colouring given in the plate on the opposite page.

Delete the whole of the existing Appendix VI, and *substitute* the following:—

APPENDIX VI.

RULES FOR THE SUBMISSION OF SURVEY PROGRAMME.

(1). The proposed programme of operations for the following field season and the forecast for the season after it should be submitted *in triplicate* by Officers in charge of units to reach the Director of the Circle by the 15th May. The programme and forecast should explain in sufficient detail all the work to be undertaken during the two ensuing field seasons, such as triangulation, traversing, detail survey, resurvey, revision survey, supplementary survey, forest survey, etc., giving scales of survey and areas; any orders conveying sanction for the work should also be quoted. The programme and the forecast should both state the number of each individual sheet proposed for survey. Index map on scale 32 miles to 1 inch should be submitted in duplicate showing the programme for the first field season only.

This programme should be accompanied by a detail statement of the personnel that will be available to complete it, giving the area expected from each individual. A rough estimate should also be given of the total expenditure for the financial year that this programme will entail giving separately the amount due on any special job not foreseen when budget estimate was prepared. This will be compared against the sanctioned budget estimate to see that the rough estimate is kept within but close to the sanctioned budget estimate.

(2). The Circle Director will forward the programmes (preliminary) of the units in his circle, with the combined index map for the circle in duplicate and a statement showing the sanctioned budget (excluding the cut) and the preliminary revised estimates which include the costs of the programmes of the units, and the total recoveries shown in both the sanctioned budget and the preliminary revised estimates to the Surveyor General by June 15th, with such modifications or comments as he thinks necessary; and the Surveyor General will issue his orders approving or modifying these proposals.

The circle Director will at the same time send the programmes of units with index maps to the Provincial Governments concerned, and ask for their approval.

(3). On receipt of Surveyor General's orders, the Circle Director will then submit a combined programme for his circle in the authorised style (*vide* attached specimen) for submission to the Government of India. This should reach the Surveyor General by July 15th, together with certain statements.

The following complete list enumerates the statements which should be submitted to the Surveyor General:—

- (a) Statement of programme and forecast, accompanied by an index map in duplicate on scale 96 miles to 1 inch illustrating the programme.

NOTE 1.—Separate index maps on scale 16 miles to 1 inch should be furnished in duplicate of programmes falling in the N. W. F. P. and Baluchistan.

NOTE 2.—Separate index maps on suitable scales should be submitted in quadruplicate illustrating the programmes which cannot be indicated on the index map referred to in (a) above.

- (b) Statement of areas of each class of survey to be surveyed by each unit.
- (c) List of major and minor Indian States in which it is proposed to conduct survey operations.
- (d) List of Provincial Governments and Political Administrations whose approval has been asked for or obtained.
- (e) Statement of cost of any paid-for extra-departmental work, which had not been foreseen when the budget was prepared, in the form annexed. A *nil* statement should be submitted if necessary.
- (f) Statement showing the sanctioned budget grant and the preliminary revised estimate of a unit which includes the cost of the programme, and the total recoveries shown in both the sanctioned budget and the preliminary revised estimates, during a financial year.

The Director, Frontier Circle should say whether the programme of frontier units has been approved by the Chief of the General Staff.

The Director, Geodetic Branch should say whether the programme of cantonment units has been approved by the Engineer-in-Chief.

Provincial Governments should be advised of any changes made in the programme when finally submitted.

(4). A sample statement of programme and forecast is attached; and the following notes are given as a guide in its preparation.

- (a) First column will give the designation of the survey unit.
- (b) Second column will give the names of provinces or major States in which the whole programme of the year will

fall. These should be given in the order of provinces, etc., as laid down in the "Abstract of Surveys in each Province and State," Section I, General Report.

- (c) Third column will give a summary of the programme for the year including—
- (i) Nature of survey work, approximate areas and scales of survey.
 - (ii) Names of districts or minor States in which the greater part of the work will fall.
 - (iii) Degree sheets in which work will fall.
 - (iv) Brief description of any special work, giving locality.
- (d) Fourth column will give forecast for the following year giving province, degree sheet and any other essential information.

(5). In all cases when the programme and forecast do not deal exclusively with public maps, they must be divided into two distinct parts which must be separately submitted; one part should deal exclusively with maps and surveys for maps classed as "public", and the other with maps and surveys for maps not classed as "public", the latter being treated as "for official use only".

Specimen.

Programme of survey operations of Survey of India for 1926-27.

No. of Unit.	Province in which the programme for 1926-27 will fall.	Programme for 1926-27.	Forecast for 1927-28.
No. 12 Party.	Bengal & Assam	<p>Topographical surveys of 1,300 sq. miles on $\frac{1}{4}$-inch and 2,500 sq. miles on 1-inch scales in Goalpara, Jalpaiguri and neighbouring districts in degree sheets 78 F and J.</p> <p>4-inch survey of 30 sq. miles of Cinchona plantations in degree sheets 78 A and B for Superintendent, Royal Botanic Gardens.</p> <p>Supplementary survey of 10 sq. miles on 1-inch scale of new railways constructed in various districts of Assam.</p> <p>Triangulation and traversing of 4,000 sq. miles in Balasore and Cuttack districts in degree sheets 78 K and L.</p>	Topographical survey in Bengal and Assam in degree sheets 78 F and G with triangulation and traverse extending into degree sheets X and Y.
No. 23 Party.	Punjab ...	Rectangulation to 100 and 25 acres of 60 and 40 sq. miles respectively for the Haveli Irrigation Project, and 4-inch survey of part of this area in districts Multan and Muzaffargarh in degree sheets 39 N and 44 B.	Rectangulation and 4-inch survey in continuation of previous season's work, degree sheets 39 N and 44 B.

Statement of paid-for work not anticipated in the budget estimate
for 1926-27.







Serial No.	Description of unfore- seen paid-for work.	Unit to be employed on the work.	Approximate cost including overhead charges.	Debitable to.	Amount already provided for in the sanctioned budget <i>e.g.</i> , pay etc., of officers etc transferred to the new work.	Additional gross expenditure anticipated.	Overhead charges.	REMARKS.
1	2	3	4	5	6	7	8	9

NOTE.—The total of amounts in columns 6, 7 and 8 should agree with the amount in column 4 which should give the total amount recoverable.

No. 47, dated 1-8-28.

APPENDIX V

COLOURS TO BE USED ON GENERAL REPORT INDEX MAPS FOR SUBMISSION TO THE SURVEYOR GENERAL

i.	Area surveyed last field season	on scale	1 in.=1M. and over	... Orange ...	
ii.	"	"	about $\frac{1}{2}$ in.=1M.	... Pink ...	
iii.	"	"	$\frac{1}{4}$ in.=1M. and less	... Yellow ...	
iv.	Area proposed for survey next field season	"	1 in.=1M. and over	... Red ...	
v.	"	"	about $\frac{1}{2}$ in.=1M.	... Red ...	
vi.	"	"	$\frac{1}{4}$ in.=1M. and less	... Red ...	

Note:— i, ii and iii should be followed on Index maps submitted to the Assistant Surveyor General with Annual Reports to Local Governments.

 APPENDIX V.

The index map to illustrate the Programme of Operations will give all the items of information detailed in the plate. The other two index maps (Nos. ii and iii in para. 3 above) will give only the information detailed in the first four items in the plate and will not distinguish areas it is proposed to survey, traverse, or triangulate during the next field season.

5. Any case not provided for by these rules should be treated specially and the colours used should be explained in a footnote on the index map.

6. Immediately after the 30th September each year, the Superintendent Map Publication prepares index maps of the Southern Asia, International, India and Adjacent Countries, quarter-inch, half-inch and one-inch series for the General Report, showing publication up to the end of the last survey year. As soon as possible, 2 printed copies of each of these index maps will be sent to the Surveyor General and one copy to each Circle Superintendent and to the Superintendent of the Trigonometrical Survey.

 APPENDIX VI.

RULES REGARDING THE SUBMISSION OF PROGRAMMES OF OPERATIONS.

(1). The proposed programme of operations for the following field season and the forecast for the season after it should be submitted by Officers in charge of parties to reach the Superintendent of the Circle by the 15th May. The programme and forecast should explain in sufficient detail all the work to be undertaken during the two ensuing field seasons, such as triangulation, traversing, detail survey, resurvey, revision survey, supplementary survey, forest survey etc., giving scales of survey and areas; any orders conveying sanction for the work should also be quoted. The proposals for the first field season only should be shown on the index maps submitted with the programme and forecast.

*Circular Order
No. 282 (Ad-
ministrative),
dated 29th
November 1909.*

(2). A combined programme for each Circle will then be drawn out in the style in which the combined programme of the department is submitted to the Government of India and forwarded to the Surveyor General by the 10th June, with a covering letter giving all necessary explanations, including a list of the Indian states, any part of which fall in the areas to be surveyed. A forecast of survey operations for the second field season, giving similar details to those shown in the programme of survey operations for the first field season, should be attached. The programme for the first season only should be coloured in accordance with the rules in Appendix V and submitted in triplicate.

 APPENDIX VII.

(3). In all cases when the programme and forecast do not deal exclusively with public maps, they must be divided into two distinct parts which must be separately submitted; one part should deal exclusively with maps and surveys for maps classed as "public", and the other with maps and surveys for maps not classed as "public", the latter being treated as "for official use only."

 APPENDIX VII.*

SCALES OF WARM CLOTHING FOR KHALASIS.

Circular Order
No. 286
(Administrative),
dated 6th
December 1944.

1. The following scales of warm clothing for *khalasis* in the field are given as a guide. The articles enumerated are those most generally required, but they need not be rigidly adhered to; and officers in charge of parties may apply for special articles, such as boots and water-proof sheets, when they consider them essential. The scales laid down are very liberal and officers in charge of parties should not propose a higher climatic scale than is absolutely necessary. When applying for sanction to purchase warm clothing full reasons must be given if any alterations to the scales are proposed.

2. Superintendents of Circles, before submitting recommendations for warm clothing to the Surveyor General for sanction, should carefully consider in every case whether any issue is necessary and if so, whether the scale is appropriate.

3. In all cases within the administrative boundary of India, half the purchase cost of warm clothing, must be recovered from each *khalasi*. The articles with which a *khalasi* is provided will become his own property on the completion of a single field season except in the case of blankets, when 2 or more are supplied, in which case he must rejoin with one, or he will be supplied with 2 or more, the cost of one of which will be recovered from him in full in addition to other recoveries. If a *khalasi* loses or makes away with any articles before the field season is over, the full cost of such articles must be recovered from him.

* See paras 549 and 551 General Hand-book.

APPENDIX VIII

Articles.	CLIMATE AND TYPICAL DISTRICTS.					
	Tropical— Coast districts of Madras, Bombay, and Burmah.	Warm, with cold nights— Madras, Bombay, Bengal, Burma, Assam, & Central India.	Temperate, with cold nights— Madras, Burma, Assam, Northern India, and low Himalayas.	Cold— The hills of Burma and Northern India, and medium Himalayas.	Very cold— High Himalayas.	Arctic— Snowy districts of highest Himalayas
Blankets, country	...	1	1	2	2	3
Caps Balaclava	1	1
Coats, warm, followers'	1	1	1
Jerseys	1	1	1	1
Mittens	1	2
Puggies	1	1	1	1
Putties	1	1	1	1
Pyjamas, warm	1	1	1
Socks worsted	2	2

These scales are intended for men who are imported from warmer climates, and are not applicable, except under special circumstances, to men of the districts in which work is in progress.

APPENDIX VIII.

DESPATCHING.

In future, all plane-table sections, original fair drawings, blue prints, proofs, colour guides and enlargements for fair drawings will be packed in boxes, each containing a single chonga of 6" or 9" diameter. Double chongas are not necessary, but after packing a strip of brown paper must be pasted along the edge of the cover to make the chonga water-tight.

Order No. 7,
Map Publication
Office, dated
26th April 1910.

The number of sheets to be ordinarily packed together is given below as a general guide—

(i) *Plane-table sections.*—In all cases these are to be insured and packed as follows:—

From 1 to 8 sections in 6-inch *chongas* within boxes, by post.

From 9 to 24 sections in 9-inch *chongas* within boxes, by rail.

Any larger number should be packed flat in double tin-lined cases.

Plane-table sections and enlargements of the same are in future to be sent separately.

 APPENDIX IX.

(ii) *Original fair drawings, enlargements for fair drawing and blue prints, including "dust on" prints on drawing paper.*—

The fair drawings are to be insured and the prints registered, and each case packed and sent as under—

From 1 to 8 sheets in 6-inch *chongas* within boxes, by post.

From 9 to 25 sheets in 9-inch *chongas* within boxes, by rail.

Any larger number to be forwarded in flat double tin-lined cases.

(iii) *Proofs, colour guides, and enlargements of plane-table sections other than on drawing paper.*—In all cases these are to be sent registered and packed as follows—

From 1 to 20 sheets in 6-inch *chongas* within boxes, by post.

From 21 to 60 sheets in 9-inch *chongas* within boxes, by rail.

Any larger number must be forwarded in flat single tin-lined cases.

Sheets of blank paper should be interposed between zinc mounted proofs and also between zinc mounted proofs and other proofs, so that the latter may not be soiled by rubbing against the zinc.

The lids of all boxes must be screwed on, and each box and lid issued must be given a consecutive number prior to issue, unless they are already numbered.

 APPENDIX IX.

TENTS.

(1). The tentage of a party will be regulated by the scale given in para. 4 below.

(2). The patterns of tents that have been found most generally useful are enumerated below and the purchase of other kinds of tents will not be sanctioned without special reason. These tents are obtainable from the Elgin Mills and the Muir Mills, Cawnpore. The prices shown are those quoted in 1923. If other manufacturers are dealt with, care must be taken to see that the tents are neither inferior in quality nor more expensive. Most tent manufacturers allow a discount up to 10% on orders for tents received from the Survey of India.

APPENDIX IX.

All tents should have jointed poles.

Description.	Size.	Price with ordinary accessories.	Special accessories.
Z. Single-poled Regulation Tent ...	18' x 14'	Rs. 1,679	Division curtain at Rs. 74. Verandah Durries at Rs. 99.
A. Single-poled Hill Tent ...	12' x 12'	.. 893	2 Kanats to enclose existing sywans at Rs. 192. Durries for 2 enclosed sywans at Rs. 60.
B. Round-ended Miniature Swiss Cottage Tent ...	12' x 12'	.. 679	Verandah and bath-room durries at Rs. 68. Verandah Chicks at Rs. 21.
C. Round-ended Cashmere Tent ...	12' x 12'	.. 740	Verandah and bath-room durries at Rs. 68.
C ¹ . Cabul Pattern Service Mess Tent of white drill ...	12' x 12'	.. 602	Verandah and bath-room durries at Rs. 75. Verandah Chicks at Rs. 21. Verandah Kanat at Rs. 68.
D. Round-ended Miniature Swiss Cottage Tent ...	10' x 10'	.. 548	Verandah and bath-room durries at Rs. 53. Verandah Chicks at Rs. 21.
E. Field Officers' Cabul Pal, made of white drill, complete with detachable bath-room, verandah and durrie ...	9' x 8'	.. 376	...
F. Officers' Light Field Service Tent made of white drill, complete with bath-room ...	8' x 8'	.. 206	...
G. General Service Tent white ...	8' x 14'	.. 143	...
I. Double-fly Indian Officers' Tent (1914 pattern), made of white drill ...	7' x 8'	.. 155	Detachable bath room at Rs. 44.
J. Survey Pal with square ends ...	11' x 8'	.. 121	Jointed poles at Rs. 2 per tent extra.
J ¹ . Sowar Pal, made of white drill ...	10' x 8'	.. 80	...
K. Necessary Tent ...	4' x 4'	.. 78	...

 APPENDIX IX.

(3). An officer in charge of a party, when applying for sanction to purchase tents, should state the number, price and class of each kind and whether they are required in order to replace old tents which have been condemned, or to increase the stock of tents in the party.

(4). *Tents for a Topographical party.*

Head Quarters.

One of A, B, C or C ¹ .	For Officer in charge. as office.
One of D, E or F. ...	Ditto. as personal office, on tour.
One of E. ...	Ditto. as clerk's office.
One of K.	
Some of G. and J. ...	For stores, khalāsis, &c.

Camp Officer's camp.

One of A, B, C or C ¹ .	For office.
One of D, E or F. ...	For personal office, on tour.
One of K.	
Some of G. and J. ...	For stores, khalāsis, &c.

Other Officers of the 1st or 2nd class.

One of D, E or F. ..	For personal use.
One of K.	
One of J.	

Other Officers of the Upper Subordinate Class.

One of F.	For personal use.
Ordinarily. one of J.	

Lower Subordinate Officers.*

One of I. ...	For officers of the first and intermediate grades.
One of I. ...	For officers below the intermediate grade, working in specially hot country.
One of J. or J ¹	For officers below the intermediate grade, working in ordinary country.

Menials.

One of J. or J ¹	For every 6 men.
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* A Lower Subordinate officer employed on triangulation or traversing may, at the discretion of the Officer in charge, be allowed one tent of F. pattern.

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