ACCOUNT OF THE OPERATIONS OF

THE GREAT TRIGONOMETRICAL SURVEY OF INDIA

VOLUME IV A.

GENERAL DESCRIPTION

OF THE

PRINCIPAL TRIANGULATION

OF

THE JODHPORE AND THE EASTERN SIND MERIDIONAL SERIES

OF

THE NORTH-WEST QUADRILATERAL,

WITH THE DETAILS OF THEIR REDUCTION AND THE FINAL RESULTS.

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PUBLISHED UNDER THE ORDERS OF
COLONEL G. C. DEPRÉE, S. C., SURVEYOR GENERAL OF INDIA.

Dehra Dun:
PRINTED AT THE OFFICE OF THE TRIGONOMETRICAL BRANCH, SURVEY OF INDIA.
B. V. HUGHES.

1886.

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Chapter II—(Continued).

PART II.

THE DETAILS OF THE OBSERVATIONS AND THE FINAL RESULTS OF THE JODHPORE AND THE EASTERN SIND MERIDIONAL SERIES OF THE NORTH-WEST QUADRILATERAL.

THE JODHPORE MERIDIONAL SERIES.

THE EASTERN SIND MERIDIONAL SERIES.

THE EASTERN SIND MERIDIONAL SERIES—(*Continued*).

PREFACE.

The present volume forms one of that series of publications, known as the *"Account of the Operations of the Great Trigonometrical Survey of India,"* of which the design is, as has already been stated in the second volume of the series, "to give full reports—historical and descriptive—of the nature and the general "procedure of the operations; to describe the instruments which were employed in executing the several "linear and angular measurements; to furnish complete details of the actual facts of observation and the "methods of reduction by which these facts have been combined together and duly harmonized; and lastly, "to give the results which have been determined after this final reduction of the operations."

The first volume of the series accordingly gives the details of the measurements of the several base-lines on which the triangulation of India rests, together with a discussion of the instruments on which the measurements depend, and the theoretical probable errors of the results. Volume II describes the principal triangulation, the theodolites with which it was executed, the procedure adopted in observing the angles, and all necessary details of the operations carried on in the field; it further describes the processes by which preliminary results were obtained from the observations, to satisfy immediate requirements, pending the completion of the several chains of triangles; also the method of final reduction which was adopted after the chains were completed, and by which the errors at the junctions of the chains with each other and with the base-lines are eliminated with the closest possible approach to mathematical rigour. It states briefly at page 28, and explains more fully at pages 162 to 170, the reasons why the method of final reduction could only be applied to limited portions of the triangulation at a time, thus necessitating the division of the triangulation into five great sections, to be reduced in succession, as indicated at page 32. It shows how the whole of the triangulation contained in the first of these sections—known as the North-West Quadrilateral—was reduced simultaneously; and, together with Volumes III and IV, it gives all the facts of angular observation appertaining to that Quadrilateral, full details of the preliminary and the final reductions of the angles and the several trigonometrical figures, and finally, the resulting values of the lengths and azimuths of the sides of the triangles and the latitudes and longitudes of the stations.

Volume V deals with a subject of its own, the Indian Pendulum Operations, which is quite unconnected with the triangulation and therefore need not be here noticed.

Volume VI treats almost entirely of the triangulation appertaining to the South-East Quadrilateral, the second of the five great sections into which the principal triangulation of India has been divided for final reduction. It commences with a brief recapitulation of the formulæ employed in the calculations, in order to obviate the necessity for frequent reference to Volume II, and then gives first, a complete exposition of the Simultaneous Reduction of the six chains or series of triangles forming the South-East Quadrilateral; and afterwards, for each series, an introductory account of the operations, a descriptive list of the stations, an abstract of the observations of each angle, full details of the preliminary reductions of the angles—made to satisfy the geometrical conditions of the trigonometrical figures—the final values of the angles after having been corrected to satisfy the conditions of the Quadrilateral, and finally, the resulting values of the lengths and azimuths of the sides, and of the latitudes and longitudes of the stations of the triangulation.

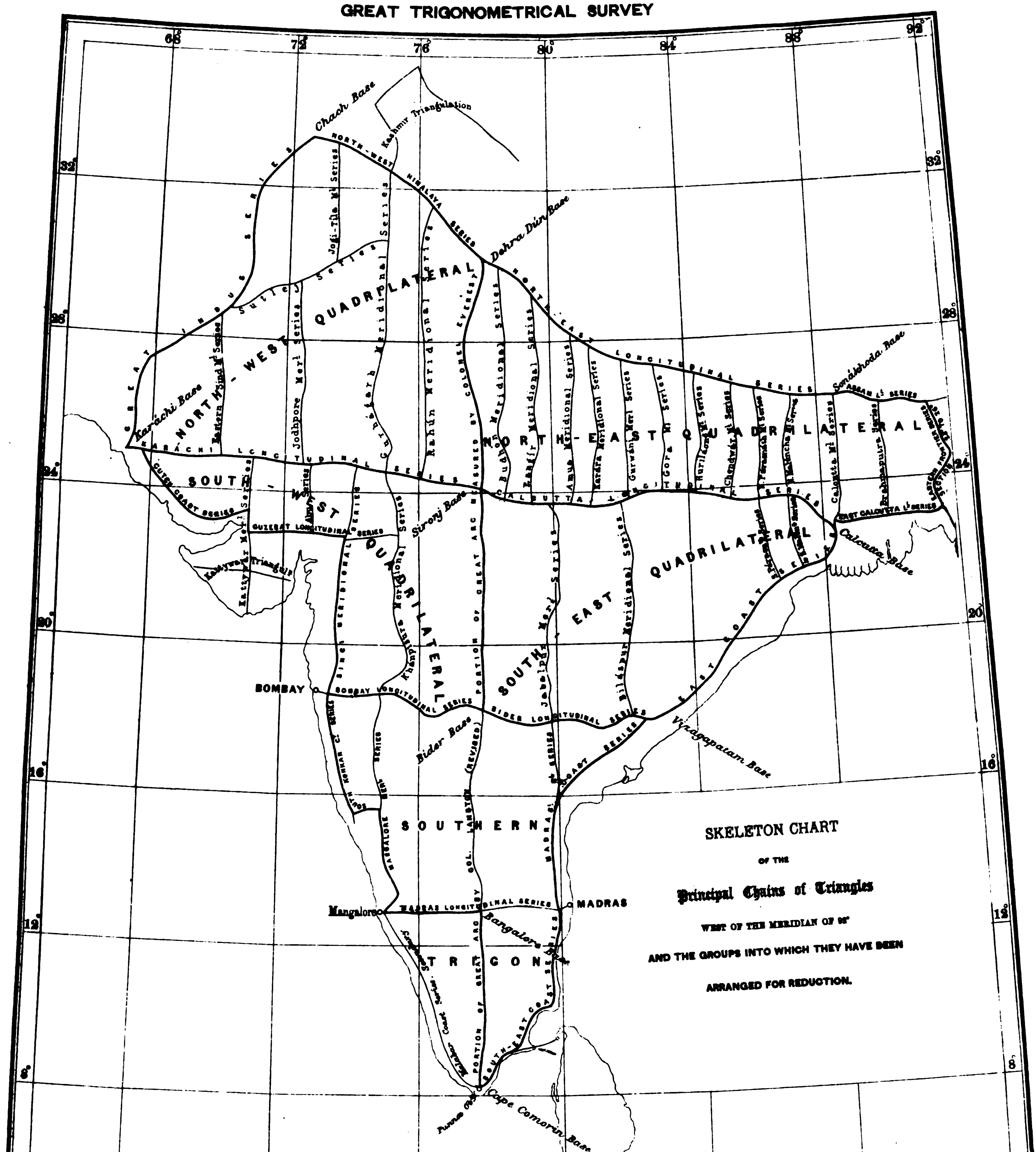
In like manner Volumes VII and VIII treat of the triangulation appertaining to the North-East Quadrilateral, the third of the five great sections before alluded to; and contain full details of the observations, reductions and final results of the sixteen chains or series of triangles embraced within the limits of that Quadrilateral.

Volume IX is devoted to the Electro-Telegraphic Longitude Operations which have been carried out by the Survey of India Department; but as no attempt has yet been made in this Department, to solve the equations of condition presented by the several arcs of longitude already measured, no combination of these equations with those of the triangulation has been possible and therefore the subject of Volume IX like that of Volume V may at present be considered as distinct from that of the other volumes.

The present volume is the tenth of the series in order of publication but is numbered IV A as it forms a supplement to Volumes II, III and IV, in that it treats of the reduction of two of the chains of the North-West Quadrilateral, the Jodhpore and the Eastern Sind Meridional Series, which did not exist at the time the North-West Quadrilateral was finally reduced, and of which the execution had been postponed indefinitely, on account of their falling in a tract of country mostly desert and not so immediately requiring triangulation as other portions of India.

In order that the reader may obtain a clear conception of the triangulation of India as a whole, and the position of the two series which form the subject of this volume relatively to the other series and especially as to their position in the North-West Quadrilateral, a Skeleton Chart of the Principal Triangulation of India is given opposite this page. In this chart each line represents a chain of triangles. The chain which approximates to the meridian of 78° and extends from the extreme south of India to latitude 30°, where it terminates on the Dehra Dún Base-line at the foot of the Himalaya Mountains, forms the back-bone of the triangulation, and is well known as the Great Meridional Arc of India, which was commenced by Colonel Lambton in Southern India, and carried upwards to the Himalayas by Colonel Everest; Colonel Lambton's portion has been revised of late years, with all the refinement which the latest and best instruments and the most approved procedure rendered possible. Of the remaining chains, some were accomplished in the earlier days of the Survey, when the instrumental equipment was generally very inferior to what it became subsequently, and when the procedure, as regards portions of the operations—more particularly the construction of towers for the principal stations in the plains—was still imperfect; other chains were executed in more modern times, with the best instruments and with the utmost possible refinement in every particular. The chains last executed are generally on a par with the Great Arc itself, while some are superior to it in accuracy. It so happened that lines of demarcation could be drawn broadly between the several chains of triangles, in such a manner as to divide the superior and the inferior chains into separate groups, each group containing a large number of interdependent chains; this circumstance was therefore availed of in designing

GREAT TRIGONOMETRICAL SURVEY



R. W. Foster, Photo. C. G. Ollenbach, Zinco.

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dūn, April 1886.

the great sections into which the triangulation had to be divided for final reduction. The bounding chains of these sections are represented in the Skeleton Chart by thick black lines, while the intermediate and all other chains are shown by thin lines. It will be seen that there are five sections in all, of which four are quadrilateral figures, while the fifth—which lies to the south of the others—is a trigon. The four quadrilaterals meet at the point Kaliánpur,—approximately in latitude 24° and longitude 78°—which was employed by Colonel Everest as the central or reference station of the triangulation; they are therefore distinguished by the corresponding cardinal points—North-East, South-East, South-West, and North-West—with reference to the central station.

It has already been shown, in Section 7 of Chapter I of Vol. II, that the most accurate of all the chains of triangles are those which enter the North-West and the South-East Quadrilaterals; the least accurate enter the North-East and the South-West Quadrilaterals. When therefore the method for the general treatment of the principal triangulation had been elaborated and was ready to be put into practice, the Simultaneous Reductions were taken in hand in the following order, *first* the North-West Quadrilateral, *second* the South-East, *third* the North-East Quadrilateral, and *fourth* the two remaining chains of the North-West Quadrilateral—the subject of the present volume,—*fifth* the Southern Trigon (now in the press), and *sixth* the South-West Quadrilateral, of which the reduction is in course of completion.

Any description of the triangulation of this Survey and the operations connected therewith, from the observations of the angles to the deduction of the most probable and therefore final results, is naturally subdivisible under six heads; *first*, the general principles in accordance with which the operations have been conducted; *second*, the practical execution of the measurement of the angles; *third*, the general principles followed in the combination and adjustment of the individual angular measures, with a view to satisfying all the geometrical conditions involved, as well as the primary linear elements which are fixed by the base-lines; *fourth*, the preliminary geometrical reduction of the individual triangles, polygons and net-works of which the chains are composed; *fifth*, the simultaneous reduction of each of the groups of chains, or sections, into which the triangulation has been divided for convenience; and *sixth*, the presentation of the most probable values of the magnitudes of the angles, of the lengths and azimuths of the sides of the triangles, and of the latitudes and longitudes of the stations of the triangulation, which are the final results of the several reductions. The first and third of these branches of the subject are of general application, and they form the principal matter of Volume II, which was intended to be introductory to all subsequent volumes relating to the triangulation. The second, fourth and sixth branches have special reference to individual series or chains of triangles. The fifth has reference to each of the sections or aggregations of chains grouped together for simultaneous reduction. In the present volume it has not been necessary to touch otherwise than lightly on the first and third divisions of the subject; but the remaining divisions, including the simultaneous reduction of each series, are dwelt on at length, and full numerical details are given for each of the chains of triangles.

For their linear and geodetic elements the Jodhpore and the Eastern Sind Meridional Series are dependent on the final elements of the Karáchi (Kurrachee) Longitudinal Series and the Sutlej and the Great Indus Series.

The present volume is divided into two parts. Part I is devoted to the final reduction of each series and Part II to the details of each series.

Part I.

Chapter I gives a general account of each chain of triangles, indicates their dependency on the North-West Quadrilateral for their fixed data and describes the structure of the principal stations.

Chapter II describes the procedure followed in the measurement of the horizontal angles, and the methods adopted in determining their weights; it quotes the mathematical formulæ employed in the reduction of the triangulation from Volume II, where they are demonstrated; it indicates the final adjustment of the trigonometrical determinations of height by connection with the main lines of spirit levels; and lastly, it indicates the general principles of the final reduction of each series.

Chapter III gives full details of the Simultaneous or Final Reduction of each Series separately as follows:—

First. Preliminary remarks.

Second. A synopsis of the independent partial reductions antecedent to the Final Reduction.

Third. A description of the Reduction Charts which are given at the end of the volume, and of which a careful study is essential to a clear understanding of the several processes of calculation.

Fourth. A general out-line of the formation of the Linear and Geodetic Equations of Condition, four in number for each series, which had to be satisfied, in order to produce the requisite consistency in the triangulation *per se,* and between it and the fixed elements on which it depended.

Fifth. The method of constructing the Coefficients of the Unknown Quantities in the Equations of Condition, showing the general notation which was adopted for expressing the values of these coefficients, and specifying every exception to the general form.

Sixth. A synoptical exhibition of the several Equations of Condition, showing at a glance the triangles of which the angular errors enter as unknown quantities into each of the four Equations of Condition.

Seventh. The Numerical Values of the Fixed Data on which each series is based.

Eighth. The Values of the Sides and Angles of the Circuit Triangles, as they stood before the Final Reduction.

Ninth. The Latitudes, Longitudes and Azimuths of the Stations on the right-hand flanks of the Circuit Triangles, as they stood before the Final Reduction.

Tenth. The Numerical Values of the Absolute Terms in the several Linear and Geodetic Equations of Condition.

Eleventh. The Numerical Values of the μs and ϕs, the geodetic summations—exhibited in the table at pages [42] and [43]—which are required in forming the Coefficients of the Unknown Quantities (the Angular Errors) in the Geodetic Equations of Condition.

Twelfth. The Numerical Values of the Coefficients, $\mathfrak{b}$ and $\mathfrak{c}$, of the Unknown Quantities in the several Linear and Geodetic Equations of Condition.

Thirteenth. The Coefficients, $\mathfrak{B}$ and $\mathfrak{C}$, of the Indeterminate Factors, in the equations in which the values of the Angular Errors are expressed in terms of those factors.

Fourteenth. The Equations between the Indeterminate Factors, showing every Significant Coefficient and Absolute Term as it stood, first on the formation of the equations, and secondly after the successive eliminations of individual factors in the process of solution; finally, the numerical values of the Factors are given.

Fifteenth. The Values of the Errors, x, y and z, of the angles of each triangle, resulting from each Final Reduction and the subsequent apportionments of residual error.

Sixteenth. The Dispersion of the Residual Errors which were met with after the Final Reduction.

Seventeenth. A Statement of the Final Results of each reduction, shewing the numerical accuracy ultimately attained in the calculations.

Chapter IV gives the Reduction of the Non-Circuit Triangles of the two series,—*viz.*, the triangles excluded from each Final Reduction—which was needed for the final adjustments of their angles, to satisfy the geometrical conditions of the polygonal figures to which they appertain.

Part II.

This part gives full details of the principal work of the two chains or series of triangles—from the observations of the principal angles to the determination of the final results, angular, linear and geodetic—series by series. The Secondary and Tertiary Triangulations which were executed *pari passû* with the principal triangulation for geographical and topographical purposes, are as usual relegated to the corresponding Synoptical Volume; the volumes of the *Accounts of the Operations &c.* being exclusively devoted to the details of the principal triangulation, excepting in so far that what has been done in the way of secondary and minor triangulation in each series, is described in the Introduction to the series.

It is now desirable to give first a summary, and afterwards a general explanation, of the information and numerical data which the present volume furnishes for each chain of triangles. Summarised they are as follows:—

1. Introduction.
2. Alphabetically arranged List of Stations.
3. Numerically arranged List of Stations.
4. The Description of Stations.
5. The Observed Angles, with the Weights of the Concluded Results.
6. The Reduction of the Polygonal Figures.
7. The Final Values of the Sides and Angles of the Triangles.
8. The computed Latitudes and Longitudes of the Stations and the Azimuths at each Station.
9. The trigonometrically determined Differences of Height of the Stations and the Absolute Height of each Station above the Mean Sea Level.
10. Astronomical Observations of the Azimuth, and their Reduction.

Plate. The Diagrams of the several Polygonal Figures contained in the series.

1. The Introduction gives a historical sketch of the progress of the whole of the operations in the field,—both principal and secondary—from year to year, mentions the Officers by whom they were conducted, and the theodolites with which the principal angles were measured, and indicates the work done by each of the Assistants.

2 and 3. It has been found convenient to indicate the Principal Stations by a system of numerals, as well as by their names. Consequently at the commencement of the details of each series two lists are given, in the first of which the stations are arranged alphabetically with the numbers opposite the names, in the second numerically with the names opposite the numbers. Roman numerals have been adopted throughout for the nomenclature of the stations, and they are progressive in order from south to north in the two chains, the first number for each series being unity.

4. The Descriptions of the Stations are based generally on those made originally by the observers and entered on the spot into the angle books, subject to such modifications as are occasionally required to take cognizance of any alterations which have been subsequently effected. They give the names of the district and the sub-division in which the station was situated at the time when its description was written. For information as to the general form and structure of the stations, reference should be made to Section 4 of Chapter I.

5. In the pages which are allotted to the observed horizontal angles, the name of the observer, the distinguishing number and the name of the maker of the theodolite, and the month and year in which the observations were taken, are specified for each station.

In the details of the measures of the angles are given the reference number of the station on which the telescope was set at the commencement of each round of measures, and the reading to which the azimuthal circle was set, after each 'change of zero'; thus the graduations of the circle to which the readings were taken, at every measure of any angle, may be readily ascertained for an investigation of the law of the graduation error, such as will be found for Troughton and Simms' 18-inch Theodolite No. 1, in Appendix No. 4 of Volume II.

In the right-hand column of the record are given M, the mean of the several groups of measures on each setting, w and $\frac{1}{w}$, the weight and its reciprocal of the angle as deduced from differences between individual measures and between individual groups, and C, the concluded value of the angle as thus derived from the observations only; for fuller explanations reference must be made to Section 4, Chapter VII, Volume II, to the example at page 342 of the same volume, and to Section 2 of Chapter II of this volume.

The abstracts of angles are followed by lists of the Sums of Squares of Apparent Errors of Single Observations and Single Zeros, which furnish data for the investigation of the average *e.m.s.* (theoretical error of mean square) of observation in a single measure of an angle, and the average *e.m.s.* of graduation *plus* observation in the mean of the measures on a single zero. Such determinations are made in the first instance for groups of angles measured by the same observer, with the same instrument, and under similar conditions, and then for various combinations of these groups. With data thus obtained, from series of triangles, for seven of the large theodolites which have been chiefly employed in the measurement of the principal angles, the investigation of the influences of Mixed Errors of Observation and Graduation was made which forms the subject of Section 3, Chapter VII, Volume II.

6. The Reductions of the several Polygonal Figures which are contained in each series show how the angles of which each figure is composed were made consistent and harmonious *inter se*, so as to satisfy all geometrical conditions, with due regard to the respective weights of the angles. Full explanation of the principles and the procedure of these reductions, will be found in Chapter VIII of Volume II, and the for-

mulæ are given in Section 3 of Chapter II of the present volume. The figures are numbered consecutively in each series. Diagrams of the figures are given in the Plates appertaining to each series. The small numerals within each of the observed angles correspond to the subscripts to the general symbol, x, which is employed to indicate the error of any angle, the numerical subscript denoting the angle. Thus on referring to the diagram of Figure No. 2 and to the reduction of that figure on page 71, x_3 is the error of the angle 3, at Station II between Stations I and III. The tabular statements of the reductions give, *firstly* the observed angles and the reciprocals of their weights; *secondly* the equations by the solution of which the geometrical conditions of the figure are satisfied,—see equations on page [12]; *thirdly* the equations between the 'indeterminate factors'; *fourthly* the values of the indeterminate factors; *fifthly* the values of the angular errors; and *sixthly* the summation of the products of the square of each error and its weight—the value of which summation is made a minimum, in order that the values to be obtained for the several angular errors may be the most probable of each of the many values by which the geometrical conditions of the figure may be satisfied. In the group of equations between the indeterminate factors, the coefficient of the pth factor in the qth line is the same as that of the qth factor in the pth line; thus if a diagonal line be drawn from the coefficient of the first term in the first line to that of the last term in the last line, the coefficients which are symmetrically disposed on opposite sides of this line will be identical with each other. Consequently only the coefficients on and above the diagonal have been given; the absence of those below is indicated by an asterisk.

8. The Tabular statement of the Triangles. The first two columns of this table give the number adopted for each triangle to designate its place in the series; this number is entered in the first column if the triangle appertains to the chains of single triangles forming the two circuits whose closing errors are eliminated by the Final Reduction; it is entered in the second column for the non-circuit triangles exterior to the chains. The triangles which enter the circuits are shown in the Reduction Charts (at the end of this volume) in firm lines, with their distinguishing numbers written in the centre; those which do not enter the circuits are shown in dotted lines, and their numbers are indicated by numerals of a smaller size than the former, commencing with 49 for the Jodhpore and 40 for the Eastern Sind Meridional Series, 48 and 39 being the numbers of the last of the circuit triangles in the respective series. The columns in the table which contain the corrections to the observed angles give, *first* the correction for the error of the angle, with reference merely to the triangle or polygonal figure to which it belongs, as obtained from the primary reductions; and *secondly* the further correction which has to be applied either for the apportionment of circuit error, should the angle appertain to one of the circuits, or for the restoration of consistency in the polygonal figure after the application of the circuit errors, should it appertain to a non-circuit triangle Finally, the corrected plane angles and the lengths of the sides are given, as computed by the rules of Plane Trigonometry, in accordance with Legendre's theorem; see Section 4 of Chapter II.

9. The Table of the Latitudes and Longitudes of the Stations and the Azimuths and Lengths of the Sides. The principles on which the calculations of the Geodetic Co-ordinates and Azimuths have been made and the method of computation, are fully explained in Sections 2 and 4 of Chapter IX of Volume II, and the formulæ are quoted in Section 5 of Chapter II of the present volume. All Azimuths are referred to the south point and are measured right round the horizon by the west.

10. The Determinations of the Differences of Height of the several stations have been obtained from the measurements of the vertical angles, as explained in Section 6 of Chapter II of this volume. It has not

been considered necessary to give the individual measures of these angles, as has been done for the horizontal angles, because this portion of the operations is less exact and important. But the mean of the whole of the measures of each vertical angle, the calculated mean value of the amount of refraction in each angle and of the coefficient of refraction, the hour of observation, the heights of the signal and of the observer's telescope above the summits of the stations, the differences of height of the said summits and the absolute heights above the mean-sea level, are given. The errors generated trigonometrically between the initial and terminal obligatory stations of each series, have been duly dispersed by the method of simple proportion over the intermediate trigonometrical values, as explained in Section 7 of Chapter II of the present volume.

It may be here stated that all trigonometrically determined heights invariably refer to the upper surfaces of the central masonry pillars at the principal stations. Spirit-leveled values on the other hand sometimes refer to the upper surface and sometimes to the basement of the pillar, whichever the leveling-staff was set upon; a description of the exact point of reference then becomes necessary.

11. Finally come the details and reductions of the Astronomical Observations which have been taken, at certain stations in each series, for the determination of the Azimuth of one of the surrounding stations, or of a referring mark, the angle between which and a contiguous station has been measured. The methods of observing and of reducing the observations are fully described in Chapter XII of Volume II. For reasons which are explained in the first section of that chapter, the results have not been used in the general reduction of the triangulation, further than to give a more exact mean value of the fundamental astronomical azimuth (at Kaliánpur) than the one obtained by the observations on the spot. At the end of the details of the determination of each azimuth, the difference between the observed value and the value obtained by calculation through the triangulation from the fundamental azimuth is given. These differences may be of much value in future investigations of the Figure of the Earth and of the influence of local attraction.

Full details regarding the Unit of the Linear Measures, the Base-lines, the Initial Elements of Latidue, Longitude and Azimuth, and the Elements of the Figure of the Earth which have been adopted in the calculations, will be met with in Volumes I and II. In this place it is only necessary to state that:—

(1). The Unit of Length is the Indian Standard 10-feet Bar **A**, the relations between which and the principal European Standards of Length are given at page 28 of Volume I.

(2). The adopted Elements of the Figure of the Earth—assumed to be spheroidal—are given at page [15] of this volume.

(3). The Longitudes depend on an astronomically determined value of the Longitude of the Madras Observatory, East of the Royal Observatory at Greenwich, which was deduced about the year 1815. The Longitude of the Madras Observatory has however been recently re-determined, by the Electro-Telegraphic method, by observations which were made at Greenwich, Mokattam (in Egypt), Suez, Aden, Bombay and at certain stations of the triangulation in India, and with the following preliminary results:—

	h	m	s		
Longitude of Mokattam	2	5	6·320	East of Greenwich	Supplied by Sir G. Airy, from observations taken in connection with Transit of Venus in 1874.
Increase for Suez	0	5	6·917	„	
„ Aden	0	49	42·656	„	By the operations of this Survey; see the Annual Report for 1876-77.
„ Bombay	1	51	19·983	„	
„ Madras	0	29	43·540	„	
Longitude of Madras	5	20	59·416	„	

This value of the Longitude of the Madras Observatory is equivalent to 80° 14′ 51″; and as the originally adopted value, on which the longitudes of the whole of the stations of this Survey are based, is 80° 17′ 21″—see page 135 of Volume II—the following precept may be accepted with considerable confidence:—

All the values of longitude in this volume require a constant correction, probably of – 2′ 30″.

The orthography of Indian names in the present volume is in accordance with the provincial lists of spellings constructed under the immediate orders of the Government of India. The newly authorised spellings were adopted for all names and other words contained in these lists; but for words for which there was no specific authority, the spellings have been framed in accordance with the methods followed in the preparation of the published lists, reference being made in the present instance more particularly to the Gazetted Lists for Rajputana and for Bombay. As a general rule the pronunciations of the vowels are as follows:—*a* has a variable sound as in wom*a*n, rur*a*l, p*a*ltry; *á* as in t*a*rtan; *i* as in b*i*t; *í* as in rav*i*ne; *u* as in b*u*ll; *ú* as in r*u*ral; *o* as in n*o*te; *e* as *a* in s*a*y; *au* as *ou* in cl*ou*d; *ai* as *i* in r*i*de. Final vowels and those in well-known terminals are unaccented. When the popular spelling of a name has been accepted by Government, its correct transliteration is given in parenthesis where the name occurs for the first time.

It now only remains for me to state that the Introductory Chapters forming Part I of this volume are the work of Mr. W. H. Cole, M.A., Deputy Superintendent. The Introductions to both series were written by Major M. W. Rogers, R.E., Deputy Superintendent. The reduction of the Jodhpore Meridional Series was effected chiefly with the aid of Baboos Gunga Pershad, Gopal Chandra Sarcar and Kedar Nath, and that of the Eastern Sind with the aid of Baboos Gunga Pershad and Mizaji Lal. The volume like its predecessors has been printed at the Trigonometrical Branch Office at Dehra; Mr. Peychers and Baboo Gunga Pershad have rendered valuable service in the examination of the press proofs generally, and Mr. Peychers more particularly in regard to the numerical and mathematical details which require the utmost care in supervision through the press, and in this respect from his natural aptitude and experience his assistance has been most valuable.

DEHRA DUN,
March, 1886.

C. T. HAIG, COLONEL, R.E.,
Offg. Dy. Surveyor General,
In charge Trigonometrical Surveys.

ERRATA ET ADDENDA.

THE JODHPORE MERIDIONAL SERIES.

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VOCABULARY OF CERTAIN NATIVE WORDS MADE USE OF IN THIS VOLUME.

Orthography employed.	Correct Orthography.	Meaning.
Amír	Amír	Title of the rulers of Sind.
Bajri	Bájri	A kind of grain, millet.
Bhati Rájput	Bhatti Rájpút	A clan of Rájpúts, a warrior caste of India.
Chunam	Chúna	Lime employed in preparing mortar.
Darbár	Darbár	Government.
Draen	Dráíñ	Tracts of shifting sand.
Jágír	Jágír	Land given by Government as a reward for services.
Jain	Jain	A sect of Hindus.
Játs	Játs	Ditto.
Kacha	Kachchá	Built of clay only; or of stone or unburnt brick and clay.
Maháraja	Mahárája	A king or ruler.
Maharáwal	Mahárávwal	Ditto.
Mot	Moth	A kind of grain, pulse.
Pargana	Pargana	A sub-division of a district.
Phog	Phog	A shrub of the Calligonum species.
Rao	Ráo	A chief.
Sardár	Sardár	A chief or headman.
Tahsíl	Tahsíl	Portion of a district subject to a Revenue Collector.
Taluk / Taluka	Taälluk / Taälluka	A sub-division of a district.
Thakur	Thákur	Title of a Rájpút chief.
Thána	Thána	A small police sub-division.
Vishnu	Vishnu	One of the three principal Hindu deities.

PART I, INTRODUCTORY.

THE FINAL REDUCTIONS

OF THE

JODHPORE MERIDIONAL SERIES

AND OF THE

EASTERN SIND MERIDIONAL SERIES

OF THE

NORTH-WEST QUADRILATERAL.

CHAPTER I.

ACCOUNT OF THE TRIANGULATION OF THE JODHPORE AND EASTERN SIND MERIDIONAL SERIES.

1.

The Triangulation included in this Volume.

The Jodhpore and Eastern Sind Meridional Series form two of the internal chains of that section of the triangulation of India, designated the North-West Quadrilateral, which embraces all the principal triangulation between the parallels of 24° and 34° and the meridians of 67° and 78°.

These two series had not been commenced at the time, 1868, the Simultaneous Reduction of the North-West Quadrilateral was undertaken; and although they formed part of the scheme for the triangulation of India, it was considered undesirable to await their execution, for reasons which are fully stated in Section 7 of Chapter I of Vol. II of the *Account of the Operations of the Great Trigonometrical Survey of India.* It thus happens that while they are on a par with the most refined work of the Survey, they have had to be separately reduced to accord with the rest of the triangulation of the North-West Quadrilateral.

2.

The Observers and the Instruments employed on the Triangulation.

The Jodhpore Series, meridian 72½°.

This Series emanates from the side Súnda–Bonik of the Karáchi Longitudinal Series and closes on the side Kaimsir–Kanda of the Sutlej Series. It was commenced by Lieutenant (now Major) M. W. Rogers, R.E., in 1872-73, who advanced the principal chain a distance of 95 miles, fixing 12 stations forming a quadrilateral and two single polygons. Lieutenant Rogers having proceeded on furlough, the charge of the party was transferred to Lieutenant (now Major) J. Hill, R.E., who carried the chain of principal triangles a further distance of 90 miles by a series of consecutive polygonal figures. Captain Rogers returned from furlough and relieved Captain Hill of the charge of the party on the 20th November 1874, and during that and the following field season he succeeded in completing the Series. The chain is double throughout. It comprises 3 quadrilaterals, 8 single polygons, and 2 double polygons, and is 310 miles long. The instrument employed was Barrow's 24-inch Theodolite No. 2, of which a description will be found in Appendix No. 2 of Vol. II.

The Eastern Sind Series, meridian 70°.

Operations were commenced on this Series during the field season of 1875-76. While Captain Rogers was bringing the Jodhpore Meridional Series to a conclusion, he detached one of his assistants to commence the selection of stations on the meridian of 70°, starting from the Karáchi Longitudinal Series. The side Rojhra–Sandohar was selected as a base; and the neighbouring stations of Fulrár and Chánga having been destroyed, new ones were built on their sites and employed in constructing a hexagon about Sandohar. When he himself had brought the Jodhpore Series to a termination on the 3rd January 1876, he marched to the proposed northern terminus of the Eastern Sind Meridional Series to commence preliminary operations from that end. In the neighbourhood where the Series was to have closed to the north, several stations of the Great Indus Series had been washed away by the river, and Captain Rogers was obliged to adopt the side Dáowála–Máchka west of the meridian of 70° and to work on to this meridian. Only preliminary operations were carried on this season, the chain being laid out for 110 miles at its southern end and for 24 miles at the northern end. In the field season of 1876-77 the final observations were commenced and the Series was carried forward a distance of 125 miles from its southern terminus. During the next season the party was employed in Baluchistan; and the season following, war having broken out between India and Afghanistan, Captain Rogers was attached to the Force operating in the latter country from the south. Towards the end of 1879 Captain Rogers returned from Afghanistan but not in time to effect a full season's work on the Eastern Sind Meridional Series. He however advanced it 64 miles, and there then remained only so much as could be easily completed during one field season.

In April, 1880, Captain Rogers went to England on furlough, when the party proceeded to Mussooree, and during the recess season was placed temporarily under Mr. J. B. N. Hennessey, in addition to his other duties. At the end of the recess, having equipped the party for the field, Mr. Hennessey transferred it to Colonel Branfill, who met it in Sind on the 6th November, 1880. The remainder of the chain of principal triangles was then completed in about two and a half months. The Series is double throughout, comprising 3 quadrilaterals, 7 single polygons and 2 double polygons. The instrument employed by Captain Rogers was Barrow's 24-inch Theodolite No. 2, and that by Colonel Branfill was Troughton and Simms' 24-inch Theodolite No. 1.

3.

The Dependency of the Triangulation on the North-West Quadrilateral for the fixed data.

Both the Jodhpore and Eastern Sind Meridional Series emanate from the Karáchi Longitudinal Series; the former closing on the Sutlej Series, and the latter on the Great Indus. All these three appertain to the North-West Quadrilateral which, as already stated, had been finally reduced before the two chains were executed. The only connection between the chains, other than that through triangulation which stood finally reduced, is by a secondary series, and therefore their reduction consists of two independent operations. The fixed data for each were the length and position of the side of origin and the same elements of the closing side.

4.

The Construction of the Principal Stations.

The Jodhpore Meridional Series.

The principal stations of this Series are nearly all situated on hills; they consist of circular masonry pillars from 3 to 4 feet in diameter, for the large theodolite to rest on, are generally surrounded by platforms of stones and earth, or sand, of sufficient size to support the observatory tent. Several of the stations fell on sand hills which did not afford a satisfactory foundation for the pillars; piles were then driven into the sand and the foundation laid on them, the pillars being built so that their surfaces were nearly flush with the hill top. Owing to their elevated positions the pillars rarely had to be raised to a height of more than 3 or 4 feet; they contain two or more marks the upper of which is generally flush with the surface. Over the upper mark a rectangular protecting pillar, bearing a sufficiently accurate mark for Topographical and Revenue Survey purposes—as shewn at page 74 of Vol. II of the *Account of the Operations, &c.*—was erected after the completion of the observations, and the station was then further protected by a pile of stones and earth.

The Eastern Sind Meridional Series.

The great majority of the stations of this Series are situated on sand hills and their construction is as follows:—A solid, circular pillar of masonry for the theodolite to stand on, isolated by means of an annular wall, was built up from a depth of 3 feet to the level of the hill top; in this pillar were placed two or more mark-stones vertically over one another, the upper one being in the surface of the pillar. The remaining stations are tower stations: they consist of either a solid or perforated pillar surrounded by a solid tower of sun-dried bricks set in mud for the accommodation of the observatory tent. The solid pillars have marks at the top, at the bottom and intermediately, while the perforated pillars have a mark in the floor and another below it in the foundation, access to the mark in the ground floor being obtained by a vaulted passage through the tower and pillar. The pillars themselves were constructed in rectangular blocks of masonry surmounting one another, each succeeding block being contracted so as to leave a plinth at its base; the uppermost block, for the theodolite to stand on, is circular, $3\frac{1}{2}$ feet in diameter, and isolated from the tower. The upper mark-stones where the pillars were solid, were in all cases protected by rectangular pyramidal pillars erected over them after the completion of the observations, and bearing a sufficiently accurate mark for Topographical and Revenue Survey purposes.

CHAPTER II.

THE MEASUREMENT OF THE ANGLES AND THE GENERAL PRINCIPLES FOLLOWED IN THE REDUCTION OF THE TRIANGULATION.

1.

The Measurement of the Horizontal Angles and their Record.

In Chapter IV of Vol. II full particulars have been given of the methods of observing both horizontal and the vertical angles which have been in practice since the year 1823. It will not be necessary therefore to do more here than briefly indicate the procedure, in order that the reader may be enabled to understand the details of the observations.

The method of observing horizontal angles was that introduced by Colonel Everest, and had for its object the giving of readings at equal intervals round the azimuthal circle, with a view to the cancellation of periodic errors of graduation. When the instrument was set up for use, and had been properly centred over the station mark and levelled, either one of the surrounding stations, or a referring mark specially set up for the purpose, was adopted as what is called the *zero-station*, or the station for which the readings of the instrument are obligatory. The telescope being directed to this station, the index was made to read 0° 0′. The remaining stations were then observed to in succession, two or more rounds of observations being taken. When these were completed the telescope was turned over in altitude and brought round in azimuth to point to the *zero-station*: the index would then read 180° 0′. With this zero-reading another set of observations, similar to the last, was taken. A single measure on each of the two zero-settings constitute a pair of collimated observations, the face of the vertical circle being to the left of the observer at one setting and to his right at the other. The instrument was next shifted in azimuth, so as to bring the index to another arbitrary reading while the telescope pointed to the zero-station, and observations were again taken on F. L., face left, and F. R., face right; and so on. These arbitrary shifts were through arcs of 10° for theodolites with 3 microscopes and 7° 12′ for 5-microscope theodolites. In 1860, in order to secure a greater change of position of the axis in its socket, and so avoid the occurrence of certain constant errors which might be prejudicial in a long chain of triangles, Colonel Waugh decided that the arc between the microscopes should be added to each shift.

The system of zero-settings employed in the Jodhpore and Eastern Sind Meridional Series was as follows:—

$$\frac{0^\circ\ 0'}{180^\circ\ 0'},\ \frac{79^\circ\ 12'}{259^\circ\ 12'},\ \frac{158^\circ\ 24'}{338^\circ\ 24'},\ \frac{237^\circ\ 36'}{57^\circ\ 36'}\ \text{and}\ \frac{316^\circ\ 48'}{136^\circ\ 48'}.$$

The minimum number of rounds on each zero was three; but when differences shewed themselves in successive measures of an angle, greater than it was considered the instrument ought to give, the observations were repeated.

The several measures of each angle, with the name of the observer and instrument employed and the date of the observations, are given in Part II of this volume, commencing for the Jodhpore Series at page 14 and for the Eastern Sind Series at page 131. Against each single measure is a letter in italics, shewing whether the signal observed to was *l*, a lamp, or *h*, a heliotrope; sometimes a direct measurement of an angle was not obtained owing to the temporary invisibility of one of the signals, but the value of the angle was deduced from the measure of the double angle given by the omission of the signal in the round, and from a direct measure of the other angle; in this case the measure is preceded by the letter *d*.

Below the individual measures are their means from which M the general mean is obtained. The several measures and zero means are then treated as described in the following Section, and give C the concluded angle, together with w, its relative weight to the other angles measured under similar circumstances, and $\frac{1}{w}$, the reciprocal.

2.

The Deduction of an Angle from its several Measures and its Weight.

It has been stated that the number of measures of an angle on the same zero is not always constant, but is occasionally increased at the discretion of the observer. Of old the custom was to take the general mean of all the zero-means as the most probable value of the angle resulting from the several measures; but, for reasons which are explained in Chapter VII of Vol. II, this practice has been departed from, and the following procedure has been adopted in deducing the value and the weight of each angle in the present volume.

Let d', d'', d''', &c., be the differences between the successive single measures and the mean of the measures on the zero to which they respectively belong, n_1, n_2, n_3, &c., the number of measures on each zero, the sum of all which is $= N$, and D_1, D_2, D_3, &c., the algebraical excess of the successive zero means, Z in number, over the arithmetical mean, M, of all the zeros.

Now put

$$o^2 = \frac{d'^2 + d''^2 + d'''^2 + \ldots}{N - 1}$$

$$g^2 = \frac{D_1^2 + D_2^2 + D_3^2 + \ldots}{Z - 1}$$

and let

$$w_1 = \frac{1}{g^2 + \frac{o^2}{n_1}}, \quad w_2 = \frac{1}{g^2 + \frac{o^2}{n_2}}, \quad w_3 = \frac{1}{g^2 + \frac{o^2}{n_3}}, \ldots$$

Then the resulting angle C, usually called the '*Concluded Angle*',

$$= M + \frac{w_1 D_1 + w_2 D_2 + w_3 D_3 + \ldots}{w_1 + w_2 + w_3 + \ldots}$$

Here o* and g are taken as preliminary approximations to the theoretical *error of mean square* of observation and graduation, o being the *e.m.s.* of observation and g that of graduation in a single measure of an angle; these quantities being known, the *weights*, $w_1, w_2, \ldots$, of the successive zero-means are ascertained, whereby these means are readily combined to give the value of the Concluded Angle, as in the last equation.

Let w be the weight of the angle thus deduced; then we may put,

$$w = w_1 + w_2 + w_3 + \ldots$$

and if the preliminary values of o and g, as obtained from the observations, are absolutely true, then w will be the reciprocal of the square of the *e.m.s.* of the concluded angle.

It must be here observed that the values of *e.m.s.* thus obtained immediately from the observations, cannot be considered to be in the same terms when the instruments and circumstances under which the observations are taken are different. The values are only to be regarded as preliminary, applicable in any combination of angles measured with the same instrument and under similar circumstances, but requiring to be multiplied by factors of the nature of *moduli* before they can be employed in a combination of angles measured with different instruments and under different circumstances. This subject is fully treated of in Section 5 of Chapter VII of Volume II, to which reference can be made if desired. It need not be entered on here for the angles of the Jodhpore Meridional Series having been observed with the same instrument and under the same circumstances needed no *modulus* to equalize the weights; and although on the Eastern Sind Meridional Series two instruments

* Strictly speaking the denominator in the expression which gives the value of o would be $N-Z$; but a larger denominator, as N or $N-1$, is preferable in the present instance, because o is combined with g which, strictly speaking, would represent the total error and not that of graduation only, if each measure were absolutely independent of all the others, which it is not. Thus, though the denominator $N-1$ was originally employed by an oversight, as may be here frankly acknowledged, it has been retained as more appropriate than $N-Z$ under existing circumstances.

were employed, one of them was used for such a small portion of the triangulation as to afford too few data for determining a *modulus*, and being both 24-inch theodolites of practically equal capabilities it was the less desirable to attempt to deduce any; hence the weights of this Series were also assumed to be in the same terms.

The record of the measures of the angles is followed by a list of the "Sums of Squares of Apparent Errors of Single Observations and of Apparent Errors of Single Zeros," furnishing the requisite data for the investigation—by which it is followed—of the average 'error of mean square,' of observation only, in a single measure, and that of graduation *plus* observation in the mean of the several measures on a single zero; these are determined for certain groups of the angles in which all the measures have been made by the same observer with the same instrument and under the same conditions, and also for groups formed by various other combinations of the conditions. With the data thus obtained for each of the series, investigations of the influence of "Mixed Errors of Observation and Graduation", similar to those which are given in Chapter VII of Vol. II, may be made.

3.

Preliminary Reductions of the Groups of Angles contained in independent Trigonometrical Figures.

So long as chains of triangles are treated as independent of one another, the angles naturally separate themselves into as many groups as there are single triangles, and combinations of triangles into single polygonal figures and net-works. Each triangle is subject to the geometrical condition that the three angles are equal to 180° *plus* the spherical excess, and each group of triangles to additional geometrical conditions, such as that the angles at any central point should together equal 360°, and that the value of any side as calculated through any portion of the figure back to itself should be unaltered.

The formula which has been employed for calculating the spherical excess of the triangles in this volume is

$$\epsilon = ab \sin C \times \frac{\operatorname{cosec} 1''}{2r^2} \text{*}$$

in which ϵ is the spherical excess in seconds, a, b and C two sides of the triangle and the included angle, and r the radius of curvature for the oblique section of which the azimuth is 45°, that is, $r = \frac{2\rho\nu}{\rho+\nu}$, ρ being the radius of curvature to the meridian and ν the normal on the axis minor for the mean latitude of the triangle.

* The factor $\frac{\operatorname{cosec} 1''}{2r^2}$ has been tabulated for every degree of latitude from 5 to 36 in the *Auxiliary Tables to facilitate the calculations of the Survey Department of India*, Dehra Doon, 1868.

The geometrical conditions connecting groups of angles divide themselves under three heads, *triangular*, *central* and *side*. The first is, as before stated, that the three angles of a triangle must equal 180° + the spherical excess, the second that all the angles meeting at a point and completely surrounding it must equal 360°, or when an angle is measured as a whole and also in parts, the whole should equal the parts, and the third springs from the condition that the value of any side carried through the triangulation back on itself should reproduce itself. The excesses or deficiencies which manifest themselves in these comparisons either become the right hand members of the equations amongst the angular errors furnished by the conditions, or they furnish the means of obtaining them.

The number of the equations for each independent trigonometrical figure is given by the formula

$$N - 2S + 4$$

in which N is the number of angles and S the number of stations.

In order to express the equations, denote the observed angles by $X_1, X_2, X_3, \ldots$ the corresponding angular errors by $x_1, x_2, x_3, \ldots$ and the absolute terms of the equations by e with subscripts denoting the equations to which they appertain. The triangular and central equations will then take the form.

$$x_1 + x_2 + \ldots = e$$

The side equations may be expressed in either of the two following forms, it is immaterial which, so far as the accuracy of the results is concerned; but the second entails least labour in calculation, and for that reason is preferred:—

If $a_1 = \cot X_1$, $a_2 = \cot X_2$, &c., the side equations will be represented by

$$a_1 x_1 - a_2 x_2 + a_3 x_3 - a_4 x_4 + \ldots = \frac{\operatorname{cosec} 1''}{\mathrm{M}} \times \log \frac{\sin X_1 . \sin X_3 \ldots}{\sin X_2 . \sin X_4 \ldots} \quad \ldots \quad (1)$$
$$= e$$

M being the modulus of common logarithms; or if

$a_1 =$ tabular difference of log. sin X_1 for a change of 1″
$a_2 =$ „ „ log. sin X_2 „

and so on

$$a_1 x_1 - a_2 x_2 + a_3 x_3 - a_4 x_4 + \ldots = \log. \frac{\sin X_1 . \sin X_3 \ldots}{\sin X_2 . \sin X_4 \ldots} \quad \ldots\ldots \quad (2)$$
$$= e$$

These geometrical conditions have to be satisfied in such a manner, that the angles shall receive the most probable of the several series of corrections which present themselves. This is done by the method of minimum squares, which is now so well known that nothing need be said regarding it further than that it requires the following expression shall be made a minimum,

$$U = \frac{x_1^2}{u_1} + \frac{x_2^2}{u_2} + \ldots + \frac{x_t^2}{u_t}$$

in which $u_1, u_2, \ldots u_t$ are the reciprocals of the weights, $w_1, w_2, \ldots w_t$, of the observed angles.

The following equations—taken from Section 5, Chapter VIII, Vol. II—express first the geometrical conditions, secondly their relations with the indeterminate factors, $\lambda_a, \lambda_b, \ldots \lambda_n$, by the introduction of which U is made a minimum, and thirdly the most probable values of the angular errors in terms of the geometrical conditions and the indeterminate factors.

The geometrical equations of condition, n in number between t unknown quantities are

$$\begin{array}{l} a_1\, x_1 + a_2\, x_2 + \quad . \quad . \quad . \quad + a_t\, x_t = e_a \\ b_1\, x_1 + b_2\, x_2 + \quad . \quad . \quad . \quad + b_t\, x_t = e_b \\ . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \\ n_1\, x_1 + n_2\, x_2 + \quad . \quad . \quad . \quad + n_t\, x_t = e_n \end{array}$$

The equations between the indeterminate factors are

$$\begin{array}{l} [aa.\, u]\, \lambda_a + [ab.\, u]\, \lambda_b + \quad . \quad . \quad . \quad + [an.\, u]\, \lambda_n = e_a \\ [ab.\, u]\, \lambda_a + [bb.\, u]\, \lambda_b + \quad . \quad . \quad . \quad + [bn.\, u]\, \lambda_n = e_b \\ . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \\ [an.\, u]\, \lambda_a + [bn.\, u]\, \lambda_b + \quad . \quad . \quad . \quad + [nn.\, u]\, \lambda_n = e_n \end{array}$$

in which the brackets [ ] indicate summations, thus

$$[aa.\, u] = a_1 a_1.\, u_1 + a_2 a_2.\, u_2 + \quad . \quad . \quad . \quad + a_t a_t.\, u_t.$$

The resulting values of the angular errors are

$$\begin{array}{l} x_1 = u_1\, (a_1\, \lambda_a + b_1\, \lambda_b + \quad . \quad . \quad . \quad + n_1\, \lambda_n) \\ x_2 = u_2\, (a_2\, \lambda_a + b_2\, \lambda_b + \quad . \quad . \quad . \quad + n_2\, \lambda_n) \\ . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \\ x_t = u_t\, (a_t\, \lambda_a + b_t\, \lambda_b + \quad . \quad . \quad . \quad + n_t\, \lambda_n) \end{array}$$

and the value of the minimum, U, is

$$\lambda_a\, e_a + \lambda_b\, e_b + \ldots + \lambda_n\, e_n.$$

Abstracts of the reductions of the figures will be found in Part II for the Jodhpore

Meridional Series on pages 69 to 84 and for the Eastern Sind Meridional Series on pages 181 to 195. In these abstracts are given for each figure the observed angles with their reciprocal weights, the equations to be satisfied, the resulting equations between the indeterminate factors, the values of these factors and the values of the angular errors obtained; finally the value of the minimum is also noted.

4.

Calculation of the Sides of the Triangles.

The values of the angular errors having thus been computed are applied to the observed angles with contrary signs; then the angles of every triangle are reduced to plane angles by the subtraction of one-third of the spherical excess of the triangle from each, and the sides of the triangles are obtained in the ordinary manner. The angular corrections furnished by the figural reductions, besides being the most probable, in so far as the conditions to which they have been subjected are concerned, render each figure or net of triangles consistent, so that the ratio of any one side to any other side is the same by whatever route it is calculated.

5.

Geodetic Elements of Stations and Sides.

The lengths of the sides of triangles and the dimensions of the Figure of the Earth being known, it will be evident that if the latitude of any one station and the azimuth of any side of the triangulation from it to a second station are given, the difference in latitude and longitude between it and the second station, and the back azimuth of the connecting side, may be computed.

Now the origin of co-ordinates which has been adopted for the Indian triangulation is Kaliánpur, Station 1 of the North-West Quadrilateral, the initial elements at which are

	°	′	″
Latitude North	24	7	11·26
Longitude E. of Greenwich	77	41	44·75
Azimuth of Station 29 (Súrantál)	190	27	5·10

as explained in Chapter XI of Vol. II.

But as the positions of all the stations of the North-West Quadrilateral are regarded as having been finally fixed in the Simultaneous Reduction of that figure, the elements of any of them may be adopted in place of those of Kaliánpur, whenever it happens to be convenient to do so. Thus, as the Jodhpore and Eastern Sind Meridional Series are based on sides of the Karáchi Longitudinal Series, one of the Series of the North-West Quadrilateral, the elements of those sides have been adopted as the initial elements of the two series, instead of falling back on Kaliánpur.

The formulæ which have been employed on the successive calculations of latitude, longitude and reverse azimuth are given below.

If A and B be two stations on the earth's surface, and the latitude and longitude of A, and the azimuth of B at A be λ, L and A respectively, the distance between A and B being c, and if

$\Delta\lambda$ denote the difference of latitude between A and B
ΔL „ „ longitude „
B „ azimuth of A at B
$\Delta A = B-(\pi+A)$
e „ the excentricity of the spheroid
ρ „ the radius of curvature to the meridian at λ
ν „ the normal to the meridian at λ terminated by the minor axis,

then

$$\Delta\lambda = \begin{cases} -\dfrac{c}{\rho}\cos A \operatorname{cosec} 1'' \\ -\dfrac{1}{1.2}\dfrac{c^2}{\rho.\nu}\sin^2 A \tan\lambda \operatorname{cosec} 1'' \\ -\dfrac{3}{4}\dfrac{c^2}{\rho.\nu}\dfrac{e^2}{1-e^2}\cos^2 A \sin 2\lambda \operatorname{cosec} 1'' \\ +\dfrac{1}{1.2.3}\dfrac{c^3}{\rho.\nu^2}\sin^2 A \cos A\,(1+3\tan^2\lambda)\operatorname{cosec} 1'', \end{cases}$$

$$\Delta L = \begin{cases} -\dfrac{c}{\nu}\dfrac{\sin A}{\cos\lambda}\operatorname{cosec} 1'' \\ +\dfrac{1}{1.2}\dfrac{c^2}{\nu^2}\dfrac{\sin 2A \tan\lambda}{\cos\lambda}\operatorname{cosec} 1'' \\ -\dfrac{1}{1.2.3}\dfrac{c^3}{\nu^3}\dfrac{(1+3\tan^2\lambda)\sin 2A \cos A}{\cos\lambda}\operatorname{cosec} 1'' \\ +\dfrac{1}{1.2.3}\dfrac{c^3}{\nu^3}\dfrac{2\sin^3 A \tan^2\lambda}{\cos\lambda}\operatorname{cosec} 1'' \end{cases}$$

and

$$B = \pi + A + \begin{cases} -\frac{c}{\nu} \sin A \tan \lambda \operatorname{cosec} 1'' \\ +\frac{1}{4}\frac{c^2}{\nu^2}\left\{1 + 2\tan^2\lambda + \frac{e^2 \cos^2\lambda}{1-e^2}\right\} \sin 2A \operatorname{cosec} 1'' \\ -\frac{c^3}{\nu^3}\left(\frac{5}{6} + \tan^2\lambda\right)\frac{\tan\lambda}{2} \sin 2A \cos A \operatorname{cosec} 1'' \\ +\frac{1}{2.3}\frac{c^3}{\nu^3} \sin^3 A \tan\lambda\,(1 + 2\tan^2\lambda) \operatorname{cosec} 1'' \end{cases}$$

For the derivation of these formulæ, and also for the manner in which they have been arranged for calculation, see Chapter IX of Volume II, also the *Auxiliary Tables to facilitate the calculations of the Survey Department of India.*

The values of the elements of the Figure of the Earth which have been employed in the calculations are those known as "Everest's Constants, 1st set", and are:—

Semi-axis major,	$a = 20{,}922{,}932$ feet,	Log $= 7{\cdot}320\,6225\,4$
Semi-axis minor,	$b = 20{,}853{,}375$ feet,	„ $= 7{\cdot}319\,1763\,4$
Ellipticity,	$c = \frac{a-b}{a} = \frac{1}{300{\cdot}80}$	„ $= \bar{3}{\cdot}521\,7196\,8$
	$e^2 = \frac{a^2-b^2}{a^2} = 0{\cdot}0066378$	„ $= \bar{3}{\cdot}822\,0271\,8$
	$1 - e^2 = 0{\cdot}9933622$	„ $= \bar{1}{\cdot}997\,1076\,1$

from which ρ and ν are found by the well known formulæ.

6.

Reduction of the Vertical Angles for the determination of Differences of Height and Co-efficients of Refraction.

The relative heights of the principal stations of this Survey are determined in all instances by measuring the reciprocal vertical angles. The heights so obtained are controlled, wherever possible, by connecting the stations of the triangulation with those of lines of Spirit Levels, which are executed by this Survey, and occasionally with Tidal Stations on the coasts of the Peninsula, at which direct determinations of the mean sea level have been made. The formula that was employed for many years in the calculation of differences of height, is due to Colonel Everest, and is as follows :—

If h be the difference of height of two stations **A** and **B**, D' the depression of **B** at **A** and D that of **A** at **B**, H the height of **A** above mean sea level, c the distance between **A** and **B** at that level, and r the radius of curvature corresponding to the mean latitude of **A** and **B**, then the angle subtended at the lower station by the excess of height of the higher, or the so-called *subtended angle*, is $\frac{1}{2}(D-D')$ and the height of **B** above or below **A** is given by the expression

$$h = c\left(1+\frac{H}{r}\right)\frac{\sin\frac{1}{2}(D-D')}{\cos D}$$

according as the result is *plus* or *minus*. If either of the angles is an elevation instead of a depression its value must be employed with the opposite sign to that here given.

In order to use this formula it is first necessary to correct the observed angles for the heights of the observing instrument and observed signal. A much less laborious process is to employ the uncorrected vertical angles, and then reduce the result thus obtained to the levels of the stations by an algebraical combination of the heights of the instruments and signals. This procedure is as follows :—

If i_a, i_b be the heights in feet of the theodolites at **A** and **B** respectively
s_a, s_b ,, signals ,, ,,
D_a, D_b the observed vertical angles, both assumed to be depressions,

and we put

$$\delta = s_a - s_b + i_a - i_b$$

then

$$h = c\left(1+\frac{H}{r}\right)\frac{\sin\frac{1}{2}(D_b-D_a)}{\cos D_b}+\frac{\delta}{2}$$

This formula, though not absolutely rigorous, holds good for all cases that have hitherto occurred or are likely to occur in this Survey.

For r, the radius of curvature, the same formula is employed as in the calculation of spherical excess, see page [10], ρ and ν being here taken for the mean latitude of the stations.

In the preceding formulæ it is assumed that the reciprocal angles are equally affected by refraction, and in order that this may be as nearly the case as possible, the vertical angles are generally measured between the hours of 1 and 3 P. M., when the amount of refraction is usually a minimum.

The reciprocal angles are also employed to determine the coefficient of refraction, to be used in reducing unreciprocated vertical angles; for, putting C for the arc between the stations **A** and **B**, or the *contained arc* as it is usually called, and ϕ_a, ϕ_b for the refraction at the respective stations, we have

$$C = D_a + \phi_a + D_b + \phi_b - \beta$$

in which expression

$$\beta = \frac{i_a - s_a + i_b - s_b}{c \sin 1''}.$$

Thus, the mean refraction, ϕ, is given by the expression

$$\phi = \tfrac{1}{2} \{ C - (D_a + D_b) + \beta \}$$

and $\frac{\phi}{C}$ gives the terrestrial refraction in decimals of contained arc—or in other words the *coefficient of refraction*—for each pair of reciprocated observations. From the several values of the coefficient thus determined, those which are deemed most suitable are selected for employment in the reduction of vertical angles to secondary points, at which reciprocal observations have not been taken.

The formula for calculating the *contained arc* is

$$C'' = \frac{c}{r} \operatorname{cosec} 1''.$$

Abstracts of the calculations of differences of height as well as the final heights for the Jodhpore Meridional Series will be found on pages 97 to 106, and for the Eastern Sind Meridional Series on pages 207 to 215. In these abstracts the stations are entered in pairs as reciprocally observed, and there are given for each station the astronomical date and mean time of observation, the mean of the observed angles, preceded by a letter shewing whether it is a depression, D, or an elevation E, and the number of observations of which it is the mean. Then follow in succession the height in feet of the signal observed to and of the instrument employed, the contained arc between each pair of stations, the terrestrial refraction expressed in seconds and also in decimals of contained arc, and the resulting difference of height of the deduced station by each deduction, the height thus deduced, and the mean of several deductions. Lastly the final values of height—determined as explained in the next section—are given followed by the height of the pillar or tower above ground level.

7.

The Final Values of Height.

The tide-gauge stations on the coast and the lines of spirit-levels connected with them and traversing the continent of India afford a great system of heights, which being determined with the highest attainable accuracy are considered absolute. The reciprocal vertical angles of the chains or series of triangles of the Great Trigonometrical Survey provide another very extensive system of relative heights; but from the irregularities of refraction and other causes these relative heights are less reliable than differences obtained by spirit levelling. The two systems are connected at numerous points, and where discrepancies appear, they are treated as errors in the trigonometrical heights and eliminated from them by dispersion. After this has been done the trigonometrical heights are considered as absolute also. No lines of spirit leveling having been undertaken which cross or approach the two series under report the final heights of these series have been determined by dispersing over each the discrepancy between the relative excess in height of its terminal over its initial stations as exhibited by the triangulation and the excess determined at the time of the final reduction of the North-West Quadrilateral. The initial stations of both series lie in the Karáchi Longitudinal Series; the terminals of the Jodhpore being in the Sutlej, and of the Eastern Sind in the Great Indus Series.

8.

The Determinations of Azimuth by Astronomical Observations.

It has been the practice in this Survey to determine azimuths at certain stations in the course of the execution of each chain of triangles. It used to be customary to select stations for this purpose in meridional series at about 1° apart, and in longitudinal series at shorter intervals. Of late the choice of stations has also been governed by the nature of the surrounding country, those localities only being accepted where there was reason to expect that the results would be least influenced by local attraction. These independent observations of azimuth will be valuable hereafter, in investigations of the Figure of the Earth and of local attraction. But for reasons which have already been explained at page 142 of Vol. II, it would not, as a rule, be proper to employ them in the general reduction of the triangulation. It happens however that the observations have been reduced each year *pari passû* with the preliminary reductions of the triangulation—figure by figure, or series by series—which precede the final simultaneous reductions. The observations and their reductions are therefore given in the volumes which treat of the triangulation; as they have more in common with it than with the astronomical observations for the determinations of latitude and differential longitudes.

The observations for azimuth consist of measures of the angle between a circumpolar star, when near either elongation, and some station—either directly or through the medium of a referring mark—which are made in accordance with the system followed in observing the horizontal angles as regards the changes of zero, but with a larger number of repetitions on each zero, as the observations are individually liable to greater error.

The time of each intersection of the star being carefully noted, the difference of the momentary azimuth, δA, from the value at elongation is subsequently calculated and applied to the observed angle between the referring mark and the star. Thus a series of determinations of the angle between the referring mark and the star's position at elongation is obtained, from each of which and the known value of the azimuth of the star at elongation a determination of the azimuth of the referring mark is deduced.

The formula employed for the calculation has been

$$\delta A^{*} = \frac{(2 \sin^2 \tfrac{1}{2} \delta P \operatorname{cosec} 1'') \tan A \cos^2 a}{1 - (2 \sin^2 a \sin^2 \tfrac{1}{2} \delta P) \pm (\cot P \sin \delta P)}$$

in which A is the azimuth of the star at elongation, P the corresponding hour angle, a the north polar distance of the star, and δA the difference in azimuth for the time δP before and after elongation. The last term of the denominator is positive when the star is below and negative when above the position of maximum elongation.

At each station where the azimuth of a referring mark is observed, the angle between the referring mark and one of the contiguous stations of the triangulation is also observed, just as any other horizontal angle; and the several measures will be found in the Abstract of the Observed Angles at the observing station.

Abstracts of the azimuthal observations made on each series will be found for the Jodhpore Meridional Series on pages 107 to 115 and for the Eastern Sind Meridional Series on pages 216 to 227, in which are given, besides all necessary information regarding the observations themselves, such details of the calculations as will enable them to be followed up to the final result, *viz.*, the difference between the Astronomical and Geodetical azimuths. Sometimes the whole of the observations on a pair of zeros could not be completed on one night; in such cases the remainder were taken on a subsequent night, and the change of the star's place was duly allowed for in the reductions.

9.

The Final Reduction of the Triangulation. Preliminary Sketch.

So far the triangulation has only been made to fulfil those geometrical conditions, which apply to single triangles, polygonal figures and net-works, or all such conditions as

* The values of the portions of the formula enclosed in brackets within the limits of $\delta P = 30^{m}$ and $a = 10°$ have been calculated and are given in the *Auxiliary Tables*, and as $\tan A \cos^2 a$ may be treated as a constant for each elongation, the calculation of δA is easily performed.

exist until a chain closes on a side of known length and position or two or more chains unite together to form a circuit; it now becomes necessary to apply such conditions as will make the closing points of each chain take the positions already assigned them by the general reduction of the North-West Quadrilateral.

Before proceeding to indicate the forms of equations resulting from the conditions requisite for this adjustment it may be as well to anticipate a possible objection in their application. As all errors are to be dispersed by the method of minimum squares, which assumes the independency of all the quantities under investigation, it might be imagined that we must now again revert to the observed angles, as the angles which have been corrected for figural conditions cannot be considered independent. It has however been shewn in Appendix No. 8 of Vol. II, that the observed angles may be corrected in accordance with a part only of the conditions which govern them; and that when new conditions present themselves the corrected angles may be employed for finding other corrections; so that final corrections can be obtained by employing the angles after they have received any number of partial corrections, provided that the conditions which have already been satisfied are maintained when the further corrections, required to satisfy additional conditions, are calculated.

All preliminary calculations therefore stand good, and consequently equations due to new conditions may be obtained by employing the corrected, instead of reverting to the observed, values of the angles. But when we are seeking for final corrections, we must treat the corrected angles in such a manner as to preserve all the conditions already satisfied. These have however in general been so numerous and entangled as to make an exact solution of the problem impossible. Consequently all central and side conditions of the different polygonal figures and net-works composing the chains have been excluded, by omitting from the simultaneous reductions all angles appertaining to polygonal figures and net-works over and above what were needed to form continuous chains of single triangles, and increasing the weights of the angles of the retained triangles. By this means the entanglement has been greatly diminished, and the number of figural equations reduced to one for each triangle, of the simple form

$$x + y + z = 0$$

which permits of the elimination of one of the unknown quantities in each triangle, and thus enables all the triangular equations to be dispensed with. Thus the number of equations to be solved was eventually reduced to the number of new conditions to be satisfied or in other words to the number of what are here called circuit equations, the term having reference to all the closing errors of the chains of triangles, whether occurring internally at the ends of the circuits or externally on the base-lines.

In the present case there was not the same excuse for neglecting the central and side equations, as each reduction only involved one chain of triangles; yet as each is double throughout, the introduction of all the equations would have largely added to the labor without any corresponding advantage. Hence the original plan was followed, except that Mr. J. B. N. Hennessey, who was at the time in charge of the Computing Office, decided that the weights of all the angles in each chain of selected triangles should be considered equal or taken as unity.

After the completion of the reductions, the angles appertaining to the portions of the polygonal figures and net-works, which had been excluded, were corrected in such a manner as to restore the consistency of each figure, without altering the values of the angles already fixed.

10.

The Final Reduction of the Triangulation. Formation of the Circuit Equations.

The Final Reduction of each of the two series, the Jodhpore and Eastern Sind Meridional, was an independent operation; but the process was the same for each and may be generally described as follows:—

The triangles presented for simultaneous reduction in each case consist only of a single chain, and are numbered consecutively from south to north. The angle opposite the flank side of each triangle is known as X, that opposite the side of continuation as Y and that opposite the base as Z, each being further distinguished by a subscript, which is the number of the triangle: x, y and z with corresponding subscripts are the symbols employed to represent the errors of the angles, or, in other words, the unknown fallible quantities of which the most probable values that will satisfy the equations have to be found. These equations are respectively termed *Linear* and *Geodetic,* the former taking cognizance of the errors in the sides of the triangles, which are met with at the termination of the chain, and the latter expressing the errors in latitude, longitude and azimuth at the closing station.

It is unnecessary here to repeat the deduction of the analytical expressions for the circuit equations. This has already been demonstrated in Volumes II, VI and VII of the *Account of the Operations of the Great Trigonometrical Survey of India,* to which reference can be made if necessary; it will be sufficient now to give the expressions themselves.

I. *Linear Equations.*

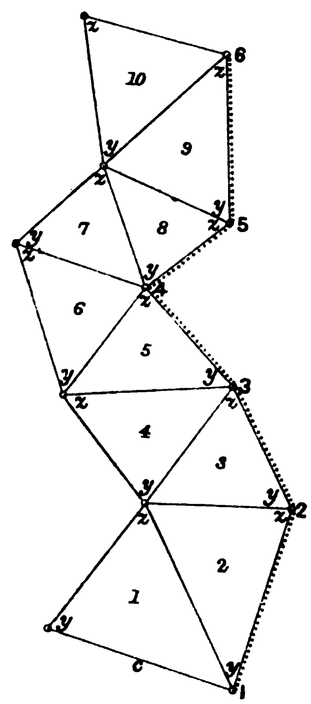
Denoting for brevity the tabular difference (t. d.) of log sin Y for 1″ by β, and of log sin Z by γ, and by E the error in the logarithmic value of the closing side of the chain, then

$$E = \beta_1 y_1 - \gamma_1 z_1 + \beta_2 y_2 - \gamma_2 z_2 + \ldots + \beta_m y_m - \gamma_m z_m$$

m being the number of triangles in the chain. As in this equation E as well β and γ represent quantities in the 7th place of decimals, it is convenient to treat them as if both sides of the equation were multiplied by 10^7, by which means E, β and γ become respectively the number of units in the 7th place of decimals.

If we employ brackets to denote summation the equation may be briefly written

$$E = {}_{1}^{n}\left[\beta y - \gamma z\right].$$



II. *Geodetic Equations.*

The diagram in the margin represents the commencement of a chain of triangles in which station 1 is assumed to be the origin of geodetic co-ordinates, and 2, 3, . . . stations on the most direct route—indicated by the dotted line running parallel to the sides on one flank of the chain—which connects 1 with any station in advance. The side c is the side of origin of the chain, and its azimuth at 1 the fundamental azimuth of the chain.

The following symbols are required to denote the differences of latitude, longitude and azimuth, the length of side, and the forward and back azimuths from station to station along the right flank of the chain:—

For the side 1 to 2; $\Delta\lambda_1$, ΔL_1, ΔA_1, c_1, A_1 and B_1

. . . .

" n to $n+1$; $\Delta\lambda_n$, ΔL_n, ΔA_n, c_n, A_n and B_n.

The errors in latitude, longitude and azimuth at the closing station, the $(n+1)th$, are denoted by $d\lambda_{n+1}$, dL_{n+1}, dB_n.

Now writing μ and ϕ for certain functions of $\Delta\lambda$, ΔL, ΔA and A as exhibited in the *Table of Substitutions* which follows, we have a general expression for each of the geodetic equations in which E represents the error in latitude, longitude or azimuth, as the case may be, at the closing station, and β and γ have the same signification as in the linear equation, while a stands for t.d. log sin X for a change of $1''$:—

$$\begin{aligned}
E = &+ (\mu_1 \beta_1 - \phi_1)\, y_1 && + (-\mu_1 \gamma_1 - \phi_1)\, z_1 \\
&+ \{(\mu_2 - \mu_1)\, a_2 + \mu_2 \beta_2 + \phi_1\}\, y_2 && + \{(\mu_2 - \mu_1)\, a_2 - \mu_1 \gamma_2 + \phi_2\}\, z_2 \\
&+ \{(\mu_3 - \mu_2)\, a_3 + \mu_3 \beta_3 + \phi_2\}\, y_3 && + \{(\mu_3 - \mu_2)\, a_3 - \mu_2 \gamma_3 + \phi_3\}\, z_3 \\
&+ (\mu_3 \beta_4 - \phi_3)\, y_4 && + (-\mu_3 \gamma_4 - \phi_3)\, z_4 \\
&+ \; . \; . \; . \; .
\end{aligned}$$

in which the μ s and ϕ s take their subscripts from the flank numbers of the stations and a β and γ from the triangles.

The general forms for the coefficients of y and z are:—

First.—If the pth triangle have no side in the line of traverse, but only an angle at the station l,

$$(\mu_l \beta_p - \phi_l)\, y_p + (-\mu_l \gamma_p - \phi_l)\, z_p.$$

Secondly.—If the qth triangle have a side in the traverse between the stations l and $l+1$,

$$\{(\mu_{l+1} - \mu_l)\, a_q + \mu_{l+1} \beta_q + \phi_l\}\, y_q + \{(\mu_{l+1} - \mu_l)\, a_q - \mu_l \gamma_q + \phi_{l+1}\}\, z_q.$$

Exceptions will appear to present themselves at the commencement and end of chains owing to the non-existence of some of the coefficients. In all instances however it will be found that ϕ_l enters the coefficients of all the errors at station l, and μ_l enters the coefficients of the other angles of the same triangles, with a *plus* sign if looking from station l the angle is the left-hand one of the triangle, and a *minus* sign if the right-hand.

The substitutions for μ and ϕ to render the general equation applicable to either latitude, longitude or azimuth are given in the following table.

Table of Substitutions for μ and ϕ.

	Latitude.	Longitude.	Azimuth.
For E	$d\lambda_{n+1}$	dL_{n+1}	dB_n
,, μ	${}_\lambda\mu$	${}_L\mu$	${}_A\mu$
,, ϕ	${}_\lambda\phi$	${}_L\phi$	${}_A\phi$
,, μ_1	$+\sum_1^n\left[\frac{1}{\text{t.d.log}\,\Delta\lambda}\right]$	$+\sum_1^n\left[\frac{1}{\text{t.d.log}\,\Delta L}\right]$	$+\sum_1^n\left[\frac{1}{\text{t.d.log}\,\Delta A}\right]$
,, μ_2	$+\sum_2^n\left[\frac{1}{\text{t.d.log}\,\Delta\lambda}\right]$	$+\sum_2^n\left[\frac{1}{\text{t.d.log}\,\Delta L}\right]$	$+\sum_2^n\left[\frac{1}{\text{t.d.log}\,\Delta A}\right]$
. .	. . . .	. . . .	. . . .
,, μ_n	$+\frac{1}{\text{t.d.log}\,\Delta\lambda_n}$	$+\frac{1}{\text{t.d.log}\,\Delta L_n}$	$+\frac{1}{\text{t.d.log}\,\Delta A_n}$
,, ϕ_1	$+\sum_1^n\left[\frac{\text{t.d.log}\cos A}{\text{t.d.log}\,\Delta\lambda}\right]$	$+\sum_1^n\left[\frac{\text{t.d.log}\sin A}{\text{t.d.log}\,\Delta L}\right]$	$1+\sum_1^n\left[\frac{\text{t.d.log}\sin A}{\text{t.d.log}\,\Delta A}\right]$
,, ϕ_2	$+\sum_2^n\left[\frac{\text{t.d.log}\cos A}{\text{t.d.log}\,\Delta\lambda}\right]$	$+\sum_2^n\left[\frac{\text{t.d.log}\sin A}{\text{t.d.log}\,\Delta L}\right]$	$1+\sum_2^n\left[\frac{\text{t.d.log}\sin A}{\text{t.d.log}\,\Delta A}\right]$
. .	. . . .	. . . .	. . . .
,, ϕ_n	$+\frac{\text{t.d.log}\cos A_n}{\text{t.d.log}\,\Delta\lambda_n}$	$+\frac{\text{t.d.log}\sin A_n}{\text{t.d.log}\,\Delta L_n}$	$1+\frac{\text{t.d.log}\sin A_n}{\text{t.d.log}\,\Delta A_n}$

The values of the absolute terms, E, for the geodetic equations are the differences between the values of latitude, longitude and azimuth at the closing station, as obtained by the calculation along the traverse, and the final values as given by the Reduction of the North-West Quadrilateral; and if the subscripts f and v denote the *final* and *traverse* values at the closing station

$$E_\lambda = \lambda_v - \lambda_f$$
$$E_L = L_v - L_f$$
$$E_A = B_v - B_f$$

When the linear and geodetic equations have been obtained in the manner here described, it will be found that the numerical values of the coefficients are much larger in the former than in the latter, and that those in latitude and longitude are least of all. Although this cannot produce any effect on the final results it may increase the labour of the calculations. It has therefore been sometimes thought desirable to introduce factors which roughly equalize the coefficients. Such factors were employed for the Eastern Sind Series; they were

for the azimuth equation	1
„ latitude and longitude equations	10
„ linear equation	0·1

11.

Final Reduction of the Triangulation. The Solution of the Equations between the Indeterminate Factors.

If we assume that the number of triangles entering the reduction is t and that they furnish n circuit equations, the latter may now be briefly written in order thus:—

$$
\begin{array}{l}
{}_1\mathfrak{b}_1 y_1 + {}_1\mathfrak{c}_1 z_1 + \ . \ \ . \ \ . + {}_1\mathfrak{b}_t y_t + {}_1\mathfrak{c}_t z_t = {}_1E \\
{}_2\mathfrak{b}_1 y_1 + {}_2\mathfrak{c}_1 z_1 + \ . \ \ . \ \ . + {}_2\mathfrak{b}_t y_t + {}_2\mathfrak{c}_t z_t = {}_2E \\
. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \\
{}_n\mathfrak{b}_1 y_1 + {}_n\mathfrak{c}_1 z_1 + \ . \ \ . \ \ . + {}_n\mathfrak{b}_t y_t + {}_n\mathfrak{c}_t z_t = {}_nE
\end{array}
$$

in which equations the left-hand subscript in 'old face' type corresponds to the number of the equation and the right-hand subscript in ordinary type gives the number of the triangle.

Since the weights of the angles are all taken as equal, the minimum which governs the solution of the foregoing equations will, when x has been eliminated from it, become

$$U = \{(y_1 + z_1)^2 + y_1^2 + z_1^2\} + \ . \ \ . \ \ . \ + \{(y_t + z_t)^2 + y_t^2 + z_t^2\}$$

The symbols employed for the indeterminate factors are ${}_1\Lambda$, ${}_2\Lambda$, ${}_3\Lambda$, &c., and the equations between them are*

$$
\begin{aligned}
&{}_1^t\Big[{}_1\mathfrak{b}\,{}_1\mathfrak{B} + {}_1\mathfrak{c}\,{}_1\mathfrak{C}\Big]{}_1\Lambda + {}_1^t\Big[{}_1\mathfrak{b}\,{}_2\mathfrak{B} + {}_1\mathfrak{c}\,{}_2\mathfrak{C}\Big]{}_2\Lambda + \ldots + {}_1^t\Big[{}_1\mathfrak{b}\,{}_n\mathfrak{B} + {}_1\mathfrak{c}\,{}_n\mathfrak{C}\Big]{}_n\Lambda = {}_1E \\
&{}_1^t\Big[{}_2\mathfrak{b}\,{}_1\mathfrak{B} + {}_2\mathfrak{c}\,{}_1\mathfrak{C}\Big]{}_1\Lambda + {}_1^t\Big[{}_2\mathfrak{b}\,{}_2\mathfrak{B} + {}_2\mathfrak{c}\,{}_2\mathfrak{C}\Big]{}_2\Lambda + \ldots + {}_1^t\Big[{}_2\mathfrak{b}\,{}_n\mathfrak{B} + {}_2\mathfrak{c}\,{}_n\mathfrak{C}\Big]{}_n\Lambda = {}_2E \\
&\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \\
&{}_1^t\Big[{}_n\mathfrak{b}\,{}_1\mathfrak{B} + {}_n\mathfrak{c}\,{}_1\mathfrak{C}\Big]{}_1\Lambda + {}_1^t\Big[{}_n\mathfrak{b}\,{}_2\mathfrak{B} + {}_n\mathfrak{c}\,{}_2\mathfrak{C}\Big]{}_2\Lambda + \ldots + {}_1^t\Big[{}_n\mathfrak{b}\,{}_n\mathfrak{B} + {}_n\mathfrak{c}\,{}_n\mathfrak{C}\Big]{}_n\Lambda = {}_nE
\end{aligned}
$$

in which

$$\mathfrak{B} = \frac{1}{3}(2\mathfrak{b} - \mathfrak{c}) \quad \text{and} \quad \mathfrak{C} = \frac{1}{3}(2\mathfrak{c} - \mathfrak{b}).\dagger$$

These equations having been solved, the values of the angular errors are given by the formulæ

$$
\begin{aligned}
y_p &= {}_1\mathfrak{B}_p\,{}_1\Lambda + {}_2\mathfrak{B}_p\,{}_2\Lambda + \ldots + {}_n\mathfrak{B}_p\,{}_n\Lambda, \\
z_p &= {}_1\mathfrak{C}_p\,{}_1\Lambda + {}_2\mathfrak{C}_p\,{}_2\Lambda + \ldots + {}_n\mathfrak{C}_p\,{}_n\Lambda, \\
x_p &= -(y_p + z_p).
\end{aligned}
$$

---

* In these equations, although the corresponding coefficients on opposite sides of the diagonal appear to differ, their values are in reality identical in each term of the summation. Both forms, however, have been made use of as a check on the calculations; and for a like reason the diagonal coefficients have been obtained also by the formula

$$\frac{2}{3}\,{}_1^t\Big[(\mathfrak{b}^2 - \mathfrak{b}\mathfrak{c} + \mathfrak{c}^2)\Big]$$

† As the factor $\frac{1}{3}$ enters all the coefficients of all the equations, its omission from the actual calculations can have no effect on the final values of the angular errors x, y and z; it was accordingly omitted.

CHAPTER III.

THE DETAILS OF THE FINAL REDUCTIONS.

1.

Preliminary Remarks.

The general principles followed in the reduction of the triangulation, as described in the preceding chapter, apply equally to both the Jodhpore and Eastern Sind Meridional Series; but in the present chapter which deals with the details of the reductions, it will be necessary, as the two series are entirely independent, to keep these details apart, while it will be convenient to include them in the same sections. The same preamble for each section will be made to apply to both reductions, the details themselves being headed by the name of the series to which they belong.

2.

The Figural Reductions antecedent to the Final Simultaneous Reduction of each Series.

The Jodhpore Meridional Series comprises 3 quadrilaterals, 8 single polygons and 2 double polygons, containing 225 observed angles connected together by 76 *Triangular*, 12 *Central* and 15 *Side* equations of condition.

The Eastern Sind Meridional Series comprises 3 quadrilaterals, 7 single polygons and 2 double polygons, containing 198 observed angles connected together by 67 *Triangular*, 11 *Central* and 14 *Side* equations of condition.

The figural conditions and reductions are given for each series immediately after the Abstracts of the Observed Angles: a diagram of each figure is also given in the Plate following the details of each series. These together afford the means of readily following the calculations appertaining to each figure.

3.

The Description of the Reduction Charts.

The respective Reduction Charts at the end of this volume exhibit the whole of the Principal Triangulation in each series. The triangulation in each case consists of polygonal figures from which only a single chain of triangles was selected for treatment simultaneously. The fixed data for the final reduction of the two series are the lengths and positions of the emanation-sides in the Karáchi Longitudinal and the termination-sides in the Sutlej and Great Indus Series, between which they respectively depend. These sides are shewn on the charts by double lines, terminated by black circles with white centres.

The so-called *circuit* triangles—the errors of whose angles are the unknown quantities in each reduction—are indicated by continuous lines. The *non-circuit* triangles, or those which are excluded from the simultaneous reduction, have their sides indicated by broken lines.

Along the flank on the right-hand side, looking north, of each chain, a dotted line runs parallel to the sides of the triangles; this is the line of the traverse.

The principal stations are indicated on the charts by small circles, with the names and the serial numbers by which it has been found convenient to distinguish them for reference in the course of the reductions. These numbers are in Roman character and are progressive from south to north.

All the principal stations which fall on the lines of traverse have an additional number in block type assigned to them, called their *traverse number*, these numbers commence from the initial station.

The circuit triangles are numbered in the Jodhpore Meridional Series from 1 to 48, commencing from the side Súnda–Bonik, and the non-circuit triangles are numbered in succession in smaller type from 49 to 76. In the Eastern Sind Meridional Series the circuit triangles are numbered from 1 to 39, commencing from the side Rojhra–Sandohar, and the non-circuit triangles are numbered from 40 to 67 in smaller type. In each of the circuit triangles one of the angles is marked y and another z; y and z are the symbols for the errors of the 'angles of continuation', while x is the symbol for the errors of the flank angles; but as x has been eliminated throughout by the substitution for it of $-(y+z)$, it is not indicated on the charts. The addition of the number of any triangle as a subscript to either of these symbols, particularizes the angle in each instance.

The polygonal figures or net-works are distinguished by figural numbers as Fig. 1, Fig. 2, and these distinctions are continued in the diagrams and reductions of figures.

4.

General Outline of the Formation of the Linear and Geodetic Equations of Condition.

The Jodhpore Meridional Series.

The triangulation having first been made consistent so far as all figural conditions were concerned, the linear calculations were commenced from the side Súnda–Bonik of the Karáchi Longitudinal Series, and carried northwards, through the circuit triangles only, until they closed on the side Kaimsir–Kanda of the Sutlej Series. The calculations of geodetic latitudes, longitudes and azimuths were then carried along the eastern flank of the chain, commencing and terminating with the linear calculations. The errors which form the absolute terms of the equations, are the differences between the two sets of linear and geodetic values of the side Kaimsir–Kanda and at the station Kanda, as obtained by the calculations just described and as already given finally by the Simultaneous Reduction of the North-West Quadrilateral. Thus there are four equations which may be symbolized as follows, if we employ S to denote the sum of the terms on the right-hand side of the linear equation on page [22] and of the geodetic equation on page [22] with the subscript c to denote the linear, λ the latitudinal, L the longitudinal, and A the azimuthal equations; while E with the corresponding subscript denotes the absolute term:—

$$(1) \quad {}_c\mathrm{S} = {}_cE,$$

$$(2) \quad {}_\lambda\mathrm{S} = {}_\lambda E,$$

$$(3) \quad {}_L\mathrm{S} = {}_L E,$$

$$(4) \quad {}_A\mathrm{S} = {}_A E.$$

The Eastern Sind Meridional Series.

This series having in like manner been first made consistent so far as the figural conditions were concerned, the linear calculations were commenced from the side Rojhra–Sandohar of the Karáchi Longitudinal Series and closed on the side Dáowála–Máchka of the Great Indus Series, the geodetic calculations being carried along the eastern flank. The errors are the differences between two sets of values of the closing side Dáowála–Máchka and at the closing station Dáowála, as given by the Simultaneous Reduction of the North-West Quadrilateral and as obtained by the calculations carried through the series. The equations may be symbolized as before.

5.

Formation of the Coefficients of the Unknown Quantities.

On page [24] the equations of condition are represented by a form of which the following may be taken as a general illustration:—

$$ {}_m\mathfrak{b}_1 \, y_1 + {}_m\mathfrak{c}_1 \, z_1 + {}_m\mathfrak{b}_2 \, y_2 + {}_m\mathfrak{c}_2 \, z_2 + \ . \ \ . \ \ . \ = {}_mE $$

the left-hand subscript denoting the equation number and the right-hand subscript the number of the triangle to which the errors appertain, and $\mathfrak{b}$ and $\mathfrak{c}$ being the coefficient of y and z respectively.

For the *Linear* Equation we shall have generally, see page [21],

$$ \mathfrak{b}_p = + \beta_p = + \text{ t.d. log sin } Y \text{ for } 1'' $$
$$ \mathfrak{c}_p = - \gamma_p = - \text{ t.d. log sin } Z \quad ,, $$

For the *Geodetic* Equations we shall have, see page [23],

$$ \mathfrak{b}_p = + (\mu_l \, \beta_p - \phi_l), $$
$$ \mathfrak{c}_p = - (\mu_l \, \gamma_p + \phi_l), $$

or

$$ \mathfrak{b}_p = + \{(\mu_{l+1} - \mu_l) \, a_p + \mu_{l+1} \, \beta_p + \phi_l\}, $$
$$ \mathfrak{c}_p = + \{(\mu_{l+1} - \mu_l) \, a_p - \mu_l \, \gamma_p + \phi_{l+1}\}, $$

the former being applicable to any, the pth, triangle when it has only the angle X in the traverse at station l, and the latter when it has the side opposite X in the traverse and lying between the stations l and $l + 1$.

Exceptions to the General Expressions for $\mathfrak{b}$ *and* $\mathfrak{c}$.

The Jodhpore Meridional Series.

Equation 1 has no exceptional coefficients; but in Equations 2, 3 and 4

$$ \mathfrak{b}_{47} = - \mu_{23} \, a_{47} + \phi_{23}, \qquad \mathfrak{c}_{47} = - \mu_{23} \, (a_{47} + \gamma_{47}), $$

with the exception of $\mathfrak{c}_{47}$ in Equation 4 in Azimuth, which needs the addition of unity to carry the calculations as far as the side Kanda–Randu, and the same equation has two extra coefficients

$$ \mathfrak{b}_{48} = - 1 \text{ and } \mathfrak{c}_{48} = - 1, $$

to carry the calculations to the closing side Kanda–Kaimsir.

The Eastern Sind Meridional Series.

Equation 1 has no exceptional coefficients, but in Equations 2, 3 and 4

$$\mathfrak{b}_{38} = -\mu_{19}\,\alpha_{38} + \phi_{19}, \qquad \mathfrak{c}_{38} = -\mu_{19}\,(\alpha_{38} + \gamma_{38}),$$

with the exception of $\mathfrak{c}_{38}$ in Equation 4 in Azimuth, which needs the addition of unity to carry the calculations as far as the side Dáowála–Kubba; and the same equation has two extra coefficients

$$\mathfrak{b}_{39} = -1 \text{ and } \mathfrak{c}_{39} = -1,$$

to carry the calculations to the closing side Dáowála–Máchka.

6.

Synoptical Exhibition of the several Equations of Condition.

For the sake of brevity let us put ${}_m\mathrm{k}_p$ for ${}_m\mathfrak{b}_p\, y_p + {}_m\mathfrak{c}_p\, z_p$ or, in other words, for the sum of the errors y and z of the angles Y and Z in any, the pth, triangle, respectively multiplied by their coefficients $\mathfrak{b}$ and $\mathfrak{c}$ in any, the mth, equation of condition; and further, let us put ${}_m\mathrm{k}\Big|_p^q$ to represent the sum of the terms ${}_m\mathrm{k}$ for a series of triangles of which the first term is ${}_m\mathrm{k}_p$ and the last ${}_m\mathrm{k}_q$.

The equations will then be expressed as follows:—

The Jodhpore Meridional Series.

(1). *Linear.* $\quad {}_1\mathrm{k}\Big|_1^{48} \;.\;.\; = {}_1E,$

(2). *Latitude.* $\quad {}_2\mathrm{k}\Big|_1^{47} \;.\;.\; = {}_2E,$

(3). *Longitude.* $\quad {}_3\mathrm{k}\Big|_1^{47} \;.\;.\; = {}_3E,$

(4). *Azimuth.* $\quad {}_4\mathrm{k}\Big|_1^{48} \;.\;.\; = {}_4E.$

The Eastern Sind Meridional Series.

(1). *Linear.* $\quad {}_1\mathrm{k}\Big|_1^{39} \;.\;.\; = {}_1E,$

(2). *Latitude.* $\quad {}_2\mathrm{k}\Big|_1^{38} \;.\;.\; = {}_2E,$

(3). *Longitude.* $\quad {}_3\mathrm{k}\Big|_1^{38} \;.\;.\; = {}_3E,$

(4). *Azimuth.* $\quad {}_4\mathrm{k}\Big|_1^{39} \;.\;.\; = {}_4E.$

7.

The Numerical Values of the Fixed Data on which the Separate Reductions of the Jodhpore and Eastern Sind Meridional Series are based.

Both series emanate from the Karáchi Longitudinal Series; the Jodhpore closes on the Sutlej Series and the Eastern Sind on the Great Indus Series. The fixed data furnished by these series are given in Vols. III and IV of the *Account of the Operations &c.*; but for the geodetic elements a third place of decimals has been obtained by reference to the calculations of the North-West Quadrilateral. The data are as follows :—

The Jodhpore Meridional Series.

Vol. III, page 47—b.

Station of origin Bonik or XLI; side of origin Bonik or XLI to Súnda or XLIV.

At Bonik.

Latitude North	25°	3′	51″·496,	
Longitude East of Greenwich	72	54	21 ·852,	
Azimuth of Súnda	55	4	15 ·670,	
Distance „ ... ... Log Feet	5·2541461,0.			

Vol. IV, page 9—h.

Closing station Kanda or XXI; closing side Kanda or XXI to Kaimsir or XIX.

At Kanda.

Latitude North	29°	27′	41″·523,	
Longitude East of Greenwich	72	22	12 ·292,	
Azimuth of Kaimsir	73	26	34 ·581,	
Distance „ ... ... Log Feet	4·8021262,6.			

The Eastern Sind Meridional Series.

Vol. III, page 49—b.

Station of origin Rojhra or LXXV; side of origin Rojhra or LXXV to Sandohar or LXXVIII.

At Rojhra.

Latitude North	...	...	...	24°	57′	26″·278,
Longitude East of Greenwich		...	...	70	16	45 ·080,
Azimuth of Sandohar	...	...	...	111	55	37 ·085,
Distance „	...	...	Log Feet	4·9613162,0.		

Vol. III, page 63—d.

Closing station Dáowála or LXII; closing side Dáowála or LXII to Máchka or LIX.

At Dáowála.

Latitude North	...	...	...	28°	20′	12″·867,
Longitude East of Greenwich		...	...	69	52	57 ·861,
Azimuth of Máchka	...	...	...	87	1	26 ·701,
Distance „	...	...	Log Feet	4·7780782,8.		

8.

The Sides and Angles of the Circuit Triangles.

The values of the Figurally Corrected Angles, and the logarithms of the Side-lengths, computed (in feet) with these angles in terms of the fixed sides of origins furnished by the Karáchi Longitudinal Series, are exhibited in the following table. The given angles are the corrected plane angles, obtained by deducting the sum of the spherical excess and the figural error from the observed angles. Should it be desired to trace the formation of any corrected plane angle, reference must be made to the Abstract of the Observed Angles and to the final data of the Sides and Angles of the Triangles, which are given for each Series in Part II of this volume. The final data will be found to contain three columns of angular corrections, which are respectively headed by the words 'Figure', 'Circuit' and 'Non-Circuit',—'figure' being here taken to include single triangles as well as polygons and net-works; the corrections in the first column are what have been applied, with the spherical excess, to the observed angles, in order to obtain the figurally corrected plane angles; those in the second column are what have been derived from the Simultaneous Reduction; and those in the third column are what have been computed to satisfy the geometrical conditions of figures containing non-circuit triangles, which had to be adjusted to the fixed circuit triangles; the application of the correction in the second or the third column, as the case may be, to the figurally corrected plane angle gives the finally corrected plane angle.

In order that it may be readily ascertained—without reference to the Reduction Chart—whether any angle is a 'flank angle' or an 'angle of continuation', a column is inserted in the table which gives the symbolic error of the angle, either *x*, *y*, or *z*, but without the numerical subscript, as that may be inferred from the number of the triangle in the contiguous column. And since the stations on the right-hand flank of each chain are those at which the angles are the data for the formation of the values of the forward azimuth, and the side-lengths are the distances which were employed in the calculations of latitude, longitude and back azimuth—see the next section—these stations are indicated by numbers in block type, shewing by their sequence the order in which the geodetic calculations were performed, as well as by their Serial-numbers.

The logarithm of the side* opposite any angle is given in the same horizontal line as the angle.

The Jodhpore Meridional Series.

Sides and Angles of the Circuit Triangles.

Triangle Number	Symbolic Error	Station Numbers: Serial	Station Numbers: Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet	Triangle Number	Symbolic Error	Station Numbers: Serial	Station Numbers: Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet
				° ′ ″	″						° ′ ″	″	
	y	XLIV†		67 46 16·374	1·546	5·2394300,3		*y*	VI		48 42 30·539	·988	5·0322902,7
1	*x*	XLI†	1	38 58 34·012	1·545	5·0716169,6	7	*x*	VII	4	57 47 49·880	·988	5·0838972,8
	z	I		73 15 9·614	1·546	5·2541461,0		*z*	VIII		73 29 39·581	·988	5·1381654,0
		XLI†	1	42 1 18·916	·896	5·0802170,3			VII	4	78 52 35·925	·994	5·1596831,5
2	„	I		32 57 38·418	·895	4·9901710,1	8	„	VIII		54 5 20·027	·994	5·0763658,2
		II	2	105 1 2·666	·896	5·2394300,3			X	5	47 2 4·048	·993	5·0322902,7
		I		62 5 14·311	1·152	5·1262122,9			X	5	58 28 48·631	·920	5·0955752,0
3	„	II	2	65 16 14·201	1·153	5·1381524,5	9	„	VIII		40 23 2·671	·919	4·9764150,2
		III		52 38 31·488	1·152	5·0802170,3			XII	6	81 8 8·698	·920	5·1596831,5
		II	2	81 14 27·158	1·448	5·2492743,0			VIII		54 17 18·500	·839	5·0262998,0
4	„	III		50 38 46·034	1·448	5·1426858,1	10	„	XII	6	53 27 47·666	·838	5·0217343,0
		V	3	48 6 46·808	1·447	5·1262122,9			XI		72 14 53·834	·839	5·0955752,0
		V	3	55 2 24·543	1·406	5·1672445,4			XI		58 35 3·569	·613	4·9804863,8
5	„	III		43 5 43·054	1·405	5·0882237,0	11	„	XII	6	49 54 37·059	·612	4·9330120,5
		VII	4	81 51 52·403	1·406	5·2492743,0			XIII		71 30 19·372	·613	5·0262998,0
		III		59 58 37·349	1·259	5·1381654,0			XII	6	55 52 6·311	·530	4·9300395,0
6	„	VII	4	52 14 10·360	1·259	5·0986603,6	12	„	XIII		55 44 31·893	·530	4·9293894,0
		VI		67 47 12·291	1·260	5·1672445,4			XV	7	68 23 21·796	·531	4·9804863,8

* In calculating these values 7-place Logarithm Tables were employed, the 8th place here shewn being obtained by interpolation.
† Stations XLI and XLIV appertain to the Karáchi Longitudinal Series.

Triangle Number	Symbolic Error	Station Numbers: Serial	Station Numbers: Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet
				° ′ ″	″	
13	y	XV	7	41 2 28·235	·387	4·7829912,5
	x	XIII		71 51 28·531	·387	4·9435445,6
	z	XVII	8	67 6 3·234	·387	4·9300395,0
14	,,	XIII		62 58 19·023	·308	4·8462106,8
		XVII	8	66 39 51·219	·309	4·8593750,6
		XVI		50 21 49·758	·308	4·7829912,5
15	,,	XVI		61 47 49·370	·293	4·8288978,5
		XVII	8	51 41 39·470	·292	4·7784961,4
		XVIII		66 30 31·160	·293	4·8462106,8
16	,,	XVII	8	58 51 57·020	·312	4·8248875,5
		XVIII		61 22 36·792	·312	4·8358251,7
		XX	9	59 45 26·188	·312	4·8288978,5
17	,,	XX	9	65 34 7·195	·322	4·8602877,0
		XVIII		57 22 36·487	·322	4·8264608,8
		XXII	10	57 3 16·318	·321	4·8248875,5
18	,,	XVIII		49 1 44·785	·269	4·7538358,6
		XXII	10	56 13 29·638	·270	4·7955835,4
		XXI		74 44 45·577	·270	4·8602877,0
19	,,	XXII	10	71 6 24·992	·213	4·7957041,1
		XXI		49 40 9·593	·213	4·7018942,9
		XXIV	11	59 13 25·415	·213	4·7538358,6
20	,,	XXI		49 15 47·618	·186	4·6832567,7
		XXIV	11	51 43 55·099	·186	4·6986876,7
		XXIII		79 0 17·283	·187	4·7957041,1
21	,,	XXIII		75 11 12·014	·247	4·8566384,9
		XXIV	11	64 22 53·389	·246	4·8263767,7
		XXV		40 25 54·597	·246	4·6832567,7
22	,,	XXIV	11	47 2 9·207	·247	4·7296621,8
		XXV		54 21 24·784	·247	4·7751913,7
		XXVI	12	78 36 26·009	·248	4·8566384,9
23	,,	XXV		65 53 51·365	·230	4·7909997,2
		XXVI	12	61 40 28·499	·230	4·7752303,5
		XXVII		52 25 40·136	·230	4·7296621,8
24	,,	XXVI	12	52 36 18·938	·238	4·7377397,9
		XXVII		63 28 54·528	·238	4·7893845,2
		XXIX	13	63 54 46·534	·239	4·7909997,2
25	,,	XXIX	13	64 49 25·635	·333	4·8999677,4
		XXVII		76 38 51·253	·333	4·9314159,3
		XXXI	14	38 31 43·112	·333	4·7377397,9
26	,,	XXVII		47 29 25·249	·354	4·7991134,9
		XXXI	14	64 5 47·364	·355	4·8855658,5
		XXX		68 24 47·387	·355	4·8999677,4

Triangle Number	Symbolic Error	Station Numbers: Serial	Station Numbers: Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet
				° ′ ″	″	
27	y	XXX		62 36 10·878	·232	4·7831059,3
	x	XXXI	14	50 17 54·648	·231	4·7209139,3
	z	XXXII		67 5 54·474	·232	4·7991134,9
28	,,	XXXI	14	54 41 13·360	·268	4·7769521,4
		XXXII		69 27 16·907	·268	4·8367174,3
		XXXV	15	55 51 29·733	·268	4·7831059,3
29	,,	XXXII		67 0 40·435	·198	4·7738584,7
		XXXV	15	44 59 31·366	·198	4·6592209,5
		XXXIV		67 59 48·199	·198	4·7769521,4
30	,,	XXXV	15	70 37 23·043	·285	4·8555127,5
		XXXIV		57 57 48·695	·285	4·8090846,2
		XXXVI	16	51 24 48·262	·284	4·7738584,7
31	,,	XXXIV		68 16 58·548	·296	4·8631099,7
		XXXVI	16	45 48 22·079	·295	4·7505939,5
		XXXVII		65 54 39·373	·296	4·8555127,5
32	,,	XXXVI	16	76 14 23·798	·523	5·0172653,4
		XXXVII		60 49 55·059	·523	4·9710226,1
		XXXIX	17	42 55 41·143	·522	4·8631099,7
33	,,	XXXVII		62 27 53·960	·756	5·0326389,5
		XXXIX	17	58 40 37·235	·755	5·0164334,0
		XLI		58 51 28·805	·755	5·0172653,4
34	,,	XLI		44 29 21·242	·807	4·9806427,3
		XXXIX	17	83 20 2·847	·807	5·1321181,7
		XLIII		52 10 35·911	·807	5·0326389,5
35	,,	XXXIX	17	50 7 57·125	·681	4·9668066,8
		XLIII		77 27 33·887	·682	5·0712249,0
		XLIV	18	52 24 28·988	·682	4·9806427,3
36	,,	XLIV	18	61 46 57·777	·559	4·9653924,4
		XLIII		56 5 3·506	·559	4·9393418,5
		XLV	19	62 7 58·717	·560	4·9668066,8
37	,,	XLIII		46 42 57·515	·423	4·8402865,0
		XLV	19	57 7 5·041	·423	4·9023478,8
		XLVI		76 9 57·444	·423	4·9653924,4
38	,,	XLVI		61 41 27·643	·240	4·8014600,7
		XLV	19	43 59 57·462	·240	4·6985442,8
		XLVIII		74 18 34·895	·240	4·8402865,0
39	,,	XLV	19	60 54 9·807	·389	4·9053616,1
		XLVIII		75 38 7·094	·389	4·9501573,9
		XLIX	20	43 27 43·099	·388	4·8014600,7
40	,,	XLIX	20	54 14 25·146	·347	4·8351057,4
		XLVIII		53 12 46·377	·347	4·8293903,2
		L	21	72 32 48·477	·348	4·9053616,1

Triangle Number	Symbolic Error	Station Numbers: Serial	Station Numbers: Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet	Triangle Number	Symbolic Error	Station Numbers: Serial	Station Numbers: Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet
				° ′ ″	″						° ′ ″	″	
	y	XLVIII		72 28 35·609	·352	4·9075724,8		y	LIV	22	45 15 20·358	·151	4·6059389,0
41	x	L	21	53 42 55·525	·351	4·8345912,9	45	x	LV		60 2 25·646	·151	4·6922322,3
	z	LI		53 48 28·866	·351	4·8351057,4		z	LVII	23	74 42 13·996	·151	4·7388607,5
		LI		61 1 3·915	·311	4·8610759,6			LV		56 49 15·965	·093	4·5578291,3
42	„	L	21	42 10 17·234	·310	4·7461320,9	46	„	LVII	23	53 56 55·257	·093	4·5427961,7
		LIII		76 48 38·851	·311	4·9075724,8			LIX		69 13 48·778	·093	4·6059389,0
		L	21	63 22 13·301	·272	4·8333217,7			LVII	23	63 2 16·479	·154	4·7375477,8
43	„	LIII		44 16 54·664	·272	4·7259946,3	47	„	LIX		80 51 26·717	·154	4·7819679,9
		LIV	22	72 20 52·035	·273	4·8610759,6			XXI*		36 6 16·804	·153	4·5578291,3
		LIII		52 22 56·280	·218	4·7388607,5			LIX		73 52 44·873	·210	4·8021139,2
44	„	LIV	22	47 41 58·303	·217	4·7090919,8	48	„	XXI*		50 13 50·356	·210	4·7052510,1
		LV		79 55 5·417	·218	4·8333217,7			XIX*		55 53 24·771	·210	4·7375477,8

The Eastern Sind Meridional Series.

Sides and Angles of the Circuit Triangles.

Triangle Number	Symbolic Error	Station Numbers: Serial	Station Numbers: Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet	Triangle Number	Symbolic Error	Station Numbers: Serial	Station Numbers: Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet
				° ′ ″	″						° ′ ″	″	
	y	LXXV†	1	60 25 36·142	·689	5·0107629,1		y	X	4	82 32 9·929	·399	4·9775212,5
1	x	LXXVIII†		68 39 56·059	·689	5·0405510,9	7	x	IX		43 6 33·422	·398	4·8158867,0
	z	V	2	50 54 27·799	·689	4·9613162,0		z	XII	5	54 21 16·649	·398	4·8911147,1
		LXXVIII†		66 39 1·865	·651	5·0220231,3			IX		49 41 17·487	·407	4·8637686,8
2	„	V	2	49 53 29·779	·650	4·9426942,5	8	„	XII	5	48 3 51·359	·407	4·8530204,8
		IV		63 27 28·356	·650	5·0107629,1			XI		82 14 51·154	·407	4·9775212,5
		IV		54 30 56·859	·582	4·9506968,5			XI		60 41 0·605	·432	4·9089527,3
3	„	V	2	51 49 21·859	·582	4·9354045,2	9	„	XII	5	67 31 27·620	·432	4·9341636,6
		VII		73 39 41·282	·583	5·0220231,3			XIV		51 47 31·775	·431	4·8637686,8
		V	2	45 29 6·174	·459	4·8445767,8			XII	5	57 3 26·471	·445	4·8944242,1
4	„	VII		68 56 56·008	·460	4·9614489,2	10	„	XIV		62 44 33·923	·446	4·9194326,2
		VIII	3	65 33 57·818	·459	4·9506968,5			XV	6	60 11 59·606	·446	4·9089527,3
		VIII	3	71 47 47·024	·320	4·8870788,9			XV	6	55 49 56·225	·416	4·8740090,7
5	„	VII		48 43 50·218	·319	4·7853734,8	11	„	XIV		64 1 50·061	·416	4·9100682,1
		X	4	59 28 22·758	·320	4·8445767,8			XVII	7	60 8 13·714	·416	4·8944242,1
		VII		58 5 33·733	·428	4·8911147,1			XIV		56 8 31·166	·336	4·8308845,6
6	„	X	4	64 39 21·248	·428	4·9183059,1	12	„	XVII	7	57 21 1·570	·337	4·8368912,3
		IX		57 15 5·019	·427	4·8870788,9			XVI		66 30 27·264	·337	4·8740090,7

* Stations XIX and XXI appertain to the Sutlej Series.
† Stations LXXV and LXXVIII appertain to the Karáchi Longitudinal Series.

Triangle Number	Symbolic Error	Station Numbers — Serial	Station Numbers — Traverse	Corrected Plane Angle	Spherical Excess	Logarithm of side-length in Feet
				° ′ ″	″	
	y	XVI		77 11 24·737	·396	4·9539047,0
13	x	XVII	7	55 32 19·563	·396	4·8810459,7
	z	XIX		47 16 15·700	·396	4·8308845,6
		XVII	7	41 55 0·934	·334	4·7795369,8
14	„	XIX		51 36 23·514	·335	4·8489119,1
		XX	8	86 28 35·552	·335	4·9539047,0
		XX	8	56 58 45·571	·277	4·7952413,0
15	„	XIX		69 3 7·045	·277	4·8420544,4
		XXII	9	53 58 7·384	·276	4·7795369,8
		XIX		57 5 2·499	·242	4·7626348,0
16	„	XXII	9	58 6 11·752	·242	4·7675390,3
		XXI		64 48 45·749	·242	4·7952413,0
		XXII	9	96 47 51·989	·307	4·9735696,1
17	„	XXI		45 32 39·977	·307	4·8302062,6
		XXIV	10	37 39 28·034	·306	4·7626348,0
		XXI		53 51 39·689	·377	4·8828828,3
18	„	XXIV	10	41 47 58·259	·377	4·7995097,2
		XXIII		84 20 22·052	·378	4·9735696,1
		XXIII		53 5 46·074	·292	4·7980356,0
19	„	XXIV	10	50 27 6·823	·291	4·7822440,8
		XXVI		76 27 7·103	·292	4·8828828,3
		XXIV	10	50 52 6·395	·325	4·8211916,3
20	„	XXVI		81 47 18·952	·325	4·9270230,5
		XXIX	11	47 20 34·653	·324	4·7980356,0
		XXVI		64 59 12·135	·278	4·8287844,9
21	„	XXIX	11	52 4 35·885	·277	4·7685410,7
		XXVIII		62 56 11·980	·278	4·8211916,3
		XXIX	11	70 11 35·997	·348	4·8964929,2
22	„	XXVIII		56 11 39·291	·348	4·8425402,3
		XXXI	12	53 36 44·712	·348	4·8287844,9
		XXVIII		55 22 29·880	·362	4·8445223,3
23	„	XXXI	12	56 34 38·848	·362	4·8506760,9
		XXX		68 2 51·272	·363	4·8964929,2
		XXXI	12	53 10 19·774	·332	4·8144035,6
24	„	XXX		67 44 37·678	·333	4·8774508,3
		XXXIII	13	59 5 2·548	·333	4·8445223,3
		XXX		49 35 11·380	·223	4·7143950,9
25	„	XXXIII	13	56 58 6·983	·223	4·7562272,9
		XXXII		73 26 41·637	·224	4·8144035,6
		XXXIII	13	85 7 36·193	·263	4·8990466,5
26	„	XXXII		54 14 3·144	·263	4·8098613,5
		XXXVI	14	40 38 20·663	·262	4·7143950,9
	y	XXXII		53 8 56·058	·357	4·8313370,8
27	x	XXXVI	14	57 35 23·738	·358	4·8546028,5
	z	XXXV		69 15 40·204	·358	4·8990466,5
		XXXVI	14	80 54 58·440	·309	4·9148888,6
28	„	XXXV		44 31 54·224	·308	4·7662763,7
		XXXVIII	15	54 33 7·336	·308	4·8313370,8
		XXXV		67 48 44·755	·438	4·9390420,9
29	„	XXXVIII	15	51 2 25·685	·438	4·8632041,5
		XL		61 8 49·560	·438	4·9148888,6
		XXXVIII	15	51 45 15·170	·434	4·8656802,9
30	„	XL		59 49 40·747	·435	4·9073853,9
		XLIII	16	68 25 4·083	·435	4·9390420,9
		XL		51 3 12·711	·237	4·7592824,2
31	„	XLIII	16	45 24 44·366	·236	4·7210395,8
		XLII		83 32 2·923	·237	4·8656802,9
		XLIII	16	90 57 38·993	·214	4·8751695,0
32	„	XLII		39 4 15·346	·214	4·6747655,0
		XLV	17	49 58 5·661	·214	4·7592824,2
		XLII		39 23 48·183	·173	4·6906554,1
33	„	XLV	17	36 41 34·965	·173	4·6644544,3
		XLIV		103 54 36·852	·174	4·8751695,0
		XLV	17	47 39 45·093	·102	4·5604379,1
34	„	XLIV		46 16 27·476	·101	4·5506137,7
		XLVI	18	86 3 47·431	·102	4·6906554,1
		XLIV		61 37 39·705	·120	4·6434293,2
35	„	XLVI	18	71 45 4·427	·120	4·6765957,7
		XLVIII		46 37 15·868	·119	4·5604379,1
		XLVI	18	54 51 24·099	·106	4·5786147,4
36	„	XLVIII		53 27 39·582	·105	4·5709725,7
		XLIX	19	71 40 56·319	·106	4·6434293,2
		XLVIII		60 29 15·293	·090	4·5642379,9
37	„	XLIX	19	55 24 53·341	·090	4·5401437,5
		LI		64 5 51·366	·091	4·5786147,4
		XLIX	19	45 42 26·938	·101	4·5466079,7
38	„	LI		86 5 44·591	·102	4·6908169,2
		LXII		48 11 48·471	·102	4·5642379,9
		LI		85 58 0·530	·142	4·7780708,6
39	„	LXII		58 12 4·394	·141	4·7085175,6
		LIX		35 49 55·076	·141	4·5466079,7

NOTE.—Stations LIX and LXII apportain to the Great Indus Series.

9.

Preliminary Latitudes, Longitudes, and Azimuths of the Stations on the Line of the Traverse.

The following table gives the Geodetic Latitudes, Longitudes, and Azimuths, which have been obtained for all the stations and sides on the line of the traverse by applying the values of the difference of latitude, longitude, and azimuth—computed by the formulæ of Section 5 of the preceding chapter—first to the elements of the station of origin which are given on pages [31] and [32] and then to the deduced elements of every subsequent station in the order of succession which is indicated by the Traverse-numbers. Each station is thus regarded, first as the 'Deduced Station B' and afterwards as the 'Fixed Station A'.

In order to ascertain the differential values given by the geodetic calculations on which the tabulated elements are built up, we have for any, the ath, side on the flank of the chain

$$\Delta\lambda_a = (\lambda_{a+1} - \lambda_a)\,; \qquad \Delta L_a = (L_{a+1} - L_a)\,;$$

$$\Delta A_a = B_a - (\pi + A_a)\,;$$

where A_a stands for the forward azimuth at 'fixed station' A_a of 'deduced station' B_a, and B_a for the back azimuth of A_a at B_a.

The three differential values depend on the length c_a and forward azimuth A_a of the side a, and also on the latitude λ_a. The logarithmic length is given in the preceding section, on the same horizontal line as the angle at the serial station which enters, in the table, between the stations numbered in block type a and $(a + 1)$. The forward azimuth of the side a may be deduced by adding all the spherical angles at a, as given in the table, to the back azimuth B_{a-1}. Thus the logarithmic length of flank-side 4 in the Jodhpore Meridional Series is 5·0763658,2 which occurs in Triangle No. 8 on the same line as Serial Station VIII, entering between the flank stations 4 and 5; and the forward azimuth of this side is equal to the back azimuth of 3 at 4 and the sum of the spherical angles at 4, which occur in Triangles Nos. 5, 6, 7 and 8, the respective values of which are 81° 51′ 53″·809, 52° 14′ 11″·619, 57° 47′ 50″·868 and 78° 52′ 36″·919, together amounting to 270° 46′ 33″·215.

The Jodhpore Meridional Series.

Geodetic Elements of the Traverse Stations.

Fixed Station A				Deduced Station B										
No. in Traverse	Azimuth of B			No. in Traverse	Latitude North			Longitude East of Greenwich			Azimuth of A			
	°	′	″		°	′	″	°	′	″	°	′	″	
1	136	4	11·039	2	25	15	28·459	72	42	2·971	315	58	56·892	
2	207	30	44·414	3	25	35	48·287	72	53	43·884	27	35	45·364	
3	130	44	59·568	4	25	48	59·547	72	36	48·017	310	37	38·920	
4	221	24	12·135	5	26	3	44·632	72	51	12·776	41	30	30·400	
5	147	1	24·992	6	26	16	51·325	72	41	46·339	326	57	15·157	
6	207	19	57·791	7	26	29	19·000	72	48	55·906	27	23	8·690	
7	136	48	59·639	8	26	39	52·735	72	37	53·447	316	44	3·258	
8	201	3	35·501	9	26	50	25·979	72	42	25·309	21	5	37·877	
9	146	25	11·894	10	26	59	39·130	72	35	35·230	326	22	6·249	
10	150	45	18·001	11	27	6	54·046	72	31	3·044	330	43	14·200	
11	193	5	38·202	12	27	16	28·856	72	33	32·681	13	6	46·589	
12	206	0	0·751	13	27	25	36·824	72	38	32·258	26	2	18·388	
13	154	46	31·129	14	27	38	21·665	72	31	47·578	334	43	24·061	
14	182	20	3·732	15	27	49	41·047	72	32	18·732	2	20	18·230	
15	173	48	43·123	16	28	0	15·339	72	31	1·244	353	48	6·845	
16	167	15	42·086	17	28	15	18·795	72	27	10·566	347	13	53·328	
17	222	18	14·443	18	28	29	40·832	72	41	59·428	42	25	16·867	
18	156	36	44·873	19	28	42	51·016	72	35	31·696	336	33	39·242	
19	200	42	51·881	20	28	56	36·587	72	41	26·683	20	45	43·054	
20	118	27	52·034	21	29	1	54·718	72	30	18·012	298	22	27·981	
21	170	10	43·799	22	29	10	33·811	72	28	35·615	350	9	53·993	
22	155	28	5·330	23	29	17	57·168	72	24	44·732	335	26	12·559	
23	167	7	38·689	XXI*	29	27	41·351	72	22	12·171	347	6	23·842	

* This Station appertains to the Sutlej Series.

The Eastern Sind Meridional Series.

Geodetic Elements of the Traverse Stations.

Fixed Station A				Deduced Station B										
No. in Traverse	Azimuth of B			No. in Traverse	Latitude North			Longitude East of Greenwich			Azimuth of A			
	°	′	″		°	′	″	°	′	″	°	′	″
1	172	21	13·916	2	25	15	24·179	70	14	5·949	352	20	6·395
2	190	26	34·386	3	25	30	15·594	70	17	7·000	10	27	51·990
3	147	49	37·611	4	25	38	46·993	70	11	11·984	327	47	4·351
4	174	26	59·433	5	25	49	32·234	70	10	2·703	354	26	29·349
5	221	26	33·130	6	25	59	48·684	70	20	5·343	41	30	56·471
6	157	32	53·164	7	26	12	12·776	70	14	24·431	337	30	23·182
7	192	27	0·446	8	26	23	35·752	70	17	11·872	12	28	14·630
8	155	55	36·365	9	26	34	4·253	70	11	59·558	335	53	17·106
9	184	45	29·056	10	26	45	11·871	70	13	1·459	4	45	56·831
10	185	32	37·641	11	26	59	5·157	70	14	31·740	5	33	18·444
11	175	10	5·928	12	27	10	31·893	70	13	26·831	355	9	36·379
12	158	31	20·755	13	27	22	6·796	70	8	20·532	338	29	0·404
13	179	39	46·947	14	27	32	45·984	70	8	16·314	359	39	45·002
14	178	48	28·772	15	27	42	24·009	70	8	2·800	358	48	22·505
15	156	9	11·876	16	27	54	35·662	70	1	58·661	336	6	21·999
16	180	53	50·326	17	28	2	23·887	70	2	6·927	0	53	54·203
17	135	13	20·411	18	28	6	33·563	69	57	27·418	315	11	8·868
18	167	51	25·153	19	28	12	34·031	69	55	59·856	347	50	43·830
19	160	39	0·725	LXII*	28	20	12·444	69	52	57·889	340	37	34·532

* This Station appertains to the Great Indus Series.

10.

Numerical Values of the Absolute Terms in the Primary Equations of Condition.

The Lengths and Azimuths of the sides of the triangles, and the Latitudes and Longitudes of the Stations on the traverse flank of each chain, having been computed—as set forth in the two preceding sections—the values of the several Absolute Terms in the Primary Equations of Condition are indicated by the discrepancies between the computed values as here obtained at the junctions with the Sutlej and Great Indus Series and the corresponding values given in Volumes III and IV, and quoted in Section 7 of this Volume. The closing linear discrepancies are expressed logarithmically and the 7th place of decimals is treated as unity.

The Absolute Terms will now be particularised.

The Jodhpore Meridional Series.

Equation 1, *Linear*. Between the sides Súnda–Bonik and Kaimsir–Kanda.

Log. computed length Kaimsir–Kanda by Triangle No. 48	4·8021139,2
Log. final value; see page [31]	4·8021262,6
$_1E = -123{\cdot}4$ Logarithmic Error —	·0000123,4

Equations 2 to 4, *Geodetic*. Terminal Station, Kanda. Terminal side, Kaimsir–Kanda.

	Latitude. ° ′ ″	*Longitude.* ° ′ ″	*Azimuth.* ° ′ ″
Computed values	29 27 41·351	72 22 12·171	73 26 31·365
Final values; see page [31]	29 27 41·523	72 22 12·292	73 26 34·581
Errors	$_2E = -0{\cdot}172$	$_3E = -0{\cdot}121$	$_4E = -3{\cdot}216$

The Eastern Sind Meridional Series.

Equation 1, *Linear*. Between the sides Rojhra–Sandohar and Dáowála–Máchka.

Log. computed length Dáowála–Máchka by Triangle No. 39	4·7780708,6
Log. final value; see page [32]	4·7780782,8
$_1E = -74{\cdot}2$ Logarithmic Error —	·0000074,2

Equations 2 to 4, *Geodetic.* Terminal Station, Dáowála. Terminal side, Dáowála–Máchka.

	Latitude.	*Longitude.*	*Azimuth.*
	° ′ ″	° ′ ″	° ′ ″
Computed values	28 20 12·444	69 52 57·889	87 1 27·640
Final values; see page [32]	28 20 12·867	69 52 57·861	87 1 26·701
Errors	${}_2E = -0{\cdot}423$	${}_3E = +0{\cdot}028$	${}_4E = +0{\cdot}939$

These absolute terms when multiplied by the equalizing factors given on page [24] become

$${}_1E = -7{\cdot}42, \qquad {}_2E = -4{\cdot}23, \qquad {}_3E = +0{\cdot}28, \qquad {}_4E = +0{\cdot}939.$$

11.

Numerical Values of the μs and φs.

The table of substitutions at page [23] shews the general form of the factors μ and ϕ. The numerical values are tabulated in this section: they were constructed in the opposite order to that in which they are now recorded, commencing at the closing of the chain.*

On reference to the equation on page [22] it will be observed that the μs are factors of the tab. log. differences of sine, α, β or γ. In the side equations it has been found convenient to multiply α, β and γ by 10^7, or in other words to treat the 7th place of decimals as unity. It is convenient to do the same in the geodetic equations and to divide the μs by 10^7, because the latter are large integral quantities containing more significant figures than are required: after division the last two places of decimals can be omitted. In the following tables $\mu \times \frac{1}{10^7}$ is accordingly given.

* The values of the tabular log. differences of the first terms of $\Delta\lambda$, ΔL and ΔA in the expressions for them on pages [14] and [15] were employed for t.d. log. $\Delta\lambda$, t.d. log. ΔL and t.d. log. ΔA.

The Jodhpore Meridional Series.

Numerical Values of the μs and ϕs.

No. of Station in Traverse	Latitude		Longitude		Azimuth	
	${}_\lambda\mu \times \frac{1}{10^7}$	${}_\lambda\phi$	${}_L\mu \times \frac{1}{10^7}$	${}_L\phi$	${}_A\mu \times \frac{1}{10^7}$	${}_A\phi$
1	+ ·00356	+ ·0077	− ·00044	+ ·0866	− ·00020	+ 1·0394
2	339	45	27	829	13	1·0378
3	311	76	44	763	20	1·0350
4	293	31	20	721	10	1·0332
5	273	70	40	675	19	1·0312
6	255	45	27	633	13	1·0294
7	237	64	37	592	17	1·0276
8	223	36	22	555	10	1·0260
9	208	48	28	521	13	1·0245
10	196	30	19	491	09	1·0231
11	195	19	12	467	06	1·0220
12	181	26	16	436	08	1·0206
13	169	39	23	406	11	1·0192
14	151	21	13	364	07	1·0173
15	135	23	14	327	07	1·0156
16	121	20	12	292	06	1·0140
17	100	12	07	242	04	1·0117
18	080	50	27	195	13	1·0095
19	062	34	18	151	09	1·0074
20	043	49	27	106	13	1·0052
21	036	21	11	086	05	1·0042
22	024	16	09	057	04	1·0028
23	014	07	04	032	02	1·0016

The Eastern Sind Meridional Series.

Numerical Values of the μs and ϕs.

No. of Station in Traverse	Latitude		Longitude		Azimuth	
	$_\lambda\mu \times \frac{1}{10^7}$	$_\lambda\phi$	$_L\mu \times \frac{1}{10^7}$	$_L\phi$	$_A\mu \times \frac{1}{10^7}$	$_A\phi$
1	+·00281	+ ·0060	−·00033	+ ·0654	−·00015	+1·0293
2	256	52	29	597	13	1·0269
3	235	60	33	549	15	1·0248
4	223	45	25	522	12	1·0237
5	208	42	23	488	11	1·0222
6	194	69	37	456	17	1·0208
7	177	54	30	416	14	1·0191
8	161	62	33	380	15	1·0174
9	146	49	26	345	12	1·0159
10	131	52	28	309	13	1·0143
11	112	56	30	265	14	1·0123
12	096	52	28	228	13	1·0106
13	080	40	21	190	10	1·0089
14	066	40	21	155	10	1·0073
15	052	40	21	123	10	1·0058
16	035	23	12	084	06	1·0040
17	025	23	13	059	06	1·0028
18	019	11	06	045	03	1·0021
19	011	07	04	025	02	1·0012

12.

Numerical Values of the Coefficients $\mathfrak{b}$ *and* $\mathfrak{c}$ *of the Unknown Quantities* y *and* z.

The following table gives the numerical values of the coefficients $\mathfrak{b}$ and $\mathfrak{c}$ of the unknown quantities y and z in each equation of condition. Should it be desired to reproduce any one of these coefficients, as the value of $\mathfrak{b}_p$ in the qth equation, it is first necessary to ascertain by reference to pages [29] and [30], whether the coefficient is one of those of an exceptional form for which symbolical expressions are there given. When not found in this list it will be understood to take one of the general forms on page [29].

Examples.

(1). To find the values of $\mathfrak{b}_8$ and $\mathfrak{c}_8$ in equation 1 of the Jodhpore Meridional Series.

This is a linear equation, and the forms of the coefficients are normal,

$$ {}_1\mathfrak{b}_8 = + \text{ t.d. log sin } 78^\circ\ 52'\ 35'' = +\ 4; $$

$$ {}_1\mathfrak{c}_8 = - \text{ t.d. log sin } 47\quad 2\quad 4 = -\ 19. $$

(2). To find the values of $\mathfrak{b}_8$ and $\mathfrak{c}_8$ in equation 3 of the Jodhpore Meridional Series.

The equation is longitudinal, and the forms of the coefficients are normal,

$$ \begin{aligned} {}_3\mathfrak{b}_8 &= + \left\{ ({}_L\mu_5 - {}_L\mu_4)\, a_8 + {}_L\mu_5\, \beta_8 + {}_L\phi_4 \right\} \\ &= + \left\{ - 2000 \times \cdot 0000015 - 4023 \times \cdot 0000004 + \cdot 0721 \right\} \\ &= + \cdot 0675; \\ {}_3\mathfrak{c}_8 &= + \left\{ ({}_L\mu_5 - {}_L\mu_4)\, a_8 - {}_L\mu_4\, \gamma_8 + {}_L\phi_5 \right\} \\ &= + \left\{ - 2000 \times \cdot 0000015 + 2023 \times \cdot 0000019 + \cdot 0675 \right\} \\ &= + \cdot 0683. \end{aligned} $$

(3). To find the values of $\mathfrak{b}_{47}$ and $\mathfrak{c}_{47}$ in equation 4 of the Jodhpore Meridional Series.

The equation is azimuthal, and the forms of the coefficients are exceptional, see page [29],

$$ \begin{aligned} {}_4\mathfrak{b}_{47} &= - {}_A\mu_{23}\, a_{47} + {}_A\phi_{23} \\ &= + 172 \times \cdot 0000004 + 1 \cdot 0016 \\ &= + 1 \cdot 0017; \\ {}_4\mathfrak{c}_{47} &= 1 - {}_A\mu_{23}\, (a_{47} + \gamma_{47}) \\ &= 1 + 172 \times (\cdot 0000004 + \cdot 0000029) \\ &= 1 \cdot 0006. \end{aligned} $$

The Jodhpore Meridional Series.

No. of Circuit Triangle	Coefficients of y and z	
	b	c
1st Equation.		*Linear.*
1	+ 8	− 6
2	24	+ 6
3	11	− 16
4	3	19
5	14	3
6	12	9
7	19	6
8	4	19
9	12	3
10	16	6
11	13	7
12	14	9
13	24	9
14	10	17
15	11	9
16	13	12
17	10	14
18	18	6
19	7	13
20	19	4
21	6	25
22	19	4
23	10	17
24	16	10
25	10	26
26	20	9
27	11	9
28	15	14
29	9	8
30	8	17

No. of Circuit Triangle	Coefficients of y and z	
	b	c
1st Equation—(Continued).		
31	+ 9	− 10
32	5	23
33	11	13
34	22	17
35	18	16
36	11	11
37	19	5
38	11	6
39	12	23
40	15	6
41	7	16
42	11	5
43	11	7
44	16	4
45	21	5
46	14	8
47	10	29
48	6	14
2nd Equation.		*Latitude.*
1	+0·0207	− 0·0290
2	·0839	+ ·0205
3	·0328	− ·0588
4	·0087	·0620
5	·0446	·0102
6	·0321	·0295
7	·0526	·0207
8	·0109	·0518
9	·0330	·0082
10	·0362	·0198

No. of Circuit Triangle	Coefficients of y and z	
	b	c
2nd Equation—(Continued).		
11	+0·0286	− 0·0223
12	·0351	·0191
13	·0589	·0188
14	·0187	·0415
15	·0209	·0237
16	·0290	·0236
17	·0226	·0280
18	·0322	·0147
19	·0164	·0237
20	·0351	·0097
21	·0098	·0505
22	·0344	·0072
23	·0155	·0334
24	·0283	·0155
25	·0181	·0427
26	·0281	·0157
27	·0145	·0157
28	·0211	·0202
29	·0099	·0131
30	·0101	·0229
31	·0089	·0141
32	·0045	·0291
33	·0098	·0142
34	·0208	·0182
35	·0148	·0118
36	·0091	·0081
37	·0083	·0065
38	·0034	·0071
39	·0076	·0102
40	·0090	·0017

No. of Circuit Triangle	Coefficients of y and z	
	b	c
2nd Equation—(Continued).		
41	+0·0004	− 0·0078
42	·0018	·0039
43	·0022	·0034
44	·0022	·0025
45	·0032	·0017
46	·0012	·0018
47	·0002	·0044
3rd Equation.		*Longitude.*
1	−0·0902	− 0·0839
2	+ ·0856	+ ·0858
3	− ·0859	− ·0785
4	+ ·0787	+ ·0786
5	·0786	·0785
6	− ·0745	− ·0703
7	·0759	·0709
8	+ ·0675	+ ·0683
9	·0674	·0677
10	− ·0677	− ·0617
11	·0668	·0614
12	+ ·0566	+ ·0602
13	·0551	·0599
14	− ·0577	− ·0518
15	·0579	·0535
16	+ ·0511	+ ·0539
17	·0515	·0543
18	− ·0524	− ·0480
19	+ ·0493	+ ·0502
20	− ·0490	− ·0462
21	·0474	·0436

The Jodhpore Meridional Series.

No. of Circuit Triangle	Coefficients of y and z		No. of Circuit Triangle	Coefficients of y and z		No. of Circuit Triangle	Coefficients of y and z		No. of Circuit Triangle	Coefficients of y and z	
	b	c		b	c		b	c		b	c
3rd Equation—(Continued).			*3rd Equation*—(Continued).			*4th Equation*—(Continued).			*4th Equation*—(Continued).		
22	+0·0432	+0·0436	41	−0·0094	−0·0068	11	−1·0311	−1·0285	30	+1·0152	+1·0153
23	− ·0452	− ·0409	42	·0098	·0080	12	+1·0263	+1·0281	31	−1·0145	−1·0134
24	+ ·0393	+ ·0415	43	+ ·0081	+ ·0070	13	1·0256	1·0281	32	+1·0141	+1·0134
25	·0398	·0428	44	− ·0071	− ·0053	14	−1·0270	−1·0242	33	−1·0121	−1·0112
26	− ·0391	− ·0352	45	+ ·0056	+ ·0042	15	1·0271	1·0251	34	1·0125	1·0111
27	·0379	·0352	46	− ·0037	− ·0029	16	+1·0240	+1·0255	35	+1·0089	+1·0097
28	+ ·0342	+ ·0345	47	+ ·0033	+ ·0011	17	1·0242	1·0256	36	1·0091	1·0095
29	− ·0340	− ·0316				18	−1·0247	−1·0226	37	−1·0091	−1·0070
30	+ ·0319	+ ·0318	*4th Equation.*		*Azimuth.*	19	+1·0232	+1·0237	38	1·0084	1·0069
31	− ·0303	− ·0280	1	−1·0410	−1·0382	20	−1·0232	−1·0218	39	+1·0057	+1·0071
32	+ ·0295	+ ·0276	2	+1·0386	+1·0390	21	1·0224	1·0205	40	1·0056	1·0062
33	− ·0250	− ·0233	3	−1·0393	−1·0357	22	+1·0203	+1·0206	41	−1·0046	−1·0033
34	·0257	·0230	4	+1·0360	+1·0363	23	−1·0214	−1·0193	42	1·0048	1·0039
35	+ ·0185	+ ·0198	5	1·0358	1·0360	24	+1·0186	+1·0197	43	+1·0039	+1·0034
36	·0188	·0194	6	−1·0344	−1·0323	25	1·0187	1·0203	44	−1·0035	−1·0026
37	− ·0186	− ·0142	7	1·0351	1·0326	26	−1·0186	−1·0167	45	+1·0027	+1·0021
38	·0171	·0140	8	+1·0312	+1·0318	27	1·0180	1·0167	46	−1·0018	−1·0015
39	+ ·0115	+ ·0144	9	1·0311	1·0313	28	+1·0163	+1·0165	47	+1·0017	+1·0006
40	·0114	·0127	10	−1·0315	−1·0286	29	−1·0162	−1·0150	48	−1·0000	−1·0000

The Eastern Sind Meridional Series.

No. of Circuit Triangle	Coefficients of *y* and *z*: b	c	No. of Circuit Triangle	Coefficients of *y* and *z*: b	c	No. of Circuit Triangle	Coefficients of *y* and *z*: b	c	No. of Circuit Triangle	Coefficients of *y* and *z*: b	c
1st Equation.		*Linear.*	*1st Equation*—(Continued).			*2nd Equation*—(Continued).			*3rd Equation*—(Continued).		
1	+ 12	− 17	31	+ 17	− 2	20	+0·0236	− 0·0199	10	+0·0426	+ 0·0470
2	9	10	32	− 1	17	21	·0056	·0168	11	·0422	·0468
3	15	6	33	+ 26	+ 5	22	·0111	·0138	12	− ·0458	− ·0389
4	21	9	34	20	− 2	23	·0082	·0129	13	·0431	·0359
5	7	12	35	12	20	24	·0166	·0099	14	+ ·0330	+ ·0376
6	13	14	36	14	7	25	·0104	·0096	15	·0350	·0401
7	3	16	37	11	10	26	·0024	·0183	16	− ·0379	− ·0319
8	18	3	38	21	19	27	·0059	·0093	17	+ ·0349	+ ·0377
9	11	17	39	2	29	28	·0032	·0088	18	− ·0351	− ·0303
10	13	12				29	·0002	·0102	19	·0354	·0295
11	14	12	*2nd Equation.*		*Latitude.*	30	·0074	·0041	20	+ ·0257	+ ·0317
12	14	9	1	+0·0347	− 0·0446	31	·0037	·0030	21	− ·0295	− ·0235
13	5	19	2	·0178	·0308	32	− ·0009	·0066	22	+ ·0246	+ ·0276
14	24	1	3	·0332	·0206	33	+ ·0042	·0010	23	− ·0267	− ·0206
15	14	15	4	·0529	·0187	34	·0049	·0006	24	+ ·0200	+ ·0232
16	13	10	5	·0193	·0260	35	·0012	·0049	25	− ·0228	− ·0175
17	− 2	27	6	·0245	·0357	36	·0014	·0018	26	+ ·0188	+ ·0208
18	+ 15	2	7	·0074	·0348	37	·0005	·0018	27	− ·0187	− ·0138
19	16	5	8	·0332	·0104	38	·0005	·0023	28	+ ·0147	+ ·0155
20	17	19	9	·0187	·0396				29	− ·0140	− ·0098
21	10	10	10	·0280	·0195	*3rd Equation.*		*Longitude.*	30	+ ·0114	+ ·0111
22	8	15	11	·0300	·0196	1	+0·0622	+ 0·0656	31	− ·0104	− ·0082
23	14	8	12	·0194	·0213	2	− ·0623	− ·0568	32	+ ·0085	+ ·0079
24	16	13	13	·0035	·0390	3	·0641	·0580	33	− ·0093	− ·0066
25	18	7	14	·0413	+ ·0017	4	+ ·0525	+ ·0572	34	+ ·0059	+ ·0060
26	1	25	15	·0254	− ·0205	5	·0546	·0577	35	− ·0052	− ·0033
27	15	8	16	·0141	·0195	6	− ·0555	− ·0487	36	+ ·0042	+ ·0032
28	4	15	17	− ·0009	·0374	7	+ ·0519	+ ·0532	37	− ·0029	− ·0021
29	8	12	18	+ ·0145	·0078	8	− ·0529	− ·0481	38	+ ·0026	+ ·0008
30	16	8	19	·0158	·0118	9	·0513	·0449			

The Eastern Sind Meridional Series.

No. of Circuit Triangle	Coefficients of y and z		No. of Circuit Triangle	Coefficients of y and z		No. of Circuit Triangle	Coefficients of y and z		No. of Circuit Triangle	Coefficients of y and z	
	b	c		b	c		b	c		b	c
4th Equation.		*Azimuth.*	*4th Equation*—(Continued).			*4th Equation*—(Continued).			*4th Equation*—(Continued).		
1	+1·0279	+ 1·0297	11	+1·0191	+ 1·0214	21	−1·0137	− 1·0109	31	−1·0050	− 1·0039
2	−1·0281	− 1·0256	12	−1·0211	− 1·0178	22	+1·0114	+ 1·0128	32	+1·0041	+ 1·0038
3	1·0289	1·0261	13	1·0198	1·0164	23	−1·0124	− 1·0096	33	−1·0044	− 1·0031
4	+1·0235	+ 1·0258	14	+1·0152	+ 1·0172	24	+1·0093	+ 1·0109	34	+1·0028	+ 1·0028
5	1·0248	1·0263	15	1·0159	1·0184	25	−1·0107	− 1·0082	35	−1·0025	− 1·0015
6	−1·0253	− 1·0220	16	−1·0175	− 1·0147	26	+1·0088	+ 1·0098	36	+1·0020	+ 1·0016
7	+1·0236	+ 1·0243	17	+1·0160	+ 1·0173	27	−1·0088	− 1·0065	37	−1·0014	− 1·0010
8	−1·0242	− 1·0219	18	−1·0163	− 1·0140	28	+1·0069	+ 1·0073	38	+1·0012	+ 1·0004
9	1·0234	1·0203	19	1·0164	1·0136	29	−1·0066	− 1·0046	39	−1·0000	− 1·0000
10	+1·0194	+ 1·0215	20	+1·0119	+ 1·0148	30	+1·0053	+ 1·0053			

13.

The Coefficients of the Indeterminate Factors in the Values of the Unknown Quantities.

On reference to the equations on page [12] it will be seen that the general expression for the error x_p of any angle X_p appertaining to a trigonometrical figure, is, when the weight is unity,

$$x_p = (a_p \lambda_a + b_p \lambda_b + \quad . \quad . \quad . \quad + n_p \lambda_n)$$

so that the coefficients of $\lambda_a, \lambda_b, \quad . \quad . \quad . \quad \lambda_n$, the indeterminate factors, are the coefficients of x_p in the several absolute geometrical equations to which the indeterminate factors are respectively related. But one of the three unknown quantities appertaining to every triangle having been eliminated, as a preliminary to the simultaneous reduction of each series, the coefficients of the Indeterminate Factors take a more complex form which is given on page [25]. The expressions are :—

$$y_p = {}_1\mathfrak{B}_p\,{}_1\Lambda + {}_2\mathfrak{B}_p\,{}_2\Lambda + \quad . \quad . \quad . \quad + {}_n\mathfrak{B}_p\,{}_n\Lambda,$$
$$z_p = {}_1\mathfrak{C}_p\,{}_1\Lambda + {}_2\mathfrak{C}_p\,{}_2\Lambda + \quad . \quad . \quad . \quad + {}_n\mathfrak{C}_p\,{}_n\Lambda,$$

where, see note to page [25],

$${}_1\mathfrak{B}_p = (2\,{}_1\mathfrak{b}_p - {}_1\mathfrak{c}_p)\,; \qquad {}_2\mathfrak{B}_p = (2\,{}_2\mathfrak{b}_p - {}_2\mathfrak{c}_p)\,; \qquad . \quad . \quad .$$
$${}_1\mathfrak{C}_p = (2\,{}_1\mathfrak{c}_p - {}_1\mathfrak{b}_p)\,; \qquad {}_2\mathfrak{C}_p = (2\,{}_2\mathfrak{c}_p - {}_2\mathfrak{b}_p)\,; \qquad . \quad . \quad .$$

the left-hand subscripts indicating the number of any one of the equations into which the errors y and z of any, the pth, triangle happen to enter.

The values of $\mathfrak{b}_p$ and $\mathfrak{c}_p$ for each equation into which the y_p and z_p enter, are given in the table in the preceding section.

Examples.

From the Jodhpore Meridional Series.

$${}_2\mathfrak{B}_6 = (2\,{}_2\mathfrak{b}_6 - {}_2\mathfrak{c}_6) = (2 \times + 0{\cdot}0321 + 0{\cdot}0295) = + 0{\cdot}0937$$
$${}_2\mathfrak{C}_6 = (2\,{}_2\mathfrak{c}_6 - {}_2\mathfrak{b}_6) = (2 \times - 0{\cdot}0295 - 0{\cdot}0321) = - 0{\cdot}0911.$$

The following tables give the values of the significant coefficients $\mathfrak{B}$ and $\mathfrak{C}$ of the Indeterminate Factors ${}_1\Lambda$, ${}_2\Lambda$, . . . for the y and z of every triangle for each series.

The Jodhpore Meridional Series.

No. of Circuit Triangle	$\mathfrak{B}$	$\mathfrak{C}$	No. of Circuit Triangle	$\mathfrak{B}$	$\mathfrak{C}$	No. of Circuit Triangle	$\mathfrak{B}$	$\mathfrak{C}$	No. of Circuit Triangle	$\mathfrak{B}$	$\mathfrak{C}$
1st Equation. Linear.			*1st Equation*—(Continued).			*1st Equation*—(Continued).			*1st Equation*—(Continued).		
1	+ 22	− 20	9	+ 27	− 18	17	+ 34	− 38	25	+ 46	− 62
2	42	12	10	38	28	18	42	30	26	49	38
3	38	43	11	33	27	19	27	33	27	31	29
4	25	41	12	37	32	20	42	27	28	44	43
5	31	20	13	57	42	21	37	56	29	26	25
6	33	30	14	37	44	22	42	27	30	33	42
7	44	31	15	31	29	23	37	44	31	28	29
8	27	42	16	38	37	24	42	36	32	33	51

The Jodhpore Meridional Series.

No. of Circuit Triangle	B	C
1st Equation—(Continued).		
33	+ 35	− 37
34	61	56
35	52	50
36	33	33
37	43	29
38	28	23
39	47	58
40	36	27
41	30	39
42	27	21
43	29	25
44	36	24
45	47	31
46	36	30
47	49	68
48	26	34
2nd Equation.		*Latitude.*
1	+0·0704	− 0·0787
2	·1473	·0429
3	·1244	·1504
4	.0794	·1327
5	·0994	·0650
6	·0937	·0911
7	·1259	·0940
8	·0736	·1145
9	·0742	·0494
10	·0922	·0758
11	·0795	·0732
12	·0893	·0733

No. of Circuit Triangle	B	C
2nd Equation—(Continued).		
13	+0·1366	− 0·0965
14	·0789	·1017
15	·0655	·0683
16	·0816	·0762
17	·0732	·0786
18	·0791	·0616
19	·0565	·0638
20	·0799	·0545
21	·0701	·1108
22	·0760	·0488
23	·0644	·0823
24	·0721	·0593
25	·0789	·1035
26	·0719	·0595
27	·0447	·0459
28	·0624	·0615
29	·0329	·0361
30	·0431	·0559
31	·0319	·0371
32	·0381	·0627
33	·0338	·0382
34	·0598	·0572
35	·0414	·0384
36	·0263	·0253
37	·0231	·0213
38	·0139	·0176
39	·0254	·0280
40	·0197	·0124
41	·0086	·0160
42	·0075	·0096

No. of Circuit Triangle	B	C
2nd Equation—(Continued).		
43	+0·0078	− 0·0090
44	·0069	·0072
45	·0081	·0066
46	·0042	·0048
47	·0048	·0090
3rd Equation.		*Longitude.*
1	−0·0965	− 0·0776
2	+ ·0854	+ ·0860
3	− ·0933	− ·0711
4	+ ·0788	+ ·0785
5	·0787	·0784
6	− ·0787	− ·0661
7	·0809	·0659
8	+ ·0667	+ ·0691
9	·0671	·0680
10	− ·0737	− ·0557
11	·0722	·0560
12	+ ·0530	+ ·0638
13	·0503	·0647
14	− ·0636	− ·0459
15	·0623	·0491
16	+ ·0483	+ ·0567
17	·0487	·0571
18	− ·0568	− ·0436
19	+ ·0484	+ ·0511
20	− ·0518	− ·0434
21	·0512	·0398
22	+ ·0428	+ ·0440
23	− ·0495	− ·0366

No. of Circuit Triangle	B	C
3rd Equation—(Continued).		
24	+0·0371	+ 0·0437
25	·0368	·0458
26	− ·0430	− ·0313
27	·0406	·0325
28	+ ·0339	+ ·0348
29	− ·0364	− ·0292
30	+ ·0320	+ ·0317
31	− ·0326	− ·0257
32	+ ·0314	+ ·0257
33	− ·0267	− ·0216
34	·0284	·0203
35	+ ·0172	+ ·0211
36	·0182	·0200
37	− ·0230	− ·0098
38	·0202	·0109
39	+ ·0086	+ ·0173
40	·0101	·0140
41	− ·0120	− ·0042
42	·0116	·0062
43	+ ·0092	+ ·0059
44	− ·0089	− ·0035
45	+ ·0070	+ ·0028
46	− ·0045	− ·0021
47	+ ·0055	·0011
4th Equation.		*Azimuth.*
1	−1·0438	− 1·0354
2	+1·0382	+ 1·0394
3	−1·0429	− 1·0321
4	+1·0357	+ 1·0366

The Jodhpore Meridional Series.

No. of Circuit Triangle	𝔅	ℭ	No. of Circuit Triangle	𝔅	ℭ	No. of Circuit Triangle	𝔅	ℭ	No. of Circuit Triangle	𝔅	ℭ
4th Equation—(Continued).			*4th Equation*—(Continued).			*4th Equation*—(Continued).			*4th Equation*—(Continued).		
5	+1·0356	+ 1·0362	16	+1·0225	+ 1·0270	27	−1·0193	− 1·0154	38	−1·0099	− 1·0054
6	−1·0365	− 1·0302	17	1·0228	1·0270	28	+1·0161	+ 1·0167	39	+1·0043	+ 1·0085
7	1·0376	1·0301	18	−1·0268	− 1·0205	29	−1·0174	− 1·0138	40	1·0050	1·0068
8	+1·0306	+ 1·0324	19	+1·0227	+ 1·0242	30	+1·0151	+ 1·0154	41	−1·0059	− 1·0020
9	1·0309	1·0315	20	−1·0246	− 1·0204	31	−1·0156	− 1·0123	42	1·0057	1·0030
10	−1·0344	− 1·0257	21	1·0243	1·0186	32	+1·0148	+ 1·0127	43	+1·0044	+ 1·0029
11	1·0337	1·0259	22	+1·0200	+ 1·0209	33	−1·0130	− 1·0103	44	−1·0044	− 1·0017
12	+1·0245	+ 1·0299	23	−1·0235	− 1·0172	34	1·0139	1·0097	45	+1·0033	+ 1·0015
13	1·0231	1·0306	24	+1·0175	+ 1·0208	35	+1·0081	+ 1·0105	46	−1·0021	− 1·0012
14	−1·0298	− 1·0214	25	1·0171	1·0219	36	1·0087	1·0099	47	+1·0028	+ 0·9995
15	1·0291	1·0231	26	−1·0205	− 1·0148	37	−1·0112	− 1·0049	48	−1·0000	− 1·0000

The Eastern Sind Meridional Series.

No. of Circuit Triangle	𝔅	ℭ	No. of Circuit Triangle	𝔅	ℭ	No. of Circuit Triangle	𝔅	ℭ	No. of Circuit Triangle	𝔅	ℭ
1st Equation.		*Linear.*	*1st Equation*—(Continued).			*1st Equation*—(Continued).			*1st Equation*—(Continued).		
1	+ 41	− 46	11	+ 40	− 38	21	+ 30	− 30	31	+ 36	− 21
2	28	29	12	37	32	22	31	38	32	15	33
3	36	27	13	29	43	23	36	30	33	47	16
4	51	39	14	49	26	24	45	42	34	42	24
5	26	31	15	43	44	25	43	32	35	44	52
6	40	41	16	36	33	26	27	51	36	35	28
7	22	35	17	23	52	27	38	31	37	32	31
8	39	24	18	32	19	28	23	34	38	61	59
9	39	45	19	37	26	29	28	32	39	33	60
10	38	37	20	53	55	30	40	32			

The Eastern Sind Meridional Series.

No. of Circuit Triangle	B	C	No. of Circuit Triangle	B	C	No. of Circuit Triangle	B	C	No. of Circuit Triangle	B	C
2nd Equation.		*Latitude.*	*2nd Equation*—(Continued).			*3rd Equation*—(Continued).			*4th Equation*—(Continued).		
1	+0·1140	−0·1239	31	+0·0104	−0·0097	21	−0·0355	−0·0175	11	+1·0168	+1·0237
2	·0664	·0794	32	·0048	·0123	22	+·0216	+·0306	12	−1·0244	−1·0145
3	·0870	·0744	33	·0094	·0062	23	−·0328	−·0145	13	1·0232	1·0130
4	·1245	·0903	34	·0104	·0061	24	+·0168	+·0264	14	+1·0132	+1·0192
5	·0646	·0713	35	·0073	·0110	25	−·0281	−·0122	15	1·0134	1·0209
6	·0847	·0959	36	·0046	·0050	26	+·0168	+·0228	16	−1·0203	−1·0119
7	·0496	·0770	37	·0028	·0041	27	−·0236	−·0089	17	+1·0147	+1·0186
8	·0768	·0540	38	·0033	·0051	28	+·0139	+·0163	18	−1·0186	−1·0117
9	·0770	·0979				29	−·0182	−·0056	19	1·0192	1·0108
10	·0755	·0670	*3rd Equation.*		*Longitude.*	30	+·0117	+·0108	20	+1·0090	+1·0177
11	·0796	·0692	1	+0·0588	+0·0690	31	−·0126	−·0060	21	−1·0165	−1·0081
12	·0601	·0620	2	−·0678	−·0513	32	+·0091	+·0073	22	+1·0100	+1·0142
13	·0460	·0815	3	·0702	·0519	33	−·0120	−·0039	23	−1·0152	−1·0068
14	·0809	·0379	4	+·0478	+·0619	34	+·0058	+·0061	24	+1·0077	+1·0125
15	·0713	·0664	5	·0515	·0608	35	−·0071	−·0014	25	−1·0132	−1·0057
16	·0477	·0531	6	−·0623	−·0419	36	+·0052	+·0022	26	+1·0078	+1·0108
17	·0356	·0739	7	+·0506	+·0545	37	−·0037	−·0013	27	−1·0111	−1·0042
18	·0368	·0301	8	−·0577	−·0433	38	+·0044	·0010	28	+1·0065	+1·0077
19	·0434	·0394	9	·0577	·0385				29	−1·0086	−1·0026
20	·0671	·0634	10	+·0382	+·0514	*4th Equation.*		*Azimuth.*	30	+1·0053	+1·0053
21	·0280	·0392	11	·0376	·0514	1	+1·0261	+1·0315	31	−1·0061	−1·0028
22	·0360	·0387	12	−·0527	−·0320	2	−1·0306	−1·0231	32	+1·0044	+1·0035
23	·0293	·0340	13	·0503	·0287	3	1·0317	1·0233	33	−1·0057	−1·0018
24	·0431	·0364	14	+·0284	+·0422	4	+1·0212	+1·0281	34	+1·0028	+1·0028
25	·0304	·0296	15	·0299	·0452	5	1·0233	1·0278	35	−1·0035	−1·0005
26	·0231	·0390	16	−·0439	−·0259	6	−1·0286	−1·0187	36	+1·0024	+1·0012
27	·0211	·0245	17	+·0321	+·0405	7	+1·0229	+1·0250	37	−1·0018	−1·0006
28	·0152	·0208	18	−·0399	−·0255	8	−1·0265	−1·0196	38	+1·0020	+0·9996
29	·0106	·0206	19	·0413	·0236	9	1·0265	1·0172	39	−1·0000	−1·0000
30	·0189	·0156	20	+·0197	+·0377	10	+1·0173	+1·0236			

14.

The Equations between the Indeterminate Factors, and their Solution.

In the equations between the Indeterminate Factors, the coefficients of the factors are summations of terms of the form ($\mathfrak{b}\mathfrak{B} + \mathfrak{c}\mathfrak{C}$), such as are exhibited in the equations on page [25].

In the equations appertaining to the Eastern Sind Meridional Series Equalizing Factors were employed, see page [24]; these factors were not applied directly to the $\mathfrak{b}$s and $\mathfrak{c}$s, as such a proceeding was unnecessary, but they were introduced at once into the coefficients themselves.

The manner in which this has been done will appear if the geometrical equations of condition on page [12] are multiplied in succession by the equalizing factors f_a, f_b, f_c, &c., and λ'_a, λ'_b, λ'_c are put for the corresponding Indeterminate Factors. The equations between the latter will then be

$$f_a f_a [aa.u] \lambda'_a + f_a f_b [ab.u] \lambda'_b + \dots + f_a f_n [an.u] \lambda'_n = f_a e_a,$$

$$f_a f_b [ab.u] \lambda'_a + f_b f_b [bb.u] \lambda'_b + \dots + f_b f_n [bn.u] \lambda'_n = f_b e_b,$$

$$\dots\dots\dots\dots\dots\dots$$

$$f_a f_n [an.u] \lambda'_a + f_b f_n [bn.u] \lambda'_b + \dots + f_n f_n [nn.u] \lambda'_n = f_n e_n;$$

$$\text{in which } \lambda'_a = \frac{\lambda_a}{f_a},\ \lambda'_b = \frac{\lambda_b}{f_b},\ \dots\ \lambda'_n = \frac{\lambda_n}{f_n}.$$

From this it appears that after the solution of the equations appertaining to the Eastern Sind Meridional Series, the resulting values of the Indeterminate Factors had to be multiplied by the corresponding equalizing factors before they could be employed in the formulæ on page [25] for obtaining the values of the errors y and z.

The coefficients of the Indeterminate Factors, and the Absolute Terms, in each of the 4 equations which were presented for simultaneous solution by either series are here given in a tabular form.

The tables following the groups of equations between the Indeterminate Factors, give the first of each group of equations between certain of the indeterminate factors which remained after the other factors had been eliminated. These are the equations which were used in obtaining the numerical values of the factors by successive substitutions backwards from the last to the first.

The Jodhpore Meridional Series.

The Equations between the Indeterminate Factors expressed in Natural Numbers.

No. of Equation	The Indeterminate Factors and their Coefficients				The Absolute Terms
	$_1\Lambda$	$_2\Lambda$	$_3\Lambda$	$_4\Lambda$	
1	+ 46834·0	+ 72·2865	− 4·8070	− 59·4742	− 123·4
2	+ 72·2865	+ 0·1553	+ 0·0015	+ 0·1318	− 0·172
3	− 4·8070	+ 0·0015	+ 0·2159	+ 3·9612	− 0·121
4	− 59·4742	+ 0·1318	+ 3·9612	+ 99·6618	− 3·216

The Equations between the Indeterminate Factors after the Successive Eliminations.

No. of Equation	The Indeterminate Factors and their Coefficients				The Absolute Terms
	$_1\Lambda$	$_2\Lambda$	$_3\Lambda$	$_4\Lambda$	
1	+ 46834·0	+ 72·2865	− 4·8070	− 59·4742	− 123·4
2		+ 0·0437	+ 0·0089	+ 0·2236	+ 0·0185
3			+ 0·2136	+ 3·9096	− 0·1375
4				+ 26·8833	− 0·9507

The Eastern Sind Meridional Series.

The Equations between the Indeterminate Factors expressed in Natural Numbers, before the application of the Equalizing Factors.

No. of Equation	The Indeterminate Factors and their Coefficients				The Absolute Terms
	$_1\Lambda$	$_2\Lambda$	$_3\Lambda$	$_4\Lambda$	
1	+ 38716·	+ 45·3001	− 8·7746	− 109·1557	− 74·2
2	+ 45·3001	+ 0·08076	− 0·005415	+ 0·07154	− 0·423
3	− 8·7746	− 0·005415	+ 0·09630	+ 2·331265	+ 0·028
4	− 109·1557	+ 0·07154	+ 2·331265	+ 80·11747	+ 0·939

The Equations between the Indeterminate Factors expressed in Natural Numbers, after the application of the Equalizing Factors.

No. of Equation	The Indeterminate Factors and their Coefficients				The Absolute Terms
	$_1\Lambda$	$_2\Lambda$	$_3\Lambda$	$_4\Lambda$	
1	+ 387·16	+ 45·3001	− 8·7746	− 10·9156	− 7·42
2	+ 45·3001	+ 8·076	− 0·5415	+ 0·7154	− 4·23
3	− 8·7746	− 0·5415	+ 9·630	+ 23·3127	+ 0·28
4	− 10·9156	+ 0·7154	+ 23·3127	+ 80·1175	+ 0·939

The Equations between the Indeterminate Factors after the Successive Eliminations.

No. of Equation	The Indeterminate Factors and their Coefficients				The Absolute Terms
	$_1\Lambda$	$_2\Lambda$	$_3\Lambda$	$_4\Lambda$	
1	+ 387·16	+ 45·3001	− 8·7746	− 10·9156	− 7·42
2		+ 2·7756	+ 0·4852	+ 1·9926	− 3·3618
3			+ 9·3463	+ 22·7170	+ 0·6995
4				+ 23·1635	+ 1·4430

The following table gives the values of the factors to 4 places of decimals as deduced from the solution of the equations.

The Jodhpore Meridional Series.

Numerical Values of the Indeterminate Factors.

Factor	Numerical Value
$_1\Lambda$	− 0·0036
$_2\Lambda$	+ 0·6041
$_3\Lambda$	+ 0·0042
$_4\Lambda$	− 0·0354

The Eastern Sind Meridional Series.

Numerical Values of the Indeterminate Factors.

Factor	Numerical Value	Numerical Value × Equalizing Factors
${}_1\Lambda$	+ 0·1262	+ 0·0126
${}_2\Lambda$	− 1·2425	− 12·425
${}_3\Lambda$	− 0·0766	− 0·766
${}_4\Lambda$	+ 0·0623	+ 0·0623

15.

The Angular Errors x, y and z.

The following table gives the values of the errors of the angles of every circuit triangle, the errors y and z having first been deduced for any, the pth, triangle by the formulæ

$$y_p = {}_1\mathfrak{B}_p\,{}_1\Lambda + {}_2\mathfrak{B}_p\,{}_2\Lambda + \quad . \quad . \quad .$$

$$z_p = {}_1\mathfrak{C}_p\,{}_1\Lambda + {}_2\mathfrak{C}_p\,{}_2\Lambda + \quad . \quad . \quad .$$

the error x_p was simply determined by finding the value of its equivalent, $-\,(y_p + z_p)$.

The Jodhpore Meridional Series.

The Angular Errors.

No. of Triangle	x	y	z	No. of Triangle	x	y	z	No. of Triangle	x	y	z	No. of Triangle	x	y	z
	″	″	″		″	″	″		″	″	″		″	″	″
1	−0·061	0·000	+0·061	13	+0·102	−0·159	+0·057	25	+0·029	−0·154	+0·125	37	−0·021	−0·106	+0·127
2	+ ·118	− ·099	− ·019	14	− ·084	− ·050	+ ·134	26	− ·039	− ·098	+ ·137	38	− ·051	− ·057	+ ·108
3	− ·075	− ·026	+ ·101	15	− ·063	− ·036	+ ·099	27	− ·064	− ·049	+ ·113	39	+ ·033	− ·190	+ ·157
4	+ ·047	− ·079	+ ·032	16	+ ·073	− ·124	+ ·051	28	+ ·075	− ·157	+ ·082	40	+ ·099	− ·154	+ ·055
5	+ ·092	− ·088	− ·004	17	+ ·061	− ·115	+ ·054	29	− ·066	− ·038	+ ·104	41	− ·099	− ·068	+ ·167
6	− ·064	− ·026	+ ·090	18	− ·039	− ·068	+ ·107	30	+ ·047	− ·129	+ ·082	42	− ·049	− ·057	+ ·106
7	− ·045	− ·046	+ ·091	19	+ ·054	− ·099	+ ·045	31	− ·072	− ·046	+ ·118	43	+ ·087	− ·136	+ ·049
8	+ ·043	− ·089	+ ·046	20	− ·034	− ·067	+ ·101	32	+ ·021	− ·132	+ ·111	44	− ·028	− ·090	+ ·118
9	+ ·090	− ·089	− ·001	21	− ·116	− ·055	+ ·171	33	− ·076	− ·070	+ ·146	45	+ ·127	− ·200	+ ·073
10	− ·046	− ·045	+ ·091	22	+ ·110	− ·142	+ ·032	34	− ·055	− ·148	+ ·203	46	− ·049	− ·092	+ ·141
11	− ·054	− ·035	+ ·089	23	− ·086	− ·059	+ ·145	35	+ ·076	− ·198	+ ·122	47	+ ·005	− ·210	+ ·205
12	+ ·081	− ·116	+ ·035	24	+ ·086	− ·144	+ ·058	36	+ ·071	− ·139	+ ·068	48	− ·099	− ·059	+ ·158

The Eastern Sind Meridional Series.

The Angular Errors.

No. of Triangle	x	y	z	No. of Triangle	x	y	z	No. of Triangle	x	y	z	No. of Triangle	x	y	z
	"	"	"		"	"	"		"	"	"		"	"	"
1	−0·090	−0·880	+0·970	11	+0·045	−0·450	+0·405	21	−0·054	−0·005	+0·059	31	−0·069	+0·272	−0·203
2	− ·112	− ·484	+ ·596	12	− ·025	− ·303	+ ·328	22	− ·031	− ·010	+ ·041	32	+ ·022	+ ·185	− ·207
3	+ ·077	− ·637	+ ·560	13	− ·198	− ·231	+ ·429	23	− ·044	+ ·052	− ·008	33	− ·239	+ ·423	− ·184
4	+ ·230	− ·876	+ ·646	14	+ ·171	− ·345	+ ·174	24	− ·047	+ ·082	− ·035	34	− ·289	+ ·459	− ·170
5	− ·062	− ·450	+ ·512	15	+ ·004	− ·303	+ ·299	25	− ·033	+ ·123	− ·090	35	+ ·173	+ ·408	− ·581
6	− ·079	− ·564	+ ·643	16	− ·032	− ·168	+ ·200	26	+ ·010	+ ·104	− ·114	36	− ·212	+ ·443	− ·231
7	− ·223	− ·314	+ ·537	17	− ·181	− ·113	+ ·294	27	− ·030	+ ·173	− ·143	37	+ ·092	+ ·310	− ·402
8	+ ·144	− ·482	+ ·338	18	− ·005	− ·086	+ ·091	28	− ·034	+ ·154	− ·120	38	− ·170	+ ·788	− ·618
9	− ·130	− ·484	+ ·614	19	− ·012	− ·104	+ ·116	29	+ ·033	+ ·173	− ·206	39	+ ·466	+ ·354	− ·820
10	+ .034	− ·424	+ ·390	20	− ·011	− ·117	+ ·128	30	− ·168	+ ·324	− ·156				

16.

Arbitrary Corrections.

The values of the angular errors were first obtained to 4 places of decimals and then reduced to 3 places by rejecting the 4th and increasing the 3rd place if the 4th was not less than 5. This introduced certain closing errors in the Eastern Sind Meridional Series only, to eliminate which small arbitrary corrections had to be made: these are shewn in the following table:—

The Eastern Sind Meridional Series			
y		z	
No. of Triangle	Correction	No. of Triangle	Correction
	"		"
37	−0·001	9	+0·001
...	...	25	·001
...	...	31	·001
...	...	34	·001

17.

The Final Results of the Simultaneous Reduction of each Series.

The errors recorded in Section 15 were severally applied with changed signs to the values of the figurally corrected angles which are given in Section 8, and corresponding corrections were obtained to the logarithmic lengths of the sides of the circuit triangles in that section. The corrections to the sides and angles were then introduced into the several geodetic calculations from which the values of latitude, longitude and azimuth for the stations on the line of the traverse had been obtained, as given in Section 9.

After all the corrections had been applied the residual differences were as follows :—

The Jodhpore Meridional Series.

At Kanda.

		″
Latitude North	+	0·001
Longitude East of Greenwich	+	·001
Azimuth of Kaimsir	+	·001
Distance in the 7th place of logs. ...	+	·3

The Eastern Sind Meridional Series.

At Dáowála.

		″
Latitude North	+	0·002
Longitude East of Greenwich	−	·002
Azimuth of Máchka	−	·003
Distance in the 7th place of logs. ...	−	·2

CHAPTER IV.

THE NON-CIRCUIT TRIANGLES AND THEIR FINAL FIGURAL ADJUSTMENTS.

Only a single chain of triangles having been selected for the Final Reduction of the Jodhpore and Eastern Sind Meridional Series, it followed that when each reduction was completed, the remaining or *Non*-circuit triangles had to be brought into accord with the reduced or Circuit triangles, all the elements of the latter being maintained unaltered. The only conditions thus required to be satisfied were the following:—

1. That at any station falling within the circuit at which angles had been measured completely round the horizon, the sum of the *Non*-circuit angles + the sum of the Circuit angles should be equal to 360°.
2. That the ratios of sides common both to Circuit and *Non*-circuit triangles, must be the same by the latter as by the former.
3. That the algebraical sum of the corrections to the angles of each *Non*-circuit triangle should = o.

In certain cases it happened that a *Non*-circuit triangle had two sides and the included angle already determined by the Circuit triangles, and the unknown quantities were the errors of the other two angles. Conditions 2 and 3 furnished two equations for determining these two unknown quantities, and the equations were solved as ordinary algebraical simultaneous equations.

In the pages of tabular matter which follow, are given, separately for each Series, the data of the *Non*-circuit triangles similar to those of the Circuit triangles shewn on pages [33] to [36], and in the same terms with them; these are followed by the "Final Figural Adjustments" of the groups. In connection with the sides and angles are shewn first the Figure to which each *Non*-circuit triangle belongs, secondly, the number of the triangle, and thirdly the Figural numbers of the angles employed in the Preliminary Reductions and again made use of here, as shewn on the Plates at the end of the numerical details of each Series. In the column giving the number of the station, the numerals corresponding to those stations of which the positions stand fixed by the Final Reduction are printed in Roman type, the rest in Italic type.

In the abstracts of the final adjustments, each group of triangles is designated by the figure to which it appertains and by the numbers of triangles it includes. The constants furnished by the Final Reduction are given, with a reference to the page from which they are taken; these are followed by the equations of condition which have to be satisfied. Lastly are shewn the *adopted* angular errors. They are so designated because they differ occasionally, but only in the last place of decimals, from those which actually resulted from the calculations; slight arbitrary corrections having been applied in order to make the logarithmic values of common sides agree where the number of places of decimals employed in the calculations had not sufficed to do so.

The Jodhpore Meridional Series. Sides and Angles of the Non-Circuit Triangles.

Number of Figure	Number of Triangle	Figural No. of Angle	Number of Station	Corrected Plane Angle	Spherical Excess	Logarithm of Side-length in Feet	Number of Figure	Number of Triangle	Figural No. of Angle	Number of Station	Corrected Plane Angle	Spherical Excess	Logarithm of Side-length in Feet
				° ′ ″	″						° ′ ″	″	
1	49	2+3	XLI	80 59 54·001	1·368	5·2799380,6	9	63	12	*XXXIII*	40 46 35·977	·176	4·6592209,2
		4	XLIV	30 27 7·283	1·367	4·9901710,8			10	XXXII	94 26 45·334	·177	4·8429244,1
		1	II	68 32 58·716	1·367	5·2541461,0			11	XXXIV	44 46 38·689	·176	4·6920244,3
2	50	18	I	52 40 50·026	1·663	5·1895968,2	10	64	5	XXXV	73 44 28·461	·286	4·8688079,7
		16	III	82 22 27·324	1·663	5·2852253,8			4	XXXVI	49 28 9·347	·285	4·7673799,7
		17	*IV*	44 56 42·650	1·662	5·1381524,5			6	*XXXVIII*	56 47 22·192	·285	4·8090846,2
„	51	15	*IV*	46 5 17·394	1·450	5·0986603,9	„	65	8	*XXXVIII*	62 5 32·652	·297	4·8405821,0
		13	III	71 15 46·349	1·451	5·2174330,0			7	XXXVI	47 20 17·511	·297	4·7607793,5
		14	VI	62 38 56·257	1·450	5·1895968,2			9	*XL*	70 34 9·837	·297	4·8688079,7
3	52	18	VI	47 51 11·303	·952	5·0185048,0	„	66	10	XXXVI	89 43 56·808	·511	5·0649959,4
		16	VIII	72 36 55·187	·953	5·1281303,5			11	*XL*	53 39 2·723	·511	4·9710226,0
		17	*IX*	59 31 53·510	·953	5·0838972,8			12	XXXIX	36 37 0·469	·510	4·8405821,0
„	53	15	*IX*	57 46 11·572	·785	5·0217343,1	„	67	33	*XL*	51 44 39·077	·642	4·9677159,9
		13	VIII	65 7 38·556	·785	5·0521333,3			31	XXXIX	49 1 11·968	·641	4·9506173,0
		14	XI	57 6 9·872	·784	5·0185048,0			32	*XLII*	79 14 8·955	·642	5·0649959,4
4	54	18	XI	53 27 43·865	·359	4·8480958,8	„	68	30	*XLII*	88 44 4·580	·546	5·0712249,1
		16	XIII	48 51 26·240	·358	4·8199665,6			28	XXXIX	39 17 24·751	·546	4·8729051,0
		17	*XIV*	77 40 49·895	·359	4·9330120,5			29	XLIV	51 58 30·669	·546	4·9677159,9
„	55	15	*XIV*	67 5 50·466	·304	4·8593750,5	11	69	5	XLIV	42 38 49·459	·460	4·8360926,4
		13	XIII	49 3 52·442	·303	4·7732412,8			4	XLV	78 6 52·563	·460	4·9957840,1
		14	XVI	63 50 17·092	·304	4·8480958,8			6	*XLVII*	59 14 17·978	·460	4·9393418,5
5	56	18	XVI	55 56 1·754	·239	4·7539904,9	„	70	8	*XLVII*	74 27 35·792	·408	4·9501573,9
		16	XVIII	62 50 44·783	·239	4·7850382,9			7	XLV	57 43 53·931	·407	4·8934740,2
		17	*XIX*	61 13 13·463	·239	4·7784961,4			9	XLIX	47 48 30·277	·407	4·8360926,4
„	57	15	*XIX*	63 2 44·220	·249	4·7955835,6	12	71	5	XLIX	52 24 57·952	·197	4·7306728,7
		13	XVIII	62 51 44·309	·249	4·7948741,8			4	L	43 28 52·703	·197	4·6693578,0
		14	XXI	54 5 31·471	·248	4·7539904,9			6	*LII*	84 6 9·345	·197	4·8293903,2
6	58	4+5	XXI	98 55 57·389	·221	4·9096312,4	„	72	8	*LII*	47 18 16·005	·224	4·7259946,0
		3	XXII	37 25 48·809	·220	4·6986876,8			7	L	84 42 51·057	·225	4·8578758,0
		6	XXIII	43 38 13·802	·221	4·7538358,6			9	LIV	47 58 52·938	·225	4·7306728,7
7	59	4	XXIII	38 24 15·519	·211	4·7751914,5	13	73	18	LIII	60 42 25·770	·110	4·6539847,5
		2+3	XXIV	111 25 2·878	·211	4·9508791,0			16	LV	37 21 10·052	·110	4·4963923,8
		1	XXVI	30 10 41·603	·211	4·6832567,7			17	*LVI*	81 56 24·178	·111	4·7090919,8
8	60	18	XXV	59 47 10·382	·276	4·8061403,7	„	74	15	*LVI*	62 9 23·151	·145	4·6732240,2
		16	XXVII	66 37 26·660	·276	4·8323548,0			13	LV	60 4 26·534	·145	4·6645148,8
		17	*XXVIII*	53 35 22·958	·276	4·7752303,5			14	*LVIII*	57 46 10·315	·145	4·6539847,5
„	61	15	*XXVIII*	73 37 41·976	·311	4·8855658,1	„	75	10	LV	65 47 35·551	·118	4·6600505,3
		13	XXVII	53 19 40·432	·311	4·8077523,1			12	*LVIII*	44 7 41·210	·118	4·5427962,7
		14	XXX	53 2 37·592	·311	4·8061403,7			11	LIX	70 4 43·239	·119	4·6732240,2
9	62	15	XXX	55 50 14·894	·180	4·6920244,3	„	76	20	*LVIII*	61 36 15·090	·167	4·7052511,1
		13	XXXII	61 59 21·795	·180	4·7201758,6			19	LIX	65 57 15·650	·167	4·7215006,6
		14	*XXXIII*	62 10 23·311	·180	4·7209139,3			21	XIX	52 26 29·260	·167	4·6600505,3

NOTES.—Stations XLI and XLIV appertain to the Karáchi Longitudinal Series. Station XIX appertains to the Sutlej Series.

The Jodhpore Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 1.

Triangle 49.

Constants (from page 85).

							Contained Angle.
XLIV to XLI	Log. feet	5·2541461,0	}	...	3+2	...	80° 59′ 55″·529
XLI „ II	„	4·9901706,7					

Equations to be satisfied.

$x_1 + x_4 = + \cdot 160$

$36 x_4 - 9 x_1 = + 4 \cdot 1$

Adopted Errors.

$x_1 = + {}'' \cdot 039$

$x_4 = + \cdot 121$

Figure 2.

Triangles 50 and 51.

Constants (from pages 85 and 86).

							Contained Angle.
I to III	Log. feet	5·1381529,7	}	...	16+13	...	153° 38′ 17″·025
III „ VI	„	5·0986612,2					

Equations to be satisfied. Factor.

						Factor.
x_{16}	$+ x_{17}$	$+ x_{18}$	...	$= e_1$	$= \cdot 000,$	λ_1
x_{13}	$+ x_{14}$	$+ x_{15}$	...	$= e_2$	$= \cdot 000,$	λ_2
x_{16}	$+ x_{13}$	...	...	$= e_3$	$= - \cdot 238,$	λ_3
$16 x_{18}$	$- 21 x_{17}$	$+ 21 x_{15}$	$- 10 x_{14}$	$= e_4$	$= - 3 \cdot 1,$	λ_4

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	− 5	$\lambda_1 = + \cdot 056$	$x_{13} = - {}'' \cdot 111$	$x_{16} = - {}'' \cdot 127$
2	·000		+3	+1	+ 11	$\lambda_2 = + \cdot 072$	$x_{14} = + \cdot 100$	$x_{17} = + \cdot 117$
3	− ·238			+2	...	$\lambda_3 = - \cdot 183$	$x_{15} = + \cdot 011$	$x_{18} = + \cdot 010$
4	−3·1		*		+1238	$\lambda_4 = - \cdot 003$		

Figure 3.

Triangles 52 and 53.

Constants (from page 86).

							Contained Angle.
VI to VIII	Log. feet	5·0838982,0	}	...	16+13	...	137° 44′ 35″·660
VIII „ XI	„	5·0217355,9					

Equations to be satisfied.

						Factor.
x_{16}	$+ x_{17}$	$+ x_{18}$	...	$= e_1$	$= \cdot 000,$	λ_1
x_{13}	$+ x_{14}$	$+ x_{15}$	...	$= e_2$	$= \cdot 000,$	λ_2
x_{16}	$+ x_{13}$	...	...	$= e_3$	$= - \cdot 179,$	λ_3
$19 x_{18}$	$- 13 x_{17}$	$+ 13 x_{15}$	$- 13 x_{14}$	$= e_4$	$= - 3 \cdot 6,$	λ_4

* In the tables of the equations between the factors the co-efficients of the terms below the diagonal are omitted for convenience, the co-efficient of the pth term in the qth line being always the same as the co-efficient of the qth term in the pth line.

The Jodhpore Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 3—(Continued).

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 6	λ_1 = + ·056	x_{13} = −″·094	x_{16} = −″·085
2	·000		+3	+1	0	λ_2 = + ·047	x_{14} = + ·107	x_{17} = + ·115
3	− ·179			+2	...	λ_3 = − ·141	x_{15} = − ·013	x_{18} = − ·030
4	−3·6		*		+868	λ_4 = − ·005		

Figure 4.

Triangles 54 and 55.

Constants (from pages 86 and 87).

						Contained Angle.
XI	to	XIII	Log. feet	4·9330134,9	... 16+13 ...	97° 55′ 19″·565
XIII	„	XVI	„	4·8593774,0		

Equations to be satisfied. Factor.

x_{16}	+ x_{17}	+ x_{18}	...	= e_1	=	·000,	λ_1
x_{13}	+ x_{14}	+ x_{15}	...	= e_2	=	·000,	λ_2
x_{16}	+ x_{13}	...	...	= e_3	=	− ·222,	λ_3
$16\,x_{18}$	− $5\,x_{17}$	+ $8\,x_{15}$	$-11\,x_{14}$	= e_4	=	−9·1,	λ_4

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 11	λ_1 = + ·155	x_{13} = −″·165	x_{16} = −″·057
2	·000		+3	+1	− 3	λ_2 = + ·048	x_{14} = + ·301	x_{17} = + ·270
3	− ·222			+2	...	λ_3 = − ·213	x_{15} = − ·136	x_{18} = − ·213
4	−9·1		*		+466	λ_4 = − ·023		

Figure 5.

Triangles 56 and 57.

Constants (from page 87).

						Contained Angle.
XVI	to	XVIII	Log. feet	4·7784986,6	... 16+13 ...	125° 42′ 29″·745
XVIII	„	XXI	„	4·7955865,4		

Equations to be satisfied. Factor.

x_{16}	+ x_{17}	+ x_{18}	...	= e_1	=	·000,	λ_1
x_{13}	+ x_{14}	+ x_{15}	...	= e_2	=	·000,	λ_2
x_{16}	+ x_{13}	...	...	= e_3	=	− ·165,	λ_3
$14\,x_{18}$	$-11\,x_{17}$	$+10\,x_{15}$	$-16\,x_{14}$	= e_4	=	−4·6,	λ_4

The Jodhpore Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 5—(Continued).

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 3	λ_1 = + ·046	x_{13} = −″·093	x_{16} = −″·072
2	·000		+3	+1	− 6	λ_2 = + ·026	x_{14} = + ·137	x_{17} = + ·122
3	− ·165			+2	...	λ_3 = − ·119	x_{15} = − ·044	x_{18} = − ·050
4	−4·6		*		+673	λ_4 = − ·007		

Figure 6.

Triangle 58.

Constants (from page 87).

Contained Angle.

XXII	to	XXI	Log. feet	4·7538389,3	...	4+5	...	98° 55′ 57″·623
XXI	„	XXIII	„	4·6986909,8				

Equations to be satisfied.

$x_3 + x_6 = + ·013$

$27\,x_3 - 22\,x_6 = -2·3$

Adopted Errors.

x_3 = −″·041

x_6 = + ·054

Figure 7.

Triangle 59.

Constants (from page 88).

Contained Angle.

XXIII	to	XXIV	Log. feet	4·6832601,5	...	3+2	...	111° 25′ 3″·347
XXIV	„	XXVI	„	4·7751950,4				

Equations to be satisfied.

$x_1 + x_4 = + ·258$

$26\,x_4 - 36\,x_1 = -2·1$

Adopted Errors.

x_1 = +″·141

x_4 = + ·117

Figure 8.

Triangles 60 and 61.

Constants (from page 88).

Contained Angle.

XXV	to	XXVII	Log. feet	4·7752348,0	...	16+13	...	119° 57′ 7″·841
XXVII	„	XXX	„	4·8855711,7				

Equations to be satisfied.

						Factor.
x_{16}	$+ x_{17}$	$+ x_{18}$	...	$= e_1$	= ·000,	λ_1
x_{13}	$+ x_{14}$	$+ x_{15}$	...	$= e_2$	= ·000,	λ_2
x_{16}	$+ x_{13}$	...	...	$= e_3$	= − ·162,	λ_3
$12\,x_{18}$	$-15\,x_{17}$	$+ 6\,x_{15}$	$-16\,x_{14}$	$= e_4$	= −9·1,	λ_4

The Jodhpore Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 8—(Continued).

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	− 3	λ_1 = + ·011	x_{13} = −″·097	x_{16} = −″·065
2	·000		+3	+1	− 10	λ_2 = − ·021	x_{14} = + ·203	x_{17} = + ·221
3	− ·162			+2	...	λ_3 = − ·076	x_{15} = − ·106	x_{18} = − ·156
4	−9·1		*		+661	λ_4 = − ·014		

Figure 9.

Triangles 62 and 63.

Constants (from pages 88 and 89).

						Contained Angle.
XXX	to	XXXII	Log. feet	4·7209196,2	... 13+10 ...	156° 26′ 7″·636
XXXII	„	XXXIV	„	4·6592271,6		

Equations to be satisfied.

							Factor.
x_{13}	$+ x_{14}$	$+ x_{15}$	...	$= e_1$	=	·000,	λ_1
x_{10}	$+ x_{11}$	$+ x_{12}$	...	$= e_2$	=	·000,	λ_2
x_{18}	$+ x_{10}$	...	...	$= e_3$	=	− ·150,	λ_3
$15 x_{15}$	$-11 x_{14}$	$+24 x_{12}$	$-21 x_{11}$	$= e_4$	=	−5·5,	λ_4

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 4	λ_1 = + ·046	x_{10} = −″·076	x_{13} = −″·074
2	·000		+3	+1	+ 3	λ_2 = + ·044	x_{11} = + ·132	x_{14} = + ·093
3	− ·150			+2	...	λ_3 = − ·120	x_{12} = − ·056	x_{15} = − ·019
4	−5·5		*		+1363	λ_4 = − ·004		

Figure 10.

Triangles 64 to 68.

Constants (from page 89).

						Contained Angles.
XXXV	to	XXXVI	Log. feet	4·8090908,1	... 4+7 +10 ...	186° 32′ 24″·637
XXXVI	„	XXXIX	„	4·9710293,6		
XXXIX	„	XLIV	„	5·0712328,4	... 12+31+28 ...	124 55 38 ·667

Equations to be satisfied.

									Factor.
x_4	$+ x_5$	$+ x_6$	...	...	...	$= e_1$	=	·000,	λ_1
x_7	$+ x_8$	$+ x_9$	...	...	...	$= e_2$	=	·000,	λ_2
x_{10}	$+ x_{11}$	$+ x_{12}$	...	...	...	$= e_3$	=	·000,	λ_3
x_{31}	$+ x_{32}$	$+ x_{33}$	...	...	...	$= e_4$	=	·000,	λ_4
x_{28}	$+ x_{29}$	$+ x_{30}$	...	...	...	$= e_5$	=	·000,	λ_5
x_4	$+ x_7$	$+ x_{10}$	...	...	...	$= e_6$	=	+ ·122,	λ_6
x_{12}	$+ x_{31}$	$+ x_{28}$	...	...	...	$= e_7$	=	+ ·218,	λ_7
$7 x_5$	$-14 x_6$	$+11 x_8$	$-7 x_9$	$+16 x_{11}$	$-29 x_{12}$	$= e_8$	=	− 5·7,	λ_8
$0 x_{10}$	$-16 x_{11}$	$+17 x_{33}$	$-4 x_{32}$	$+ x_{30}$	$-17 x_{29}$	$= e_9$	=	−11·7,	λ_9

The Jodhpore Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 10—(Continued).

Equations between the Factors											Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of											
		λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8	λ_9			
1	·000	+3	...	...	...	...	+1	...	− 7	...	λ_1 = − ·0770	x_4 = +″·095	x_{12} = +″·091
2	·000		+3	...	...	...	+1	...	+ 4	...	λ_2 = − ·0458	x_5 = − ·137	x_{28} = − ·061
3	·000			+3	...	...	+1	+1	− 13	− 16	λ_3 = − ·2697	x_6 = + ·042	x_{29} = + ·263
4	·000				+3	...	...	+1	...	+ 13	λ_4 = + ·0737	x_7 = + ·125	x_{30} = − ·202
5	·000					+3	...	+1	...	− 16	λ_5 = − ·1757	x_8 = − ·139	x_{31} = + ·188
6	+ ·122						+3	...	...	0	λ_6 = + ·1715	x_9 = + ·014	x_{32} = + ·177
7	+ ·218				*			+3	− 29	...	λ_7 = + ·1144	x_{10} = − ·098	x_{33} = − ·365
8	− 5·7								+1512	−256	λ_8 = − ·0085	x_{11} = + ·007	
9	−11·7									+851	λ_9 = − ·0258		

Figure 11.

Triangles 69 and 70.

Constants (from page 90).

									Contained Angle.
XLIV	to	XLV	Log. feet	4·9393501,4	}	...	4+7	...	135° 50′ 47″·167
XLV	„	XLIX	„	4·9501666,8	}				

Equations to be satisfied. Factor.

x_4	+ x_5	+ x_6	...	=	e_1	=	·000,	λ_1
x_7	+ x_8	+ x_9	...	=	e_2	=	·000,	λ_2
x_4	+ x_7	...	...	=	e_3	=	+ ·194,	λ_3
$23\,x_5$	$-13\,x_6$	$+\ 6\,x_8$	$-19\,x_9$	=	e_4	=	−10·0,	λ_4

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 10	λ_1 = − ·017	x_4 = +″·136	x_7 = +″·058
2	·000		+3	+1	− 13	λ_2 = − ·095	x_5 = − ·250	x_8 = − ·155
3	+ ·194			+2	...	λ_3 = + ·153	x_6 = + ·114	x_9 = + ·097
4	−10·0		*		+1095	λ_4 = − ·010		

Figure 12.

Triangles 71 and 72.

Constants (from page 90).

									Contained Angle.
XLIX	to	L	Log. feet	4·8293997,4	}	...	4+7	...	128° 11′ 43″·953
L	„	LIV	„	4·7260047,2	}				

Equations to be satisfied. Factor.

x_4	+ x_5	+ x_6	...	=	e_1	=	·000,	λ_1
x_7	+ x_8	+ x_9	...	=	e_2	=	·000,	λ_2
x_4	+ x_7	...	...	=	e_3	=	+ ·229,	λ_3
$16\,x_5$	$-\ 2\,x_6$	$+19\,x_8$	$-19\,x_9$	=	e_4	=	−7·0,	λ_4

The Jodhpore Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 12—(Continued).

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 14	$\lambda_1 = -$ ·017	$x_4 = +''$·131	$x_7 = +''$·098
2	·000		+3	+1	0	$\lambda_2 = -$ ·049	$x_5 = -$ ·128	$x_8 = -$ ·180
3	+ ·229			+2	...	$\lambda_3 = +$ ·148	$x_6 = -$ ·003	$x_9 = +$ ·082
4	− 7·0		*		+982	$\lambda_4 = -$ ·007		

Figure 13.

Triangles 73 to 76.

Constants (from page 91).

							Contained Angles.	
LIII	to	LV	Log. feet	4·7091025,0	} ...	16+13+10	...	163° 13′ 12″·663
LV	„	LIX	„	4·5428074,2				
LIX	„	XIX	„	4·7052635,0	} ...	11+19	...	136 1 59 ·262

Equations to be satisfied. Factor.

x_{16}	$+ x_{17}$	$+ x_{18}$	...	...	...	$= e_1 =$	·000,	λ_1
x_{13}	$+ x_{14}$	$+ x_{15}$	...	...	...	$= e_2 =$	·000,	λ_2
x_{10}	$+ x_{11}$	$+ x_{12}$	...	...	...	$= e_3 =$	·000,	λ_3
x_{19}	$+ x_{20}$	$+ x_{21}$	...	...	...	$= e_4 =$	·000,	λ_4
x_{16}	$+ x_{13}$	$+ x_{10}$	...	...	...	$= e_5 =$	− ·153,	λ_5
x_{11}	$+ x_{19}$	...	...	...	...	$= e_6 =$	− ·087,	λ_6
$12 x_{18}$	$- 3 x_{17}$	$+ 12 x_{15}$	$- 13 x_{14}$	$+ 21 x_{12}$	$- 8 x_{11}$	$= e_7 =$	− 6·3,	λ_7
$9 x_{10}$	$- 21 x_{12}$	$+ 11 x_{20}$	$- 16 x_{21}$	...	...	$= e_8 =$	−12·4,	λ_8

Equations between the Factors										Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of										
		λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8			
1	·000	+3	...	...	...	+1	...	+ 9	...	$\lambda_1 = +$ ·0658		
2	·000		+3	...	...	+1	...	− 1	...	$\lambda_2 = +$ ·0021	$x_{10} = -''$·170	$x_{16} = +''$·040
3	·000			+3	...	+1	+1	+ 13	− 12	$\lambda_3 = +$ ·0543	$x_{11} = +$ ·053	$x_{17} = +$ ·123
4	·000				+3	...	+1	...	− 5	$\lambda_4 = +$ ·0146	$x_{12} = +$ ·117	$x_{18} = -$ ·163
5	− ·153					+3	...	...	+ 9	$\lambda_5 = -$ ·0255	$x_{13} = -$ .023	$x_{19} = -$ ·140
6	− ·087						+2	− 8	...	$\lambda_6 = -$ ·1544	$x_{14} = +$ ·250	$x_{20} = -$ ·230
7	− 6·3				*			+971	−441	$\lambda_7 = -$ ·0191	$x_{15} = -$ ·227	$x_{21} = +$ ·370
8	−12·4								+899	$\lambda_8 = -$ ·0221		

The Eastern Sind Meridional Series. Sides and Angles of the Non-Circuit Triangles.

Number of Figure	Number of Triangle	Figural No. of Angle	Number of Station	Corrected Plane Angle	Spherical Excess	Logarithm of Side-length in Feet	Number of Figure	Number of Triangle	Figural No. of Angle	Number of Station	Corrected Plane Angle	Spherical Excess	Logarithm of Side-length in Feet
				° ′ ″	″						° ′ ″	″	
		18	LXXV	46 47 48·398	·340	4·8242053,0			27	XXV	70 10 32·086	·353	4·8990234,6
1	40	16	LXXVIII	44 57 21·029	·340	4·8106694,6	7	54	25	XXVIII	53 38 48·331	·352	4·8315552,2
		17	I	88 14 50·573	·340	4·9613162,0			26	XXVII	56 10 39·583	·352	4·8450351,1
		15	I	39 13 53·781	·254	4·6899733,5			24	XXVII	51 10 5·477	·411	4·8506760,9
"	41	13	LXXVIII	81 16 52·656	·255	4·8838948,2	"	55	22	XXVIII	68 17 21·288	·412	4·9271895,1
		14	II	59 29 13·563	·255	4·8242053,0			23	XXX	60 32 33·235	·412	4·8990234,6
		12	II	84 46 38·214	·283	4·9273813,9			5	XXXI	43 6 11·886	·385	4·8140819,1
"	42	10	LXXVIII	60 1 9·420	·283	4·8668031,5	8	56	4	XXXIII	84 38 57·694	·386	4·9775640,0
		11	III	35 12 12·366	·283	4·6899733,5			6	XXXIV	52 14 50·420	·386	4·8774508,3
		9	III	73 40 56·177	·364	4·9426942,1			7	XXXIII	74 10 15·058	·319	4·8933367,3
"	43	7	LXXVIII	38 25 36·389	·363	4·7540012,5	"	57	8	XXXIV	52 32 46·562	·319	4·8098613,0
		8	IV	67 53 27·434	·363	4·9273813,9			9	XXXVI	53 16 58·380	·319	4·8140819,1
		18	IV	49 24 6·365	·421	4·8468089,0			17	XXXIV	38 54 0·180	·246	4·6919156,8
2	44	16	VII	61 59 19·285	·422	4·9122897,5	"	58	16	XXXVI	54 13 13·580	·246	4·8031478,4
		17	VI	68 36 34·350	·422	4·9354045,2			18	XXXVII	86 52 46·240	·246	4·8933367,3
		15	VI	76 1 33·768	·345	4·9183059,1			20	XXXVII	59 51 59·497	·217	4·7662764,0
"	45	13	VII	48 34 36·918	·344	4·8063238,8	"	59	19	XXXVI	73 21 3·488	·217	4·8107321,9
		14	IX	55 23 49·314	·344	4·8468089,0			21	XXXVIII	46 46 57·015	·217	4·6919156,8
		4+5	IX	92 47 51·277	·437	5·0337260,3			18	XXXV	43 45 36·413	·333	4·7729996,7
3	46	3	X	41 12 39·846	·437	4·8530204,9	9	60	16	XL	77 53 9·778	·334	4·9233391,1
		6	XI	45 59 28·877	·437	4·8911147,1			17	XXXIX	58 21 13·809	·334	4·8632041,5
		18	XI	46 38 46·613	·424	4·8332488,9			15	XXXIX	46 27 37·215	·208	4·6787084,5
4	47	16	XIV	66 48 52·687	·425	4·9350641,8	"	61	13	XL	69 17 33·934	·209	4·7894287,7
		17	XIII	66 32 20·700	·424	4·9341636,6			14	XLI	64 14 48·851	·209	4·7729996,7
		15	XIII	61 11 26·145	·315	4·8368912,5			12	XLI	77 3 55·831	·130	4·7210396,2
"	48	13	XIV	58 28 38·020	·314	4·8249342,2	"	62	10	XL	40 47 31·488	·129	4·5473245,7
		14	XVI	60 19 55·835	·314	4·8332488,9			11	XLII	62 8 32·681	·129	4·6787084,5
		18	XVI	45 31 59·807	·303	4·7561267,6			4+5	XLII	78 28 3·711	·205	4·8203503,4
5	49	16	XIX	62 23 3·198	·303	4·8501078,9	10	63	3	XLIII	43 10 50·242	·205	4·6644544,2
		17	XVIII	72 4 56·995	·303	4·8810459,7			6	XLIV	58 21 6·047	·205	4·7592824,2
		15	XVIII	54 43 25·502	·251	4·7675390,0			5	XLV	50 45 52·915	·080	4·4917850,0
"	50	13	XIX	72 36 6·239	·252	4·8353101,2	11	64	4	XLVI	66 44 50·783	·080	4·5659412,4
		14	XXI	52 40 28·259	·251	4·7561267,6			6	XLVII	62 29 16·302	·080	4·5506137,7
		4+5	XXI	99 24 20·066	·284	4·9651280,5			8	XLVII	55 49 49·308	·090	4·5709725,8
6	51	3	XXII	42 21 27·814	·284	4·7995097,3	"	65	7	XLVI	80 34 52·762	·090	4·6473738,5
		6	XXIII	38 14 12·120	·283	4·7626348,0			9	XLIX	43 35 17·930	·090	4·4917850,0
		15	XXIII	59 41 54·086	·308	4·8353369,2			15	XLVIII	63 42 36·363	·087	4·5686641,5
7	52	13	XXVI	70 28 51·543	·308	4·8734298,9	12	66	13	LI	59 11 39·448	·087	4·5500296,7
		14	XXV	49 49 14·371	·308	4·7822440,8			14	L	57 5 44·189	·087	4·5401437,5
		10	XXVI	66 17 28·775	·290	4·8450351,1			12	L	71 50 14·245	·135	4·7085175,8
"	53	12	XXV	50 9 4·037	·290	4·7685410,8	"	67	10	LI	64 38 43·508	·135	4·6867262,2
		11	XXVIII	63 33 27·188	·290	4·8353369,2			11	LIX	43 31 2·247	·135	4·5686641,5

NOTES.—Stations LXXV and LXXVIII appertain to the Karáchi Longitudinal Series. Station LIX appertains to the Great Indus Series.

The Eastern Sind Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 1.

Triangles 40 to 43.

Constants (from page 196).

						Contained Angle.
LXXV to LXXVIII	Log. feet	4·9613162,0 }	...	16+13+10+7	...	= 224° 41′ 0″·162
LXXVIII „ IV	„	4·9426977,8 }				

Equations to be satisfied.

										Factor.
x_{16}	$+ x_{17}$	$+ x_{18}$	...	...	...	...	...	$= e_1 =$	·000,	λ_1
x_{13}	$+ x_{14}$	$+ x_{15}$	...	...	...	...	...	$= e_2 =$	·000,	λ_2
x_{10}	$+ x_{11}$	$+ x_{12}$	...	...	...	...	...	$= e_3 =$	·000,	λ_3
x_7	$+ x_8$	$+ x_9$	...	...	...	...	...	$= e_4 =$	·000,	λ_4
x_{16}	$+ x_{13}$	$+ x_{10}$	$+ x_7$	...	...	...	...	$= e_5 =$	+ ·573,	λ_5
$20 x_{18}$	$-0 x_{17}$	$+26 x_{15}$	$-12 x_{14}$	$+2 x_{12}$	$-30 x_{11}$	$+6 x_9$	$-9 x_8$	$= e_6 =$	−35·7,	λ_6

Equations between the Factors								Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of								
		λ_1	λ_2	λ_3	λ_4	λ_5	λ_6			
1	·000	+3	...	...	...	+1	+ 20	$\lambda_1 = +$ ·0642	$x_7 = +$″·118	$x_{13} = +$″·232
2	·000		+3	...	...	+1	+ 14	$\lambda_2 = +$ ·0242	$x_8 = +$ ·091	$x_{14} = +$ ·265
3	·000			+3	...	+1	− 28	$\lambda_3 = -$ ·2558	$x_9 = -$ ·209	$x_{15} = -$ ·497
4	·000				+3	+1	− 3	$\lambda_4 = -$ ·0891	$x_{10} = -$ ·049	$x_{16} = +$ ·272
5	+ ·573		*			+4	...	$\lambda_5 = +$ ·2074	$x_{11} = +$ ·345	$x_{17} = +$ ·064
6	−35·7						+2241	$\lambda_6 = -$ ·0200	$x_{12} = -$ ·296	$x_{18} = -$ ·336

Figure 2.

Triangles 44 and 45.

Constants (from page 197).

						Contained Angle.
IV to VII	Log. feet	4·9354085,1 }	...	16+13	...	= 110° 33′ 57″·133
VII „ IX	„	4·9183152,4 }				

Equations to be satisfied.

						Factor.
x_{16}	$+ x_{17}$	$+ x_{18}$	...	$= e_1 =$	·000,	λ_1
x_{13}	$+ x_{14}$	$+ x_{15}$	...	$= e_2 =$	·000,	λ_2
x_{16}	$+ x_{13}$	...	...	$= e_3 =$	− ·164,	λ_3
$18 x_{18}$	$-8 x_{17}$	$+5 x_{15}$	$-15 x_{14}$	$= e_4 =$	−53·4,	λ_4

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 10	$\lambda_1 = +$ ·3527	$x_{13} = -$″·394	$x_{16} = +$″·230
2	·000		+3	+1	− 10	$\lambda_2 = -$ ·2707	$x_{14} = +1$ ·132	$x_{17} = +1$ ·101
3	− ·164		*	+2	...	$\lambda_3 = -$ ·1230	$x_{15} = -$ ·738	$x_{18} = -1$ ·331
4	−53·4				+638	$\lambda_4 = -$ ·0935		

The Eastern Sind Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 3.

Triangle 46.

Constants (from page 197). Contained Angle.

X to IX	Log. feet	4·8911247,0	} ...	4+5	... = 92° 47′ 52″·419
IX „ XI	„	4·8530312,6			

Equations to be satisfied. Adopted Errors.

x_3	$+\ x_6$	$= e_1 = +\ ·705$		$x_3 = +\ ''·143$	
$24\,x_3$	$-20\,x_6$	$= e_2 = -7·8$		$x_6 = +\ ·562$	

Figure 4.

Triangles 47 and 48.

Constants (from page 198). Contained Angle.

XI to XIV	Log. feet	4·9341767,2	} ...	16+13	... = 125° 17′ 31″·836
XIV „ XVI	„	4·8369072,0			

Equations to be satisfied.

					Factor.
x_{16}	$+\ x_{17}$	$+\ x_{18}$	...	$= e_1 =\ ·000,$	λ_1
x_{13}	$+\ x_{14}$	$+\ x_{15}$	...	$= e_2 =\ ·000,$	λ_2
x_{16}	$+\ x_{13}$	...	...	$= e_3 = -\ ·390,$	λ_3
$20\,x_{18}$	$-10\,x_{17}$	$+11\,x_{15}$	$-12\,x_{14}$	$= e_4 = -28·9,$	λ_4

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+10	$\lambda_1 = +\ ·2650$	$x_{13} = -''·270$	$x_{16} = -''·120$
2	·000		+3	+1	−1	$\lambda_2 = +\ ·1146$	$x_{14} = +\ ·608$	$x_{17} = +\ ·676$
3	− ·390			+2	...	$\lambda_3 = -\ ·3850$	$x_{15} = -\ ·338$	$x_{18} = -\ ·556$
4	−28·9		*		+765	$\lambda_4 = -\ ·0411$		

Figure 5.

Triangles 49 and 50.

Constants (from page 198). Contained Angle.

XVI to XIX	Log. feet	4·8810634,6	} ...	16+13	... = 134° 59′ 10″·428
XIX „ XXI	„	4·7675582,6			

Equations to be satisfied.

					Factor.
x_{16}	$+\ x_{17}$	$+\ x_{18}$	...	$= e_1 =\ ·000,$	λ_1
x_{13}	$+\ x_{14}$	$+\ x_{15}$	...	$= e_2 =\ ·000,$	λ_2
x_{16}	$+\ x_{13}$	...	...	$= e_3 = -\ ·436,$	λ_3
$21\,x_{18}$	$-7\,x_{17}$	$+15\,x_{15}$	$-16\,x_{14}$	$= e_4 = -17·7,$	λ_4

The Eastern Sind Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 5—(Continued).

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 14	λ_1 = + ·2321	x_{13} = −″·271	x_{16} = −″·165
2	·000		+3	+1	− 1	λ_2 = + ·1251	x_{14} = + ·467	x_{17} = + ·382
3	− ·436			+2	...	λ_3 = − ·3966	x_{15} = − ·196	x_{18} = − ·217
4	−17·7		*		+971	λ_4 = − ·0214		

Figure 6.

Triangle 51.

Constants (from page 199).

					Contained Angle.
XXII to XXI	Log. feet	4·7626542,1	} ...	4+5 ...	= 99° 24′ 20″·617
XXI „ XXIII	„	4·7995299,5			

Equations to be satisfied.

$x_3 + x_6 = e_1 = +\ ·267$

$24\,x_3 - 27\,x_6 = e_2 = -\ 8·1$

Adopted Errors.

$x_3 = -\ ·018$

$x_6 = +\ ·285$

Figure 7.

Triangles 52 to 55.

Constants (from page 199).

					Contained Angles.
XXIII to XXVI	Log. feet	4·7822645,1	} ...	13+10 ...	= 136° 46′ 21″·015
XXVI „ XXVIII	„	4·7685622,2			
XXVIII „ XXX	„	4·8506972,9	} ...	11+25+22 ...	= 185 29 37 ·941

Equations to be satisfied.

								Factor.
x_{13}	$+ x_{14}$	$+ x_{15}$	...	...	...	$= e_1 =$	·000,	λ_1
x_{10}	$+ x_{11}$	$+ x_{12}$	...	...	...	$= e_2 =$	·000,	λ_2
x_{25}	$+ x_{26}$	$+ x_{27}$	...	...	...	$= e_3 =$	·000,	λ_3
x_{22}	$+ x_{23}$	$+ x_{24}$	...	...	...	$= e_4 =$	·000,	λ_4
x_{13}	$+ x_{10}$	...	...	...	...	$= e_5 =$	− ·099,	λ_5
x_{11}	$+ x_{25}$	$+ x_{22}$	...	...	...	$= e_6 =$	− ·080,	λ_6
$13\,x_{15}$	$-18\,x_{14}$	$+18\,x_{12}$	$-11\,x_{11}$	...	...	$= e_7 =$	−7·1,	λ_7
$9\,x_{10}$	$-18\,x_{12}$	$+8\,x_{27}$	$-14\,x_{26}$	$+17\,x_{24}$	$-12\,x_{23}$	$= e_8 =$	− ·6,	λ_8

Equations between the Factors										Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8			
1	·000	+3	...	...	...	+1	...	− 5	...	λ_1 = + ·0130		
2	·000		+3	...	...	+1	+1	+ 7	− 9	λ_2 = + ·0880	x_{10} = −″·021	x_{22} = −″·077
3	·000			+3	...	...	+1	...	− 6	λ_3 = + ·0359	x_{11} = + ·081	x_{23} = + ·069
4	·000				+3	...	+1	...	+ 5	λ_4 = + ·0436	x_{12} = − ·060	x_{24} = + ·008
5	− ·099					+2	...	...	+ 9	λ_5 = − ·0906	x_{13} = − ·078	x_{25} = − ·084
6	− ·080				*		+3	− 11	...	λ_6 = − ·1203	x_{14} = + ·198	x_{26} = + ·065
7	−7·1							+938	− 324	λ_7 = − ·0103	x_{15} = − ·120	x_{27} = + ·019
8	− ·6								+1098	λ_8 = − ·0021		

The Eastern Sind Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 8.

Triangles 56 to 59.

Constants (from page 200).

								Contained Angles.
XXXI	to	XXXIII	Log. feet	4·8774718,9	}	... 4+7	...	= 158° 49′ 13″·493
XXXIII	„	XXXVI	„	4·8098816,6	}			
XXXVI	„	XXXVIII	„	4·7662962,0	}	... 9+16+19	...	= 180 51 16 ·240

Equations to be satisfied.

										Factor.
x_4	$+ x_5$	$+ x_6$	...	...	...	=	e_1	=	·000,	λ_1
x_7	$+ x_8$	$+ x_9$	...	...	...	=	e_2	=	·000,	λ_2
x_{16}	$+ x_{17}$	$+ x_{18}$	...	...	...	=	e_3	=	·000,	λ_3
x_{19}	$+ x_{20}$	$+ x_{21}$	...	...	...	=	e_4	=	·000,	λ_4
x_4	$+ x_7$	...	...	...	...	=	e_5	=	− ·036,	λ_5
x_9	$+ x_{16}$	$+ x_{19}$	...	...	...	=	e_6	=	− ·010,	λ_6
$22 x_5$	$-16 x_6$	$+16 x_8$	$-16 x_9$	...	...	=	e_7	=	+7·0,	λ_7
$6 x_7$	$-16 x_8$	$+26 x_{17}$	$- x_{18}$	$+13 x_{20}$	$-20 x_{21}$	=	e_8	=	+5·6,	λ_8

Equations between the Factors										Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of										
		λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8			
1	·000	+3	...	...	...	+1	...	+ 6	...	λ_1 = + ·0002		
2	·000		+3	...	...	+1	+1	0	− 10	λ_2 = + ·0179	x_4 = −″·046	x_{16} = −″·016
3	·000			+3	...	...	+1	...	+ 25	λ_3 = − ·0722	x_5 = + ·167	x_{17} = + ·093
4	·000				+3	...	+1	...	− 7	λ_4 = − ·0039	x_6 = − ·121	x_{18} = − ·077
5	− ·036					+2	...	...	+ 6	λ_5 = − ·0463	x_7 = + ·010	x_{19} = + ·053
6	− ·010						+3	− 16	...	λ_6 = + ·0566	x_8 = + ·037	x_{20} = + ·079
7	+7·0			*				+1252	− 256	λ_7 = + ·0076	x_9 = − ·047	x_{21} = − ·132
8	+5·6								+1538	λ_8 = + ·0064		

Figure 9.

Triangles 60 to 62.

Constants (from pages 200 and 201).

								Contained Angle.
XXXV	to	XL	Log. feet	4·8632235,3	}	... 16+13+10	...	= 187° 58′ 15″·770
XL	„	XLII	„	4·7210583,2	}			

Equations to be satisfied.

										Factor.
x_{16}	$+ x_{17}$	$+ x_{18}$	...	...	...	=	e_1	=	·000,	λ_1
x_{13}	$+ x_{14}$	$+ x_{15}$	...	...	...	=	e_2	=	·000,	λ_2
x_{10}	$+ x_{11}$	$+ x_{12}$	...	...	...	=	e_3	=	·000,	λ_3
x_{16}	$+ x_{13}$	$+ x_{10}$	...	...	...	=	e_4	=	+ ·102,	λ_4
$21 x_{18}$	$-13 x_{17}$	$+20 x_{15}$	$-10 x_{14}$	$+5 x_{12}$	$-11 x_{11}$	=	e_5	=	+6·8,	λ_5

The Eastern Sind Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 9—(Continued).

Equations between the Factors							Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of							
		λ_1	λ_2	λ_3	λ_4	λ_5			
1	·000	+3	...	...	+1	+ 8	$\lambda_1 = -$ ·0367	$x_{10} = +''$·054	$x_{15} = +''$·077
2	·000		+3	...	+1	+ 10	$\lambda_2 = -$ ·0406	$x_{11} = -$ ·074	$x_{16} = +$ ·026
3	·000			+3	+1	− 6	$\lambda_3 = -$ ·0091	$x_{12} = +$ ·020	$x_{17} = -$ ·113
4	+ ·102				+3	...	$\lambda_4 = +$ ·0628	$x_{13} = +$ ·022	$x_{18} = +$ ·087
5	+ 6·8			*		+1256	$\lambda_5 = +$ ·0059	$x_{14} = -$ ·099	

Figure 10.

Triangle 63.

Constants (from page 201).

							Contained Angle.
XLIII	to	XLII	Log. feet	4·7593005,6	...	4+5	... = 78° 28′ 3″·471
XLII	„	XLIV	„	4·6644730,1			

Equations to be satisfied.

$x_3 + x_6 = e_1 = -$ ·445

$23\,x_3 - 13\,x_6 = e_2 = -$ 4·5

Adopted Errors.

$x_3 = -$ ·287

$x_6 = -$ ·158

Figure 11.

Triangles 64 and 65.

Constants (from page 201).

							Contained Angle.
XLV	to	XLVI	Log. feet	4·5506311,3	...	4+7	... 147° 19′ 44″·161
XLVI	„	XLIX	„	4·5709869,6			

Equations to be satisfied.

						Factor.
x_4	$+\ x_5$	$+\ x_6$	...	$= e_1 =$	·000,	λ_1
x_7	$+\ x_8$	$+\ x_9$	...	$= e_2 =$	·000,	λ_2
x_4	$+\ x_7$	...	...	$= e_3 =$	− ·446,	λ_3
$17\,x_5$	$-11\,x_6$	$+14\,x_8$	$-22\,x_9$	$= e_4 =$	+29·8,	λ_4

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of						
		λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	+ 6	$\lambda_1 = +$ ·0594	$x_4 = -''$·289	$x_7 = -''$·157
2	·000		+3	+1	− 8	$\lambda_2 = +$ ·1920	$x_5 = +$ ·542	$x_8 = +$ ·590
3	− ·446			+2	...	$\lambda_3 = -$ ·3487	$x_6 = -$ ·253	$x_9 = -$ ·433
4	+29·8		*		+1090	$\lambda_4 = +$ ·0284		

The Eastern Sind Meridional Series. Final Figural Adjustments of the Non-Circuit Triangles.

Figure 12.

Triangles 66 and 67.

Constants (from page 202).

							Contained Angle.
XLVIII	to	LI	Log. feet	4·5401566,3	} ...	13+10	... = 123° 50′ 22″·960
LI	„	LIX	„	4·7085244,3			

Equations to be satisfied.

							Factor.
x_{13}	$+ x_{14}$	$+ x_{15}$	...	$= e_1$	=	·000,	λ_1
x_{10}	$+ x_{11}$	$+ x_{12}$	...	$= e_2$	=	·000,	λ_2
x_{13}	$+ x_{10}$	...	...	$= e_3$	=	+ ·218,	λ_3
$10 x_{15}$	$-14 x_{14}$	$+7 x_{12}$	$-22 x_{11}$	$= e_4$	=	+60·3,	λ_4

Equations between the Factors						Values of the Factors	Adopted Errors	
No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4			
1	·000	+3	...	+1	− 4	λ_1 = + ·1861	x_{10} = + ″·260	x_{13} = −″·042
2	·000		+3	+1	− 15	λ_2 = + ·4886	x_{11} = −1 ·306	x_{14} = − ·949
3	+ ·218			+2	...	λ_3 = − ·2284	x_{12} = +1 ·046	x_{15} = + ·991
4	+60·3		*		+829	λ_4 = + ·0825		

PART II.

THE DETAILS OF THE OBSERVATIONS

AND

THE FINAL RESULTS.

OF

THE JODHPORE MERIDIONAL SERIES

AND OF

THE EASTERN SIND MERIDIONAL SERIES

OF THE

NORTH-WEST QUADRILATERAL.

JODHPORE MERIDIONAL SERIES

AND

EASTERN SIND MERIDIONAL SERIES.

JODHPORE (JODHPUR) MERIDIONAL SERIES.

INTRODUCTION.

This chain of triangles is the eastern of two meridional series which were intended to fill up the space between the Gurhágarh Meridional Series in long. 75° and the Great Indus in long. 68°, and so complete the North-West Quadrilateral. From Calcutta westward to the Gurhágarh Meridional Series the meridional series were carried at intervals of one degree; but in filling up the remaining area two series $2\frac{1}{2}$ degrees apart were considered sufficient; these series, however, were to be double throughout and to have an extended secondary triangulation between them.

On completion of the revision of the Great Arc Series from Bangalore to Bider, Lieutenant M. W. Rogers, R.E., and his establishment were transferred to Rajputana (Rájputána) to carry out this work. The Jodhpore Meridional Series emanates from the side Súnda (XLIV) to Bonik (XLI) of the Karáchi Longitudinal Series and closes on the side Kanda (XXI) to Kaimsir (XIX) of the Sutlej Series.

Season 1872-73.

PERSONNEL.

Lieut. M. W. Rogers, R.E., Offg. Deputy Supt., 3rd Grade.
Mr. W. C. Price, Asst. Surveyor, 1st Grade.
„ C. P. Torrens, „ „ 3rd „
„ A. Bryson, „ „ 4th „
„ W. Oldham, „ „ 4th „

Lieutenant Rogers having detached Mr. Torrens to finish up the work remaining on the Great Arc Series, Section 18° to 24°, proceeded withthe remainder of the party by rail to Poona (Puna), where the office and heavy stores were left, and thence to Ahmedabad (Amdávád), which, owing to the destruction of several bridges on the Bombay and Baroda Railway and the consequent stoppage of traffic, was not reached until the end of November. Messrs. Price and Bryson marched thence direct to the scene of operations, to inspect the country and commence the approximate work. Lieutenant Rogers visited Mount Abu, which it was intended to make the permanent recess quarters of the party, and marched thence *viâ* Erinpura to aid the assistants in their selection of stations.

The country from the origin of the Series for about 60 miles is very favorable for triangulation, being generally flat with high isolated hills rising from it. The approximate series was soon sufficiently advanced to commence principal observations, and Mr. Oldham having brought up the large theodolite (Barrow's 24-inch No. 2*) from Ahmedabad, where it had been left in charge of the Executive Engineer, the measurement of the final angles was begun at Súnda (XLIV) of the Karáchi Longitudinal Series on the 31st January 1873 and proceeded with steadily until the beginning of April. Observations were taken at 14 principal stations, forming 15 triangles, which extended a distance of 95 miles. Lieutenant Rogers also took astronomical observations for the direct determination of azimuth at Thob (VIII), about 44 miles W.S.W. of the city of Jodhpore. The field operations were brought to a close at Dodo (X) on the 8th April 1873, and the party marched towards Ahmedabad in separate detachments, closing stations on the road, *i.e.*, building small rectangular pyramidal pillars over the upper marks to protect them from injury, and arrived at recess quarters in Poona on the 8th May.

Messrs. Price and Bryson made good progress in the approximate operations, Mr. Price having charge of the selection, and Mr. Bryson of the building of the stations. The total out-turn of approximate work for the season was the selection of 25 stations extending over a distance of 147 miles.

Mr. Torrens was employed on the Great Arc Series, Section 18° to 24°, and Mr. Oldham acted as Lieutenant Rogers' assistant in the office and observatory.

The country through which the season's operations were carried, is sandy and flat, with an elevation towards the east of about 700 feet, diminishing towards the west and the Lúni river to 300 or 400 feet. South of the Lúni small detached ranges and isolated hills are numerous: their sides are precipitous and covered with jungle, and many of them rise to a considerable height above the plain, several exceeding 2,000 feet. To the east, towards the Lúni, which flowing west across the Series turns south and skirts its western flank, the country becomes barren and sandy, with sand hills covered with low shrubs; water is scarce and brackish, and villages few and far between. The ranges disappear, and save sand hills, the country is level for 70 miles, as far as the Bálmír hills. North of the Lúni the country becomes still more sandy and desolate, and nearly all the water in the tract embraced by the Series is brackish. About 15 miles north of the Lúni and 20 miles from the east flank of the Series, is the city of Jodhpore, which lies at the foot of the hill on which the fort is situated and at its southern side: its greatest length from north to south is 2½ miles and its greatest breadth ¾ of a mile. It is closed in on the north by the fort, and on the east, south and west by a high wall capable of mounting guns, and having six gateways. Jodhpore is a good specimen of a native city and is kept fairly clean: it possesses many wells and three tanks; one of the latter, which is artificial, is very fine and large, its bed and sides being of stone masonry.

The fort is built on a hill, the highest in the neighbourhood, rising 360 feet above the surrounding country. There are two roads leading up to it which unite a few yards from the gateway and turn a sharp corner before reaching the gate; both roads are well protected by guns. Besides this gate there are two others to be passed before the fort is gained—the first a small though strong one in a narrow pass between two rocks, and the second a large one approached by a steep ascent, well commanded by guns, and like the

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* For the description of this instrument *vide* Appendix No. 2, Volume II of the *Account of the Operations, &c.*

outer one made difficult by being placed round a corner. Access to the fort from any other direction would be impossible, as the sides are sheer precipices from two to three hundred feet high. The country below is commanded on all sides by the guns of the fort, save one small eminence opposite the fort gate and within the outer line of fortification.

Season 1873-74.

PERSONNEL.

Lieut. J. Hill, R.E., Asst. Supt. 1st Grade.
Mr. W. C. Price, Asst. Surveyor 1st Grade.
" C. P. Torrens, " " 3rd "
" W. Oldham, " " 4th "

In October 1873, Lieutenant Rogers took furlough to England, and the charge of the party was transferred to Lieutenant (now Major) J. Hill, R.E. Lieutenant Hill left Poona on the 1st November 1873 and marched to the first station of observation, having *en route* established his Head Quarters at Mount Abu. The country to be triangulated this season was a sandy desert; and the difficulty of obtaining water and provisions soon began to make itself felt. By the kindness of the Jodhpore *Darbár* (Court), a *vakíl* (Agent) and staff of *sowárs* (mounted men), &c., was attached to the party as in the former season, and by their aid the difficulties of the country were successfully surmounted. Lieutenant Hill experienced delay from the cloudy and misty weather; he calculated that he lost 34 days in four months from this cause; however the work was pushed on vigorously by all concerned. The sand hills in the desert were generally flat-topped, low and of about equal altitudes, so that the advantages of a hilly country were lost and short sides were unavoidable. Observations were taken at 21 principal stations extending over a distance of 90 miles. The towns of Phalodi and Pokaran were fixed in position and height, and a considerable amount of secondary triangulation was accomplished.

The Superintendent having directed that three sets of observations for the determination of azimuth should be taken on the Series, at equal intervals between the Karáchi Longitudinal and Sutlej Series, astronomical observations were made at Jambo (XXVI) in lat. 27° 16′. Angular observations were closed at Harban (XXVIII) on the 3rd April, and the party arrived at their recess quarters at Mount Abu on the 30th of that month.

During the season Mr. Price who was employed in laying out the approximate series in advance worked with great energy, and in spite of the difficult nature of the country, pushed on the work for 102 miles, selecting 21 stations.

Mr. Torrens was employed on secondary triangulation. Mr. Oldham assisted Lieutenant Hill as observatory recorder.

Captain Hill writes:—" With the exception of the approximate work which extends " into Bickaneer (Bíkaner), the field operations of the season were confined to the States of " Jodhpore and Jeysulmere (Jáisalmír). This season in the Jodhpore desert the triangulation " traversed a sandy country, but towards the close of the season the Series entered a part of " Jeysulmere where the ground is hard and strewn with dark, shining stones. The reflection " from these stones is something like the reflection from water, and for this reason vertical ob- " servations to certain of the heliotropes gave a good deal of trouble. Mirage was frequently " observable in the mornings, but, except in one or two instances, did not retard the work."

" Throughout the country triangulated, and especially in Jeysulmere, water is scarce "and in general brackish. In many cases, according to the statement of the people, well water, "which is drinkable in the cold season, becomes actually poisonous in the hot weather. The "villages and wells are few and far between. The former generally consist of a collection of "circular wigwams, the inhabitants of which are a primitive, dirty and good humoured people, "but given to highway robbery and other forms of thieving. The wells are very deep, one at "the village of Akhadna near the station of Nok (xxx) in Jeysulmere, (said by the people to be "80 *purush* in depth) is 5 feet in diameter and 374 feet deep. The water arrived at after such a "laborious excavation was unfortunately bitter and quite unfit for use. The deepest well I "have seen is at the village of Bákri in Jodhpore; it has been bored through a rock and is 5 feet "4 inches in diameter and 450 feet in depth: its water is good. I know of no other well so "deep in Rajputana. The city of Jeysulmere, which was fixed this season, is much smaller "than that of Jodhpore, its reported number of inhabitants being 10,000; but from all I could "see and hear the place was once in a far more flourishing state; the ruins of its former great-"ness are yet to be seen. The water supply for the city is obtained from an adjoining lake; "when this fails, which is generally the case in June, good water has to be brought from a small "village, Kisamghát, which is about 3 miles distant. There are numerous wells in the city but "the water is not good. The city used to be closed in by a rampart, now useless, as the wall is "rapidly crumbling to pieces. The fort, once strong, is now in a dilapidated state and would "ill stand an assault; it contains no tanks but many wells. The Jain temples in the fort are "very fine, the carving in the stone being exquisite; in fact this may be said of most of the "houses in the city, the doors, windows and walls having more or less carving about them. "The greater number of the inhabitants who reside within the walls of the fort are Bhati "Rájputs and Jains, and are as a rule great opium eaters."

Season 1874-75.

PERSONNEL.

Capt. M. W. Rogers, R.E., Offg. Dy. Supt., 3rd Grade.
Mr. W. C. Price, Surveyor, 4th Grade.
„ C. P. Torrens, Asst. Surveyor, 3rd Grade.
„ P. F. Prunty, „ „ 4th „

In November 1874, Captain Rogers having returned from furlough again took charge of the party and proceeded at once into the field to carry on the principal observations. These were commenced at Nok (xxx) on the 17th December, and carried on without interruption. Work was closed at Bhulan (XLIX) on the 21st March, as the party had a long march across the desert to Mount Abu. During the season observations were taken at 25 principal stations and the Series was advanced 104 miles. The work lay chiefly in the States of Bickaneer and Jeysulmere whose *darbárs* afforded very great assistance to the party. Astronomical observations for the determination of azimuth were taken at Mugrala (XLIII) in lat. 28° 31′. The approximate series under Mr. Price was pushed on 64 miles and brought to a successful termination by junction with the Sutlej Series on the side Kanda (XXI) to Kaimsir (XIX), 17 stations being selected and built.

Mr. Torrens carried a minor series eastward to the city of Bickaneer, of which the height had not been fixed by the Gurhágarh Meridional Series. He effected a junction with the minor series emanating from the Gurhágarh, with very satisfactory results. He then returned to the main series, built small rectangular pyramidal pillars over the principal stations at which observations had been completed, and connected the town of Pungal and also the trijunction pillar of the States of Bickaneer, Baháwalpur and Jeysulmere by a minor triangulation.

Mr. Prunty who had joined the party from the Computing Office at Dehra acted as observatory recorder.

Bickaneer is a fine city, built on a slightly elevated spot in the desert where the ground is hard, stony, and intersected by ravines. It has a wall $3\frac{1}{2}$ miles in circuit wholly built of stone, in which are eight gates and three sally ports; the wall is from 15 to 30 feet high and in good repair, and has a ditch on three sides about 15 feet deep. There are many highly carved houses in the city and two imposing looking Jain temples. Water is plentiful from many very fine wells. The chief productions are sugarcandy and blankets, both of which are of a superior kind. The population is about 35,000. The fort of Bickaneer which contains the Mahárája's palace is about 300 yards N.E. of the city. The palace rises above the battlements which gives it an imposing appearance; it is 1,100 yards in circumference and has two gates, numerous bastions and a ditch all round.

Season 1875-76.

PERSONNEL.

Capt. M. W. Rogers, R.E., Dy. Supt., 3rd Grade.
Mr. W. C. Price, Surveyor, 4th Grade.
" C. P. Torrens, Asst. Surveyor, 3rd Grade.
" P. F. Prunty, " " 4th "

Owing to the heavy rains of 1875 the return of men from leave and the collection of stores for the party were much delayed and Captain Rogers did not leave Mount Abu until October 23rd. He however utilised his time by visiting Deesa and inspecting the Meteorological Observatory there and laying out a small triangulation to connect both it and the Telegraph Office with the main triangulation of the Karáchi Longitudinal Series. After a long march the party reached the scene of operations on the 4th December. Observations were at once commenced and the 21 miles remaining to complete the Series were finished on the 3rd January 1876. After this the party marched westward to take up the Eastern Sind Series on the meridian of 70°.

Mr. Price was this year employed in selecting stations for the new series.

Mr. Torrens first took up the connection of Deesa (Dísa), on completion of which he commenced a minor series on the meridian of 71° 15′, starting from the Karáchi Longitudinal Series and effecting a junction in the vicinity of the town of Jeysulmere with a secondary series which had been extended to this place in the field season of 1873-74.

Mr. Prunty was employed for a month in connecting such of the Baháwalpur Revenue Survey stations as could be identified near the Series.

The Jodhpore Meridional Series is 310 miles in length, and with the exception of a small portion to the south of the river Lúni, it passes over a sandy tract of nearly utter desolation. On all sides nothing meets the eye for miles but sand-hills dotted here and there with tufts of coarse grass and stunted shrubs. These sand ridges vary from 20 to 200 feet in height and are sometimes 2 or 3 miles in length: they appear to be scattered on every side like the billows of the sea, but run generally in a N.E. and S.W. direction. The villages are few in number and consist of collections of squalid wigwams situated around spots where wells have been excavated. These are sometimes as much as 200 feet deep and often yield only brackish water; for the soil seems to be impregnated, although capriciously, with saline matter, and the water from a large number of the wells is more or less unfit for drinking purposes.

In the whole distance between the Lúni River and the Sutlej Series—250 miles—only one place, Phalodi, was met with which could be dignified by the name of a town, and but four which ranked as fair sized villages. There is not much difference in the degree of barrenness in the country traversed by the whole Series, but if any, the northern portion in Baháwalpur is the most sterile. There the Series passed over a length of 70 miles in which there were only three wells of drinkable water, and these were within a space of 10 miles. In Baháwalpur the sand hills grow smaller and fewer, and are replaced by long stretches of perfectly level hard clay like the beds of dried up tanks, separated by tracts of drifting sand, accumulating here and there into mounds; there is not a particle of vegetation save a few sparsely scattered *Phog* (*Calligonum*) bushes. However, for two or three months in the year the desert presents a cheerful appearance: each village has several hamlets, called *dhanis*, established where there is any hard soil capable of retaining water; in excavations made in this, water lodges for two or three months after the rains, and the inhabitants of the villages come to these to feed their flocks and herds on the freshly grown herbage, and to cultivate the few miserable fields which they have in the hollows between the sand hills. The rainfall is however very small, 4 or 5 inches; and the inhabitants have a hard struggle for life in respect to both food and water; their food they supplement with the seeds of various grasses, the principal of which is the *bhurut*. The grain of this grass is about the size of a pin's head and is enclosed in a prickly husk which causes a great deal of discomfort to both man and beast as it sticks in the clothes of the former and the hair of the latter and is very difficult to get rid of. Water is collected in receptacles called *tankas*, cylindrical reservoirs about 6 feet in diameter and 8 or 10 feet deep, coated with fine chunam. When full they are covered in with brushwood and mud and are not used until the well water fails or becomes brackish, as generally happens in the hot weather. When, as is often the case these tanks also fail, those who can afford it send for water 15 or 20 miles from the nearest fresh-water well, and the poorer drink the brackish water mixing it with a little *dahi* or curds.

Under these circumstances great care had to be taken to ensure a supply of wholesome water for the main camp and detached signal parties, and in many cases it had to be brought from upwards of 15 miles and sometimes over 20 miles, and even with all these precautions at times every one had to put up with brackish and hardly drinkable water; this was especially the case on the approximate series under Mr. Price, who, having to reconnoitre in parts concerning which no sure information could be got, had often to take with him a camel load of water and march on, not knowing when or where he might get a fresh supply. However every one bore with cheerfulness these privations when they occurred, and owing to the good arrangements for supplies &c., combined with the healthiness of the desert, there was but little sickness and the party lost but one man during the four years.

The most sterile part of the country, as mentioned above, crossed by the northern portion of the Series, is very near the district which at page XXIV—$_{G.}$ of the Introduction to the Jogi-Tila Meridional Series (see Synoptical Volume VI) is mentioned as having been visited by Lieutenant J. Tennant and Mr. J. W. Armstrong with a view to carrying that series south of the Sutlej. They found it impracticable without the arrangements which the experience of the Executive Officers of the Jodhpore Meridional Series had taught them to adopt, and moreover they experienced hindrance and opposition from the Baháwalpur *Sardárs.* It shows the improvement which has taken place in that country under the guardianship of Colonel Minchin, that, instead of opposition, Captain Rogers met with civility and help from every one, that all trouble as to carriage of water, provisions and materials for station building was taken off his hands, native officials vying with each other in aiding the survey operations. This was also the case, though perhaps in a lesser degree, in the States of Marwar (Márwár), Bickaneer and Jeysulmere, the *darbárs* of which gave great aid to the party. In fact without such assistance no series could have been taken across the desert except at an enormous expense.

The calculations of the triangulation of this Series having been carried up from the side of origin, Súnda-Bonik, of the Karáchi Longitudinal Series, to the terminal side, Kaimsir-Kanda, of the Sutlej Series, the following discrepancies were met with between the original values of the length and azimuth of the terminal side above named and those of the latitude and longitude of the terminal station Kanda, and the values of the same as derived from the Sutlej Series after the Simultaneous Reduction of the North-West Quadrilateral:—

In Logarithm of the side in feet ...	...	$-$ 0·000,0123,4 = 1·8 inches per mile.
„ Latitude	...	$-$ 0″·172
„ Longitude	...	$-$ 0 ·121
„ Azimuth	...	$-$ 3 ·216

These discrepancies were treated as errors in the Jodhpore Meridional Series and were dispersed as described in Part I of this Volume.

The heights of the stations above mean sea level are entirely dependent on trigonometrical determinations, no line of spirit-leveling having been executed in the neighbourhood of this Series. The heights of the terminal stations, Kanda and Kaimsir of the Sutlej Series, as brought up by the Jodhpore Series, were in excess of the final values given in Volume IV of the *Account of the Operations, &c.*, by 8·6 and 12·8 feet respectively. The mean difference 10·7 feet was treated as an error generated in the Jodhpore Series and was dispersed by simple proportion.

Secondary Triangulation.

This may be divided into two classes:—

(1st). Secondary series of some length.

(2nd). Permanent marks intersected from the principal stations with the large theodolite or fixed by one or two triangles observed with a smaller instrument.

As already mentioned on page III, the intervals between the principal chains of triangles in this desert country were increased from 1° to $2\frac{1}{2}$°. This reduction in the amount of the principal required an increase in that of the secondary triangulation, otherwise a sufficient number of fixed points of reference would not be provided for topographical surveys; it was therefore decided to run a longitudinal chain of secondary triangles from the Indus to the Jodhpore Meridional Series, and also a meridional chain between it and the next intended principal series to the west, which should supply points in the southern and better inhabited portion of the country. In pursuance of this scheme the undermentioned secondary series were executed:—

The Bálmír and Jeysulmere Secondary Series. The longitudinal portion of this series, between the stations of Daichu (XIX), Jalora (XXI), and Ekka (XXIII) of the Jodhpore Meridional Series, and the city of Jeysulmere, was executed in the field season of 1873-74, and the meridional portion (which is double throughout) between the stations of Gangasára (LXV), Didáwa (LXII), and Támpi (LX) of the Karáchi Longitudinal Series, and the city of Jeysulmere, in the season of 1875-76. Both portions were executed by Mr. C. P. Torrens with a 10-inch theodolite by Troughton and Simms, and extend a distance of about 230 miles. The meridional portion passes through the district of Mallani which is well inhabited for that region, and fixes the town of Bálmír and many permanent marks. The whole chain has been treated as one series in the Synoptical Volume of this series and adjusted between the final position values of the principal stations of the Karáchi Longitudinal and Jodhpore Meridional Series.

The Bickaneer Secondary Series. This series was executed in the field season of 1874-75 by Mr. C. P. Torrens with a 10-inch theodolite, and emanates from the side Ronesar (XL) to Bithnok (XXXVIII) of the principal series, extends eastwards for about 45 miles, and closes on the side Bickaneer–Hethiári of the Bickaneer Secondary Series which extends westwards from the Gurhágarh Meridional Series (see Synoptical Volume IV). Thus the Jodhpore and Gurhágarh Meridional Series are connected by a longitudinal chain of triangles.

Mount Abu Secondary Triangulation. This was executed by No. 7 Topographical Survey Party, Rajputana Survey, under Captain G. Strahan, R.E., during the field season of 1869-70, and is based on the side Gúrú Sikkar–Súnda (XLII–XLIV) of the Karáchi Longitudinal Series. At the greater number of the stations, observations were taken with a 14-inch theodolite to luminous signals; but in a few cases, when an ascent was too steep and dangerous to carry up the large instrument, a 6-inch theodolite was employed: it will be seen that the summit of Mount Abu rises about 4,700 feet above the plain of Sirohee at the foot of the mountain. In 1876 Mr. Prunty connected the Hospital and the Survey Office at Mount Abu with the above triangulation, observations being taken with a 10-inch theodolite to luminous signals. The stations of this triangulation are in general marked with an engraved circle and dot and covered by a cairn of stones.

The remainder of the secondary triangulation was mainly executed *pari passû* with the principal series, by the measurement—with the large theodolite—of angles at the principal stations to the surrounding secondary stations, trijunction and Revenue Survey pillars and other prominent objects, the angles at the secondary stations being measured with smaller theodolites: in this way the positions of the following places of note were determined, the town of Erinpura, the fort of Jálor, the city of Jodhpore, the large village of Pungal and the towns of Mároth, Mírgarh and Maujgarh in Baháwalpur.

MALCOLM W. ROGERS, R.E.

August, 1884.

EASTERN SIND MERIDIONAL SERIES.

INTRODUCTION.

The Eastern Sind is the western of the two meridional series which have been carried across the deserts of Rajputana (Rájputána) and Sind, between the Great Indus and the Gurhágarh Meridional Series.

The Series is double throughout and 240 miles in length: it originates from the side Rojhra (LXXV) to Sandohar (LXXVIII) of the Karáchi Longitudinal Series and after passing through the Thar and Párkar district of Sind, the eastern portion of the Khairpur State and the western portion of Jeysulmere (Jáisalmír), enters the Ubauro taluk of Shikárpur, its eastern flank stations being within the boundaries of the Baháwalpur State; it terminates on the side Dáowála (LXII) to Máchka (LIX) of the Great Indus Series. Operations were commenced in the field season of 1875-76, and continued the following year, but were suspended from 1877 to 1879, at first on account of the failure of the rains in 1877 which deprived the country of its natural water supply, and afterwards because Major Rogers's services were required with the Army in Southern Afghanistan. The Series was continued in 1879-80 and finally completed by Lieut.-Colonel Branfill in 1880-81.

With the exception of the last 50 miles of the Series on which Colonel Branfill used Troughton and Simms' 24-inch Theodolite No. 1, the observations were taken by Captain (now Major) Rogers, R.E., with Barrow's 24-inch Theodolite No. 2.

Season 1875-76.

PERSONNEL.

Capt. M. W. Rogers, R.E., Offg. Dy. Supt., 3rd Grade.
Mr. W. C. Price, Surveyor, 4th Grade.
„ C. P. Torrens, Asst. Surveyor, 3rd Grade.
„ P. F. Prunty „ „ 4th „

On the completion of the Jodhpore Meridional Series in January 1876, Captain Rogers having been ordered to commence a series on the meridian of 70°, marched from Kaimsir (XIX) of the Sutlej Series where he had closed his observations, through Baháwalpur to the portion of the Great Indus Series which lies on that meridian.

Unfortunately the River Indus had washed away several of the old stations about the most convenient locality, so that Captain Rogers had to adopt a side west of the given meridian, intending to gradually work on to it and then turn southwards.

The country south of the Indus is quite flat and covered with dense tree and grass jungle and for four or five months in the year is inundated; it therefore became necessary in the 20 miles which intervene between the river and the sand hills to resort to ray-tracing and tower-building, and as this style of work was new to all the members of the party, the progress was in consequence slow. Eight stations were selected, advancing the Series to the the sand hills a distance of 24 miles. Two towers were built and 104 miles of rays cleared.

Mr. Price, who was to take up the selection of stations in the southern section, was delayed for a month owing to his camp being attacked by fever and having to go to Deesa (Dísa) for medical treatment, he then marched to the meridian of 70° on the Karáchi Longitudinal Series and commenced selecting and building. Mr. Price found the station Rojhra of the Karáchi Longitudinal Series in complete preservation, and the pillar at the station of Sandohar was also in good condition except that the upper mark was wanting. The neighbouring stations of Fulrár and Chánga were in ruins. He therefore based his work on the side Rojhra–Sandohar and rebuilt the stations Fulrár and Chánga as nearly on their old sites as possible making use of them to construct a hexagon about Sandohar. The elements for these stations given in the details of the Karáchi Longitudinal Series are therefore no longer applicable. He selected 24 stations and built eight, extending the Series 110 miles.

During this season there were no final observations taken, but the party was employed in pushing on the preliminary work in order to get a fair start for the next season.

Season 1876-77.

PERSONNEL.

Capt. M. W. Rogers, R. E., Offg. Dy. Supt., 3rd Grade.
Mr. W. C Price, Surveyor, 4th Grade.
" C. P. Torrens, Asst. Surveyor, 3rd Grade.
" P. F. Prunty, " " 4th "

The party took the field in October and marched from Mount Abu to Chháchra in Thar and Párkar, and thence to Rojhra station of the Karáchi Longitudinal Series. Observations were commenced here on the 20th November and were carried on continuously through the Thar and Párkar district of Sind, the Khairpur State and Jeysulmere, and were closed at Dhanono (XXIV) on the 18th March up to which the weather had been very favourable for observations; after this, as is usual in the desert, high winds and duststorms commenced and made the observing difficult and tedious.

Twenty-six new principal stations were fixed, extending the Series 125 miles along the meridian. An azimuth was observed at Malar (XIV) to two circumpolar stars.

Mr. Price selected 21 new principal stations, advancing the Series 98 miles and completing its junction with the southernmost side of the work laid out by Captain Rogers during the previous season.

Mr. Torrens built 19 and closed 16 principal stations, and moreover did a good deal of work in identifying and fixing a number of stations of the Sind Revenue Survey. The construction of stations in the desert involved a large amount of trouble, owing to the difficulties of making good bricks and of transporting them, when made, to the sites where they were required.

The country through which the Series passed this season, in the district of Thar and

Párkar, chiefly consisted of narrow sand hills sometimes of considerable height, running from south-west to north-east in perfectly parallel lines: they are higher and closer together than those in Rajputana, and their slopes are steep, cut up by ravines and covered with low thorn jungle. Travelling was thus rendered very tedious, the village tracks had to be followed and long detours made, 10 miles was a heavy march for laden camels, and much time was spent in moving from station to station. This season, for about 50 miles along the western side of the Series, the country was inundated and a vast expanse of water stretched as far as the eye could reach. The town of Umarkot, when visited was surrounded on two sides by water which came up to the base of the fort.

In the north of Thar and Párkar and the western portion of Jeysulmere a new phenomenon is met with. This is the *draens* or expanse of shifting sand, which occurs here and there amongst the desert sand hills and is often many miles in extent. These draens have no vegetation, and their surface is continually changing, the sand is in one place scooped out into funnel shaped hollows, and in another thrown up into beautifully rounded hills. They were only crossed, when unavoidable, and then the road had to be inspected and prepared beforehand, and five miles was a fatiguing march. It is a curious fact that in certain places in these draens there are wells of water on small pieces of hard ground, which seem to be spared by the overwhelming sand, and the water of which is invariably good. The draens are very numerous for some 75 miles north of parallel 26°. They impoverish the already sterile country, the acme of desolation being reached in eastern Khairpur and western Jeysulmere. There are no crops and the people live nearly entirely on milk in various forms; a little *bajri* and *mot* are however imported from Sind in exchange for sheep. The inhabitants say that the draens travel gradually northwards, but very slowly. Their summits rise to a considerable height, in many cases overtopping the sand hills: and it was a matter of considerable difficulty to arrange the Series so that the stations should not fall on them. In two cases this could not be avoided, and although all precautions for stability were taken in their construction, it is doubtful if they can remain for long. The villages are of the same description as those met with in other parts of the desert, and the majority of the houses are merely wigwams of brushwood; a house with mud walls is a rarity, and brick and stone are almost unknown. With the exception of Umarkot there is no place along the Series worthy of the name of a town. The villages are, nearly without exception, built on the summits of sand hills, and often at a great distance from their wells, which are in the hollows between the hills. The reason for this custom seems to be, that in the cold weather the tops of the sand hills are considerably warmer than the valleys where the cold is sometimes very great. The party experienced considerable trouble from the difficulty of procuring drinking water, especially on the eastern side of the Series, near the junction of the four States of Marwar (Márwár), Jeysulmere, Khairpur, and Thar and Párkar, where there is a tract of country 30 miles broad by 40 long without any drinkable water.

During the season of 1877-78 the operations of the Eastern Sind Meridional Series were suspended owing to the failure of the rains in Rajputana. Captain Rogers and his assistants, Messrs. Torrens and Prunty, were sent to carry on a survey across the Frontier in Beluchistan, whilst Mr. Price was sent to the Eastern Frontier Series in Burma.

During the season of 1878-79, Captain Rogers was sent as Survey Officer with the Army into Southern Afghanistan. Mr. Price remained with the party and continued the triangulation in Beluchistan, Mr. Torrens joining him after having completed some secondary triangulation to connect the main series with the Jeysulmere secondary series and reconnoitred the intended Sehwán secondary series.

Season 1879-80.

PERSONNEL.

Captain M. W. Rogers, R.E., Offg. Dy. Supt., 3rd Grade.
Mr. W. C. Price, Surveyor, 4th Grade.
" C. P. Torrens, Asst. Surveyor, 2nd Grade.

Having completed the operations on which he had been engaged in Southern Afghanistan in connection with the military movements, Captain Rogers returned to Sind to resume the principal and secondary triangulations which had been suspended in 1878 when war with Afghanistan was declared. On his return he was much delayed for want of transport, all available animals being required for the Army, and when he arrived at Hyderabad, Sind, where his principal instruments had been left in store, he was further delayed because no *hammáls* or bearers were to be obtained for the carriage of the large theodolite, all persons of this calling having either joined the Army or deserted the country through fear of being required to do so. Thus it was necessary to wait until bearers could be brought up from Poona (Púna) before operations could be commenced. This enforced delay was utilised in computing and projecting the series of triangles from Quetta to Kandahár the observations of which had been taken by Captain Rogers a few months before.

The amount of work remaining to be completed on the Eastern Sind Series would have been just possible to accomplish in a long field season and under a very favourable combination of circumstances, if the survey party were fresh and in full vigour after some months' residence in recess quarters: but it could hardly be expected from Captain Rogers and his party who had just returned from more than a year's continuous field service in Afghanistan and Beluchistan, and who were unable to commence their observations until late in the season.

Having obtained bearers from Poona, Captain Rogers left Hyderabad on the 7th January and marching through Sind and western Jeysulmere commenced observations at Ráviláhu (XXVI) on the 27th January; work was closed at Chauki (XXXV) on the 27th March, and the party marched to Reti on the Indus Valley Railway, and thence proceeded by rail and road to Dehra Dún. Fifty angles were observed at the stations, advancing the Series 64 miles: an azimuth was observed at Asu (XXXI) to two circumpolar stars.

The country through which the Series passed was much the same as described the last season, but draens were not met with outside the tract that lies between the meridians of 69° 15′ and 79° 15′ and the parallels of 26° and 27°. It was taken from the Amírs of Sind after the war of 1845 and given as a reward to the Maharáwal of Jeysulmere to whom it still belongs, it contains no towns of any size, and but three forts, two of which, Sháhgarh and Kháro, are of mud and in ruins, being rapidly buried by the desert sand; the third, Gotáru, is of brick and much larger; it contains two wells and is in fair repair, with two antiquated cannons on the ramparts.

Season 1880-81.

PERSONNEL.

Lieut.-Col. B. R. Branfill, Dy. Supt., 2nd Grade.
Mr. C. P. Torrens, Asst. Surveyor, 1st Grade.

Colonel Branfill having finished the principal triangulation in Southern India proceeded from Bangalore to Sind, where on the 6th November he assumed charge of the Bombay Party formerly under Major Rogers, R.E.; it had been equipped for the field by Mr. Hennessey who had held temporary charge in addition to his other duties since Major Rogers' departure on furlough to Europe in April.

The southern portion of the country triangulated in this year was desert pure and simple, water having to be carried on camels many miles to each station. Then, as the boundary between the Baháwalpur desert and the valley of the Indus was approached, hills and long ridges of drift sand were met with, interspersed with stretches of low lying, alluvial flats, which are mostly dependent on rainfall for their supply of water, and are thus practically desert for the greater portion of the year: when rain does fall, grass and shrubs spring up and render these tracts good grazing ground for cattle and camels for a short time afterwards; to some of them the flood waters of the Indus find occasional access by the old river channels, the deeper parts of which contain water for several months after the subsidence of the annual inundation, and are thus natural reservoirs; they are locally called *dhauds.* Finally, the valley of the Indus was entered and the principal operations were brought to a close on two stations—Dáowála (LXII) and Máchka (LIX)—of the Great Indus Series, which had been established in the year 1859-60; this part of the country was covered with a dense growth of acacias and other trees, the clearance of the necessary rays through which was tedious and laborious.

The triangulation had already been designed and laid out by Major Rogers in 1876-77 in the form of a hexagon, a quadrilateral, and two pentagonal figures. Half the stations had been built; but three towers and as many platform stations remained to be completed, and 140 miles of line had to be cleared on the rays between the principal stations. The ray on the side, between the stations of Chauki (XXXV) and Trisingh (XXXVIII) was found to have become blocked up by a moving sand hill during the interval of six months which had elapsed since the stations were last visited; but Major Rogers had fortunately anticipated that this might happen, and had taken observations at both the base stations to the forward station at the vertex of the first triangle; thus it only remained to measure the third angle, and the necessity for clearing a ray through the sand hill was avoided.

The terminal stations in the valley of the Indus, consisting of towers about 24 feet high, were found still serviceable, having been put in repair in 1876-77, but had both become deflected to some extent; it was thus necessary to enlarge the upper portions of the central shafts before the large theodolite could be plumbed over the mark-stone at the ground level.

The principal triangulation completed this season extended for a distance of 50 miles along the meridian, introducing 13 new stations. The vertical angles were observed with some trouble owing to variations in atmospheric conditions materially influencing the terrestrial refraction, which in several cases was found to be negative, to an average extent of an eighth of the contained arc, thus making signals at a distance of 10 miles appear to be as much as 14 feet below their actual position.

Observations for azimuth to circumpolar stars were taken at two stations on the series, Vijnot (XLIV), and Dáowála (LXII) of the Great Indus Series.

Although so much of the country traversed by the Eastern Sind Meridional Series is a dreary wilderness of sand, it is not entirely devoid of interest, from the fact that it may only have become a desert in comparatively recent times, and being in a state of continual motion it is now probably spreading in the direction of the prevailing wind during the dry, hot season. That a part of the desert was not always so, appears from the existence of many ruined places and forts within its borders, and from the change of the bed of the river Indus from east to west within historic times. The westerly tendency of the river bed has been attributed to the natural "set" to the westward of a north to south flowing current in the northern hemisphere, due to the increasing velocity of diurnal rotation of the parallels which it successively crosses; but a more effective cause of change may be found in the prevalence of westerly or south-westerly over easterly or north-easterly winds, especially in the dry, hot months of March, April and May, when the sand of the river channel is transported continually to the eastward, tending to fill up the more easterly channels and to protect their eastern banks from erosion by the water of the ensuing inundation, besides going to increase the actual amount of drift sand in the desert to the eastward. However this may be, there is no doubt that many towns and villages have been deserted by the rivers which once watered them. The ruins of some of these and the traces of the river channels on which they were built are still met with, especially on the western and northern edges of the desert where the sand has not quite obliterated them; but most of them have probably been overwhelmed and lost in the ever moving flood of sand from the south-westward.

In the portion of Baháwalpur traversed by the Jodhpore Meridional Series the ruinous and nearly deserted towns of Maujgarh, Mírgarh and Mároth mark the course of the now non-existent Hurkaru river, and on the north of the Eastern Sind Series were met with the ruins of Vijnot and Sirwáhi (or Seoráe), the former of which is a collection of blackened mounds from 10 to 20 feet in height, consisting of the *débris* of bricks and pottery mixed with earth and comminuted pieces of charcoal, indicating the site of a considerable town extending over half a mile in length and nearly a quarter of a mile in width. Exclusive of suburban mounds the site now measures a mile and a half in circumference. The only tradition about Vijnot amongst the country folk is, that it was one of the five (or seven) chief cities of Sind in the early days before the Muhammadan conquest (711 A.D.). The place lies about half a mile east of the Reni nadi, an old channel of the river Indus, and about 4 miles south of the Reni station of the Indus Valley State Railway.

Sirwáhi, the site of a lofty fort close to a town which is also said to be one of the ancient fortified cities of Sind, is situated about five miles N.E. of Sabzalkot and 3 miles N.W. of the Walhár station of the Indus Valley State Railway in the Baháwalpur State. The fort is about a quarter of a mile in circumference and rises 50 feet above the great plain around it, whilst the mound on which the adjacent town stood is perhaps half to three quarters of a mile around and 20 to 30 feet high.

The calculations of the triangulation of this Series having been carried from the side of origin, Rojhra–Sandohar of the Karáchi Longitudinal Series, to the terminal side, Máchka–Dáowála of the Great Indus Series, the following discrepancies were met with between the original values of the length and azimuth of the terminal side above named and those of the latitude and longitude of the terminal station Dáowála, and the values of the same as derived from the Great Indus Series after the Simultaneous Reduction of the North-West Quadrilateral:—

In Logarithm of the side ...	... ... =	$-$ 0·000,0074,2 = 1·1 inches per mile.
„ Latitude	... =	$-$ 0″·423
„ Longitude	... =	$+$ 0 ·028
„ Azimuth	... =	$+$ 0 ·939

These discrepancies were treated as errors in the Eastern Sind Meridional Series and were dispersed as described in Part I of this Volume.

The heights of the stations above mean sea level are entirely dependent on trigonometrical determinations, no line of spirit-leveling having been executed in the neighbourhood of this Series. The heights of the terminal stations, Máchka and Dáowála of the Great Indus Series, as brought up by the Eastern Sind Meridional Series, were in excess of the final values given in Volume III of the *Account of the Operations, &c.*, by 5·0 and 0·3 feet respectively. The mean difference 2·7 feet was treated as an error generated in the Eastern Sind Meridional Series and was dispersed by simple proportion.

Secondary Triangulation.

The secondary triangulation executed in connection with the Eastern Sind Meridional Series may be divided into three portions.

(1st). Secondary Series of some length.

The Jeysulmere Secondary Series. The extension of the Jeysulmere chain of secondary triangles of the Jodhpore Series westward from the city of Jeysulmere to meet the principal triangulation of the Eastern Sind Meridional Series. This work was done by Mr. C. P. Torrens, Assistant Surveyor, 2nd Grade, in the field season of 1878-79. It is about 60 miles in length and extends from the side Asu–Maringra of the Eastern Sind Meridional Series to the side Jeysulmere–Thaiat of the Jeysulmere Minor Series, thereby establishing a secondary longitudinal series on the parallel of 27°, extending from the Jodhpore to the Eastern Sind Meridional Series.

The Sehwán Secondary Series. This series originates from the side Ramsar (XVI) to Patanawári (XVIII) of the Eastern Sind Series and extends on the parallel of 26° 25′ to the side Mírkhán (XII) to Bhit (X) of the Great Indus Series. It consists of 24 triangles extending over a direct distance of 154 miles. The whole of this series was the work of Mr. C. P. Torrens, in the field seasons of 1878-79, 1879-80 and 1880-81. The instrument used for the observations was a 10-inch theodolite; it gave very satisfactory results, the closing errors at the junction with the Great Indus Series being minute.

(2nd). Permanent marks intersected from the principal stations with the large theodolite or fixed by one or more triangles observed with a smaller instrument.

(3rd). In addition to these triangulations a considerable amount of secondary work was executed during the progress of the Series in order to fix all the stations of the Sind Revenue Survey which could be identified and which fell within the limits of the principal triangulation, also the boundary and junction pillars of the States of Marwar, Khairpur, Jeysulmere, Sind and Baháwalpur, and several forts which had once been important in that part of the country. Owing to the nature of the country and the innumerable sand hills, auxiliary stations had to be established in nearly every case. In the season of 1876-77 observations were taken with a 7-inch theodolite by Mr. C. P. Torrens, and in 1879-80 by Captain Rogers with the same instrument. Owing to the desert nature of the country the same dearth of intersected points prevails on this Series as was noticed on the Jodhpore Meridional Series.

MALCOLM W. ROGERS, R.E.

August, 1884.

JODHPORE MERIDIONAL SERIES.

JODHPORE MERIDIONAL SERIES.

ALPHABETICAL LIST OF PRINCIPAL STATIONS.

Adori	XI.
Aukli	LII.
Bhada	XLV.
Bhádrájan	V.
Bhulan	XLIX.
Bijli	LVII.
Bikampur	XXXIII.
Bintli	XXIX.
Bithnok	XXXVIII.
Bonik (of the Karáchi Longitudinal Series).	XLI.
Borla	IX.
Borta	I.
Chamu	XVII.
Daichu	XIX.
Dhaula	II.
Dodo	X.
Dugur	XII.
Ekka	XXIII.
Girondi	XXXV.
Habib	XLVI.
Harban	XXVIII.
Hasan	LV.
Jalora	XXI.
Jambo	XXVI.
Jodasar	XLII.
Kaimsir (of the Sutlej Series).	XIX.
Kanda (of the Sutlej Series).	XXI.
Karamala	XLVII.
Ketu	XIII.
Khirsar	XLIV.
Khirwa	XXV.
Kundal	III.
Loharan	XVI.
Loháwat	XXII.
Malunga	XV.
Mandaula	IV.
Mankasar	XXXVI.
Mansa	LIII.
Marot	LIV.
Modia	XXXIX.
Mongolia	XXXI.
Mugrala	XLIII.
Nagar	VI.
Nok	XXX.
Omlo	XXIV.
Pabusar	XXXII.
Panchkot	LVIII.
Pelu	XVIII.
Phogala	XLVIII.
Phulasar	XXXIV.
Randu	LIX.
Ronesar	XL.
Sachu	XLI.
Samdari	VII.
Sirad	XXVII.
Soma	L.
Sorau	XX.
Sulkia Thalau	XIV.
Sultán	LVI.
Súnda (of the Karáchi Longitudinal Series).	XLIV.
Thob	VIII.
Telu	LI.
Uperthal	XXXVII.

JODHPORE MERIDIONAL SERIES.

NUMERICAL LIST OF PRINCIPAL STATIONS.

XLI (of the Karáchi Longitudinal Series).	Bonik.
XLIV (of the Karáchi Longitudinal Series).	Súnda.
I	Borta.
II	Dhaula.
III	Kundal.
IV	Mandaula.
V	Bhádrájan.
VI	Nagar.
VII	Samdari.
VIII	Thob.
IX	Borla.
X	Dodo.
XI	Adori.
XII	Dugur.
XIII	Ketu.
XIV	Sulkia Thalau.
XV	Malunga.
XVI	Loharan.
XVII	Chamu.
XVIII	Pelu.
XIX	Daichu.
XX	Sorau.
XXI	Jalora.
XXII	Loháwat.
XXIII	Ekka.
XXIV	Omlo.
XXV	Khirwa.
XXVI	Jambo.
XXVII	Sirad.
XXVIII	Harban.
XXIX	Bintli.
XXX	Nok.
XXXI	Mongolia.
XXXII	Pabusar.
XXXIII	Bikampur.
XXXIV	Phulasar.
XXXV	Girondi.
XXXVI	Mankasar.
XXXVII	Uperthal.
XXXVIII	Bithnok.
XXXIX	Modia.
XL	Ronesar.
XLI	Sachu.
XLII	Jodasar.
XLIII	Mugrala.
XLIV	Khirsar.
XLV	Bhada.
XLVI	Habib.
XLVII	Karamala.
XLVIII	Phogala.
XLIX	Bhulan.
L	Soma.
LI	Telu.
LII	Aukli.
LIII	Mansa.
LIV	Marot.
LV	Hasan.
LVI	Sultán.
LVII	Bijli.
LVIII	Panchkot.
LIX	Randu.
XIX (of the Sutlej Series).	Kaimsir.
XXI (of the Sutlej Series).	Kanda.

JODHPORE MERIDIONAL SERIES.

DESCRIPTION OF PRINCIPAL STATIONS.

The Principal Stations of this Series consist of circular masonry pillars from 3 to 4 feet in diameter for the large Theodolite to rest on, and in general are surrounded by a platform of stones and earth, or sand, on which the observatory tent was pitched. In certain instances the sand hills, on which several of the stations fell, did not afford a satisfactory foundation for the pillars; and piles were driven deep down on which the foundations were laid and the pillars built so that their surfaces were nearly flush with the level of the hill top. When this was the case a platform was not always necessary. Being almost invariably on the highest accessible points the pillars rarely required to be raised more than 3 or 4 feet. They contain mark-stones placed vertically over one another, the uppermost being generally flush with the surface: over this a rectangular protecting pillar, bearing a sufficiently accurate mark for Topographical and Revenue Survey purposes—as shown at page 74 of Volume II of the "*Account of the Operations, &c.*"—was erected after the completion of the observations.

The following descriptions have been compiled from those given by the officers who executed the Series. The orthography of such names of parganas, districts &c., as has been fixed by Government for Rajputana has been adhered to. A few details, such as the name of a village or pargana within which a station is situated, have been obtained from the returns furnished by the political authorities to whose charge the stations have been committed.

XLI.—(*Of the Karáchi Longitudinal Series*). Bonik Hill Station, lat. 25° 4′, long. 72° 54′—observed at in 1850 and 1873—is situated in a group of hills which are unconnected with the Aravalli range and lie 25 miles north of Mount Abu on the border of Marwar; pargana Jhara Kharul of the Sirohee territories. The station is fixed on the most prominent though not the most elevated hill of the group, being an acute peak crowned with large naked masses of granite of square outline. The platform is built upon and amongst these rocks, the upper surface of the pillar being 2 feet 9 inches below the highest one, *viz.*, that towards the north-west angle of the platform.

The pillar, which is surrounded by a platform of the usual construction, is solid, and contains three marks, one at the surface, the others 1 foot and 3 feet below it, the last being at the level of the foundation. When visited in 1872 prior to the commencement of the Jodhpore Meridional Series, the station of 1850 was found intact. The azimuths and distances of the surrounding villages are:—Wáan 190°, at foot of hill; Barwára 325°, miles 2; Andor 356°, miles 2·5; Modoni (temple) 83°, miles 7·3.

XLIV.—(*Of the Karáchi Longitudinal Series*). Súnda Hill Station, lat. 24° 47′, long. 72° 28′—observed at in 1851 and 1873—is situated on an isolated group of hills, about 24 miles W. by N. of Mount Abu. The southern half of this group, known as the Nímbáj hills, from the town of Nímbáj, which lies at their foot, belongs to the Sirohee territories. The northern portion, including the hill of Súnda, after which the station is named, is in taluk Jálor of the Jodhpore territories. The ascent commences at the small village of Usmat on the eastern side of the hill.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains three marks, one at the surface, the others 1·21 and 3·21 feet below it, the last being at the level of the foundation. When visited in 1872 prior to the commencement of the Jodhpore Meridional Series, the station of 1851 was found intact. The azimuths and distances of the surrounding villages are:—Warra 288°, miles 2·8; Víkanwa 240°, miles 4·7; Nímbáj (temple) 293°, miles 4·1; Rajiraua 155°, miles 6·0.

I. Borta Hill Station, lat. 25° 6′, long. 72° 23′—observed at in 1873—is on the highest part of a short range running N.E. and S.W., south of Borta village and 8 miles N.E. of Bhínmál, a large village. It is on the northern portion of the hill which is locally called Renáva. The road has been made from about a mile W. of the village and N.E. of the station. The station is in sub-division Bhínmál of taluk Jálor of the Jodhpore territories.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, one level with the hill top on a very large stone, and the other at the surface of the pillar which is 3·10 feet high. The azimuths and distances of the circumjacent villages are:—Pádru 127°, miles 2·8; Borta 224°, miles 1·2; Ledramír 351°, miles 2·7.

II. Dhaula Hill Station, lat. 25° 15′, long. 72° 42′—observed at in 1873—is situated on a small detached hill about 440 feet above the plain, the platform being on a mass of boulders on the eastern and highest portion. The hill, which is locally named Pansútia, is apparently a portion of the Ásarona hills, being the most southwesterly of all. The station derives its name from Dhaula village, in the lands of which it lies; it is in taluk Jálor of the Jodhpore territories. The large town and fort of Jálor are about 5·4 miles W.N.W. of the station.

The pillar, which is surrounded by a platform of the usual construction, contains two marks, the lower on the rock *in sitú*, and the upper in the surface of the pillar, which is 2·75 feet high. The azimuths and distances of the circumjacent villages are:—Bhaugal 109°, miles 2·9; Dhaula 224°, mile 1·0; Naranáwa 346°, miles 1·4.

III. Kundal Hill Station, lat. 25° 29′, long. 72° 22′—observed at in 1873—is on a hill locally called Waduwár and is on the peak which is the highest and most southerly, and most westerly but one, of a long range about 10 miles N. of the Sukri river, 16 miles N.W. of Jálor and 12 miles S. of Siwána village, extending in a curved line from Kanki to Mangi village. The hill on which the station is situated is about 1¼ miles S.W. of Kundal village from whence the ascent begins. It is in taluk Siwána of the Jodhpore territories. There is a higher hill, about 3 miles N., called Saura, or Mahádeo-ka-Bakra, which is the highest in that portion of the country.

The pillar, which is surrounded by a platform of the usual contruction, is solid and contains two marks, one on a huge boulder and flush with the surface of the hill, and the other at the surface of the pillar which is 3·33 feet high. The azimuths and distances of the circumjacent villages are:—Pádru 104°, miles 7·9; Kundal 171°, at foot of hill; Elana 301°, miles 8·5.

IV. Mandaula Hill Station, lat. 25° 25′, long. 71° 55′—observed at in 1873—is situated on a sand hill (locally called Ura) about 200 yards from the left bank of the Lúni river, and about two miles W. of the village of Mandaula. The station is in the lands of that village in taluk Maloni of the Jodhpore territories.

The pillar, which has no surrounding platform but is sunk so that its surface is level with the ground, is solid and contains two marks, one at the top and the other 3·25 feet below at the level of the foundation. The azimuths and distances of the cicumjacent villages are:—Harra 92°, mile 1; Koela 220°, miles 4; Mandaula 239°, miles 2·27.

V. Bhádrájan Hill Station, lat. 25° 36′, long. 72° 54′—observed at in 1873—is identical with the station of the same name of the Rajputana Topographical Survey. It is on the bastion of an old fort on the highest and most westerly peak of a small group of hills at the north-eastern foot of which lies the large village of Bhádrájan. The hill is locally called Dhumra and is in the Bhádrájan jágír, taluk Jodhpore, of the Jodhpore territories. The bastion on which the station is placed is 16 feet in diameter and the highest on the southern face of the fort.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, the lower on the rock *in sitú* and the upper in the surface of the pillar which is 3·17 feet high. The azimuths and distances of the circumjacent villages are:—Agalia 51°, miles 4·5; Ráma 186°, miles 4·1; Bhádrájan 270°, at foot of hill; and Koala 307°, miles 1·9.

VI. Nagar Hill Station, lat. 25° 47′, long. 72° 12′—observed at in 1873—is situated on one of three peaks locally called Vauki Taunka, on the western portion of a long low range running east and west about 3 miles S. of Lúni river and 5 miles S.W. of Bálotra. The station derives its name from the village of Nagar which lies at the foot of the hill on the north. The hill is difficult of ascent; it is in sub-division Jasol, talúk Maloni of the Jodhpore territories.

The pillar, which is surrounded by a platform of irregular shape, is solid and contains two marks, one in the foundation and the other in the surface of the pillar which is 3 feet high. The azimuths and distances of the circumjacent villages are:—Nagar 147°, at foot of hill; Temawa 215°, miles 3·5; and Tápra 354°, miles 3·95.

VII. Samdari Hill Station, lat. 25° 49′, long. 72° 37′—observed at in 1873—is on a small isolated, irregularly shaped hill locally named Mátalalasi, on the north bank of the river Lúni and close to the large village of Samdari, in taluk Siwána of the Jodhpore territories.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains three marks, one in the foundation, 2 feet below the ground, another flush with the hill top and the third on the surface of the pillar; the difference of height between the upper and lower marks is 3·13 feet. The azimuths and distances of the circumjacent villages are:—Devalihari 66°, miles 1·7; Mokrundi 180°, miles 2·25; Deopura 243°, miles 2·1; and Kamáwas 335°, miles 2·6.

VIII. Thob Hill Station, lat. 26° 3′, long. 72°, 25′—observed at in 1873—is on a low hill, about half a mile W. of the large village of Thob and 10 miles N. of Pachbudra village, in taluk Siwána of the Jodhpore territories. There is a well of fairly good water near the village.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, one in the foundation, flush with the hill top and the other in the surface of the pillar which is 3 feet high. The azimuths and distances of the circumjacent villages are:—Havadhan Roáro 35°, miles 2·95; Thob 266°, mile 0·63; and Roáro 348°, miles 2·22.

IX. Borla Hill Station, lat. 26° 9′, long. 72° 7′—observed at in 1873— derives its name from the local name of the sand hill on which it stands, and which is about 3 miles N.W. from the village of Lapúndra to the lands of which it appertains. It is in a desolate and barren country the nearest village being Lapúndra. Perao village lies to the N.E. distant 3·1 miles. The water of the villages is hardly drinkable, but a small supply for a short time may be obtained from the villagers' tanks. The station lies about 16 miles W. of Patodi in taluk Maloni of the Jodhpore territories.

The pillar, which is built on a foundation laid on wooden stakes driven into the ground which had previously been excavated to a depth of 4 feet, is solid and contains two marks, one in the foundation and the other in the surface of the pillar 3 feet above it. There is no platform.

X. Dodo Hill Station, lat. 26° 4′, long. 72° 51′—observed at in 1873—is on a flat rock to the west of higher but unsuitable rocks on the western side of a low irregular rocky hill about 20 miles south-east of Jodhpore, near the road from Jasol and Bálotra to Jodhpore. The hill is in the lands of Doda-Lonasar village in taluk Jodhpore of the Jodhpore territories. Water can be obtained up to the end of March from a tank ⅓ mile to the north.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, the lower on the rock *in sitú* and the upper in the surface of the pillar 3·33 feet above it. The azimuths and distances of the circumjacent villages are:—Selawa 91°, miles 2·2; Lauowás 160°, miles 1·8; Kalijára 354°, miles 1·4; and Katowás 186°, miles 4·2.

XI. Adori Hill Station, lat. 26° 20′, long. 72° 23′—observed at in 1873—is on a small rocky hill about 300 feet above the level of the surrounding country and situated amongst the sand hills, between the villages of Shera and Sheráda. It is in the lands of Tína village in taluk Jodhpore of the Jodhpore territories.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, the lower on the rock *in sitú* and the upper at the surface of the pillar which is 2·08 feet high. The azimuths and distances of the circumjacent villages are:—Shera 73°, miles 2·5; Tína 101°, miles 1·5; Sheráda 263°, miles 2·0; and Soítra 328°, miles 4·0.

XII. Dugur Hill Station, lat. 26° 17′, long. 72° 42′—observed at in 1873—is situated on a conical rocky hill, the northernmost of a range of isolated hills running north and south about 23 miles west of Jodhpore city. The ascent of the hill is from the village of Dugur. There is a tank of good water about ½ a mile from the hill. It is in taluk Jodhpore of the Jodhpore territories.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, one on the rock *in sitû* and the other on the surface of the pillar which is 1 foot high. The azimuths and distances of the circumjacent villages are:—Angolai 105°, miles 1·34; Batila 253°, miles 3·22; and Sironi 343°, miles 2·99.

XIII. Ketu Hill Station, lat. 26° 31′, long. 72° 33′—observed at in 1873—is situated on a rocky hill, distant about 4 miles in an easterly direction from the village of Ketu, and about 3 miles in a westerly direction from the village of Belwa. It is in taluk Ketu of the Jodhpore territories. The water is good but scarce in the hot weather.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, one on the rock *in sitû* and the other at the surface of the pillar which is 3 feet high. Kirja village lies S. W. by W., at a distance of 10·7 miles.

XIV. Sulkia Thalau Hill Station, lat. 26° 31′, long. 72° 20′—observed at in 1873—is on the westernmost knoll of a range of sand hills, and is distant 2 miles to the N.E. from the large village of Sulkia Thalau in taluk Jodhpore of the Jodhpore territories. There is no good water near the station. The water in the village of Sulkia Thalau is brackish.

The pillar, which has no surrounding platform, but is sunk so that its surface is level with the ground, is solid and contains three marks, one at the bottom of the foundation, a second 2 feet above it, and a third in the surface of the pillar, which is 3·04 feet high. The azimuths and distances of the circumjacent villages are:—Loharan 205°, miles 10·5; and Kirja 325°, miles 8·5.

XV. Malunga Hill Station, lat. 26° 29′, long. 72° 49′—observed at in 1874—is situated on a conspicuous conical-shaped rocky hill which rises to the height of 320 feet above the surrounding country. The small hamlet of Digari lies at its foot to the south-east, and the village of Malunga is distant 2·4 miles and 58° E. of S. The water at the village of Malunga is good. The station lies within the boundary of the village of Malunga, taluk Ketu of the Jodhpore territories.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, one at the surface and the other at the bottom of the pillar which is 3 feet high. The azimuths and distances of the circumjacent places are:—Báro 255°, miles 2 nearly; and Jodhpore city 311°, miles 20·1.

XVI. Loharan Hill Station, lat. 26° 40′, long. 72° 25′—observed at in 1874—is situated on a low range of sand hills at a distance of ¾ of a mile in a direction 22° E. of N. from the village of Loharan. It is within the boundary of the village of Loharan in taluk Ketu of the Jodhpore territories. There is no good water near the station.

The pillar, which is solid and 3 feet high, is built on a foundation 2 feet thick. There are three mark-stones, one at the bottom of the foundation, a second 2 feet above it and a third in the surface of the pillar. The sand had to be heaped up 1½ feet above the former hill top level, so as to form a platform flush with the upper surface of the pillar. The bearings and distances of the circumjacent villages are:—Kanudia W.N.W., about 4 miles; Laurta N.E., about 3 miles; and Daidu E.S.E., about 8 miles.

XVII. Chamu Hill Station, lat. 26° 40′, long. 72° 38′—observed at in 1874—is distant about 1 mile in a direction 42° E. of N. from the village of Chamu, and is situated on the highest sand hill in the vicinity of that village. It lies within the boundary of the village of Chamu in taluk Ketu of the Jodhpore territories.

The pillar, which is solid and 3 feet high, has been sunk so that its surface is level with the ground, and has been built on a circular foundation 6 feet in diameter and 1 foot in thickness, resting on wooden piles. It contains two marks, one at the surface and the other at the bottom of the pillar. Barnau village lies about 4 miles N.W.

XVIII. Pelu Hill Station, lat. 26° 49′, long. 72° 30′—observed at in 1874—is situated on a small sand hill, and is distant 2½ miles in a direction 30° E. of S. from the village of Pelu. It lies on the boundary between the villages of Pelu and Marla in taluk Ketu of the Jodhpore territories.

The pillar, which is solid and 3 feet high, has been sunk so that its surface is level with the ground and has been built upon a circular foundation 6 feet in diameter and 1 foot in thickness, resting on wooden piles. It contains two marks, one at the surface and the other at the bottom of the pillar. The azimuth and distance of Bákri village are 235°, miles 10·8.

XIX. Daichu Hill Station, lat. 26° 49′, long. 72° 20′—observed at in 1874—is situated at the eastern extremity of a long range of sand hills, and lies about 3½ miles in a north-westerly direction from the large village of Daichu and 2 miles in a direction 7° 30′ W. of N. from the village of Ságra. It is on the lands of the village of Daichu, in taluk Ketu of the Jodhpore territories.

The pillar, which is solid and 3 feet high, has been sunk so that its surface is level with the ground and has been built on a foundation 2 feet thick. It contains three mark-stones, one in the upper surface of the pillar, the second at the bottom of the pillar, and the third at the bottom of the foundation. The azimuths and distances of the circumjacent villages are:—Marla 149°, miles 4·7; and Koru 191°, miles 7·2.

XX. Sorau Hill Station, lat. 26° 50′, long. 72° 42′—observed at in 1874—is situated on the highest knoll of a rather elevated sand ridge, and is distant $2\frac{1}{2}$ miles in a direction 68° E. of N. from the good sized village of Sorau. It is on the lands of the village of Sorau, in pargana Phalodi of the Jodhpore territories.

The pillar, which is solid and 3·08 feet high, has been sunk so that its surface is level with the ground, and has been built on a foundation 2 feet thick. It contains three mark-stones, one in the upper surface of the pillar, the second at the bottom of the pillar, and the third at the bottom of the foundation. The azimuth and distance of Bákri village are 138° 30′, miles 5·5.

XXI. Jalora Hill Station, lat. 26° 58′, long. 72° 25′—observed at in 1874—is situated on a rocky hill which has but a small elevation above the surrounding country. It is distant 2·7 miles in a direction 33° W. of S. from the village of Jalora, and is on the lands of that village in pargana Phalodi of the Jodhpore territories.

The pillar, which is surrounded by a platform of the usual construction, is solid and contains two marks, one in the surface and the other in the foundation 4 feet below. The azimuths and distances of the circumjacent villages are;—Koru 51°, miles 5·4; and Dhaiakor 328° 30′, miles 5·4.

XXII. Loháwat Hill Station, lat. 27° 0′, long. 72° 36′—observed at in 1874—is situated on a conspicuous conical-shaped rocky hill which rises to a height of 250 feet above the rather elevated piece of country which immediately surrounds it. It lies in a direction 80° W. of N. from the Vishnui portion and 65° W. of N. from the Ját portion of the village of Loháwat, and is distant 2·4 miles from a point about half way between these parts of the village. It is within the boundary of the village of Loháwat in pargana Phalodi of the Jodhpore territories. Good water can be obtained from the village of Loháwat from a well 333 feet deep.

The pillar, which is surrounded by a platform of the usual construction, is solid, 3 feet high and contains two marks, one at its surface and the other at the bottom of the pillar. The azimuth and distance of Bákri village are 332°, miles 7·2.

XXIII. Ekka Hill Station, lat. 27° 6′, long. 72° 22′—observed at in 1874—is situated on the highest of a low group of sand hills and is distant 1·1 miles in a direction S.W. from the village of Ekka and 3·2 miles in a direction 36° W. of S. from the fort in the town of Phalodi. It is on the lands of the village of Ekka in pargana Phalodi of the Jodhpore territories.

The pillar, which is solid and 3 feet high, has been sunk so that its surface is level with the ground. It has been built on a foundation 1 foot thick which rests on piles driven into the sand. There are two mark-stones, one at the top and the other at the bottom of the pillar. The azimuth and distance of Mokheri village are 27° 30′, miles 2·4.

XXIV. Omlo Hill Station, lat. 27° 7′, long. 72° 31′—observed at in 1874—is situated on a low stony hill and is distant 0·8 of a mile from the village of Omlo in a direction 31° W. of S. It is on the lands of the village of Omlo in pargana Phalodi of the Jodhpore territories.

The pillar, which is surrounded by a platform of the usual construction, is solid, 5 feet high and rests on a foundation 1 foot thick. It contains two marks, one at the top and the other at the bottom. The azimuths and distances of the circumjacent places are:—Phalodi town 100°, miles 7·3; and Kicham village 108° 15′, miles 4·1.

XXV. Khirwa Hill Station, lat. 27° 17′, long. 72° 24′—observed at in 1874—is situated on land of the village of Khirwa in pargana Báp of the Jeysulmere territories. The station is built on one of a group of sand knolls at a distance of about $2\frac{1}{2}$ miles in a direction 65° 30′ E. of S. from the village of Khirwa.

The pillar, which is surrounded by a rough platform of sand covered with a layer of stones 1 foot thick, is solid and 3 feet high and has been sunk so that its surface is flush with the level of the platform. It has been built on a foundation 2 feet thick. It contains three mark-stones, one in the upper surface of the pillar, the second at the bottom of the pillar and the third at the bottom of the foundation. The azimuths and distances of the circumjacent places are:—Báp village of the Jeysulmere territories 180° 27′, miles 6·64; Agar village of the Jodhpore territories 281°, miles 5·75; and Phalodi town of the latter territories 357° 30′, miles 10·0.

XXVI. Jambo Hill Station, lat. 27° 16′, long. 72° 34′—observed at in 1874—is situated on a long sand ridge which runs in a N.E. and S.W. direction. It is distant 2·4 miles in a direction due south from the village of Jambo and is on the lands of Naneo village in pargana Phalodi of the Jodhpore territories.

The pillar, which is surrounded by a rough platform of sand covered with a layer of stones 1 foot thick, is solid and 3 feet high and has been sunk so that its surface is flush with the level of the platform. It has been built on a foundation 2 feet thick. It contains three mark-stones, one in the upper surface of the pillar, the second at the bottom of the pillar and the third at the bottom of the foundation. The azimuths and distances of the circumjacent places are:—Phalodi town 45°, miles 13·75; Sawanti village 76° 30′, miles 3; and Báp village of the Jeysulmere territories 125°, miles 12·2.

XXVII. Sirad Platform Station, lat. 27° 26′, long. 72° 28′—observed at in 1874—is situated on an extensive flat, the soil of which is very hard and stony. It is on the lands of the village of Bara Sirad in pargana Nok of the Jeysulmere territories. The nearest village is Nauagaon, from which the station is distant 3¼ miles in a direction 50° E. of S.

The pillar, which is surrounded by a platform of the usual construction, is solid and 3·94 feet high, resting on a foundation 2 feet thick the upper surface of which is flush with the surface of the ground. There are three marks, one on the upper surface of a large stone in the bottom of the foundation, the second 7 inches above it and level with the surface of the ground, and the third in the upper surface of the pillar. The azimuths and distances of the circumjacent villages are;—Báp 54°, miles 6·0; and Sirad 169° 30′, miles 3·9.

XXVIII. Harban (or Ghatori Mál) Hill Station, lat. 27° 26′, long. 72° 17′—observed at in 1874—is situated on a rocky hillock about 50 yards from which is another, surmounted by a stone pillar bearing an inscription. It is distant from Harban village 3·9 miles, in a direction 24° W. of N. It is on the lands of the village of Báp in pargana Báp of the Jeysulmere territories.

The pillar, which is surrounded by a platform of the usual construction, is solid and 3 feet high, resting on a foundation 2 feet thick. There are two mark-stones, one in the upper surface of the pillar and the other at the ground level. The azimuths and distances of the circumjacent villages are:—Sheora 211° 30′, miles 8; Báp 299°, miles 8·3; and Mondáli 136° 30′, miles 2·75.

XXIX. Bintli Hill Station, lat. 27° 26′, long. 72° 39′—observed at in 1874—is named after some fields that are in its neighbourhood, and is built on the highest sand hill in that part of the country. The boundary between the Jodhpore and Jeysulmere states passes close to the station on its eastern side. The nearest village is Partáb Sing-ka-sirad from which the station is distant 6·3 miles in a direction 72° 30′ E. of S. The station is on the lands of that village in pargana Nok of the Jeysulmere territories.

The pillar, which is surrounded by a rough platform of sand covered with a layer of stones 1 foot thick, is solid and 3 feet high and has been sunk so that its surface is flush with the level of the platform. It has been built on a foundation 2 feet thick. It contains three mark-stones, one in the upper surface of the pillar, the second at the bottom of the pillar and the third at the bottom of the foundation. The azimuths and distances of the circumjacent villages are;—Jambo in the Jodhpore territories 32°, miles 9·6; and Modia in the Jeysulmere territories 192° 30′, miles 12·0.

XXX. Nok Hill Station, lat. 27° 36′, long. 72° 20′—observed at in 1874—is on the easternmost of a number of low sand knolls near the village of Nok. The knoll on which the station has been built is known as Mátá ji khejri-ka-dhúra. The station is on the lands of the village of Nok, from which it is distant 3·6 miles in a direction 45° 30′ E. of N; pargana Nok of the Jeysulmere territories. The water obtained from its wells is good, and the supply never fails.

The pillar, which is surrounded by a rough platform of sand covered with a layer of stones 1 foot thick, is solid and 3 feet high, and has been sunk so that its surface is flush with the level of the platform. It has been built on a foundation 2 feet thick. It contains three mark-stones, one in the upper surface of the pillar, the second at the bottom of the pillar and the third at the bottom of the foundation. The azimuth and distance of Sheora village are 356° 30′, miles 4·8.

XXXI. Mongolia Platform Station, lat. 27° 38′, long. 72° 32′—observed at in 1874—is situated on a slight rise near the spot where the former hamlet of Mongolia once stood. The site of that village is still marked by a few plum and other trees. The nearest village is Girájsúr from which the station is distant 6¾ miles in a direction 25° W. of S. The station is on the lands of Nok village in pargana Nok of the Jeysulmere territories.

The pillar, which is surrounded by a rough platform of sand covered with a layer of stones 1 foot thick, is solid and 3 feet high, and has been sunk so that its surface is flush with the level of the platform. It has been built on a foundation 2 feet thick and contains three mark-stones, one in the upper surface of the pillar, the second at the bottom of the pillar and the third at the bottom of the foundation. The azimuths and distances of the circumjacent villages are:—Sirad 21°, miles 11·6; Nokra 270° 30′, miles 9·5; and Trijunction Pillar on Jodhpore, Bickaneer and Jeysulmere boundary 281°, miles 12·6.

XXXII. Pabusar Hill Station, lat. 27° 44′, long. 72° 23′—observed at in 1874—is called after the village of that name which is distant 0·35 mile at an azimuth of 255°. It is on the northern end of a sand hill about 52·5 feet high terminating abruptly at the station. The path from Bikampur to Pabusar skirts its base. The village of Pabusar is very small and has a well of brackish water; fresh water comes from Nok. The village of Kolasir a little larger lies about 5 miles to the E. The station is in that portion of pargana Nok which belongs to the Thakur of Bikampur in the Jeysulmere territories.

The pillar is 3 feet high having a foundation of 2 feet with three mark-stones, one at the bottom, another 1 foot above it and the upper one at the surface. No mention is made in the records of the existence of a platform.

XXXIII. Bikampur Hill Station, lat. 27° 43′, long. 72° 14′—observed at in 1874—is on the highest point of a sand ridge about 64·5 feet in height, the nearest village being Bikampur distant 4·9 miles at an azimuth of 131°. The fort, or Thakur's residence, built of white stone can be seen from the station. The water at Bikampur is brackish in the wells, a small quantity for drinking is stored in small excavations. The station is in the lands of the Thakur of Bikampur, in pargana Nok of the Jeysulmere territories.

The pillar is solid and 3 feet high exclusive of foundation, and has three mark-stones, one at the bottom, the second 9 inches above it and the third at the surface. No mention is made in the records of the existence of a platform. The bearings and distances of the circumjacent villages are:—Borono S.W., miles 8; and Charanala N.N.W., miles 8.

XXXIV. Phulasar Hill Station, lat. 27° 52′, long. 72° 22′—observed at in 1874-75—is named after a small village of Vishnu worshippers, which is distant 5·3 miles at an azimuth of 174°. There is a dry tank called Natheri about 1 mile south; and the station itself is on the highest sand hill in the vicinity. The only village seen is Phulasar. There is a well of brackish water at Phulasar but no good water nearer than Bikampur. The station is in the lands of the village of Gogaliala, belonging to the Thakur of Bikampur, in pargana Nok of the Jeysulmere territories.

The pillar, which is surrounded by a rough platform of sand and stones, is solid and 3 feet high exclusive of the foundation. It has three mark-stones, one at the base on a large stone, another 9 inches above it and the third at the surface. The approximate azimuths and distances of the circumjacent villages are;—Charanala 81°, miles 6; and Gogaliala 47°, miles 9.

XXXV. Girondi Hill Station, lat. 27° 50′, long. 72° 32′—observed at in 1875—is on a high sand hill locally called Gadalet-ka-dhúra near the boundary of Jeysulmere. Girondi village is distant 1·72 miles at an azimuth of 336°. The station is in the lands of the village of Nok in pargana Nok, of the Jeysulmere territories. There are wells of brackish water at Girondi and drinking water can be obtained from the chunam tanks.

The pillar, which is surrounded by a rough platform of stones and sand, is 3 feet high with a foundation of 2 feet and has three mark-stones, one in the foundation, another 7 inches above it flush with the hill top and the third at the surface. The azimuths and distances of the circumjacent villages are:—Ghariala (which is visible from the station and is in the Bickaneer territories) 314°, miles 7·26; and Girajsar (approximately) 338°, miles 7.

XXXVI. Mankasar Hill Station, lat. 28° 0′, long. 72° 31′—observed at in 1875—is on a sand ridge 2·62 miles from Mankasar village which lies at an azimuth of 216°. All the villages about are small and have wells of brackish water, drinking water being obtained from tanks. Bangarsar is the nearest village for supplies. The station is on the lands of Nok village, in pargana Nok of the Jeysulmere territories.

The pillar, which is surrounded by a platform of stones and sand, is solid and 3·71 feet high with a 2 feet foundation. It contains three mark-stones, one at the bottom, another 2 feet above it flush with the hill surface and the third at the surface. The approximate azimuth and distance of Bangarsar village are 287°, miles 8 nearly.

XXXVII. Uperthal Hill Station, lat. 28° 0′, long. 72° 17′—observed at in 1875—is on a very high sand hill called by the natives Uperthal from its being the highest in those parts; it is 170 feet above the plain to the east and commands a good view all round. The station is on the lands of Nok village, in pargana Nok of the Jeysulmere territories. The water at Goru is brackish.

The pillar is solid and 3·04 feet high exclusive of the foundation. It contains three mark-stones, one at the bottom, another 7 inches above it and the third at the top. The bearings and distances of the circumjacent villages are:—Goru (a Vishnu village) S.E., miles 1·16; Nargroh W., about miles 10; Phulasar S.S.E., miles 6; and Barsalpur the only large village N.N.W., miles 14·6.

XXXVIII. Bithnok Hill Station, lat. 27° 53′ long. 72° 42′—observed at in 1875—is on the highest sand hill of a range running N. and S. locally called Gajath Thal a few hundred yards south of a cart track from Bithnok to Bagu village. Bithnok is a large village with good water. The station is in the lands of that village in pargana Magra of the Bickaneer territories.

The pillar, which is surrounded by a platform of sand and stones, is solid and 3·5 feet above the ground with a foundation and has two mark-stones, one at the bottom and the other 2 feet above it level with the top of the hill. No mention is made of a mark-stone having been placed at the surface of the pillar. The azimuths and distances of the circumjacent villages are:—Bangarsar (approximately) 141°, miles 9 nearly; Bithnok 275°, miles 5·22; and Mandal 323°, miles 10 nearly.

XXXIX. Modia Hill Station, lat. 28° 15′, long. 72° 27′—observed at in 1875—is on a very conspicuous, high, long sand hill overlooking the country on all sides, 11·88 miles S.E. by E. of the large village of Barsalpur. There are no villages near, only dhanis, *e.i*, cold weather temporary villages; of these Modia is the nearest. The station is in the lands of the Rao of Barsalpur in pargana Nok of the Jeysulmere territories.

The pillar, which is surrounded by a paltform of sand, is solid and 4 feet in height above the ground and has three mark-stones, one in the lowest part of the foundation, the second 2 feet above it flush with the hill top and the third at the surface of the pillar. The approximate azimuths and distances of the circumjacent villages are:—Modia 29°, miles 2·82; Bhati Walla 59°, miles 5·61; and Bhim Walla 104°, miles 4.

XL. Ronesar Hill Station, lat. 28° 3′, long. 72° 44′—observed at in 1875—is on a high flat and extensive sand hill, not on the very highest point on account of the ray to Modia H. S. No villages are visible from the station. Water and supplies are scarce in the small villages around. The station is on the lands of the village of Ronesar in pargana Magra of the Bickaneer territories.

The pillar, which is surrounded by a platform of stones and sand, is solid and 3 feet high above the ground and has three mark-stones, one at the bottom of the foundation, the second 1 foot above it flush with the ground and the third on the top of the pillar. The approximate azimuths and distances of the circumjacent villages are:—Ronesar 314°, miles 6; and Angnu 180°, miles 6.

XLI. Sachu Hill Station, lat. 28° 15′, long. 72° 7′—observed at in 1875—is on a sand hill 183·9 feet high and 10·29 miles distant from the large village of Barsalpur to the N.N.W.: the cart track from thence to Sachu village runs about 1 mile S. of the hill. The station is on the lands of the village of Sachu which belongs to the Rao of Barsalpur in pargana Nok of the Jeysulmere territories. The well water at Sachu is drinkable.

The pillar, which is surrounded by a platform of stones and earth, is solid and 3·83 feet high with a foundation of 1 foot. There are three mark-stones, one at the bottom of the foundation, the second 11 inches above this flush with the hill top and the third at the surface of the pillar. Sachu village is distant 2·69 miles at an azimuth of 54°.

XLII. Jodasar Hill Station, lat. 28° 18′, long. 72° 44′—observed at in 1875—is on a high sand hill called by the natives Keridi dhúra, and is 6·1 miles E. of the village of Jodasar and about 8 miles S.S.E. of Ramra village. The station is on the lands of Jodasar village which belongs to the Rao of Pungal in the Bickaneer territories. The water at Jodasar village is brackish. Good water has to be brought from Pungal which is 15 miles distant to the N.E.

The pillar, which is surrounded by a platform of stones and sand, is solid and 5·06 feet high with a foundation of 1·75 feet. It has three mark-stones, one on the top of the foundation, the second 2·64 feet above it and the third 2·42 feet above the second at the surface of the pillar.

XLIII. Mugrala Hill Station, lat. 28° 31′, long. 72° 25′—observed at in 1875—is on a high sand hill called Mugrala. It is in the lands of the village of Akasar in the estate of the Rao of Pungal in the Bickaneer territories. The water at Akasar and Siasar is very brackish, at Balhar slightly better, at Rachni there is a small tank. Besides this there is no good water nearer than Bhiawala toba (tank), 24 miles distant to the N.N.W., in the Baháwalpur territories.

The pillar is solid and 5·17 feet high, with a foundation, which with the pillar contains 5 mark-stones, the first at the bottom of the foundation, the second 2 feet above it, the third 0·50 foot above the second, and flush with the hill surface, the fourth 2·50 feet above the third, and the fifth 2·67 feet above the fourth and flush with the upper surface of the pillar. The bearings and distances of the circumjacent villages are:—Akasar N.E., miles 4·8; Rachni S.W., miles 8·46; Balhar S., miles 8; and Siasar N.E., miles 10.

XLIV. Khirsar Hill Station, lat. 28° 30′, long. 72° 42′—observed at in 1875—derives its name from Khirsar village in the lands of which it lies in pargana Pungal of the Bickaneer territories. The hill slopes gently from the south and terminates abruptly to the north being there 186 feet above the adjacent plain. The path from Dattohar to Pungal runs south of the hill. The water of Khirsar village is brackish, drinking water comes from Pungal.

The pillar, which is surrounded by a platform of stones and sand, is solid and 5·15 feet high with a 1 foot foundation, and has three mark-stones, one at the top of the foundation, a second 2·54 feet above it and the third 2·60 feet above the second flush with the top of the pillar. The approximate bearings and distances of the circumjacent villages are:—Khirsar E. by S., miles 3·37; Dattohar S.W. by S., miles 10·05; Pungal E., miles 9·5; and Ramra S., miles 6 nearly.

XLV. Bhada Hill Station, lat. 28° 43′, long. 72° 36′—observed at in 1875—is on the highest point of an extensive sand hill with many spurs. It is on the lands of Bhada village belonging to the Rao of Pungal in the Bickaneer territories. The track from Pungal to Maujgarh is a little to the north. The water at Bhada is very brackish, at Bheria and Siasar slightly so.

The pillar, which is surrounded by a platform of stones and sand, is solid, 3 feet high with 1 foot foundation and has two mark-stones, one on the top of the foundation flush with the hill top and the second 3 feet above it at the surface of the pillar. The azimuths and distances of the circumjacent places are:—Bhada village 8°, miles 2·90; Siasar village (approximately) 45°, miles 8 nearly; and Bheria well 273°, miles 6·40.

XLVI. Habib Hill Station, lat. 28° 44′, long. 72° 23′—observed at in 1875—is on a low flat-topped hill in the desert near no village. The station is in the lands of the village of Maujgarh (24 miles N.N.W.) in thána Maujgarh, pargana Khairpur of the Baháwalpur territories.

The pillar is solid and 5·33 feet high exclusive of a 2 feet foundation and has three marks, one on the top of the foundation flush with the hill top, the second 2·33 feet above the first and the third at the surface of the pillar 3 feet above the second. The boundary between Bickaneer and Baháwalpur runs near the station and the nearest visible boundary pillars have the following azimuths and distances:—No. 1, 299°, mile 0·89; No. 2, 270°, miles 1·13; No. 3, 242°, miles 3·23. The approximate bearings and distances of neighbouring places are:—Bhiawala toba (tank) N.N.W., miles 8; and Bhaian-kí-verah (well) S.E., miles 9.

XLVII. Karamala Hill Station, lat. 28° 45′, long. 72° 48′—observed at in 1875—is on a hill which rises gradually from the well at Karamala village, the water of which is slightly brackish. It is on the lands of that village which belongs to the Rao of Pungal in the Bickaneer territories.

The pillar, which is surrounded by a platform of stones and sand, is 3 feet high with 1 foot foundation and has two mark-stones, one on the top of the foundation flush with the hill surface and the second 3 feet above it at the surface of the pillar. The approximate bearings and distances of the following places are:—Alden-kí-verah (well) S., miles 6 nearly; Naishera S.S.W., miles 8; Karamala well S.W., mile 0·68; and Rakasam well E. by S., mile 0·97.

XLVIII. Phogala Hill Station, lat. 28° 51′, long. 72° 28′—observed at in 1875—is on a low sand hill called either "Tappiwala dhúra" or Phogala from the numerous Phog trees on it. It is in the desert in the lands of Bhiawala village in thána Maujgarh of the Baháwalpur state and pargana. There are a number of small tanks in the neighbourhood which dry up about January.

The pillar is solid and sunk in the ground so that its top is flush with the hill surface: it has two marks, one at the surface of the pillar and a second 4·25 feet below it, on the second lowest course of bricks. The Bickaneer and Baháwalpur boundary runs near the station, the three nearest visible boundary pillars have the following azimuths and distances:—No. 1, 356° 51′, miles 3·78; No. 2, 348° 33′, miles 3·64; No. 3, 3° 33′, miles 4·01. Bhiawala toba (tank) is 8 miles W., and Maujgarh 20 miles N.W.

XLIX. Bhulan Hill Station, lat. 28° 57′, long. 72° 41′—observed at in 1875—is on a rising ground 4 miles S.S.W. of Bhulan tank and about ½ mile S.S.W. of Karamala small tank (both dry in February) in the heart of the desert. It is on the lands of Bhulan hamlet thána Marot; pargana Khairpur of the Baháwalpur territories.

The pillar, which is surrounded by a platform of sundried bricks and sand, is solid and 3 feet high having three marks on bricks, one at the very bottom of the foundation, one 2 feet above it flush with the surface of the hill and the third 3 feet above the second, at the surface of the pillar. Three of the pillars on the boundary of Bikaneer and Baháwalpur have azimuths and distances as follows:—No. 1, 340° 47′, miles 2·39; No. 2, 316° 54′, miles 2·38; and No. 3, 1° 15′, miles 2.78. Mírgarh village lies 15 miles N.; Phulera 15 miles N.E.; and Sakhi in Bickaneer 14 miles E., the three nearest places at which drinkable water can be obtained.

L. Soma Hill Station, lat. 29° 2′, long. 72° 30′—observed at in 1875—is on a small mound on the highest sand hill 5·88 miles, 23° E. of S. of Soma well hamlet and about 5 miles E.S.E. of Jalalsar well hamlet and about 10 miles S. of Marot town. The path from Marot to Pungal in Bickaneer passes about a mile and a half E. of the hill. The station is in the lands of Soma hamlet; thána Marot, pargana Khairpur, in the Baháwalpur territories. The water at Soma and Jalalsar is undrinkable; all supplies of water are got from Marot.

The pillar, which is surrounded by a platform of sundried bricks and sand, is solid and 3·15 feet high with a foundation of 1·75 feet; it has three marks, one at the bottom of the foundation, another 1·75 feet above it and the third 3·15 feet above the second, at the surface of the pillar.

LI. Telu Hill Station, lat. 28° 56′, long. 72° 17′—observed at in 1875—is on a sand rise of ground hardly to be called a hill, about 6 miles N. of Bhiawala tank and 7·77 miles S.E. of Maujgarh town. There are two old mud towers near Telu from which the station takes its name, distant 0·55 of a mile at an azimuth of 86° 16′. It is in thána Maujgarh, pargana and state Baháwalpur. Water is obtained from either Bhiawala or Maujgarh.

The pillar, which is surrounded by a platform of sundried bricks and sand, is solid and 5 feet high with a 2·5 feet foundation. There are three mark-stones, one at the bottom of the foundation, the second 2½ feet above it flush with the hill top and the third 5 feet above the second at the surface of the pillar. The azimuth and distance of Gidarwala village are 180° 45′, miles 2·37.

LII. Aukli Hill Station, lat. 29° 4′, long. 72° 40′—observed at in 1875—is on a black looking hill with plenty of shrubs on the top, about 5 miles N.W. of Bhulan tank which dries up in January, in pargana Khairpur, thána Marot, and state Baháwalpur. Water is brought from Mírgarh.

The pillar, which is surrounded by a platform of sundried bricks and sand, is solid and 3·52 feet high having three mark-stones, one at the bottom of the pillar, a second 2·46 feet above it and flush with the hill top, and the third 1·06 feet above the second at the surface of the pillar. The azimuths and distances of the circumjacent places are:—Jamgarh 144° 58′, miles 8·2; Mírgarh 177° 38′, miles 7·2; and Kheniwala Thul (an old mud tower) 196° 25′, miles 4·25.

LIII. Mansa Hill Station, lat. 29° 5′, long. 72° 17′—observed at in 1875—is 2 miles E. of a higher sand hill called by this same on a loose, shifting sand knoll, having no vegetation on the top, but being the best procurable. The country here is more or less a plain, with small rises and gentle slopes. The station is in the lands of Chápu village; in thána Maujgarh, pargana and state Baháwalpur. Water is obtained from Kundai wells 3 and 4 miles east and from Chápu village.

The pillar, which is surrounded by a platform of sundried bricks and sand, is solid and sunk into the hill. It is 5·08 feet high, with three mark-stones, one at the bottom, a second 2·62 feet above it and the third 2·46 feet above the second at the surface of the pillar. The approximate bearings and distances of the circumjacent places are:—Maujgarh town S.W., miles 8·2; Khirsar hamlet N.W., miles 4; and Chápu village N., miles 4·51.

LIV. Marot Station, lat. 29° 11′, long. 72° 29′—observed at in 1875—is on the fort on the highest mud bastion at the S.E. corner which is about 150 feet above the ground. The fort which is of mud, about 725 feet square is quite in ruins and the town lies partly within and partly without the walls. The bastion on which the station stands is of solid clay and is approached by a ramp. It is in pargana Khairpur of the Baháwalpur state. There are a tank and wells at this place.

The pillar is solid and has been sunk in the bastion; it is 4·25 feet deep with two marks, the lower at the bottom of the pillar and the upper 4·25 feet above it at the surface of the pillar.

LV. Hasan Hill Station, lat. 29° 14′, long. 72° 19′—observed at in 1875—is in the desert on a ridge called Hasanwala tibba the top of which is loose sand, 12·6 miles W. 20° N. of Marot town and about 6 miles N. of Chápu wells. The station is in the lands of Chápu village, thána Marot, division Khairpur, and state Baháwalpur.

The pillar, which is surrounded by a low platform of bricks and sand, is solid and 3 feet deep with 3 mark-stones, one at the bottom of the pillar, a second 2 feet above the first and a third (at the surface of the pillar) 1 foot above the second. The azimuths and distances of the circumjacent places are:—Bakshanwala hill (approximately) 180°, miles 2; Mashkiwali thul (deserted tower) 230°, miles 1·66; and Saduwala thul 297°, miles 3 nearly.

LVI. Sultán Hill Station, lat. 29° 9′, long. 72° 13′—observed at in 1875—is on a sand hill locally named Sultánwala tibba, which is a mass of moving sand hills; but the station has been carefully built and it is anticipated that it may be permanent. The Marot-Baháwalpur track which is marked by pyramídal kacha pillars runs about 1¼ miles north; the nearest pillar—the 7th from Marot on the Revenue Survey maps—having an azimuth of 139° is distant 1¾ miles. The station is on the lands of Chápu and Khirsar villages in the Maujgarh thána, division and state Baháwalpur.

The pillar, which is surrounded by a platform of bricks and mud, is solid and 3 feet deep with two mark-stones, one in the foundation and the second 3 feet above it at the surface of the pillar which is flush with the surface of the hill. The bearings and distances of the circumjacent places are:—Khirsar hamlet and well S., miles 2; Chápu well E., about 5·5 miles; and Maujgarh town S., miles 9.

LVII. Bijli Hill Station, lat. 29° 18′, long. 72° 25′—observed at in 1875—is on a flat-topped sand hill called Bijli by the inhabitants and Jewunee on the Revenue Survey charts. It is in thána Marot, division Khairpur of the Baháwalpur state. It is about a mile east of the track from Marot to Khairpur. The nearest good well water is obtained from Marot.

The pillar, which is surrounded by a platform of sand and bricks, is 3 feet deep with 3 mark-stones, one at the bottom of the pillar, a second 1 foot above the first flush with the hill surface and a third 2 feet above the second and at the surface of the pillar. The bearings and distances of the following places are:—Mauri Rania temple (not visible) S.S.E., miles 3·50; Khandowala toba N.W. by N., miles 2·68; Marot town S., miles 10; and Khairpur town N., miles 21.

LVIII. Panchkot Hill Station, lat. 29° 16′, long. 72° 10′—observed at in 1875—is on the highest portion of a flat-topped hill in the desert 18 miles S. of the Sutlej River, and is called after a toba or tank which is 0·65 of a mile distant at an azimuth of 345°. It is on the lands of Bhiawala toba (30 miles S.), thána Maujgarh, division and state Baháwalpur. When the tanks are dry the nearest good water is at Chápu about 12 miles S.E.

The pillar, which is surrounded by a low platform of bricks and sand, is solid and 3 feet high with 3 mark-stones, one at the bottom of the pillar, a second one foot above this flush with the hill top and a third 2 feet above the second on the surface of the pillar. Gharialwala toba lies to W., about miles 3.

LIX. Randu Hill Station, lat. 29° 19′, long. 72° 18′—observed at in 1875—is on a flat-topped sand hill of the Kali Dhari range, the highest point of which is 3 miles to the east. It is in the heart of the desert, in the lands of the town of Khairpur, in division Khairpur, of the Baháwalpur state.

The pillar, which is surrounded by a platform of sand and bricks, is solid and 3 feet high with 3 mark-stones, one at the bottom of the foundation, a second 1·08 feet above it flush with the hill top and a third 1·92 feet above the second on the surface of the pillar. The bearings and distances of the following places are:—Kimsir well (good) N.W., miles 10; Naganiwala toba N., miles 2; Jamsar well (slightly brackish) N.N.E., miles 10; Ganiwala toba N.E., miles 3; Bahawala toba N.E., miles 4; Rohriwala N.E., miles 3·50; and Sera well (brackish) S.E., miles 8.

XIX.—(*Of the Sutlej Series*). Kaimsir Tower Station, lat. 29° 25′, long. 72° 11′—observed at in 1862 and 1876—is situated in the Baháwalpur territories, and stands in the desert about 7 miles S. of the village of Asrani. There is a well about 1¼ miles to the N.

The pillar is perforated, and 10·8 feet high. It has a mark-stone at level of ground floor. The station was visited in 1876 for the purpose of connecting the Jodhpore with the Sutlej Series and the mark-stone at the level of the ground was found intact.

XXI.—(*Of the Sutlej Series*). Kanda Tower Station, lat. 29° 28′, long. 72° 22′—observed at in 1862 and 1875—is situated in the Baháwalpur territories, and stands in the desert about 10 miles S. E. of the town of Khairpur. There is a well about 2 miles to the W.

The pillar is perforated, and 20·4 feet high. It has a mark-stone at level of ground floor. The station was visited in 1875 for the purpose of connecting the Jodhpore with the Sutlej Series and the mark-stone on the level of the ground was found intact.

J. B. N. HENNESSEY,
In charge of Computing Office.

April 1878.

JODHPORE MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. OBSERVED ANGLES.

At XLI (Bonik)

February 1873; *observed by Lieut. M. W. Rogers, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLIV										M = Mean of Groups w = Relative Weight C = Concluded Angle
	279° 1′	99° 1′	358° 18′	178° 18′	77° 25′	257° 25′	156° 37′	236° 37′	235° 50′	55° 50′	
XLIV & I	″ l 34·14 l 35·84 l 35·52	″ l 36·24 l 36·70 l 36·26	″ l 33·92 l 35·86 l 33·38 l 34·30	″ l 35·48 l 35·24 l 35·56	″ l 37·16 l 36·14 l 37·14	″ l 36·48 l 36·92 l 35·92	″ l 35·22 l 35·74 l 35·42	″ l 36·38 l 33·92 l 36·70 l 36·38	″ h 35·04 h 36·60 h 35·84 d 35·93	″ h 37·02 h 35·56 h 34·78 h 35·88	$M = 35''\cdot76$ $w = 15\ \cdot56$ $\frac{1}{w} = 0\ \cdot06$ $C = 38^\circ\ 58'\ 35''\cdot75$
	35·17	36·40	34·37	35·43	36·81	36·44	35·46	35·84	35·85	35·81	
I & II	l 21·50 l 20·12 l 19·86	l 19·80 l 19·94 l 18·86	l 20·34 l 19·66 l 21·32	l 19·78 l 19·10 l 20·86	l 18·94 l 18·46 l 19·16	l 20·98 l 19·46 l 19·10	l 19·80 l 19·44 l 19·98	l 21·34 l 21·94 l 18·46 l 18·96	h 18·24 h 19·42 h 19·08 d 19·01	h 20·10 h 19·00 h 20·72	$M = 19''\cdot79$ $w = 20\ \cdot02$ $\frac{1}{w} = 0\ \cdot05$ $C = 42^\circ\ 1'\ 19''\cdot78$
	20·49	19·53	20·44	19·91	18·85	19·85	19·74	20·18	18·94	19·94	

NOTE.—Stations XLI and XLIV appertain to the Karáchi Longitudinal Series.

At XLIV (Súnda)

January and February 1873*; observed by Lieut. M. W. Rogers, R.E., with Barrow's* 24*-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on I 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
I & II	h 9·86 h 11·40 h 11·00	h 10·18 l 9·86 l 8·54 l 9·02	l 9·40 l 8·40 l 9·78	l 8·52 l 11·06 l 8·54 l 8·98	l 9·72 l 9·94 l 10·60	h 10·62 h 8·90 h 7·32 h 9·76 h 8·30	h 7·88 h 9·92 h 10·14 h 11·70 h 11·20	h 7·80 h 9·26 h 8·58	h 8·74 h 8·88 h 9·02	h 9·94 h 10·20 l 9·32	$M = 9''·51$ $w = 14·98$ $\frac{1}{w} = 0·07$ $C = 37° 19' 9''·51$
	10·75	9·40	9·19	9·28	10·09	8·98	10·17	8·55	8·88	9·82	
II & XLI	h 8·20 h 8·24 l 10·04 l 9·68	l 8·32 l 10·48 l 8·44 l 8·50	l 8·72 l 9·36 l 6·92 l 7·78	l 8·74 l 6·60 l 7·90 l 9·10	l 8·22 l 7·06 l 8·56	h 9·14 h 6·50 h 9·00 h 7·90	h 8·90 h 7·70 h 9·08	h 10·58 h 9·28 h 8·90 h 10·02	h 9·32 h 8·20 h 10·36 h 9·00	h 7·68 h 7·30 l 9·28	$M = 8''·59$ $w = 17·96$ $\frac{1}{w} = 0·06$ $C = 30° 27' 8''·60$
	9·04	8·94	8·19	8·09	7·95	8·13	8·56	9·70	9·22	8·09	

At I (Borta)

February 1873; *observed by Lieut. M. W. Rogers, R. E., with Barrow's* 24*-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on IV 139° 3′	319° 3′	218° 13′	38° 14′	297° 26′	117° 26′	16° 38′	196° 38′	95° 49′	275° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
IV & III	l 49·60 l 51·92 l 51·76 l 52·10	l 50·84 h 54·78 h 50·72 h 51·76 h 48·84 h 48·84 h 49·66	h 52·94 h 51·26 h 53·48 h 53·62	h 51·70 h 52·66 h 52·76	h 51·80 h 50·32 h 52·20	h 52·06 h 50·76 h 50·82	l 52·26 l 50·34 l 51·00	l 50·14 l 51·76 l 49·96	l 49·74 l 51·58 l 50·60	l 51·60 l 50·36 l 49·32	$M = 51''·29$ $w = 10·25$ $\frac{1}{w} = 0·10$ $C = 52° 40' 51''·29$
	51·35	50·78	52·82	52·37	51·44	51·21	51·20	50·62	50·64	50·43	
III & II	l 13·86 l 13·68 l 14·58 l 16·26	l 16·60 l 15·98 l 15·98	h 15·20 h 14·40 h 14·16 h 14·24	h 14·90 h 15·16 h 13·96	h 16·54 h 17·30 h 17·02	h 16·82 h 15·76 h 15·60	l 14·94 l 14·72 l 15·80	l 14·78 l 14·82 l 14·44	l 14·80 l 15·00 l 15·52	l 14·52 l 14·98 l 15·24	$M = 15''·28$ $w = 12·88$ $\frac{1}{w} = 0·08$ $C = 62° 5' 15''·28$
	14·60	16·19	14·50	14·67	16·95	16·06	15·15	14·68	15·11	14·91	
II & XLI	l 40·94 l 39·88 l 38·36 l 37·64 l 37·66	l 37·80 l 40·02 l 40·62 l 40·26	h 41·94 h 39·86 h 37·96 h 40·66 h 40·32	h 37·56 h 37·10 h 38·62 h 40·96 h 39·70	h 38·74 h 38·32 h 38·80	h 38·34 h 39·90 h 40·50 l 39·72	l 40·32 l 40·56 l 40·34	l 38·46 l 40·10 l 39·96	l 41·10 l 41·54 l 38·76 l 40·06	l 39·14 l 39·52 l 39·46	$M = 39''·54$ $w = 14·44$ $\frac{1}{w} = 0·07$ $C = 32° 57' 39''·54$
	38·90	39·68	40·15	38·79	38·62	39·61	40·41	39·51	40·37	39·37	

Note.—Stations XLI and XLIV appertain to the Karáchi Longitudinal Series.

At I (Borta)—(*Continued*).

Angle between	Circle readings, telescope being set on IV: 139° 3′	319° 3′	218° 13′	38° 14′	297° 26′	117° 26′	16° 38′	196° 38′	95° 49′	275° 49′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
XLI & XLIV	″ l 13·52 l 10·40 l 12·94 l 11·30 l 11·02	″ l 10·78 l 9·68 l 8·76 l 10·60	″ h 9·94 h 13·16 h 13·52 h 11·64 h 13·62	″ h 11·20 h 13·52 h 13·34 h 11·96	″ h 9·08 h 12·40 h 11·00 h 10·82 h 10·14	″ h 12·44 h 10·10 h 11·40 l 10·72	″ l 10·50 l 10·38 l 11·16	″ l 12·38 l 9·84 l 11·88 l 11·54	″ l 10·74 l 9·22 l 11·68 l 11·64	″ l 11·56 l 11·74 l 10·12	$M = 11''\cdot26$ $w = 11\cdot21$ $\frac{1}{w} = 0\cdot09$ $C = 73^\circ\ 15'\ 11''\cdot27$
	11·84	9·96	12·38	12·50	10·69	11·17	10·68	11·41	10·82	11·14	

At II (Dhaula)

February 1873; *observed by Lieut. M. W. Rogers, R. E., with Barrow's* 24*-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLI: 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
XLI & XLIV	″ h 57·64 h 61·34 h 60·46 h 59·98 h 60·76	″ h 58·70 h 63·52 h 60·58 h 59·74 h 60·96 h 59·78	″ h 59·88 l 62·30 l 59·70 l 60·08	″ l 60·80 l 60·88 l 59·70	″ l 59·78 l 60·90 l 59·80 d 60·21	″ l 60·64 l 60·32 l 59·56	″ h 60·54 h 59·96 h 59·20	″ h 60·16 h 58·70 h 58·28	″ h 61·46 h 60·68 h 59·84	″ h 59·70 h 60·56 h 59·78	$M = 60''\cdot15$ $w = 20\cdot98$ $\frac{1}{w} = 0\cdot05$ $C = 68^\circ\ 33'\ 0''\cdot17$
	60·04	60·55	60·49	60·46	60·17	60·17	59·90	59·05	60·66	60·01	
XLIV & I	h 1·70 h 4·28 h 2·78 h 2·92	h 4·14 h 1·12 h 2·82 h 3·48 h 2·98	h 1·80 l 3·96 l 2·68 l 2·18	l 3·62 l 3·96 l 5·26 l 4·22	l 3·50 l 3·66 l 4·22 d 3·84	l 4·40 l 3·28 l 3·64	h 4·46 h 3·56 h 3·08	h 2·46 h 2·20 h 3·60	h 2·76 h 4·22 h 5·26 h 5·12	h 3·00 h 4·44 h 2·30 h 2·74	$M = 3''\cdot42$ $w = 18\cdot15$ $\frac{1}{w} = 0\cdot06$ $C = 36^\circ\ 28'\ 3''\cdot42$
	2·92	2·91	2·66	4·26	3·81	3·77	3·70	2·75	4·34	3·12	
I & III	h 16·74 h 14·08 h 15·28 h 16·04	h 14·34 h 14·90 h 14·86	l 13·34 l 15·16 l 16·26 l 17·58 l 15·04	l 14·52 l 15·30 l 13·18 l 16·28 l 14·92	l 15·42 l 15·60 l 15·18	l 15·04 l 13·58 l 16·18 l 14·04	h 16·34 h 16·68 h 16·86	h 15·80 h 14·38 h 15·10	h 13·60 h 15·06 h 12·34 h 14·90	h 14·58 h 14·76 h 14·72 h 15·34	$M = 15''\cdot12$ $w = 13\cdot96$ $\frac{1}{w} = 0\cdot07$ $C = 65^\circ\ 16'\ 15''\cdot11$
	15·54	14·70	15·48	14·84	15·40	14·71	16·63	15·09	13·97	14·85	
III & V	h 29·32 h 28·58 h 29·28	h 31·16 h 30·28 h 29·42	l 28·86 l 28·34 l 27·14	l 29·10 l 28·66 l 27·48 l 28·92 l 28·74	l 29·28 l 28·04 l 29·84	l 29·32 l 29·36 l 28·58	h 28·50 h 28·58 h 29·34	h 28·58 h 30·48 h 28·26 h 28·14	h 30·02 h 26·82 h 28·46 h 27·90	h 27·78 h 26·80 h 28·44 h 27·54 h 28·36	$M = 28''\cdot79$ $w = 16\cdot20$ $\frac{1}{w} = 0\cdot06$ $C = 81^\circ\ 14'\ 28''\cdot77$
	29·06	30·29	28·11	28·58	29·05	29·09	28·81	28·87	28·30	27·78	

Note.—Stations XLI and XLIV appertain to the Karáchi Longitudinal Series.

At III (Kundal)

February and March 1873; *observed by Lieut. M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on VI										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 1′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	
	″	″	″	″	″	″	″	″	″	″	
VI & VII	h 39·46 h 38·20 h 40·58 h 39·06	h 37·96 h 39·26 h 37·26	l 37·32 l 38·18 l 38·08	l 37·98 l 37·86 l 38·86	l 37·10 l 40·80 l 36·02 l 39·72 l 39·12 l 39·50	h 39·74 h 38·98 h 39·72	h 38·60 h 38·16 h 37·36 d 38·71	h 37·96 h 38·38 h 38·12	l 39·66 l 39·22 l 37·30 l 39·06	l 38·42 l 39·94 l 38·72	$M = 38''·60$ $w = 18·47$ $\frac{1}{w} = 0·05$ $C = 59° 58' 38''·61$
	39·33	38·16	37·86	38·23	38·71	39·48	38·21	38·15	38·81	39·03	
VII & V	h 45·42 h 43·90 h 46·06 h 44·82 h 44·88	h 43·38 h 43·30 h 43·04	l 44·62 l 44·68 l 44·86	l 45·56 l 42·82 l 44·68 l 44·08 d 42·81	l 43·84 l 42·54 l 45·62 l 43·94 l 44·42	h 44·52 h 45·70 h 44·88	h 44·28 h 43·92 h 45·32 d 45·18	h 43·96 h 44·54 h 44·08	l 44·98 l 45·44 l 46·10 l 44·32	l 44·58 l 44·22 l 44·10	$M = 44''·44$ $w = 20·42$ $\frac{1}{w} = 0·05$ $C = 43° 5' 44''·44$
	45·02	43·24	44·72	43·99	44·07	45·03	44·68	44·19	45·21	44·30	
V & II	h 49·74 h 48·94 h 48·90 h 49·02	h 47·64 h 46·48 h 48·64 h 46·82	l 47·62 l 48·02 l 47·24	l 48·62 l 49·98 l 49·82 d 47·99	l 47·60 l 48·46 l 46·70	h 48·86 h 47·00 h 48·52	h 49·62 h 48·74 h 48·40 h 47·56	h 47·70 h 47·70 h 45·78	l 46·66 l 47·02 l 46·60	l 48·70 l 46·98 l 47·34	$M = 47''·91$ $w = 12·31$ $\frac{1}{w} = 0·08$ $C = 50° 38' 47''·92$
	49·15	47·40	47·63	49·10	47·59	48·13	48·58	47·06	46·76	47·67	
II & I	h 32·88 h 33·20 h 32·90	h 31·62 h 33·08 h 33·06	l 32·60 l 32·64 l 32·14	l 31·76 l 32·26 l 32·12	l 33·06 l 32·80 l 33·38	h 32·14 h 31·40 h 31·58	h 31·40 h 34·04 h 33·12 h 31·74	h 32·42 h 32·94 h 32·72	l 33·34 l 33·82 l 33·48	l 32·00 l 33·52 l 32·66	$M = 32''·64$ $w = 27·96$ $\frac{1}{w} = 0·04$ $C = 52° 38' 32''·64$
	32·99	32·59	32·46	32·05	33·08	31·71	32·58	32·69	33·55	32·73	
I & IV	h 28·44 h 30·68 h 27·80 h 28·62	l 28·58 l 30·72 l 29·32	l 28·66 l 28·86 l 29·32	l 29·80 l 28·96 l 28·32	l 28·98 l 31·02 l 27·98 l 29·78	h 29·98 h 30·38 h 27·46 h 30·16	h 28·98 h 29·10 h 29·50	h 28·32 h 28·14 l 28·34	l 27·90 l 27·02 l 29·24 l 29·34	l 28·26 l 27·82 l 29·66	$M = 28''·98$ $w = 23·02$ $\frac{1}{w} = 0·03$ $C = 82° 22' 28''·98$
	28·89	29·54	28·95	29·03	29·44	29·49	29·19	28·27	28·38	28·58	
IV & VI	h 46·02 h 49·50 h 48·96 h 47·90	l 48·12 l 48·22 l 46·38	l 48·72 l 47·96 l 48·30	l 46·68 l 48·92 l 48·18 l 47·94	l 47·76 l 45·50 l 46·26 l 47·18	h 46·32 h 47·82 h 47·74 h 49·56	h 45·96 l 49·62 l 47·38 l 47·32	h 49·06 h 48·40 l 48·08	l 49·64 l 47·08 l 46·12 l 46·86 l 46·88	l 48·80 l 47·22 l 47·30	$M = 47''·76$ $w = 17·81$ $\frac{1}{w} = 0·06$ $C = 71° 15' 47''·74$
	48·10	47·57	48·33	47·93	46·67	47·86	47·57	48·51	47·32	47·77	

At IV (Mandaula)

February 1873; *observed by Lieut. M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on VI: 0° 0′	180° 0′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
VI & III	″ h 19·58 h 19·88 h 19·58	″ h 17·22 h 17·48 h 18·42	″ h 19·58 h 20·02 h 17·46 h 17·42	″ h 19·98 h 19·04 h 19·06	″ h 20·06 h 18·72 l 18·60	″ l 19·00 l 18·98 l 17·72	″ l 17·32 l 18·12 l 16·58	″ l 18·16 l 17·30 l 17·66	″ h 19·04 h 20·38 h 16·62 h 17·18 h 16·58	″ h 18·26 h 16·66 h 17·07	$M = 18''\cdot34$ $w = 10\cdot39$ $\frac{1}{w} = 0\cdot10$ $C = 46^\circ\ 5'\ 18''\cdot34$
	19·68	17·71	18·62	19·36	19·13	18·57	17·34	17·71	17·96	17·31	
III & I	h 46·42 h 44·64 h 45·34	h 45·80 h 44·14 h 44·38	h 42·12 h 43·10 h 44·06 h 42·86 h 44·46	h 43·10 h 43·32 h 42·54 h 44·28	h 43·80 h 45·24 h 45·18	l 44·54 l 45·34 l 44·94	l 42·54 l 44·00 l 43·62	l 43·84 l 44·86 l 43·64	h 43·96 h 43·48 h 45·08	h 43·44 h 44·54 h 43·06	$M = 44''\cdot19$ $w = 13\cdot70$ $\frac{1}{w} = 0\cdot07$ $C = 44^\circ\ 56'\ 44''\cdot18$
	45·47	44·77	43·32	43·31	44·74	44·94	43·39	44·11	44·17	43·68	

At V (Bhádrájan)

March 1873; *observed by Lieut. M. W. Rogers, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on II: 256° 52′	76° 52′	336° 3′	156° 3′	55° 16′	235° 16′	134° 28′	314° 28′	213° 39′	33° 39′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
II & III	″ h 46·88 h 47·28 h 49·34 h 48·58	″ h 46·66 h 48·96 h 47·54 h 49·42	″ l 48·32 l 48·22 l 49·36	″ l 49·32 l 49·76 l 47·82	″ l 49·24 l 46·26 l 48·72 l 47·98	″ l 47·86 l 49·34 l 49·48	″ l 48·10 l 48·16 l 47·90	″ l 47·22 l 47·92 l 48·28	″ h 48·96 h 48·46 h 47·24	″ h 48·74 h 48·14 h 47·96	$M = 48''\cdot31$ $w = 28\cdot59$ $\frac{1}{w} = 0\cdot03$ $C = 48^\circ\ 6'\ 48''\cdot30$
	48·02	48·15	48·63	48·97	48·05	48·89	48·05	47·81	48·22	48·28	
III & VII	h 23·86 h 23·94 h 23·64 h 25·04 h 25·38 h 25·30	h 25·00 h 25·12 h 24·26 h 25·60	l 25·66 l 26·32 l 26·30	l 25·30 l 26·46 l 26·06	l 26·92 l 26·06 l 25·04	l 24·20 l 25·76 l 24·40	l 26·24 l 26·82 l 27·26	l 25·22 l 27·22 l 27·18 h 27·74	h 25·72 h 24·36 h 26·20	h 27·14 h 25·76 h 25·76	$M = 25''\cdot76$ $w = 12\cdot93$ $\frac{1}{w} = 0\cdot08$ $C = 55^\circ\ 2'\ 25''\cdot75$
	24·53	25·00	26·09	25·94	26·01	24·79	26·77	26·84	25·43	26·22	

At VI (Nagar)

March 1873; *observed by Lieut. M. W. Rogers, R.E., with Barrow's* 24*-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on IX 312° 10′	132° 10′	31° 22′	211° 22′	110° 33′	290° 33′	189° 45′	9° 45′	268° 57′	88° 58′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
IX & VIII	h 12·90 h 12·28 h 11·62	h 12·58 h 11·64 l 12·66	l 12·44 l 11·66 l 11·86	l 11·26 l 11·14 l 12·04	l 12·88 l 13·00 l 11·74	h 12·24 h 12·02 h 11·98	h 11·14 h 12·20 h 13·18 h 11·00	h 13·22 h 13·80 h 13·44 h 14·70	h 11·94 h 12·18 l 12·26	l 12·78 l 12·46 l 10·98	$M = 12''·25$ $w = 21·48$ $\frac{1}{w} = 0·05$
	12·27	12·29	11·99	11·48	12·54	12·08	11·88	13·79	12·13	12·07	$C = 47° 51' 12''·26$
VIII & VII	h 30·92 h 32·30 h 32·90	l 30·88 l 30·26 l 31·28	l 31·64 l 31·52 l 31·34	l 33·82 l 31·86 l 31·88	l 31·56 l 31·40 l 32·90	h 32·00 h 32·76 h 32·12	h 32·82 h 30·84 h 32·52	h 32·48 h 31·90 h 31·86 h 28·84 h 29·46	h 31·20 h 31·08 h 30·68	l 30·74 l 31·40 l 30·88	$M = 31''·61$ $w = 16·16$ $\frac{1}{w} = 0·06$
	32·04	30·81	31·50	32·52	31·95	32·29	32·06	30·91	30·99	31·01	$C = 48° 42' 31''·60$
VII & III	h 12·10 h 13·44 h 12·72 h 14·50	l 14·44 l 13·82 l 13·60	l 12·84 l 14·76 l 14·30	l 12·42 l 13·78 l 13·58	l 13·76 l 13·68 l 14·62	h 12·12 h 14·04 h 13·14	h 13·46 h 14·24 h 12·18 h 12·58	h 12·96 h 11·76 h 13·52 h 13·96 h 13·20	h 13·76 h 14·46 h 13·18	l 12·62 l 13·18 l 13·96	$M = 13''·47$ $w = 32·90$ $\frac{1}{w} = 0·03$
	13·19	13·95	13·97	13·26	14·02	13·10	13·12	13·08	13·80	13·25	$C = 67° 47' 13''·45$
III & IV	h 55·98 h 57·10 h 58·62 h 57·68	h 55·76 h 57·92 l 55·38 l 56·84 h 58·20	l 57·82 l 57·74 l 56·80	l 56·32 l 58·14 l 57·82	l 58·84 l 57·10 h 58·04	h 57·88 h 58·36 h 57·40	h 58·36 h 57·74 h 59·32	h 58·18 h 56·44 h 56·04 h 56·56 h 56·06	h 57·58 h 58·24 h 57·18	l 58·42 l 57·42 l 58·04	$M = 57''·57$ $w = 20·98$ $\frac{1}{w} = 0·05$
	57·35	56·82	57·45	57·43	57·99	57·88	58·47	56·66	57·67	57·96	$C = 62° 38' 57''·54$

At VII (Samdari)

March 1873; *observed by Lieut, M. W. Rogers, R. E., with Barrow's* 24*-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on V 0° 0′	180° 0′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
V & III	l 52·30 l 53·50 l 55·26 l 53·04	l 53·64 l 54·12 l 54·24	l 53·72 l 54·52 l 52·32 l 53·66	l 53·90 l 55·42 l 52·90 l 54·84	h 54·98 h 53·58 h 53·32	h 53·16 h 53·80 h 52·64	l 51·60 l 52·38 l 53·98 l 53·98	l 53·88 l 52·30 l 54·78 l 54·02	l 53·48 l 52·96 l 53·38	h 54·12 h 55·10 h 54·90 h 52·64	$M = 53''·67$ $w = 25·52$ $\frac{1}{w} = 0·04$
	53·53	54·00	53·55	54·27	53·96	53·20	52·98	53·75	53·27	54·19	$C = 81° 51' 53''·67$

At VII (Samdari)—(*Continued*).

Angle between	Circle readings, telescope being set on V 0° 0′	180° 0′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
III & VI	*l* 11·96 *l* 10·40 *l* 12·96 *l* 12·10 *l* 12·56	*l* 11·12 *l* 10·98 *l* 12·66	*l* 11·02 *l* 11·64 *l* 11·44	*l* 10·30 *l* 11·08 *l* 11·30 *l* 11·22	*h* 12·98 *h* 11·50 *h* 11·44 *h* 10·82	*h* 11·12 *h* 11·22 *h* 11·96	*l* 11·16 *l* 12·90 *l* 10·98 *l* 12·10	*l* 10·88 *l* 11·52 *l* 10·64	*l* 11·92 *l* 12·04 *l* 11·20	*h* 11·42 *h* 10·74 *h* 13·60	$M = 11''\cdot55$ $w = 37\cdot42$ $\frac{1}{w} = 0\cdot03$ $C = 52^\circ\ 14'\ 11''\cdot56$
	12·00	11·59	11·37	10·98	11·68	11·43	11·79	11·01	11·72	11·92	
VI & VIII	*l* 51·68 *l* 51·88 *l* 50·00 *l* 50·20 *l* 50·70	*l* 49·92 *l* 51·20 *l* 48·92 *l* 48·62 *l* 51·80	*l* 50·10 *l* 51·56 *l* 50·28	*l* 51·96 *l* 51·54 *h* 51·24	*h* 52·12 *h* 50·46 *h* 50·62	*h* 52·38 *h* 52·54 *h* 52·00	*l* 52·50 *l* 50·32 *l* 51·72 *l* 50·06	*l* 50·36 *l* 50·26 *l* 51·14	*l* 52·24 *l* 51·02 *l* 51·48	*h* 50·82 *h* 48·78 *h* 50·22 *h* 48·98	$M = 50''\cdot96$ $w = 13\cdot14$ $\frac{1}{w} = 0\cdot08$ $C = 57^\circ\ 47'\ 50''\cdot94$
	50·89	50·09	50·65	51·58	51·07	52·31	51·15	50·59	51·58	49·70	
VIII & X	*l* 37·10 *l* 37·28 *l* 37·94	*h* 37·58 *h* 39·18 *h* 38·80 *h* 37·12 *h* 38·14	*h* 36·58 *h* 35·92 *h* 37·12	*h* 36·12 *h* 38·12 *h* 35·72 *h* 36·64 *h* 38·82	*h* 36·98 *h* 37·32 *h* 37·72	*h* 37·58 *h* 35·12 *h* 34·30 *h* 36·02 *h* 36·62	*l* 36·02 *l* 36·70 *l* 36·36	*l* 37·20 *l* 36·68 *l* 36·62	*l* 35·06 *l* 36·48 *l* 36·12	*h* 36·62 *h* 38·36 *h* 37·62	$M = 36''\cdot91$ $w = 14\cdot01$ $\frac{1}{w} = 0\cdot07$ $C = 78^\circ\ 52'\ 36''\cdot91$
	37·44	38·16	36·54	37·08	37·34	35·93	36·36	36·83	35·89	37·53	

At VIII (Thob)

***March* 1873; *observed by Lieut. M. W. Rogers, R. E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on VII 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 36′	316° 49′	136° 48′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
VII & VI	*h* 41·90 *h* 40·96 *h* 39·44 *h* 40·60	*h* 40·08 *l* 39·72 *l* 40·10 *l* 37·94	*h* 40·44 *h* 42·08 *h* 40·18 *h* 40·22	*l* 40·98 *l* 40·74 *l* 38·98	*h* 39·22 *h* 41·16 *h* 41·62 *h* 40·04	*h* 41·66 *h* 41·66 *l* 41·46	*h* 40·54 *h* 40·58 *h* 41·14	*h* 40·22 *h* 40·10 *h* 40·26	*h* 41·04 *h* 42·16 *h* 40·66	*h* 39·20 *h* 40·60 *h* 40·08 *l* 39·36	$M = 40''\cdot53$ $w = 17\cdot85$ $\frac{1}{w} = 0\cdot06$ $C = 73^\circ\ 29'\ 40''\cdot52$
	40·73	39·46	40·73	40·23	40·51	41·59	40·75	40·19	41·29	39·81	
VI & IX	*h* 55·10 *h* 54·88 *h* 55·64 *h* 55·30	*h* 56·64 *l* 54·24 *l* 54·86 *l* 56·02	*h* 55·40 *h* 56·74 *h* 55·98	*l* 54·74 *l* 55·60 *l* 55·48	*h* 57·62 *h* 55·24 *h* 57·48 *h* 55·06	*l* 56·72 *h* 55·96 *h* 55·30	*h* 57·08 *h* 57·00 *h* 57·54	*h* 56·54 *h* 55·04 *h* 55·08	*h* 56·46 *h* 57·38 *h* 57·84	*h* 56·24 *h* 55·50 *h* 56·86 *h* 55·72	$M = 56''\cdot04$ $w = 14\cdot86$ $\frac{1}{w} = 0\cdot07$ $C = 72^\circ\ 36'\ 56''\cdot03$
	55·23	55·44	56·04	55·27	56·35	55·99	57·21	55·55	57·23	56·08	

At VIII (Thob)—(*Continued*).

Angle between	Circle readings, telescope being set on VII 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 36′	316° 49′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
IX & XI	h 39·92 h 38·80 h 41·38 h 37·78 h 39·82	h 39·82 l 40·82 l 42·20	h 41·36 h 39·40 l 39·84	l 40·10 l 38·16 l 39·24	h 39·74 h 40·14 h 38·20 h 38·92	h 38·94 h 38·50 l 38·58	h 40·02 h 37·88 h 38·52 h 37·38	h 38·94 h 40·36 h 39·34	h 39·84 h 37·54 h 38·44 h 39·78	h 40·12 h 38·70 h 37·94 h 38·54	$M = 39''·45$ $w = 12·42$ $\frac{1}{w} = 0·08$ $C = 65° 7' 39''·43$
	39·54	40·95	40·20	39·17	39·25	38·67	38·45	39·55	38·90	38·83	
XI & XII	h 19·40 h 19·62 h 18·52	h 18·92 l 19·18 l 17·78	h 17·32 h 20·46 l 20·98 h 21·76	l 20·06 l 19·88 l 21·18	h 18·14 h 18·46 h 19·52 h 19·50	h 18·02 h 18·86 l 19·04 l 20·58	h 20·52 h 20·42 h 19·48 h 20·42	h 18·42 h 17·44 l 19·50	h 17·96 h 18·76 h 19·76	h 18·76 h 19·08 h 19·14 h 18·42	$M = 19''·27$ $w = 14·46$ $\frac{1}{w} = 0·07$ $C = 54° 17' 19''·28$
	19·18	18·63	20·13	20·37	18·91	19·12	20·21	18·45	18·83	18·85	
XII & X	h 1·76 h 2·02 h 3·46 l 4·36	h 3·68 l 3·84 l 4·32	h 4·90 h 2·22 h 3·44 l 3·04	l 4·44 l 4·46 l 3·60	h 3·26 h 3·92 h 3·14	h 3·94 h 4·16 l 2·40	h 1·36 h 3·12 h 4·24 h 1·44	l 3·90 h 3·02 h 2·84	h 4·04 h 3·60 h 2·90	h 4·76 h 2·70 h 2·86	$M = 3''·41$ $w = 23·78$ $\frac{1}{w} = 0·04$ $C = 40° 23' 3''·39$
	2·90	3·95	3·40	4·17	3·44	3·50	2·54	3·25	3·51	3·44	
X & VII	h 20·96 h 21·52 h 21·54	h 21·38 l 21·02 l 21·98 l 20·58	h 19·28 h 21·32 h 20·38 l 19·32	l 20·42 l 21·48 l 20·46	h 23·44 h 19·32 h 19·06 h 19·58 h 20·58	h 20·74 h 20·34 l 21·24	h 20·96 h 22·00 h 20·18	l 22·38 h 22·42 h 23·06 h 21·22 h 18·62	h 21·04 h 21·76 h 20·16	h 20·36 h 22·04 h 21·06	$M = 20''·93$ $w = 21·18$ $\frac{1}{w} = 0·05$ $C = 54° 5' 20''·92$
	21·34	21·24	20·08	20·79	20·40	20·77	21·05	21·54	20·99	21·15	

At IX (Borla)

March* 1873; *observed by Lieut. M. W. Rogers, R. E., with Barrow's 24-inch Theodolite No. 2.

Angle between	Circle readings, telescope being set on XI 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 25′	237° 37′	57° 37′	316° 48′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XI & VIII	h 10·30 h 12·98 h 13·14 h 13·18	h 12·90 h 13·08 h 13·86	h 11·60 h 12·38 h 13·22	h 12·88 h 11·86 h 13·04	h 13·26 h 12·92 h 11·60	l 11·64 l 12·56 l 13·42	l 12·14 l 12·60 l 12·16	l 13·16 l 13·46 h 11·88	h 11·16 h 12·12 h 11·46	h 12·20 h 12·98 h 10·80 h 12·86	$M = 12''·47$ $w = 27·76$ $\frac{1}{w} = 0·04$ $C = 57° 46' 12''·47$
	12·40	13·28	12·40	12·59	12·59	12·54	12·30	12·83	11·58	12·21	

At IX (Borla)—(*Continued*).

Angle between	Circle readings, telescope being set on XI: 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 25′	237° 37′	57° 37′	316° 48′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
VIII & VI	″ h 55·32 h 55·02 h 54·60	″ h 54·36 h 54·46 h 55·34	″ h 54·36 h 55·34 h 54·80	″ h 53·36 h 53·34 h 54·80 h 54·68	″ h 53·72 h 53·44 h 54·36 h 54·36	″ l 55·60 l 54·66 l 54·46	″ l 54·22 l 53·88 l 56·70 l 54·36	″ l 53·16 l 53·20 h 53·52 h 53·52 h 56·88	″ h 54·58 h 53·02 h 53·44 h 55·44	″ h 52·02 h 55·02 h 56·68 h 55·86 h 53·58	$M = 54''\cdot51$ $w = 23\cdot48$ $\frac{1}{w} = 0\cdot04$ $C = 59^\circ\,31'\,54''\cdot48$
	54·98	54·72	54·83	54·05	53·97	54·91	54·79	54·06	54·12	54·63	

At X (Dodo)

April 1873; *observed by Lieut. M. W. Rogers, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on VII: 254° 30′	74° 30′	333° 41′	153° 41′	52° 54′	232° 54′	132° 6′	312° 6′	211° 18′	31° 18′	M = Mean of Groups w = Relative Weight C = Concluded Angle
VII & VIII	″ h 4·90 h 4·34 h 3·24	″ h 4·44 h 5·54 h 5·62	″ h 5·22 h 4·96 h 4·84	″ h 5·08 h 4·12 h 6·08	″ h 4·46 h 5·22 h 4·54	″ h 4·04 h 5·72 h 5·86	″ h 5·32 h 4·86 h 5·16	″ h 4·44 h 5·28 h 4·50	″ h 5·62 h 4·64 h 6·28	″ h 6·46 h 4·90 h 5·14	$M = 5''\cdot03$ $w = 35\cdot70$ $\frac{1}{w} = 0\cdot03$ $C = 47^\circ\,2'\,5''\cdot03$
	4·16	5·20	5·01	5·09	4·74	5·21	5·11	4·74	5·51	5·50	
VIII & XII	h 49·78 h 49·72 h 50·32	h 49·34 h 50·84 h 49·30	h 50·44 h 48·06 h 50·54 h 49·86	h 49·26 h 50·36 h 48·36	h 47·78 h 48·32 h 49·12 h 50·64	h 49·46 h 49·48 h 49·28	h 49·40 h 50·54 h 49·96	h 49·20 h 48·80 h 48·46 h 49·64	h 48·18 h 48·42 h 48·02 h 50·00 h 51·20	h 48·74 h 49·14 h 50·44	$M = 49''\cdot48$ $w = 29\cdot46$ $\frac{1}{w} = 0\cdot03$ $C = 58^\circ\,28'\,49''\cdot46$
	49·94	49·83	49·73	49·33	48·96	49·41	49·97	49·03	49·16	49·44	

At XI (Adori)

December 1873; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XIV: 247° 55′	67° 54′	327° 21′	147° 20′	46° 21′	226° 20′	125° 38′	305° 37′	204° 46′	24° 46′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XIV & XIII	″ h 43·70 h 42·50 h 43·36	″ h 45·42 l 45·56 l 45·24	″ l 43·50 l 43·90 l 44·58	″ l 44·36 l 42·02 l 44·42 l 41·78	″ h 45·32 h 44·36 h 45·56	″ h 43·30 h 44·94 h 44·84	″ l 43·38 l 41·82 l 43·72	″ h 44·30 h 44·50 h 43·90	″ l 43·72 l 44·70 l 43·96	″ l 43·46 l 43·42 l 45·06	$M = 44''\cdot05$ $w = 12\cdot57$ $\frac{1}{w} = 0\cdot08$ $C = 53^\circ\,27'\,44''\cdot05$
	43·19	45·41	43·99	43·15	45·08	44·36	42·97	44·23	44·13	43·98	

At XI (Adori)—(*Continued*).

Angle between	Circle readings, telescope being set on XIV										M = Mean of Groups w = Relative Weight C = Concluded Angle
	247° 55′	67° 54′	327° 21′	147° 20′	46° 21′	226° 20′	125° 38′	305° 37′	204° 46′	24° 46′	
XIII & XII	″ h 3·98 h 3·72 h 3·90	″ h 4·92 l 4·08 l 3·88	″ l 5·54 l 6·26 l 3·28 l 4·12	″ l 4·18 l 4·60 l 3·84	″ h 3·28 h 5·14 h 3·24	″ h 4·24 l 3·72 l 4·08	″ l 4·22 l 3·98 l 4·50	″ h 5·36 h 5·40 h 3·86	″ l 5·04 l 3·24 l 4·32	″ l 4·84 l 4·58 l 4·30	$M = 4''\cdot29$ $w = 39\cdot20$ $\frac{1}{w} = 0\cdot03$ $C = 58^\circ\ 35'\ 4''\cdot30$
	3·87	4·29	4·80	4·21	3·89	4·01	4·23	4·87	4·20	4·57	

March 1873; *observed by Lieut. M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XII										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	180° 0′	79° 12′	259° 12′	158° 25′	338° 25′	237° 36′	57° 36′	316° 49′	136° 49′	
XII & VIII	″ h 53·48 h 56·14 h 56·02 h 54·00	″ h 54·52 h 54·84 h 54·18	″ h 54·44 h 55·28 h 54·90	″ h 55·94 h 54·04 h 54·98	″ h 55·96 h 53·96 l 53·30 l 55·84 d 54·13	″ l 54·94 l 53·64 l 55·78 l 55·82	″ l 53·64 l 53·78 l 52·94 h 54·90 d 53·76	″ h 56·62 h 55·50 h 54·50 h 56·86	″ h 55·36 h 54·52 h 53·36	″ h 54·90 h 54·28 h 53·28	$M = 54''\cdot72$ $w = 19\cdot29$ $\frac{1}{w} = 0\cdot05$ $C = 72^\circ\ 14'\ 54''\cdot72$
	54·91	54·51	54·87	54·99	54·64	55·05	53·80	55·87	54·41	54·15	
VIII & IX	h 11·30 h 11·92 h 11·48	h 10·54 h 10·72 h 10·90	h 11·26 h 9·54 h 10·16	h 9·72 h 11·36 h 10·10	h 11·08 h 12·00 h 12·60 d 11·25	l 10·76 l 11·64 l 9·24 l 11·56	l 10·32 h 11·62 h 10·34 d 10·70	l 11·12 l 9·64 l 10·52 l 10·74	h 10·14 h 10·74 h 9·20 h 10·64	h 11·08 h 11·16 h 10·38	$M = 10''\cdot78$ $w = 27\cdot45$ $\frac{1}{w} = 0\cdot04$ $C = 57^\circ\ 6'\ 10''\cdot78$
	11·57	10·72	10·32	10·39	11·73	10·80	10·75	10·50	10·18	10·87	

At XII (Dugur)

March 1873; *observed by Lieut. M. W. Rogers, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on X										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	
X & VIII	″ h 10·12 h 10·64 h 7·60 h 11·04 h 8·92	″ h 8·62 h 9·34 h 12·12 h 9·98	″ h 9·28 h 9·20 h 9·44	″ h 8·70 h 9·14 h 8·04	″ h 9·88 l 8·22 l 9·94	″ l 9·98 l 10·22 l 9·28	″ l 8·40 l 9·70 l 8·50	″ l 10·28 l 9·38 l 10·70	″ l 8·90 l 9·94 l 10·58	″ l 8·84 l 9·20 l 8·76	$M = 9''\cdot45$ $w = 21\cdot09$ $\frac{1}{w} = 0\cdot05$ $C = 81^\circ\ 8'\ 9''\cdot46$
	9·66	10·02	9·31	8·63	9·35	9·83	8·87	10·12	9·81	8·93	

At XII (Dugur)—(*Continued*).

Angle between	Circle readings, telescope being set on X: 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	$M = 48''\cdot55$
VIII & XI	h 49·90	h 50·10	h 49·90	h 48·16	h 47·02	l 47·40	l 47·90	l 47·78	l 49·80	l 48·08	
	h 48·24	h 48·72	h 48·02	h 47·56	l 48·44	l 48·78	l 48·44	l 48·56	l 48·54	l 48·60	$w = 25\cdot60$
	h 49·08	h 48·22	h 48·22	h 49·44	l 47·76	l 48·40	l 48·40	l 48·02	l 49·94	l 49·18	$\frac{1}{w} = 0\cdot04$
	49·07	49·01	48·71	48·39	47·74	48·19	48·25	48·12	49·43	48·62	$C = 53°\ 27'\ 48''\cdot55$

December 1873; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XI: 0° 0′	179° 59′	79° 11′	259° 10′	158° 25′	338° 25′	237° 36′	57° 35′	316° 47′	136° 47′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XI & XIII	h 38·88	h 39·30	h 40·54	h 37·98	l 37·34	l 39·16	h 36·36	h 37·10	h 38·00	l 37·82	$M = 37''\cdot80$
	h 38·68	h 36·60	h 38·08	h 37·72	l 37·96	l 39·46	h 36·54	h 37·52	h 37·46	h 36·84	
	h 38·00	h 37·24	h 37·10	h 37·24	l 39·58	l 38·06	h 38·42	h 37·70	h 37·04	h 37·28	$w = 16\cdot61$
		h 36·90	h 36·18		l 39·44		h 37·38				$\frac{1}{w} = 0\cdot06$
			h 37·00								
			h 35·90								
	38·52	37·51	37·47	37·65	38·58	38·89	37·18	37·44	37·50	37·31	$C = 49°\ 54'\ 37''\cdot79$
XIII & XV	h 7·04	h 6·72	h 3·42	h 6·78	l 5·00	l 5·66	h 7·48	h 8·20	h 8·14	l 7·88	$M = 6''\cdot99$
	h 7·28	h 8·14	h 5·82	h 6·22	l 7·60	l 7·34	h 7·10	h 7·70	l 7·94	h 8·36	
	h 7·22	h 8·78	h 7·42	h 5·48	l 6·20	l 6·66	h 6·28	h 7·04	l 8·54	h 6·96	$w = 8\cdot65$
		h 8·94	h 4·98		l 5·80						$\frac{1}{w} = 0\cdot12$
			h 4·40								
	7·18	8·15	5·21	6·16	6·15	6·55	6·95	7·65	8·21	7·73	$C = 55°\ 52'\ 6''\cdot98$

At XIII (Ketu)

December 1873; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XII: 359° 59′	179° 59′	79° 11′	259° 10′	158° 23′	338° 23′	237° 38′	57° 38′	316° 49′	136° 49′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XII & XI	l 21·28	l 20·60	h 20·92	l 19·42	h 17·98	l 20·42	h 20·36	h 19·76	l 18·84	h 19·00	$M = 20''\cdot04$
	l 20·04	l 19·26	h 20·70	l 18·76	h 19·90	l 21·40	h 20·36	h 19·34	h 20·78	l 20·28	
	h 21·68	l 19·54	l 20·10	l 18·74	h 20·92	l 20·04	h 20·80	l 19·68	h 20·20	l 19·26	$w = 19\cdot05$
					h 20·58						$\frac{1}{w} = 0\cdot05$
	21·00	19·80	10·57	18·97	19·85	20·62	20·51	19·59	19·94	19·51	$C = 71°\ 30'\ 20''\cdot04$

At XIII (Ketu)—(*Continued*).

Angle between	Circle readings, telescope being set on XII										M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	359° 59′	179° 59′	79° 11′	259° 10′	158° 23′	338° 23′	237° 38′	57° 38′	316° 49′	136° 49′	
	″	″	″	″	″	″	″	″	″	″	
XI & XIV	l 25·66	l 24·60	h 26·86	l 27·82	h 25·98	l 25·56	h 26·06	h 26·52	l 28·10	h 25·90	M = 26″·48
	h 25·88	l 26·72	h 25·20	l 26·90	h 26·20	l 25·60	h 25·74	h 26·34	h 26·12	h 25·82	w = 25·84
	h 27·84	l 26·68	l 27·00	l 27·06	h 26·44	l 27·22	h 25·58	l 25·74	h 28·12	l 27·14	$\frac{1}{w}$ = 0·04
	h 26·66	d 26·63					h 27·38				
	26·51	26·16	26·35	27·26	26·21	26·13	26·19	26·20	27·45	26·29	C = 48° 51′ 26″·47
XIV & XVI	h 51·52	l 53·90	h 52·16	l 52·28	h 52·20	l 52·50	h 52·94	h 52·58	l 53·06	h 53·48	M = 52″·66
	h 52·58	l 51·46	h 54·70	l 52·54	h 51·40	l 52·70	h 52·74	h 52·34	h 54·12	h 53·62	w = 18·90
	h 52·64	l 52·64	h 52·22	l 52·00	h 52·94	l 52·20	h 54·58	l 51·62	h 54·10	l 51·96	$\frac{1}{w}$ = 0·05
		l 53·08	l 50·80								
		d 53·40	l 50·92								
	52·25	52·90	52·16	52·27	52·18	52·47	53·42	52·18	53·76	53·02	C = 49° 3′ 52″·65
XVI & XVII	h 18·40	l 19·44	h 19·54	l 20·94	h 19·68	l 18·38	h 19·24	h 18·40	l 18·86	h 18·42	M = 19″·29
	h 18·86	h 19·78	h 17·26	l 19·36	h 19·64	l 20·12	h 19·90	h 20·28	h 18·90	h 18·54	w = 20·13
	h 19·08	l 19·18	l 18·76	l 21·18	h 20·12	l 19·88	h 17·96	l 20·12	h 19·94	l 18·62	$\frac{1}{w}$ = 0·05
			l 18·62								
	18·78	19·47	18·55	20·49	19·81	19·46	19·03	19·60	19·23	18·53	C = 62° 58′ 19″·29
XVII & XV	h 27·74	h 28·78	h 29·72	l 27·96	h 27·72	l 30·20	h 28·16	h 28·48	l 29·40	h 29·48	M = 28″·83
	h 30·12	l 29·86	h 28·56	l 29·12	h 28·36	l 28·66	h 28·14	h 27·86	h 27·60	h 28·40	w = 25·28
	h 29·50	l 29·52	l 30·56	l 29·40	h 28·82	l 28·40	h 28·78	l 29·64	h 27·44	l 29·30	$\frac{1}{w}$ = 0·04
	h 28·02										
	28·85	29·39	29·61	28·83	28·30	29·09	28·36	28·66	28·15	29·06	C = 71° 51′ 28″·83
XV & XII	h 34·08	h 31·72	h 30·98	l 31·04	h 31·60	l 32·22	h 33·70	h 33·90	l 32·02	h 33·20	M = 32″·32
	h 31·40	l 30·94	h 31·86	l 33·60	h 31·98	l 31·86	h 32·64	h 33·14	h 31·60	l 33·26	w = 16·62
	h 32·24	l 31·94	l 31·86	l 32·88	h 33·06	l 32·96	h 32·28	l 32·66	h 30·72	l 33·34	$\frac{1}{w}$ = 0·06
	h 30·80			l 32·76							
	32·13	31·53	31·57	32·57	32·21	32·35	32·87	33·23	31·45	33·27	C = 55° 44′ 32″·32

At XIV (Sulkia Thalau)

December 1873; *observed by Lieut. J. Hill, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XVI										M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	0° 0′	179° 59′	79° 13′	259° 13′	158° 25′	338° 24′	237° 35′	57° 34′	316° 48′	136° 47′	
	″	″	″	″	″	″	″	″	″	″	
XVI & XIII	h 52·12	h 51·18	h 50·54	h 52·24	h 50·20	l 49·22	h 49·50	h 50·00	h 49·48	h 49·74	M = 50″·71
	h 49·98	h 50·52	h 52·70	h 50·58	l 50·00	h 49·16	h 51·06	h 52·14	h 50·42	h 49·58	w = 12·78
	h 51·70	h 50·52	h 52·96	h 50·06	l 49·80	h 51·32	h 50·66	h 51·28	h 50·16	h 50·98	$\frac{1}{w}$ = 0·08
	h 53·32		h 50·40	h 50·72				h 52·26			
	h 52·82										
	51·99	50·74	51·65	50·90	50·00	49·90	50·41	51·42	50·02	50·10	C = 67° 5′ 50″·74

At XIV (Sulkia Thalau)—(*Continued*).

Angle between	Circle readings, telescope being set on XVI										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	179° 59′	79° 13′	259° 13′	158° 25′	338° 24′	237° 35′	57° 34′	316° 48′	136° 47′	
XIII & XI	″ h 48·96 h 50·22 h 49·88	″ h 50·64 h 50·54 h 49·94	″ h 50·16 h 49·46 h 48·94	″ h 50·12 h 50·62 h 50·04	″ h 49·84 l 50·72 l 50·80	″ l 48·62 h 51·34 h 49·30 h 49·66	″ h 49·40 h 49·22 h 50·70	″ h 49·56 h 50·10 h 50·02	″ h 50·38 h 52·08 h 51·92	″ h 51·02 h 51·86 h 49·98	$M = 50''\cdot21$ $w = 19\cdot32$ $\frac{1}{w} = 0\cdot05$ $C = 77^\circ\ 40'\ 50''\cdot21$
	49·69	50·37	49·52	50·26	50·45	49·73	49·77	49·89	51·46	50·95	

At XV (Malunga)

January 1874; *observed by Lieut. J. Hill, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XII										M = Mean of Groups w = Relative Weight C = Concluded Angle
	359° 56′	179° 55′	79° 12′	259° 11′	158° 25′	338° 25′	237° 34′	57° 34′	316° 49′	136° 49′	
XII & XIII	″ h 20·88 h 21·92 h 22·92	″ h 22·66 l 23·34 l 22·52 h 20·46	″ l 23·66 l 22·58 l 23·00	″ h 22·02 h 20·68 h 21·56	″ l 21·62 l 21·62 l 20·24	″ l 23·70 l 23·38 l 22·06	″ h 23·94 h 21·96 l 22·42	″ l 22·42 l 22·84 l 24·88 h 21·48 h 22·68	″ h 22·18 h 22·30 h 22·42	″ h 22·88 h 21·02 h 21·96 d 22·88	$M = 22''\cdot30$ $w = 15\cdot70$ $\frac{1}{w} = 0\cdot06$ $C = 68^\circ\ 23'\ 22''\cdot31$
	21·91	22·25	23·08	21·42	21·16	23·05	22·77	22·86	22·30	22·18	
XIII & XVII	h 29·16 h 29·16 h 26·40 h 28·44	h 29·18 l 27·88 l 28·72	l 29·06 l 27·90 l 27·40	h 28·18 h 29·72 h 29·12	l 30·72 l 29·02 l 29·88	l 29·46 l 29·14 l 29·34	h 29·08 h 28·20 h 29·40	l 28·64 l 27·68 l 27·22 l 26·84	h 28·08 h 29·58 h 28·52	h 28·10 h 27·12 h 30·06 h 28·64 d 29·41	$M = 28''\cdot71$ $w = 17\cdot42$ $\frac{1}{w} = 0\cdot06$ $C = 41^\circ\ 2'\ 28''\cdot70$
	28·29	28·59	28·12	29·01	29·87	29·31	28·89	27·60	28·73	28·67	

At XVI (Loharan)

January 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XIX										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	180° 0′	79° 12′	259° 12′	158° 24′	338° 24′	237° 39′	57° 38′	316° 49′	136° 49′	
XIX & XVIII	″ h 2·44 h 3·42 h 2·84	″ l 2·76 l 2·04 h 2·76	″ h 2·82 h 4·16 h 2·36	″ h 1·38 h 2·00 h 1·92	″ l 1·26 l 1·00 h 2·62	″ h 2·08 h 0·48 h 2·02	″ l 0·86 l 1·74 l 0·66	″ h 0·58 h 1·04 h 1·48	″ h 0·64 l 2·02 l 2·28	″ l 2·16 h 2·70 h 2·44	$M = 1''\cdot97$ $w = 15\cdot90$ $\frac{1}{w} = 0\cdot06$ $C = 55^\circ\ 56'\ 1''\cdot97$
	2·90	2·52	3·11	1·77	1·63	1·53	1·09	1·03	1·65	2·43	

At XVI (Loharan)—(*Continued*).

Angle between	Circle readings, telescope being set on XIX										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	180° 0′	79° 12′	259° 12′	158° 24′	338° 24′	237° 39′	57° 38′	316° 49′	136° 49′	
	″	″	″	″	″	″	″	″	″	″	
XVIII & XVII	h 49·08 h 48·48 h 49·28	h 49·06 h 49·98 h 49·76	l 51·06 h 48·84 h 50·52 h 48·66	h 50·42 h 50·24 l 50·28 h 51·50	l 50·86 l 49·24 h 49·72	h 50·60 h 49·56 h 50·08	l 49·62 l 48·38 l 49·42	h 49·68 h 51·08 h 49·88	h 51·48 l 50·66 l 49·98	l 48·78 l 48·80 l 48·60	$M = 49''{\cdot}77$ $w = 17{\cdot}70$ $\frac{1}{w} = 0{\cdot}06$
	48·95	49·60	49·77	50·61	49·94	50·08	49·14	50·21	50·71	48·73	$C = 61° 47' 49''{\cdot}77$
XVII & XIII	h 50·92 h 50·86 h 50·24	h 50·36 h 50·86 h 50·60	l 49·56 h 51·08 h 49·18 h 50·26	h 51·24 h 49·88 l 51·02	l 50·12 h 49·02 h 49·30	h 48·82 h 50·04 h 51·04 h 49·76	l 50·68 l 50·36 l 49·96	h 49·68 h 49·36 h 49·24	h 49·46 l 50·16 l 49·50	l 49·84 h 49·46 h 50·08	$M = 50''{\cdot}07$ $w = 31{\cdot}70$ $\frac{1}{w} = 0{\cdot}03$
	50·67	50·61	50·02	50·71	49·48	49·92	50·33	49·43	49·71	49·79	$C = 50° 21' 50''{\cdot}07$
XIII & XIV	h 17·78 h 17·72 h 15·96	l 17·00 l 15·92 h 16·00 h 18·76	h 17·00 h 17·50 h 17·42	h 17·82 h 17·18 l 17·20	l 17·36 h 18·44 h 17·68	h 18·18 h 17·12 h 18·12	l 16·72 l 17·18 l 17·22	h 18·04 h 16·58 h 17·06	l 16·90 l 18·06 l 18·86	h 18·18 h 17·90 h 17·02	$M = 17''{\cdot}43$ $w = 36{\cdot}30$ $\frac{1}{w} = 0{\cdot}03$
	17·15	16·92	17·31	17·40	17·83	17·81	17·04	17·23	17·94	17·70	$C = 63° 50' 17''{\cdot}42$

At XVII (Chamu)

January 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24*-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XV										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 2′	180° 1′	79° 7′	259° 6′	158° 24′	338° 24′	237° 37′	57° 37′	316° 47′	136° 47′	
	″	″	″	″	″	″	″	″	″	″	
XV & XIII	h 4·34 h 3·86 h 3·36	h 3·92 h 2·76 h 4·78 h 3·36	l 2·68 l 2·84 h 2·94	h 5·26 h 4·56 h 3·56	h 2·78 h 2·78 l 4·12	l 4·56 l 2·84 l 3·18	l 3·94 l 4·00 h 4·66	h 4·40 h 2·96 h 3·78	l 2·98 l 3·94 l 3·64 d 3·47	h 1·74 h 3·14 h 3·70	$M = 3''{\cdot}59$ $w = 25{\cdot}40$ $\frac{1}{w} = 0{\cdot}04$
	3·85	3·71	2·82	4·46	3·23	3·53	4·20	3·71	3·51	2·86	$C = 67° 6' 3''{\cdot}59$
XIII & XVI	h 51·96 h 52·24 l 51·02	h 52·90 h 50·74 h 50·42 h 51·24	l 50·88 l 51·08 h 51·56	h 52·80 h 52·30 h 51·52	h 50·72 h 52·68 l 51·34	l 52·38 l 51·40 l 52·08	l 52·22 l 50·20 h 51·06 h 51·54	h 50·52 h 51·88 h 50·36	l 52·82 l 51·50 l 52·12 d 52·10	h 50·60 h 52·52 h 51·36	$M = 51''{\cdot}58$ $w = 30{\cdot}57$ $\frac{1}{w} = 0{\cdot}03$
	51·74	51·33	51·17	52·21	51·58	51·95	51·25	50·92	52·14	51·49	$C = 66° 39' 51''{\cdot}58$

At XVII (Chamu)—(*Continued*).

Angle between	Circle readings, telescope being set on XV 0° 2′	180° 1′	79° 7′	259° 6′	158° 24′	338° 24′	237° 37′	57° 37′	316° 47′	136° 47′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XVI & XVIII	″ h 38·44 h 38·50 l 39·92	″ h 39·98 h 40·28 h 38·98	″ l 38·92 l 40·62 h 40·98 h 40·92	″ h 38·98 h 38·42 h 40·16	″ h 42·10 h 40·76 l 40·30	″ l 39·10 l 40·06 l 39·34	″ l 39·58 l 39·48 h 41·14	″ h 39·68 h 39·12 h 39·30	″ h 38·54 l 39·42 l 38·44	″ h 40·54 h 39·54 h 40·86	$M = 39''\cdot74$ $w = 15\cdot71$ $\frac{1}{w} = 0\cdot06$
	38·95	39·75	40·36	39·19	41·05	39·50	40·07	39·37	38·80	40·31	$C = 51° 41' 39''\cdot74$
XVIII & XX	h 57·86 l 56·90 h 57·88	h 56·40 h 57·72 h 56·90	l 57·16 l 55·34 h 55·72	h 57·90 h 58·70 h 57·82	h 57·56 h 55·56 l 57·30	l 57·38 l 57·26 l 58·50	l 57·76 l 57·00 h 58·06	h 57·62 h 57·88 h 58·58	h 58·92 l 57·30 l 57·98	h 58·56 h 58·34 h 56·30 h 57·64 h 55·48	$M = 57''\cdot43$ $w = 16\cdot61$ $\frac{1}{w} = 0\cdot06$
	57·55	57·01	56·07	58·14	56·81	57·71	57·61	58·03	58·07	57·26	$C = 58° 51' 57''\cdot43$

At XVIII (Pelu)

January 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24*-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXI 359° 59′	179° 59′	79° 11′	259° 11′	158° 20′	338° 19′	237° 37′	57° 36′	316° 47′	136° 47′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XXI & XXII	″ l 46·58 h 44·78 h 44·74	″ h 44·34 h 46·12 h 44·18	″ l 44·38 l 45·42 l 45·52	″ l 44·48 h 45·78 h 43·78	″ h 44·34 h 46·42 h 44·52 h 44·46	″ h 46·82 h 44·08 h 45·94 h 44·54	″ h 46·18 l 45·04 l 44·82	″ l 44·06 l 45·18 l 44·40	″ h 44·60 h 44·58 l 44·40	″ l 45·52 l 44·54 l 44·86	$M = 44''\cdot97$ $w = 35\cdot94$ $\frac{1}{w} = 0\cdot03$
	45·37	44·88	45·11	44·68	44·94	45·34	45·35	44·55	44·53	44·97	$C = 49° 1' 44''\cdot98$
XXII & XX	l 37·60 h 36·92 h 37·22	h 37·70 h 36·00 h 36·58	l 37·66 l 35·90 l 36·98	h 35·82 h 37·42 h 36·04	h 36·22 h 36·48 h 37·26	h 36·32 h 36·54 h 36·36	h 36·26 l 36·42 l 36·50	l 37·02 l 36·52 l 36·58	h 36·78 h 37·04 l 38·60	l 36·18 l 37·30 l 36·78	$M = 36''\cdot77$ $w = 45\cdot50$ $\frac{1}{w} = 0\cdot02$
	37·25	36·76	36·85	36·43	36·65	36·41	36·39	36·71	37·47	36·75	$C = 57° 22' 36''\cdot77$
XX & XVII	l 36·80 h 38·14 h 37·84	h 37·44 h 37·64 l 36·48	l 35·84 l 36·74 h 36·46	h 36·56 h 37·36 h 37·76	h 36·68 h 36·34 l 35·96	h 37·68 h 36·86 h 38·12	h 37·90 l 37·88 l 36·96	l 36·62 l 36·80 l 36·42	l 38·18 l 37·44 l 36·20	l 37·28 l 36·38 l 36·18	$M = 37''\cdot03$ $w = 29\cdot40$ $\frac{1}{w} = 0\cdot03$
	37·59	37·19	36·35	37·23	36·33	37·55	37·58	36·61	37·27	36·61	$C = 61° 22' 37''\cdot03$

At XVIII (Pelu)—(*Continued*).

Angle between	Circle readings, telescope being set on XXI: 359° 59′	179° 59′	79° 11′	259° 11′	158° 20′	338° 19′	237° 37′	57° 36′	316° 47′	136° 47′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XVII & XVI	l 31·78 h 31·86 h 31·00	h 31·12 h 31·08 l 31·86	l 30·80 l 31·92 l 32·02	l 30·84 h 31·40 h 31·40	h 32·20 h 31·34 l 31·76	h 31·24 h 31·50 h 31·08	l 32·08 l 32·26 l 31·04	l 30·18 l 31·18 l 32·22 l 30·10	l 32·30 l 31·62 l 31·86	l 30·08 l 31·36 l 30·90	$M = 31''\cdot42$ $w = 45\cdot95$ $\frac{1}{w} = 0\cdot02$
	31·55	31·35	31·58	31·21	31·77	31·27	31·79	30·92	31·93	30·78	$C = 66° 30' 31''\cdot41$
XVI & XIX	l 44·64 h 44·60 h 45·12	h 45·70 h 44·38 l 45·60 l 46·24	l 45·20 l 45·74 l 43·76	l 44·70 h 45·16 h 44·76	h 45·18 h 44·42 h 44·74	h 45·68 h 45·58 h 43·82	l 44·28 l 44·24 l 45·52	l 45·60 l 46·64 l 45·52	l 43·46 l 44·76 l 44·52	l 44·82 l 44·20 l 45·10	$M = 44''\cdot94$ $w = 31\cdot62$ $\frac{1}{w} = 0\cdot03$
	44·79	45·48	44·90	44·87	44·78	45·03	44·68	45·92	44·25	44·71	$C = 62° 50' 44''\cdot95$
XIX & XXI	l 42·56 l 44·74 h 42·84 h 42·94	h 43·42 h 44·26 l 44·26	l 45·22 l 44·94 l 44·42	l 43·12 l 43·96 h 42·56	l 43·90 l 45·00 h 44·74	h 44·16 h 43·48 h 44·34	l 44·40 l 44·32 l 45·50	l 46·00 l 44·88 l 45·74	h 43·72 l 44·68 l 44·56	l 45·96 l 46·76 l 45·78	$M = 44''\cdot46$ $w = 10\cdot42$ $\frac{1}{w} = 0\cdot10$
	43·27	43·98	44·86	43·21	44·55	43·99	44·74	45·54	44·32	46·17	$C = 62° 51' 44''\cdot46$

At XIX (Daichu)

January 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXI: 0° 0′	180° 0′	79° 14′	259° 14′	158° 25′	338° 25′	237° 34′	57° 34′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXI & XVIII	h 44·10 h 44·26 h 45·74	h 45·44 h 45·10 h 45·44	h 43·54 l 45·48 l 44·78	l 44·24 l 44·06 l 44·90	l 45·12 l 44·72 l 43·60	l 44·40 l 43·98 l 44·14	l 43·28 l 44·40 l 44·42	l 45·52 l 43·86 l 45·34	h 44·78 h 43·94 h 44·34	h 43·36 h 44·98 h 44·12	$M = 44''\cdot51$ $w = 37\cdot00$ $\frac{1}{w} = 0\cdot03$
	44·70	45·33	44·60	44·40	44·48	44·17	44·03	44·91	44·35	44·15	$C = 63° 2' 44''\cdot51$
XVIII & XVI	h 14·22 h 14·48 h 13·80	h 12·62 h 12·98 h 12·90	h 14·92 l 14·12 l 13·80	l 14·56 l 13·32 l 13·48	l 13·44 l 12·84 l 13·96	l 14·84 l 14·62 l 15·24	l 14·06 l 13·24 l 13·68	l 12·54 l 12·94 l 13·36	h 14·18 h 14·44 h 14·50	h 13·34 h 13·74 h 13·18	$M = 13''\cdot78$ $w = 21\cdot30$ $\frac{1}{w} = 0\cdot05$
	14·17	12·83	14·28	13·79	13·41	14·90	13·66	12·95	14·37	13·42	$C = 61° 13' 13''\cdot78$

At XX (Sorau)

February 1874; *observed by Lieut. J. Hill, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XVII 234° 42′	54° 41′	313° 54′	133° 53′	33° 3′	213° 3′	112° 16′	292° 16′	191° 30′	11° 30′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XVII & XVIII	″ h 25·04 h 26·38 l 27·46 h 27·98	″ h 27·44 h 25·54 h 25·52	″ h 25·62 h 26·72 h 26·74	″ l 25·52 l 25·48 l 25·98	″ l 27·52 h 27·20 h 26·06	″ l 27·64 l 24·94 l 27·56 l 26·46	″ l 25·78 l 25·16 l 27·12	″ l 26·12 l 26·08 l 25·86	″ l 25·60 l 26·84 l 25·74	″ h 27·82 h 28·84 h 28·02	$M = 26''·48$ $w = 14·08$ $\frac{1}{w} = 0·07$
	26·72	26·17	26·36	25·66	26·93	26·65	26·02	26·02	26·06	28·23	$C = 59° 45' 26''·48$
XVIII & XXII	h 7·20 h 7·42 l 8·58	h 6·20 h 5·86 h 6·92	h 8·82 h 8·82 h 9·22	l 9·12 l 8·36 l 8·28	l 8·76 h 7·00 h 7·36	l 6·70 l 7·12 l 7·68	l 7·98 l 6·58 l 7·06	l 8·40 l 7·74 l 8·30	l 7·76 l 7·28 l 6·84	h 8·14 h 6·88 h 7·10	$M = 7''·65$ $w = 15·20$ $\frac{1}{w} = 0·07$
	7·73	6·33	8·95	8·59	7·71	7·17	7·21	8·15	7·29	7·37	$C = 65° 34' 7''·65$

At XXI (Jalora)

February 1874; *observed by Lieut. J. Hill, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXIII 132° 14′	312° 14′	211° 27′	31° 26′	290° 39′	110° 40′	9° 50′	189° 50′	89° 0′	269° 0′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXIII & XXIV	″ h 47·38 h 47·66 h 48·40	″ h 47·34 l 47·36 l 47·82	″ h 48·48 h 48·62 h 47·68	″ h 49·00 h 48·10 l 48·88	″ l 48·52 l 48·38 l 47·16	″ h 48·78 h 48·62 h 48·38	″ h 47·74 h 47·92 h 48·90	″ h 48·26 l 48·86 l 48·58	″ h 46·20 h 47·94 h 46·60	″ h 46·18 h 47·86 h 47·58	$M = 47''·97$ $w = 22·20$ $\frac{1}{w} = 0·05$
	47·81	47·51	48·26	48·66	48·02	48·59	48·19	48·57	46·91	47·21	$C = 49° 15' 47''·97$
XXIV & XXII	h 10·24 h 10·16 h 9·80	h 9·30 l 9·80 l 11·26	h 9·06 h 8·60 h 10·84 h 9·92	h 10·64 h 10·92 l 10·10	l 8·68 l 9·08 l 9·38	h 8·36 h 9·48 h 9·94	h 11·00 h 8·96 h 9·06 l 10·06	h 9·62 l 8·76 l 9·30	h 10·38 h 10·20 h 9·38 d 9·61	h 10·82 h 10·54 h 9·24	$M = 9''·77$ $w = 28·75$ $\frac{1}{w} = 0·03$
	10·07	10·12	9·61	10·55	9·05	9·26	9·77	9·23	9·89	10·20	$C = 49° 40' 9''·77$
XXII & XVIII	h 45·48 h 46·54 h 45·48	h 45·72 l 45·98 l 46·00 d 45·68	h 47·00 h 45·22 h 45·44	h 46·84 h 46·12 l 45·50	l 46·24 l 46·18 l 45·78	h 45·78 h 44·16 h 45·66	h 45·28 h 46·16 h 46·72	h 45·90 l 45·42 l 45·10	l 46·58 h 45·38 h 46·54 d 45·79	h 46·60 h 45·96 h 45·18	$M = 45''·85$ $w = 57·00$ $\frac{1}{w} = 0·02$
	45·83	45·85	45·89	46·15	46·07	45·20	46·05	45·47	46·07	45·91	$C = 74° 44' 45''·85$
XVIII & XIX	h 31·66 h 31·52 h 31·38	h 32·10 l 32·18 l 31·90 d 31·84	h 32·54 h 33·58 h 32·60	h 29·80 h 30·24 h 30·18 l 31·72	l 30·82 l 32·10 l 32·52	h 30·78 h 31·70 h 32·08	h 31·36 h 33·04 h 31·24	h 32·08 l 32·86 l 33·30	l 32·10 h 32·48 h 33·06 h 31·42	h 32·88 h 32·60 h 31·44 h 31·28	$M = 31''·92$ $w = 17·30$ $\frac{1}{w} = 0·06$
	31·52	32·01	32·91	30·48	31·81	31·52	31·88	32·75	32·27	32·05	$C = 54° 5' 31''·92$

At XXII (Loháwat)

February 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XX										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 1′	79° 13′	259° 13′	158° 27′	338° 27′	237° 36′	57° 36′	316° 45′	136° 45′	
	″	″	″	″	″	″	″	″	″	″	
XX & XVIII	h 17·04 h 15·14 h 17·92 h 16·36	h 15·86 l 17·34 l 16·26	l 17·52 l 15·78 l 16·90	l 16·46 h 17·94 h 16·52	h 17·04 h 16·30 h 15·64 h 17·62	l 16·18 l 16·58 l 16·34	l 17·68 l 17·66 l 16·04	h 15·04 h 16·24 h 16·26	h 17·26 l 15·62 l 16·28	l 17·14 l 16·76 l 17·64	$M = 16''·64$ $w = 32·18$ $\frac{1}{w} = 0·03$ $C = 57°\ 3'\ 16''·64$
	16·62	16·49	16·73	16·97	16·65	16·37	17·13	15·85	16·39	17·18	
XVIII & XXI	h 29·60 h 30·34 h 29·74	l 29·44 l 30·64 l 29·46	l 32·10 l 31·42 l 30·78	l 30·48 h 30·06 h 30·46	h 28·76 h 29·78 h 30·34	l 30·64 l 30·32 l 30·60	l 28·52 l 28·82 l 28·94	h 29·36 h 29·54 h 30·58	l 30·30 l 30·88 l 30·86	l 29·78 l 28·88 l 28·96	$M = 30''·01$ $w = 15·60$ $\frac{1}{w} = 0·06$ $C = 56°\ 13'\ 30''·01$
	29·89	29·85	31·43	30·33	29·63	30·52	28·76	29·83	30·68	29·21	
XXI & XXIII	h 50·00 h 50·46 h 49·34	l 49·30 l 48·78 l 49·34	l 47·74 l 48·68 l 48·96	l 49·86 h 48·56 h 48·00	h 48·50 h 47·36 h 49·42 h 47·72	l 50·00 l 50·64 l 50·52	l 50·46 l 49·66 l 51·48	h 49·32 h 48·82 h 50·30	h 49·14 l 49·44 l 49·40	l 47·84 l 49·10 l 48·44	$M = 49''·28$ $w = 13·25$ $\frac{1}{w} = 0·08$ $C = 37°\ 25'\ 49''·28$
	49·93	49·14	48·46	48·81	48·25	50·39	50·53	49·48	49·33	48·46	
XXIII & XXIV	h 35·82 h 36·08 h 34·84	l 36·04 l 35·56 l 36·18	l 35·98 l 37·42 l 35·50	l 34·80 h 34·32 h 35·92	h 35·78 h 35·62 h 37·50	l 35·56 l 34·86 l 35·38	l 35·72 l 34·88 l 35·72	h 35·54 h 36·24 h 35·22	h 37·08 h 36·66 l 36·12	l 37·10 l 38·28 l 36·32	$M = 35''·94$ $w = 17·20$ $\frac{1}{w} = 0·06$ $C = 33°\ 40'\ 35''·94$
	35·58	35·93	36·30	35·01	36·30	35·27	35·44	35·67	36·62	37·23	

At XXIII (Ekka)

February 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXV										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 0′	79° 13′	259° 13′	158° 23′	338° 23′	237° 35′	57° 35′	316° 49′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
XXV & XXVI	h 56·74 h 56·98 h 57·08	h 58·08 h 57·86 h 57·04	l 55·62 l 56·52 l 57·42 h 59·02 h 56·36	h 56·82 h 57·68 h 56·96	h 56·36 h 57·34 h 56·38	h 57·60 h 57·04 h 56·52	l 58·10 l 56·32 l 56·40	l 56·26 h 55·48 h 56·94	h 58·70 h 57·70 h 55·56 h 55·64 h 56·38	h 55·84 h 57·20 h 55·42	$M = 56''·86$ $w = 25·78$ $\frac{1}{w} = 0·04$ $C = 36°\ 46'\ 56''·86$
	56·93	57·66	56·99	57·15	56·69	57·05	56·94	56·23	56·80	56·15	

At XXIII (Ekka)—(*Continued*).

Angle between	Circle readings, telescope being set on XXV 0° 1′	180° 0′	79° 13′	259° 13′	158° 23′	338° 23′	237° 35′	57° 35′	316° 49′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXVI & XXIV	h 17·44 h 16·22 h 15·34 h 17·10	h 13·36 h 14·00 h 14·98	l 16·94 l 16·84 h 15·18 h 13·82 h 13·80	h 14·80 h 14·74 h 14·92	h 14·78 h 13·56 h 14·24	h 15·56 h 16·46 h 16·56	l 15·00 l 16·88 l 16·02	l 16·46 h 15·64 h 15·86	h 13·02 h 15·00 h 14·66	h 15·82 h 16·00 h 15·34	$M = 15''·31$ $w = 9·83$ $\frac{1}{w} = 0·10$ $C = 38° 24' 15''·32$
	16·53	14·11	15·32	14·82	14·19	16·19	15·97	15·99	14·23	15·72	
XXIV & XXII	h 2·34 h 4·92 h 3·94 h 2·14	h 4·78 h 4·94 h 4·64	l 4·94 l 5·04 h 3·70 h 4·40 h 3·22	h 5·18 h 4·26 h 5·06	h 3·22 h 4·18 h 4·10	h 3·02 h 2·36 h 2·40	l 4·22 l 3·04 l 2·76	l 2·54 l 3·30 h 3·04	h 3·38 h 4·34 h 3·54	h 3·36 h 3·52 h 2·18	$M = 3''·67$ $w = 14·06$ $\frac{1}{w} = 0·07$ $C = 35° 22' 3''·67$
	3·34	4·79	4·26	4·83	3·83	2·59	3·34	2·96	3·75	3·02	
XXII & XXI	h 14·18 h 12·48 h 15·22 h 14·90	h 13·58 h 13·44 h 13·18	l 12·76 h 13·88 h 14·54 h 14·98	h 13·34 h 14·58 h 14·04	h 14·64 h 13·48 h 13·92	h 14·18 h 15·30 h 14·80	l 13·90 l 12·78 l 12·76	l 14·84 l 13·84 h 13·62	h 15·64 h 14·94 h 13·98	h 12.88 h 13·22 h 14·42	$M = 14''·00$ $w = 22·64$ $\frac{1}{w} = 0·04$ $C = 43° 38' 14''·00$
	14·20	13·40	14·04	13·99	14·01	14·76	13·15	14·10	14·85	13·51	

At XXIV (Omlo)

February 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24*-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXII 0° 1′	180° 1′	79° 13′	259° 13′	158° 26′	338° 26′	237° 34′	57° 34′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXII & XXI	h 25·02 h 25·68 l 26·84	h 26·06 h 25·32 h 26·14	h 26·32 h 26·62 h 24·50 h 25·64	l 26·20 l 24·94 h 25·70	h 26·30 h 25·62 h 26·40	h 25·62 h 26·48 l 24·88	l 24·78 l 25·16 l 25·96	h 25·32 h 25·96 h 24·80	h 26·00 h 24·30 h 24·98 l 25·64	h 25·52 l 25·60 l 26·08	$M = 25''·65$ $w = 54·31$ $\frac{1}{w} = 0·02$ $C = 59° 13' 25''·64$
	25·85	25·84	25·77	25·61	26·11	25·66	25·30	25·36	25·23	25·73	
XXI & XXIII	h 54·90 h 55·32 l 56·22 d 54·66	h 54·94 h 55·44 h 54·76	h 54·84 h 53·50 h 54·48 d 53·53	l 56·22 l 54·06 h 54·98 h 54·16	h 55·34 h 55·26 h 55·90	h 55·58 h 56·54 l 55·86	l 55·58 l 55·68 l 54·78	h 55·30 h 55·50 h 54·52	h 56·30 h 56·52 h 54·76	h 56·00 h 55·82 h 54·00	$M = 55''·24$ $w = 25·11$ $\frac{1}{w} = 0·04$ $C = 51° 43' 55''·23$
	55·28	55·05	54·09	54·85	55·50	55·99	55·35	55·11	55·86	55·27	

At XXIV (Omlo)—(*Continued*).

Angle between	Circle readings, telescope being set on XXII										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 1′	79° 13′	259° 13′	158° 26′	338° 26′	237° 34′	57° 34′	316° 48′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
XXIII & XXV	h 55·22 h 55·40 l 54·92 d 54·36	h 54·20 h 54·62 h 54·16	h 54·96 h 54·82 h 55·44 d 54·33	l 54·30 l 52·94 l 53·26	h 53·58 h 53·12 h 52·98	h 52·88 h 53·14 l 52·34	l 53·82 l 53·30 l 54·78	h 52·98 h 54·56 h 54·42	h 55·58 h 54·20 h 55·64	h 53·08 l 53·48 l 52·80	$M = 53''·99$ $w = 13·06$ $\frac{1}{w} = 0·08$ $C = 64° 22' 53''·99$
	54·98	54·33	54·89	53·50	53·23	52·79	53·97	53·99	55·14	53·12	
XXV & XXVI	h 10·46 h 9·98 h 7·74 l 7·78	h 8·86 h 8·70 h 8·98	h 7·32 h 10·18 h 9·60 h 9·58	l 8·24 l 9·04 l 8·12	h 9·20 h 9·78 h 9·68	h 9·40 h 10·20 l 8·26	l 10·46 l 9·90 l 8·32	h 7·74 h 9·96 h 9·56 h 9·54	h 10·54 h 10·48 h 8·82	h 8·18 l 7·46 l 7·86	$M = 9''·09$ $w = 17·77$ $\frac{1}{w} = 0·06$ $C = 47° 2' 9''·09$
	8·99	8·85	9·17	8·47	9·55	9·29	9·56	9·20	9·95	7·83	

At XXV (Khirwa)

March 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXVIII										M = Mean of Groups w = Relative Weight C = Concluded Angle
	234° 19′	54° 18′	313° 32′	133° 32′	32° 43′	212° 43′	111° 56′	291° 56′	191° 9′	11° 9′	
	″	″	″	″	″	″	″	″	″	″	
XXVIII & XXVII	h 9·90 h 9·38 l 9·52	l 8·20 h 10·38 h 9·22 h 7·60	h 10·66 h 8·90 h 10·22	h 10·06 h 9·22 h 11·22	h 10·98 h 10·46 h 10·40	h 10·28 h 9·42 h 10·80	h 10·04 h 8·58 l 9·42	l 10·30 h 11·08 h 9·20	h 12·46 h 11·26 h 10·60	h 11·02 h 11·36 h 11·42	$M = 10''·16$ $w = 12·37$ $\frac{1}{w} = 0·08$ $C = 59° 47' 10''·15$
	9·60	8·85	9·93	10·17	10·61	10·17	9·35	10·19	11·44	11·27	
XXVII & XXVI	h 50·62 h 51·04 h 51·38	h 52·68 h 52·20 h 53·20	h 53·22 h 51·94 h 51·84	h 51·16 h 52·50 l 51·92	h 52·08 h 52·02 h 53·26	h 52·26 h 52·78 h 52·70	h 50·98 h 51·06 l 49·94	l 51·56 h 52·90 h 53·22	h 51·78 h 51·80 h 51·48	h 52·56 h 51·34 l 52·88	$M = 52''·01$ $w = 17·20$ $\frac{1}{w} = 0·06$ $C = 65° 53' 52''·01$
	51·01	52·69	52·33	51·86	52·45	52·58	50·66	52·56	51·69	52·26	
XXVI & XXIV	h 26·06 h 24·80 h 25·70	l 25·68 h 24·44 h 24·94	h 24·32 h 25·88 h 25·98	h 24·16 h 23·94 h 25·24	h 23·36 h 25·62 h 24·52 h 25·88	h 26·34 h 24·12 h 25·00 h 25·12	h 24·10 h 25·20 l 25·82	l 24·92 h 23·80 h 25·08	h 25·36 h 25·80 h 23·62 l 25·96	h 25·52 h 27·06 h 25·28	$M = 25''·11$ $w = 27·41$ $\frac{1}{w} = 0·04$ $C = 54° 21' 25''·11$
	25·52	25·02	25·39	24·45	24·85	25·14	25·04	24·60	25·19	25·95	

At XXV (Khirwa)—(*Continued*).

Angle between	Circle readings, telescope being set on XXVIII 234° 19′	54° 18′	313° 32′	133° 32′	32° 43′	212° 43′	111° 56′	291° 56′	191° 9′	11° 9′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXIV & XXIII	″ h 53·96 h 53·72 h 54·28	″ l 53·84 h 53·80 h 54·96	″ h 55·82 h 54·80 h 54·06	″ h 54·32 h 55·54 h 53·88	″ h 53·64 h 56·10 h 53·54 h 55·66	″ h 55·00 h 55·62 h 54·80	″ h 54·86 h 53·30 h 54·84 l 54·82	″ l 55·72 h 54·80 h 55·48	″ h 55·70 h 54·36 h 55·80	″ h 55·14 h 54·62 h 53·94	$M = 54''·72$ $w = 29·34$ $\frac{1}{w} = 0·03$ $C = 40° 25' 54''·72$
	53·99	54·20	54·89	54·58	54·74	55·14	54·45	55·33	55·29	54·57	

At XXVI (Jambo)

February and March 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXIV 0° 0′	179° 59′	79° 11′	259° 11′	158° 26′	338° 26′	237° 38′	57° 38′	316° 47′	136° 47	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXIV & XXIII	″ h 42·62 h 43·68 h 42·20	″ h 42·64 h 40·50 h 42·70	″ h 40·34 h 41·30 h 41·60	″ h 42·20 h 42·10 h 42·98	″ h 40·74 h 41·86 h 41·54	″ h 43·38 h 43·34 h 43·58	″ h 43·68 h 44·02 h 43·04	″ h 43·62 h 42·14 h 42·14	″ h 42·46 h 42·92 h 42·70	″ h 41·86 h 42·88 h 40·94	$M = 42''·39$ $w = 12·70$ $\frac{1}{w} = 0·08$ $C = 30° 10' 42''·39$
	42·83	41·95	41·08	42·43	41·38	43·43	43·58	42·63	42·69	41·89	
XXIII & XXV	l 43·84 h 44·16 h 43·66	h 45·22 h 44·14 h 43·12	h 43·88 h 45·22 h 45·52	h 44·06 h 43·38 h 44·60	h 44·26 h 44·14 h 44·74	h 44·38 h 45·70 h 45·72	h 42·28 h 42·46 h 43·86	h 42·96 h 43·42 h 43·72	h 43·90 h 43·22 h 44·28	h 43·76 h 43·28 h 44·64	$M = 44''·05$ $w = 17·20$ $\frac{1}{w} = 0·06$ $C = 48° 25' 44''·05$
	43·89	44·16	44·87	44·01	44·38	45·27	42·87	43·37	43·80	43·89	
XXV & XXVII	h 27·42 h 29·12 h 27·18 d 29·29 d 28·67	h 30·36 h 28·04 h 29·66 h 30·64	h 29·52 h 29·62 h 27·48 h 27·72	h 28·34 h 29·24 h 27·94	l 27·56 l 28·08 l 28·22	l 28·84 l 29·12 l 27·88	h 27·34 h 28·56 h 26·62	h 29·34 h 26·82 h 30·04 l 26·90 d 29·45	h 29·54 h 29·16 h 28·50	h 27·14 l 27·86 l 27·58	$M = 28''·43$ $w = 15·28$ $\frac{1}{w} = 0·07$ $C = 61° 40' 28''·44$
	28·34	29·68	28·58	28·51	27·95	28·61	27·51	28·51	29·07	27·53	
XXVII & R. M.	h 9·78 h 8·90 h 8·54 d 10·45 d 9·83	h 10·70 h 9·22 h 9·02	h 9·32 h 10·28 h 10·92	h 9·66 h 9·52 h 9·06	l 9·70 l 9·20 l 8·54	l 9·20 l 9·46 l 9·76	h 10·46 h 9·88 h 11·74	h 9·24 h 10·62 h 9·26 d 10·88	h 9·84 h 9·46 h 8·16	l 9·80 l 10·14 l 8·40	$M = 9''·66$ $w = 26·93$ $\frac{1}{w} = 0·04$ $C = 3° 19' 9''·66$
	9·50	9·65	10·17	9·41	9·15	9·47	10·69	10·00	9·15	9·45	

NOTE.—R.M. denotes Referring Mark.

At XXVI (Jambo)—(*Continued*).

Angle between	Circle readings, telescope being set on XXIV 0° 0′	179° 59′	79° 11′	259° 11′	158° 26′	338° 26′	237° 38′	57° 38′	316° 47′	136° 47′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
R.M. & XXIX	h 10·04	h 9·48	h 10·18	h 9·20	l 11·18	l 9·14	h 8·70	h 9·60	h 10·64	h 8·72	M = 9″·84
	h 9·74	h 10·74	h 8·68	h 10·08	l 11·10	l 9·10	h 10·56	h 10·14	h 8·84	h 10·44	w = 19·28
	h 11·94	h 11·12	h 8·78	h 10·28	l 11·30	l 8·92	h 11·00	h 8·26	h 9·82	h 9·20	$\frac{1}{w}$ = 0·05
					l 8·76		h 10·16				
	10·57	10·45	9·21	9·85	10·59	9·05	10·10	9·33	9·77	9·45	C = 49° 17′ 9″·85

At XXVII (Sirad)

***March* 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XXIX 0° 0′	180° 0′	79° 13′	259° 13′	158° 26′	338° 25′	237° 37′	57° 37′	316° 47′	136° 47′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXIX & XXVI	h 54·84	l 55·68	l 53·84	h 55·40	h 55·32	l 54·30	h 53·74	h 55·02	h 53·80	h 53·90	M = 54″·63
	h 54·46	h 54·16	h 54·70	h 55·66	h 55·58	h 53·96	h 53·40	h 54·76	h 55·08	l 56·14	w = 25·84
	h 55·22	h 53·58	h 55·12	h 55·20	h 54·14	h 55·70	h 54·10	h 53·54	h 54·10	l 53·96	$\frac{1}{w}$ = 0·04
		h 53·90	h 56·70							l 53·86	
	54·84	54·33	55·09	55·42	55·01	54·65	53·75	54·44	54·33	54·47	C = 63° 28′ 54″·63
XXVI & XXV	h 41·44	h 39·34	l 41·30	h 39·42	h 41·36	l 41·26	h 41·84	h 40·90	h 40·18	h 40·02	M = 40″·45
	h 41·58	h 39·72	h 39·62	h 40·36	h 39·48	h 40·50	h 40·46	h 40·46	h 40·56	l 40·16	w = 29·40
	h 40·10	h 41·16	h 40·16	h 39·18	h 40·04	h 41·46	h 40·02	h 41·32	h 40·04	l 40·24	$\frac{1}{w}$ = 0·03
	41·04	40·07	40·36	39·65	40·29	41·07	40·77	40·89	40·26	40·14	C = 52° 25′ 40″·45
XXV & XXVIII	h 26·52	h 26·82	l 27·96	h 27·30	h 26·44	l 27·46	h 26·58	h 26·96	h 28·20	h 27·60	M = 27″·01
	h 26·76	h 25·98	h 25·74	h 25·62	h 28·08	h 27·52	h 27·66	h 28·10	h 26·96	l 28·22	w = 20·82
	h 27·44	h 28·12	h 24·90	h 26·14	h 27·78	h 26·26	h 28·20	h 27·24	h 26·84	l 27·26	$\frac{1}{w}$ = 0·05
		h 25·18	h 24·74							l 27·16	
			h 26·58								
	26·91	26·53	25·98	26·35	27·43	27·08	27·48	27·43	27·33	27·56	C = 66° 37′ 26″·99
XXVIII & XXX	h 41·88	h 40·12	l 39·84	h 40·84	h 40·60	l 41·00	h 41·26	h 39·48	h 41·02	l 40·00	M = 40″·69
	h 40·38	h 39·42	h 40·84	h 40·76	h 39·82	h 41·44	h 40·48	h 39·60	h 41·20	l 40·48	w = 31·20
	h 41·40	h 40·82	h 42·00	h 39·86	h 40·24	h 41·18	h 41·10	h 41·54	h 40·40	l 39·76	$\frac{1}{w}$ = 0·03
		h 40·06	h 41·68					h 42·22			
	41·22	40·11	41·09	40·49	40·22	41·21	40·95	40·71	40·87	40·08	C = 53° 19′ 40″·69

At XXVII (Sirad)—(*Continued*).

Angle between	Circle readings, telescope being set on XXIX: 0° 0′	180° 0′	79° 13′	259° 13′	158° 26′	338° 25′	237° 37′	57° 37′	316° 47′	136° 47′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXX & XXXI	h25·66	h25·24	l25·58	h25·38	h25·16	l25·70	h24·94	h25·70	h25·12	l26·14	$M = 25''·66$
	h24·40	h26·44	h25·90	h25·30	h26·28	h26·64	h25·26	h24·94	h25·64	l26·34	$w = 31·82$
	hl26·02	h25·20	h25·24	h26·46	h25·70	h25·22	h25·60	h24·02	h25·86	l27·16	$\frac{1}{w} = 0·03$
			h27·56					h24·82			
	25·36	25·63	26·07	25·71	25·71	25·85	25·27	24·87	25·54	26·55	$C = 47° 29′ 25''·66$
XXXI & XXIX	h50·70	h52·48	l50·48	h51·50	h51·50	l50·26	h53·24	h52·32	h51·00	l51·52	$M = 51''·60$
	h50·30	h51·00	h52·96	h52·98	h51·76	l51·16	h50·86	h52·20	h51·04	l51·84	
	h50·30	h50·98	h52·66	h51·48	h52·26	h51·50	h50·80	h52·26	h51·98	l50·30	$w = 21·68$
	h51·26		h52·74				h53·28			l51·04	$\frac{1}{w} = 0·05$
	50·64	51·49	52·21	51·99	51·84	50·97	52·05	52·26	51·34	51·17	$C = 76° 38′ 51''·60$

At XXVIII (Harban)

April 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXX: 0° 2′	180° 1′	79° 13′	259° 13′	158° 27′	338° 27′	237° 37′	57° 36′	316° 49′	136° 48′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXX & XXVII	h42·00	h43·28	h42·78	h42·86	h40·84	l43·08	l43·28	h43·02	h42·66	l42·56	$M = 42''·08$
	h40·96	h42·74	h40·72	h40·40	h43·00	l42·54	l39·82	h42·12	h40·60	l42·06	
	h42·44	h41·76	h42·46	h40·60	h42·66	l42·12	h42·86	h42·42	hl42·14	l41·82	$w = 27·59$
			h41·32	h42·82	l42·14		h42·80		l41·38		$\frac{1}{w} = 0·04$
							h40·20				
	41·80	42·59	41·82	41·67	42·16	42·58	41·79	42·52	41·70	42·15	$C = 73° 37′ 42''·06$
XXVII & XXV	h23·74	h23·32	h24·00	h22·94	h22·62	l24·06	l24·82	h24·12	h24·00	l23·02	$M = 23''·48$
	h23·00	h23·44	h23·46	h23·78	h21·86	l24·34	h22·70	h23·96	h23·48	l23·44	
	h22·82	h25·08	h22·22	h23·26	hl23·72	l23·98	h24·38	h22·42	l22·22	l22·94	$w = 34·34$
					l24·84		h23·48				$\frac{1}{w} = 0·03$
	23·19	23·95	23·23	23·33	23·26	24·13	23·85	23·50	23·23	23·13	$C = 53° 35′ 23''·48$

At XXIX (Bintli)

March 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXVI: 0° 1′	180° 1′	79° 14′	259° 14′	158° 24′	338° 24′	237° 36′	57° 35′	316° 51′	136° 50′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXVI & XXVII	h46·42	h45·06	l47·46	l46·16	h46·16	h45·58	h45·56	h47·60	h46·94	h47·28	$M = 46''·41$
	h45·78	h47·18	l46·80	l46·70	h47·48	h46·90	h45·18	h45·20	h46·72	h46·48	
	h45·22	l45·78	l46·90	l47·74	h46·90	h46·72	h45·14	h45·54	h45·50	h47·36	$w = 23·99$
		l46·82					h46·92	h44·90			$\frac{1}{w} = 0·04$
	45·81	46·21	47·05	46·87	46·85	46·40	45·70	45·81	46·39	47·04	$C = 63° 54′ 46''·40$

At XXIX (Bintli)—(*Continued*).

Angle between	Circle readings, telescope being set on XXVI 0° 1′	180° 1′	79° 14′	259° 14′	158° 24′	338° 24′	237° 36′	57° 35′	316° 51′	136° 50′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXVII & XXXI	h 27·20 h 27·22 h 27·28	h 26·88 l 25·84 l 26·40	l 26·24 l 27·16 l 25·70	l 25·78 l 26·48 l 26·44	h 27·84 h 28·64 h 26·02 h 25·86	h 25·82 h 26·70 h 26·82	h 25·78 h 27·02 h 26·84	h 24·52 h 25·58 h 24·60 h 25·48	h 24·60 h 26·48 h 24·46 h 25·60	h 26·04 h 25·10 h 26·26	$M = 26''\cdot24$ $w = 16\cdot18$ $\frac{1}{w} = 0\cdot06$ $C = 64^\circ\ 49'\ 26''\cdot23$
	27·23	26·37	26·37	26·23	27·09	26·45	26·55	25·05	25·28	25·80	

At XXX (Nok)

†*March* 1874; *observed by Lieut. J. Hill, R.E., with Barrow's* 24-*inch Theodolite No.* 2.
**December* 1874; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXIII 241° 34′	61° 34′	320° 46′	140° 46′	39° 58′	219° 58′	119° 11′	299° 11′	198° 22′	18° 22′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
* XXXIII & XXXII	h 15·72 h 15·14 h 14·06	h 14·26 h 14·74 h 15·42	h 15·52 h 13·02 h 16·60 l 13·52	l 16·28 l 16·38 l 13·30 l 14·92 l 14·04 l 15·64	h 16·08 h 15·12 h 13·70 h 15·96	h 16·20 h 16·16 h 14·60	h 15·66 h 16·10 h 14·68	h 15·06 h 14·86 h 14·72	h 15·44 h 15·24 h 14·60	h 14·04 h 15·26 h 15·64	$M = 15''\cdot08$ $w = 31\cdot59$ $\frac{1}{w} = 0\cdot03$ $C = 55^\circ\ 50'\ 15''\cdot08$
	14·97	14·81	14·67	15·09	15·21	15·65	15·48	14·88	15·09	14·98	
* XXXII & XXXI	h 11·42 h 8·36 h 12·28 h 8·82 h 13·14 h 12·46	h 11·58 h 12·08 h 10·52 h 12·52 h 10·74	h 13·86 h 13·04 h 12·30 h 10·76	l 11·40 l 13·70 l 15·28 l 13·20 l 11·40 l 11·30	l 10·16 h 12·06 h 11·70	h 11·80 h 10·18 h 9·82	h 13·72 h 12·62 h 13·06	h 12·18 h 12·82 h 11·48 h 15·26	h 14·52 h 13·22 h 13·82	h 12·34 h 12·86 h 11·24 h 11·28 h 12·04	$M = 12''\cdot15$ $w = 7\cdot02$ $\frac{1}{w} = 0\cdot14$ $C = 62^\circ\ 36'\ 12''\cdot14$
	11·08	11·49	12·49	12·71	11·31	10·60	13·13	12·94	13·85	11·95	

Angle between	Circle readings, telescope being set on XXXI 0° 2′	180° 2′	79° 11′	259° 11′	158° 24′	338° 24′	237° 37′	57° 36′	316° 50′	136° 50′	
	″	″	″	″	″	″	″	″	″	″	
† XXXI & XXVII	l 48·68 l 48·72 l 48·80	l 47·78 l 48·68 l 48·10	l 46·76 l 47·94 h 47·76 h 47·68	h 45·40 h 46·44 h 46·80	h 47·56 h 46·80 h 47·88	h 48·72 hl 49·36 l 48·32	l 46·66 l 46·54 h 47·12	h 47·58 h 46·24 h 45·48 h 47·12	h 46·22 h 47·20 h 47·70	h 47·04 h 47·64 h 47·10	$M = 47''\cdot46$ $w = 11\cdot84$ $\frac{1}{w} = 0\cdot08$ $C = 68^\circ\ 24'\ 47''\cdot46$
	48·73	48·19	47·54	46·21	47·41	48·80	46·77	46·60	47·04	47·26	
† XXVII & XXVIII	l 37·66 l 37·12 l 37·64	l 37·54 l 37·14 l 36·94	l 39·30 l 38·72 l 38·14	h 38·40 h 39·44 h 39·12	h 38·60 h 37·52 h 37·62	h 38·14 h 38·06 l 39·86	l 38·88 l 38·36 h 37·56	h 38·68 h 38·44 h 38·48	h 38·82 h 39·08 h 38·18	h 37·68 h 36·42 h 37·40	$M = 38''\cdot17$ $w = 18\cdot50$ $\frac{1}{w} = 0\cdot05$ $C = 53^\circ\ 2'\ 38''\cdot17$
	37·47	37·21	38·72	38·99	37·91	38·69	38·27	38·53	38·69	37·17	

At XXXI (Mongolia)

†*March* 1874; *observed by Lieut. J. Hill, R. E., with Barrow's 24-inch Theodolite No.* 2.
**December* 1874; *observed by Captain M. W. Rogers, R. E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXIX										*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	0° 2′	180° 2′	79° 14′	259° 14′	158° 24′	338° 23′	237° 36′	57° 35′	316° 49′	136° 49′	
	″	″	″	″	″	″	″	″	″	″	
† XXIX & XXVII	h 43·32 h 43·70 h 41·80	h 42·78 h 43·08 h 42·82	h 44·54 h 43·60 h 42·88	h 43·02 h 42·32 h 43·72	h 42·78 h 43·36 l 43·84	h 42·14 h 42·96 h 43·34	h 43·98 h 42·88 h 42·38	h 42·62 h 43·66 h 43·18	h 42·22 h 41·06 h 42·90	l 44·08 l 42·38 l 42·20 l 44·52	$M = 43''\cdot02$ $w = 30\cdot72$ $\frac{1}{w} = 0\cdot03$
	42·94	42·89	43·67	43·02	43·33	42·81	43·08	43·15	42·06	43·30	$C = 38°\ 31'\ 43''\cdot02$
† XXVII & XXX	h 49·08 h 49·84 h 49·90	h 49·38 h 48·58 h 48·62	h 50·42 h 49·88 h 50·04	h 47·26 h 47·82 hl 48·52	l 47·84 l 46·46 l 46·46	h 47·86 h 48·72 h 48·68	h 47·46 h 47·66 h 47·50	h 49·46 h 49·04 h 48·80	h 48·72 h 49·76 h 49·88	l 47·44 l 47·06 l 46·94	$M = 48''\cdot50$ $w = 7\cdot90$ $\frac{1}{w} = 0\cdot13$
	49·61	48·86	50·11	47·87	46·92	48·42	47·54	49·10	49·45	47·15	$C = 64°\ 5'\ 48''\cdot50$
	Circle readings, telescope being set on XXX										
	0° 0′	180° 0′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 36′	316° 49′	136° 48′ 280° 48′	
	″	″	″	″	″	″	″	″	″	″	
* XXX & XXXII	h 57·76 h 55·24 h 55·90	h 53·92 h 55·98 h 57·14 h 56·02 h 56·12	h 54·68 l 54·82 l 55·02	l 54·84 l 55·18 l 55·86	l 56·34 l 55·96 l 56·24	l 55·98 l 58·96 l 55·42 l 56·42	l 56·64 h 55·24 h 56·56	h 54·92 h 56·38 h 55·88	h 54·72 l 53·30 l 54·10 l 54·84	h 53·38 l 55·70 l 55·40 l 57·72 l 56·46	$M = 55''\cdot70$ $w = 12\cdot65$ $\frac{1}{w} = 0\cdot08$
	56·30	55·84	54·84	55·29	56·18	56·70	56·15	55·73	54·24	55·73	$C = 50°\ 17'\ 55''\cdot70$
* XXXII & XXXV	h 10·76 h 13·98 h 12·12 h 15·28 h 12·50 h 12·72	h 16·28 h 11·42 h 13·16 h 11·32	h 10·18 l 12·76 l 14·38 l 14·22	l 9·88 l 11·68 l 11·02 l 14·72 l 12·30	l 12·86 l 13·30 l 11·68	l 13·98 l 14·08 l 14·42	l 11·54 l 14·82 l 12·52 l 13·00 l 15·76 l 14·54	l 13·68 l 12·40 l 12·60	h 13·78 h 13·84 h 13·68	h 13·84 l 14·18 l 14·50	$M = 13''\cdot21$ $w = 10\cdot14$ $\frac{1}{w} = 0\cdot10$
	12·89	13·05	12·88	11·92	12·61	14·16	13·70	12·89	13·77	14·17	$C = 54°\ 41'\ 13''\cdot17$

At XXXII (Pabusar)

December 1874; *observed by Captain M. W. Rogers, R. E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXV										*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 36′	316° 48′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
XXXV & XXXI	h 16·70 h 16·92 h 17·98	h 17·04 h 16·08 h 16·60	h 17·36 h 15·80 h 16·16 h 16·90	h 15·78 h 15·82 h 17·02	h 16·08 h 17·00 l 15·38	l 17·38 l 16·76 l 17·90	l 16·84 l 17·54 l 15·72	l 17·22 l 17·72 l 17·34	h 18·98 h 18·94 h 16·84 h 16·78	h 16·54 h 16·48 h 16·80	$M = 16''\cdot87$ $w = 22\cdot52$ $\frac{1}{w} = 0\cdot04$
	17·20	16·57	16·56	16·21	16·15	17·35	16·70	17·43	17·88	16·61	$C = 69°\ 27'\ 16''\cdot87$

At XXXII (Pabusar)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXV: 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXI & XXX	h 56·64 h 54·86 h 55·18 h 52·88 h 54·16	h 54·30 h 55·68 h 55·62 h 56·14	h 53·60 h 53·52 h 54·32	h 55·54 h 54·72 h 54·32 h 54·38 h 55·44	h 55·50 h 54·54 h 56·80 h 57·30 h 56·12	l 54·46 l 55·18 l 54·44	l 54·32 l 54·06 l 53·86	l 54·60 l 56·44 l 54·92	h 52·92 h 55·32 h 55·66 h 57·98 h 55·44	h 55·36 h 55·62 h 53·78	M = 54″·94 w = 14·68 1/w = 0·07 C = 67° 5′ 54″·97
	54·74	55·44	53·81	54·88	56·05	54·69	54·08	55·32	55·46	54·92	
XXX & XXXIII	h 21·08 h 20·34 h 22·90 h 23·72 h 21·90	h 23·36 h 20·94 h 20·86 h 20·78	h 20·00 h 19·98 h 19·82	h 20·88 h 22·02 h 21·30 h 22·40 h 22·56	h 20·12 h 22·04 h 22·14	l 22·68 l 21·92 l 21·84	l 22·50 l 22·98 l 21·92	l 22·08 l 20·50 l 23·28 l 22·26	h 21·16 h 19·40 h 22·78 h 20·08 h 21·24	h 21·50 h 21·08 h 20·72	M = 21″·54 w = 13·34 1/w = 0·07 C = 61° 59′ 21″·55
	21·99	21·49	19·93	21·83	21·43	22·15	22·47	22·03	20·97	21·10	
XXXIII & XXXIV	h 44·44 h 46·50 h 43·46 h 43·66 h 43·62	h 44·90 h 44·32 h 45·18	h 47·06 h 46·86 h 46·44 h 45·46	h 48·90 h 45·10 h 46·48 h 45·48 h 44·00	h 46·50 h 45·30 h 44·04 h 44·24	l 44·96 l 43·96 l 45·62	l 44·18 l 44·88 l 45·82	l 45·90 l 44·92 l 44·74 l 43·22	h 44·08 h 45·92 h 44·70 h 43·66	h 44·76 h 44·26 h 43·86	M = 45″·00 w = 13·34 1/w = 0·07 C = 94° 26′ 45″·01
	44·34	44·80	46·46	45·99	45·02	44·85	44·96	44·69	44·59	44·29	
XXXIV & XXXV	h 40·08 h 40·00 h 41·12	h 40·82 h 41·56 h 41·82	h 39·56 h 42·60 h 40·96 h 41·22 h 39·44	h 39·02 h 40·14 h 40·52	h 39·98 h 40·26 h 38·52	l 39·84 l 40·86 l 40·40	h 41·16 h 40·38 h 39·26	l 41·78 l 41·80 l 39·60 l 40·44	h 40·90 h 39·76 h 40·40	h 41·60 h 40·28 h 42·66 h 38·70 h 39·22	M = 40″·44 w = 19·74 1/w = 0·05 C = 67° 0′ 40″·46
	40·40	41·40	40·76	39·89	39·59	40·37	40·27	40·91	40·35	40·49	

At XXXIII (Bikampur)

December 1874; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXIV: 0° 0′	180° 0′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXIV & XXXII	h 35·22 h 39·14 h 33·92 h 35·12	h 35·76 h 37·86 h 37·10 h 36·64	h 34·16 h 36·02 h 35·96	h 36·10 h 33·82 h 36·32 h 35·40	h 36·38 h 36·18 h 36·72	h 37·06 h 35·36 h 36·14	h 34·34 l 36·26 l 36·86 l 35·86	l 38·02 l 36·68 l 39·68 l 35·54 l 35·80	l 36·80 l 36·14 l 36·76	l 35·36 l 36·04 l 35·78	M = 36″·14 w = 14·44 1/w = 0·07 C = 40° 46′ 36″·16
	35·85	36·84	35·38	35·41	36·43	36·19	35·83	37·14	36·57	35·73	

At XXXIII (Bikampur)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXIV: 0° 0′	180° 0′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXII & XXX	h 21·70 h 22·22 h 20·58	h 22·90 h 22·68 h 23·72	h 22·42 h 24·30 h 21·86 h 25·00 h 23·20	h 21·54 h 24·62 h 23·64 h 24·00	h 20·72 h 20·96 h 23·56 h 21·82	h 23·84 h 24·86 h 25·04	h 23·68 h 24·24 h 24·12	l 24·56 l 23·14 l 24·58	l 21·68 l 22·38 l 23·98 l 24·82 l 23·64	l 22·20 l 23·56 l 22·06	$M = 23''·18$ $w = 8·26$ $\frac{1}{w} = 0·12$ $C = 62° 10' 23''·18$
	21·50	23·10	23·36	23·45	21·77	24·58	24·01	24·09	23·30	22·61	

At XXXIV (Phulasar)

***December* 1874 *and January* 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XXXVII: 121° 0′	301° 0′	200° 11′	20° 11′	279° 23′	99° 23′	358° 34′	178° 34′	77° 47′	257° 47′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXVII & XXXVI	l 58·74 l 58·02 l 58·98	l 58·78 l 58·70 l 59·18	h 57·72 h 59·44 h 59·02 h 58·28	h 58·10 h 56·56 h 57·54	h 58·04 h 58·30 h 60·34 h 59·98	l 58·10 l 58·12 l 59·40 d 57·60	h 59·70 h 59·10 h 58·32	h 59·98 h 59·12 h 58·72	l 58·64 l 58·06 l 58·40	l 59·24 l 59·12 l 58·36	$M = 58''·65$ $w = 24·34$ $\frac{1}{w} = 0·04$ $C = 68° 16' 58''·65$
	58·58	58·89	58·62	57·40	59·16	58·31	59·04	59·27	58·37	58·91	
XXXVI & XXXV	l 48·66 l 48·64 l 49·34	l 49·00 l 49·24 l 48·68	h 49·42 h 50·42 h 47·28 h 45·50 h 50·64 h 46·68 h 47·10	h 47·06 h 47·34 h 51·24 h 49·56 h 50·10 h 50·22	h 51·16 h 51·62 h 47·04 l 49·44 l 49·02 l 49·72	l 47·80 l 47·80 l 48·52 d 47·10	h 49·82 h 48·70 h 49·04	h 48·98 h 46·82 h 47·26 h 47·08	l 49·66 l 49·68 l 48·32	l 48·18 l 49·62 l 49·42	$M = 48''·77$ $w = 11·68$ $\frac{1}{w} = 0·09$ $C = 57° 57' 48''·76$
	48·88	48·97	48·15	49·25	49·67	47·81	49·19	47·53	49·22	49·07	
XXXV & XXXII	h 49·06 h 48·90 h 47·40	h 50·52 h 49·30 h 47·78 h 49·70	l 49·12 l 49·24 l 49·30	l 47·66 l 47·58 l 48·90	h 50·08 h 47·30 h 49·44 h 47·22 l 48·28	l 49·60 l 47·08 l 48·26 l 46·06 l 47·12	h 48·10 h 48·92 h 47·72	h 48·24 h 48·18 h 48·06	l 48·28 l 48·58 l 48·40	l 49·60 l 49·48 l 48·44	$M = 48''·51$ $w = 19·90$ $\frac{1}{w} = 0·05$ $C = 67° 59' 48''·50$
	48·45	49·33	49·22	48·05	48·46	47·62	48·25	48·16	48·42	49·17	
XXXII & XXXIII	h 38·54 h 37·18 h 39·26	h 37·36 h 37·10 h 38·92	l 38·84 l 39·12 l 37·82	l 38·88 l 37·70 l 37·28	h 36·98 h 37·68 h 39·89 h 41·80 l 40·80 l 40·36	l 37·26 l 36·40 l 39·22 l 39·08	h 38·36 h 39·44 h 39·62	h 38·32 h 37·72 h 39·04	l 39·16 l 38·98 l 38·50	l 39·22 l 38·96 l 38·40	$M = 38''·55$ $w = 16·11$ $\frac{1}{w} = 0·06$ $C = 44° 46' 38''·58$
	38·33	37·79	38·59	37·95	39·60	37·99	39·14	38·36	38·88	38·86	

At XXXV (Girondi)

January 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXI: 359° 59′	179° 59′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXI & XXXII	h 28·02 h 27·10 h 31·20 h 29·20 h 31·12 h 30·40	h 30·30 l 30·32 l 29·72	l 30·62 l 29·74 l 29·90	l 29·26 l 28·94 l 31·46 l 29·92	l 29·02 l 31·34 l 29·38 l 30·16	h 29·12 h 28·12 h 27·70	h 31·26 h 33·24 h 30·70 h 30·10	l 31·02 l 28·36 l 29·94 l 30·12	l 31·14 l 29·86 l 30·08	l 28·72 l 28·64 l 30·22	$M = 29''\cdot86$ $w = 11\cdot42$ $\frac{1}{w} = 0\cdot09$ $C = 55^\circ 51' 29''\cdot87$
	29·51	30·11	30·09	29·90	29·97	28·31	31·32	29·86	30·36	29·19	
XXXII & XXXIV	h 32·04 h 30·98 h 31·78	h 31·62 h 34·12 l 30·96 l 31·64	l 32·02 l 31·46 l 30·66	l 30·76 l 31·54 l 31·86	l 31·80 l 31·70 l 32·74	h 30·24 h 32·52 h 28·50 h 31·86 h 28·48	h 30·88 h 31·46 h 31·94	l 28·90 l 31·88 l 31·78 l 30·60	l 32·80 l 32·04 l 32·12	l 31·48 l 31·26 l 32·44 l 32·04	$M = 31''\cdot52$ $w = 15\cdot62$ $\frac{1}{w} = 0\cdot06$ $C = 44^\circ 59' 31''\cdot50$
	31·60	32·09	31·38	31·39	32·08	30·32	31·43	30·79	32·32	31·81	
XXXIV & XXXVI	h 25·32 h 21·34 h 23·56 h 24·96	h 22·36 l 24·66 l 22·56 l 22·60	l 22·52 l 23·68 l 23·62	l 24·22 l 23·36 l 22·34	l 23·18 l 22·44 l 22·86	h 22·96 h 23·20 h 25·30 h 25·88 h 23·94	h 22·16 h 23·32 h 22·26	l 21·36 l 20·28 l 22·92 l 22·78	l 20·60 l 21·32 l 23·36 l 21·64	l 22·54 l 20·96 l 22·72 l 21·58	$M = 22''\cdot86$ $w = 10\cdot14$ $\frac{1}{w} = 0\cdot10$ $C = 70^\circ 37' 22''\cdot86$
	23·80	23·04	23·27	23·31	22·83	24·26	22·58	21·84	21·73	21·95	
XXXVI & XXXVIII	h 27·66 h 27·98 h 29·26 h 27·20	h 30·52 h 30·30 l 28·10 l 28·94	l 28·54 l 27·66 l 29·16	l 29·42 l 28·14 l 29·16	l 27·10 l 28·52 l 29·00	h 26·42 h 28·78 h 29·10 h 28·74	h 28·78 h 29·22 h 26·66 h 27·82	l 28·96 l 31·42 l 28·88 l 28·68	l 30·30 l 28·52 l 29·26 l 27·78	l 28·46 l 29·24 l 30·56 l 29·34	$M = 28''\cdot73$ $w = 17\cdot75$ $\frac{1}{w} = 0\cdot06$ $C = 73^\circ 44' 28''\cdot74$
	28·03	29·46	28·45	28·91	28·21	28·26	28·12	29·49	28·96	29·40	

At XXXVI (Mankasar)

January 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXV: 0° 1′	180° 1′	79° 12′	259° 12′	158° 25′	338° 25′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXV & XXXIV	h 47·14 h 48·98 h 48·54 h 48·56 l 49·94	l 48·00 l 47·22 l 48·82	h 48·64 h 47·66 h 49·20	h 48·42 h 49·06 h 48·44	h 47·92 l 48·70 l 49·90	l 48·60 h 46·98 h 49·60 h 47·86	h 46·30 h 47·52 h 48·24 l 49·44 l 48·94	l 46·94 l 48·54 l 48·96 l 48·52	l 49·02 l 50·24 l 48·00	l 48·24 l 48·88 l 48·68	$M = 48''\cdot49$ $w = 32\cdot78$ $\frac{1}{w} = 0\cdot03$ $C = 51^\circ 24' 48''\cdot47$
	48·63	48·01	48·50	48·64	48·84	48·26	48·09	48·24	49·09	48·60	

At XXXVI (Mankasar)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXV: 0° 1′	180° 1′	79° 12′	259° 12′	158° 25′	338° 25′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXIV & XXXVII	h 22·80 h 21·68 h 24·02 l 20·68 l 20·64	l 21·48 l 20·96 h 20·14	h 22·04 h 22·90 h 21·82	h 20·68 h 20·46 h 20·70 d 21·50	h 24·00 l 22·22 l 20·34 l 19·88 l 21·10	l 19·56 h 21·80 h 23·72 h 23·10 h 24·70 h 23·14	h 22·72 h 22·26 h 20·86	l 22·74 l 24·16 l 23·10	l 23·88 l 19·52 l 21·54 h 23·84 h 23·76 h 23·50	l 21·88 l 24·14 l 21·82 h 23·46	$M = 22''·09$ $w = 9·46$ $\frac{1}{w} = 0·11$ $C = 45° 48' 22''·10$
	21·96	20·86	22·25	20·84	21·51	22·67	21·95	23·33	22·67	22·82	
XXXVII & XXXIX	h 25·22 h 22·26 h 25·32 h 24·82 h 24·60	h 21·74 h 23·04 h 24·58 h 24·48 h 26·54	h 23·86 h 24·10 h 24·62	h 25·08 h 23·50 h 26·60 h 25·48 h 23·96 d 25·81	h 21·74 l 22·36 l 22·06 h 23·36 h 24·38 h 24·68	l 23·80 l 25·94 h 27·02 h 26·44 h 25·16 h 23·96	h 25·46 h 25·56 h 25·14	l 23·14 l 24·38 l 22·98	l 25·66 l 25·28 l 24·68	l 23.20 l 23·48 l 23·12	$M = 24''·36$ $w = 9·59$ $\frac{1}{w} = 0·10$ $C = 76° 14' 24''·37$
	24·44	24·08	24·19	25·07	23·10	25·39	25·39	23·50	25·21	23·27	
XXXIX & XL	h 58·34 h 59·30 h 58·78	h 55·82 h 56·40 h 57·30	h 55·78 h 57·86 h 57·78 h 57·10	h 56·80 h 56·26 h 59·32 h 59·48 h 57·08	h 58·68 l 57·86 l 59·52	l 58·46 l 58·66 h 58·98	h 57·44 h 58·02 h 57·96 h 56·08	h 58·04 h 57·86 h 57·06	h 57·92 h 57·24 h 57·88	h 55·78 h 56·62 h 57·14	$M = 57''·68$ $w = 11·20$ $\frac{1}{w} = 0·09$ $C = 89° 43' 57''·68$
	58·81	56·51	57·13	57·79	58·69	58·70	57·38	57·65	57·68	56·51	
XL & XXXVIII	h 15·76 h 18·02 h 18·32 h 19·60 l 15·38	l 18·06 l 17·26 l 18·76	h 21·40 h 18·30 h 19·22	h 17·16 h 18·36 h 17·62	h 18·38 l 18·36 l 17·58	l 16·76 l 17·94 l 15·40 l 18·44 l 16·30	h 17·30 h 16·88 h 16·24	h 16·76 h 16·16 h 16·48	h 17·22 h 15·86 h 18·68 h 16·72	h 16·44 h 16·60 h 18·02	$M = 17''·53$ $w = 8·98$ $\frac{1}{w} = 0·11$ $C = 47° 20' 17''·52$
	17·42	18·03	19·64	17·71	18·11	16·97	16·81	16·47	17·12	17·02	
XXXVIII & XXXV	h 13·18 h 9·42 h 9·74 h 8·88 h 7·36 l 10·32 l 9·38	l 8·16 l 12·92 l 10·10 l 9·98 l 9·22 l 8·64	h 11·08 h 10·56 h 8·86 h 9·60	h 10·00 h 9·70 h 8·72	l 8·86 l 9·84 l 9·44	l 10·06 l 9·26 h 9·72	h 10·70 h 10·26 h 9·92 h 9·32	l 11·06 l 8·98 l 9·64 l 9·70	l 8·52 l 9·78 l 9·10	l 10·54 l 6·98 l 8·46 l 10·22	$M = 9''·62$ $w = 23·08$ $\frac{1}{w} = 0·04$ $C = 49° 28' 9''·65$
	9·75	9·84	10·03	9·47	9·38	9·68	10·05	9·84	9·13	9·05	

At XXXVII (Uperthal)

January 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLI										M = Mean of Groups w = Relative Weight C = Concluded Angle
	170° 48′	350° 48′	250° 0′	70° 0′	329° 12′	149° 12′	48° 24′	228° 24′	127° 36′	207° 36′	
XLI & XXXIX	″ h 55·52 h 54·78 h 54·12	″ h 54·36 h 54·28 h 54·02	″ h 53·08 h 52·94 h 55·40 h 53·98	″ h 55·34 h 53·72 h 55·40	″ h 56·56 h 55·90 h 54·72	″ h 56·96 l 54·60 l 54·50 h 55·02	″ l 53·74 l 56·58 h 54·36 h 52·84 h 53·26	″ h 51·72 h 53·60 h 55·66 h 54·26 h 56·80 h 53·12 h 54·04	″ h 52·52 h 53·82 h 54·46	″ h 55·28 h 54·96 h 55·50	$M = 54''·59$ $w = 12·84$ $\frac{1}{w} = 0·08$ $C = 62° 27' 54''·57$
	54·81	54·22	53·85	54·82	55·73	55·27	54·16	54·17	53·60	55·25	
XXXIX & XXXVI	h 55·58 h 53·56 h 55·32 h 55·98	h 56·02 h 55·44 h 54·78 h 56·82 h 56·10	h 56·24 h 55·36 h 55·36 h 57·42	h 55·86 h 56·14 h 55·64	h 54·48 h 53·56 h 56·00 h 54·26	h 52·32 l 54·10 l 53·86 l 54·96	l 56·56 l 56·18 l 53·86 l 57·80 h 56·30	h 56·02 h 54·68 h 53·42 h 54·18	h 56·86 h 55·08 h 55·12	h 56·12 h 55·74 h 55·30	$M = 55''·34$ $w = 12·10$ $\frac{1}{w} = 0·08$ $C = 60° 49' 55''·34$
	55·11	55·83	56·10	55·88	54·57	53·81	56·14	54·58	55·69	55·72	
XXXVI & XXXIV	h 38·84 h 39·68 h 37·50 h 38·42 h 36·34 h 38·88	h 39·26 h 39·70 h 36·88 h 41·78 h 41·26 h 38·58 h 40·38	h 41·02 h 42·50 h 39·42 h 38·74	h 37·90 h 39·78 h 38·16	h 39·00 h 38·66 h 39·62	h 40·14 h 40·26 l 39·08	l 37·96 l 37·86 l 38·86 l 37·18 h 39·50	h 40·58 h 41·58 h 41·00	h 38·32 h 40·36 h 40·34 h 39·02	h 39·80 h 38·94 h 38·28 h 39·60 h 38·88	$M = 39''·39$ $w = 9·23$ $\frac{1}{w} = 0·11$ $C = 65° 54' 39''·37$
	38·28	39·69	40·42	38·61	39·09	39·83	38·27	41·05	39·51	39·10	

At XXXVIII (Bithnok)

January 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXV										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	108° 0′	79° 12′	259° 12′	158° 30′	338° 30′	237° 37′	57° 37′	316° 48′	136° 48′	
XXXV & XXXVI	″ h 22·52 h 22·72 h 24·34 h 24·10 h 22·32	″ h 21·50 h 22·72 h 22·42	″ h 19·16 h 21·00 h 21·84 h 20·96 h 22·36	″ h 21·78 h 21·74 h 20·00	″ l 23·56 l 22·10 l 20·26 l 23·50 l 23·56	″ l 23·86 l 22·96 l 21·82 l 22·40	″ h 21·70 h 21·78 h 21·18	″ h 22·94 h 21·88 h 20·68	″ h 23·16 h 22·80 h 22·76	″ h 22·90 h 21·38 h 22·60	$M = 22''·22$ $w = 10·44$ $\frac{1}{w} = 0·10$ $C = 56° 47' 22''·23$
	23·80	22·21	21·06	21·17	22·60	22·76	21·55	21·83	22·91	22·29	

At XXXVIII (Bithnok)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXV 0° 0′	180° 0′	79° 12′	259° 12′	158° 30′	338° 30′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXXVI & XL	″ h 33·68 h 33·86 h 31·24 h 32·68	″ h 34·14 h 32·84 h 32·62	″ h 35·50 h 32·78 h 34·34 h 31·92 h 32·94	″ h 33·38 h 32·64 h 33·56	″ l 31·82 l 31·08 l 33·34 l 30·54	″ l 31·52 l 32·48 l 31·16	″ h 33·58 h 33·00 h 31·78	″ h 32·74 h 32·78 h 34·58	″ h 35·44 h 32·86 h 32·74 h 31·08	″ h 30·64 h 32·68 h 31·76 h 32·68	$M = 32''·73$ $w = 13·10$ $\frac{1}{w} = 0·08$ $C = 62° \ 5' \ 32''·73$
	32·87	33·20	33·50	33·19	31·69	31·72	32·79	33·37	33·03	31·94	

At XXXIX (Modia)

January 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLI 0° 1′	180° 0′	79° 13′	259° 12′	158° 24′	338° 24′	237° 37′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLI & XLIII	″ h 4·88 h 5·34 h 3·64	″ h 3·96 h 3·30 l 3·58	″ l 4·42 l 2·48 l 3·76 l 4·30	″ h 4·68 h 2·86 h 4·36 h 4·20	″ h 5·22 h 3·04 h 4·06 l 1·90 l 2·38	″ l 5·74 l 4·76 l 2·06 l 3·04 l 3·02	″ l 2·64 l 2·66 l 5·10 l 2·46	″ h 5·48 h 3·58 h 2·50 h 4·00	″ h 2·78 h 3·70 h 3·82	″ l 2·30 l 2·44 l 3·12	$M = 3''·62$ $w = 19·34$ $\frac{1}{w} = 0·05$ $C = 83° \ 20' \ 3''·62$
	4·62	3·61	3·74	4·03	3·32	3·72	3·21	3·89	3·43	2·62	
XLIII & XLIV	h 55·14 h 57·12 h 58·78 h 59·70 h 57·88 h 57·50	h 58·10 h 58·12 h 59·18	l 56·42 l 56·90 l 56·22 l 57·20	h 57·14 h 59 12 h 57·00	h 57·00 h 57·42 l 56·90 l 57·36	l 56·98 l 57·18 l 59·84 l 58·18	l 57·58 l 58·26 l 55·20 l 57·98 h 59·00	h 57·58 h 59·38 h 59·08 h 58·32	h 57·66 h 58·00 h 58·30	l 57·78 l 56·44 l 57·86	$M = 57''·74$ $w = 17·80$ $\frac{1}{w} = 0·06$ $C = 50° \ 7' \ 57''·73$
	57·69	58·47	56·69	57·75	57·17	58·04	57·60	58·59	57·99	57·36	
XLIV & XLII	h 24·22 h 24·52 h 23·42	h 24·28 h 25·86 h 24·84	l 25·96 l 23·68 l 24·38 l 26·44	h 24·08 h 24·08 h 24·02	h 25·98 h 26·02 l 28·10 l 26·80	l 24·76 l 24·08 l 24·12 l 26·14	l 28·02 h 26·56 h 23·40 h 24·98 h 27·36 h 24·60 d 23·57	h 23·80 h 24·78 h 24·26 h 24·82	h 27·40 h 25·28 h 24·48 h 26·26	l 24·54 l 26·70 l 24·26 l 26·60	$M = 25''·10$ $w = 10·07$ $\frac{1}{w} = 0·10$ $C = 39° \ 17' \ 25''·13$
	24·05	24·99	25·12	24·06	26·72	24·78	25·50	24·41	25·86	25·52	
XLII & XL	h 11·20 h 11·60 h 11·30	h 12·90 h 9·88 l 9·18 l 13·26 l 13·10 l 12·42	l 12·02 l 12·88 l 12·84	h 13·52 h 14·42 h 13·34 h 13·10	h 12·28 h 12·78 l 10·28 l 12·06 d 11·81	l 13·12 l 15·40 l 12·50 l 13·22	l 13·76 h 13·28 h 16·72 d 12·34	h 10·28 h 13·12 h 12·28	h 11·82 h 11·22 h 13·64 h 12·36	l 11·50 l 12·94 l 11·58	$M = 12''·49$ $w = 8·65$ $\frac{1}{w} = 0·12$ $C = 49° \ 1' \ 12''·50$
	11·37	11·79	12·58	13·60	11·84	13·56	14·02	11·89	12·26	12·01	

At XXXIX (Modia)—(*Continued*).

Angle between	Circle readings, telescope being set on XLI 0° 1′	180° 0′	79° 13′	259° 12′	158° 24′	338° 24′	237° 37′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XL & XXXVI	h 63·02 h 63·64 h 59·94 h 62·60 h 61·80	h 60·82 h 62·74 l 62·40 l 60·16 l 60·46	l 61·52 l 62·12 l 61·08	h 59·70 h 59·70 h 63·18 h 59·26 h 60·30	h 62·78 h 61·16 l 62·18 d 62·00	l 60·72 l 59·34 l 60·90	l 59·98 l 58·58 h 57·08 h 58·12	h 60·28 h 61·86 h 60·12	h 60·94 h 61·08 h 59·88	l 61·30 l 62·08 l 61·22 l 61·98	M = 60″·93 w = 6·94 1/w = 0·14 C = 36° 37′ 0″·93
	62·20	61·32	61·57	60·43	62·03	60·32	58·44	60·75	60·63	61·65	
XXXVI & XXXVII	h 37·76 h 38·84 h 44·96 h 41·28 h 42·22 h 42·66	h 43·00 h 41·28 l 40·38 l 40·30	l 40·08 l 42·00 l 42·08	h 43·20 h 43·78 h 40·44 h 41·94	h 39·26 h 42·42 l 41·50 l 40·14 d 40·79	l 40·84 l 40·50 l 40·18	l 44·86 l 43·70 l 44·74 h 44·64 h 42·28	h 42·90 h 40·96 h 43·70 h 43·42	h 41·26 h 41·80 h 42·48	l 44·80 l 42·46 l 41·92 l 42·76 l 43·10	M = 41″·92 w = 6·13 1/w = 0·16 C = 42° 55′ 41″·94
	41·29	41·24	41·39	42·34	40·82	40·51	44·04	42·75	41·85	43·01	
XXXVII & XLI	h 40·50 h 38·10 h 37·32 h 36·58 h 38·42	h 36·56 h 37·76 l 37·22	l 40·56 l 37·32 l 36·18 l 39·24 l 39·08	h 36·78 h 35·28 h 37·12 h 36·70	h 38·34 h 35·56 l 38·58 l 40·42 l 38·28	l 38·34 l 38·06 l 39·06	l 36·34 l 36·22 l 35·42 l 41·56 h 36·30 h 37·64 h 38·80	h 36·52 h 37·48 h 37·68 h 38·82	h 38·12 h 38·78 h 36·94	l 38·04 l 37·00 l 39·48 l 36·24 l 39·48	M = 37″·81 w = 12·16 1/w = 0·08 C = 58° 40′ 37″·82
	38·18	37·18	38·48	36·47	38·24	38·49	37·47	37·63	37·95	38·05	

At XL (Ronesar)

January 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXVIII 0° 1′	180° 1′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXVIII & XXXVI	h 11·98 h 11·36 h 9·84 h 11·48 h 9·78	h 9·72 h 8·48 h 8·96	l 9·58 l 8·64 l 7·92 h 9·86	l 9·28 l 9·06 l 8·92	h 9·60 h 9·14 h 9·08	h 10·52 h 10·66 h 9·76	h 8·64 l 8·50 l 10·48	l 10·24 l 10·50 l 9·08	l 9·64 l 12·56 l 11·26 l 10·30	l 10·10 l 10·06 l 10·26	M = 9″·78 w = 13·62 1/w = 0·07 C = 70° 34′ 9″·80
	10·89	9·05	9·00	9·09	9·27	10·31	9·21	9·94	10·94	10·14	
XXXVI & XXXIX	h 4·22 h 0·86 h 3·60 h 2·30 h 2·74 h 3·06	h 3·18 h 4·22 h 3·38	l 3·08 l 5·80 l 1·88 l 4·98 h 4·54 h 3·80	l 2·68 h 4·32 h 2·94 h 3·54	h 3·84 h 2·94 h 4·24	h 2·02 h 3·68 h 3·70	h 3·14 h 4·08 h 3·26	h 3·18 h 3·44 h 3·72	h 3·14 h 3·60 h 2·14	h 3·10 h 4·34 h 2·54	M = 3″·38 w = 31·99 1/w = 0·03 C = 53° 39′ 3″·39
	2·80	3·59	4·01	3·37	3·67	3·13	3·49	3·45	2·96	3·33	

At XL (Ronesar)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXVIII: 0° 1′	180° 1′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXIX & XLII	h 39·60 h 37·90 h 38·24 h 39·54	h 39·80 h 38·92 h 39·20	h 38·26 h 39·74 h 38·64	h 39·82 h 41·46 h 38·34 h 40·84 h 39·48	h 43·10 h 41·40 h 40·34 h 41·08 h 40·12	h 41·66 h 38·30 h 38·98 h 39·04 h 39·90	h 39·98 h 39·88 h 39·30	h 38·90 h 39·54 h 39·70	h 39·02 h 39·28 h 39·24	h 38·88 h 40·20 h 39·18	$M = 39''\cdot55$ $w = 15\cdot27$ $\frac{1}{w} = 0\cdot07$ $C = 51^\circ 44' 39''\cdot58$
	38·82	39·31	38·88	39·99	41·21	39·58	39·72	39·38	39·18	39·42	

At XLI (Sachu)

January 1875; *observed by Captain M. W. Rogers, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLIII: 256° 39′	76° 39′	335° 52′	155° 52′	55° 4′	235° 4′	134° 15′	314° 15′	213° 28′	33° 27′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XLIII & XXXIX	h 21·58 h 22·86 h 20·66	h 23·82 h 21·26 h 22·88 h 21·22	h 21·20 h 22·72 h 22·58	l 25·38 l 22·40 l 24·68 l 23·12	l 19·50 l 19·02 l 19·44 l 21·20 h 21·00	l 23·54 l 22·26 l 24·26 h 23·90	l 21·98 l 20·38 l 20·26 l 23·52 l 21·92 l 21·72	l 22·14 l 20·90 l 20·68	l 19·56 l 21·74 l 22·74 l 21·64 l 20·68	l 22·80 l 21·50 l 23·24 l 24·92	$M = 22''\cdot08$ $w = 6\cdot13$ $\frac{1}{w} = 0\cdot16$ $C = 44^\circ 29' 22''\cdot07$
	21·70	22·30	22·17	23·89	20·03	23·49	21·63	21·24	21·27	23·12	
XXXIX & XXXVII	h 29·74 h 27·46 h 26·88 h 30·02 h 29·04	h 26·48 h 27·62 h 28·22	h 30·14 h 29·02 h 28·56	h 28·22 l 27·76 l 27·02	l 31·20 l 28·32 l 31·28 l 29·68	l 28·76 l 29·16 l 29·14	l 28·96 l 30·10 l 29·44	l 32·10 l 30·78 l 32·56 h 29·98 h 29·92 h 28·10	l 31·78 l 29·56 h 27·64 h 29·54 h 27·96 h 31·70	h 28·96 h 29·86 h 29·34	$M = 29''\cdot13$ $w = 7\cdot53$ $\frac{1}{w} = 0\cdot13$ $C = 58^\circ 51' 29''\cdot17$
	28·63	27·44	29·24	27·67	30·12	29·02	29·50	30·57	29·70	29·39	

At XLII (Jodasar)

January and February 1875; *observed by Captain M. W. Rogers, R. E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XL: 0° 0′	180° 0′	79° 13′	259° 13′	158° 25′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XL & XXXIX	h 8·52 h 12·38 h 10·74 h 10·58 h 8·98	l 8·42 l 9·22 l 8·64	h 8·22 h 8·16 h 9·76 l 6·84 l 11·24 l 6·00	h 12·18 h 9·62 h 9·56 h 9·46	h 12·00 h 9·10 h 10·70 h 8·72 h 8·94	h 10·78 h 9·00 h 8·32 h 10·00	h 9·02 h 10·52 h 9·82 h 7·40	h 9·82 h 10·44 h 8·12 h 9·28	h 9·84 h 10·52 h 9·66	h 7·94 l 7·56 l 11·36 l 10·22 l 11·28	$M = 9''\cdot53$ $w = 13\cdot15$ $\frac{1}{w} = 0\cdot08$ $C = 79^\circ 14' 9''\cdot52$
	10·24	8·76	8·37	10·21	9·89	9·52	9·19	9·42	10·01	9·67	

At XLII (Jodasar)—(*Continued*).

Angle between	Circle readings, telescope being set on XL 0° 0′	180° 0′	79° 13′	259° 13′	158° 25′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXIX & XLIV	h 7·84 h 3·34 h 4·36 h 5·22 h 6·76 h 3·28	l 7·24 l 6·40 l 7·96 l 4·08 l 5·20	l 6·46 l 5·40 l 7·22	h 3·48 h 7·40 h 4·78 h 5·08	h 6·68 h 5·32 h 3·58 h 4·54 h 2·90	h 5·00 h 6·02 h 4·72	h 4·14 h 3·96 h 5·10 h 5·22	h 2·60 h 1·94 h 2·86 h 3·80 h 4·76	h 4·36 h 3·92 h 4·16	h 4·84 h 4·42 h 3·56	$M = 4''·89$ $w = 8·06$ $\frac{1}{w} = 0·12$ $C = 88° 44' 4''·89$
	5·13	6·18	6·36	5·19	4·60	5·25	4·61	3·19	4·15	4·27	

At XLIII (Mugrala)

February 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on R. M. 202° 1′	22° 1′	281° 13′	101° 13′	0° 25′	180° 25′	79° 37′	259° 37′	158° 49′	338° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
R. M. & XLVI	l 41·50 l 42·04 l 40·58	l 42·30 l 42·06 l 43·04	l 41·24 l 42·36 l 41·66	h 42·24 h 41·94 h 42·54	l 42·62 l 44·92 l 42·32 h 42·46	h 42·54 h 42·56 h 41·86	h 41·42 l 42·24 l 41·58	h 43·54 l 42·98 l 42·02	l 40·66 l 41·94 l 41·28	h 41·62 h 41·72 h 40·20	$M = 42''·03$ $w = 18·00$ $\frac{1}{w} = 0·06$ $C = 55° 11' 42''·04$
	41·37	42·47	41·75	42·24	43·08	42·32	41·75	42·85	41·29	41·18	
XLVI & XLV	h 58·50 h 58·88 h 58·80	h 57·98 h 58·06 h 57·82	l 58·88 l 57·70 l 58·08	h 56·24 h 55·94 h 59·32 h 58·02 h 56·84	l 56·58 l 58·62 l 57·28 h 57·36	h 58·94 h 58·04 h 57·22	h 58·10 l 58·18 l 58·42	h 57·98 h 57·08 h 58·10 h 56·62	h 58·64 h 58·18 h 58·22	h 58·98 h 58·42 h 58·00	$M = 58''·02$ $w = 27·42$ $\frac{1}{w} = 0·04$ $C = 46° 42' 57''·99$
	58·73	57·95	58·22	57·27	57·46	58·07	58·23	57·45	58·35	58·47	
XLV & XLIV	l 2·18 l 3·80 l 1·10 l 3·18	l 4·62 l 3·28 l 1·30	l 5·92 l 6·88 l 6·38 h 2·88 h 1·08 h 3·80 h 3·06	h 3·40 h 2·26 h 5·66 h 4·12 h 4·06	l 5·28 l 2·36 l 4·82 h 3·52	h 4·00 h 2·32 h 1·32 h 2·96	h 3·04 l 4·06 l 3·10	h 4·52 h 4·54 l 4·10	l 3·48 l 3·94 l 4·44	l 5·40 l 3·88 l 4·98	$M = 3''·70$ $w = 10·66$ $\frac{1}{w} = 0·09$ $C = 56° 5' 3''·70$
	2·57	3·07	4·29	3·90	3·99	2·65	3·40	4·39	3·95	4·75	
XLIV & XXXIX	l 37·60 l 34·86 l 35·26 l 35·94	l 33·98 l 33·56 l 33·90 l 32·80 h 33·88	h 34·02 l 33·82 h 35·38	h 34·24 h 34·00 h 35·98	h 33·98 h 33·70 h 33·40	h 34·38 h 35·94 h 34·84 h 35·20	h 35·12 h 35·56 h 33·40 h 34·66	h 32·96 h 34·64 h 34·96 h 34·32	l 35·10 l 34·68 l 33·76	l 32·76 l 35·54 l 34·42 l 32·48 l 34·78	$M = 34''·49$ $w = 15·58$ $\frac{1}{w} = 0·06$ $C = 77° 27' 34''·49$
	35·92	33·62	34·41	34·74	33·69	35·09	34·68	34·22	34·51	34·00	

NOTE.—R. M. denotes Referring Mark.

At XLIII (Mugrala)—(*Continued*).

Angle between	Circle readings, telescope being set on R. M. 202° 1′	22° 1′	281° 13′	101° 13′	0° 25′	180° 25′	79° 37′	259° 37′	158° 49′	338° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXIX & XLI	l 34·54 l 34·20 l 37·20 l 36·94 l 36·62	l 34·96 l 39·66 l 38·04 h 36·76 h 37·60 h 35·88	l 35·64 h 38·36 h 37·50 h 36·76	h 36·14 h 35·90 h 36·50	h 36·46 h 37·04 h 35·86	h 36·18 h 37·14 h 38·22 h 37·42	h 35·04 h 36·48 h 35·94	h 37·12 h 36·16 h 37·88	l 36·00 l 37·04 l 36·12	l 36·72 l 36·74 l 36·60	$M = 36''{\cdot}62$ $w = 18{\cdot}78$ $\frac{1}{w} = 0{\cdot}05$ $C = 52^\circ\ 10'\ 36''{\cdot}63$
	35·90	37·15	37·07	36·18	36·45	37·24	35·82	37·05	36·69	36·69	

At XLIV (Khirsar)

***February* 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24*-inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XLII 255° 38′	75° 38′	334° 50′	154° 50′	54° 1′	234° 1′	133° 14′	313° 14′	212° 26′	32° 26′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XLII & XXXIX	h 31·90 h 31·26 h 29·86 h 31·38 h 30·54 d 31·50	h 31·14 h 30·58 h 31·88	h 30·42 h 32·12 h 29·08	h 32·96 h 33·24 h 31·90	h 32·22 h 30·34 h 30·26	h 31·38 h 29·54 h 31·68 h 29·98	h 30·78 h 30·70 h 30·02	h 31·54 h 31·50 h 31·02	l 32·62 l 29·96 l 31·88 l 29·86	l 31·58 l 31·56 l 31·62	$M = 31''{\cdot}16$ $w = 16{\cdot}52$ $\frac{1}{w} = 0{\cdot}06$ $C = 51^\circ\ 58'\ 31''{\cdot}15$
	31·07	31·20	30·54	32·70	30·94	30·65	30·50	31·35	31·08	31·59	
XXXIX & XLIII	h 28·94 h 29·42 h 29·48 d 29·79	h 29·50 h 28·72 h 28·44	h 31·12 h 29·88 l 29·40	l 28·04 l 29·76 l 30·18 l 28·92	h 27·66 h 31·04 h 29·30 h 29·94 h 29·90	h 29·18 h 28·30 h 28·18	h 27·40 h 30·60 h 29·00 h 29·28 h 28·62	h 32·52 h 30·34 h 29·38 h 30·80 h 31·66	l 28·98 l 29·08 l 29·28	l 30·10 l 30·64 l 29·82	$M = 29''{\cdot}50$ $w = 14{\cdot}41$ $\frac{1}{w} = 0{\cdot}07$ $C = 52^\circ\ 24'\ 29''{\cdot}51$
	29·41	28·89	30·13	29·23	29·57	28·55	28·98	30·94	29·11	30·19	
XLIII & XLV	h 57·74 h 58·94 h 58·36 h 60·56	h 60·18 h 57·12 h 58·34 h 58·56 h 57·96	h 55·44 h 57·62 l 58·18 l 57·52	l 60·52 l 57·10 l 59·48 l 58·74 l 58·30	h 56·94 h 58·12 h 59·20 h 58·46	h 59·28 h 58·26 h 59·44	h 58·54 h 58·74 h 59·04	h 57·74 h 58·50 h 59·46	l 59·66 l 59·02 l 58·40	l 59·78 l 59·96 l 59·42	$M = 58''{\cdot}66$ $w = 15{\cdot}57$ $\frac{1}{w} = 0{\cdot}06$ $C = 61^\circ\ 46'\ 58''{\cdot}64$
	58·90	58·43	57·19	58·83	58·18	58·99	58·77	58·57	59·03	59·72	
XLV & XLVII	h 49·52 h 52·58 h 50·26 h 47·12 h 49·88 h 47·80 h 47·88	h 49·30 h 51·26 h 50·68	h 50·48 h 50·46 l 48·88	l 47·48 l 51·02 l 46·84 h 50·20 h 49·34 h 51·42	h 50·86 h 48·44 h 49·46 h 48·70	h 50·66 h 49·84 h 50·72	h 50·94 h 50·60 h 49·94	h 48·98 h 49·36 h 49·52	l 48·08 l 48·68 l 49·78	l 48·06 l 48·50 l 48·62	$M = 49''{\cdot}58$ $w = 11{\cdot}47$ $\frac{1}{w} = 0{\cdot}09$ $C = 42^\circ\ 38'\ 49''{\cdot}56$
	49·29	50·41	49·94	49·38	49·37	50·41	50·49	49·29	48·85	48·39	

NOTE.—R. M. denotes Referring Mark.

At XLV (Bhada)

February and March 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLVII										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	180° 0′	79° 12′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	
	″	″	″	″	″	″	″	″	″	″	
XLVII & XLIV	h 51·40 h 52·50 h 53·86 h 54·78 h 53·24	h 52·06 h 53·54 h 52·42	l 52·88 l 52·34 l 52·12	l 53·26 l 54·08 l 52·98	h 53·48 h 50·84 h 50·98 h 51·08	h 52·36 h 52·00 h 53·74	h 52·08 h 52·64 h 52·90	l 54·72 h 53·96 h 52·64 h 52·02	h 53·42 h 51·42 h 51·66 h 52·84	h 55·20 h 55·24 h 53·24 h 53·08	M = 52″·84 w = 13·74 $\frac{1}{w}$ = 0·07
	53·16	52·67	52·45	53·44	51·60	52·70	52·54	53·33	52·34	54·19	C = 78° 6′ 52″·85
XLIV & XLIII	h 58·50 h 59·66 h 59·00	h 58·86 h 58·92 h 58·64	l 58·74 l 59·48 l 57·82	l 57·92 l 58·28 l 59·54	h 58·38 h 61·00 h 58·98 h 58·96 h 58·92	h 58·92 h 59·48 h 58·90	h 59·62 h 60·02 h 59·14	h 57·92 h 59·26 h 58·82	h 59·42 h 60·38 h 59·56	h 59·64 h 59·98 h 59·50	M = 59″·12 w = 32·92 $\frac{1}{w}$ = 0·03
	59·05	58·81	58·68	58·58	59·25	59·10	59·59	58·67	59·79	59·71	C = 62° 7′ 59″·12
XLIII & XLVI	h 5·08 h 6·60 h 5·08	h 5·44 h 5·54 h 5·12	l 5·12 l 5·60 l 5·54	l 5·46 l 5·34 l 4·72	h 4·78 h 5·20 h 5·40	h 5·94 h 5·46 h 5·28	h 5·28 h 5·56 h 5·42	h 4·24 h 5·94 h 4·80	h 5·52 h 6·28 h 5·02	h 5·66 h 4·54 h 5·50	M = 5″·35 w = 100·25 $\frac{1}{w}$ = 0·01
	5·59	5·37	5·42	5·17	5·13	5·56	5·42	4·99	5·61	5·23	C = 57° 7′ 5″·35
XLVI & XLVIII	h 59·20 h 57·48 h 57·84	h 58·60 h 57·80 h 57·98	l 57·80 l 56·78 l 59·00 l 56·90	l 57·90 l 57·70 l 57·50	h 57·52 h 56·94 h 58·28	h 56·82 h 57·78 h 57·34	h 57·48 h 55·98 h 57·84	h 57·60 h 57·18 h 57·20	h 56·82 h 56·06 h 57·40	h 57·20 h 55·62 h 57·88	M = 57″·46 w = 28·15 $\frac{1}{w}$ = 0·04
	58·17	58·13	57·62	57·70	57·58	57·31	57·10	57·33	56·76	56·90	C = 43° 59′ 57″·46
XLVIII & XLIX	h 12·65 h 8·54 h 10·02 h 9·48 l 9·90 l 10·02	h 10·74 h 10·66 h 11·10	l 10·22 l 10·94 l 9·58	l 10·38 l 9·32 l 9·28	h 11·40 h 11·54 h 11·16	h 8·80 h 10·92 h 10·14 h 10·82	h 10·40 h 8·94 h 10·10	h 9·80 h 11·38 h 9·66	h 10·38 h 10·96 h 10·02	h 9·20 h 9·60 h 10·44	M = 10″·27 w = 22·58 $\frac{1}{w}$ = 0·04
	10·10	10·83	10·25	9·66	11·37	10·17	9·81	10·28	10·45	9·75	C = 60° 54′ 10″·26
XLIX & XLVII	h 49·76 h 53·80 h 53·78 h 51·64 l 51·94	h 54·30 h 53·86 h 53·58	l 53·52 l 52·42 l 54·04	l 53·86 l 53·00 h 53·12 l 51·64	h 53·42 h 50·68 h 53·56 h 51·16	h 53·48 h 52·56 h 55·24 h 53·54	h 54·46 h 54·56 h 53·08	h 55·56 h 52·36 h 55·94 h 56·74 h 55·52 h 52·16	h 55·52 h 54·30 h 55·16	h 54·30 h 52·92 h 54·72	M = 53″·59 w = 7·93 $\frac{1}{w}$ = 0·13
	52·18	53·91	53·33	52·91	52·20	53·71	54·03	54·71	54·99	53·98	C = 57° 43′ 53″·58

At XLVI (Habib)

February 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLVIII 0° 1′	180° 0′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 36′	316° 49′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLVIII & XLV	″ h 31·34 h 26·62 h 30·90 h 30·42 h 29·08 h 31·10	″ h 27·74 h 28·68 h 27·64	″ h 27·64 h 26·78 h 27·82	″ h 27·64 h 28·72 h 26·96	″ l 28·72 l 28·58 l 28·88	″ l 28·42 l 26·52 l 27·60	″ l 28·32 l 29·96 l 29·34	″ l 29·10 l 30·74 l 29·92	″ l 26·28 l 27·34 l 27·08	″ h 29·42 h 28·78 h 27·94	$M = 28''\cdot41$ $w = 7\cdot38$ $\frac{1}{w} = 0\cdot14$ $C = 61^\circ 41' 28''\cdot43$
	29·91	28·02	27·41	27·77	28·73	27·51	29·21	29·92	26·90	28·71	
XLV & XLIII	h 56·98 h 56·62 h 56·44	h 56·84 h 57·14 h 57·50	h 56·30 h 58·28 h 56·68	h 57·94 h 55·72 h 56·80 h 57·28 h 56·48	l 55·94 l 58·06 l 56·72 l 59·52	l 56·88 l 56·18 l 57·12	l 58·04 l 55·90 l 56·74 l 56·74	l 57·96 l 57·38 l 58·02	l 58·88 l 57·98 l 59·14	h 58·90 h 58·44 h 58·42	$M = 57''\cdot40$ $w = 14\cdot21$ $\frac{1}{w} = 0\cdot07$ $C = 76^\circ 9' 57''\cdot39$
	56·68	57·16	57·09	56·84	57·56	56·73	56·86	57·79	58·67	58·59	

At XLVII (Karamala)

March 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLIV 226° 18′	46° 18′	305° 31′	125° 31′	24° 42′	204° 42′	103° 54′	283° 54′	183° 6′	3° 6′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLIV & XLV	″ h 20·84 h 19·44 h 18·70 h 19·36	″ h 20·02 h 18·06 h 18·78	″ h 18·90 h 18·64 h 19·24	″ h 18·64 h 17·94 h 18·22	″ h 17·98 h 18·46 h 18·96	″ h 17·78 h 17·52 h 18·06	″ l 18·74 h 18·96 h 19·20 h 18·46 l 17·48 l 16·70	″ h 19·60 h 19·22 h 19·26	″ h 18·80 h 20·16 h 18·52	″ h 18·74 h 19·58 h 20·28	$M = 18''\cdot83$ $w = 20\cdot40$ $\frac{1}{w} = 0\cdot05$ $C = 59^\circ 14' 18''\cdot83$
	19·59	18·95	18·93	18·27	18·47	17·79	18·26	19·36	19·16	19·53	
XLV & XLIX	h 36·32 h 37·96 h 38·76 h 36·12	h 35·20 h 35·36 h 36·26	h 36·50 h 37·20 h 36·16	h 35·74 h 37·20 h 36·74	h 35·72 h 36·24 h 36·50	h 35·86 l 35·22 l 36·72	l 36·86 l 34·00 h 33·98 h 35·00 h 35·88	h 35·98 h 35·62 h 35·82	h 36·40 h 35·82 h 35·44	h 36·68 h 35·58 h 36·32	$M = 36''\cdot12$ $w = 19\cdot33$ $\frac{1}{w} = 0\cdot05$ $C = 74^\circ 27' 36''\cdot12$
	37·29	35·61	36·62	36·56	36·15	35·93	35·14	35·81	35·89	36·19	

At XLVIII (Phogala)

February 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LI 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 48′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LI & L	h 39·20	h 35·20	l 34·00	l 35·50	h 33·36	h 37·54	h 36·78	h 36·18	h 34·12	l 36·02	M = 35″·63
	h 37·68	h 34·88	l 34·98	l 36·66	h 34·16	h 35·44	h 35·94	h 36·90	l 36·34	l 36·44	
	h 36·70	h 34·44	l 35·30	l 35·44	h 35·50	h 34·18	h 35·50	h 36·32	l 33·32	l 35·88	w = 7·14
	h 38·26	l 35·60			h 35·14	h 32·02			l 35·42		$\frac{1}{w}$ = 0·14
						h 35·28			l 34·36		C = 72° 28′ 35″·62
						h 34·44					
	37·96	35·03	34·76	35·87	34·54	34·82	36·07	36·47	34·71	36·11	
L & XLIX	h 50·54	h 51·18	l 49·84	l 47·42	h 47·64	h 47·12	h 48·06	h 47·58	h 47·24	l 46·16	M = 47″·58
	h 47·94	h 48·66	l 49·34	l 44·92	h 46·98	h 48·16	h 48·16	h 45·70	l 47·26	l 47·32	
	h 49·08	h 48·40	l 47·52	l 47·60	h 45·54	h 45·88	h 45·98	h 47·00	l 47·38	l 46·32	w = 7·17
	h 47·78	l 49·12	l 49·34	l 46·80	h 47·28	h 48·00	h 46·96		l 46·26		$\frac{1}{w}$ = 0·14
		l 50·06									C = 53° 12′ 47″·59
	48·84	49·48	49·01	46·68	46·86	47·29	47·29	46·76	47·04	46·60	
XLIX & XLV	h 7·12	h 5·08	l 8·08	l 8·94	h 7·68	h 9·26	h 9·10	h 7·22	h 8·96	l 9·14	M = 8″·18
	h 9·40	h 6·34	l 7·46	l 9·18	h 8·48	h 7·66	h 8·24	h 7·34	l 7·46	l 8·08	
	h 8·14	h 8·66	l 9·04	l 8·54	h 6·94	h 7·82	h 8·04	h 7·28	l 9·48	l 9·32	
	h 6·80	l 9·18			h 7·88		l 9·88		l 8·36		w = 14·66
		l 5·76									$\frac{1}{w}$ = 0·07
		l 10·70									C = 75° 38′ 8″·15
		l 5·44									
	7·87	7·31	8·19	8·89	7·74	8·25	8·82	7·28	8·56	8·85	
XLV & XLVI	h 34·14	h 36·28	l 33·34	l 36·98	h 34·82	h 32·96	h 34·66	h 34·58	h 36·16	l 35·86	M = 34″·97
	h 31·74	h 36·64	l 35·00	l 35·54	h 34·40	h 34·40	l 34·42	h 35·40	l 33·76	l 35·50	
	h 33·84	h 34·12	l 34·26	l 38·38	h 36·62	h 35·42	l 35·70	h 35·12	l 34·84	l 35·48	w = 10·76
	h 34·48	l 33·02		l 35·72	h 34·22	h 35·26			l 35·66		$\frac{1}{w}$ = 0·09
		l 35·32									C = 74° 18′ 34″·97
	33·55	35·08	34·20	36·66	35·01	34·51	34·93	35·03	35·11	35·61	

At XLIX (Bhulan)

March 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XLVII 0° 1′	180° 1′	79° 12′	259° 13′	158° 25′	338° 24′	237° 36′	57° 36′	316° 49′	136° 48′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XLVII & XLV	h 32·74	h 29·20	h 29·36	l 32·34	l 30·50	l 32·68	h 32·54	h 30·78	l 29·92	h 31·34	M = 31″·31
	h 32·34	h 30·06	l 31·22	l 32·28	l 31·74	l 31·20	h 32·22	h 30·36	h 32·24	h 31·96	
	h 32·94	h 29·96	l 30·74	l 32·06	l 30·42	l 32·02	h 30·92	h 30·34	h 30·92	h 31·48	w = 10·95
		h 31·28	l 28·86						h 31·18		$\frac{1}{w}$ = 0·09
		h 30·92									C = 47° 48′ 31″·30
	32·67	30·28	30·05	32·23	30·89	31·97	31·89	30·49	31·06	31·59	

At XLIX (Bhulan)—(*Continued*).

Angle between	Circle readings, telescope being set on XLVII: 0° 1′	180° 1′	79° 12′	259° 13′	158° 25′	338° 24′	237° 36′	57° 36′	316° 49′	136° 48′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XLV & XLVIII	h 43·00	h 44·22	l 43·46	l 43·54	l 44·20	l 42·90	h 42·36	h 44·16	l 43·84	h 42·86	$M = 43''\cdot49$
	h 42·84	h 44·42	l 44·16	l 42·94	l 43·78	l 43·04	h 42·74	h 43·10	h 43·48	h 43·90	
	h 42·98	h 45·88	l 42·50	l 43·76	l 43·84	l 43·78	h 42·52	h 42·88	h 43·94	h 43·42	$w = 23\cdot35$
	d 43·22										$\frac{1}{w} = 0\cdot04$
	43·01	44·84	43·37	43·41	43·94	43·24	42·54	43·38	43·75	43·39	$C = 43^\circ\ 27'\ 43''\cdot49$
XLVIII & L	h 26·26	h 23·56	l 25·80	l 23·16	l 24·48	l 24·16	h 25·82	h 25·52	l 25·66	h 26·06	$M = 25''\cdot17$
	h 25·82	h 24·90	l 23·90	l 23·88	l 23·92	l 25·02	h 26·30	h 27·80	l 23·62	h 25·68	
	h 25·32	h 24·14	l 24·30	l 24·34	l 25·34	l 25·30	h 26·54	l 26·04	h 25·52	h 25·72	
	h 23·86			l 25·42				l 25·58	h 27·18		$w = 13\cdot14$
	d 25·60			l 24·42							$\frac{1}{w} = 0\cdot08$
	25·37	24·20	24·67	24·24	24·58	24·83	26·22	26·24	25·49	25·82	$C = 54^\circ\ 14'\ 25''\cdot17$
L & LII	h 58·66	h 61·00	l 58·42	l 58·70	h 58·62	h 58·28	h 58·24	h 58·02	l 56·26	h 58·76	$M = 58''\cdot30$
	h 58·94	h 57·72	l 56·68	l 57·72	h 58·36	h 57·80	h 58·96	h 57·98	l 56·70	h 56·90	
	h 60·60	h 59·02	l 58·46	l 55·76	h 59·18	h 58·24	h 58·74	l 59·18	h 57·98	h 58·50	
		h 58·84		l 57·04					h 58·72		$w = 14\cdot73$
		h 59·06									$\frac{1}{w} = 0\cdot07$
	59·40	59·13	57·85	57·31	58·72	58·11	58·65	58·39	57·41	58·05	$C = 52^\circ\ 24'\ 58''\cdot30$

At L (Soma)

March 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LII: 0° 0′	180° 0′	79° 13′	259° 12′	158° 24′	338° 23′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LII & XLIX	h 53·18	h 51·64	h 53·26	l 53·36	l 53·62	h 51·74	h 53·42	l 52·04	l 52·00	h 52·58	$M = 52''\cdot79$
	h 53·60	h 52·98	h 54·58	l 53·20	l 53·38	h 51·60	l 52·46	l 52·42	l 51·60	h 52·40	
	h 53·56	h 51·74	l 52·68	l 51·70	l 54·28	h 52·68	l 52·72	l 52·90	h 52·80	h 52·70	
	l 55·64										$w = 17\cdot37$
	h 52·72										$\frac{1}{w} = 0\cdot06$
	53·74	52·12	53·51	52·75	53·76	52·01	52·87	52·45	52·13	52·56	$C = 43^\circ\ 28'\ 52''\cdot80$
XLIX & XLVIII	h 48·46	h 48·94	h 49·52	l 48·36	l 49·76	h 47·96	h 48·72	l 48·84	l 49·56	h 48·64	$M = 48''\cdot97$
	h 49·22	h 50·16	l 48·88	l 47·92	l 49·90	h 49·88	l 49·26	l 49·18	l 50·18	h 49·74	
	l 49·08	h 48·70	l 47·26	l 47·90	l 50·26	h 48·78	l 50·54	l 48·50	h 48·68	h 48·50	
	h 46·70	h 47·68	l 49·42								$w = 21\cdot60$
	h 48·52										$\frac{1}{w} = 0\cdot05$
	48·40	48·87	48·77	48·06	49·97	48·87	49·51	48·84	49·47	48·96	$C = 72^\circ\ 32'\ 48''\cdot96$

At L (Soma)—(*Continued*).

Angle between	Circle readings, telescope being set on LII 0° 0′	180° 0′	79° 13′	259° 12′	158° 24′	338° 23′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XLVIII & LI	h 55·98 l 57·06 h 57·38 h 55·94 d 54·03	h 57·04 h 58·26 h 55·68 h 58·04	l 55·96 l 59·24 l 56·30 l 58·40 l 54·24 l 57·78	l 55·90 l 56·86 l 55·82	l 55·18 l 54·90 l 54·18 h 57·38 h 55·08	h 56·02 h 58·18 h 55·60 h 56·34	h 53·88 l 56·30 l 55·40 l 54·66	l 53·74 l 55·52 l 53·96 h 55·44	l 54·86 h 55·34 h 56·50	h 54·14 h 58·36 h 55·26 h 55·64 h 58·20 h 56·42	$M = 56''\cdot00$ $w = 9\cdot74$ $\frac{1}{w} = 0\cdot10$ $C = 53° 42' 56''\cdot01$
	56·08	57·26	56·99	56·19	55·34	56·53	55·06	54·67	55·57	56·34	
LI & LIII	h 19·84 l 18·66 l 18·66 h 18·92 d 16·88	h 17·62 h 16·94 h 19·26 h 17·92	l 18·56 l 15·06 l 15·94 l 18·44 l 16·58	l 18·28 l 18·22 l 18·24	l 16·90 l 17·26 l 16·82 l 16·60	h 17·60 h 17·20 h 17·30	h 18·66 l 17·32 l 18·42 l 18·38	l 16·82 l 19·02 l 18·08 l 16·70	l 17·54 h 18·90 h 16·38 h 17·76	h 18·00 h 15·64 h 17·68 h 16·24	$M = 17''\cdot63$ $w = 17\cdot58$ $\frac{1}{w} = 0\cdot06$ $C = 42° 10' 17''\cdot63$
	18·59	17·94	16·92	18·25	16·89	17·37	18·20	17·65	17·65	16·89	
LIII & LIV	h 10·18 l 15·20 l 16·06 h 13·44 h 13·20 h 12·76 h 12·76	h 14·86 h 14·16 h 12·16 h 12·36	l 11·98 l 14·98 l 12·62 l 15·70 l 14·40	l 15·56 l 15·54 l 15·04 h 13·38 h 12·78	l 14·84 l 15·36 l 15·42 h 13·78 h 12·98	h 14·64 l 13·74 l 12·46 l 11·98	h 10·92 l 13·88 l 13·70 l 14·28 h 12·52	l 13·32 l 14·48 l 14·10	l 15·32 h 13·74 h 12·72 h 13·74	h 13·12 h 14·56 h 12·62	$M = 13''\cdot72$ $w = 16\cdot90$ $\frac{1}{w} = 0\cdot06$ $C = 63° 22' 13''\cdot72$
	13·37	13·39	13·94	14·46	14·48	13·20	13·06	13·97	13·88	13·43	
LIV & LII	h 50·52 h 50·92 l 48·94 h 51·60	h 51·30 h 51·12 h 51·60	h 50·84 h 52·26 h 51·88	l 50·26 l 51·02 l 52·04	l 52·08 l 49·56 l 50·20 l 50·68	h 51·62 l 51·10 l 52·84	h 52·28 h 51·54 l 51·60	l 51·52 l 50·34 l 51·84	l 49·76 l 50·12 h 50·66	h 53·58 h 50·28 h 51·64 h 51·54 h 52·24	$M = 51''\cdot22$ $w = 18\cdot13$ $\frac{1}{w} = 0\cdot06$ $C = 84° 42' 51''\cdot22$
	50·50	51·34	51·66	51·11	50·63	51·85	51·81	51·23	50·18	51·86	

At LI (Telu)

March 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LIII 0° 1′	180° 1′	79° 13′	259° 13′	158° 24′	338° 24′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LIII & L	h 4·78 h 4·42 h 3·50	h 2·20 h 5·76 h 6·40 h 3·90 h 3·12 h 4·78	h 2·36 h 2·98 h 3·36 h 3·40	h 3·26 h 4·28 h 3·44	h 4·08 h 4·54 h 4·62	h 4·26 h 4·48 h 4·42	h 4·22 h 3·76 h 4·08	h 4·02 h 3·84 h 3·94	h 3·46 h 3·28 h 4·86	l 4·60 l 5·72 l 4·80	$M = 4''\cdot09$ $w = 22\cdot50$ $\frac{1}{w} = 0\cdot04$ $C = 61° 1' 4''\cdot08$
	4·23	4·36	3·03	3·66	4·41	4·39	4·02	3·93	3·87	5·04	

At LI (Telu)—(*Continued*).

Angle between	Circle readings, telescope being set on LIII										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 1′	79° 13′	259° 13′	158° 24′	338° 24′	237° 36′	57° 36′	316° 48′	136° 48′	
L & XLVIII	″ h 29·38 h 29·02 h 28·82	″ h 28·84 h 29·12 h 28·04	″ h 29·30 h 29·06 h 29·08	″ h 29·30 h 28·84 h 28·60	″ h 29·24 h 29·72 h 29·50	″ h 29·22 h 30·72 h 29·94	″ h 29·38 h 29·16 h 29·36	″ h 28·40 h 29·84 h 28·88	″ h 30·14 h 29·70 h 29·82	″ l 30·26 l 28·88 l 29·86	$M = 29''\cdot32$ $w = 43\cdot50$ $\frac{1}{w} = 0\cdot02$ $C = 53° 48' 29''\cdot32$
	29·07	28·67	29·15	28·91	29·49	29·96	29·30	29·04	29·89	29·67	

At LII (Aukli)

***March* 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XLIX										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	338° 24′	237° 36′	57° 36′	316° 49′	136° 48′	
XLIX & L	″ h 8·10 h 8·70 h 10·52 h 10·14	″ h 8·96 h 7·98 h 9·16	″ h 9·26 h 10·94 h 9·12	″ l 10·40 l 9·30 l 8·84	″ l 9·08 l 10·42 l 9·50	″ l 8·78 l 9·14 l 9·14	″ h 9·96 h 9·48 h 10·22	″ h 9·80 h 10·06 h 9·64	″ h 10·08 h 9·84 h 9·36	″ h 8·36 h 10·20 h 6·72 h 8·66 h 9·02	$M = 9''\cdot41$ $w = 25\cdot81$ $\frac{1}{w} = 0\cdot04$ $C = 84° 6' 9''\cdot39$
	9·37	8·70	9·77	9·51	9·67	9·02	9·89	9·83	9·76	8·59	
L & LIV	h 18·36 h 15·98 h 16·66 h 15·50	h 16·38 h 17·46 h 16·84	h 14·34 h 15·06 h 14·94 h 15·98	l 15·06 l 16·30 l 18·34 l 15·80 l 15·88	l 16·18 l 16·22 l 15·92	l 17·00 l 17·16 l 16·02	h 16·64 h 16·28 h 16·10	h 16·48 h 17·46 h 15·88	h 17·18 h 15·76 h 16·88	h 17·08 h 17·32 h 15·72	$M = 16''\cdot40$ $w = 23\cdot17$ $\frac{1}{w} = 0\cdot04$ $C = 47° 18' 16''\cdot38$
	16·63	16·89	15·08	16·28	16·11	16·73	16·34	16·61	16·61	16·71	

At LIII (Mansa)

***December* 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on LVI										M = Mean of Groups w = Relative Weight C = Concluded Angle
	246° 56′	66° 56′	326° 7′	146° 7′	45° 19′	225° 19′	124° 31′	304° 31′	203° 43′	23° 43′	
LVI & LV	″ h 23·18 h 27·18 h 25·82 h 26·46 h 26·26	″ h 24·52 h 27·10 h 24·16 h 26·32	″ h 27·38 h 28·46 h 27·06 h 25·92 h 25·20	″ h 27·46 h 25·90 h 26·36	″ h 25·68 h 25·96 h 26·10	″ h 26·72 h 25·78 h 26·66	″ h 25·98 h 25·50 h 26·30	″ h 26·32 h 25·82 h 25·78	″ h 24·32 h 26·28 h 25·02	″ h 25·76 h 26·22 h 25·88	$M = 26''\cdot00$ $w = 22\cdot20$ $\frac{1}{w} = 0\cdot05$ $C = 60° 42' 26''\cdot01$
	25·78	25·53	26·80	26·57	25·91	26·39	25·93	25·97	25·21	25·95	

At LIII (Mansa)—(*Continued*).

Angle between	Circle readings, telescope being set on LVI										M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	246° 56′	66° 56′	326° 7′	146° 7′	45° 19′	225° 19′	124° 31′	304° 31′	203° 43′	23° 43′	
	″	″	″	″	″	″	″	″	″	″	
LV & LIV	*h* 57·08	*h* 57·50	*h* 54·12	*h* 57·28	*h* 57·08	*h* 57·12	*h* 56·40	*h* 56·88	*h* 55·78	*h* 56·76	$M = 56''\cdot44$
	h 55·28	*h* 56·90	*h* 56·26	*h* 57·96	*h* 55·34	*h* 55·86	*h* 55·90	*h* 55·60	*h* 57·64	*h* 56·52	
	h 55·88	*h* 55·68	*h* 55·82	*h* 56·40	*h* 56·06	*h* 57·18	*h* 54·74	*h* 57·40	*h* 56·28	*h* 57·62	$w = 22\cdot61$
			h 56·60								
			h 55·74								$\frac{1}{w} = 0\cdot04$
	56·08	56·69	55·71	57·21	56·16	56·72	55·68	56·63	56·57	56·97	$C = 52°\ 22'\ 56''\cdot43$

March 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LIV										M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	0° 0′	180° 0′	79° 13′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
LIV & L	*h* 56·24	*h* 55·38	*l* 54·94	*l* 53·54	*l* 55·04	*l* 53·68	*l* 54·60	*l* 53·12	*l* 53·66	*l* 53·36	$M = 54''\cdot51$
	h 52·68	*h* 55·02	*l* 56·04	*l* 53·12	*l* 54·70	*l* 56·54	*l* 53·18	*l* 52·48	*l* 56·12	*l* 55·10	
	h 54·60	*l* 56·10	*l* 53·38	*l* 53·80	*l* 54·90	*l* 53·02	*l* 55·66	*l* 53·84	*l* 55·44	*l* 54·96	
	h 53·66		*l* 54·32			*l* 54·80	*l* 55·36		*l* 55·12		$w = 13\cdot81$
	h 55·82										$\frac{1}{w} = 0\cdot07$
	h 54·76										
	54·63	55·50	54·67	53·49	54·88	54·51	54·70	53·15	55·09	54·47	$C = 44°\ 16'\ 54''\cdot52$
L & LI	*h* 39·60	*h* 38·06	*l* 40·18	*l* 37·80	*l* 38·14	*l* 40·82	*l* 41·36	*l* 40·72	*l* 40·26	*l* 38·24	$M = 39''\cdot25$
	h 40·98	*h* 38·78	*l* 38·24	*l* 39·42	*l* 37·48	*l* 40·12	*l* 40·82	*l* 39·32	*l* 40·10	*l* 38·96	
	h 38·60	*l* 39·32	*l* 38·74	*l* 38·80	*l* 38·98	*l* 38·68	*l* 38·32	*l* 39·54	*l* 39·74	*l* 38·60	$w = 15\cdot55$
						l 40·08	*l* 39·72				$\frac{1}{w} = 0\cdot06$
							l 38·30				
	39·73	38·72	39·05	38·67	38·20	39·93	39·70	39·86	40·03	38·60	$C = 76°\ 48'\ 39''\cdot26$

At LIV (Marot)

March 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LII										M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	312° 2′	132° 1′	31° 14′	211° 14′	110° 26′	290° 26′	189° 38′	9° 38′	268° 50′	88° 50′	
	″	″	″	″	″	″	″	″	″	″	
LII & L	*h* 50·70	*h* 53·08	*h* 52·82	*h* 51·20	*h* 52·62	*l* 53·30	*l* 50·66	*l* 49·62	*h* 52·86	*h* 53·66	$M = 52''\cdot55$
	h 52·54	*h* 53·50	*h* 52·20	*h* 52·64	*l* 52·28	*l* 52·82	*l* 54·14	*h* 51·62	*h* 51·96	*h* 54·40	
	h 52·42	*h* 55·40	*h* 52·92	*h* 52·10	*l* 51·82	*l* 52·90	*l* 51·90	*h* 55·30	*h* 51·96	*h* 53·08	$w = 14\cdot38$
		h 51·78					*l* 51·20	*h* 53·80			$\frac{1}{w} = 0\cdot07$
		h 52·08					*l* 51·90				
	51·89	53·17	52·65	51·98	52·24	53·01	51·96	52·59	52·26	53·71	$C = 47°\ 58'\ 52''\cdot55$

At LIV (Marot)—(*Continued*).

Angle between	Circle readings, telescope being set on LII										M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	312° 2′	132° 1′	31° 14′	211° 14′	110° 26′	290° 26′	189° 38′	9° 38′	268° 50′	88° 50′	
	″	″	″	″	″	″	″	″	″	″	
L & LIII	h 55·08	h 52·14	h 52·36	h 51·50	h 52·78	l 52·28	l 52·66	l 54·16	h 52·26	h 49·60	M = 52″·43
	h 54·08	h 52·12	h 52·52	h 51·86	l 52·68	l 52·68	l 52·76	l 51·80	h 52·98	h 52·96	
	h 52·84	h 52·36	h 52·26	h 51·48	l 52·18	l 51·34	l 53·30	h 54·02	h 52·54	h 52·28	w = 23·43
	h 51·92							h 52·58		h 52·02	$\frac{1}{w}$ = 0·04
	h 51·98							h 52·42		h 52·26	
	53·18	52·21	52·38	51·61	52·55	52·10	52·91	53·00	52·59	51·82	C = 72° 20′ 52″·44

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LIII										M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	267° 3′	87° 3′	346° 16′	166° 16′	65° 27′	245° 27′	144° 39′	324° 39′	223° 52′	43° 52′	
	″	″	″	″	″	″	″	″	″	″	
LIII & LV	h 59·50	h 60·10	h 57·58	h 60·32	l 58·92	l 60·28	l 60·80	l 61·30	h 59·66	h 58·88	M = 59″·24
	h 58·82	h 59·44	h 58·10	h 57·80	l 60·84	l 58·46	l 60·08	l 60·20	h 57·26	h 57·38	
	h 58·44	h 58·84	h 57·80	h 58·66	l 59·94	l 60·34	l 60·54	l 60·74	h 58·84	h 58·80	w = 10·55
				h 58·38			l 58·86		h 58·70		$\frac{1}{w}$ = 0·09
	58·92	59·46	57·83	58·79	59·90	59·69	60·07	60·75	58·62	58·35	C = 47° 41′ 59″·24
LV & LVII	h 17·28	h 20·42	h 22·44	h 20·04	l 20·66	l 19·80	l 18·98	l 20·00	h 20·26	h 21·18	M = 20″·10
	h 18·02	h 20·08	h 21·14	h 20·44	l 19·72	l 19·52	l 18·70	l 18·16	h 19·74	h 19·92	
	h 18·06	h 20·72	h 20·14	h 21·22	l 21·08	l 20·06	l 18·82	l 21·76	h 20·74	h 21·44	
	h 20·70		h 19·68					h 21·14			w = 12·60
	h 19·50							h 20·16			$\frac{1}{w}$ = 0·08
	18·71	20·41	20·85	20·57	20·49	19·79	18·83	20·24	20·25	20·85	C = 45° 15′ 20″·09

At LV (Hasan)

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LIX										M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	0° 1′	180° 1′	79° 12′	259° 12′	158° 23′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
LIX & LVII	h 17·10	h 15·54	l 15·34	h 15·20	h 15·46	h 15·12	h 14·82	l 15·98	h 15·92	h 15·66	M = 15″·65
	h 16·04	h 17·16	l 16·38	h 15·54	h 17·94	h 15·60	h 16·36	h 15·94	h 15·24	h 15·10	
	h 17·00	h 15·42	l 14·30	h 14·94	h 15·20	h 14·94	h 15·90	h 14·74	h 15·24	h 14·74	w = 25·18
			l 14·70		h 16·02		h 15·86				$\frac{1}{w}$ = 0·04
	16·71	16·04	15·18	15·23	16·16	15·22	15·73	15·55	15·47	15·17	C = 56° 49′ 15″·65

At LV (Hasan)—(*Continued*).

Angle between	Circle readings, telescope being set on LIX										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 1′	79° 12′	259° 12′	158° 23′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
LVII & LIV	*h* 27·10 *h* 26·80 *h* 25·02 *h* 26·90	*h* 24·74 *h* 25·54 *l* 25·08	*l* 26·72 *l* 25·14 *l* 26·78	*h* 23·96 *h* 26·00 *h* 26·68 *h* 26·08	*h* 25·82 *h* 25·24 *h* 25·38	*h* 25·46 *h* 26·28 *h* 24·86	*h* 25·70 *h* 25·52 *h* 25·76	*l* 25·54 *h* 26·72 *h* 24·66 *h* 26·16 *h* 26·06	*h* 26·94 *h* 25·24 *h* 26·34	*h* 25·62 *h* 26·10 *h* 24·28	M = 25″·75 w = 30·81 $\frac{1}{w}$ = 0·03 C = 60° 2′ 25″·76
	26·46	25·12	26·21	25·68	25·48	25·53	25·66	25·83	26·17	25·33	
LIV & LIII	*h* 6·76 *h* 6·06 *h* 7·38 *h* 5·72	*h* 8·14 *h* 5·10 *l* 6·06 *l* 7·08 *l* 4·80	*l* 3·76 *l* 5·38 *l* 5·26	*h* 8·68 *h* 6·12 *h* 6·10 *h* 6·98	*h* 5·40 *h* 5·58 *h* 4·66	*h* 4·18 *h* 6·14 *h* 4·32	*h* 6·26 *h* 5·84 *h* 5·94	*l* 6·00 *h* 4·84 *h* 5·76	*h* 5·02 *h* 5·26 *h* 7·26 *h* 4·60	*h* 5·20 *h* 4·88 *h* 5·50	M = 5″·68 w = 14·05 $\frac{1}{w}$ = 0·07 C = 79° 55′ 5″·70
	6·48	6·24	4·80	6·97	5·21	4·88	6·01	5·53	5·54	5·19	
LIII & LVI	*h* 8·26 *h* 11·00 *h* 8·82 *h* 9·18	*h* 10·12 *h* 10·92 *l* 11·24	*l* 10·96 *l* 8·56 *l* 11·46 *l* 11·04	*h* 8·80 *h* 10·02 *h* 10·58	*h* 11·00 *h* 10·26 *h* 9·92 *h* 11·88	*h* 10·14 *h* 10·12 *h* 9·62	*h* 10·42 *h* 9·60 *h* 10·54	*l* 9·92 *h* 8·90 *h* 9·24	*h* 10·72 *h* 9·72 *h* 9·40	*h* 9·92 *h* 10·38 *h* 9·98	M = 10″·07 w = 23·99 $\frac{1}{w}$ = 0·04 C = 37° 21′ 10″·07
	9·32	10·76	10·50	9·80	10·77	9·96	10·19	9·35	9·95	10·09	
LVI & LVIII	*h* 29·96 *h* 23·58 *h* 27·92 *h* 26·34 *h* 27·18 *h* 27·34	*h* 26·68 *h* 26·02 *l* 26·36	*l* 23·34 *l* 27·62 *l* 25·60 *l* 24·14 *l* 28·44 *l* 24·98 *l* 26·32	*h* 26·68 *h* 28·00 *h* 27·28	*h* 26·54 *h* 26·26 *h* 27·48	*h* 24·92 *h* 25·88 *h* 27·36 *h* 26·86	*h* 26·48 *h* 26·58 *h* 26·90	*l* 29·78 *h* 25·96 *h* 25·88 *h* 25·24 *h* 26·24	*h* 25·36 *h* 26·56 *h* 25·28	*h* 26·04 *h* 26·94 *h* 26·28	M = 26″·49 w = 14·97 $\frac{1}{w}$ = 0·07 C = 60° 4′ 26″·48
	27·05	26·35	25·78	27·32	26·76	26·26	26·65	26·62	25·73	26·42	
LVIII & LIX	*h* 30·86 *h* 35·64 *h* 33·82 *h* 34·78 *h* 35·04	*h* 34·20 *h* 35·92 *l* 36·38 *l* 36·34	*l* 39·76 *l* 38·20 *l* 35·68 *l* 38·06 *l* 34·76 *l* 37·76 *l* 36·76	*h* 36·00 *h* 34·90 *h* 34·88	*h* 36·04 *h* 36·70 *h* 35·12	*h* 34·42 *h* 36·20 *h* 36·36	*h* 34·94 *h* 35·28 *h* 35·84	*l* 34·48 *h* 35·84 *h* 36·34	*h* 35·48 *h* 35·74 *h* 37·08	*h* 35·88 *h* 35·44 *h* 36·20	M = 35″·67 w = 10·04 $\frac{1}{w}$ = 0·10 C = 65° 47′ 35″·68
	34·03	35·71	37·28	35·26	35·95	35·66	35·35	35·55	36·10	35·84	

At LVI (Sultán)

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LVIII 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LVIII & LV	h 24·90 h 24·22 h 25·10	h 23·32 h 22·76 h 23·36	h 23·30 h 23·02 h 24·96	h 24·44 h 22·94 h 23.90	l 22·18 l 21·20 l 22·30 l 23·58	l 23·10 l 21·44 l 23·20	h 24·64 h 22·64 h 22·96	h 22·56 h 24·18 h 22·34	h 24·22 h 24·50 h 24·30	h 23·32 h 23·16 h 23·68	$M = 23''\cdot45$ $w = 14\cdot39$ $\frac{1}{w} = 0\cdot07$ $C = 62^\circ\ 9'\ 23''\cdot44$
	24·74	23·15	23·76	23·76	22·32	22·58	23·41	23·03	24·34	23·39	
LV & LIII	h 28·04 h 26·18 h 26·14 h 24·44 h 26·48	h 23·84 h 23·80 h 25·52	h 23·66 h 24·32 h 23·72	h 24·36 h 24·56 h 24·46	l 26·70 l 24·28 l 24·74 l 24·20	l 23·64 l 24·76 l 23·56	h 23·40 h 22·08 h 22·12 h 21·66 h 22·62	h 23·10 h 24·38 h 21·92 h 24·30	h 23·24 h 22·60 h 23·94	h 24·20 h 23·72 h 24·00	$M = 24''\cdot10$ $w = 7\cdot93$ $\frac{1}{w} = 0\cdot13$ $C = 81^\circ\ 56'\ 24''\cdot10$
	26·26	24·39	23·90	24·46	24·98	23·99	22·38	23·43	23·26	23·97	

At LVII (Bijli)

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LIV 0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	338° 24′	237° 37′	57° 36′	316° 49′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LIV & LV	h 16·40 h 15·96 h 17·28 h 16·22 l 15·44 l 14·30 l 14·54	h 15·18 h 15·78 h 13·46 h 14·34	l 13·00 h 13·76 h 13·66	h 13·26 h 13·06 h 13·74	h 14·10 h 14·08 h 13·76 h 14·58	h 13·56 h 13·62 h 15·08	h 14·12 h 15·18 h 13·84	h 14·26 h 13·88 h 14·46	h 13·84 l 14·34 l 14·00	l 13·82 l 15·34 l 13·60	$M = 14''\cdot24$ $w = 17\cdot78$ $\frac{1}{w} = 0\cdot06$ $C = 74^\circ\ 42'\ 14''\cdot27$
	15·73	14·69	13·47	13·35	14·13	14·09	14·38	14·20	14·06	14·25	
LV & LIX	h 57·64 h 55·30 h 57·32 h 54·16 h 54·18 l 56·02	h 54·50 h 54·72 h 56·76 h 55·44	l 53·42 h 55·34 h 53·52	h 56·60 h 56·38 h 56·36	h 54·54 h 53·86 h 55·22	h 56·04 h 53·06 h 55·32 h 54·52	h 53·00 h 55·30 h 55·54 h 55·84	h 55·30 h 54·42 h 54·52	h 56·96 l 54·68 l 54·70 l 55·00	l 56·60 l 53·82 l 56·34 l 53·44 l 53·88	$M = 55''\cdot08$ $w = 13\cdot39$ $\frac{1}{w} = 0\cdot07$ $C = 53^\circ\ 56'\ 55''\cdot09$
	55·77	55·36	54·09	56·45	54·54	54·73	54·92	54·75	55·34	54·82	

At LVII (Bijli)—(*Continued*).

Angle between	Circle readings, telescope being set on LIV										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	338° 24′	237° 37′	57° 36′	316° 49′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
LIX & XXI	h 15·16 h 14·26 h 13·62 h 13·08 l 16·94 l 16·84 l 16·44	h 17·24 h 17·24 h 16·26	h 16·72 h 16·40 h 15·38	h 17·26 h 16·52 h 16·08	h 17·40 h 16·62 h 17·02	h 16·82 h 16·00 h 16·08	h 17·72 h 16·44 h 17·12	h 17·48 h 16·24 h 16·18	l 16·32 l 15·82 l 15·78	l 16·20 l 15·58 l 15·46	$M = 16''\cdot36$ $w = 17\cdot65$ $\frac{1}{w} = 0\cdot06$ $C = 63° \; 2' \; 16''\cdot33$
	15·19	16·91	16·17	16·62	17·01	16·30	17·09	16·63	15·97	15·75	

At LVIII (Panchkot)

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XIX										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 1′	180° 1′	79° 12′	259° 12′	158° 25′	338° 25′	237° 36′	57° 37′	316° 49′	136° 49′	
	″	″	″	″	″	″	″	″	″	″	
XIX & LIX	h 15·78 h 15·32 h 15·12	h 15·84 h 15·00 h 15·38	h 16·14 h 14·76 h 14·14	h 15·42 h 16·12 h 15·32	h 16·76 h 14·64 h 15·92 h 15·04	h 15·12 h 15·80 h 14·56	h 14·44 h 14·74 h 14·72	h 15·12 h 14·88 h 14·72	h 15·60 h 16·72 h 14·28 h 17·26	h 14·82 h 15·58 h 15·18	$M = 15''\cdot28$ $w = 35\cdot30$ $\frac{1}{w} = 0\cdot03$ $C = 61° \; 36' \; 15''\cdot29$
	15·41	15·41	15·01	15·62	15·59	15·16	14·63	14·91	15·97	15·13	
LIX & LV	h 42·10 h 41·20 h 42·20	h 40·80 h 42·42 h 41·24	h 41·04 h 41·46 h 42·34	h 40·52 h 40·42 h 38·26 h 41·32	h 41·20 h 40·06 h 40·78	h 41·44 h 41·54 h 41·56	h 42·04 h 40·76 h 41·46	h 41·00 h 41·26 h 41·42	h 42·04 h 41·40 h 40·98	h 40·96 h 40·94 h 42·04	$M = 41''\cdot27$ $w = 27\cdot24$ $\frac{1}{w} = 0\cdot04$ $C = 44° \; 7' \; 41''\cdot26$
	41·83	41·49	41·61	40·13	40·68	41·56	41·42	41·23	41·47	41·31	
LV & LVI	h 10·10 h 9·68 h 8·96	h 10·34 h 9·30 h 10·70	h 9·62 h 9·74 h 9·84	h 10·04 h 11·06 h 12·30 h 9·58	h 10·36 h 11·18 h 10·50	h 10·86 h 11·34 h 10·68	h 10·18 h 10·34 h 10·58	h 9·70 h 10·78 h 10·16	h 11·06 h 9·94 h 10·68	h 9·16 h 10·28 h 11·08	$M = 10''\cdot31$ $w = 33\cdot68$ $\frac{1}{w} = 0\cdot03$ $C = 57° \; 46' \; 10''\cdot32$
	9·58	10·11	9·73	10·75	10·68	10·96	10·37	10·21	10·56	10·17	

NOTE.—Stations XIX and XXI appertain to the Sutlej Series.

At LIX (Randu)

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LVII: 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 36′	57° 36′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LVII & LV	h 48·68 h 49·26 l 48·06	l 49·54 l 48·30 l 49·30	l 48·52 l 49·46 l 47·90	l 48·66 l 47·88 l 49·56	h 49·56 h 50·96 h 49·14	h 48·42 h 47·82 h 49·00	h 49·26 h 50·08 h 49·84	h 50·28 h 48·00 h 49·48 h 49·76	l 48·88 l 48·90 l 47·98	l 48·08 l 48·16 l 47·52	M = 48″·90 w = 20·13 $\frac{1}{w}$ = 0·05 C = 69° 13′ 48″·90
	48·67	49·05	48·63	48·70	49·89	48·41	49·73	49·38	48·59	47·92	
LV & LVIII	h 44·78 h 43·34 h 44·72	l 42·62 l 43·38 l 43·46	l 43·98 l 41·90 l 43·72 l 41·34	l 43·94 l 44·42 l 42·80	h 42·30 h 43·34 h 43·92	h 43·76 h 42·46 h 42·66	h 42·52 h 42·32 h 43·46	h 43·80 h 42·86 h 42·70	l 43·82 l 44·16 l 43·20	l 43·90 l 44·36 l 43·36	M = 43″·35 w = 24·05 $\frac{1}{w}$ = 0·04 C = 70° 4′ 43″·34
	44·28	43·15	42·74	43·72	43·19	42·96	42·77	43·12	43·73	43·87	
LVIII & XIX	h 17·82 h 16·50 l 16·14 h 16·02 d 18·14	l 13·62 l 15·62 l 14·50 h 15·62	l 14·38 l 15·74 l 14·30 h 14·14	l 14·68 l 17·74 l 17·62 l 17·76 l 17·00	h 14·18 h 17·40 h 14·22 h 14·52 h 13·62	h 15·06 h 19·00 h 14·76 h 17·38 h 16·30	h 15·86 h 15·68 h 17·72 h 16·26	h 15·20 h 15·98 h 16·04	l 15·34 l 15·48 l 16·52	l 15·58 l 16·26 l 15·86	M = 15″·85 w = 10·06 $\frac{1}{w}$ = 0·10 C = 65° 57′ 15″·86
	16·92	14·84	14·64	16·96	14·79	16·50	16·38	15·74	15·78	15·90	
XIX & XXI	h 42·62 h 44·20 l 42·00 l 43·74 d 44·66	l 45·96 l 45·06 l 45·90	l 44·08 l 44·92 l 44·32 h 43·18	l 43·82 l 44·70 l 42·80 l 45·46	h 47·24 h 44·72 h 44·98 h 45·30	h 43·82 h 45·90 h 44·46 h 46·20	h 44·64 h 44·76 h 44·22	h 42·72 h 44·80 h 44·44 h 44·60	l 44·10 l 44·34 l 43·60	l 43·94 l 43·60 l 44·66	M = 44″·48 w = 14·37 $\frac{1}{w}$ = 0·07 C = 73° 52′ 44″·47
	43·44	45·64	44·13	44·19	45·56	45·10	44·54	44·14	44·01	44·07	
XXI & LVII	h 25·88 h 26·96 l 25·50	l 27·30 l 28·38 l 28·76 h 27·70	l 29·48 l 29·74 l 31·14 h 27·36 h 27·92 h 26·00	l 27·40 l 25·02 l 27·22 l 27·16	h 24·96 h 27·00 h 26·88 h 25·28	h 28·22 h 25·08 h 26·44 h 26·36 h 28·36	h 26·00 h 27·00 h 26·76	h 26·50 h 26·70 h 28·64 h 27·56	l 25·32 l 26·40 l 26·08	l 27·32 l 26·64 l 26·74	M = 26″·91 w = 9·70 $\frac{1}{w}$ = 0·10 C = 80° 51′ 26″·94
	26·11	28·04	28·61	26·70	26·03	26·89	26·59	27·35	25·93	26·90	

NOTE.—Stations XIX and XXI appertain to the Sutlej Series.

At XIX (Kaimsir)

January 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXI 251° 41′	71° 40′	330° 53′	150° 52′	50° 4′	230° 4′	129° 16′	309° 16′	208° 29′	28° 29′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXI & LIX	″ h 23·18 h 26·84 l 25·36 l 23·84 l 23·12	″ l 25·28 l 23·66 l 25·70	″ l 22·42 l 23·06 l 24·24	″ l 23·44 l 23·82 h 25·26	″ h 25·24 h 25·20 h 24·66	″ h 25·14 h 24·34 l 24·10	″ l 23·42 l 25·52 l 24·08 l 24·84	″ l 23·44 l 25·38 l 25·18	″ h 25·28 h 24·32 h 23·66 h 24·18	″ h 25·90 h 25·74 h 26·92 h 25·64 h 23·32	$M = 24''\cdot53$ $w = 16\cdot74$ $\frac{1}{w} = 0\cdot06$ $C = 55^\circ\ 53'\ 24''\cdot55$
	24·47	24·88	23·24	24·17	25·03	24·53	24·47	24·67	24·36	25·50	
LIX & LVIII	h 28·44 h 29·28 h 29·18	h 29·14 h 31·24 h 27·82 h 28·38	h 28·44 h 28·16 h 29·76	h 27·94 h 28·10 h 28·08	h 26·88 h 29·76 h 29·92 l 29·76 l 28·36	h 28·74 h 30·36 l 29·42	l 30·22 l 30·30 l 29·24	l 29·08 l 29·60 l 29·60	h 28·18 h 28·34 h 28·74	h 30·22 h 28·52 h 29·80	$M = 29''\cdot07$ $w = 20\cdot18$ $\frac{1}{w} = 0\cdot05$ $C = 52^\circ\ 26'\ 29''\cdot07$
	28·97	29·15	28·79	28·04	28·94	29·51	29·92	29·43	28·42	29·51	

At XXI (Kanda)

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LVII 273° 40′	93° 40′	352° 52′	172° 52′	72° 5′	252° 5′	151° 16′	331° 16′	230° 28′	50° 28′	M = Mean of Groups w = Relative Weight C = Concluded Angle
LVII & LIX	″ h 15·74 h 16·66 h 18·08 h 16·20	″ h 16·98 h 18·10 h 18·02	″ h 17·94 h 16·82 h 18·38	″ l 17·58 l 17·42 l 18·08	″ h 16·28 h 18·20 h 16·96 l 15·52	″ h 17·46 h 17·26 h 16·02	″ h 18·66 h 17·92 h 17·90	″ h 16·84 h 15·82 h 17·18 h 17·24	″ h 17·08 h 16·74 h 18·06	″ h 16·64 h 15·92 h 18·16	$M = 17''\cdot25$ $w = 23\cdot39$ $\frac{1}{w} = 0\cdot04$ $C = 36^\circ\ 6'\ 17''\cdot23$
	16·67	17·70	17·71	17·69	16·74	16·91	18·16	16·77	17·29	16·91	
LIX & XIX	l 49·36 l 50·00 l 49·20	l 49·88 l 49·10 l 50·14	l 49·08 l 49·10 l 50·00	l 50·54 l 50·52 l 49·74	h 50·56 h 50·88 h 49·14	h 48·54 h 48·24 h 49·68	l 50·42 l 50·12 l 50·80	l 50·90 l 49·80 l 49·68	h 51·70 h 48·58 h 48·74 l 48·56 l 47·78	h 50·00 h 49·20 h 49·94	$M = 49''\cdot73$ $w = 22\cdot09$ $\frac{1}{w} = 0\cdot05$ $C = 50^\circ\ 13'\ 49''\cdot72$
	49·52	49·71	49·39	50·27	50·19	48·82	50·45	50·13	49·07	49·71	

NOTE.—Stations XIX and XXI appertain to the Sutlej Series.

August 1878.

J. B. N. HENNESSEY,
In charge of Computing Office.

At LIX (Randu)

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No. 2.*

Angle between	Circle readings, telescope being set on LVII: 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 36′	57° 36′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LVII & LV	h 48·68 h 49·26 l 48·06	l 49·54 l 48·30 l 49·30	l 48·52 l 49·46 l 47·90	l 48·66 l 47·88 l 49·56	h 49·56 h 50·96 h 49·14	h 48·42 h 47·82 h 49·00	h 49·26 h 50·08 h 49·84	h 50·28 h 48·00 h 49·48 h 49·76	l 48·88 l 48·90 l 47·98	l 48·08 l 48·16 l 47·52	$M = 48''\cdot90$ $w = 20\cdot13$ $\frac{1}{w} = 0\cdot05$ $C = 69^\circ\ 13'\ 48''\cdot90$
	48·67	49·05	48·63	48·70	49·89	48·41	49·73	49·38	48·59	47·92	
LV & LVIII	h 44·78 h 43·34 h 44·72	l 42·62 l 43·38 l 43·46	l 43·98 l 41·90 l 43·72 l 41·34	l 43·94 l 44·42 l 42·80	h 42·30 h 43·34 h 43·92	h 43·76 h 42·46 h 42·66	h 42·52 h 42·32 h 43·46	h 43·80 h 42·86 h 42·70	l 43·82 l 44·16 l 43·20	l 43·90 l 44·36 l 43·36	$M = 43''\cdot35$ $w = 24\cdot05$ $\frac{1}{w} = 0\cdot04$ $C = 70^\circ\ 4'\ 43''\cdot34$
	44·28	43·15	42·74	43·72	43·19	42·96	42·77	43·12	43·73	43·87	
LVIII & XIX	h 17·82 h 16·50 l 16·14 h 16·02 d 18·14	l 13·62 l 15·62 l 14·50 h 15·62	l 14·38 l 15·74 l 14·30 h 14·14	l 14·68 l 17·74 l 17·62 l 17·76 l 17·00	h 14·18 h 17·40 h 14·22 h 14·52 h 13·62	h 15·06 h 19·00 h 14·76 h 17·38 h 16·30	h 15·86 h 15·68 h 17·72 h 16·26	h 15·20 h 15·98 h 16·04	l 15·34 l 15·48 l 16·52	l 15·58 l 16·26 l 15·86	$M = 15''\cdot85$ $w = 10\cdot06$ $\frac{1}{w} = 0\cdot10$ $C = 65^\circ\ 57'\ 15''\cdot86$
	16·92	14·84	14·64	16·96	14·79	16·50	16·38	15·74	15·78	15·90	
XIX & XXI	h 42·62 h 44·20 l 42·00 l 43·74 d 44·66	l 45·96 l 45·06 l 45·90	l 44·08 l 44·92 l 44·32 h 43·18	l 43·82 l 44·70 l 42·80 l 45·46	h 47·24 h 44·72 h 44·98 h 45·30	h 43·82 h 45·90 h 44·46 h 46·20	h 44·64 h 44·76 h 44·22	h 42·72 h 44·80 h 44·44 h 44·60	l 44·10 l 44·34 l 43·60	l 43·94 l 43·60 l 44·66	$M = 44''\cdot48$ $w = 14\cdot37$ $\frac{1}{w} = 0\cdot07$ $C = 73^\circ\ 52'\ 44''\cdot47$
	43·44	45·64	44·13	44·19	45·56	45·10	44·54	44·14	44·01	44·07	
XXI & LVII	h 25·88 h 26·96 l 25·50	l 27·30 l 28·38 l 28·76 h 27·70	l 29·48 l 29·74 l 31·14 h 27·36 h 27·92 h 26·00	l 27·40 l 25·02 l 27·22 l 27·16	h 24·96 h 27·00 h 26·88 h 25·28	h 28·22 h 25·08 h 26·44 h 26·36 h 28·36	h 26·00 h 27·00 h 26·76	h 26·50 h 26·70 h 28·64 h 27·56	l 25·32 l 26·40 l 26·08	l 27·32 l 26·64 l 26·74	$M = 26''\cdot91$ $w = 9\cdot70$ $\frac{1}{w} = 0\cdot10$ $C = 80^\circ\ 51'\ 26''\cdot94$
	26·11	28·04	28·61	26·70	26·03	26·89	26·59	27·35	25·93	26·90	

NOTE.—Stations XIX and XXI appertain to the Sutlej Series.

At XIX (Kaimsir)

January 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXI										M = Mean of Groups w = Relative Weight C = Concluded Angle
	251° 41′	71° 40′	330° 53′	150° 52′	50° 4′	230° 4′	129° 16′	309° 16′	208° 29′	28° 29′	
	″	″	″	″	″	″	″	″	″	″	
XXI & LIX	h 23·18 h 26·84 l 25·36 l 23·84 l 23·12	l 25·28 l 23·66 l 25·70	l 22·42 l 23·06 l 24·24	l 23·44 l 23·82 h 25·26	h 25·24 h 25·20 h 24·66	h 25·14 h 24·34 l 24·10	l 23·42 l 25·52 l 24·08 l 24·84	l 23·44 l 25·38 l 25·18	h 25·28 h 24·32 h 23·66 h 24·18	h 25·90 h 25·74 h 26·92 h 25·64 h 23·32	$M = 24''\cdot53$ $w = 16\cdot74$ $\frac{1}{w} = 0\cdot06$ $C = 55^\circ\ 53'\ 24''\cdot55$
	24·47	24·88	23·24	24·17	25·03	24·53	24·47	24·67	24·36	25·50	
LIX & LVIII	h 28·44 h 29·28 h 29·18	h 29·14 h 31·24 h 27·82 h 28·38	h 28·44 h 28·16 h 29·76	h 27·94 h 28·10 h 28·08	h 26·88 h 29·76 h 29·92 l 29·76 l 28·36	h 28·74 h 30·36 l 29·42	l 30·22 l 30·30 l 29·24	l 29·08 l 29·60 l 29·60	h 28·18 h 28·34 h 28·74	h 30·22 h 28·52 h 29·80	$M = 29''\cdot07$ $w = 20\cdot18$ $\frac{1}{w} = 0\cdot05$ $C = 52^\circ\ 26'\ 29''\cdot07$
	28·97	29·15	28·79	28·04	28·94	29·51	29·92	29·43	28·42	29·51	

At XXI (Kanda)

December 1875; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LVII										M = Mean of Groups w = Relative Weight C = Concluded Angle
	273° 40′	93° 40′	352° 52′	172° 52′	72° 5′	252° 5′	151° 16′	331° 16′	230° 28′	50° 28′	
	″	″	″	″	″	″	″	″	″	″	
LVII & LIX	h 15·74 h 16·66 h 18·08 h 16·20	h 16·98 h 18·10 h 18·02	h 17·94 h 16·82 h 18·38	l 17·58 l 17·42 l 18·08	h 16·28 h 18·20 h 16·96 l 15·52	h 17·46 h 17·26 h 16·02	h 18·66 h 17·92 h 17·90	h 16·84 h 15·82 h 17·18 h 17·24	h 17·08 h 16·74 h 18·06	h 16·64 h 15·92 h 18·16	$M = 17''\cdot25$ $w = 23\cdot39$ $\frac{1}{w} = 0\cdot04$ $C = 36^\circ\ 6'\ 17''\cdot23$
	16·67	17·70	17·71	17·69	16·74	16·91	18·16	16·77	17·29	16·91	
LIX & XIX	l 49·36 l 50·00 l 49·20	l 49·88 l 49·10 l 50·14	l 49·08 l 49·10 l 50·00	l 50·54 l 50·52 l 49·74	h 50·56 h 50·88 h 49·14	h 48·54 h 48·24 h 49·68	l 50·42 l 50·12 l 50·80	l 50·90 l 49·80 l 49·68	h 51·70 h 48·58 h 48·74 l 48·56 l 47·78	h 50·00 h 49·20 h 49·94	$M = 49''\cdot73$ $w = 22\cdot09$ $\frac{1}{w} = 0\cdot05$ $C = 50^\circ\ 13'\ 49''\cdot72$
	49·52	49·71	49·39	50·27	50·19	48·82	50·45	50·13	49·07	49·71	

NOTE.—Stations XIX and XXI appertain to the Sutlej Series.

August 1878.

J. B. N. HENNESSEY,
In charge of Computing Office.

JODHPORE MERIDIONAL SERIES.

Sums of Squares of Apparent Errors of Single Observations, and of Apparent Errors of Single Zeros.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
XLI	XLIV & I	34	15·37	10	4·47	Barrow's 24-inch No. 2.
„	I & II	32	18·78	10	2·76	
XLIV	I & II	36	25·52	10	4·18	
„	II & XLI	37	26·23	10	3·23	
I	IV & III	36	45·23	10	5·42	
„	III & II	32	8·33	10	6·22	
„	II & XLI	39	40·69	10	3·69	
„	XLI & XLIV	41	41·82	10	5·71	
II	XLI & XLIV	37	33·16	10	1·94	
„	XLIV & I	38	22·12	10	3·54	
„	I & III	38	29·54	10	4·49	
„	III & V	36	18·27	10	4·25	
III	VI & VII	36	28·16	10	2·76	
„	VII & V	38	17·40	10	3·28	
„	V & II	34	16·22	10	6·00	
„	II & I	31	8·11	10	2·39	
„	I & IV	34	24·66	10	1·85	
„	IV & VI	37	36·60	10	2·50	
IV	VI & III	33	23·77	10	6·59	
„	III & I	33	14·50	10	5·28	
V	II & III	33	20·81	10	1·39	
„	III & VII	35	15·54	10	5·74	

NOTE.—Stations XLI and XLIV appertain to the Karáchi Longitudinal Series.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
VI	IX & VIII	32	9·56	10	3·32	Barrow's 24-inch No. 2.
„	VIII & VII	32	20·24	10	3·67	
„	VII & III	34	16·03	10	1·47	
„	III & IV	35	19·90	10	2·72	
VII	V & III	36	24·74	10	1·72	
„	III & VI	35	16·97	10	1·10	
„	VI & VIII	36	22·10	10	5·22	
„	VIII & X	36	20·92	10	4·88	
VIII	VII & VI	35	17·37	10	3·70	
„	VI & IX	34	15·71	10	4·74	
„	IX & XI	36	27·72	10	5·24	
„	XI & XII	35	23·87	10	4·44	
„	XII & X	33	20·92	10	1·94	
„	X & VII	36	34·95	10	1·75	
IX	XI & VIII	32	16·70	10	1·70	
„	VIII & VI	38	37·09	10	1·46	
X	VII & VIII	30	10·01	10	1·44	
„	VIII & XII	35	23·07	10	1·22	
XI	XIV & XIII	31	14·65	10	5·77	
„	XIII & XII	31	12·31	10	1·12	
„	XII & VIII	37	25·69	10	2·88	
„	VIII & IX	35	12·58	10	2·33	
XII	X & VIII	33	21·23	10	2·39	
„	VIII & XI	30	11·56	10	2·37	
„	XI & XIII	36	27·99	10	3·37	
„	XIII & XV	34	20·66	10	8·63	
XIII	XII & XI	31	12·39	10	3·49	
„	XI & XIV	33	16·58	10	2·06	
„	XIV & XVI	34	20·47	10	3·05	
„	XVI & XVII	31	11·88	10	3·33	
„	XVII & XV	31	15·17	10	2·03	
„	XV & XII	32	15·23	10	4·08	
XIV	XVI & XIII	35	24·47	10	5·16	
„	XIII & XI	31	11·64	10	3·47	
XV	XII & XIII	34	21·77	10	3·93	
„	XIII & XVII	34	19·09	10	3·60	
XVI	XIX & XVIII	30	8·70	10	4·77	
„	XVIII & XVII	32	11·31	10	4·09	
„	XVII & XIII	32	7·57	10	2·12	
„	XIII & XIV	31	13·07	10	1·17	
XVII	XV & XIII	32	10·90	10	2·48	

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
XVII	XIII & XVI	33	14·35	10	1·67	
„	XVI & XVIII	31	12·37	10	4·53	
„	XVIII & XX	32	16·60	10	3·83	
XVIII	XXI & XXII	32	17·37	10	0·92	
„	XXII & XX	30	8·16	10	1·13	
„	XX & XVII	30	7·32	10	2·32	
„	XVII & XVI	31	7·34	10	1·29	
„	XVI & XIX	31	9·92	10	1·91	
„	XIX & XXI	31	8·47	10	7·79	
XIX	XXI & XVIII	30	9·51	10	1·40	
„	XVIII & XVI	30	3·61	10	3·87	
XX	XVII & XVIII	32	17·98	10	4·73	
„	XVIII & XXII	30	7·01	10	5·20	
XXI	XXIII & XXIV	30	7·13	10	3·29	
„	XXIV & XXII	33	12·25	10	2·11	
„	XXII & XVIII	32	8·78	10	0·79	
„	XVIII & XIX	34	11·56	10	4·22	
XXII	XX & XVIII	32	15·06	10	1·42	
„	XVIII & XXI	30	5·21	10	5·24	
„	XXI & XXIII	31	9·84	10	5·89	
„	XXIII & XXIV	30	10·26	10	4·14	Barrow's 24-inch No. 2.
XXIII	XXV & XXVI	34	21·40	10	1·72	
„	XXVI & XXIV	33	19·48	10	7·43	
„	XXIV & XXII	33	12·26	10	5·30	
„	XXII & XXI	32	13·86	10	2·67	
XXIV	XXII & XXI	32	10·47	10	0·69	
„	XXI & XXIII	33	12·05	10	2·55	
„	XXIII & XXV	32	7·09	10	6·25	
„	XXV & XXVI	33	21·17	10	3·27	
XXV	XXVIII & XXVII	31	14·18	10	5·81	
„	XXVII & XXVI	30	7·72	10	4·37	
„	XXVI & XXIV	33	18·60	10	1·75	
„	XXIV & XXIII	32	14·02	10	1·81	
XXVI	XXIV & XXIII	30	10·26	10	6·02	
„	XXIII & XXV	30	9·28	10	4·25	
„	XXV & XXVII	36	25·85	10	3·94	
„	XXVII & R. M.	33	13·70	10	2·13	
„	R.M. & XXIX	32	18·90	10	2·96	
XXVII	XXIX & XXVI	33	16·28	10	2·03	
„	XXVI & XXV	30	10·11	10	1·98	
„	XXV & XXVIII	34	20·12	10	2·72	

NOTE.—R. M. denotes Referring Mark.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
XXVII	XXVIII & XXX	33	12·61	10	1·78	Barrow's 24-inch No. 2.
„	XXX & XXXI	32	10·62	10	1·87	
„	XXXI & XXIX	34	16·62	10	2·80	
XXVIII	XXX & XXVII	36	27·71	10	1·25	
„	XXVII & XXV	32	15·83	10	1·17	
XXIX	XXVI & XXVII	33	15·20	10	2·47	
„	XXVII & XXXI	33	13·40	10	4·41	
XXX	XXXIII & XXXII	35	26·44	10	0·80	
„	XXXII & XXXI	42	57·35	10	9·63	
„	XXXI & XXVII	32	7·63	10	6·95	
„	XXVII & XXVIII	30	6·61	10	4·13	
XXXI	XXIX & XXVII	31	13·52	10	1·61	
„	XXVII & XXX	30	4·68	10	10·86	
„	XXX & XXXII	36	30·89	10	4·85	
„	XXXII & XXXV	40	68·09	10	4·74	
XXXII	XXXV & XXXI	32	12·35	10	2·92	
„	XXXI & XXX	39	33·14	10	4·01	
„	XXX & XXXIII	38	28·63	10	4·86	
„	XXXIII & XXXIV	38	35·61	10	4·38	
„	XXXIV & XXXV	35	28·38	10	2·30	
XXXIII	XXXIV & XXXII	36	41·22	10	3·21	
„	XXXII & XXX	36	29·16	10	8·73	
XXXIV	XXXVII & XXXVI	33	11·83	10	2·68	
„	XXXVI & XXXV	42	59·00	10	4·40	
„	XXXV & XXXII	35	22·17	10	2·81	
„	XXXII & XXXIII	34	32·15	10	3·00	
XXXV	XXXI & XXXII	37	34·80	10	5·47	
„	XXXII & XXXIV	35	30·13	10	3·38	
„	XXXIV & XXXVI	37	34·49	10	6·47	
„	XXXVI & XXXVIII	37	29·51	10	3·07	
XXXVI	XXXV & XXXIV	36	23·74	10	1·03	
„	XXXIV & XXXVII	42	60·47	10	6·23	
„	XXXVII & XXXIX	43	44·54	10	6·98	
„	XXXIX & XL	34	19·09	10	6·48	
„	XL & XXXVIII	35	32·68	10	7·46	
„	XXXVIII & XXXV	41	49·95	10	1·11	
XXXVII	XLI & XXXIX	38	39·72	10	4·33	
„	XXXIX & XXXVI	39	29·70	10	5·57	
„	XXXVI & XXXIV	43	43·91	10	7·37	
XXXVIII	XXXV & XXXVI	37	30·27	10	6·46	
„	XXXVI & XL	36	36·00	10	4·26	

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
XXXIX	XLI & XLIII	38	32·41	10	2·56	
„	XLIII & XLIV	39	33·35	10	2·98	
„	XLIV & XLII	40	43·45	10	6·31	
„	XLII & XL	39	45·35	10	7·52	
„	XL & XXXVI	39	34·69	10	10·84	
„	XXXVI & XXXVII	42	69·49	10	10·89	
„	XXXVII & XLI	44	75·76	10	3·66	
XL	XXXVIII & XXXVI	34	16·36	10	5·22	
„	XXXVI & XXXIX	37	24·99	10	1·11	
„	XXXIX & XLII	37	23·73	10	4·21	
XLI	XLIII & XXXIX	41	40·85	10	12·32	
„	XXXIX & XXXVII	39	47·33	10	8·84	
XLII	XL & XXXIX	43	66·68	10	3·41	
„	XXXIX & XLIV	41	53·32	10	8·08	
XLIII	R.M. & XLVI	31	11·14	10	3·95	
„	XLVI & XLV	34	14·44	10	2·08	
„	XLV & XLIV	39	55·16	10	4·98	
„	XLIV & XXXIX	38	23·44	10	4·22	
„	XXXIX & XLI	37	33·77	10	2·42	
XLIV	XLII & XXXIX	35	21·23	10	3·74	
„	XXXIX & XLIII	38	23·53	10	4·72	Barrow's 24-inch No. 2.
„	XLIII & XLV	37	26·34	10	3·92	
„	XLV & XLVII	38	48·69	10	4·53	
XLV	XLVII & XLIV	36	27·11	10	4·60	
„	XLIV & XLIII	32	9·79	10	1·82	
„	XLIII & XLVI	30	5·57	10	0·39	
„	XLVI & XLVIII	31	12·24	10	2·02	
„	XLVIII & XLIX	34	18·42	10	2·44	
„	XLIX & XLVII	38	49·00	10	8·11	
XLVI	XLVIII & XLV	33	25·33	10	10·01	
„	XLV & XLIII	34	16·72	10	4·94	
XLVII	XLIV & XLV	34	12·92	10	3·32	
„	XLV & XLIX	33	16·01	10	3·22	
XLVIII	LI & L	38	31·92	10	10·44	
„	L & XLIX	39	30·18	10	10·65	
„	XLIX & XLV	38	42·25	10	3·36	
„	XLV & XLVI	37	32·30	10	6·12	
XLIX	XLVII & XLV	34	13·40	10	7·12	
„	XLV & XLVIII	31	5·69	10	3·32	
„	XLVIII & L	36	20·88	10	5·32	
„	L & LII	34	22·00	10	4·28	

NOTE.—R. M. denotes Referring Mark.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
L	LII & XLIX	32	12·46	10	4·04	Barrow's 24-inch No. 2.
"	XLIX & XLVIII	34	16·56	10	2·77	
"	XLVIII & LI	44	59·50	10	6·29	
"	LI & LIII	40	29·00	10	3·39	
"	LIII & LIV	45	66·10	10	2·29	
"	LIV & LII	34	19·35	10	3·32	
LI	LIII & L	34	17·42	10	2·56	
"	L & XLVIII	30	4·53	10	1·64	
LII	XLIX & L	33	16·08	10	2·06	
"	L & LIV	34	17·59	10	2·41	
LIII	LVI & LV	35	26·39	10	2·01	
"	LV & LIV	32	16·55	10	2·39	
"	LIV & L	37	30·21	10	4·43	
"	L & LI	33	19·97	10	4·05	
LIV	LII & L	35	39·14	10	3·24	
"	L & LIII	36	20·39	10	2·35	
"	LIII & LV	33	16·35	10	7·12	
"	LV & LVII	35	23·42	10	5·27	
LV	LIX & LVII	33	13·03	10	2·39	
"	LVII & LIV	34	15·93	10	1·61	
"	LIV & LIII	35	23·50	10	4·63	
"	LIII & LVI	33	16·27	10	2·33	
"	LVI & LVIII	40	61·93	10	2·27	
"	LVIII & LIX	37	42·86	10	5·85	
LVI	LVIII & LV	31	13·30	10	4·96	
"	LV & LIII	36	20·62	10	9·84	
LVII	LIV & LV	36	15·23	10	3·88	
"	LV & LIX	39	40·97	10	4·11	
"	LIX & XXI	34	20·52	10	3·32	
LVIII	XIX & LIX	32	12·03	10	1·40	
"	LIX & LV	31	10·95	10	2·25	
"	LV & LVI	31	9·88	10	1·75	
LIX	LVII & LV	31	10·74	10	3·38	
"	LV & LVIII	31	13·05	10	2·39	
"	LVIII & XIX	41	40·44	10	6·68	
"	XIX & XXI	37	22·55	10	4·69	
"	XXI & LVII	39	38·86	10	6·87	
XIX	XXI & LIX	36	30·09	10	3·15	
"	LIX & LVIII	33	19·42	10	2·83	
XXI	LVII & LIX	33	15·67	10	2·50	
"	LIX & XIX	32	15·49	10	2·61	

Note.—Stations XIX and XXI appertain to the Sutlej Series.

From the preceding data of the sums of the squares of the apparent errors, in the measurement of each angle, we may ascertain the *e. m. s.* (error of mean square) *of observation* of a single measure of an angle, and the *e. m. s. of graduation and observation* of the mean of the measures on a single zero, for each group of angles measured with the same instrument, by the same observer, and under similar circumstances.

The instrument employed was Barrow's 24-inch Theodolite No. 2, having 5 microscopes to read the azimuthal circle; observations were taken on 5 pairs of zeros (*face right* and *face left*) giving circle readings at 7° 12′ apart.

The *e. m. s. of observation* of a single measure of an angle. $= \sqrt{\dfrac{\text{Sum of squares of apparent errors of observations.}}{\text{No. of observations} - \text{No. of angles} \times \text{No. of changes of zero.}}}$

The *e. m. s. of graduation and observation* of the mean of the measures on a single zero. $= \sqrt{\dfrac{\text{Sum of squares of apparent errors of zero.}}{\text{No. of angles} \times (\text{No. of changes of zero} - 1).}}$

Group.	Instrument and Observer.	Position of stations.	Intervals between microscope readings of circle.	Number of Measures on each zero (average).	Number of Angles.	Number of Single measures.	Number of Single zeros.	*e. m. s.* of observation of a single measure.	*e. m. s.* of graduation and observation of a single zero.
			° ′					″	″
I	Barrow's 24-inch Theodolite No. 2; Capt. M. W. Rogers, R. E.	Hills,	7 12	3·59	152	5455	1520	$\left\{\frac{4186 \cdot 07}{5455-1520}\right\}^{\frac{1}{2}} = \pm 1 \cdot 031$	$\left\{\frac{638 \cdot 59}{1520-152}\right\}^{\frac{1}{2}} = \pm 0 \cdot 683$
II	Barrow's 24-inch Theodolite No. 2; Lieut. J. Hill, R. E.	„	7 12	3·20	71	2272	710	$\left\{\frac{957 \cdot 18}{2272-710}\right\}^{\frac{1}{2}} = \pm 0 \cdot 783$	$\left\{\frac{244 \cdot 36}{710-71}\right\}^{\frac{1}{2}} = \pm 0 \cdot 618$
III	Barrow's 24-inch Theodolite No. 2; Capt. M. W. Rogers, R. E.	Plains,	7 12	3·35	4	134	40	$\left\{\frac{80 \cdot 67}{134-40}\right\}^{\frac{1}{2}} = \pm 0 \cdot 926$	$\left\{\frac{11 \cdot 09}{40-4}\right\}^{\frac{1}{2}} = \pm 0 \cdot 555$

August 1878.

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JODHPORE MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. REDUCTION OF FIGURES.

Figure No. 1.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	68	33	0·17	·05
2	42	1	19·78	·05
3	38	58	35·75	·06
4	30	27	8·60	·06
5	37	19	9·51	·07
6	73	15	11·27	·09
7	32	57	39·54	·07
8	36	28	3·42	·06

Equations to be satisfied — **Factor**

$$x_1 + x_2 + x_3 + x_4 = e_1 = +\,0{\cdot}198, \quad \lambda_1$$

$$x_3 + x_4 + x_5 + x_6 = e_2 = +\,0{\cdot}493, \quad \lambda_2$$

$$x_5 + x_6 + x_7 + x_8 = e_3 = +\,0{\cdot}517, \quad \lambda_3$$

$$\left.\begin{matrix} -9\,x_1 + 4\,x_2 - 22\,x_3 \\ +12\,x_6 + 6\,x_7 + 29\,x_8 \end{matrix}\right\} = e_4 = -\,4{\cdot}2, \quad \lambda_4$$

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4
1	+ 0·198	+0·22	+0·12		− 1·57
2	+ 0·493		+0·28	+0·16	− 0·24
3	+ 0·517		*	+0·29	+ 3·24
4	− 4·2				+99·83

Values of the Factors

$\lambda_1 = +\,0{\cdot}0872$

$\lambda_2 = -\,0{\cdot}9132$

$\lambda_3 = +\,4{\cdot}3381$

$\lambda_4 = -\,0{\cdot}1837$

Angular errors in seconds

$x_1 = +\,{\cdot}087$	$x_5 = +\,{\cdot}240$
$x_2 = -\,{\cdot}032$	$x_6 = +\,{\cdot}110$
$x_3 = +\,{\cdot}193$	$x_7 = +\,{\cdot}226$
$x_4 = -\,{\cdot}050$	$x_8 = -\,{\cdot}059$

$[wx^2] = 2{\cdot}58$

* In the tables of the equations between the factors the co-efficients of the terms below the diagonal are omitted for convenience, the co-efficient of the *pth* term in the *qth* line being always the same as the co-efficient of the *qth* term in the *pth* line.

Figure No. 2.

Observed Angles

No.	Value			Reciprocal Weight
	°	′	″	
1	52	38	32·64	·04
2	62	5	15·28	·08
3	65	16	15·11	·07
4	50	38	47·92	·08
5	81	14	28·77	·06
6	48	6	48·30	·03
7	43	5	44·44	·05
8	55	2	25·75	·08
9	81	51	53·67	·04
10	59	58	38·61	·05
11	52	14	11·56	·03
12	67	47	13·45	·03
13	71	15	47·74	·06
14	62	38	57·54	·05
15	46	5	18·34	·10
16	82	22	28·98	·04
17	44	56	44·18	·07
18	52	40	51·29	·10

Equations to be satisfied

	Factor
$x_1 + x_2 + x_3 = e_1 = -0{\cdot}427,$	λ_1
$x_4 + x_5 + x_6 = e_2 = +0{\cdot}647,$	λ_2
$x_7 + x_8 + x_9 = e_3 = -0{\cdot}357,$	λ_3
$x_{10} + x_{11} + x_{12} = e_4 = -0{\cdot}158,$	λ_4
$x_{13} + x_{14} + x_{15} = e_5 = -0{\cdot}731,$	λ_5
$x_{16} + x_{17} + x_{18} = e_6 = -0{\cdot}538,$	λ_6
$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_7 = +0{\cdot}33,$	λ_7
$\left.\begin{array}{lll} 10\,x_3 & -11\,x_2 & +19\,x_6 \\ -\,3\,x_5 & +\,3\,x_9 & -14\,x_8 \\ +\,9\,x_{12} & -16\,x_{11} & +20\,x_{15} \\ -10\,x_{14} & +16\,x_{18} & -21\,x_{17} \end{array}\right\} = e_8 = -9{\cdot}7,$	λ_8

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	− 0·427	+0·19						+0·04	− 0·18
2	+ 0·647		+0·17					+0·08	+ 0·39
3	− 0·357			+0·17				+0·05	− 1·00
4	− 0·158				+0·11			+0·05	− 0·21
5	− 0·731			*		+0·21		+0·06	+ 1·50
6	− 0·538						+0·21	+0·04	+ 0·13
7	+ 0·33							+0·32	
8	− 9·7								+155·67

Values of the Factors

$\lambda_1 = -\,2{\cdot}9130$
$\lambda_2 = +\,2{\cdot}5698$
$\lambda_3 = -\,3{\cdot}2902$
$\lambda_4 = -\,2{\cdot}8657$
$\lambda_5 = -\,3{\cdot}9031$
$\lambda_6 = -\,3{\cdot}0799$
$\lambda_7 = +\,2{\cdot}9048$
$\lambda_8 = -\,0{\cdot}0571$

Angular errors in seconds

$x_1 = \cdot000$	$x_7 = -\cdot019$	$x_{13} = -\cdot060$
$x_2 = -\cdot183$	$x_8 = -\cdot199$	$x_{14} = -\cdot167$
$x_3 = -\cdot244$	$x_9 = -\cdot139$	$x_{15} = -\cdot504$
$x_4 = +\cdot438$	$x_{10} = +\cdot002$	$x_{16} = -\cdot007$
$x_5 = +\cdot164$	$x_{11} = -\cdot059$	$x_{17} = -\cdot132$
$x_6 = +\cdot045$	$x_{12} = -\cdot101$	$x_{18} = -\cdot399$

$[wx^2] = 10{\cdot}56$

Figure No. 3.

Observed Angles

No.	°	′	″	Reciprocal Weight
1	73	29	40·52	·06
2	48	42	31·60	·06
3	57	47	50·94	·08
4	54	5	20·92	·05
5	78	52	36·91	·07
6	47	2	5·03	·03
7	40	23	3·39	·04
8	58	28	49·46	·03
9	81	8	9·46	·05
10	54	17	19·28	·07
11	53	27	48·55	·04
12	72	14	54·72	·05
13	65	7	39·43	·08
14	57	6	10·78	·04
15	57	46	12·47	·04
16	72	36	56·03	·07
17	59	31	54·48	·04
18	47	51	12·26	·05

Equations to be satisfied

Equation	Factor
$x_1 + x_2 + x_3 = e_1 = +0·096$,	λ_1
$x_4 + x_5 + x_6 = e_2 = -0·121$,	λ_2
$x_7 + x_8 + x_9 = e_3 = -0·449$,	λ_3
$x_{10} + x_{11} + x_{12} = e_4 = +0·034$,	λ_4
$x_{13} + x_{14} + x_{15} = e_5 = +0·326$,	λ_5
$x_{16} + x_{17} + x_{18} = e_6 = -0·088$,	λ_6
$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_7 = -0·43$,	λ_7
$\left.\begin{array}{ccc} 14\,x_3 & -19\,x_2 & +19\,x_6 \\ -\ 4\,x_5 & +\ 3\,x_9 & -12\,x_8 \\ +\ 6\,x_{12} & -15\,x_{11} & +13\,x_{15} \\ -13\,x_{14} & +19\,x_{18} & -13\,x_{17} \end{array}\right\} = e_8 = -0·6$,	λ_8

Equations between the factors

No. of e	Value of e	λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	+ 0·096	+0·20						+0·06	− 0·02
2	− 0·121		+0·15					+0·05	+ 0·29
3	− 0·449			+0·12				+0·04	− 0·21
4	+ 0·034				+0·16			+0·07	− 0·30
5	+ 0·326					+0·16		+0·08	0·00
6	− 0·088						+0·16	+0·07	+ 0·43
7	− 0·43							+0·37	
8	− 0·6								+103·19

Values of the Factors

$\lambda_1 = +1·0346$

$\lambda_2 = -0·1704$

$\lambda_3 = -3·1415$

$\lambda_4 = +1·0044$

$\lambda_5 = +2·9635$

$\lambda_6 = +0·2866$

$\lambda_7 = -1·8520$

$\lambda_8 = -0·0098$

Angular errors in seconds

$x_1 = -·049$	$x_7 = -·200$	$x_{13} = +·089$
$x_2 = +·073$	$x_8 = -·091$	$x_{14} = +·124$
$x_3 = +·072$	$x_9 = -·158$	$x_{15} = +·113$
$x_4 = -·101$	$x_{10} = -·059$	$x_{16} = -·110$
$x_5 = -·009$	$x_{11} = +·046$	$x_{17} = +·017$
$x_6 = -·011$	$\lambda_{12} = +·047$	$x_{18} = +·005$

$[wx^2] = 3·31$

Figure No. 4.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	71	30	20·04	·05
2	58	35	4·30	·03
3	49	54	37·79	·06
4	55	44	32·32	·06
5	55	52	6·98	·12
6	68	23	22·31	·06
7	71	51	28·83	·04
8	41	2	28·70	·06
9	67	6	3·59	·04
10	62	58	19·29	·05
11	66	39	51·58	·03
12	50	21	50·07	·03
13	49	3	52·65	·05
14	63	50	17·42	·03
15	67	5	50·74	·08
16	48	51	26·47	·04
17	77	40	50·21	·05
18	53	27	44·05	·08

Equations to be satisfied — Factor

$$x_1 + x_2 + x_3 = e_1 = +0{\cdot}292, \qquad \lambda_1$$
$$x_4 + x_5 + x_6 = e_2 = +0{\cdot}019, \qquad \lambda_2$$
$$x_7 + x_8 + x_9 = e_3 = -0{\cdot}041, \qquad \lambda_3$$
$$x_{10} + x_{11} + x_{12} = e_4 = +0{\cdot}015, \qquad \lambda_4$$
$$x_{13} + x_{14} + x_{15} = e_5 = -0{\cdot}101, \qquad \lambda_5$$
$$x_{16} + x_{17} + x_{18} = e_6 = -0{\cdot}346, \qquad \lambda_6$$
$$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_7 = -0{\cdot}40, \qquad \lambda_7$$
$$\left.\begin{array}{lll} 18\,x_3 & -13\,x_2 & +\ 9\,x_6 \\ -14\,x_5 & +\ 9\,x_9 & -24\,x_8 \\ +17\,x_{12} & -\ 9\,x_{11} & +\ 8\,x_{15} \\ -11\,x_{14} & +16\,x_{18} & -\ 5\,x_{17} \end{array}\right\} = e_8 = -7{\cdot}1, \qquad \lambda_8$$

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	+ 0·292	+0·14						+0·05	+ 0·69
2	+ 0·019		+0·24					+0·06	− 1·14
3	− 0·041			+0·14				+0·04	− 1·08
4	+ 0·015				+0·11			+0·05	+ 0·24
5	− 0·101					+0·16		+0·05	+ 0·31
6	− 0·346						+0·17	+0·04	+ 1·03
7	− 0·40							+0·29	
8	− 7·1								+132·27

Values of the Factors

$\lambda_1 = +3{\cdot}1093$

$\lambda_2 = +0{\cdot}2855$

$\lambda_3 = -0{\cdot}1993$

$\lambda_4 = +1{\cdot}1845$

$\lambda_5 = +0{\cdot}1166$

$\lambda_6 = -1{\cdot}1860$

$\lambda_7 = -2{\cdot}0075$

$\lambda_8 = -0{\cdot}0622$

Angular errors in seconds

$x_1 = +{\cdot}055$	$x_7 = -{\cdot}088$	$x_{13} = -{\cdot}095$
$x_2 = +{\cdot}118$	$x_8 = +{\cdot}078$	$x_{14} = +{\cdot}024$
$x_3 = +{\cdot}119$	$x_9 = -{\cdot}031$	$x_{15} = -{\cdot}030$
$x_4 = -{\cdot}103$	$x_{10} = -{\cdot}041$	$x_{16} = -{\cdot}128$
$x_5 = +{\cdot}139$	$x_{11} = +{\cdot}052$	$x_{17} = -{\cdot}044$
$x_6 = -{\cdot}017$	$x_{12} = +{\cdot}004$	$x_{18} = -{\cdot}174$

$[wx^2] = 2{\cdot}58$

Figure No. 5.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	66	30	31·41	·02
2	61	47	49·77	·06
3	51	41	39·74	·06
4	61	22	37·03	·03
5	58	51	57·43	·06
6	59	45	26·48	·07
7	57	22	36·77	·02
8	65	34	7·65	·07
9	57	3	16·64	·03
10	49	1	44·98	·03
11	56	13	30·01	·06
12	74	44	45·85	·02
13	62	51	44·46	·10
14	54	5	31·92	·06
15	63	2	44·51	·03
16	62	50	44·95	·03
17	61	13	13·78	·05
18	55	56	1·97	·06

Equations to be satisfied — **Factor**

$$x_1 + x_2 + x_3 = e_1 = +\,0{\cdot}042, \qquad \lambda_1$$
$$x_4 + x_5 + x_6 = e_2 = +\,0{\cdot}004, \qquad \lambda_2$$
$$x_7 + x_8 + x_9 = e_3 = +\,0{\cdot}095, \qquad \lambda_3$$
$$x_{10} + x_{11} + x_{12} = e_4 = +\,0{\cdot}031, \qquad \lambda_4$$
$$x_{13} + x_{14} + x_{15} = e_5 = +\,0{\cdot}144, \qquad \lambda_5$$
$$x_{16} + x_{17} + x_{18} = e_6 = -\,0{\cdot}017, \qquad \lambda_6$$
$$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_7 = -\,0{\cdot}40, \qquad \lambda_7$$
$$\left.\begin{array}{ccc} 17\,x_3 & -11\,x_2 & +12\,x_6 \\ -13\,x_5 & +14\,x_9 & -10\,x_8 \\ +\;6\,x_{12} & -14\,x_{11} & +10\,x_{15} \\ -16\,x_{14} & +14\,x_{18} & -11\,x_{17} \end{array}\right\} = e_8 = -\,9{\cdot}8, \qquad \lambda_8$$

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	+ 0·042	+0·14						+0·02	+ 0·36
2	+ 0·004		+0·16					+0·03	+ 0·06
3	+ 0·095			+0·12				+0·02	− 0·28
4	+ 0·031				+0·11			+0·03	− 0·72
5	+ 0·144					+0·19		+0·10	− 0·66
6	− 0·017			*			+0·14	+0·03	+ 0·29
7	− 0·40							+0·23	
8	− 9·8								+106·35

Values of the Factors

$\lambda_1 = +\,0{\cdot}9406$
$\lambda_2 = +\,0{\cdot}6341$
$\lambda_3 = +\,1{\cdot}1271$
$\lambda_4 = +\,0{\cdot}6200$
$\lambda_5 = +\,2{\cdot}1181$
$\lambda_6 = +\,0{\cdot}7016$
$\lambda_7 = -\,3{\cdot}0941$
$\lambda_8 = -\,0{\cdot}0772$

Angular errors in seconds

$x_1 = -\,{\cdot}043$	$x_7 = -\,{\cdot}039$	$x_{13} = -\,{\cdot}098$
$x_2 = +\,{\cdot}107$	$x_8 = +\,{\cdot}133$	$x_{14} = +\,{\cdot}201$
$x_3 = -\,{\cdot}022$	$x_9 = +\,{\cdot}001$	$x_{15} = +\,{\cdot}041$
$x_4 = -\,{\cdot}074$	$x_{10} = -\,{\cdot}074$	$x_{16} = -\,{\cdot}072$
$x_5 = +\,{\cdot}098$	$x_{11} = +\,{\cdot}102$	$x_{17} = +\,{\cdot}078$
$x_6 = -\,{\cdot}020$	$x_{12} = +\,{\cdot}003$	$x_{18} = -\,{\cdot}023$

$[wx^2] = 2{\cdot}46$

Figure No. 6.

Observed Angles

No.	Value	Reciprocal Weight
	° ′ ″	
1	59 13 25·64	·02
2	33 40 35·94	·06
3	37 25 49·28	·08
4	49 40 9·77	·03
5	49 15 47·97	·05
6	43 38 14·00	·04
7	35 22 3·67	·07
8	51 43 55·23	·04

Equations to be satisfied — **Factor**

$$x_1 + x_2 + x_3 + x_4 = e_1 = -0{\cdot}009, \quad \lambda_1$$
$$x_3 + x_4 + x_5 + x_6 = e_2 = +0{\cdot}358, \quad \lambda_2$$
$$x_5 + x_6 + x_7 + x_8 = e_3 = +0{\cdot}311, \quad \lambda_3$$
$$\left.\begin{matrix} -13\,x_1 + 8\,x_2 - 20\,x_3 \\ +18\,x_6 - 4\,x_7 + 17\,x_8 \end{matrix}\right\} = e_4 = -9{\cdot}3, \quad \lambda_4$$

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4
1	− 0·009	+0·19	+0·11		− 1·38
2	+ 0·358		+0·20	+0·09	− 0·88
3	+ 0·311		*	+0·20	+ 1·12
4	− 9·3				+64·86

Values of the Factors

$\lambda_1 = -\ 2{\cdot}2040$

$\lambda_2 = +\ 1{\cdot}0081$

$\lambda_3 = +\ 2{\cdot}3138$

$\lambda_4 = -\ 0{\cdot}2166$

Angular errors in seconds

$x_1 = +\ {\cdot}012$	$x_5 = +\ {\cdot}166$
$x_2 = -\ {\cdot}236$	$x_6 = -\ {\cdot}023$
$x_3 = +\ {\cdot}251$	$x_7 = +\ {\cdot}223$
$x_4 = -\ {\cdot}036$	$x_8 = -\ {\cdot}055$

$[wx^2] = 3{\cdot}11$

Figure No. 7.

Observed Angles

No.	Value			Reciprocal Weight
	°	′	″	
1	30	10	42·39	·08
2	47	2	9·09	·06
3	64	22	53·99	·08
4	38	24	15·32	·10
5	36	46	56·86	·04
6	40	25	54·72	·03
7	54	21	25·11	·04
8	48	25	44·05	·06

Equations to be satisfied — **Factor**

$$x_1 + x_2 + x_3 + x_4 = e_1 = +\ 0\cdot157, \qquad \lambda_1$$

$$x_3 + x_4 + x_5 + x_6 = e_2 = +\ 0\cdot151, \qquad \lambda_2$$

$$x_5 + x_6 + x_7 + x_8 = e_3 = -\ 0\cdot108, \qquad \lambda_3$$

$$\left.\begin{array}{l} -36\,x_1 - 8\,x_2 - 18\,x_3 \\ +26\,x_6 + x_7 + 19\,x_8 \end{array}\right\} = e_4 = -\ 34\cdot8, \qquad \lambda_4$$

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4
1	+ 0·157	+0·32	+0·18		− 4·80
2	+ 0·151		+0·25	+0·07	− 0·66
3	− 0·108			+0·17	+ 1·96
4	−34·8				+175·42

Values of the Factors

$\lambda_1 = -\ 9\cdot8654$

$\lambda_2 = +\ 5\cdot7692$

$\lambda_3 = +\ 2\cdot4556$

$\lambda_4 = -\ 0\cdot4741$

Angular errors in seconds

$x_1 = +\ \cdot576$	$x_5 = +\ \cdot329$
$x_2 = -\ \cdot364$	$x_6 = -\ \cdot123$
$x_3 = +\ \cdot355$	$x_7 = +\ \cdot079$
$x_4 = -\ \cdot410$	$x_8 = -\ \cdot393$

$[wx^2] = 15\cdot56$

Figure No. 8.

Observed Angles

No.	°	′	″	Reciprocal Weight
1	52	25	40·45	·03
2	65	53	52·01	·06
3	61	40	28·44	·07
4	63	28	54·63	·04
5	52	36	19·51	·09
6	63	54	46·40	·04
7	76	38	51·60	·05
8	64	49	26·23	·06
9	38	31	43·02	·03
10	47	29	25·66	·03
11	64	5	48·50	·13
12	68	24	47·46	·08
13	53	19	40·69	·03
14	53	2	38·17	·05
15	73	37	42·06	·04
16	66	37	26·99	·05
17	53	35	23·48	·03
18	59	47	10·15	·08

Equations to be satisfied

	Factor
$x_1 + x_2 + x_3 = e_1 = +0{\cdot}210,$	λ_1
$x_4 + x_5 + x_6 = e_2 = -0{\cdot}175,$	λ_2
$x_7 + x_8 + x_9 = e_3 = -0{\cdot}149,$	λ_3
$x_{10} + x_{11} + x_{12} = e_4 = +0{\cdot}556,$	λ_4
$x_{13} + x_{14} + x_{15} = e_5 = -0{\cdot}013,$	λ_5
$x_{16} + x_{17} + x_{18} = e_6 = -0{\cdot}208,$	λ_6
$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_7 = +0{\cdot}02,$	λ_7
$\left.\begin{array}{lll} 12\,x_3 & -10\,x_2 & +10\,x_6 \\ -16\,x_5 & +27\,x_9 & -10\,x_8 \\ +\ 9\,x_{12} & -10\,x_{11} & +\ 6\,x_{15} \\ -16\,x_{14} & +13\,x_{18} & -16\,x_{17} \end{array}\right\} = e_8 = -57{\cdot}3,$	λ_8

Equations between the factors

No. of e	Value of e	λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
		Co-efficients of							
1	+ 0·210	+0·16						+0·03	+ 0·24
2	− 0·175		+0·17					+0·04	− 1·04
3	− 0·149			+0·14				+0·05	+ 0·21
4	+ 0·556				+0·24			+0·03	− 0·58
5	− 0·013					+0·12		+0·03	− 0·56
6	− 0·208						+0·16	+0·05	+ 0·56
7	+ 0·02							+0·23	
8	−57·3								+125·91

Values of the Factors

$\lambda_1 = +\ 1{\cdot}8938$

$\lambda_2 = -\ 4{\cdot}3117$

$\lambda_3 = -\ 0{\cdot}6375$

$\lambda_4 = +\ 0{\cdot}9908$

$\lambda_5 = -\ 2{\cdot}6764$

$\lambda_6 = +\ 0{\cdot}1704$

$\lambda_7 = +\ 0{\cdot}9113$

$\lambda_8 = -\ 0{\cdot}5015$

Angular errors in seconds

$x_1 = +\ {\cdot}084$	$x_7 = +\ {\cdot}014$	$x_{13} = -\ {\cdot}053$
$x_2 = +\ {\cdot}415$	$x_8 = +\ {\cdot}262$	$x_{14} = +\ {\cdot}267$
$x_3 = -\ {\cdot}289$	$x_9 = -\ {\cdot}425$	$x_{15} = -\ {\cdot}227$
$x_4 = -\ {\cdot}136$	$x_{10} = +\ {\cdot}057$	$x_{16} = +\ {\cdot}054$
$x_5 = +\ {\cdot}334$	$x_{11} = +\ {\cdot}781$	$x_{17} = +\ {\cdot}246$
$x_6 = -\ {\cdot}373$	$x_{12} = -\ {\cdot}282$	$x_{18} = -\ {\cdot}508$

$[wx^2] = 30{\cdot}55$

Figure No. 9.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	67	5	54·97	·07
2	62	36	12·14	·14
3	50	17	55·70	·08
4	69	27	16·87	·04
5	54	41	13·17	·10
6	55	51	29·87	·09
7	67	0	40·46	·05
8	44	59	31·50	·06
9	67	59	48·50	·05
10	94	26	45·01	·07
11	44	46	38·58	·06
12	40	46	36·16	·07
13	61	59	21·55	·07
14	62	10	23·18	·12
15	55	50	15·08	·03

Equations to be satisfied

						Factor
x_1		$+x_2$		$+x_3$	$= e_1 = +\ 2{\cdot}115,$	λ_1
x_4		$+x_5$		$+x_6$	$= e_2 = -\ 0{\cdot}894,$	λ_2
x_7		$+x_8$		$+x_9$	$= e_3 = -\ 0{\cdot}134,$	λ_3
x_{10}		$+x_{11}$		$+x_{12}$	$= e_4 = -\ 0{\cdot}779,$	λ_4
x_{13}		$+x_{14}$		$+x_{15}$	$= e_5 = -\ 0{\cdot}730,$	λ_5
x_1	$+x_4$	$+x_7$	$+x_{10}$	$+x_{13}$	$= e_6 = -\ 1{\cdot}14,$	λ_6
$17\,x_3$	$-10\,x_2$	$+14\,x_6$	$-15\,x_5$	$+\ 8\,x_9$	$= e_7 = +20{\cdot}5,$	λ_7
$-21\,x_8$	$+24\,x_{12}$	$-21\,x_{11}$	$+15\,x_{15}$	$-11\,x_{14}$		

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7
1	+ 2·115	+0·29					+0·07	− 0·04
2	− 0·894		+0·23				+0·04	− 0·24
3	− 0·134			+0·16			+0·05	− 0·86
4	− 0·779				+0·20		+0·07	+ 0·42
5	− 0·730			*		+0·22	+0·07	− 0·87
6	− 1·14						+0·30	
7	+20·5							+194·97

Values of the Factors

$\lambda_1 = +\ 8{\cdot}4337$

$\lambda_2 = -\ 2{\cdot}9636$

$\lambda_3 = +\ 1{\cdot}1983$

$\lambda_4 = -\ 2{\cdot}4887$

$\lambda_5 = -\ 1{\cdot}4088$

$\lambda_6 = -\ 4{\cdot}6638$

$\lambda_7 = +\ 0{\cdot}1076$

Angular errors in seconds

$x_1 = +\ {\cdot}264$	$x_6 = -\ {\cdot}131$	$x_{11} = -\ {\cdot}285$
$x_2 = +1{\cdot}030$	$x_7 = -\ {\cdot}173$	$x_{12} = +\ {\cdot}007$
$x_3 = +\ {\cdot}821$	$x_8 = -\ {\cdot}064$	$x_{13} = -\ {\cdot}425$
$x_4 = -\ {\cdot}305$	$x_9 = +\ {\cdot}103$	$x_{14} = -\ {\cdot}311$
$x_5 = -\ {\cdot}458$	$x_{10} = -\ {\cdot}501$	$x_{15} = +\ {\cdot}006$

$[wx^2] = 30{\cdot}82$

Figure No. 10.

Observed Angles

No.	Value °	′	″	Reciprocal Weight	No.	Value °	′	″	Reciprocal Weight	No.	Value °	′	″	Reciprocal Weight
1	51	24	48·47	·03	12	36	37	0·93	·14	23	44	29	22·07	·16
2	57	57	48·76	·09	13	76	14	24·37	·10	24	52	10	36·63	·05
3	70	37	22·86	·10	14	42	55	41·94	·16	25	50	7	57·73	·06
4	49	28	9·65	·04	15	60	49	55·34	·08	26	77	27	34·49	·06
5	73	44	28·74	·06	16	45	48	22·10	·11	27	52	24	29·51	·07
6	56	47	22·23	·10	17	65	54	39·37	·11	28	39	17	25·13	·10
7	47	20	17·52	·11	18	68	16	58·65	·04	29	51	58	31·15	·06
8	62	5	32·73	·08	19	58	40	37·82	·08	30	88	44	4·89	·12
9	70	34	9·80	·07	20	62	27	54·57	·08	31	49	1	12·50	·12
10	89	43	57·68	·09	21	58	51	29·17	·13	32	79	14	9·52	·08
11	53	39	3·39	·03	22	83	20	3·62	·05	33	51	44	39·58	·07

Equations to be satisfied — **Factor**

$$x_1 + x_2 + x_3 = e_1 = -0{\cdot}764, \qquad \lambda_1$$
$$x_4 + x_5 + x_6 = e_2 = -0{\cdot}236, \qquad \lambda_2$$
$$x_7 + x_8 + x_9 = e_3 = -0{\cdot}841, \qquad \lambda_3$$
$$x_{10} + x_{11} + x_{12} = e_4 = +0{\cdot}468, \qquad \lambda_4$$
$$x_{13} + x_{14} + x_{15} = e_5 = +0{\cdot}082, \qquad \lambda_5$$
$$x_{16} + x_{17} + x_{18} = e_6 = -0{\cdot}767, \qquad \lambda_6$$
$$x_{19} + x_{20} + x_{21} = e_7 = -0{\cdot}706, \qquad \lambda_7$$
$$x_{22} + x_{23} + x_{24} = e_8 = -0{\cdot}101, \qquad \lambda_8$$
$$x_{25} + x_{26} + x_{27} = e_9 = -0{\cdot}315, \qquad \lambda_9$$
$$x_{28} + x_{29} + x_{30} = e_{10} = -0{\cdot}468, \qquad \lambda_{10}$$
$$x_{31} + x_{32} + x_{33} = e_{11} = -0{\cdot}325, \qquad \lambda_{11}$$
$$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_{12} = -0{\cdot}21, \qquad \lambda_{12}$$
$$x_{12} + x_{14} + x_{19} + x_{22} + x_{25} + x_{28} + x_{31} = e_{13} = -0{\cdot}33, \qquad \lambda_{13}$$
$$\left.\begin{array}{l} 7x_3 - 13x_2 + 14x_6 - 7x_5 + 7x_9 - 11x_8 \\ +29x_{12} - 16x_{11} + 12x_{15} - 23x_{14} + 9x_{18} - 10x_{17} \end{array}\right\} = e_{14} = -15{\cdot}7, \qquad \lambda_{14}$$
$$\left.\begin{array}{l} 5x_{13} - 12x_{15} + 16x_{11} - 0x_{10} + 4x_{32} - 17x_{33} + 17x_{29} \\ -\ x_{30} + 4x_{26} - 16x_{27} + 22x_{23} - 17x_{24} + 11x_{20} - 13x_{21} \end{array}\right\} = e_{15} = +14{\cdot}5, \qquad \lambda_{15}$$

Figure No. 10—(Continued).

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8	λ_9	λ_{10}	λ_{11}	λ_{12}	λ_{13}	λ_{14}	λ_{15}
1	− 0·764	+0·22											+0·03		− 0·47	
2	− 0·236		+0·20										+0·04		+ 0·98	
3	− 0·841			+0·26									+0·11		− 0·39	
4	+ 0·468				+0·26								+0·09	+0·14	+ 3·58	+ 0·48
5	+ 0·082					+0·34							+0·10	+0·16	− 2·72	− 0·46
6	− 0·767						+0·26						+0·11		− 0·74	
7	− 0·706							+0·29						+0·08		− 0·81
8	− 0·101								+0·26					+0·05		+ 2·67
9	− 0·315									+0·19				+0·06		− 0·88
10	− 0·468					*					+0·28			+0·10		+ 0·90
11	− 0·325											+0·27		+0·12		− 0·87
12	− 0·21												+0·48			+ 0·50
13	− 0·33													+0·71	+ 0·38	
14	−15·7														+291·58	− 19·20
15	+14·5															+203·09

Values of the Factors

λ_1	= − 3·8972
λ_2	= − 0·9014
λ_3	= − 3·9763
λ_4	= + 2·6530
λ_5	= − 1·1055
λ_6	= − 3·8427
λ_7	= − 2·3671
λ_8	= − 0·9341
λ_9	= − 1·5112
λ_{10}	= − 1·9155
λ_{11}	= − 1·1572
λ_{12}	= + 1·3554
λ_{13}	= + 0·2470
λ_{14}	= − 0·1122
λ_{15}	= + 0·0485

Angular errors in seconds

x_1 = − ·076	x_{12} = − ·049	x_{23} = + ·021
x_2 = − ·220	x_{13} = + ·049	x_{24} = − ·088
x_3 = − ·468	x_{14} = + ·275	x_{25} = − ·076
x_4 = + ·018	x_{15} = − ·242	x_{26} = − ·079
x_5 = − ·007	x_{16} = − ·274	x_{27} = − ·160
x_6 = − ·247	x_{17} = − ·299	x_{28} = − ·167
x_7 = − ·288	x_{18} = − ·194	x_{29} = − ·065
x_8 = − ·219	x_{19} = − ·170	x_{30} = − ·236
x_9 = − ·334	x_{20} = − ·146	x_{31} = − ·109
x_{10} = + ·361	x_{21} = − ·390	x_{32} = − ·077
x_{11} = + ·156	x_{22} = − ·034	x_{33} = − ·139

$[wx^2] = 16·26$

Figure No. 11.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	62	7	59·12	·03
2	56	5	3·70	·09
3	61	46	58·64	·06
4	78	6	52·85	·07
5	42	38	49·56	·09
6	59	14	18·83	·05
7	57	43	53·58	·13
8	74	27	36·12	·05
9	47	48	31·30	·09
10	60	54	10·26	·04
11	43	27	43·49	·04
12	75	38	8·15	·07
13	43	59	57·46	·04
14	74	18	34·97	·09
15	61	41	28·43	·14
16	57	7	5·35	·01
17	76	9	57·39	·07
18	46	42	57·99	·04

Equations to be satisfied — Factor

$$x_1 + x_2 + x_3 = e_1 = -0·218, \qquad \lambda_1$$
$$x_4 + x_5 + x_6 = e_2 = -0·140, \qquad \lambda_2$$
$$x_7 + x_8 + x_9 = e_3 = -0·222, \qquad \lambda_3$$
$$x_{10} + x_{11} + x_{12} = e_4 = +0·734, \qquad \lambda_4$$
$$x_{13} + x_{14} + x_{15} = e_5 = +0·140, \qquad \lambda_5$$
$$x_{16} + x_{17} + x_{18} = e_6 = -0·539, \qquad \lambda_6$$
$$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_7 = -1·38, \qquad \lambda_7$$
$$\left.\begin{array}{lll} 12\,x_3 & -15\,x_2 & +12\,x_6 \\ -23\,x_5 & +19\,x_9 & -6\,x_8 \\ +5\,x_{12} & -23\,x_{11} & +11\,x_{15} \\ -6\,x_{14} & +19\,x_{18} & -5\,x_{17} \end{array}\right\} = e_8 = +47·9, \qquad \lambda_8$$

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	− 0·218	+0·18						+0·03	− 0·63
2	− 0·140		+0·21					+0·07	− 1·47
3	− 0·222			+0·27				+0·13	+ 1·41
4	+ 0·734				+0·15			+0·04	− 0·57
5	+ 0·140					+0·27		+0·04	+ 1·00
6	− 0·539						+0·12	+0·01	+ 0·41
7	− 1·38							+0·32	
8	+47·9								+177·27

Values of the Factors

$\lambda_1 = +1·0128$
$\lambda_2 = +3·7811$
$\lambda_3 = +0·4230$
$\lambda_4 = +7·8435$
$\lambda_5 = +0·1934$
$\lambda_6 = -5·1249$
$\lambda_7 = -6·2498$
$\lambda_8 = +0·3378$

Angular errors in seconds

$x_1 = -·157$	$x_7 = -·758$	$x_{13} = -·242$
$x_2 = -·365$	$x_8 = -·080$	$x_{14} = -·165$
$x_3 = +·304$	$x_9 = +·616$	$x_{15} = +·547$
$x_4 = -·173$	$x_{10} = +·064$	$x_{16} = -·114$
$x_5 = -·359$	$x_{11} = +·003$	$x_{17} = -·477$
$x_6 = +·392$	$x_{12} = +·667$	$x_{18} = +·052$

$[wx^2] = 32·51$

Figure No. 12.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	72	32	48·96	·05
2	53	12	47·59	·14
3	54	14	25·17	·08
4	43	28	52·80	·06
5	52	24	58·30	·07
6	84	6	9·39	·04
7	84	42	51·22	·06
8	47	18	16·38	·04
9	47	58	52·55	·07
10	63	22	13·72	·06
11	72	20	52·44	·04
12	44	16	54·52	·07
13	42	10	17·63	·06
14	76	48	39·26	·06
15	61	1	4·08	·04
16	53	42	56·01	·10
17	53	48	29·32	·02
18	72	28	35·62	·14

Equations to be satisfied

Equation	Factor
$x_1 + x_2 + x_3 = e_1 = +0·678,$	λ_1
$x_4 + x_5 + x_6 = e_2 = -0·101,$	λ_2
$x_7 + x_8 + x_9 = e_3 = -0·524,$	λ_3
$x_{10} + x_{11} + x_{12} = e_4 = -0·137,$	λ_4
$x_{13} + x_{14} + x_{15} = e_5 = +0·038,$	λ_5
$x_{16} + x_{17} + x_{18} = e_6 = -0·104,$	λ_6
$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_7 = +0·34,$	λ_7
$\left.\begin{array}{rrr} 16\,x_3 & -15\,x_2 & +\;2\,x_6 \\ -16\,x_5 & +19\,x_9 & -19\,x_8 \\ +21\,x_{12} & -\;7\,x_{11} & +11\,x_{15} \\ -\;5\,x_{14} & +\;7\,x_{18} & -16\,x_{17} \end{array}\right\} = e_8 = -51·2,$	λ_8

Equations between the factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	+ 0·678	+0·27						+0·05	− 0·82
2	− 0·101		+0·17					+0·06	− 1·04
3	− 0·524			+0·17				+0·06	+ 0·57
4	− 0·137				+0·17			+0·06	+ 1·19
5	+ 0·038					+0·16		+0·06	+ 0·14
6	− 0·104			*			+0·26	+0·10	+ 0·66
7	+ 0·34							+0·39	
8	−51·2								+160·92

Values of the Factors

$\lambda_1 = +\ 1·2381$

$\lambda_2 = -\ 3·1290$

$\lambda_3 = -\ 2·4916$

$\lambda_4 = +\ 0·9886$

$\lambda_5 = -\ 0·0218$

$\lambda_6 = -\ 0·1244$

$\lambda_7 = +\ 1·4616$

$\lambda_8 = -\ 0·3300$

Angular errors in seconds

$x_1 = +\ ·135$	$x_7 = -\ ·062$	$x_{13} = +\ ·086$
$x_2 = +\ ·866$	$x_8 = +\ ·151$	$x_{14} = +\ ·098$
$x_3 = -\ ·323$	$x_9 = -\ ·613$	$x_{15} = -\ ·146$
$x_4 = -\ ·100$	$x_{10} = +\ ·147$	$x_{16} = +\ ·134$
$x_5 = +\ ·151$	$x_{11} = +\ ·132$	$x_{17} = +\ ·103$
$x_6 = -\ ·152$	$x_{12} = -\ ·416$	$x_{18} = -\ ·341$

$[wx^2] = 19·73$

Figure No. 13.

Observed Angles

No.	Value	Reciprocal Weight	No.	Value	Reciprocal Weight	No.	Value	Reciprocal Weight
	° ′ ″			° ′ ″			° ′ ″	
1	79 55 5·70	·07	10	65 47 35·68	·10	19	65 57 15·86	·10
2	52 22 56·43	·04	11	70 4 43·34	·04	20	61 36 15·29	·03
3	47 41 59·24	·09	12	44 7 41·26	·04	21	52 26 29·07	·05
4	60 2 25·76	·03	13	60 4 26·48	·07	22	73 52 44·47	·07
5	45 15 20·09	·08	14	57 46 10·32	·03	23	55 53 24·55	·06
6	74 42 14·27	·06	15	62 9 23·44	·07	24	50 13 49·72	·05
7	56 49 15·65	·04	16	37 21 10·07	·04	25	80 51 26·94	·10
8	53 56 55·09	·07	17	81 56 24·10	·13	26	36 6 17·23	·04
9	69 13 48·90	·05	18	60 42 26·01	·05	27	63 2 16·33	·06

Equations to be satisfied								Factor
x_1	$+x_2$	$+x_3$	...	...	...	...	$= e_1 = +0{\cdot}717,$	λ_1
x_4	$+x_5$	$+x_6$	...	...	...	...	$= e_2 = -0{\cdot}333,$	λ_2
x_7	$+x_8$	$+x_9$	...	...	...	...	$= e_3 = -0{\cdot}639,$	λ_3
x_{10}	$+x_{11}$	$+x_{12}$	...	...	...	...	$= e_4 = -0{\cdot}075,$	λ_4
x_{13}	$+x_{14}$	$+x_{15}$	...	...	...	...	$= e_5 = -0{\cdot}195,$	λ_5
x_{16}	$+x_{17}$	$+x_{18}$	...	...	...	...	$= e_6 = -0{\cdot}151,$	λ_6
x_{19}	$+x_{20}$	$+x_{21}$	...	...	...	...	$= e_7 = -0{\cdot}281,$	λ_7
x_{22}	$+x_{23}$	$+x_{24}$	...	...	...	...	$= e_8 = -1{\cdot}890,$	λ_8
x_{25}	$+x_{26}$	$+x_{27}$	...	...	...	...	$= e_9 = +0{\cdot}039,$	λ_9
x_1	$+x_4$	$+x_7$	$+x_{10}$	$+x_{13}$	$+x_{16}$	...	$= e_{10} = -0{\cdot}66,$	λ_{10}
x_9	$+x_{11}$	$+x_{19}$	$+x_{22}$	$+x_{25}$			$= e_{11} = -0{\cdot}49,$	λ_{11}
$20\,x_3$ $+21\,x_{12}$	$-16\,x_2$ $-\ 8\,x_{11}$	$+\ 6\,x_6$ $+12\,x_{15}$	$-21\,x_5$ $-13\,x_{14}$	$+\ 8\,x_9$ $+12\,x_{18}$	$-16\,x_8$ $-\ 3\,x_{17}$ }	...	$= e_{12} = +33{\cdot}8,$	λ_{12}
$9\,x_{10}$ $-10\,x_{27}$	$-21\,x_{12}$ $+14\,x_{23}$	$+16\,x_8$ $-18\,x_{24}$	$-14\,x_7$ $+11\,x_{20}$	$+29\,x_{26}$ $-16\,x_{21}$ }	...	...	$= e_{13} = +29{\cdot}3,$	λ_{13}

Figure No. 13—(Continued).

Equations between the factors														
No. of e	Value of e	Co-efficients of												
		λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8	λ_9	λ_{10}	λ_{11}	λ_{12}	λ_{13}
1	+ 0·717	+0·20									+0·07		+ 1·16	
2	− 0·333		+0·17								+0·03		− 1·32	
3	− 0·639			+0·16							+0·04	+0·05	− 0·72	+ 0·56
4	− 0·075				+0·18						+0·10	+0·04	+ 0·52	+ 0·06
5	− 0·195					+0·17					+0·07		+ 0·45	
6	− 0·151						+0·22				+0·04		+ 0·21	
7	− 0·281							+0·18				+0·10		− 0·47
8	− 1·890								+0·18			+0·07		− 0·06
9	+ 0·039					*				+0·20		+0·10		+ 0·56
10	− 0·66										+0·35			+ 0·34
11	− 0·49											+0·36	+ 0·08	
12	+33·8												+148·52	− 35·56
13	+29·3													+135·53

Values of the Factors	Angular errors in seconds		
λ_1 = + 2·6042	x_1 = + ·065	x_{10} = + ·011	x_{19} = + ·043
λ_2 = + 0·4294	x_2 = − ·068	x_{11} = − ·018	x_{20} = + ·033
λ_3 = − 4·2697	x_3 = + ·720	x_{12} = − ·068	x_{21} = − ·357
λ_4 = − 0·9689	x_4 = − ·037	x_{13} = − ·199	x_{22} = − ·613
λ_5 = − 1·1747	x_5 = − ·419	x_{14} = − ·140	x_{23} = − ·431
λ_6 = − 0·6407	x_6 = + ·123	x_{15} = + ·144	x_{24} = − ·846
λ_7 = − 2·2597	x_7 = − ·408	x_{16} = − ·092	x_{25} = + ·069
λ_8 = − 11·4442	x_8 = − ·260	x_{17} = − ·189	x_{26} = + ·273
λ_9 = − 2·0023	x_9 = + ·029	x_{18} = + ·130	x_{27} = − ·303
λ_{10} = − 1·6667			
λ_{11} = + 2·6889			
λ_{12} = + 0·2697		$[wx^2]$ = 44·86	
λ_{13} = + 0·3046			

September 1878.

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In charge of Computing Office.

JODHPORE MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. TRIANGLES.

No. of triangle: Circuit	No. of triangle: Non-circuit	Station	Spherical Excess	Corrections to Observed Angle: Figure	Corrections to Observed Angle: Circuit	Corrections to Observed Angle: Non-circuit	Corrections to Observed Angle: Total	Corrected Plane Angle	Distance: Log. feet	Distance: Feet	Distance: Miles
			″	″	″	″	″	° ′ ″			
1		XLI	1·545	−·193	+·061		−·132	38 58 34·073	5·0716171,6	117928·06	22·335
		XLIV	1·546	−·190	·000		−·190	67 46 16·374	5·2394300,7	173552·19	32·870
		I	1·546	−·110	−·061		−·171	73 15 9·553	5·2541461,0	179533·76	34·003
			4·637				−·493	180 0 0·000			
2		XLI	·896	+·032	+·099		+·131	42 1 19·015	5·0802173,1	120286·62	22·782
		I	·895	−·227	−·118		−·345	32 57 38·300	4·9901706,7	97762·13	18·516
		II	·896	−·028	+·019		−·009	105 1 2·685	5·2394300,7	173552·19	32·870
			2·687				−·223	180 0 0·000			
	49	XLI	1·368	−·161		+·160	−·001	80 59 54·161	5·2799381,5	190518·93	36·083
		XLIV	1·367	+·050		−·121	−·071	30 27 7·162	4·9901706,7	97762·13	18·516
		II	1·367	−·087		−·039	−·126	68 32 58·677	5·2541461,0	179533·76	34·003
			4·102				−·198	180 0 0·000			
3		I	1·152	+·183	+·026		+·209	62 5 14·337	5·1262127,6	133725·05	25·327
		II	1·153	+·244	+·075		+·319	65 16 14·276	5·1381529,7	137452·62	26·033
		III	1·152	·000	−·101		−·101	52 38 31·387	5·0802173,1	120286·62	22·782
			3·457				+·427	180 0 0·000			
4		II	1·448	−·164	+·079		−·085	81 14 27·237	5·2492748,6	177531·25	33·623
		III	1·448	−·438	−·047		−·485	50 38 45·987	5·1426862,7	138894·89	26·306
		V	1·447	−·045	−·032		−·077	48 6 46·776	5·1262127,6	133725·05	25·327
			4·343				−·647	180 0 0·000			

NOTES.—1. The values of the side are given in the same line with the opposite angle.
2. Stations XLI and XLIV appertain to the Karáchi Longitudinal Series.

No. of triangle: Circuit	No. of triangle: Non-circuit	Station	Spherical Excess	Corrections to Observed Angle: Figure	Circuit	Non-circuit	Total	Corrected Plane Angle	Distance: Log. feet	Feet	Miles
			″	″	″	″	″	° ′ ″			
		III	1·405	+ ·019	− ·092		− ·073	43 5 42·962	5·0882240,5	122524·82	23·205
5		V	1·406	+ ·199	+ ·088		+ ·287	55 2 24·631	5·1672452,2	146975·60	27·836
		VII	1·406	+ ·139	+ ·004		+ ·143	81 51 52·407	5·2492748,6	177531·25	33·623
			4·217				+ ·357	180 0 0·000			
		III	1·259	− ·002	+ ·026		+ ·024	59 58 37·375	5·1381661,9	137456·80	26·033
6		VII	1·259	+ ·059	+ ·064		+ ·123	52 14 10·424	5·0986612,2	125505·06	23·770
		VI	1·260	+ ·101	− ·090		+ ·011	67 47 12·201	5·1672452,2	146975·60	27·836
			3·778				+ ·158	180 0 0·000			
		I	1·663	+ ·399		− ·010	+ ·389	52 40 50·016	5·1895975,8	154738·21	29·306
	50	III	1·663	+ ·007		+ ·127	+ ·134	82 22 27·451	5·2852261,9	192852·92	36·525
		IV	1·662	+ ·132		− ·117	+ ·015	44 56 42·533	5·1381529,7	137452·62	26·033
			4·988				+ ·538	180 0 0·000			
		III	1·451	+ ·060		+ ·111	+ ·171	71 15 46·460	5·2174339,4	164981·00	31·246
	51	IV	1·450	+ ·504		− ·011	+ ·493	46 5 17·383	5·0986612,2	125505·06	23·770
		VI	1·450	+ ·167		− ·100	+ ·067	62 38 56·157	5·1895975,8	154738·21	29·306
			4·351				+ ·731	180 0 0·000			
		VI	·988	− ·073	+ ·046		− ·027	48 42 30·585	5·0322912,1	107718·74	20·401
7		VII	·988	− ·072	+ ·045		− ·027	57 47 49·925	5·0838982,0	121310·45	22·975
		VIII	·988	+ ·049	− ·091		− ·042	73 29 39·490	5·1381661,9	137456·80	26·033
			2·964				− ·096	180 0 0·000			
		VII	·994	+ ·009	+ ·089		+ ·098	78 52 36·014	5·1596842,2	144438·91	27·356
8		VIII	·994	+ ·101	− ·043		+ ·058	54 5 19·984	5·0763667,8	119224·86	22·580
		X	·993	+ ·011	− ·046		− ·035	47 2 4·002	5·0322912,1	107718·74	20·401
			2·981				+ ·121	180 0 0·000			
		VIII	·919	+ ·200	− ·090		+ ·110	40 23 2·581	4·9764158,6	94714·36	17·938
9		X	·920	+ ·091	+ ·089		+ ·180	58 28 48·720	5·0955763,7	124616·74	23·602
		XII	·920	+ ·158	+ ·001		+ ·159	81 8 8·699	5·1596842,2	144438·91	27·356
			2·759				+ ·449	180 0 0·000			
		VIII	·839	+ ·059	+ ·045		+ ·104	54 17 18·545	5·0263010,9	106243·18	20·122
10		XII	·838	− ·046	+ ·046		·000	53 27 47·712	5·0217355,9	105132·15	19·911
		XI	·839	− ·047	− ·091		− ·138	72 14 53·743	5·0955763,7	124616·74	23·602
			2·516				− ·034	180 0 0·000			
		VI	·952	− ·005		+ ·030	+ ·025	47 51 11·333	5·0185059,2	104353·23	19·764
	52	VIII	·953	+ ·110		+ ·085	+ ·195	72 36 55·272	5·1281314,8	134317·15	25·439
		IX	·953	− ·017		− ·115	− ·132	59 31 53·395	5·0838982,0	121310·45	22·975
			2·858				+ ·088	180 0 0·000			
		VIII	·785	− ·089		+ ·094	+ ·005	65 7 38·650	5·0521346,8	112754·70	21·355
	53	IX	·785	− ·113		+ ·013	− ·100	57 46 11·585	5·0217355,9	105132·15	19·911
		XI	·784	− ·124		− ·107	− ·231	57 6 9·765	5·0185059,2	104353·23	19·764
			2·354				− ·326	180 0 0·000			
		XI	·613	− ·118	+ ·035		− ·083	58 35 3·604	4·9804877,8	95606·58	18·107
11		XII	·612	− ·119	+ ·054		− ·065	49 54 37·113	4·9330134,9	85706·45	16·232
		XIII	·613	− ·055	− ·089		− ·144	71 30 19·283	5·0263010,9	106243·18	20·122
			1·838				− ·292	180 0 0·000			
		XII	·530	− ·139	+ ·116		− ·023	55 52 6·427	4·9300411,0	85121·86	16·122
12		XIII	·530	+ ·103	− ·081		+ ·022	55 44 31·812	4·9293907,2	84994·47	16·097
		XV	·531	+ ·017	− ·035		− ·018	68 23 21·761	4·9804877,8	95606·58	18·107
			1·591				− ·019	180 0 0·000			

No. of triangle: Circuit	No. of triangle: Non-circuit	Station	Spherical Excess	Corrections to Observed Angle: Figure	Circuit	Non-circuit	Total	Corrected Plane Angle	Distance: Log. feet	Feet	Miles
			"	"	"	"	"	° ′ "			
13		XIII	·387	+ ·088	− ·102		− ·014	71 51 28·429	4·9435461,4	87810·44	16·631
		XV	·387	− ·078	+ ·159		+ ·081	41 2 28·394	4·7829932,9	60672·69	11·491
		XVII	·387	+ ·031	− ·057		− ·026	67 6 3·177	4·9300411,0	85121·86	16·122
			1·161				+ ·041	180 0 0·000			
14		XIII	·308	+ ·041	+ ·050		+ ·091	62 58 19·073	4·8462130,0	70179·94	13·292
		XVII	·309	− ·052	+ ·084		+ ·032	66 39 51·303	4·8593774,0	72339·82	13·701
		XVI	·308	− ·004	− ·134		− ·138	50 21 49·624	4·7829932,9	60672·69	11·491
			·925				− ·015	180 0 0·000			
	54	XI	·359	+ ·174		+ ·213	+ ·387	53 27 44·078	4·8480978,0	70485·18	13·349
		XIII	·358	+ ·128		+ ·057	+ ·185	48 51 26·297	4·8199682,4	66064·51	12·512
		XIV	·359	+ ·044		− ·270	− ·226	77 40 49·625	4·9330134,9	85706·45	16·232
			1·076				+ ·346	180 0 0·000			
	55	XIII	·303	+ ·095		+ ·165	+ ·260	49 3 52·607	4·7732438,0	59325·82	11·236
		XIV	·304	+ ·030		+ ·136	+ ·166	67 5 50·602	4·8593773,9	72339·82	13·701
		XVI	·304	− ·024		− ·301	− ·325	63 50 16·791	4·8480978,0	70485·18	13·349
			·911				+ ·101	180 0 0·000			
15		XVI	·293	− ·107	+ ·036		− ·071	61 47 49·406	4·8289003,0	67437·32	12·772
		XVII	·292	+ ·022	+ ·063		+ ·085	51 41 39·533	4·7784986,6	60048·02	11·373
		XVIII	·293	+ ·043	− ·099		− ·056	66 30 31·061	4·8462130,0	70179·94	13·292
			·878				− ·042	180 0 0·000			
16		XVII	·312	− ·098	+ ·124		+ ·026	58 51 57·144	4·8248902,3	66817·50	12·655
		XVIII	·312	+ ·074	− ·073		+ ·001	61 22 36·719	4·8358276,0	68521·62	12·978
		XX	·312	+ ·020	− ·051		− ·031	59 45 26·137	4·8289003,0	67437·32	12·772
			·936				− ·004	180 0 0·000			
17		XVIII	·322	+ ·039	− ·061		− ·022	57 22 36·426	4·8264635,6	67060·01	12·701
		XX	·322	− ·133	+ ·115		− ·018	65 34 7·310	4·8602905,7	72492·08	13·730
		XXII	·321	− ·001	− ·054		− ·055	57 3 16·264	4·8248902,3	66817·50	12·655
			·965				− ·095	180 0 0·000			
18		XVIII	·269	+ ·074	+ ·068		+ ·142	49 1 44·853	4·7538389,3	56733·42	10·745
		XXII	·270	− ·102	+ ·039		− ·063	56 13 29·677	4·7955865,4	62457·78	11·829
		XXI	·270	− ·003	− ·107		− ·110	74 44 45·470	4·8602905,7	72492·08	13·730
			·809				− ·031	180 0 0·000			
	56	XVI	·239	+ ·023		+ ·050	+ ·073	55 56 1·804	4·7539932,1	56753·57	10·749
		XVIII	·239	+ ·072		+ ·072	+ ·144	62 50 44·855	4·7850410,2	60959·45	11·545
		XIX	·239	− ·078		− ·122	− ·200	61 13 13·341	4·7784986,6	60048·02	11·373
			·717				+ ·017	180 0 0·000			
	57	XVIII	·249	+ ·098		+ ·093	+ ·191	62 51 44·402	4·7948772,2	62355·86	11·810
		XIX	·249	− ·041		+ ·044	+ ·003	63 2 44·264	4·7955865,4	62457·78	11·829
		XXI	·248	− ·201		− ·137	− ·338	54 5 31·334	4·7539932,1	56753·57	10·749
			·746				− ·144	180 0 0·000			
19		XXI	·213	+ ·036	− ·054		− ·018	49 40 9·539	4·7018973,2	50338·15	9·534
		XXII	·213	− ·015	+ ·099		+ ·084	71 6 25·091	4·7957073,2	62475·15	11·832
		XXIV	·213	− ·012	− ·045		− ·057	59 13 25·370	4·7538389,3	56733·42	10·745
			·639				+ ·009	180 0 0·000			
20		XXI	·186	− ·166	+ ·067		− ·099	49 15 47·685	4·6832601,5	48223·66	9·133
		XXIV	·186	+ ·055	+ ·034		+ ·089	51 43 55·133	4·6986909,8	49967·88	9·464
		XXIII	·187	− ·200	− ·101		− ·301	79 0 17·182	4·7957073,2	62475·15	11·832
			·559				− ·311	180 0 0·000			

No. of triangle		Station	Spherical Excess	Corrections to Observed Angle				Corrected Plane Angle	Distance		
Circuit	Non-circuit			Figure	Circuit	Non-circuit	Total		Log. feet	Feet	Miles
			″	″	″	″	″	° ′ ″			
		XXI	.221	− .130		+ .013	− .117	98 55 57.402	4.9096344,2	81214.66	15.382
	58	XXII	.220	− .251		+ .041	− .210	37 25 48.850	4.6986909,8	49967.88	9.464
		XXIII	.221	+ .023		− .054	− .031	43 38 13.748	4.7538389,3	56733.42	10.745
			.662				− .358	180 0 0.000			
		XXIII	.247	+ .081	+ .055		+ .136	75 11 12.069	4.8566423,2	71885.67	13.615
21		XXIV	.246	− .355	+ .116		− .239	64 22 53.505	4.8263806,9	67047.20	12.698
		XXV	.246	+ .123	− .171		− .048	40 25 54.426	4.6832601,5	48223.66	9.133
			.739				− .151	180 0 0.000			
		XXIV	.247	+ .364	+ .142		+ .506	47 2 9.349	4.7296662,9	53661.92	10.163
22		XXV	.247	− .079	− .110		− .189	54 21 24.674	4.7751950,4	59592.98	11.287
		XXVI	.248	− .183	− .032		− .215	78 36 25.977	4.8566423,2	71885.67	13.615
			.742				+ .102	180 0 0.000			
		XXIII	.211	+ .410		− .117	+ .293	38 24 15.402	4.7751950,4	59592.98	11.287
	59	XXIV	.211	+ .009		+ .258	+ .267	111 25 3.136	4.9508827,8	89306.44	16.914
		XXVI	.211	− .576		− .141	− .717	30 10 41.462	4.6832601,5	48223.66	9.133
			.633				− .157	180 0 0.000			
		XXV	.230	− .415	+ .059		− .356	65 53 51.424	4.7910041,2	61802.23	11.705
23		XXVI	.230	+ .289	+ .086		+ .375	61 40 28.585	4.7752348,0	59598.42	11.288
		XXVII	.230	− .084	− .145		− .229	52 25 39.991	4.7296662,9	53661.92	10.163
			.690				− .210	180 0 0.000			
		XXVI	.238	− .334	+ .144		− .190	52 36 19.082	4.7377444,7	54669.42	10.354
24		XXVII	.238	+ .136	− .086		+ .050	63 28 54.442	4.7893888,8	61572.80	11.662
		XXIX	.239	+ .373	− .058		+ .315	63 54 46.476	4.7910041,2	61802.23	11.705
			.715				+ .175	180 0 0.000			
		XXVII	.333	− .014	− .029		− .043	76 38 51.224	4.9314209,2	85392.73	16.173
25		XXIX	.333	− .262	+ .154		− .108	64 49 25.789	4.8999729,0	79427.87	15.043
		XXXI	.333	+ .425	− .125		+ .300	38 31 42.987	4.7377444,7	54669.42	10.354
			.999				+ .149	180 0 0.000			
		XXVII	.354	− .057	+ .098		+ .041	47 29 25.347	4.7991189,6	62967.86	11.926
26		XXXI	.355	− .781	+ .039		− .742	64 5 47.403	4.8855711,7	76837.13	14.552
		XXX	.355	+ .282	− .137		+ .145	68 24 47.250	4.8999729,0	79427.87	15.043
			1.064				− .556	180 0 0.000			
		XXV	.276	+ .508		+ .156	+ .664	59 47 10.538	4.8061453,4	63994.90	12.120
	60	XXVII	.276	− .054		+ .065	+ .011	66 37 26.725	4.8323596,4	67976.63	12.874
		XXVIII	.276	− .246		− .221	− .467	53 35 22.737	4.7752348,0	59598.42	11.288
			.828				+ .208	180 0 0.000			
		XXVII	.311	+ .053		+ .097	+ .150	53 19 40.529	4.8077577,7	64232.94	12.165
	61	XXVIII	.311	+ .227		+ .106	+ .333	73 37 42.082	4.8855711,7	76837.13	14.552
		XXX	.311	− .267		− .203	− .470	53 2 37.389	4.8061453,4	63994.90	12.120
			.933				+ .013	180 0 0.000			
		XXX	.232	− 1.030	+ .049		− .981	62 36 10.927	4.7831115,6	60689.22	11.494
27		XXXI	.231	− .821	+ .064		− .757	50 17 54.712	4.7209196,2	52591.99	9.961
		XXXII	.232	− .264	− .113		− .377	67 5 54.361	4.7991189,6	62967.86	11.926
			.695				− 2.115	180 0 0.000			
		XXXI	.268	+ .458	+ .157		+ .615	54 41 13.517	4.7769581,3	59835.39	11.332
28		XXXII	.268	+ .305	− .075		+ .230	69 27 16.832	4.8367231,2	68663.05	13.004
		XXXV	.268	+ .131	− .082		+ .049	55 51 29.651	4.7831115,6	60689.22	11.494
			.804				+ .894	180 0 0.000			

No. of triangle		Station	Spherical Excess	Corrections to Observed Angle				Corrected Plane Angle	Distance		
Circuit	Non-circuit			Figure	Circuit	Non-circuit	Total		Log. feet	Feet	Miles
			″	″	″	″	″	° ′ ″			
29		XXXII	·198	+ ·173	+ ·038		+ ·211	67 0 40·473	4·7738645,8	59410·68	11·252
		XXXV	·198	+ ·064	+ ·066		+ ·130	44 59 31·432	4·6592271,6	45627·55	8·642
		XXXIV	·198	− ·103	− ·104		− ·207	67 59 48·095	4·7769581,3	59835·39	11·332
			·594				+ ·134	180 0 0·000			
	62	XXX	·180	− ·006		+ ·019	+ ·013	55 50 14·913	4·6920302,5	49207·38	9·320
		XXXII	·180	+ ·425		+ ·074	+ ·499	61 59 21·869	4·7201817,4	52502·72	9·944
		XXXIII	·180	+ ·311		− ·093	+ ·218	62 10 23·218	4·7209196,2	52591·99	9·961
			·540				+ ·730	180 0 0·000			
	63	XXXII	·177	+ ·501		+ ·076	+ ·577	94 26 45·410	4·8429305,0	69651·50	13·192
		XXXIII	·176	− ·007		+ ·056	+ ·049	40 46 36·033	4·6592271,6	45627·55	8·642
		XXXIV	·176	+ ·285		− ·132	+ ·153	44 46 38·557	4·6920302,5	49207·38	9·320
			·529				+ ·779	180 0 0·000			
30		XXXIV	·285	+ ·220	− ·047		+ ·173	57 57 48·648	4·8090908,1	64430·40	12·203
		XXXV	·285	+ ·468	+ ·129		+ ·597	70 37 23·172	4·8555191,1	71699·99	13·580
		XXXVI	·284	+ ·076	− ·082		− ·006	51 24 48·180	4·7738645,8	59410·68	11·252
			·854				+ ·764	180 0 0·000			
31		XXXIV	·296	+ ·194	+ ·046		+ ·240	68 16 58·594	4·8631164,8	72965·32	13·819
		XXXVI	·295	+ ·274	+ ·072		+ ·346	45 48 22·151	4·7506005,7	56311·94	10·665
		XXXVII	·296	+ ·299	− ·118		+ ·181	65 54 39·255	4·8555191,1	71699·99	13·580
			·887				+ ·767	180 0 0·000			
32		XXXVI	·523	− ·049	+ ·132		+ ·083	76 14 23·930	5·0172721,8	104057·21	19·708
		XXXVII	·523	+ ·242	− ·021		+ ·221	60 49 55·038	4·9710293,6	93546·89	17·717
		XXXIX	·522	− ·275	− ·111		− ·386	42 55 41·032	4·8631164,8	72965·32	13·819
			1·568				− ·082	180 0 0·000			
33		XXXVII	·756	+ ·146	+ ·070		+ ·216	62 27 54·030	5·0326460,5	107806·78	20·418
		XXXIX	·755	+ ·170	+ ·076		+ ·246	58 40 37·311	5·0164405,2	103858·14	19·670
		XLI	·755	+ ·390	− ·146		+ ·244	58 51 28·659	5·0172721,8	104057·21	19·708
			2·266				+ ·706	180 0 0·000			
34		XXXIX	·807	+ ·034	+ ·055		+ ·089	83 20 2·902	5·1321256,3	135558·14	25·674
		XLI	·807	− ·021	+ ·148		+ ·127	44 29 21·390	4·9806505,1	95642·42	18·114
		XLIII	·807	+ ·088	− ·203		− ·115	52 10 35·708	5·0326460,5	107806·78	20·418
			2·421				+ ·101	180 0 0·000			
35		XXXIX	·681	+ ·076	+ ·198		+ ·274	50 7 57·323	4·9668150,0	92643·51	17·546
		XLIII	·682	+ ·079	− ·076		+ ·003	77 27 33·811	5·0712328,4	117823·75	22·315
		XLIV	·682	+ ·160	− ·122		+ ·038	52 24 28·866	4·9806505,1	95642·42	18·114
			2·045				+ ·315	180 0 0·000			
	64	XXXV	·286	+ ·007		+ ·137	+ ·144	73 44 28·598	4·8688143,2	73928·92	14·002
		XXXVI	·285	− ·018		− ·095	− ·113	49 28 9·252	4·7673860,5	58531·02	11·085
		XXXVIII	·285	+ ·247		− ·042	+ ·205	56 47 22·150	4·8090908,1	64430·40	12·203
			·856				+ ·236	180 0 0·000			
	65	XXXVI	·297	+ ·288		− ·125	+ ·163	47 20 17·386	4·7607854,7	57648·17	10·918
		XXXVIII	·297	+ ·219		+ ·139	+ ·358	62 5 32·791	4·8405886,1	69276·92	13·121
		XL	·297	+ ·334		− ·014	+ ·320	70 34 9·823	4·8688143,2	73928·92	14·002
			·891				+ ·841	180 0 0·000			
	66	XXXVI	·511	− ·361		+ ·098	− ·263	89 43 56·906	5·0650027,1	116145·59	21·997
		XL	·511	− ·156		− ·007	− ·163	53 39 2·716	4·9710293,6	93546·89	17·717
		XXXIX	·510	+ ·049		− ·091	− ·042	36 37 0·378	4·8405886,1	69276·92	13·121
			1·532				− ·468	180 0 0·000			

No. of triangle: Circuit	No. of triangle: Non-circuit	Station	Spherical Excess	Corrections to Observed Angle: Figure	Corrections to Observed Angle: Circuit	Corrections to Observed Angle: Non-circuit	Corrections to Observed Angle: Total	Corrected Plane Angle	Distance: Log. feet	Distance: Feet	Distance: Miles
			"	"	"	"	"	° ' "			
	67	XL	·642	+ ·139		+ ·365	+ ·504	51 44 39·442	4·9677234,5	92837·50	17·583
		XXXIX	·641	+ ·109		− ·188	− ·079	49 1 11·780	4·9506238,0	89253·20	16·904
		XLII	·642	+ ·077		− ·177	− ·100	79 14 8·778	5·0650027,1	116145·59	21·997
			1·925				+ ·325	180 0 0·000			
	68	XXXIX	·546	+ ·167		+ ·061	+ ·228	39 17 24·812	4·8729131,7	74629·96	14·134
		XLII	·546	+ ·236		+ ·202	+ ·438	88 44 4·782	5·0712328,4	117823·75	22·315
		XLIV	·546	+ ·065		− ·263	− ·198	51 58 30·406	4·9677234,5	92837·50	17·583
			1·638				+ ·468	180 0 0·000			
36		XLIII	·559	+ ·365	− ·071		+ ·294	56 5 3·435	4·9393501,4	86966·13	16·471
		XLIV	·559	− ·304	+ ·139		− ·165	61 46 57·916	4·9654010,0	92342·36	17·489
		XLV	·560	+ ·157	− ·068		+ ·089	62 7 58·649	4·9668150,0	92643·51	17·546
			1·678				+ ·218	180 0 0·000			
37		XLIII	·423	− ·052	+ ·106		+ ·054	46 42 57·621	4·8402953,2	69230·16	13·112
		XLV	·423	+ ·114	+ ·021		+ ·135	57 7 5·062	4·9023565,3	79865·01	15·126
		XLVI	·423	+ ·477	− ·127		+ ·350	76 9 57·317	4·9654010,0	92342·36	17·489
			1·269				+ ·539	180 0 0·000			
38		XLV	·240	+ ·242	+ ·051		+ ·293	43 59 57·513	4·6985532,8	49952·04	9·461
		XLVI	·240	− ·547	+ ·057		− ·490	61 41 27·700	4·8014690,2	63309·52	11·990
		XLVIII	·240	+ ·165	− ·108		+ ·057	74 18 34·787	4·8402953,2	69230·16	13·112
			·720				− ·140	180 0 0·000			
39		XLV	·389	− ·064	+ ·190		+ ·126	60 54 9·997	4·9053711,5	80421·31	15·231
		XLVIII	·389	− ·667	− ·033		− ·700	75 38 7·061	4·9501666,8	89159·30	16·886
		XLIX	·388	− ·003	− ·157		− ·160	43 27 42·942	4·8014690,2	63309·52	11·990
			1·166				− ·734	180 0 0·000			
	69	XLIV	·460	+ ·359		+ ·250	+ ·609	42 38 49·709	4·8361016,5	68564·87	12·986
		XLV	·460	+ ·173		− ·136	+ ·037	78 6 52·427	4·9957923,9	99035·84	18·757
		XLVII	·460	− ·392		− ·114	− ·506	59 14 17·864	4·9393501,4	86966·13	16·471
			1·380				+ ·140	180 0 0·000			
	70	XLV	·407	+ ·758		− ·058	+ ·700	57 43 53·873	4·8934831,4	78249·79	14·820
		XLVII	·408	+ ·080		+ ·155	+ ·235	74 27 35·947	4·9501666,8	89159·30	16·886
		XLIX	·407	− ·616		− ·097	− ·713	47 48 30·180	4·8361016,5	68564·87	12·986
			1·222				+ ·222	180 0 0·000			
40		XLVIII	·347	− ·866	− ·099		− ·965	53 12 46·278	4·8293997,4	67514·91	12·787
		XLIX	·347	+ ·323	+ ·154		+ ·477	54 14 25·300	4·8351155,5	68409·37	12·956
		L	·348	− ·135	− ·055		− ·190	72 32 48·422	4·9053711,5	80421·31	15·231
			1·042				− ·678	180 0 0·000			
41		XLVIII	·352	+ ·341	+ ·068		+ ·409	72 28 35·677	4·9075826,0	80831·87	15·309
		L	·351	− ·134	+ ·099		− ·035	53 42 55·624	4·8346015,3	68328·44	12·941
		LI	·351	− ·103	− ·167		− ·270	53 48 28·699	4·8351155,5	68409·37	12·956
			1·054				+ ·104	180 0 0·000			
42		L	·310	− ·086	+ ·049		− ·037	42 10 17·283	4·7461423,8	55736·84	10·556
		LI	·311	+ ·146	+ ·057		+ ·203	61 1 3·972	4·8610862,0	72625·02	13·755
		LIII	·311	− ·098	− ·106		− ·204	76 48 38·745	4·9075826,0	80831·87	15·309
			·932				− ·038	180 0 0·000			
43		L	·272	− ·147	+ ·136		− ·011	63 22 13·437	4·8333321,9	68129·03	12·903
		LIII	·272	+ ·416	− ·087		+ ·329	44 16 54·577	4·7260047,2	53211·40	10·078
		LIV	·273	− ·132	− ·049		− ·181	72 20 51·986	4·8610862,0	72625·02	13·755
			·817				+ ·137	180 0 0·000			

No. of triangle		Station	Spherical Excess	Corrections to Observed Angle				Corrected Plane Angle	Distance		
Circuit	Non-circuit			Figure	Circuit	Non-circuit	Total		Log. feet	Feet	Miles
			″	″	″	″	″	° ′ ″			
	71	XLIX	·197	− ·151		+ ·128	− ·023	52 24 58·080	4·7306825,0	53787·64	10·187
		L	·197	+ ·100		− ·131	− ·031	43 28 52·572	4·6693669,3	46705·38	8·846
		LII	·197	+ ·152		+ ·003	+ ·155	84 6 9·348	4·8293997,4	67514·91	12·787
			·591				+ ·101	180 0 0·000			
	72	L	·225	+ ·062		− ·098	− ·036	84 42 50·959	4·8578855,6	72091·75	13·654
		LII	·224	− ·151		+ ·180	+ ·029	47 18 16·185	4·7260047,2	53211·40	10·078
		LIV	·225	+ ·613		− ·082	+ ·531	47 58 52·856	4·7306825,0	53787·64	10·187
			·674				+ ·524	180 0 0·000			
44		LIII	·218	+ ·068	+ ·090		+ ·158	52 22 56·370	4·7388713,6	54811·46	10·381
		LIV	·217	− ·720	+ ·028		− ·692	47 41 58·331	4·7091025,0	51180·26	9·693
		LV	·218	− ·065	− ·118		− ·183	79 55 5·299	4·8333321,9	68129·03	12·903
			·653				− ·717	180 0 0·000			
45		LIV	·151	+ ·419	+ ·200		+ ·619	45 15 20·558	4·6059499,7	40359·89	7·644
		LV	·151	+ ·037	− ·127		− ·090	60 2 25·519	4·6922427,2	49231·46	9·324
		LVII	·151	− ·123	− ·073		− ·196	74 42 13·923	4·7388713,6	54811·46	10·381
			·453				+ ·333	180 0 0·000			
46		LV	·093	+ ·408	+ ·092		+ ·500	56 49 16·057	4·5578404,4	36127·71	6·842
		LVII	·093	+ ·260	+ ·049		+ ·309	53 56 55·306	4·5428074,2	34898·56	6·610
		LIX	·093	− ·029	− ·141		− ·170	69 13 48·637	4·6059499,7	40359·89	7·644
			·279				+ ·639	180 0 0·000			
47		LVII	·154	+ ·303	+ ·210		+ ·513	63 2 16·689	4·7375598,9	54646·19	10·350
		LIX	·154	− ·069	− ·005		− ·074	80 51 26·712	4·7819798,8	60531·29	11·464
		XXI	·153	− ·273	− ·205		− ·478	36 6 16·599	4·5578404,4	36127·71	6·842
			·461				− ·039	180 0 0·000			
48		LIX	·210	+ ·613	+ ·059		+ ·672	73 52 44·932	4·8021262,9	63405·40	12·009
		XXI	·210	+ ·846	+ ·099		+ ·945	50 13 50·455	4·7052635,0	50729·84	9·608
		XIX	·210	+ ·431	− ·158		+ ·273	55 53 24·613	4·7375598,9	54646·19	10·350
			·630				+ 1·890	180 0 0·000			
	73	LIII	·110	− ·130		+ ·163	+ ·033	60 42 25·933	4·6539955,0	45081·21	8·538
		LV	·110	+ ·092		− ·040	+ ·052	37 21 10·012	4·4964028,1	31361·93	5·940
		LVI	·111	+ ·189		− ·123	+ ·066	81 56 24·055	4·7091025,0	51180·26	9·693
			·331				+ ·151	180 0 0·000			
	74	LV	·145	+ ·199		+ ·023	+ ·222	60 4 26·557	4·6645259,9	46187·66	8·748
		LVI	·145	− ·144		+ ·227	+ ·083	62 9 23·378	4·6732353,7	47123·27	8·925
		LVIII	·145	+ ·140		− ·250	− ·110	57 46 10·065	4·6539955,0	45081·21	8·538
			·435				+ ·195	180 0 0·000			
	75	LV	·118	− ·011		+ ·170	+ ·159	65 47 35·721	4·6600620,7	45715·35	8·658
		LVIII	·118	+ ·068		− ·117	− ·049	44 7 41·093	4·5428074,2	34898·56	6·610
		LIX	·119	+ ·018		− ·053	− ·035	70 4 43·186	4·6732353,7	47123·27	8·925
			·355				+ ·075	180 0 0·000			
	76	LVIII	·167	− ·033		+ ·230	+ ·197	61 36 15·320	4·7052635,0	50729·84	9·608
		LIX	·167	− ·043		+ ·140	+ ·097	65 57 15·790	4·7215129,4	52663·90	9·974
		XIX	·167	+ ·357		− ·370	− ·013	52 26 28·890	4·6600620,7	45715·35	8·658
			·501				+ ·281	180 0 0·000			

NOTE.—Stations XIX and XXI appertain to the Sutlej Series.

September 1878.

J. B. N. HENNESSEY,
In charge of Computing Office.

JODHPORE MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. LATITUDES, LONGITUDES AND AZIMUTHS.

Station A					Side AB			Station B
Circuit No.	Series No.	Name	Latitude North	Longitude East of Greenwich	Azimuth at A	Log. Feet	Azimuth at B	Series No.
			° ′ ″	° ′ ″	° ′ ″		° ′ ″	
1	XLI	Bonik	25 3 51·50	72 54 21·85	55 4 15·67	5·2541461,0	234 53 2·57	XLIV
”	”	”	”	”	94 2 51·29	5·2394300,7	273 49 32·90	I
”	”	”	”	”	136 4 11·20	4·9901706,7	315 58 57·05	II
	XLIV	Súnda	24 46 50·77	72 27 44·54	167 6 44·65	5·0716171,6	347 4 43·99	I
	”	”	”	”	204 25 54·05	5·2799381,5	24 31 57·10	II
	I	Borta	25 5 49·53	72 22 58·39	240 51 53·70	5·0802173,1	61 0 0·63	II
	”	”	”	”	178 46 38·21	5·1381529,7	358 46 24·54	III
	”	”	”	”	126 5 46·53	5·2852261,9	305 53 41·41	IV
2	II	Dhaula	25 15 28·46	72 42 2·97	126 16 16·06	5·1262127,6	306 7 52·00	III
”	”	”	”	”	207 30 44·75	5·1426862,7	27 35 45·70	V
	III	Kundal	25 28 30·85	72 22 26·38	81 8 53·65	5·1895975,8	260 56 57·21	IV
	”	”	”	”	255 29 4·56	5·2492748,6	75 42 33·92	V
	”	”	”	”	152 24 41·56	5·0986612,2	332 20 6·50	VI
	”	”	”	”	212 23 20·20	5·1672452,2	32 29 33·12	VII
	IV	Mandaula	25 24 32·35	71 54 38·69	214 51 38·38	5·2174339,4	34 59 4·11	VI

NOTE.—Stations XLI and XLIV appertain to the Karáchi Longitudinal Series.

Station A					Side AB			Station B
Circuit No.	Series No.	Name	Latitude North	Longitude East of Greenwich	Azimuth at A	Log. Feet	Azimuth at B	Series No.
			° ′ ″	° ′ ″	° ′ ″		° ′ ″	
3	V	Bhádrájau	25 35 48·29	72 53 43·89	130 44 59·96	5·0882240,5	310 37 39·31	VII
	VI	Nagar	25 46 52·33	72 11 50·44	264 32 53·04	5·1381661,9	84 43 44·81	VII
	"	"	"	"	215 50 21·47	5·0838982,0	35 56 1·90	VIII
	"	"	"	"	167 59 9·18	5·1281314,8	347 56 54·86	IX
4	VII	Samdari	25 48 59·55	72 36 48·02	142 31 35·72	5·0322912,1	322 26 21·42	VIII
"	"	"	"	"	221 24 12·73	5·0763667,8	41 30 30·99	X
	VIII	Thob	26 3 5·85	72 24 49·35	108 32 58·12	5·0185059,2	288 25 0·51	IX
	"	"	"	"	268 21 0·44	5·1596842,2	88 32 35·99	X
	"	"	"	"	173 40 37·56	5·0217355,9	353 39 41·37	XI
	"	"	"	"	227 57 56·94	5·0955763,7	48 5 25·41	XII
	IX	Borla	26 8 33·54	72 6 43·60	230 38 48·14	5·0521346,8	50 45 51·92	XI
5	X	Dodo	26 3 44·63	72 51 12·79	147 1 25·63	4·9764158,6	326 57 15·80	XII
	XI	Adori	26 20 20·83	72 22 42·07	281 24 46·79	5·0263010,9	101 33 13·96	XII
	"	"	"	"	222 49 42·57	4·9330134,9	42 54 28·04	XIII
	"	"	"	"	169 21 58·14	4·8199682,4	349 20 58·40	XIV
6	XII	Dugur	26 16 51·33	72 41 46·35	151 27 51·69	4·9804877,8	331 24 8·15	XIII
"	"	"	"	"	207 19 58·65	4·9293907,2	27 23 9·55	XV
	XIII	Ketu	26 30 43·00	72 33 23·52	91 45 54·70	4·8480978,0	271 40 8·41	XIV
	"	"	"	"	275 39 35·81	4·9300411,0	95 46 31·84	XV
	"	"	"	"	140 49 47·61	4·8593774,0	320 46 2·15	XVI
	"	"	"	"	203 48 6·99	4·7829932,9	23 50 7·80	XVII
	XIV	Sulkia Thalau	26 31 3·92	72 20 27·84	204 34 17·51	4·7732438,0	24 36 19·25	XVI
7	XV	Malunga	26 29 19·00	72 48 55·92	136 49 0·62	4·9435461,4	316 44 4·24	XVII
	XVI	Loharan	26 39 58·22	72 24 59·81	270 24 12·22	4·8462130,0	90 29 59·42	XVII
	"	"	"	"	208 36 22·52	4·7784986,6	28 38 45·30	XVIII
	"	"	"	"	152 40 20·48	4·7850410,2	332 38 1·48	XIX
8	XVII	Chamu	26 39 52·74	72 37 53·46	142 11 39·24	4·8289003,0	322 8 13·95	XVIII
"	"	"	"	"	201 3 36·70	4·8358276,0	21 5 39·07	XX
	XVIII	Pelu	26 48 40·25	72 30 17·16	91 29 30·40	4·7539932,1	271 24 47·90	XIX
	"	"	"	"	260 45 36·92	4·8248902,3	80 51 5·52	XX
	"	"	"	"	154 21 15·05	4·7955865,4	334 18 59·92	XXI
	"	"	"	"	203 23 0·17	4·8602905,7	23 25 24·10	XXII
	XIX	Daichu	26 48 54·50	72 19 50·89	208 22 3·38	4·7948772,2	28 24 31·50	XXI
9	XX	Sorau	26 50 25·99	72 42 25·33	146 25 13·16	4·8264635,6	326 22 7·51	XXII
	XXI	Jalora	26 57 57·81	72 25 18·36	259 34 14·18	4·7538389,3	79 38 54·04	XXII

Station A					Side AB			Station B
Circuit No.	Series No.	Name	Latitude North	Longitude East of Greenwich	Azimuth at A	Log. Feet	Azimuth at B	Series No.
			° ′ ″	° ′ ″	° ′ ″		° ′ ″	
	XXI	Jalora	26 57 57·81	72 25 18·36	160 38 16·55	4·6986909,8	340 36 53·24	XXIII
	„	„	„	„	209 54 4·42	4·7957073,2	29 56 41·13	XXIV
10	XXII	Loháwat	26 59 39·15	72 35 35·25	117 4 43·11	4·9096344,2	296 58 39·27	XXIII
„	„	„	„	„	150 45 19·35	4·7018973,2	330 43 15·55	XXIV
	XXIII	Ekka	27 5 44·66	72 22 15·04	261 36 35·87	4·6832601,5	81 40 36·45	XXIV
	„	„	„	„	186 25 23·55	4·8263806,9	6 26 1·54	XXV
	„	„	„	„	223 12 20·26	4·9508827,8	43 17 29·86	XXVI
11	XXIV	Omlo	27 6 54·07	72 31 3·07	146 3 30·20	4·8566423,2	326 0 6·87	XXV
„	„	„	„	„	193 5 39·80	4·7751950,4	13 6 48·19	XXVI
	XXV	Khirwa	27 16 44·49	72 23 38·18	271 38 41·95	4·7296662,9	91 43 14·41	XXVI
	„	„	„	„	205 44 50·29	4·7752348,0	25 47 2·32	XXVII
	„	„	„	„	145 57 39·48	4·8323596,4	325 54 25·40	XXVIII
12	XXVI	Jambo	27 16 28·88	72 33 32·71	153 23 43·23	4·7910041,2	333 21 22·10	XXVII
„	„	„	„	„	206 0 2·55	4·7893888,8	26 2 20·19	XXIX
	XXVII	Sirad	27 25 36·03	72 28 25·53	92 24 29·32	4·8061453,4	272 19 2·39	XXVIII
	„	„	„	„	269 52 27·42	4·7377444,7	89 57 6·90	XXIX
	„	„	„	„	145 44 10·16	4·8855711,7	325 40 28·00	XXX
	„	„	„	„	193 13 35·86	4·8999729,0	13 15 9·28	XXXI
	XXVIII	Harban	27 26 2·16	72 16 35·84	198 41 19·99	4·8077577,7	18 43 5·70	XXX
13	XXIX	Biutli	27 25 36·85	72 38 32·30	154 46 33·02	4·9314209,2	334 43 25·96	XXXI
	XXX	Nok	27 36 4·67	72 20 24·63	257 15 40·40	4·7991189,6	77 20 57·03	XXXI
	„	„	„	„	194 39 29·24	4·7209196,2	14 40 38·03	XXXII
	„	„	„	„	138 49 14·15	4·7201817,4	318 46 15·60	XXXIII
14	XXXI	Mongolia	27 38 21·71	72 31 47·62	127 38 51·98	4·7831115,6	307 34 43·44	XXXII
„	„	„	„	„	182 20 5·76	4·8367231,2	2 20 20·26	XXXV
	XXXII	Pabusar	27 44 28·51	72 22 52·77	76 40 0·08	4·6920302,5	256 35 52·21	XXXIII
	„	„	„	„	171 6 45·67	4·6592271,6	351 6 9·03	XXXIV
	„	„	„	„	238 7 26·34	4·7769581,3	58 11 50·18	XXXV
	XXXIII	Bikampur	27 42 35·85	72 13 59·97	215 49 16·00	4·8429305,0	35 52 47·76	XXXIV
	XXXIV	Phulasar	27 51 54·92	72 21 34·22	283 6 20·74	4·7738645,8	103 11 21·81	XXXV
	„	„	„	„	225 8 31·80	4·8555191,1	45 12 57·46	XXXVI
	„	„	„	„	156 51 32·91	4·7506005,7	336 49 37·23	XXXVII
15	XXXV	Girondi	27 49 41·10	72 32 18·78	173 48 45·27	4·8090908,1	353 48 8·99	XXXVI
„	„	„	„	„	247 33 14·15	4·7673860,5	67 37 55·91	XXXVIII
16	XXXVI	Mankasar	28 0 15·40	72 31 1·30	91 1 19·90	4·8631164,8	270 54 57·68	XXXVII

Station A					Side AB			Station B
Circuit No.	Series No.	Name	Latitude North	Longitude East of Greenwich	Azimuth at A	Log. Feet	Azimuth at B	Series No.
			° ′ ″	° ′ ″			° ′ ″	
16	XXXVI	Mankasar	28 0 15·40	72 31 1·30	304 19 59·46	4·8688143,2	124 25 18·34	XXXVIII
"	"	"	"	"	167 15 44·36	4·9710293,6	347 13 55·60	XXXIX
"	"	"	"	"	256 59 41·77	4·8405886,1	77 5 35·79	XL
	XXXVII	Uperthal	28 0 27·62	72 17 27·29	210 5 2·12	5·0172721,8	30 9 37·16	XXXIX
	"	"	"	"	147 37 7·33	5·0164405,2	327 32 14·09	XLI
	XXXVIII	Bithnok	27 53 22·03	72 42 21·73	186 30 51·43	4·7607854,7	6 31 25·67	XL
17	XXXIX	Modia	28 15 18·87	72 27 10·63	310 36 54·72	5·0650027,1	130 44 39·01	XL
"	"	"	"	"	88 50 15·22	5·0326460,5	268 40 44·68	XLI
"	"	"	"	"	261 35 42·29	4·9677234,5	81 43 48·98	XLII
"	"	"	"	"	172 10 18·93	4·9806505,1	352 9 9·51	XLIII
"	"	"	"	"	222 18 16·94	5·0712328,4	42 25 19·37	XLIV
	XL	Ronesar	28 2 49·20	72 43 34·73	182 29 19·10	4·9506238,0	2 29 39·56	XLII
	XLI	Sachu	28 14 55·74	72 7 5·29	224 11 22·48	5·1321256,3	44 19 46·02	XLIII
	XLII	Jodasar	28 17 32·17	72 44 18·09	170 27 54·31	4·8729131,7	350 26 48·42	XLIV
	XLIII	Mugrala	28 30 57·06	72 24 44·59	274 41 35·02	4·9668150,0	94 49 48·92	XLIV
	"	"	"	"	218 36 31·02	4·9654010,0	38 41 40·98	XLV
	"	"	"	"	171 53 32·98	4·9023565,3	351 52 32·36	XLVI
18	XLIV	Khirsar	28 29 40·91	72 41 59·52	156 36 47·40	4·9393501,4	336 33 41·77	XLV
"	"	"	"	"	199 15 37·57	4·9957923,9	19 18 33·40	XLVII
19	XLV	Bhada	28 42 51·12	72 35 31·79	95 48 46·46	4·8402953,2	275 42 34·62	XLVI
"	"	"	"	"	258 26 48·88	4·8361016,5	78 32 51·73	XLVII
"	"	"	"	"	139 48 44·21	4·8014690,2	319 45 3·02	XLVIII
"	"	"	"	"	200 42 54·60	4·9501666,8	20 45 45·78	XLIX
	XLVI	Habib	28 43 59·93	72 22 38·06	214 1 6·68	4·6985532,8	34 3 38·04	XLVIII
	XLVII	Karamala	28 45 6·50	72 48 6·58	153 0 28·08	4·8934831,4	332 57 15·20	XLIX
	XLVIII	Phogala	28 50 49·77	72 27 52·35	244 6 55·57	4·9053711,5	64 13 29·11	XLIX
	"	"	"	"	190 54 8·94	4·8351155,5	10 55 19·47	L
	"	"	"	"	118 25 32·91	4·8346015,3	298 20 6·12	LI
20	XLIX	Bhulan	28 56 36·70	72 41 26·80	118 27 54·76	4·8293997,4	298 22 30·70	L
"	"	"	"	"	170 52 53·04	4·6693669,3	350 52 12·59	LII
21	L	Soma	29 1 54·85	72 30 18·12	64 38 15·45	4·9075826,0	244 31 37·07	LI
"	"	"	"	"	254 53 37·93	4·7306825,0	74 58 22·13	LII
"	"	"	"	"	106 48 33·04	4·8610862,0	286 42 12·38	LIII
"	"	"	"	"	170 10 46·75	4·7260047,2	350 9 56·95	LIV
	LI	Telu	28 56 11·34	72 16 35·98	183 30 32·79	4·7461423,8	3 30 51·44	LIII

Station A					Side AB			Station B
Circuit No.	Series No.	Name	Latitude	Longitude East of Greenwich	Azimuth at A	Log. Feet	Azimuth at B	Series No.
			° ′ ″	° ′ ″	° ′ ″		° ′ ″	
	LII	Aukli	29 4 13·28	72 40 3·38	122 16 38·54	4·8578855,6	302 11 3·87	LIV
	LIII	Mansa	29 5 22·15	72 17 14·43	242 25 17·53	4·8333321,9	62 30 49·21	LIV
	"	"	"	"	190 2 20·94	4·7091025,0	10 3 10·01	LV
	"	"	"	"	129 19 54·90	4·4964028,1	309 17 41·77	LVI
22	LIV	Marot	29 10 33·95	72 28 35·73	110 12 47·75	4·7388713,6	290 8 4·49	LV
"	"	"	"	"	155 28 8·46	4·6922427,2	335 26 15·69	LVII
	LV	Hasan	29 13 41·10	72 18 55·14	47 24 20·13	4·6539955,0	227 21 17·61	LVI
	"	"	"	"	230 5 38·82	4·6059499,7	50 8 29·77	LVII
	"	"	"	"	107 28 46·83	4·6732353,7	287 24 38·86	LVIII
	"	"	"	"	173 16 22·67	4·5428074,2	353 16 0·09	LIX
	LVI	Sultán	29 8 38·88	72 12 40·84	165 11 54·08	4·6645259,9	345 10 49·07	LVIII
23	LVII	Bijli	29 17 57·32	72 24 44·85	104 5 25·17	4·5578404,4	284 2 11·36	LIX
"	"	"	"	"	167 7 42·01	4·7819798,8	347 6 27·17	XXI
	LVIII	Panchkot	29 16 0·97	72 10 27·60	243 16 57·65	4·6600620,7	63 20 43·39	LIX
	"	"	"	"	181 40 42·16	4·7215129,4	1 40 50·71	XIX
	LIX	Randu	29 19 24·24	72 18 8·95	129 17 59·35	4·7052635,0	309 14 21·65	XIX
	"	"	"	"	203 10 44·49	4·7375598,9	23 12 43·92	XXI
	XIX	Kaimsir	29 24 42·15	72 10 45·04	253 20 56·83	4·8021262,9	73 26 34·58	XXI
	XXI	Kanda	29 27 41·52	72 22 12·29				

NOTE.—Stations XIX and XXI appertain to the Sutlej Series.

September 1878.

J. B. N. HENNESSEY,
In charge of Computing Office.

JODHPORE MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. HEIGHTS ABOVE MEAN SEA LEVEL.

The following table gives, first, the usual data of the observed vertical angles and the heights of the signal and instrument, &c., in pairs of horizontal lines, the first line of which gives the data for the 1st or the fixed station, and the second line the data for the 2nd or the deduced station. This is followed by the arc contained between the two stations, and then by the terrestrial refraction, and the height of the 2nd station above or below the 1st, as computed from the vertical angles in the usual manner. This difference of height applied to the given height above mean sea level of the fixed station, gives that of the deduced station. Usually there are two or three independent values of the height of the deduced station; the details are so arranged as to show these consecutively and their mean in the columns of "Trigonometrical Results". The mean results thus obtained are however liable to receive corrections for the errors generated in the trigonometrical operations, which are shown up by the spirit leveling operations, whenever a junction between the two has been effected. The spirit leveled determinations, when available, are always accepted as final, and the trigonometrical heights of stations, lying between other stations fixed by the leveling operations, are adjusted—usually by simple proportion—to accord with the latter.

The heights of Jodhpore Meridional Series have been adjusted between the final values of Bonik and Súnda the fixed points of the Karáchi Longitudinal Series, and those of the fixed stations of Kaimsir and Kanda of the Sutlej Series. The heights of the fixed points are as follows:—

XLI, Bonik	... 2098	feet above Mean Sea Level at Karáchi from Karáchi Longitudinal Series.
XLIV, Súnda	... 3252	
XIX, Kaimsir	... 461	„ „ from Sutlej Series.
XXI, Kanda	... 478	

The trigonometrical heights always refer to the upper mark-stone, or to the upper surface of the pillar on which the theodolite stood. When the pillar of the station is perforated, the height given in the last column, is that between the upper surface of pillar and ground level mark-stone in floor of passage; otherwise it is the approximate height of the structure above the ground at the base of the station.

Astronomical Date 1873		Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
		h. m.		° ′ ″				″							feet
			XLI												
Feb.	15	3 45	I	E 0 2 52·8	12	4·10	5·25	1715	113*	·066*	− 772·7	1325·3			
Jan.	31	3 24	XLIV	D 1 4 43·3	12	2·70	5·25	1165	72	·062	−1926·3	1325·7	1326·0	1326	3·1
Feb.	15	3 23	I	E 0 47 33·9	12	2·69	5·25								
„	11	3 20	II	D 0 4 16·7	12	2·69	5·25	1188	80	·068	+ 152·5	1326·9			
„	15	3 19	I	D 0 12 59·8	12	2·56	5·25								
„	8	2 45	XLI	D 0 39 31·2	12	2·56	5·25	966	64	·066	− 922·8	1175·2			
„	10	2 46	II	E 0 25 26·2	12	4·42	5·25								

* Estimated.

Astronomical Date 1873	Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Re	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Jany. 31, Feb. 1	3 14	XLIV	D 0 51 9·5	12	2·56	5·25	1882	125	·066	−2078·5	1173·5	1173·9	1174	2·8
Feb. 11	3 13	II	E 0 23 50·6	12	2·74	5·25								
„ 15	3 19	I	D 0 12 59·8	12	2·56	5·25	1188	80	·068	− 152·5	1173·0			
„ 11	3 20	II	D 0 4 16·7	12	2·69	5·25								
„ 15	2 57	I	E 0 25 19·7	12	2·57	5·25	1358	90	·066	+1408·4	2734·4			
„ 27,28	2 58	III	D 0 45 6·4	12	2·73	5·25						2735·1	2735	3·3
„ 11	3 24	II	E 0 30 34·7	12	2·57	5·25	1321	91	·069	+1561·9	2735·8			
„ 27	3 23	III	D 0 49 42·8	12	2·56	5·25								
„ 15	2 48	I	D 0 30 50·0	12	2·71	5·25	1905	124	·065	− 952·2	373·8			
„ 20,21	3 5	IV	E 0 3 6·7	20	2·70	5·25						375·0	374	3·3
„ 27,28	3 14	III	D 1 3 31·2	12	2·71	5·25	1529	101	·066	−2359·0	376·1			
„ 21	3 13	IV	E 0 41 16·8	12	2·57	5·25								
„ 11	3 29	II	E 0 13 14·2	12	2·57	5·25	1372	91	·067	+ 938·1	2112·0			
Mar. 5	3 20	V	D 0 33 11·7	12	2·57	5·25						2112·1	2111	3·2
Feb. 27,28	2 45	III	D 0 24 47·8	12	2·57	5·25	1754	116	·066	− 622·9	2112·2			
Mar. 5	2 47	V	D 0 0 40·4	12	2·56	5·25								
Feb. 26,27	2 59	III	D 0 46 52·7	12	2·71	5·25	1240	82	·066	−1381·9	1353·2			
Mar. 12	2 59	VI	E 0 28 48·8	12	2·55	5·25								
Feb. 20,21	3 10	IV	E 0 8 25·7	12	2·71	5·25	1630	100	·061	+ 979·2	1354·2	1353·6	1352	3
Mar. 12	3 12	VI	D 0 32 22·6	12	2·71	5·25								
„ 8	3 34	VII	E 0 2 49·2	12	2·71	5·25	1358	92	·067	+ 506·7	1353·5			
„ 12	3 34	VI	D 0 22 31·6	12	2·58	5·25								
Feb. 27,28	3 0	III	D 0 54 45·0	16	2·57	5·25	1452	93	·064	−1887·6	847·5			
Mar. 8	3 2	VII	E 0 33 32·2	16	2·55	5·25								
„ 5	3 2	V	D 0 44 22·0	12	2·58	5·25	1210	79	·065	−1265·9	846·2	846·9	846	3·1
„ 8	3 2	VII	E 0 26 39·7	12	2·58	5·25								
„ 12	3 34	VI	D 0 22 31·6	12	2·58	5·25	1358	92	·067	− 506·7	847·0			
„ 8	3 34	VII	E 0 2 49·2	12	2·71	5·25								
„ 12,13	2 50	VI	D 0 22 52·1	12	2·58	5·25	1198	75	·062	− 495·9	857·7			
„ 17,19	2 50	VIII	E 0 5 14·5	12	2·71	5·25						857·2	856	3
„ 8	3 19	VII	D 0 7 29·0	12	2·58	5·25	1064	70	·065	+ 9·7	856·6			
„ 17,18,19	3 19	VIII	D 0 8 6·2	12	2·57	5·25								
„ 12,13	2 54	VI	D 0 25 28·5	12	2·68	5·25	1327	80	·060	− 612·8	740·8			
„ 25	2 55	IX	E 0 5 53·4	12	2·70	5·25						740·4	739	3

Astronomical Date 1873	Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station – 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Mar. 17,18	3 3	VIII	D 0 11 35·2	12	2·71	5·25	1031	57	·055	− 117·1	740·1			
„ 25	3 4	IX	D 0 3 52·8	12	2·56	5·25								
„ 8	3 19	VII	D 0 11 54·2	12	2·56	5·25	1178	72	·061	− 111·6	735·3			
Apr. 6	3 20	X	D 0 5 27·8	12	2·71	5·25						736·2	735	3·3
Mar. 18	3 14	VIII	D 0 13 22·8	8	2·55	5·25	1427	86	·060	− 120·0	737·2			
Apr. 6,7	3 19	X	D 0 7 40·0	16	2·58	5·25								
Mar. 17,18	3 5	VIII	D 0 1 39·5	12	2·69	5·25	1039	60	·058	+ 185·8	1043·0			
„ 28	3 5	XI	D 0 13 48·9	12	2·59	5·25								
„ 25	2 57	IX	E 0 0 49·4	12	2·68	5·25	1114	58	·052	+ 302·3	1042·7	1043·6	1042	2·1
„ 28	2 58	XI	D 0 17 36·5	12	2·70	5·25								
„ 31	3 27	XII	D 0 3 30·1	16	2·69	5·25	1050	62	·059	+ 132·6	1045·0			
„ 28	3 27	XI	D 0 12 5·2	16	2·56	5·25								
„ 17,18	3 8	VIII	D 0 7 32·3	12	2·56	5·25	1231	77	·062	+ 55·1	912·3			
„ 31	3 8	XII	D 0 10 34·5	12	2·58	5·25								
Apr. 5,6	3 13	X	D 0 0 34·3	12	2·56	5·25	936	56	·059	+ 176·3	912·5	911·7	910	1
Mar. 31	3 13	XII	D 0 13 22·0	12	2·56	5·25								
„ 28	3 27	XI	D 0 12 5·2	16	2·56	5·25	1050	62	·059	− 132·6	910·3			
„ 31	3 27	XII	D 0 3 30·1	16	2·69	5·25								
Dec. 16,17	3 21	XI	E 0 0 20·8	12	2·59	5·25	847	53	·063	+ 165·6	1209·2			
„ 25,29,30	3 21	XIII	D 0 12 55·8	12	2·69	5·25						1208·8	1207	3
„ 10,11	3 18	XII	E 0 3 43·0	16	2·58	5·25	945	62	·066	+ 296·6	1208·3			
„ 27,30	3 16	XIII	D 0 17 36·7	12	2·69	5·25								
„ 16	3 15	XI	D 0 7 37·1	12	2·58	5·25	653	37	·057	− 50·7	992·9			
„ 22	3 14	XIV	D 0 2 19·9	12	2·69	5·25						992·5	990	0†
„ 27,29,30	3 6	XIII	D 0 15 47·2	12	2·59	5·25	696	42	·060	− 216·6	992·2			
„ 22,23	2 46	XIV	E 0 5 20·2	12	2·57	5·25								
1873-74														
Dec. 11	2 55	XII	E 0 8 31·2	12	2·58	5·25	840	57	·068	+ 363·3	1275·0			
Jan. 2	2 55	XV	D 0 20 51·3	12	2·70	5·25						1275·3	1273	3
Dec. 25,27,30	3 28	XIII	D 0 3 23·1	12	2·62	5·25	841	63	·075	+ 66·9	1275·7			
Jan. 2,3	3 26	XV	D 0 8 47·4	12	2·57	5·25								
Dec. 29	3 19	XIII	D 0 12 8·0	12	2·57	5·25	715	47	·066	− 143·5	1065·3			
Jan. 13	3 18	XVI	E 0 1 30·1	12	2·57	5·25								
Dec. 20	3 22	XIV	D 0 0 11·9	12	2·57	5·25	586	34	·058	+ 73·8	1066·3	1065·5	1063	0†
Jan. 13,14	3 23	XVI	D 0 8 45·4	12	2·62	5·25								

† Pillar 3 feet in height is sunk having its upper surface flush with the ground.

Astronomical Date 1873-74	Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h m		° ′ ″				″							feet
Jan. 8,9,10	3 11	XVII	D 0 5 20·7	16	2·57	5·25	693	41	·059	− 2·3	1064·9			
„ 13,15,16	3 20	XVI	D 0 5 6·8	12	2·69	5·25								
Dec. 31	3 0	XIII	D 0 12 36·8	12	2·70	5·25	599	34	·057	− 141·9	1066·9			
Jan. 8,9	3 0	XVII	E 0 3 27·2	12	2·57	5·25								
„ 3	3 18	XV	D 0 14 27·9	12	2·70	5·25	867	60	·069	− 207·7	1067·6	1067·5	1065	0†
„ 8,9	3 17	XVII	E 0 1 47·9	12	2·73	5·25								
„ 13,15,16	3 20	XVI	D 0 5 6·8	12	2·69	5·25	693	41	·059	+ 2·3	1068·1			
„ 8,9,10	3 11	XVII	D 0 5 20·7	16	2·57	5·25								
„ 15,16	3 8	XVI	D 0 5 4·7	12	2·62	5·25	593	36	·061	− 10·3	1055·2			
„ 24,28	3 2	XVIII	D 0 3 54·2	12	2·58	5·25						1055·1	1052	0†
„ 9,10	3 12	XVII	D 0 5 40·9	12	2·59	5·25	666	39	·059	− 12·6	1054·9			
„ 24,29	3 31	XVIII	D 0 4 23·3	12	2·71	5·25								
„ 14,15	3 2	XVI	D 0 6 51·9	12	2·71	5·25	603	31	·051	− 39·0	1026·5			
„ 19,20,22	3 2	XIX	D 0 2 28·7	12	2·58	5·25						1026·4	1023	0†
„ 29,31	3 28	XVIII	D 0 5 58·5	8	2·69	5·25	561	37	·066	− 28·7	1026·4			
„ 20,22	3 24	XIX	D 0 2 30·3	12	2·62	5·25								
„ 8,10	2 57	XVII	E 0 0 13·2	12	2·73	5·25	677	41	·061	+ 106·1	1173·6			
Feb. 2,5	2 55	XX	D 0 10 25·4	12	2·71	5·25						1173·3	1170	0†
Jan. 28	3 23	XVIII	E 0 1 6·0	12	2·72	5·25	660	40	·061	+ 118·0	1173·1			
Feb. 2,5	3 22	XX	D 0 11 2·3	12	2·67	5·25								
Jan. 29	3 9	XVIII	D 0 3 46·8	8	2·59	5·25	617	35	·057	+ 16·9	1072·0			
Feb. 11,12	3 8	XXI	D 0 5 38·6	12	2·55	5·25								
Jan. 19,22	3 12	XIX	D 0 2 9·6	12	2·58	5·25	616	36	·058	+ 45·8	1072·2	1072·2	1069	4
Feb. 11,13	3 11	XXI	D 0 7 11·7	12	2·70	5·25								
„ 6,7	3 33	XXII	D 0 15 30·0	12	2·57	5·25	561	39	·070	− 186·4	1072·4			
„ 11,12	3 32	XXI	E 0 7 5·6	12	2·58	5·25								
Jan. 24,28,29	2 46	XVIII	E 0 4 17·4	12	2·56	5·25	716	44	·061	+ 203·7	1258·8			
Feb. 7	2 48	XXII	D 0 15 1·7	12	2·56	5·25								
„ 2,5	3 7	XX	D 0 0 36·3	12	2·55	5·25	662	40	·060	+ 85·6	1258·9	1258·7	1255	3
„ 6,7	3 6	XXII	D 0 9 22·6	12	2·71	5·25								
„ 11,12	3 32	XXI	E 0 7 5·6	12	2·58	5·25	561	39	·070	+ 186·4	1258·5			
„ 6,7	3 33	XXII	D 0 15 30·0	12	2·57	5·25								
„ 13	3 13	XXI	D 0 14 22·1	12	2·78	5·25	493	19	·039	− 151·4	920·8			
„ 16,17	3 14	XXIII	E 0 6 26·9	12	2·57	5·25								

† Pillar 3 feet in height is sunk having its upper surface flush with the ground.

Astronomical Date 1874	Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station—1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Feb. 9	3 30	XXII	D 0 20 17·5	12	2·71	5·25	802	48	·060	− 337·8	920·9	921·5	918	0
„ 16,17,18	3 33	XXIII	E 0 8 17·6	12	2·57	5·25								
„ 20,23	3 3	XXIV	D 0 4 12·3	12	2·77	5·25	476	21	·044	− 5·8	922·9			
„ 17,19	3 0	XXIII	D 0 3 23·9	12	2·56	5·25								
„ 14	3 12	XXI	D 0 12 44·0	12	2·58	5·25	617	28	·045	− 143·7	928·5			
„ 20,23,24	3 9	XXIV	E 0 3 5·0	12	2·55	5·25								
„ 6,7	3 6	XXII	D 0 26 29·8	12	2·56	5·25	497	21	·042	− 329·8	928·9	928·0	924	5
„ 21,24	3 3	XXIV	E 0 18 32·7	12	2·55	5·25								
„ 17,19	3 0	XXIII	D 0 3 23·9	12	2·56	5·25	476	21	·044	+ 5·8	926·7			
„ 20,23	3 3	XXIV	D 0 4 12·3	12	2·77	5·25								
„ 17,18	3 16	XXIII	D 0 14 6·0	12	2·57	5·25	662	31	·047	− 174·7	746·8			
Mar. 10,11,12	3 16	XXV	E 0 3 49·4	12	2·74	5·25								
Feb. 21,23,24	3 28	XXIV	D 0 14 3·0	12	2·58	5·25	710	37	·052	− 180·3	747·7	747·4	743	3‡
Mar. 11,12	3 26	XXV	E 0 3 11·9	12	2·58	5·25								
„ 8	3 7	XXVI	D 0 5 59·3	12	2·57	5·25	530	28	·053	− 28·8	747·8			
„ 10,12	3 10	XXV	D 0 2 16·9	12	2·65	5·25								
Feb. 16,18,19	3 7	XXIII	D 0 12 20·6	12	2·71	5·25	882	40	·045	− 144·6	776·9			
„ 28, Mar. 3,5	3 7	XXVI	D 0 1 12·9	12	2·74	5·25								
„ 20,21,23	3 16	XXIV	D 0 13 21·0	12	2·71	5·25	589	29	·049	− 151·6	776·4	776·5	772	3‡
„ 28, Mar. 5	3 13	XXVI	E 0 4 8·1	12	2·54	5·25								
Mar. 10,12	3 10	XXV	D 0 2 16·9	12	2·65	5·25	530	28	·053	+ 28·8	776·1			
„ 8	3 7	XXVI	D 0 5 59·3	12	2·57	5·25								
„ 10,12	3 1	XXV	D 0 4 56·0	16	2·73	5·25	589	18	·031	− 2·7	744·7			
„ 14,16,18,19	2 57	XXVII	D 0 4 38·2	16	2·57	5·25						744·6	740	4
„ 5,6	3 15	XXVI	D 0 6 56·8	6	5·86	5·25	611	− 2	·003	− 32·0	744·5			
„ 14	3 13	XXVII	D 0 3 23·7	4	5·71	5·25								
„ 13,16	3 9	XXVII	D 0 5 59·3	12	2·58	5·25	632	5	·008	− 12·2	732·4	732·4	728	3
„ 30, Apr. 2	3 9	XXVIII	D 0 4 40·9	12	2·58	5·25								
Feb. 27	3 19	XXVI	E 0 1 7·7	12	2·57	5·25	608	28	·046	+ 105·3	881·8			
Mar. 20,23	3 19	XXIX	D 0 10 37·8	12	2·58	5·25						881·0	876	3‡
„ 13,18,19	3 4	XXVII	E 0 3 59·1	18	2·58	5·25	540	7	·013	+ 135·7	880·3			
„ 20,21,23	3 7	XXIX	D 0 13 5·2	14	2·56	5·25								
„ 16,17,18	3 20	XXVII	D 0 9 8·9	16	2·71	5·25	759	− 5	·007	− 58·4	686·2			
„ 28	3 21	XXX	D 0 3 56·0	12	2·58	5·25								

‡ Approximate, see Description of the Station.

Astronomical Date: 1874	Astronomical Date: Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Mar. 30	2 46	XXVIII	D 0 7 33·3	12	2·71	5·25	635	19	·030	− 45·2	687·2	686·6	682	3‡
„ 27,28	2 46	XXX	D 0 2 42·9	12	2·58	5·25								
„ 25	2 52	XXXI	D 0 10 47·5	12	2·71	5·25	622	1	·002	− 100·6	686·5			
„ 27	2 52	XXX	E 0 0 11·5	12	2·68	5·25								
„ 14,16,17	3 17	XXVII	D 0 4 54·5	14	2·68	5·25	784	− 4	·005	+ 41·8	786·4			
„ 25	3 16	XXXI	D 0 8 31·8	12	2·58	5·25								
„ 23	3 15	XXIX	D 0 10 29·2	12	2·68	5·25	843	25	·030	− 93·2	787·8	787·2	782	3‡
„ 25	3 15	XXXI	D 0 2 58·9	12	2·59	5·25								
„ 27	2 52	XXX	E 0 0 11·5	12	2·68	5·25	622	1	·002	+ 100·6	787·3			
„ 25	2 52	XXXI	D 0 10 47·5	12	2·71	5·25								
Dec. 18,19	2 41	XXX	D 0 2 49·4	16	2·72	5·25	519	18	·035	+ 21·3	707·9			
„ 23,24	2 40	XXXII	D 0 5 37·0	16	2·59	5·25								
„ 21,22	3 13	XXXI	D 0 8 45·2	16	2·71	5·25	599	31	·052	− 72·9	714·3	711·1	706	3
„ 23,24	3 12	XXXII	D 0 0 30·0	16	2·72	5·25								
„ 18,19	2 46	XXX	D 0 5 14·3	16	2·72	5·25	518	23	·044	− 17·3	669·3			
„ 28	2 48	XXXIII	D 0 2 59·1	16	2·60	5·25								
„ 24	2 48	XXXII	D 0 6 40·1	12	2·74	5·25	486	19	·039	− 39·6	671·5	670·4	665	3
„ 28	2 53	XXXIII	D 0 1 8·0	12	2·72	5·25								
„ 23,24	2 48	XXXII	D 0 7 29·6	12	2·58	5·25	451	24	·053	− 52·3	658·8			
1874-75 Dec. 31, Jan. 1	2 56	XXXIV	E 0 0 21·9	16	2·71	5·25								
„ 28	3 1	XXXIII	D 0 5 55·0	12	2·58	5·25	688	37	·054	− 13·6	656·8	658·7	653	3
„ 31, Jan. 2	3 32	XXXIV	D 0 4 35·3	16	2·73	5·25								
Jan. 4,5	2 52	XXXV	D 0 7 45·7	12	2·74	5·25	587	31	·053	− 55·6	660·4			
Dec. 31, Jan. 1,2	2 51	XXXIV	D 0 1 20·3	12	2·59	5·25								
„ 21,22	3 1	XXXI	D 0 9 22·0	20	2·58	5·25	678	− 5	·007	− 69·7	717·5			
Jan. 4,5	3 1	XXXV	D 0 2 22·4	20	2·71	5·25								
Dec. 23,24	2 42	XXXII	D 0 4 21·0	12	2·60	5·25	591	33	·056	+ 3·3	714·4	715·1	709	2
Jan. 4,5	2 22	XXXV	D 0 4 43·4	12	2·72	5·25								
Dec. 31, Jan. 1,2	2 51	XXXIV	D 0 1 20·3	12	2·59	5·25	587	31	·053	+ 55·6	713·4			
Jan. 4,5	2 52	XXXV	D 0 7 45·7	12	2·74	5·25								
Dec. 31, Jan. 1	2 57	XXXIV	D 0 6 22·5	12	2·58	5·25	708	33	·047	− 18·7	640·0			
Jan. 14,15	2 56	XXXVI	D 0 4 34·6	12	2·68	5·25						639·6	633	2
1875 Jan. 4,5	3 17	XXXV	D 0 8 56·4	12	2·58	5·25	636	34	·054	− 75·9	639·2			
„ 14,16	3 17	XXXVI	D 0 0 49·9	12	2·71	5·25								

‡ Approximate, see Description of the Station.

Astronomical Date 1874-75	Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h m		° ′ ″				″							feet
Dec. 31, Jan. 1	3 2	XXXIV	D 0 6 7·3	12	2·57	5·25	556	35	·063	− 31·0	627·7			
Jan. 18	3 3	XXXVII	D 0 2 19·4	12	2·70	5·25								
1875												628·3	622	3
„ 14	2 47	XXXVI	D 0 5 56·1	12	2·57	5·25	721	44	·061	− 10·7	628·9			
„ 18,19	2 46	XXXVII	D 0 4 54·8	12	2·66	5·25								
„ 4,5	2 57	XXXV	D 0 0 39·1	16	2·57	5·25	578	32	·055	+ 64·7	779·8			
„ 7,8	2 57	XXXVIII	D 0 8 14·4	16	2·71	5·25								
												780·0	774	3·5
„ 14,15,16	3 16	XXXVI	E 0 1 1·6	16	2·58	5·25	730	42	·058	+ 140·7	780·3			
„ 7	3 6	XXXVIII	D 0 12 3·3	12	2·58	5·25								
„ 14,15,16	3 14	XXXVI	D 0 2 36·2	12	2·58	5·25	684	28	·041	+ 55·9	695·5			
„ 9,11	3 13	XL	D 0 8 8·1	12	2·70	5·25								
												695·5	689	3
„ 7	3 16	XXXVIII	D 0 9 26·6	12	3·00	5·25	570	29	·051	− 84·6	695·4			
„ 9	3 18	XL	E 0 0 37·4	12	2·58	5·25								
„ 15	2 48	XXXVI	D 0 7 56·8	12	7·26	5·25	924	36	·039	− 25·1	614·5			
„ 25,26	2 47	XXXIX	D 0 6 16·5	12	2·66	5·25								
„ 18	3 22	XXXVII	D 0 7 55·7	12	2·59	5·25	1028	60	·058	− 8·7	619·6	617·5	610	4
„ 25,26	3 23	XXXIX	D 0 7 21·3	12	2·57	5·25								
„ 11	2 57	XL	D 0 10 55·7	12	5·67	5·25	1147	54	·047	− 77·2	618·3			
„ 25,26	2 59	XXXIX	D 0 6 23·5	12	4·58	5·25								
„ 19	2 54	XXXVII	D 0 10 15·0	12	2·75	5·25	1026	52	·051	− 75·4	552·9			
„ 21	2 55	XLI	D 0 5 16·0	12	2·57	5·25								
												551·3	544	3·8
„ 25	2 57	XXXIX	D 0 10 2·4	12	2·72	5·25	1065	65	·061	− 67·8	549·7			
„ 21,22	2 57	XLI	D 0 5 43·2	12	2·59	5·25								
„ 26	2 34	XXXIX	D 0 5 26·7	16	3·63	5·25	917	44	·048	+ 41·6	659·1			
„ 30	2 33	XLII	D 0 8 26·8	12	5·60	5·25								
												660·3	653	5·1
„ 12	2 55	XL	D 0 8 3·4	12	2·73	5·25	881	42	·048	− 34·1	661·4			
„ 30	2 55	XLII	D 0 5 26·2	12	2·57	5·25								
„ 25,26	2 44	XXXIX	D 0 10 27·4	12	2·71	5·25	944	56	·059	− 95·3	522·2			
„ 15,16	2 50	XLIII	D 0 3 36·6	12	2·50	5·25								
„ 21,22	3 30	XLI	D 0 10 40·4	20	5·85	5·25	1339	68	·051	− 24·9	526·4	524·7	517	5·2
Feb. 16	4 12	XLIII	D 0 9 24·8	8	5·83	5·25								
„ 7	3 4	XLIV	D 0 10 2·0	12	2·70	5·25	915	52	·057	− 85·4	525·6			
„ 16	3 7	XLIII	D 0 3 42·1	12	2·60	5·25								
Jan. 25,26	2 43	XXXIX	D 0 9 2·9	12	2·59	5·25	1164	58	·050	− 8·0	609·5			
Feb. 7	2 44	XLIV	D 0 8 29·7	12	5·60	5·25								

Astronomical Date 1875		Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
		h. m.		° ′ ″				″							feet
Jan.	30	3 21	XLII	D 0 7 52·9	12	2·59	5·25	737	36	·049	− 47·9	612·4	610·5	603	5·2
Feb.	5	3 23	XLIV	D 0 3 17·3	12	6·56	5·25								
„	16	3 7	XLIII	D 0 3 42·1	12	2·60	5·25	915	52	·057	+ 85·4	609·7			
„	7	3 4	XLIV	D 0 10 2·0	12	2·70	5·25								
„	16,17	2 53	XLIII	D 0 6 44·1	12	2·56	5·25	912	28	·031	+ 13·6	538·3			
„	28	2 52	XLV	D 0 7 44·2	12	2·71	5·25								
„	5,6	3 5	XLIV	D 0 9 39·4	12	2·57	5·25	859	40	·047	− 76·7	533·8	536·1	528	3
„	27	3 7	XLV	D 0 3 35·5	12	2·58	5·25								
„	15,16	3 6	XLIII	D 0 8 19·0	12	2·56	5·25	789	2	·003	− 38·2	486·5			
„	22,23	3 5	XLVI	D 0 5 1·4	16	2·72	5·25								
„	27,28	3 12	XLV	D 0 8 23·1	16	2·59	5·25	684	10	·015	− 54·9	481·2	483·9	476	5·3
„	22,23	3 11	XLVI	D 0 2 56·1	12	2·56	5·25								
„	6,7	3 14	XLIV	D 0 9 20·0	12	2·73	5·25	978	47	·048	− 54·0	556·5			
Mar.	2	3 15	XLVII	D 0 5 35·6	12	2·58	5·25								
Feb.	27,28	2 53	XLV	D 0 4 1·8	12	2·73	5·25	677	30	·044	+ 24·9	561·0	558·7	551	3
Mar.	2	2 53	XLVII	D 0 6 31·7	12	2·70	5·25								
Feb.	27	2 48	XLV	D 0 6 47·0	12	2·73	5·25	625	18	·029	− 31·7	504·4			
„	24	2 47	XLVIII	D 0 3 21·4	12	2·56	5·25								
„	22,23	2 52	XLVI	D 0 2 42·7	12	2·72	5·25	493	7	·014	+ 21·2	505·1	504·8	496	0
„	24	2 52	XLVIII	D 0 5 36·8	12	2·76	5·25								
Mar.	21	2 58	XLIX	D 0 7 45·5	12	4·32	5·25	794	−15	·019	− 20·3	504·9			
Feb.	24,25	2 58	XLVIII	D 0 6 5·9	12	2·60	5·25								
„	28	3 27	XLV	D 0 7 54·6	12	2·60	5·25	881	− 7	·008	− 9·0	527·1			
Mar.	4	3 26	XLIX	D 0 7 12·6	12	2·71	5·25								
„	2	2 39	XLVII	D 0 7 55·7	12	2·60	5·25	773	12	·016	− 35·5	523·2	525·1	517	3
„	4,6	2 39	XLIX	D 0 4 48·4	12	2·58	5·25								
Feb.	24,25	2 58	XLVIII	D 0 6 5·9	12	2·60	5·25	794	−15	·019	+ 20·3	525·1			
Mar.	21	2 58	XLIX	D 0 7 45·5	12	4·32	5·25								
Feb.	24,25	3 4	XLVIII	D 0 4 27·2	16	2·69	5·25	676	16	·024	+ 21·0	525·8			
Mar.	7,8	3 5	L	D 0 6 33·7	16	2·71	5·25								
„	4	2 53	XLIX	D 0 5 23·8	12	2·57	5·25	667	15	·023	+ 1·0	526·1	526·0	517	3·2
„	7,8	2 53	L	D 0 5 29·3	12	2·71	5·25								
Feb.	25	2 58	XLVIII	D 0 7 5·2	12	2·57	5·25	675	− 1	·001	− 25·8	479·0			
Mar.	12	2 58	LI	D 0 4 28·9	12	2·73	5·25						478·6	470	5

Astronomical Date 1875		Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station — 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
		h. m.		° ′ ″				″							feet
Mar.	9	3 13	L	D 0 8 39·6	12	5·58	5·25	798	3	·004	− 47·8	478·2			
”	12	3 13	LI	D 0 4 34·5	12	5·86	5·25								
”	4	3 12	XLIX	D 0 4 37·5	12	2·77	5·25	461	− 1	·002	− 7·9	517·2			
”	19	3 13	LII	D 0 3 28·4	12	2·72	5·25								
”	7,8	3 27	L	D 0 4 56·3	12	2·75	5·25	531	18	·034	− 10·2	515·8	516·5	507	1·1
”	19	3 28	LII	D 0 3 38·8	12	2·58	5·25								
”	9	2 43	L	D 0 7 58·1	12	2·58	5·25	717	10	·014	− 42·5	483·5			
”	15	2 44	LIII	D 0 3 56·5	12	2·58	5·25								
”	12,13	3 10	LI	D 0 4 18·6	12	2·58	5·25	551	7	·013	+ 5·6	484·2	484·7	475	0
”	15	3 13	LIII	D 0 4 56·2	12	3·58	5·25								
”	17	3 19	LIV	D 0 8 35·1	12	2·58	5·25	673	28	·042	− 65·4	486·4			
”	15	3 19	LIII	D 0 1 58·9	12	2·57	5·25								
”	8	3 16	L	D 0 2 43·2	12	2·56	5·25	526	11	·021	+ 25·8	551·8			
”	17	3 16	LIV	D 0 6 2·9	12	2·58	5·25								
”	19	2 44	LII	D 0 4 10·6	12	2·73	5·25	712	12	·017	+ 35·3	551·8	551·0	542	†
”	17	2 44	LIV	D 0 7 31·9	12	2·75	5·25								
”	15	3 19	LIII	D 0 1 58·9	12	2·57	5·25	673	28	·042	+ 65·4	549·3			
”	17	3 19	LIV	D 0 8 35·1	12	2·58	5·25								
Dec.	6	3 23	LIII	D 0 3 53·6	12	2·54	5·25	505	25	·050	+ 1·4	486·1			
”	15	3 23	LV	D 0 4 5·1	12	2·60	5·25						487·4	478	0
”	18	2 52	LIV	D 0 8 3·2	12	2·67	5·25	541	32	·059	− 62·4	488·6			
”	15	2 50	LV	D 0 0 14·6	12	2·57	5·25								
”	6	3 18	LIII	D 0 4 33·2	12	2·70	5·25	310	11	·035	− 17·0	467·7			
”	10,11	3 19	LVI	D 0 0 50·8	12	2·58	5·25						467·8	458	0
”	15	3 4	LV	D 0 5 3·0	12	2·70	5·25	445	22	·049	− 19·5	467·9			
”	10	3 3	LVI	D 0 2 5·3	12	2·54	5·25								
”	18	3 6	LIV	D 0 6 6·7	12	2·55	5·25	486	24	·049	− 32·7	518·3			
”	21	3 5	LVII	D 0 1 32·4	12	2·58	5·25						517·2	507	2
”	16	3 1	LV	D 0 0 49·3	12	2·57	5·25	398	17	·043	+ 28·8	516·2			
”	21	2 55	LVII	D 0 5 43·4	12	2·70	5·25								
”	16	3 11	LV	D 0 4 13·3	12	2·70	5·25	466	21	·045	− 6·8	480·6			
”	13,14	3 11	LVIII	D 0 3 15·0	12	2·55	5·25						480·8	471	2
”	11	2 57	LVI	D 0 2 43·1	12	2·70	5·25	456	17	·037	+ 13·2	481·0			
”	13	2 56	LVIII	D 0 4 40·9	12	2·70	5·25								

† For particulars, see Description of the Station.

Astronomical Date 1875	Mean of Times of observation	Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Mar. 15	2 34	LV	D 0 2 4·9	12	2·58	5·25	345	9	·026	+ 9·4	496·8	497·4	487	1·9
„ 24	2 34	LIX	D 0 3 55·9	12	2·67	5·25								
„ 21	2 58	LVII	D 0 4 52·3	16	2·57	5·25	357	13	·036	− 19·3	497·9			
„ 24,25,28	3 3	LIX	D 0 1 11·5	20	2·60	5·25								
„ 13	3 12	LVIII	D 0 2 28·9	12	2·58	5·25	452	15	·033	+ 16·6	497·4			
„ 25	3 12	LIX	D 0 4 57·8	12	2·70	5·25								
Dec. 14	2 29	LVIII	D 0 4 37·9	12	13·43	5·25	520	15	·029	− 5·9	474·9	473·8	461	10·8
1876 Jan. 1	2 30	XIX	D 0 3 51·9	12	2·70	5·25								
1875 Dec. 25,28	3 4	LIX	D 0 6 9·4	16	13·30	5·25	501	− 8	·016	− 24·6	472·8			
1876 Jan. 1	3 5	XIX	D 0 2 48·6	16	2·57	5·25								
1875 Dec. 22	2 43	LVII	D 0 6 54·9	12	22·90	5·25	598	− 4	·007	− 30·2	487·0	486·6	478	20·4
„ 29	2 50	XXI	D 0 3 29·3	12	2·60	5·25								
„ 25	2 30	LIX	D 0 5 22·7	12	22·90	5·25	540	− 1	·002	− 11·3	486·1			
„ 29	2 32	XXI	D 0 3 56·6	12	2·57	5·25								

Note.—Stations XIX and XXI appertain to the Sutlej Series.

October 1878.

J. B. N. HENNESSEY,
In charge of Computing Office.

JODHPORE MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. AZIMUTHAL OBSERVATIONS.

At VIII (Thob)

Lat. N. 26° 3′ 5″·85 ; Long. E. 72° 24′ 49″·35 = 4^h 49^m 39^s·3 ; Height above Mean Sea Level, 856 feet.
March 1873 ; observed by Lieutenant M. W. Rogers, R. E., with Barrow's 24-inch Theodolite No. 2.

Stars observed	*a* Ursæ Minoris (West)	and No. 1612† (East)
Mean Right Ascension 1873·0	1^h 12^m 18^s	13^h 46^m 4^s
Mean North Polar Distance 1873·0	1° 22′ 4″·30	6° 36′ 38″·70
Local Mean Times of Elongation, Mar. 16	Western 7^h 32^m	Eastern 8^h 18^m

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT				FACE RIGHT			
			Observed Horizontal Angle: Diff. of Readings Ref. Mark−Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark−Star at Elongation	Observed Horizontal Angle: Diff. of Readings Ref. Mark−Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark−Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Mar. 16	W.	180 0	+143 57 36·94	6 50	+ 0 2·43	+143 57 39·37	+143 57 15·86	17 27	+ 0 15·87	+143 57 31·73
		&	57 38·80	3 5	0 0·50	39·30	57 22·66	15 39	0 12·76	35·42
		0 0	57 31·70	11 22	0 6·73	38·43	57 33·64	2 54	0 0·44	34·08
			57 29·50	13 28	0 9·45	38·95	57 35·40	5 9	0 1·38	36·78
							57 9·70	22 33	0 26·43	36·13
„ 17	E.	180 0	+135 5 6·38	11 51	− 0 35·04	+135 4 31·34	+135 6 33·78	22 38	− 2 7·57	+135 4 26·21
		&	4 53·70	9 50	0 24·12	29·58	6 8·76	20 15	1 42·14	26·62
		0 0	4 32·04	1 40	0 0·70	31·34	4 35·16	6 16	0 9·84	25·32
			4 31·32	0 38	0 0·10	31·22	4 41·20	8 0	0 16·07	25·13
			6 44·52	23 13	2 15·74	28·78	5 9·70	13 31	0 45·89	23·81
			7 7·08	25 1	2 37·50	29·58	5 26·92	15 50	1 3·05	23·87
„ 18	W.	259 13	+143 57 44·52	1 3	+ 0 0·06	+143 57 44·58	+143 57 28·88	8 46	+ 0 4·00	+143 57 32·88
		&	57 42·50	0 46	0 0·03	42·53	57 29·72	6 36	0 2·27	31·99
		79 13	57 32·12	14 42	0 11·25	43·37	57 31·24	7 8	0 2·65	33·89
			57 27·70	17 40	0 16·23	43·93	57 26·66	8 59	0 4·20	30·86
			57 7·98	26 18	0 35·95	43·93				
			57 1·66	27 54	0 40·46	42·12				
„ 18	E.	259 13	+135 4 37·38	4 28	− 0 4·98	+135 4 32·40	+135 5 26·90	15 47	− 1 2·19	+135 4 24·71
		&	4 31·20	1 47	0 0·80	30·40	4 57·52	12 16	0 37·55	19·97
		79 13	5 16·78	13 17	0 44·32	32·46	4 26·44	3 47	0 3·60	22·84
			5 33·78	15 51	1 3·17	30·61	4 31·40	6 34	0 10·81	20·59

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT				FACE RIGHT			
			Observed Horizontal Angle: Diff. of Readings Ref. Mark—Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark—Star at Elongation	Observed Horizontal Angle: Diff. of Readings Ref. Mark—Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark—Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Mar. 19	W.	338 24	+143 57 39·40	5 5	+ 0 1·35	+143 57 40·75	+143 57 31·60	13 50	+ 0 9·98	+143 57 41·58
		&	57 32·28	2 27	0 0·31	32·59	57 34·96	12 1	0 7·53	42·49
		158 24	57 24·02	16 51	0 14·78	38·80	57 35·92	6 3	0 1·90	37·82
			57 16·64	19 41	0 20·13	36·77	57 34·76	9 45	0 4·95	39·71
„ 19	E.	338 24	+135 4 31·18	4 3	− 0 4·09	+135 4 27·09	+135 5 27·62	14 55	− 0 55·55	+135 4 32·07
		&	4 27·88	0 39	0 0·11	27·77	5 7·68	12 21	0 38·07	29·61
		158 25	5 48·28	17 53	1 20·35	27·93	4 47·28	8 14	0 17·02	30·26
			6 7·82	20 8	1 41·95	25·87	4 57·12	10 21	0 26·93	30·19
„ 20	W.	57 36	+143 57 34·08	9 36	+ 0 4·81	+143 57 38·89	+143 57 22·92	18 7	+ 0 17·10	+143 57 40·02
		&	57 34·84	7 12	0 2·70	37·54	57 27·66	15 50	0 13·08	40·74
		237 36	57 36·52	7 54	0 3·25	39·77	57 40·72	0 59	0 0·05	40·77
			57 32·48	9 33	0 4·75	37·23	57 39·50	2 39	0 0·37	39·87
„ 20	E.	57 36	+135 4 32·90	3 22	− 0 2·83	+135 4 30·07	+135 5 8·10	12 35	− 0 39·52	+135 4 28·58
		&	4 30·90	1 1	0 0·26	30·64	4 58·08	10 41	0 28·47	29·61
		237 36	5 24·70	14 57	0 56·19	28·51	4 36·12	5 33	0 7·72	28·40
			5 48·82	17 49	1 19·73	29·09	4 46·10	8 5	0 16·40	29·70
„ 21	W.	136 49	+143 57 39·26	5 41	+ 0 1·69	+143 57 40·95	+143 57 34·78	12 47	+ 0 8·51	+143 57 43·29
		&	57 38·14	3 29	0 0·63	38·77	57 31·76	11 10	0 6·50	38·26
		316 49	57 32·16	11 32	0 6·92	39·08	57 42·48	2 10	0 0·24	42·72
			57 27·46	13 21	0 9·28	36·74	57 42·40	4 6	0 0·88	43·28
							57 20·04	21 7	0 23·17	43·21
							57 12·84	23 26	0 28·54	41·38
„ 21	E.	136 48	+135 4 39·04	5 52	− 0 8·61	+135 4 30·43	+135 5 26·66	14 35	− 0 53·10	+135 4 33·56
		&	4 32·50	3 29	0 3·02	29·48	5 10·74	12 25	0 38·48	32·26
		316 49	5 6·74	11 55	0 35·63	31·11	4 35·60	3 19	0 2·77	32·83
			5 25·72	14 51	0 55·42	30·30	4 39·02	6 24	0 10·25	28·77
			6 49·08	23 23	2 17·69	31·39	7 14·10	25 30	2 43·67	30·43
„ 22	W.	180 1	+143 57 34·50	5 0	+ 0 1·30	+143 57 35·80	+143 57 31·80	14 5	+ 0 10·35	+143 57 42·15
		&	57 34·94	3 1	0 0·47	35·41	57 33·14	12 18	0 7·89	41·03
		0 1	57 26·42	15 1	0 11·73	38·15	57 44·06	3 49	0 0·76	44·82
			57 22·34	17 6	0 15·22	37·56	57 38·18	6 39	0 2·30	40·48
							57 8·64	26 13	0 35·70	44·34
„ 22	E.	180 1	+135 4 31·02	3 32	− 0 3·12	+135 4 27·90	+135 5 7·68	11 52	− 0 35·14	+135 4 32·54
		&	4 27·34	1 3	0 0·28	27·06	4 53·06	10 0	0 24·95	28·11
		0 1	5 28·64	15 37	1 1·32	27·32	4 39·28	5 12	0 6·76	32·52
			5 43·90	17 30	1 17·08	26·82	4 51·86	9 28	0 22·51	29·35

Abstract of Astronomical Azimuth observed at VIII (Thob) 1873.

1. By Eastern Elongation of No. 1612†.

Face	L	R	L	R	L	R	L	R	L	R
Zero	180°	0°	259°	79°	338°	158°	58°	238°	137°	317°
Date	March 17		March 18		March 19		March 20		March 21	
	"	"	"	"	"	"	"	"	"	"
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	31·34 29·58 31·34 31·22 28·78 29·58 *26·36 *25·52 *25·78 *25·28	26·21 26·62 25·32 25·13 23·81 23·87 *31·00 *26·57 *30·98 *27·81	32·40 30·40 32·46 30·61	24·71 19·97 22·84 20·59	27·09 27·77 27·93 25·87	32·07 29·61 30·26 30·19	30·07 30·64 28·51 29·09	28·58 29·61 28·40 29·70	30·43 29·48 31·11 30·30 31·39	33·56 32·26 32·83 28·77 30·43
Means	28·48	26·73	31·47	22·03	27·17	30·53	29·58	29·07	30·54	31·57
	° ′ "		"		"		"		"	
Means of both faces	+135 4 27·61		26·75		28·85		29·33		31·06	
Level Corrections	− ·08		+ 1·61		− ·21		− ·11		− ·59	
Corrected Means	+135 4 27·53		28·36		28·64		29·22		30·47	
Az. of Star fr. S., by W.	187 21 56·96		56·65		56·35		56·04		55·74	
Az. of Ref. M. „	322 26 24·49		25·01		24·99		25·26		26·21	

2. By Western Elongation of α Ursæ Minoris.

Face	L	R	L	R	L	R	L	R	L	R
Zero	180°	0°	259°	79°	338°	158°	58°	238°	137°	317°
Date	March 16		March 18		March 19		March 20		March 21	
	"	"	"	"	"	"	"	"	"	"
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	39·37 39·30 38·43 38·95 *33·80 *33·41 *36·15 *35·56	31·73 35·42 34·08 36·78 36·13 *40·15 *39·03 *42·82 *38·48 *42·34	44·58 42·53 43·37 43·93 43·93 42·12	32·88 31·99 33·89 30·86	40·75 32·59 38·80 36·77	41·58 42·49 37·82 39·71	38·89 37·54 39·77 37·23	40·02 40·74 40·77 39·87	40·95 38·77 39·08 36·74	43·29 38·26 42·72 43·28 43·21 41·38
Means	36·87	37·70	43·41	32·41	37·23	40·40	38·36	40·35	38·89	42·02
	° ′ "		"		"		"		"	
Means of both faces	+ 143 57 37·29		37·91		38·82		39·36		40·46	
Level Corrections	− ·03		+ 1·38		+ 1·26		− ·04		+ ·02	
Corrected Means	+ 143 57 37·26		39·29		40·08		39·32		40·48	
Az. of Star fr. S., by W.	178 28 46·78		46·11		45·78		45·45		45·11	
Az. of Ref. M. „	322 26 24·04		25·40		25·86		24·77		25·59	

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

NOTE.—Where observations occurred on the same pair of zeros on different nights they are reduced in this abstract to one date—the most convenient—by allowing for star's change of place. The date so adopted appears at the head of the column, and the reduced observation is preceded by an asterisk.

At VIII (Thob)—(*Continued*).

		°	″
Astronomical Azimuth of Referring Mark or VII (Samdari)	by Eastern Elongation	322 26	25·19
	by Western „	„	25·13
Astronomical Azimuth of VII (Samdari) by observation, mean of above		322 26	25·16
Geodetical Azimuth of „ by calculation from that adopted (*Vol.* II, page 141) at Kaliánpur, *see* page 93 *ante*		322 26	21·42
Astronomical—Geodetical Azimuth at VIII (Thob)		+	3·74

At XXVI (Jambo)

Lat. N. 27° 16′ 28″·88; Long. E. 72° 33′ 32″·71 = 4^h 50^m 14^s·2; Height above Mean Sea Level, 772 feet.
February and March 1874; observed by Lieutenant J. Hill, R. E., with Barrow's 24-inch Theodolite No. 2.

Stars observed	α Ursæ Minoris (West)	and 1612† (East).
Mean Right Ascension 1874·0	1^h 12^m 38^s	13^h 46^m 2^s
Mean North Polar Distance 1874·0	1° 21′ 45″·24	6° 36′ 56″·74
Local Mean Times of Elongation, Feb. 26	Western 8^h 44^m	Eastern 9^h 35^m

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark — Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark — Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark — Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark — Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Feb. 26	W.	323 36	− 21 45 23·90	0 22	+ 0 0·01	− 21 45 23·89	− 21 45 34·26	14 56	+ 0 11·69	− 21 45 22·57
		&	45 24·54	4 1	0 0·84	23·70	45 25·80	9 53	0 5·11	20·69
		143 36	46 0·08	25 24	0 33·71	26·37	45 32·94	13 53	0 10·09	22·85
			46 9·88	29 29	0 45·37	24·51	45 39·00	16 54	0 14·93	24·07
„ 26	E.	323 36	− 30 43 33·22	13 7	− 0 43·44	− 30 44 16·66	− 30 44 19·24	1 57	− 0 0·97	− 30 44 20·21
		&	43 54·14	10 3	0 25·57	19·71	44 20·22	0 28	0 0·06	20·28
		143 36	43 51·14	10 36	0 28·54	19·68	41 58·06	23 38	2 22·33	20·39
			43 33·36	13 27	0 46·04	19·40	41 10·12	27 17	3 9·72	19·84

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark—Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark—Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark—Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark—Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Feb. 27	W.	42 48	− 21 45 36·44	14 12	+ 0 10·55	− 21 45 25·89	− 21 46 4·68	28 15	+ 0 41·80	− 21 45 22·88
		&	45 33·04	11 13	0 6·59	26·45	45 52·24	24 28	0 31·37	20·87
		222 48	45 39·60	15 11	0 12·06	27·54	45 22·32	1 26	0 0·11	22·21
			45 45·44	18 46	0 18·40	27·04	45 22·20	2 15	0 0·27	21·93
„ 27	E.	42 48	− 30 42 1·22	23 34	− 2 19·74	− 30 44 20·96	− 30 43 57·82	8 42	− 0 19·16	− 30 44 16·98
		&	42 48·14	19 3	1 31·47	19·61	44 11·16	5 7	0 6·61	17·77
		222 48	44 12·40	6 19	0 10·13	22·53	42 27·54	21 1	1 52·58	20·12
			43 59·32	9 23	0 22·33	21·65	41 38·16	24 56	2 38·48	16·64
„ 28	W.	122 1	− 21 45 32·52	12 29	+ 0 8·16	− 21 45 24·36	− 21 46 0·26	26 12	+ 0 35·96	− 21 45 24·30
		&	45 29·90	9 8	0 4·37	25·53	45 52·76	22 48	0 27·25	25·51
		302 1	45 43·76	18 19	0 17·55	26·21	45 24·60	2 53	0 0·43	24·17
			45 51·18	21 15	0 23·60	27·58	45 26·34	6 39	0 2·32	24·02
„ 28	E.	122 1	− 30 42 57·68	17 57	− 1 21·23	− 30 44 18·91				
			43 24·68	14 53	0 55·97	20·65				
Mar. 3	W.	201 14	− 21 45 40·94	17 33	+ 0 16·15	− 21 45 24·79	− 21 46 14·66	31 38	+ 0 52·40	− 21 45 22·26
		&	45 35·78	14 31	0 11·04	24·74	46 3·14	27 32	0 39·72	23·42
		21 14	45 32·76	14 26	0 10·90	21·86	45 24·62	2 29	0 0·32	24·30
			45 40·10	18 3	0 17·06	23·04	45 22·66	1 7	0 0·06	22·60
„ 3	E.	201 14	− 30 41 59·86	23 31	− 2 19·13	− 30 44 18·99	− 30 43 56·80	9 36	− 0 23·33	− 30 44 20·13
		&	42 37·18	20 13	1 43·01	20·19	44 7·96	6 15	0 9·88	17·84
		21 14	44 12·34	5 28	0 7·58	19·92	42 41·78	19 32	1 37·19	18·97
			44 0·92	8 40	0 19·04	19·96	41 57·78	23 42	2 23·12	20·90
„ 5	W.	280 23	− 21 45 33·96	14 56	+ 0 11·68	− 21 45 22·28	− 21 46 10·24	30 33	+ 0 48·92	− 21 45 21·32
		&	45 31·60	11 42	0 7·18	24·42	45 59·10	27 0	0 38·19	20·91
		100 23					45 20·82	0 4	0 0·00	20·82
„ 6	W.	280 23	− 21 45 27·98	9 20	+ 0 4·56	− 21 45 23·42	− 21 45 53·28	24 31	+ 0 31·51	− 21 45 21·77
		&	45 25·64	5 43	0 1·72	23·92	45 44·14	20 10	0 21·30	22·84
		100 23	45 41·98	19 26	0 19·75	22·23	45 23·92	6 22	0 2·12	21·80
							45 27·14	9 21	0 4·58	22·56
„ 6	E.	280 23	− 30 42 44·72	19 21	− 1 34·35	− 30 44 19·07	− 30 44 2·60	8 13	− 0 17·08	− 30 44 19·68
		&	43 6·00	17 7	1 13·83	19·83	44 13·30	4 47	0 5·78	19·08
		100 23	44 15·12	4 56	0 6·18	21·30	42 48·68	18 43	1 29·21	17·89
			44 4·00	8 11	0 16·97	20·97	42 9·62	22 31	2 9·12	18·74
„ 7	E.	122 1	− 30 44 5·94	5 7	− 0 6·65	− 30 44 12·59	− 30 43 20·24	15 22	− 0 59·59	− 30 44 19·83
		&	43 34·30	12 28	0 39·55	13·85	43 41·66	12 21	0 38·48	20·14
		302 2					38 1·18	38 22	6 15·89	17·07

Abstract of Astronomical Azimuth observed at XXVI (Jambo) 1874.

1. By Eastern Elongation of No. 1612†.

Face	L	R	L	R	L	R	L	R	L	R
Zero	324°	144°	43°	223°	122°	302°	201°	21°	280°	100°
Date	February 26		February 27		March 7		March 3		March 6	
	"	"	"	"	"	"	"	"	"	"
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	16·66	20·21	20·96	16·98	*17·27	19·83	18·99	20·13	19·07	19·68
	19·71	20·28	19·61	17·77	*19·01	20·14	20·19	17·84	19·83	19·08
	19·68	20·39	22·53	20·12	12·59	17·07	19·92	18·97	21·30	17·89
	19·40	19·84	21·65	16·64	13·85		19·96	20·90	20·97	18·74
Means	18·86	20·18	21·19	17·88	15·68	19·01	19·77	19·46	20·29	18·85

	February 26	February 27	March 7	March 3	March 6
	° ' "	"	"	"	"
Means of both faces	− 30 44 19·52	19·54	17·35	19·62	19·57
Level Corrections	− ·27	− ·39	− ·62	+ ·40	+ 1·26
Corrected Means	− 30 44 19·79	19·93	17·97	19·22	18·31
Az. of Star fr. S., by W.	187 27 12·29	12·05	10·19	11·12	10·42
Az. of Ref. M. „	156 42 52·50	52·12	52·22	51·90	52·11

2. By Western Elongation of *a* Ursæ Minoris.

Face	L	R	L	R	L	R	L	R	L	R
Zero	324°	144°	43°	223°	122°	302°	201°	21°	280°	100°
Date	February 26		February 27		February 28		March 3		March 6	
	"	"	"	"	"	"	"	"	"	"
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	23·89	22·57	25·89	22·88	24·36	24·30	24·79	22·26	*22·05	*21·09
	23·70	20·69	26·45	20·87	25·53	25·51	24·74	23·42	*24·19	*20·68
	26·37	22·85	27·54	22·21	26·21	24·17	21·86	24·30	23·42	*20·59
	24·51	24·07	27·04	21·93	27·58	24·02	23·04	22·60	23·92	21·77
									22·23	22·84
										21·80
										22·56
Means	24·62	22·55	26·73	21·97	25·92	24·50	23·61	23·15	23·16	21·62

	February 26	February 27	February 28	March 3	March 6
	° ' "	"	"	"	"
Means of both faces	− 21 45 23·59	24·35	25·21	23·38	22·39
Level Corrections	− ·27	− ·59	− ·34	+ ·34	+ ·77
Corrected Means	− 21 45 23·86	24·94	25·55	23·04	21·62
Az. of Star fr. S., by W.	178 28 16·94	16·71	16·49	15·59	14·80
Az. of Ref. M. „	156 42 53·08	51·77	50·94	52·55	53·18

		° ' "
Astronomical Azimuth of Referring Mark	by Eastern Elongation	156 42 52·17
	by Western „	„ 52·30
	Mean	„ 52·24
Angle Referring Mark and XXVII (Sirad) *see* page 34		− 3 19 9·66
Astronomical Azimuth of Sirad by observation		153 23 42·58
Geodetical Azimuth of „ by calculation from that adopted (*Vol.* II, page 141) at Kaliánpur, *see* page 94 *ante*		153 23 43·23
Astronomical—Geodetical Azimuth at XXVI (Jambo)		− 0·65

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

NOTE.—Where observations occurred on the same pair of zeros on different nights they are reduced in this abstract to one date—the most convenient—by allowing for star's change of place. The date so adopted appears at the head of the column, and the reduced observation is preceded by an asterisk.

At XLIII (Mugrala)

Lat. N. 28° 30′ 57″·06; Long. E. 72° 24′ 44″·59 = 4h 49m 39s·0; Height above Mean Sea Level, 517 feet.
February 1875; observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No. 2.

Stars observed	α Ursæ Minoris (West) and No. 1612† (East).	
Mean Right Ascension 1875·0	1h 12m 59s	13h 46m 0s
Mean North Polar Distance 1875·0	1° 21′ 26″·18	6° 37′ 14″·77
Local Mean Times of Elongation, Feb. 15	Western 9h 28m	Eastern 10h 19m

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark − Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark − Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Feb. 15	W.	180 25	− 61 45 58·40	12 19	+ 0 7·99	− 61 45 50·41	− 61 46 15·62	20 12	+ 0 21·50	− 61 45 54·12
		&	45 51·22	9 47	0 5·05	46·17	46 11·18	18 26	0 17·93	53·25
		0 25	45 50·42	6 53	0 2·49	47·93	45 50·40	1 50	0 0·18	50·22
			45 52·62	9 28	0 4·72	47·90	45 49·58	0 30	0 0·01	49·57
			46 6·22	17 44	0 16·55	49·67	46 17·64	21 45	0 24·90	52·74
" 15	E.	180 25	− 70 50 55·68	2 17	− 0 1·34	− 70 50 57·02	− 70 48 52·54	22 29	− 2 8·91	− 70 50 61·45
		&	50 54·50	0 8	0 0·00	54·50	49 16·24	20 3	1 42·56	58·80
		0 25	50 14·42	12 10	0 38·08	52·50	50 53·66	5 7	0 6·72	60·38
			50 3·64	13 57	0 50·11	53·75	50 47·54	7 1	0 12·66	60·20
			49 18·78	19 27	1 37·65	56·43	48 33·80	23 55	2 27·67	61·47
" 16	W.	259 37	− 61 45 51·22	4 6	+ 0 0·89	− 61 45 50·33	− 61 46 0·32	13 2	+ 0 8·95	− 61 45 51·37
		&	45 48·68	1 52	0 0·18	48·50	46 2·70	10 58	0 6·35	56·35
		79 37	45 53·92	11 25	0 6·86	47·06	45 57·16	4 32	0 1·08	56·08
			45 56·70	13 32	0 9·64	47·06	45 58·10	6 19	0 2·10	56·00
			46 11·58	20 7	0 21·29	50·29	46 26·70	24 32	0 31·67	55·03
" 16	E.	259 37	− 70 50 53·50	4 51	− 0 6·03	− 70 50 59·53	− 70 49 55·98	16 42	− 1 11·18	− 70 50 67·16
		&	50 53·06	2 33	0 1·66	54·72	49 21·16	12 57	0 42·90	64·06
		79 37	50 11·38	12 56	0 43·09	54·47	50 32·24	11 2	0 31·14	63·38
			49 57·66	14 51	0 56·87	54·53	50 59·62	3 45	0 3·61	63·23
			48 55·28	21 29	1 59·14	54·42	50 53·24	6 12	0 9·90	63·14
" 18	W.	338 49	− 61 46 0·02	3 20	+ 0 0·59	− 61 45 59·43	− 61 46 7·80	15 13	+ 0 12·20	− 61 45 55·60
		&	45 53·14	0 2	0 0·00	53·14	46 0·66	11 22	0 6·82	53·84
		158 49	46 0·70	14 52	0 11·65	49·05	45 56·84	9 52	0 5·13	51·71
			46 5·78	17 3	0 15·30	50·48	46 0·10	5 51	0 1·81	58·29
			46 20·26	22 41	0 27·05	53·21	45 59·46	7 33	0 3·01	56·45
" 18	E.	338 49	− 70 50 49·12	5 43	− 0 8·35	− 70 50 57·47	− 70 49 50·32	16 54	− 1 12·94	− 70 50 63·26
		&	50 52·40	3 53	0 3·88	56·28	50 20·86	12 32	0 40·22	61·08
		158 49	50 36·88	9 6	0 21·27	58·15	50 27·22	10 47	0 29·77	56·99
			50 28·38	10 46	0 29·81	58·19	51 1·90	1 41	0 0·73	62·63
			49 37·50	16 57	1 14·00	51·50	50 57·84	3 39	0 3·42	61·26
" 19	W.	22 1	− 61 45 50·86	5 37	+ 0 1·67	− 61 45 49·19	− 61 46 6·28	17 36	+ 0 16·33	− 61 45 49·95
		&	45 46·34	3 43	0 0·73	45·61	46 1·02	13 46	0 10·00	51·02
		202 1	45 51·20	9 46	0 5·02	46·18	45 56·00	11 7	0 6·52	49·48
			45 52·60	11 50	0 7·38	45·22	45 48·88	1 39	0 0·14	48·74
			46 4·30	17 56	0 16·92	47·38	45 49·76	3 29	0 0·64	49·12

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT				FACE RIGHT			
			Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark − Star at Elongation	Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark − Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Feb. 19	E.	22 1	− 70 49 38·42	17 51	− 1 21·27	− 70 50 59·69	− 70 50 19·92	12 38	− 0 40·80	− 70 50 60·72
		&	50 59·90	1 43	0 0·75	60·65	50 30·76	11 0	0 30·93	61·69
		202 1	50 55·72	3 31	0 3·18	58·90	50 42·90	8 52	0 20·21	63·11
			49 37·26	17 53	1 22·43	59·69	50 17·96	12 30	0 40·25	58·21
			49 18·14	19 43	1 40·28	58·42	47 55·96	26 42	3 4·12	60·08
„ 20	W.	101 13	− 61 45 45·62	0 47	+ 0 0·03	− 61 45 45·59	− 61 45 50·78	5 29	+ 0 1·59	− 61 45 49·19
		&	45 57·86	10 38	0 5·96	51·90	45 55·96	6 12	0 2·02	53·94
		281 13	45 56·02	13 26	0 9·52	46·50	46 11·44	18 2	0 17·12	54·32
			46 35·38	29 21	0 45·30	50·08	46 14·06	19 24	0 19·82	54·24
			46 50·04	34 12	1 1·44	48·60	47 18·92	40 19	1 25·27	53·65
„ 20	E.	101 13	− 70 49 19·42	19 19	− 1 35·28	− 70 50 54·70	− 70 50 49·74	6 47	− 0 11·78	− 70 50 61·52
		&	50 57·30	0 27	0 0·05	57·35	50 55·32	4 53	0 6·10	61·42
		281 13	50 53·92	2 58	0 2·27	56·19	50 45·36	7 18	0 13·69	59·05
			48 38·96	23 1	2 16·69	55·65	50 40·36	8 55	0 20·46	60·82
							47 17·46	29 21	3 42·50	59·96

Abstract of Astronomical Azimuth observed at XLIII (Mugrala), 1875.

1. By Eastern Elongation of No. 1612†.

Face	L	R	L	R	L	R	L	R	L	R
Zero	180°	0°	260°	80°	339°	159°	22°	202°	101°	281°
Date	February 15		February 16		February 18		February 19		February 20	
	″	″	″	″	″	″	″	″	″	″
Observed difference of Circle-Readings, Ref. M. − Star reduced to Elongation	57·02	61·45	59·53	67·16	57·47	63·26	59·69	60·72	54·70	61·52
	54·50	58·80	54·72	64·06	56·28	61·08	60·65	61·69	57·35	61·42
	52·50	60·38	54·47	63·38	58·15	56·99	58·90	63·11	56·19	59·05
	53·75	60·20	54·53	63·23	58·19	62·63	59·69	58·21	55·65	60·82
	56·43	61·47	54·42	63·14	51·50	61·26	58·42	60·08		59·96
Means	54·84	60·46	55·53	64·19	56·32	61·04	59·47	60·76	55·97	60·55

	° ′ ″	″	″	″	″
Means of both faces	− 70 50 57·65	59·86	58·68	60·12	58·26
Level Corrections	− 2·05	− ·21	− ·70	− ·18	− ·03
Corrected Means	− 70 50 59·70	60·07	59·38	60·30	58·29
Az. of Star fr. S., by W.	187 32 48·85	48·69	48·38	48·22	48·06
Az. of Ref. M. „	116 41 49·15	48·62	49·00	47·92	49·77

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

Abstract of Astronomical Azimuth observed at XLIII (Mugrala) 1875—(*Continued*).

2. By Western Elongation of α Ursæ Minoris.

Face	L	R	L	R	L	R	L	R	L	R
Zero	180°	0°	260°	80°	339°	159°	22°	202°	101°	281°
Date	February 15		February 16		February 18		February 19		February 20	
	″	″	″	″	″	″	″	″	″	″
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	50·41	54·12	50·33	51·37	59·43	55·60	49·19	49·95	45·59	49·19
	46·17	53·25	48·50	56·35	53·14	53·84	45·61	51·02	51·90	53·94
	47·93	50·22	47·06	56·08	49·05	51·71	46·18	49·48	46·50	54·32
	47·90	49·57	47·06	56·00	50·48	58·29	45·22	48·74	50·08	54·24
	49·67	52·74	50·29	55·03	53·21	56·45	47·38	49·12	48·60	53·65
Means	48·42	51·98	48·65	54·97	53·06	55·18	46·72	49·66	48·53	53·07

	February 15	February 16	February 18	February 19	February 20
	° ′ ″	″	″	″	″
Means of both faces	− 61 45 50·20	51·81	54·12	48·19	50·80
Level Corrections	− 1·21	+ ·34	+ 1·12	− 1·36	− ·03
Corrected Means	− 61 45 51·41	51·47	53·00	49·55	50·83
Az. of Star fr. S., by W.	178 27 40·43	40·20	39·97	39·74	39·51
Az. of Ref. M. „	116 41 49·02	48·73	46·97	50·19	48·68

		° ′ ″
Astronomical Azimuth of Referring Mark	by Eastern Elongation	116 41 48·89
	by Western „	„ 48·72
	Mean	„ 48·81
Angle Referring Mark and XLVI (Habib) *see* page 47		+ 55 11 42·04
Astronomical Azimuth of Habib by observation		171 53 30·85
Geodetical Azimuth of „ by calculation from that adopted (*Vol.* II, page 141) at Kaliánpur, *see* page 95 *ante*		171 53 32·98
Astronomical—Geodetical Azimuth at XLIII (Mugrala)		− 2·13

October 1878.

J. B. N. HENNESSEY,
In charge of Computing Office.

PLATE 1.

JODHPORE MERIDIONAL SERIES.

Fig. No. 4

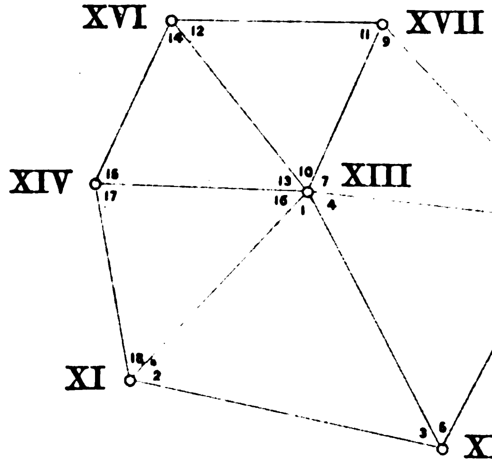


Fig. No. 3

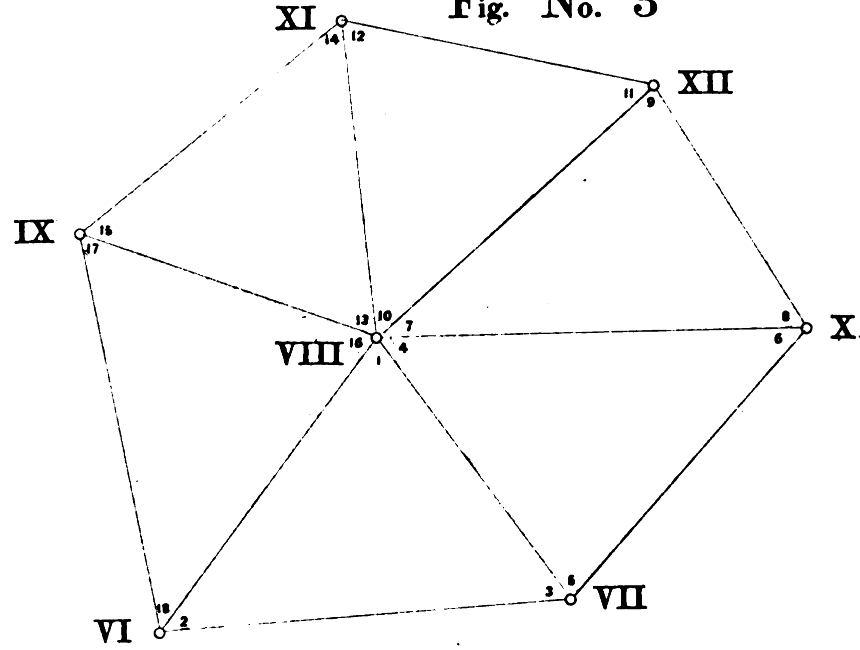


Fig. No. 2

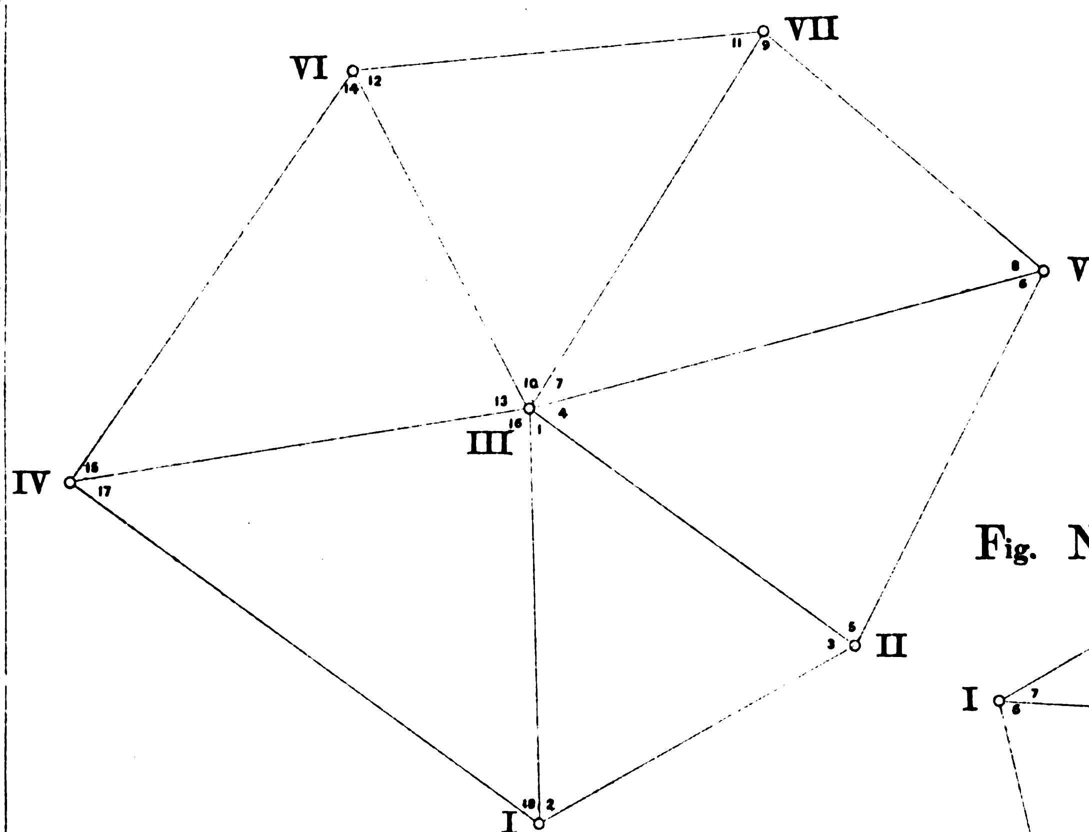
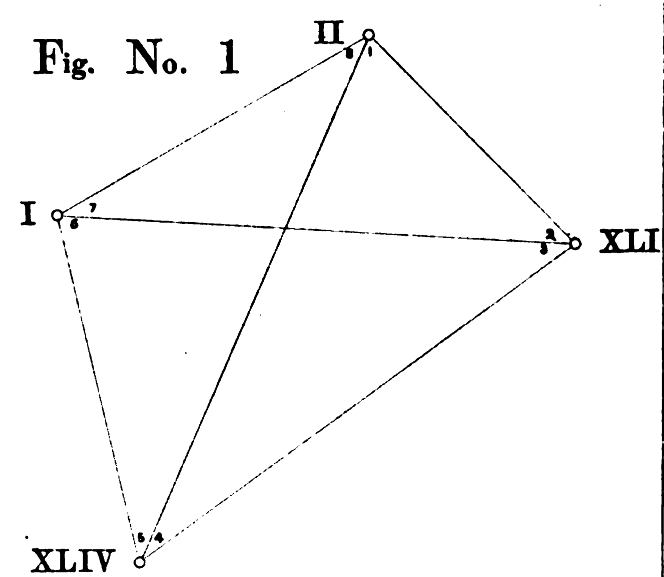


Fig. No. 1



Scale 1 Inch = 12 Miles or $\frac{1}{760320}$

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, March 1886.

Sibba Ram, Photo. C. G. Ollenbach, Zinco.

PLATE 2.

JODHPORE MERIDIONAL SERIES

Fig. No. 13

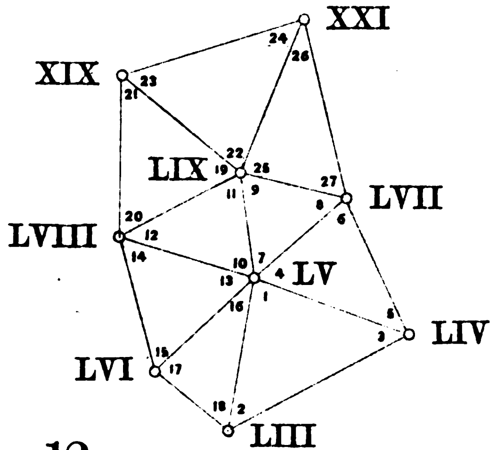


Fig. No. 10

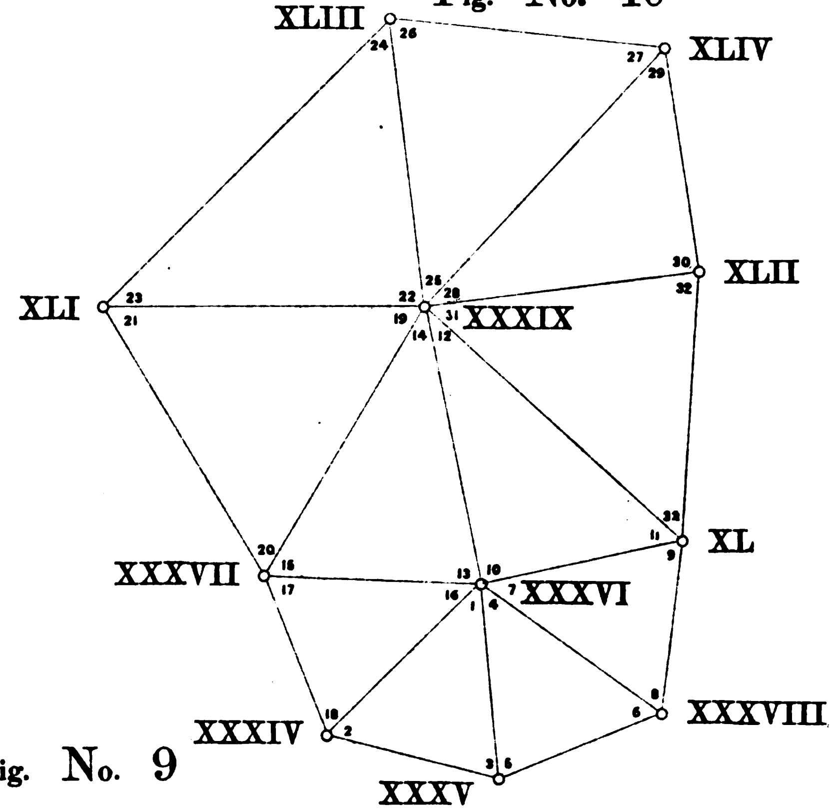


Fig. No. 12

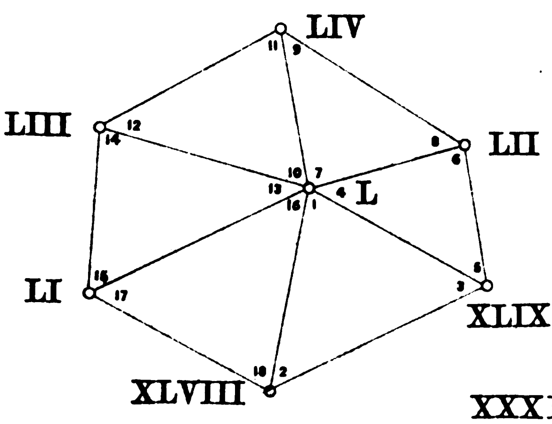


Fig. No. 9

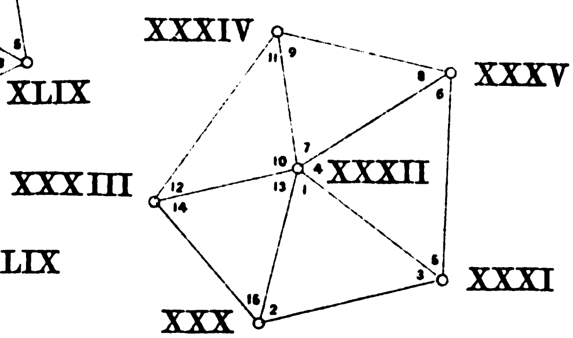


Fig. No. 8

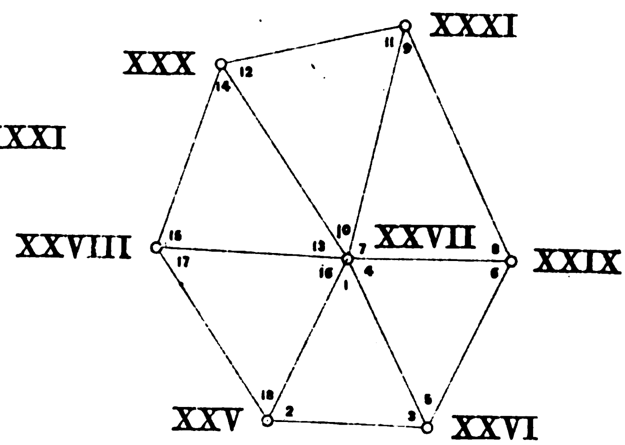


Fig. No. 11

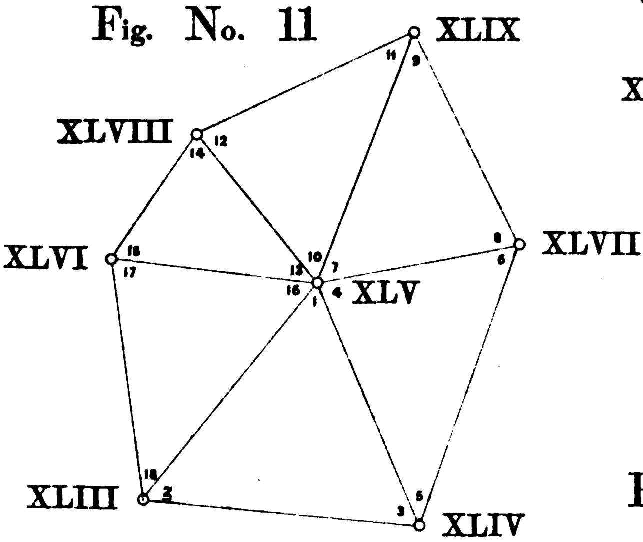


Fig. No. 5

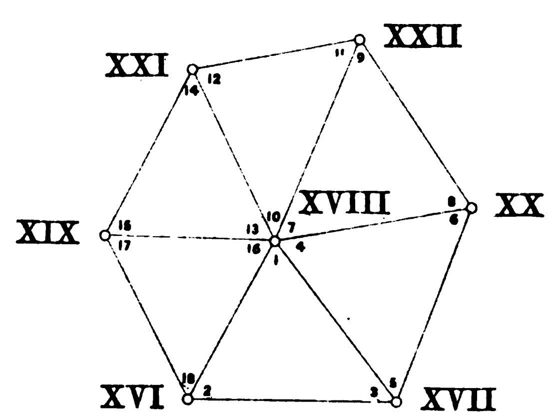


Fig. No. 6

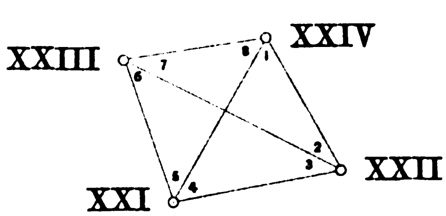
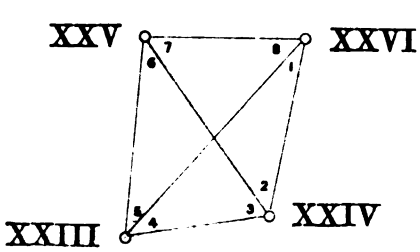


Fig. No. 7



Scale 1 Inch = 12 Miles or $\frac{1}{760320}$

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dun, March 1886.

Sibba Ram, Photo. C. G. Ollenbach, Zinco.

EASTERN SIND MERIDIONAL SERIES.

EASTERN SIND MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. ALPHABETICAL LIST OF STATIONS.

Arrabhit	XXII.
Asu	XXXI.
Badhor	XV.
Bándri	XXV.
Bhádi	V.
Bhitala	X.
Bitri	XXXII.
Chánga	II.
Chauki	XXXV.
Dáowála (Of the Great Indus Series).	LXII.
Dewari	XLVIII.
Dhanono	XXIV.
Fulrár	I.
Ghundi	LI.
Girája	XXVIII.
Got Mír Muhammad	XLVII.
Harnáo	XXIII.
Hatodan	VI.
Jeysulmere	XIII.
Joganali	XIX.
Kanakotri	VIII.
Kardo	XX.
Kháro	XXXVI.
Kiraríwáro	XL.
Kolu	XXXIV.
Kot Sabzal	XLIX.
Kubba	L.
Longwáli	XLV.
Máchka (Of the Great Indus Series).	LIX.
Máhu	XXVII.
Malar	XIV.
Mangtor	IX.
Mári	XLI.
Máringra	XXIX.
Morgich	XXXVII.
Narhar	XI.
Narithal	IV.
Núrpír	XLIII.
Parethal	XXXIII.
Patatonk	III.
Potanawári	XVIII.
Ramsar	XVI.
Ráviláhu	XXVI.
Rojhra (Of the Karáchi Longitudinal Series).	LXXV.
Rupihar	VII.
Sanahu	XXI.
Sandohar (Of the Karáchi Longitudinal Series.)	LXXVIII.
Sinaba	XVII.
Singra	XXX.
Thakur	XII.
Thar Muhári	XXXIX.
Trisingh	XXXVIII.
Vijnot	XLIV.
Vín	XLVI.
Yáru	XLII.

EASTERN SIND MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. NUMERICAL LIST OF STATIONS.

LXXV	Rojhra. (Of the Karáchi Longitudinal Series).
LXXVIII	Sandohar. (Of the Karáchi Longitudinal Series).
I	Fulrár.
II	Chánga.
III	Patatonk.
IV	Narithal.
V	Bhádi.
VI	Hatodan.
VII	Rupihar.
VIII	Kanakotri.
IX	Mangtor.
X	Bhitala.
XI	Narhar.
XII	Thakur.
XIII	Jeysulmere.
XIV	Malar.
XV	Badhor.
XVI	Ramsar.
XVII	Sinaba.
XVIII	Potanawári.
XIX	Joganali.
XX	Kardo.
XXI	Sanahu.
XXII	Arrabhit.
XXIII	Harnáo.
XXIV	Dhanono.
XXV	Bándri.
XXVI	Ráviláhu.
XXVII	Máhu.
XXVIII	Giràja.
XXIX	Máringra.
XXX	Singra.
XXXI	Asu.
XXXII	Bitri.
XXXIII	Parethal.
XXXIV	Kolu.
XXXV	Chauki.
XXXVI	Kháro.
XXXVII	Morgich.
XXXVIII	Trisingh.
XXXIX	Thar Muhári.
XL	Kirariwáro.
XLI	Mári.
XLII	Yáru.
XLIII	Núrpír.
XLIV	Vijnot.
XLV	Longwáli.
XLVI	Vín.
XLVII	Got Mír Muhammad.
XLVIII	Dewari.
XLIX	Kot Sabzal.
L	Kubba.
LI	Ghundi.
LIX	Máchka. (Of the Great Indus Series).
LXII	Dáowála. (Of the Great Indus Series).

EASTERN SIND MERIDIONAL SERIES.

DESCRIPTION OF PRINCIPAL STATIONS.

Of the 51 Principal Stations composing this Series, those numbered I to XLIII and XLVII are situated on sand hills. Each consists of a solid, circular, isolated pillar of masonry surrounded by an annular wall, the pillar being sunk to a depth of 3 feet, and having its upper surface flush with the hill top. In the centre and upper surface of the pillar a mark (circle and dot) engraved either on stone or brick, was imbedded in the normal of one or two other similar marks previously inserted within the pillar. Stations LXXV and LXXVIII of the Karáchi Longitudinal Series are similar in construction to those above described, with the exception that the pillars are not sunk but rise above the hill tops and are surrounded by platforms about 14 feet square for the observatory tent to stand on. The remainder with stations LIX and LXII of the Great Indus Series, on which this Series closes, are tower stations. Each consists of either a solid or perforated central pillar surrounded by solid towers of sun-dried bricks set in mud cement for the accommodation of the observatory tent: the pillars themselves are composed of rectangular blocks of masonry surmounting one another, each succeeding block being contracted, so as to leave a plinth at its base, the uppermost block, for the theodolite to stand on, is circular, $3\frac{1}{3}$ feet in diameter, and isolated from the tower. The solid pillars have marks, as already described, at top and bottom and others intermediately, the perforated pillars have a mark imbedded at about the level of the floor and another below in the foundation. In the case of perforated pillars access to the upper mark is obtained by a vaulted passage, especially constructed for the purpose, through the tower and the central pillar. The upper mark-stones, where the pillars are solid, are protected by a rectangular pyramidal pillar of masonry erected after the completion of the observations, and bearing a sufficiently accurate mark for Topographical and Revenue Survey purposes—as shown at page 74 of Volume II of the *Account of the Operations &c.*

The following descriptions have been compiled from those given by the officers who executed the Series. The orthography of such names of parganas, districts &c., as has been fixed by Government for Rajputana and Sind has been adhered to. A few details, such as the name of a village or pargana within which a station is situated, have been obtained from the returns furnished by the political authorities to whose charge the stations have been committed.

LXXV.—(*Of the Karáchi Longitudinal Series*). Rojhra Hill Station, lat. 24° 57′, long. 70° 17′—observed at in 1851 and 1876—is situated on a high, narrow hill $1\frac{1}{4}$ miles west of the road from Cháchra to Islámkot. The hill lies in that part of the Thar or little desert which appertains to Bhuj. It is in the lands of Rohrara village, taluka Cháchra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid and 3 feet high. It contains three mark-stones, one at the foundation, another 2 feet above it, and the third at the surface of the pillar. When visited in 1876 for originating the Eastern Sind Meridional Series, the pillar was found in good order and the upper mark-stone intact, and no alteration in the construction of the station was made. The azimuths and distances of the circumjacent villages are:—Pariara 143°, miles 3·4; and Dhakla 297°, miles 2.

LXXVIII.—(*Of the Karáchi Longitudinal Series*). Sandohar Hill Station, lat. 25° 3′, long. 70° 1′—observed at in 1851 and 1876—is situated on a narrow and extensive hill in that portion of the Thar or little desert appertaining to Bhuj, about 2 miles N. of the road from Cháchra to Chelár. It is in the lands of Akli village, taluka Cháchra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid and 3 feet high. It contains three mark-stones, one at the foundation, another 2 feet above, and the third at the upper surface of the pillar. When visited in 1876 for originating the Eastern Sind Meridional Series, the pillar was found in good preservation, but there was no upper mark: on cutting into the pillar the second mark on stone was found intact one foot below the surface. The pillar was then re-built to its original height and a new mark was placed in its upper surface one foot above and in the normal of the mark found. The azimuths and distances of the circumjacent villages are:—Sandohar 88°, mile 0·5; and Arnára 198°, mile 1.

I. Fulrár Hill Station, lat. 24° 53′, long. 70° 6′—observed at in 1876—is on a high and narrow sand hill in that portion of the Thar or little desert appertaining to Bhuj. It is in the lands of Fulrár village, taluka Cháchra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains two mark-stones, one at the bottom and the other 3 feet above it at the surface of the pillar. This station is nearly identical with station LXXVI of the Karáchi Longitudinal Series established in 1851, which was found almost totally destroyed in 1876. The centre of the old pillar was determined from the lowest layer of bricks indicating its circumference. The azimuths and distances of the circumjacent villages are:—Fulrár 157°, mile 1; Dhurio 10°, miles 2; and Bisasar 44°, miles 4.

II. Chánga Hill Station, lat. 24° 59′, long. 69° 54′—observed at in 1876—is situated on a sand hill bearing that name in that portion of the Thar or little desert appertaining to Bhuj. It lies 1½ miles S.W. of the road from Chelár to Nabisar. The nearest good water is at Asar 2·4 miles S.E. The station is in the lands of Chelár village, taluka Cháchra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid and 3½ feet deep. It contains three marks, two on stone, one at the foundation, the other 1½ feet above it, and the third on brick at the surface of the pillar. This station is nearly identical with station LXXX of the Karáchi Longitudinal Series established in 1851, which was found entirely destroyed. The present pillar is erected on the ruins of the base of the old pillar. The azimuths and distances of the circumjacent villages are:—Chelár 275°, miles 3·8; and Jojar 263°, miles 4·5.

III. Patatonk Hill Station, lat. 25° 10′, long. 69° 48′—observed at in 1876—is situated on a hill peak midway between the high roads from Umarkot to Nabisar and Chelár, 7 miles E. of the former and the same distance W. of the latter, and 4 miles E. of the plains of Sind. It is in the lands of Pata village, taluka Cháchra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three marks, two on stone, one at the foundation, the other 1 foot above it, and the third on brick at the surface of the pillar. The station mark at the foundation was originally fixed in the course of the execution of the Umarkot Minor Series of the Karáchi Longitudinal Series. Pata (Ali Akbar) well azimuth 187°, mile 0·5.

IV. Narithal Hill Station, lat. 25° 16′, long. 69° 55′—observed at in 1876—is situated on a sand hill of the same name. The high road from Umarkot to Cháchra runs 1½ miles W. and that to Kesar 4 miles N. It is in the lands of Kacholi village, taluka Umarkot, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The station is identical with that of the Umarkot Minor Series of the Karáchi Longitudinal Series, the marks being plumbed over the old station mark. The azimuths and distances of the circumjacent places are:—Ajba well 205°, mile ½; and Rojhra or Rodhar well 36°, miles 2.

V. Bhádi Hill Station, lat. 25° 15′, long. 70° 14′—observed at in 1876—is situated on a high, narrow and very long sand hill, 2 miles E.N.E. of Bhádi sweet-water well. Gatta village and well lie at the foot of the hill to the N.W. The road from Umarkot to Kesar runs about 7 miles N. It is in the lands of Bhádi village, taluka Cháchra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three marks, the upper engraved on stone is let into the surface of the pillar, and two others on bricks are 2 and 3 feet respectively below it. The azimuths and distances of the circumjacent villages are:—Bhádi 75°, miles 2; and Gatta 230°, mile 1.

VI. Hatodan Hill Station, lat. 25° 30′, long. 69° 52′—observed at in 1876—is situated on the northern extremity of a long sand hill running in the usual direction and terminating abruptly towards the north, about $1\frac{3}{4}$ miles W. of the road from Umarkot to Ranáhu village, 3 miles W. of the low ground inundated by the Nára river, and $2\frac{1}{2}$ miles S.E. of Sínai (new) sweet-water wells. It is in the lands of Chor village, taluka Umarkot, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar. The azimuths and distances of the circumjacent places are :—Kerlo sweet-water well 280°, miles $1\frac{1}{2}$; Chor village old (Sínai) 134°, miles 4; and Chor village new 186°, miles 2·2.

VII. Rupihar Hill Station, lat. 25° 27′, long. 70° 5′—observed at in 1876—is situated on a sand hill 1 mile north of the village so called on the high road from Umarkot to Gadra and Balmer. It is in the lands of Rupihar village, taluka Umarkot, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three marks, the upper engraved on stone is flush with the surface of the pillar, and two others on brick are 2 and 3 feet respectively below it. Rupihar well azimuth $23\frac{1}{2}$°, mile 0·9.

VIII. Kanakotri Hill Station, lat. 25° 30′, long. 70° 17′—observed at in 1876—is situated on a high sand hill about $3\frac{1}{2}$ miles S. E. of the road from Umarkot to Kesar village. It is in the lands of Kanakotri village, taluka Umarkot, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three marks, the upper engraved on stone flush with the surface of the pillar, and two others on brick 2 and 3 feet respectively below it. The azimuths and distances of the circumjacent villages are :—Jagmal 174°, miles 1·5 ; and Silali 104°, mile 0·7.

IX. Mangtor Hill Station, lat. 25° 39′, long. 69° 57′—observed at in 1877—is situated on a low flat hill, about 2 miles S. of the well of the same name, and 5 miles E. of the road from Chor and Umarkot to Ránáhu. It is in the lands of Mangtor village, taluka Umarkot, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall $1\frac{1}{2}$ feet thick, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three marks, one at the foundation, another 1 foot above it, and the third on the surface of the pillar. The azimuths and distances of the circumjacent wells are :—Goedani 48°, miles 4 (by road 4·7 miles) ; Bandho 48°, miles 6·7; and Mangtor 180°, miles 2.

X. Bhitala Hill Station, lat. 25° 39′, long. 70° 11′—observed at in 1877—is situated on a long, narrow sand hill running N. E. and S. W., about 3 miles S. W. by S. of Khuiri or Khokro village, and 3 miles S. of Lapla well. It is in the lands of Khara Lapla village, taluka Umarkot, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar. The azimuths and distances of the circumjacent wells are :—Datura 133°, miles 8·5 ; and Somo 157°, miles 8·9.

XI. Narhar Hill Station, lat. 25° 51′, long. 69° 57′—observed at in 1877—is situated on the hill on which the Revenue Survey station of Bamniwáro formerly existed, and about $5\frac{1}{2}$ miles E. of the road from Umarkot and Chor to Ránáhu. It is in the lands of Narhar village, taluka Khipra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall $1\frac{1}{2}$ feet thick, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another one foot above it, and the third on the surface of the pillar. Narhar village distant 1·6 miles, azimuth 68°.

XII. Thakur Hill Station, lat. 25° 50′, long. 70° 10′—observed at in 1877—is situated on a sand ridge, about 3 miles W. of the boundary between Jodhpore and Sind. It is in the lands of Juma village, taluka Khipra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall $1\frac{1}{2}$ feet thick, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar. The azimuths and distances of the circumjacent places are :—Katarlo well 345°, miles 3; Tar Rang Dahar (large village) 152°, miles $5\frac{1}{2}$; Marwar village 258°, miles 5; and Juma well 69°, miles 2. It is identical with the Revenue Survey station of the same name.

XIII. Jeysulmere Hill Station, lat. 26° 5′, long. 69° 54′—observed at in 1877—was situated on the highest elevated sand knoll of the Jeysulmere draen (a tract of shifting sand) which extends for a space of about 50 square miles and has in parts sand knolls of considerable height. It was close to the Revenue Survey station of the same name. There are two wells of good water in the draen, about $\frac{3}{4}$ and $1\frac{1}{2}$ miles respectively W. of the site of the station, which is in the lands of Lodhar village, taluka Khipra, district Thar and Párkar.

The masonry pillar, which was surrounded by an annular wall, was solid, 5 feet deep and $3\frac{1}{2}$ feet in diameter. It contained three mark-stones, one at the foundation, another 2 feet above it, and the third on the surface of the pillar. Lodhar village is distant 3·6 miles, azimuth 77°. This station was reported by the district officer in May 1879 to have been completely carried away by the shifting sand, the *debris* were collected and heaped together close to the original site.

XIV. Malar Hill Station, lat. 26° 2′, long. 70° 6′—observed at in 1877—is situated on the lowest and southernmost of three sand hills about a mile distant from each other, named after a hamlet about 2 miles to N.W., and 2 miles W. of the boundary between Sind and Marwar. It is in the lands of Saiadáhu village, taluka Khipra, district Thar and Párkar.

The masonry pillar, which is surrounded by an annular wall $1\frac{1}{2}$ feet thick, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar. Saiadáhu village, on the road from Khipra to Jeysulmere town, is distant 4 miles, azimuth 128°.

XV. Badhor Hill Station, lat. 26° 0′, long. 70° 20′—observed at in 1877—is situated on a high sand hill in division Giraub, taluka Shiu, territory Jodhpore.

The masonry pillar, which is surrounded by an annular wall $1\frac{1}{2}$ feet thick, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar. The azimuths and distances of the circumjacent places are:—Saijado well 217°, miles 3; and Sundra 143°, miles 10.

XVI. Ramsar Hill Station, lat. 26° 13′, long. 70° 2′—observed at in 1877—is situated on a hill 2 miles N. of the boundary between Thar and Párkar and Khairpur State. It is in lands of Wuriáhu village, Khairpur State, Sind.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar which is flush with the hill top. The azimuths and distances of the circumjacent villages are:—Ramsar Bhil 325°, mile 1; and Wuriáhu 175°, miles 2.

XVII. Sinaba Hill Station, lat. 26° 12′, long. 70° 14′—observed at in 1877—is situated on the northern summit of a long sand ridge, about 4 miles N.E. of Khara well and a mile N.W. of the path from Saidáhu to Jeysulmere town, which passes by Khara. The nearest good water is at Saidáhu, 14 miles S.W. It is in village and division of Mehájliar, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar which is flush with the hill top. The azimuths and distances of the circumjacent places are:—Badhi Baor hill (close to which is the quadri-junction pillar of Thar and Párkar, Jeysulmere, Khairpur and Jodhpore) 36°, miles 4; Sundra (in Jodhpore) 340°, miles 9; and Mehájliar (in Jeysulmere) 250°, miles 12.

XVIII. Potanawári Hill Station, lat. 26° 24′, long. 69° 56′—observed at in 1877—is situated on a low sand hill 2 miles W. 19° N. of Bakshiwári village. It is in the lands of Bakshiwári village, Khairpur State, Sind.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar which is flush with the hill top. The azimuths and distances of the circumjacent places are:—Juma wells 332°, miles 2 and 3; Chanáhu well 116°, miles 1·6; Raknáhu well 255°, miles 3·3; and Bakshiwári village 289°, miles 2·3.

XIX. Joganali Hill Station, lat. 26° 25′, long. 70° 6′—observed at in 1877—is situated on the second highest hill in the locality, about $1\frac{1}{2}$ miles S.E. of Gauj Sing's wand and the same distance S.W. of Gagu hill which is the highest in this part of the country. It is in the lands of Sartanáhu village, Khairpur State, Sind.

The masonry pillar, which is surrounded by an annular wall, is solid, $3\frac{1}{2}$ feet deep and $3\frac{1}{2}$ feet in diameter. It contains three mark-stones, one at the foundation, another $1\frac{1}{2}$ feet above it, and the third $3\frac{1}{2}$ feet above, on the surface of the pillar which is flush with the ground. Azimuth and distance of Sartanáhu village are 54°, miles 4·8.

XX. Kardo Hill Station, lat. 26° 24′, long. 70° 17′—observed at in 1877—is situated on a long sand ridge running N.E. and S.W. in the lands of Kardo (Karora) village, division Mehájliar, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third on the surface of the pillar which is flush with the hill top. The azimuths and distances of the circumjacent places are:—Pochina well 350°, miles 2; and Komprajro Par 27°, miles 8½; and Kardo or Karora village 204°, miles 2·2.

XXI. Sanahu Hill Station, lat. 26° 34′, long 70° 1′—observed at in 1877—is situated on a sand hill conspicuous from its having several large trees on it, about ⅛ of a mile N. E. of a well so called, and 2 miles S. of the boundary between Khairpur and Jeysulmere. To the west, north and south there are extensive draens. It is in the lands of Sanahu village, Khairpur State, Sind.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The azimuth and distance of Sumráhu village are 353°, miles 5½.

XXII. Arrabhit Hill Station, lat. 26° 34′, long. 70° 12′—observed at in 1877—was situated on a long sand hill, about 200 yards N.E. of the boundary between Jeysulmere and Khairpur, and 4 miles N.E. of Sonhar village. It is in the lands of Shem village, Jeysulmere State.

The masonry pillar, which was surrounded by an annular wall, was solid, 3 feet deep and 3½ feet in diameter. It contained three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar which was flush with the hill top. The azimuths and distances of the circumjacent villages are:—Petrio 49°, miles 2½; Sumráhu 61°, miles 12. This station was reported in 1880 by the District Officer as totally destroyed.

XXIII. Harnáo Hill Station, lat. 26° 44′, long. 69° 59′—observed at in 1877—was situated on the highest knoll of the draen called after the well of Harnáo about 1½ miles east. It was in the lands of Harnáo village, taluka Sháhgarh, Jeysulmere State.

The masonry pillar, which was surrounded by an annular wall, was solid, 5 feet deep and 3½ feet in diameter. It contained three mark-stones, one at the foundation, another 2 feet above it, and the third flush with the surface of the pillar. The directions and distances of the circumjacent places are:—Harnhár conspicuous sand-hill N.N.E., miles 4; Saunhar well E.N.E., miles 8; Kharodi well W., mile 1. This station was reported by Major Rogers in 1880 to have been completely carried away by the shifting sand.

XXIV. Dhanono Hill Station, lat. 26° 45′, long. 70° 13′—observed at in 1877—is situated on the highest part of a long sand ridge, about 5 miles N.W. of Dhanono well, 9 miles E.S.E. of Saunhar well, and 8 miles S.S.W. of Bhoiána well. It is in the lands of Dhanono village, division Shem, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXV. Bándri Hill Station, lat. 26° 55′, long. 69° 52′—observed at in 1877—is situated on a sand hill, which, though low, is the highest for some miles around. It is in the midst of draens, the largest of which is to the west and extends to the foot of the station hill. Saira well is 4·7 miles to the west. The station is in the lands of Bándri well, division Sháhgarh, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXVI. Ráviláhu Hill Station, lat. 26° 52′, long. 70° 5′—observed at in 1877 and 1880—is situated on the highest sand hill in the vicinity. Ráviláhu fresh water well is distant 1·5 miles and Saunhar well 5·7 miles. It is in the lands of Ráviláhu well, taluka Sháhgarh, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. When again visited in 1880 for continuing the Series northwards, the station was found in good order and the upper mark-stone intact, and no alteration in its construction is stated to have been made.

XXVII. Máhu Hill Station, lat. 27° 5′, long. 69° 48′—observed at in 1880—is situated on a sand hill which is also called Ramúwáribhit from the toba (or tank) of that name at its N.W. foot. About 3¼ miles W. of Máhu well. Maiha conspicuous Tar tree on a draen is distant 4 miles. The station is in the lands of Máhu well, taluka Sháhgarh, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXVIII. Girája Hill Station, lat. 27° 2′, long. 70° 3′—observed at in 1880—is situated on a high sand hill 8 miles S.S.W. of the village of Sháhgarh, and 3 miles E. of Girája well. It is in the lands of Girája well, taluka Sháhgarh, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXIX. Máringra Hill Station, lat. 26° 59′, long. 70° 15′—observed at in 1880—is situated on the highest part of a long sand hill, 4·6 miles S. of Mírwála well; and about 3 miles W. of Máringra well. It is in the lands of Máringra well, taluka Shem, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXX. Singra Hill Station, lat. 27° 14′, long. 70° 1′—observed at in 1880—stands on a rather conspicuous sand hill midway between the villages of Sháhgarh and Gotaru, the road between them passing by the eastern base of the hill. The nearest fresh water is obtained from a small well on the north side of the Sháhgarh draen, distant about 6 miles. The station is in the lands of Sháhgarh village, taluka Sháhgarh, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The directions and distances of the following places are:—Gotaru fort N., miles 8; and Sháhgarh village S., miles 8.

XXXI. Asu Hill Station, lat. 27° 11′, long. 70° 13′—observed at in 1880—is situated on a sand hill known in the neighbourhood as Báwalwála, which has several of equal or even greater height near it. The road from Gotaru to Jeysulmere, *viá* Khiwála, passes about 8 miles N. Asu well is distant about 5 miles. The station is in the lands of Asu well, taluka Khiwála (Kháro), Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXXII. Bitri Hill Station, lat. 27° 23′, long. 69° 59′—observed at in 1880—is situated on a sand hill locally known as Saian-ki-Khabri, about 1½ miles S. of the path from Gotaru to Mitrau in Sind, and 4 miles E. of the Sind boundary. Gotaru fort and village, the nearest places for water, are about 7½ miles S.E. by E. The station is in the lands of Gotaru village, taluka Gotaru, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXXIII. Parethal Hill Station, lat. 27° 22′, long. 70° 8′—observed at in 1880—is situated on the highest sand hill in the neighbourhood, which is not much above the general level of the country, about ½ mile E. of the path from Gotaru to Hingora well. Gotaru fort, at which fresh water is obtained, is distant 5 miles S.W. The station is in the lands of Gotaru village, taluka Gotaru, Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXXIV. Kolu Hill Station, lat. 27° 25′, long. 70° 20′—observed at in 1880—is situated on a low sand hill locally called Baurawála, about 2½ miles E. of Kolu well, and 7 miles distant in the same direction from Hassu and Hakara wells. It is in the lands of Kolu well, taluka Khiwála (Kháro), Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXXV. Chauki Hill Station, lat. 27° 34′, long. 69° 56′—observed at in March and December 1880—is situated on the top of the sand hill which rises about 120 feet above the adjacent hollows. Fresh water is available from the Kiridi wells, 12 miles to N. The station is in Deh Sutiyáro, taluka Mirpur, district Shikárpur.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. When again visited in December 1880 for continuing the Series northwards, "the station was evidently in perfect order, and the upper mark-stone intact," and no alteration in its construction is stated to have been made. The directions and distances of the circumjacent places are:—Ditta-ka-Toba N.E., mile ¾; Korárdara N.W., miles 3; Sháhbáz Khán Wali Toba S.S.W., miles 2; Bandli N, miles 9; and Sone-ka-Dara (Daro Sono) W.S.W., miles 2.

XXXVI. Kháro Hill Station, lat. 27° 33′, long. 70° 8′—observed at in 1880—is situated on a flat-topped sand hill called by the natives Koudíwáladara from the tank at its northern base. The road from Kháro to Bandli in Sind passes 2 miles S. of the station. Kháro ruined fort is distant 3¾ miles S.S.E., and Hingora well 7 miles S. Drinking water must be brought from Hassu well, about 12 miles S.E. It is in the lands of Hingora village, taluka Khiwála (Kháro), Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXXVII. Morgich Hill Station, lat. 27° 35′, long. 70° 17′—observed at in 1880—is situated on a small sand hill west of and close to the track from Kolu well to Khairgarh in Sind, and about 5 miles N. of the Karibhar well. It is in the lands of Karibhar well, taluka Khiwála (Kháro), Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar.

XXXVIII. Trising Hill Station, lat. 27° 42′, long. 70° 8′—observed at in March and December 1880—is situated on the northernmost of three high sand hills of that name lying together in the heart of the desert, far from any place. The station is built 200 yards S. of the declivity. The hill is a narrow ridge, 120 feet high, and steep except on the south side; a stone on the boundary of Sind and Jeysulmere, at the S.W. foot of the hill, is distant 1,105 feet W.S.W. from the station. Good water is available from the Kiridi and Sand (Khairgarh) wells in Sind, distant 16 and 14 miles respectively. The station is in the lands of Hingora well, taluka Khiwála (Kháro), Jeysulmere State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The approximate directions and distances of the circumjacent places are:—Islám-ka-Tarái S. by W., miles 3 or 4; Kardo W. by S., miles 3 or 4; and Band Lodi E.N.E., miles 3 or 4. When again visited in December 1880 for continuing the Series northwards, it is presumed from the absence of any remarks in the original records that the station was found in good order and the upper mark-stone intact; and that no alteration in its construction was made.

XXXIX. Thar Muhári Hill Station, lat. 27° 42′, long. 69° 43′—observed at in 1880—is situated on the northern summit of the sand hill of that name which rises to a height of about 100 feet above its base, 1½ miles S.S.W. from the present hamlet. It is in the lands of Saranwáro village, Deh Sutiyáro, taluka Mirpur, district Shikárpur.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The directions and distances of the circumjacent places are:—Saranwáro village N.N.E., miles 1½; Yáru Lund N.W., miles 9½; and Thar Bangáhu well W., miles 1½.

XL. Kiraríwáro Hill Station, lat. 27° 46′, long. 69° 52′—observed at in 1880—is situated on the sand hill locally known as Kír-ri-wáro, about 80 feet high, which stands out from the more desert tract to the south-east, in the Patti or low ground which is still occasionally reached by the (Sind) inundation, and is called Kirari and Kanderawála. It is in Deh Sutiyáro, taluka Mirpur, district Shikárpur.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The directions and distances of the circumjacent places are:—Bandli S.S.E., miles 5; and Janganwáli N.N.E., miles 6.

XLI. Mári Hill Station, lat. 27° 51′, long. 69° 46′—observed at in 1880—is situated on the top of a large sand ridge about 70 feet above the plain, known as Daro Mári from an old deserted hamlet at its south-west foot. It is in the lands of Bhághibhit, Deh Sutiyáro, taluka Mirpur, district Shikárpur.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The directions and distances of the circumjacent places are:—Yáru Lund W.S.W., miles 8; Bhághibhit S.S.E., mile 1; Chanesar E.N.E., miles 5; Chándan N.N.W., miles 9; and Simna or Sinwála N.E., mile 1.

XLII. Yáru Hill Station, lat. 27° 55′, long. 69° 51′—observed at in 1880—is situated on a sand hill, locally known as Chor-ka-Dara, rising about 70 feet above the adjacent ground to its N. and W. It is in Deh Sutiyáro, taluka Mirpur, district Shikárpur.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The directions and distances of the circumjacent places are:—Reti Railway Station N. by E., miles 12½; Chándan Imámwáh W.N.W., miles 8½; Chanesar S.S.W., miles 2½; and Khenju N.E. by E., miles 5¼.

XLIII. Núrpír Hill Station, lat. 27° 55′, long. 70° 2′—observed at in 1880—is situated on the present central summit of the somewhat isolated sand hill of that name which rises to a height of about 120 feet above the ground at its base, about 1½ miles W. by S. of Khairgarh fort, and 330 feet S.S.W. of the piles of old bricks supposed to mark the grave of Núrpír, after whom the place is named. It is in the lands of Deh Poh, taluka Mirpur, district Shikárpur.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3½ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The directions and distances of the circumjacent places are:—Khenju W.N.W., miles 7; Sand wells S.S.E., miles 2; and Khángarh village N., miles 2½.

XLIV. Vijnot Tower Station, lat. 28° 2′, long. 69° 53′—observed at in 1880 and 1881—stands on one of the highest mounds of the ruins of the ancient Hindu town of Vijnot, 3·8 miles S. by W. from the Railway Station of Reti. It is in Deh Vijnot, taluka Mirpur, district Shikárpur.

The station consists of a tower of sun-dried bricks set in mud cement, 20 feet square at base and 14 feet square at top, enclosing a central, perforated pillar of masonry 13 feet high. There are two marks, one engraved on stone is imbedded in the floor (15 feet above ground level) and the other, cut on a large brick, is 3 feet below it in the foundation of the pillar. A vaulted passage especially constructed for the purpose gives access to the upper mark. When again visited in 1881, the station was found in good preservation, the upper mark-stone intact, and no alteration in its construction is stated to have been made. The directions and distances of the circumjacent places are:—Reti village N.W., miles 4·2; and Reninadi W., miles 3¼.

XLV. Longwáli Hill Station, lat. 28° 2′, long. 70° 2′—observed at in 1881—is situated on the N.N.W. summit of the somewhat isolated sand ridge which rises to a height of 80 or 90 feet above the low ground at its base on three sides, *viz.*, the western, northern and eastern. The ridge is known as Rabbanwála Tibba, and among the Játs as Lániwáli Muhár, and is about 1⅜ miles N.E. by E. from the pond called Longwáli Talái, and 11 miles E.S.E. from the Reti Railway Station. The station is in the lands of Lakhíwáh village, tahsíl Sádikabad, Baháwalpur State.

The masonry pillar, which is surrounded by an annular wall, and a platform of earth and brushwood, is solid, 10 feet high and 3½ feet in diameter. It contains five mark-stones, one at its upper surface, and four others at 4, 7, 9 and 10 feet below it respectively.

XLVI. Vín Tower Station, lat. 28° 7′, long. 69° 57′—observed at in 1881—is built on a small mound on the northern edge of the southern branch of the rice fields, about a mile S.E. of the Indus Valley State Railway, and 750 yards S.E. by E. from the old masonry well of Vín deserted village. It is in the lands of Sabzalwáh village, tahsíl Sádikabad, Baháwalpur State.

The station consists of a tower of sun-dried bricks set in mud cement 16½ feet square at base and about 14 feet square at top, enclosing a central, perforated pillar of masonry 12·2 feet high. There are two mark-stones, one 0·2 foot below the floor level, and the other 2·75 feet below it in the foundation of the pillar. A vaulted passage especially constructed for the purpose gives access to the upper mark. The directions and distances of the circumjacent places are:—Reti Railway Station W.S.W., miles 3·8; Dhandi village N.N.W., miles 2·7; and Kalandar Sháh's tomb S.E. by S., miles 1·1.

XLVII. Got Mír Muhammad Hill Station, lat. 28° 8′, long. 70° 3′—observed at in 1881—is situated on the northern end of a low sand ridge, perhaps better known as Dhandhi Tálibwáli, from the slight hollow or low ground so called to the N.N.E., and otherwise named Wáhi Uhde Dás from a masonry well of that name about 1 mile to N.W. and 1⅛ miles E.N.E. of Got Jummá village. The station is named after Got Mír Muhammad, a hamlet about a mile N.W. by W. and near the brick well of Uhde Dás. The sand ridge may be about 20 feet above the adjacent low ground. Formerly it was called after Músa Máchi who occupied both ends of the ridge and a hamlet to the N.E. The station is in the lands of Got Mír Muhammad village, tahsíl Sádikabad, Baháwalpur State.

The masonry pillar, which is surrounded by an annular wall, is solid, 3 feet deep and 3¼ feet in diameter. It contains three mark-stones, one at the foundation, another 1 foot above it, and the third at the surface of the pillar. The azimuth and distance of Walhár Railway Station are 168° 38′ and miles 4·4.

XLVIII. Dewari Tower Station, lat. 28° 9′, long. 69° 50′—observed at in 1881—is built on the top of an old earthen watch-tower of Abdul Khair Dahar of Ubauro, which stands on an irregular mound long used for a graveyard, and named after one Mahmúd Bádala. It is in the lands of Dewari village, taluka Ubauro, district Shikárpur.

The masonry pillar, which is enclosed in a tower of sun-dried bricks set in mud cement, 18 feet square at base and 14 feet square at top, is solid, 16 feet high and 3¼ feet in diameter at top. It carries a mark at its top and others below, the number and their distances are not forthcoming. The directions and distances of the circumjacent places are:—Dewari village S.E., 0·6 mile; Kádu Rind (Juna) hamlet W.N.W., about 500 yards; Ubauro W. by N., 3⅜ miles; and Reti Railway Station S.E., 6¼ miles.

XLIX. Kot Sabzal Tower Station, lat. 28° 13′, long. 69° 56′—observed at in 1881—is built on the mound which once formed the south-western round tower or bastion of the fort or fortified town of this name, and immediately over the new bridge across the Sabzalwáh canal at the S.W. corner of the place. The station is about 28 feet high above the level of the adjacent flat ground. It is in the lands of Kot Sabzal village, tahsíl Sádikabad, Baháwalpur State.

The isolated masonry pillar which is enclosed in a tower of sun-dried bricks set in mud cement, 14 feet square, is solid, 8 feet high and 3¼ feet in diameter at top, built on the top of the old tower which was cut down to afford a level platform. The pillar has a mark on its upper surface and others below it, the number and the relative distances apart of these are not forthcoming.

L. Kubba Tower Station, lat. 28° 12′, long. 69° 44′—observed at in 1881—is built on a low mound about 30 yards N.E. of another such mound said to be the site of a ruined kubba (tomb or mausoleum) of Walla Kalál. The remains of a well are to be seen between the two mounds. The station is a few yards E. of the road, 3·2 miles N.W. of Ubauro. It is in the lands of Lángha village, taluka Ubauro, district Shikárpur.

The perforated masonry pillar which is enclosed in a tower of sun-dried bricks set in mud cement, of the usual dimensions, is 21 feet high above the floor of the vaulted passage. It contains two marks engraved on bricks, one in the floor and the other in the foundation 2 feet below it. A vaulted passage especially constructed for the purpose gives access to the upper mark. The directions and distances of the circumjacent places are:—Basti Jiwan Sháh N.W., miles 3; and Ubauro S.E., miles 3.

LI. Ghundi Tower Station, lat. 28° 15′, long. 69° 50′—observed at in 1881—is built on the south bank of the canal called (Abul Khair) Dahrwáh, about 28 feet above its bed, and 150 yards S.E. of a rough stone set up on its N. bank, said to mark the tenth mile-stone. It lies 1 mile S.W. by S. from the old Ghundi graveyard. It is in the lands of Ghundi village, taluka Ubauro, district Shikárpur.

The station consists of a tower of sun-dried bricks set in mud cement, 21 feet square at base, 15 feet square at top, enclosing a central, perforated pillar of masonry 21 feet high. The upper surface of the pillar is 18·8 feet above the mark imbedded in the floor of the vaulted passage, this mark is 3 inches below the floor level, a second mark-stone is in the foundation 1 foot below the upper mark. A vaulted passage especially constructed for the purpose gives access to the upper mark.

LIX.—(*Of the Great Indus Series*). Máchka Tower Station, lat. 28° 20′, long. 69° 42′—observed at in 1859, 1861 and 1881—is built on an island near the left bank of the Indus, or on a flat between the present main channel and the Kirár and Gudu branches, about 7 miles south of Kasmor. The flat is annually flooded during the inundation. The station is in the lands of Máchka village, tahsíl Sádikabad, Baháwalpur State.

The station as originally constructed in 1859 and 1861 consists of a tower of sun-dried bricks set in mud cement, enclosing a central, perforated pillar of masonry 24·6 feet high above the mark-stone at the ground level. When again visited in

1881, for the purpose of closing the Eastern Sind Meridional Series, the tower although somewhat settled and split, was found in a very serviceable condition, and the mark-stone at the floor level appeared unaltered. The pillar had however become inclined to the S.S.E., so that it was necessary to enlarge the perforation on the N.N.E. side to a depth of about 2 or 3 feet from the top of the pillar to allow of the mark-stone being plumbed over. The isolation and stability of the pillar were tested and seemed sufficiently perfect, and no alteration in the construction of the station was made. The directions and distances of the circumjacent places are:—Máchka (the present site of) S.E. by E., miles 1½; Daulatpur N.E., miles 1½; and Kharor W.S.W., mile 1.

LXII. (*Of the Great Indus Series*). Dáowála Tower Station, lat. 28° 20′, long. 69° 53′—observed at in 1860-61 and 1881—is situated on low flat marshy ground of the Dhora Simna. It lies about 1¾ miles N.E. from Dáowála village, the same distance N.N.W. of Mubárak Bhára, a mile E. from the head of the Sabzal-wáh canal. It is in Mauza Dáowála, tahsíl Sádikabad, Baháwalpur State.

The station as originally constructed in 1860-61 consists of a tower of sun-dried bricks and mud cement built on an artificial basement 8 feet high and 23 feet square, enclosing a central, perforated pillar of masonry 22·4 feet high and 3½ feet in diameter at top, having a mark-stone at its floor level. The station was visited by Captain Rogers in 1880 who identified and restored it; but the records do not say in what condition it was found. When again visited in 1881, for the purpose of closing the Eastern Sind Meridional Series, the station was in the same state as left by Captain Rogers. The top of the pillar was found deflected a couple of inches to the north, but no alteration in the construction of the station was made. The directions and distances of the circumjacent places are:—Khambra S.W., miles 3½; and Kot Sabzal S.S.E., miles 9·3.

December, 1883.

W. H. COLE,
In charge of Computing Office.

EASTERN SIND MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. OBSERVED ANGLES.

At LXXV (Rojhra)

November 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on I (Fulrár) 0° 0′	180° 0′	79° 13′	259° 13′	158° 25′	338° 24′	237° 37′	57° 37′	316° 49′	186° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
I (Fulrár) and LXXVIII (Sandohar)	″ *h* 48·48 *h* 49·28 *h* 48·90	″ *h* 48·16 *h* 48·28 *h* 48·18	″ *l* 50·82 *l* 45·86 *l* 45·50 *l* 46·70 *h* 49·50 *h* 50·72 *h* 48·00	″ *h* 50·16 *h* 47·60 *h* 46·86 *h* 47·38 *h* 47·78	″ *h* 47·58 *h* 49·68 *h* 48·88 *h* 49·22	″ *h* 49·86 *h* 48·06 *h* 47·16 *h* 46·92	″ *h* 48·50 *h* 49·32 *h* 47·14 *h* 48·64	″ *h* 48·56 *h* 47·88 *h* 47·76	″ *h* 47·82 *h* 48·02 *h* 49·02	″ *h* 48·38 *h* 46·20 *h* 46·98 *h* 47·38	$M = 48''{\cdot}21$ $w = 18{\cdot}02$ $\frac{1}{w} = 0{\cdot}06$ $C = 46^\circ 47' 48''{\cdot}19$
	48·89	48·21	48·16	47·96	48·84	48·00	48·40	48·07	48·29	47·24	
LXXVIII (Sandohar) and V (Bhádi)	*h* 38·68 *h* 39·54 *h* 38·68 *h* 37·76 *h* 40·98	*h* 37·76 *h* 37·60 *h* 38·58	*l* 34·84 *l* 37·08 *l* 36·28 *l* 35·96 *h* 34·00 *h* 38·44	*h* 34·76 *h* 34·76 *h* 35·48 *h* 37·84 *h* 37·82	*h* 36·94 *h* 36·20 *h* 38·04	*h* 36·94 *h* 37·52 *h* 39·88 *h* 39·78	*h* 37·38 *h* 38·88 *h* 37·54	*h* 37·22 *h* 37·12 *h* 36·64	*h* 37·56 *h* 38·12 *h* 38·06	*h* 37·38 *h* 37·58 *h* 36·74	$M = 37''{\cdot}50$ $w = 7{\cdot}96$ $\frac{1}{w} = 0{\cdot}13$ $C = 60^\circ 25' 37''{\cdot}49$
	39·13	37·98	36·10	36·13	37·06	38·53	37·93	36·99	37·91	37·23	

NOTE.—Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series of the North-West Quadrilateral.

At LXXVIII (Sandohar)

November and December 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LXXV (Rojhra) 0° 0′	180° 0′	79° 13′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
LXXV (Rojhra) and I (Fulrár)	″ h 21·46 h 22·86 l 21·60	″ l 21·18 l 24·82 l 21·78 l 22·48 l 22·98	″ h 23·58 h 22·74 h 21·10 h 21·92	″ h 21·04 h 21·66 h 23·74 h 21·40	″ h 20·68 h 21·58 h 21·12	″ l 20·42 l 20·98 l 20·26	″ h 20·86 h 22·66 h 23·64 h 20·64	″ h 20·76 h 21·12 h 21·72 h 22·58	″ h 21·44 h 22·54 h 21·52	″ h 21·68 l 24·36 l 21·80 l 20·36 l 22·06	$M = 21''\cdot80$ $w = 16\cdot33$ $\frac{1}{w} = 0\cdot06$
	21·97	22·65	22·34	21·96	21·13	20·55	21·95	21·54	21·83	22·05	$C = 44°\ 57'\ 21''\cdot83$
I (Fulrár) and II (Chánga)	h 53·54 h 52·74 h 53·64	l 53·40 l 52·84 l 53·08	h 50·92 h 52·28 h 51·70	h 51·68 h 52·90 h 53·78 h 52·60	h 53·00 h 53·60 hl 52·90	l 52·94 l 54·78 l 52·94	h 51·92 h 51·64 h 53·12	h 52·12 h 50·82 h 54·16 h 53·94 h 53·00	h 53·40 h 52·10 h 55·24	h 53·16 l 53·66 l 54·04	$M = 52''\cdot98$ $w = 16\cdot48$ $\frac{1}{w} = 0\cdot06$
	53·31	53·11	51·63	52·74	53·17	53·55	52·23	52·81	53·58	53·62	$C = 81°\ 16'\ 52''\cdot98$
II (Chánga) and III (Patatonk)	h 5·76 h 9·24 h 7·72 l 5·96 l 6·96	l 8·20 l 6·76 l 7·10	h 9·56 h 9·36 h 8·46	h 8·84 h 8·94 h 8·68	h 9·18 h 9·50 lh 9·44	l 9·00 l 7·62 l 7·80 d 9·45	h 9·26 h 11·60 h 10·42 h 10·16	h 8·22 h 9·62 h 10·38 h 9·94	h 10·78 h 8·38 h 7·50 h 8·74	h 9·36 l 7·26 l 9·50 l 8·90	$M = 8''\cdot78$ $w = 8\cdot80$ $\frac{1}{w} = 0\cdot11$
	7·13	7·35	9·13	8·82	9·37	8·47	10·36	9·54	8·85	8·76	$C = 60°\ 1'\ 8''\cdot78$
III (Patatonk) and IV (Narithal)	h 34·30 h 36·62 h 37·96 l 37·64 l 37·70	l 34·04 l 35·78 l 37·04 l 36·26 l 35·04	h 38·18 h 35·96 h 37·30 h 36·88	h 37·74 h 37·68 h 36·76	h 36·74 h 36·22 h 36·06	l 37·10 l 37·76 l 36·82 d 38·54	h 37·04 h 35·80 h 37·88 h 36·46	h 37·38 h 36·10 h 36·64 h 36·12	h 36·34 h 35·70 h 36·70	h 36·62 l 36·12 l 36·40	$M = 36''\cdot68$ $w = 19\cdot90$ $\frac{1}{w} = 0\cdot05$
	36·84	35·63	37·08	37·39	36·34	37·56	36·79	36·56	36·25	36·38	$C = 38°\ 25'\ 36''\cdot68$
IV (Narithal) and V (Bhádi)	h 1·10 h 3·90 h 0·16 l 2·68 l 2·32	l 3·14 l 2·56 l 4·88 l 1·62 l 4·22	h 2·74 h 3·24 h 0·60 h 4·58 h 1·86	h 3·62 h 3·28 h 2·22	h 2·40 h 2·42 hl 1·84	l 3·14 l 3·12 l 2·06 l 2·92	h 1·64 h 2·14 h 1·26	h 1·54 h 0·06 h 1·96	h 2·22 h 3·58 h 2·20	hl 2·52 l 2·04 l 3·12	$M = 2''\cdot41$ $w = 20\cdot65$ $\frac{1}{w} = 0\cdot05$
	2·03	3·28	2·60	3·04	2·22	2·81	1·68	1·19	2·67	2·56	$C = 66°\ 39'\ 2''\cdot43$

NOTE.—Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series of the North-West Quadrilateral.

At LXXVIII (Sandohar)—(*Continued*).

Angle between	Circle readings, telescope being set on LXXV (Rojhra) 0° 0′	180° 0′	79° 13′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
V (Bhádi) and LXXV (Rojhra)	″ h 56·08 h 58·80 h 54·60 h 56·00 h 57·50 h 55·46	″ l 57·58 l 55·78 l 55·82 l 55·48	″ h 55·44 h 56·70 h 56·70 h 58·58	″ h 58·38 h 57·08 h 56·60	″ h 57·02 h 57·22 l 57·04	″ l 56·64 l 54·96 l 57·14 l 56·92	″ h 56·72 h 56·42 h 56·50	″ h 56·08 h 57·92 h 55·38 h 57·64	″ h 55·70 h 55·96 h 57·04 h 56·72	″ l 56·78 l 57·22 l 56·92	$M = 56''\cdot66$ $w = 28\cdot17$ $\frac{1}{w} = 0\cdot04$ $C = 68^\circ 39' 56''\cdot69$
	56·41	56·17	56·85	57·35	57·09	56·42	56·55	56·75	56·36	56·97	

At I (Fulrár)

December 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on II (Chánga) 232° 32′	52° 31′	311° 44′	131° 44′	30° 56′	210° 56′	110° 8′	290° 8′	189° 20′	9° 20′	M = Mean of Groups w = Relative Weight C = Concluded Angle
II (Chánga) and LXXVIII (Sandohar)	″ h 53·18 h 52·92 h 54·48	″ h 53·48 h 52·36 h 53·02	″ h 53·36 h 53·12 h 53·96	″ h 53·80 h 53·60 h 53·58	″ h 53·46 h 53·06 h 52·56	″ h 53·18 h 52·78 l 52·82	″ h 54·46 h 53·60 h 54·00	″ h 55·36 h 53·68 h 54·18	″ h 53·32 h 52·62 h 53·66	″ h 53·26 h 53·48 h 52·66	$M = 53''\cdot43$ $w = 32\cdot30$ $\frac{1}{w} = 0\cdot03$ $C = 39^\circ 13' 53''\cdot43$
	53·53	52·95	53·48	53·66	53·03	52·93	54·02	54·41	53·20	53·13	
LXXVIII (Sandohar) and LXXV (Rojhra)	h 50·62 h 51·66 h 49·98	h 50·84 h 51·26 h 52·46	h 51·64 h 51·38 h 51·82	h 51·88 h 51·36 h 51·64	h 50·34 h 50·82 h 50·48	h 51·82 h 49·52 h 50·78 l 49·78	h 50·96 h 50·14 h 50·64	h 50·62 h 51·48 h 52·18	h 51·66 h 50·64 h 51·62	h 50·74 h 51·46 h 50·96	$M = 51''\cdot09$ $w = 31\cdot50$ $\frac{1}{w} = 0\cdot03$ $C = 88^\circ 14' 51''\cdot09$
	50·75	51·52	51·61	51·63	50·55	50·48	50·58	51·43	51·31	51·05	

At II (Chánga)

December 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on III (Patatonk) 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
III (Patatonk) and LXXVIII (Sandohar)	″ h 40·06 h 36·26 h 37·92 h 39·24 h 38·62	″ h 39·40 h 37·76 h 38·50	″ h 38·10 h 36·38 h 37·52	″ h 38·68 h 36·84 h 36·18 h 38·14	″ h 36·14 h 39·08 h 37·64 h 38·76	″ h 38·40 h 38·22 h 39·58	″ h 38·78 l 36·96 l 38·28	″ l 37·14 l 38·18 l 38·02	″ h 37·42 h 38·90 h 38·02	″ h 38·52 h 38·12 h 37·40	$M = 38''\cdot03$ $w = 23\cdot03$ $\frac{1}{w} = 0\cdot04$ $C = 84^\circ 46' 38''\cdot03$
	38·42	38·55	37·33	37·46	37·91	38·73	38·01	37·78	38·11	38·01	

NOTE.—Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series of the North-West Quadrilateral.

At II (Chánga)—(*Continued*).

Angle between	Circle readings, telescope being set on III (Patatonk) 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LXXVIII (Sandohar) and I (Fulrár)	h 12·90	h 14·32	h 14·08	h 11·94	h 14·30	h 14·22	l 14·24	l 14·44	h 14·28	h 12·56	$M = 14''\cdot07$
	h 13·40	h 13·58	h 14·16	h 14·20	h 14·08	h 14·72	l 14·18	l 14·76	h 14·52	h 15·38	$w = 39\cdot00$
	h 14·18	h 14·08	h 14·34	h 14·20	h 13·88	h 14·54	l 13·68	l 13·94	h 15·02	h 14·34	$\frac{1}{w} = 0\cdot03$
										h 13·56	
	13·49	13·99	14·19	13·45	14·09	14·49	14·03	14·38	14·61	13·96	$C = 59^\circ 29' 14''\cdot07$

At III (Patatonk)

December 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on IV (Narithal) 251° 7′	71° 7′	330° 19′	150° 19′	49° 31′	229° 31′	128° 44′	308° 44′	207° 55′	27° 55′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
IV (Narithal) and LXXVIII (Sandohar)	h 55·36	h 54·66	h 55·62	h 54·30	h 56·84	h 55·64	h 56·02	h 55·34	h 56·06	h 57·32	$M = 55''\cdot98$
	h 56·92	h 56·62	h 56·08	h 55·28	h 56·06	h 55·76	h 56·04	h 55·80	h 53·04	h 57·64	
	h 56·42	h 55·48	h 57·66	h 55·16	h 55·64	h 56·38	h 54·76	h 55·10	h 56·98	h 57·18	$w = 14\cdot65$
			h 56·82						h 54·58	h 57·34	$\frac{1}{w} = 0\cdot07$
									h 57·58		
									h 57·66		
	56·23	55·59	56·55	54·91	56·18	55·93	55·61	55·41	55·98	57·37	$C = 73^\circ 40' 56''\cdot00$
LXXVIII (Sandohar) and II (Chánga)	h 12·42	h 11·50	h 13·90	h 13·30	h 13·92	h 14·62	h 11·92	h 12·70	h 13·38	h 13·96	$M = 13''\cdot27$
	h 11·26	h 13·42	h 14·66	h 12·96	h 13·94	h 13·76	h 13·78	h 12·34	h 13·34	h 12·34	$w = 19\cdot20$
	h 12·72	h 12·76	h 13·82	h 13·66	h 13·50	h 13·68	h 13·58	h 13·30	h 14·30	h 13·46	$\frac{1}{w} = 0\cdot05$
	12·13	12·56	14·13	13·31	13·79	14·02	13·09	12·78	13·67	13·25	$C = 35^\circ 12' 13''\cdot27$

At IV (Narithal)

December 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on VI (Hatodan) 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 23′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups; w = Relative Weight; C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
VI (Hatodan) and VII (Rupihar)	h 8·54	h 5·68	l 4·52	h 6·44	h 4·80	h 6·76	h 6·66	h 5·74	h 7·78	h 5·54	$M = 6''\cdot61$
	h 9·00	h 7·10	l 8·14	h 6·28	h 6·32	h 7·62	h 8·18	h 4·48	h 8·90	h 7·26	
	h 8·60	h 7·58	h 4·26	h 4·20	h 5·12	h 8·04	h 7·76	h 5·76	h 7·16	h 3·92	$w = 8\cdot42$
	h 4·66	h 6·46	h 7·16	h 8·52						h 5·80	
	l 5·42		h 6·08	h 6·78						h 7·86	$\frac{1}{w} = 0\cdot12$
	l 5·10			h 7·76							
	6·89	6·71	6·03	6·66	5·41	7·47	7·53	5·33	7·95	6·08	$C = 49^\circ 24' 6''\cdot60$

NOTE.—Station LXXVIII (Sandohar) appertains to the Karáchi Longitudinal Series of the North-West Quadrilateral.

At IV (Narithal)—(*Continued*).

Angle between	Circle readings, telescope being set on VI (Hatodan) 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 23′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
VII (Rupihar) and V (Bhádi)	″ h 55·68 h 57·32 h 55·58	″ h 56·76 h 57·86 h 57·04	″ l 56·90 l 56·94 h 56·08 h 56·66	″ h 57·94 h 55·24 h 55·58 h 57·44 h 57·58 h 55·28	″ h 57·82 h 57·50 h 58·30	″ h 55·62 h 58·00 h 56·46 h 56·34	″ h 57·76 h 56·08 h 56·34	″ h 57·44 h 58·30 h 57·08	″ h 55·72 h 57·94 h 57·70 h 57·90	″ h 57·22 h 57·74 h 56·90	$M = 57''·00$ $w = 21·61$ $\frac{1}{w} = 0·05$
	56·19	57·22	56·65	56·51	57·87	56·60	56·73	57·61	57·32	57·29	$C = 54° 30' 56''·98$
V (Bhádi) and LXXVIII (Sandohar)	h 26·90 h 27·14 h 28·76	h 27·60 h 27·90 h 28·74	l 27·76 l 27·02 h 29·80 h 27·10	h 29·90 h 29·80 h 30·94 h 26·88 h 29·14 h 28·20	h 26·78 h 27·50 h 27·60	h 27·96 h 28·12 h 29·64	h 29·04 h 28·96 h 29·08	h 27·96 h 27·86 h 28·20	h 28·96 h 27·92 h 28·12	h 27·78 h 29·36 h 29·50	$M = 28''·29$ $w = 16·94$ $\frac{1}{w} = 0·06$
	27·60	28·08	27·92	29·14	27·29	28·57	29·03	28·01	28·33	28·88	$C = 63° 27' 28''·30$
LXXVIII (Sandohar) and III (Patatonk)	h 26·98 h 27·72 h 25·98 h 27·56	h 28·02 h 27·46 h 27·58	l 28·40 l 27·98 h 28·52	h 27·70 h 28·62 h 29·76 h 27·88	h 26·20 h 28·14 h 28·86 h 29·10	h 27·12 h 27·76 h 26·56	h 28·50 h 28·38 h 29·12	h 28·58 h 28·38 h 27·98	h 27·74 h 26·56 h 27·92	h 29·84 h 28·12 h 27·80 h 29·82	$M = 28''·01$ $w = 18·06$ $\frac{1}{w} = 0·06$
	27·06	27·69	28·30	28·49	28·08	27·15	28·67	28·31	27·41	28·89	$C = 67° 53' 28''·01$

At V (Bhádi)

December 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on LXXV (Rojhra) 161° 54′	341° 54′	241° 6′	61° 6′	320° 18′	140° 17′	39° 30′	219° 30′	118° 42′	298° 42′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
LXXV (Rojhra) and LXXVIII (Sandohar)	″ h 25·08 h 24·68 h 28·74 h 26·52 l 25·64 l 28·02	″ h 26·90 h 27·88 h 27·28	″ l 28·88 l 27·28 l 27·34	″ l 28·06 l 28·58 l 27·74	″ h 28·18 h 27·44 h 29·00	″ h 28·18 h 26·84 h 29·00 h 28·32	″ h 28·56 h 27·84 h 27·54 d 28·51	″ h 26·62 h 28·54 h 27·34	″ l 27·30 l 27·98 l 27·16	″ l 26·68 l 28·60 l 27·38	$M = 27''·67$ $w = 19·93$ $\frac{1}{w} = 0·05$
	26·45	27·35	27·83	28·13	28·21	28·09	28·11	27·50	27·48	27·55	$C = 50° 54' 27''·65$

NOTE.—Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series of the North-West Quadrilateral.

At V (Bhádi)—(*Continued*).

Angle between	Circle readings, telescope being set on LXXV (Rojhra) 161° 54′	341° 54′	241° 6′	61° 6′	320° 18′	140° 17′	39° 30′	219° 30′	118° 42′	298° 42′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	"	"	"	"	"	"	"	"	"	"	
LXXVIII (Sandohar) and IV (Narithal)	h 31·16	h 29·58	l 31·00	l 31·28	h 30·54	h 30·70	h 30·98	h 30·98	l 31·18	l 30·82	$M = 30''\cdot63$
	h 28·84	h 30·50	l 29·40	l 29·96	h 30·84	h 30·82	h 31·24	h 30·20	l 30·76	l 30·92	$w = 53\cdot82$
	h 32·02	h 30·36	l 30·58	l 30·48	h 30·96	h 30·04	h 30·26	h 30·94	l 30·06	l 31·80	$\frac{1}{w} = 0\cdot02$
	h 30·36						d 29·36				
	h 31·06						d 31·36				
	h 30·98										$C = 49° 53' 30''\cdot63$
	30·74	30·15	30·33	30·57	30·78	30·52	30·64	30·71	30·67	31·18	
IV (Narithal) and VII (Rupihar)	h 23·02	h 23·12	l 23·30	l 22·48	h 22·42	h 21·98	h 21·22	h 22·36	l 20·08	l 22·58	$M = 22''\cdot12$
	h 22·28	h 22·62	l 20·90	l 23·16	h 22·96	h 22·36	h 21·92	h 20·96	l 21·10	l 21·78	$w = 19\cdot35$
	h 19·18	h 21·52	l 22·60	l 22·62	h 22·24	h 21·92	h 21·54	h 22·62	l 21·42	l 22·06	$\frac{1}{w} = 0\cdot05$
	h 22·74		l 22·08		d 23·91		l 22·84	h 21·86			
	h 23·68						d 20·41				
	h 22·88										$C = 51° 49' 22''\cdot12$
	22·30	22·42	22·22	22·75	22·88	22·09	21·59	21·95	20·87	22·14	
VII (Rupihar) and VIII (Kanakotri)	h 6·64	h 6·50	l 7·20	l 6·38	h 6·98	h 5·50	h 8·64	h 7·18	l 8·62	l 4·16	$M = 6''\cdot19$
	h 4·56	h 4·62	l 6·06	l 5·10	h 5·64	h 4·08	h 5·32	h 6·28	l 4·90	l 7·56	$w = 17\cdot19$
	h 8·50	h 6·22	l 6·22	l 6·10	h 6·02	h 5·26	h 6·86	h 6·44	l 8·28	l 6·56	$\frac{1}{w} = 0\cdot06$
	h 4·74				d 7·58		h 6·46		l 5·84	l 6·76	
	h 5·82						l 5·70		l 5·74	l 6·68	
	h 5·48										$C = 45° 29' 6''\cdot20$
	5·96	5·78	6·49	5·86	6·56	4·95	6·60	6·63	6·68	6·34	

At VI (Hatodan)

***December* 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on IX (Mangtor) 215° 22′	35° 22′	294° 34′	114° 33′	13° 46′	193° 46′	92° 58′	272° 58′	172° 11′	352° 11′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	"	"	"	"	"	"	"	"	"	"	
IX (Mangtor) and VII (Rupihar)	h 35·30	h 32·88	h 33·08	h 36·10	l 32·44	l 35·36	l 36·30	l 33·86	h 32·18	h 33·26	$M = 33''\cdot82$
	h 32·82	h 34·70	h 32·22	h 33·28	l 33·00	l 33·62	l 34·22	l 30·56	h 34·08	h 34·62	$w = 11\cdot38$
	h 33·86	h 33·20	h 34·34	h 34·22	l 34·08	l 33·16	l 33·62	l 31·98	h 33·66	h 35·46	$\frac{1}{w} = 0\cdot09$
	h 33·50		h 33·76	h 36·56		l 33·58	l 34·28	l 31·00		h 34·60	
				h 35·96				l 34·98			
								l 33·68			$C = 76° 1' 33''\cdot83$
	33·87	33·59	33·35	35·22	33·17	33·93	34·61	32·68	33·31	34·48	

NOTE.—Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series of the North-West Quadrilateral.

At VI (Hatodan)—(*Continued*).

Angle between	Circle readings, telescope being set on IX (Mangtor) 215° 22′	35° 22′	294° 34′	114° 33′	13° 46′	193° 46′	92° 58′	272° 58′	172° 11′	352° 11′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
VII (Rupihar) and IV (Narithal)	″ *h* 33·74 *h* 34·10 *h* 34·12	″ *h* 36·34 *h* 34·18 *h* 35·74 *h* 34·10	″ *h* 35·10 *h* 35·58 *h* 34·48	″ *h* 34·82 *h* 34·90 *h* 34·18 *h* 33·22	″ *h* 33·12 *l* 34·44 *l* 34·18 *l* 34·22	″ *l* 33·98 *l* 34·42 *l* 34·96	″ *l* 33·80 *l* 33·96 *l* 34·74	″ *l* 35·38 *h* 34·34 *h* 35·28 *h* 35·60	″ *h* 36·28 *h* 32·64 *h* 35·54 *h* 34·12 *h* 34·48	″ *h* 36·46 *h* 34·68 *h* 35·20	$M = 34''\cdot62$ $w = 23\cdot17$ $\frac{1}{w} = 0\cdot04$
	33·99	35·09	35·05	34·28	33·99	34·45	34·17	35·15	34·61	35·45	$C = 68°\,36'\,34''\cdot62$

At VII (Rupihar)

December 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on VI (Hatodan) 0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
VI (Hatodan) and IX (Mangtor)	″ *h* 37·04 *h* 36·78 *h* 38·42	″ *h* 36·56 *h* 39·70 *h* 36·80 *h* 37·02 *l* 36·80	″ *h* 37·26 *h* 36·38 *h* 38·46 *h* 37·64	″ *h* 37·80 *h* 36·64 *h* 37·06	″ *h* 38·04 *h* 37·14 *h* 36·12	″ *h* 37·40 *h* 37·68 *h* 36·60	″ *h* 37·44 *l* 40·50 *l* 37·44 *l* 37·52 *l* 38·94	″ *l* 37·60 *h* 37·06 *h* 36·70	″ *h* 36·70 *h* 37·90 *h* 35·24 *h* 39·20 *h* 36·06	″ *h* 36·34 *h* 36·78 *h* 36·80	$M = 37''\cdot29$ $w = 22\cdot72$ $\frac{1}{w} = 0\cdot04$
	37·41	37·38	37·44	37·17	37·10	37·23	38·37	37·12	37·02	36·64	$C = 48°\,34'\,37''\cdot32$
IX (Mangtor) and X (Bhitala)	*h* 31·92 *h* 34·42 *h* 35·60 *h* 35·10 *h* 34·46	*h* 34·38 *h* 34·84 *h* 36·04 *h* 36·60 *h* 35·24	*h* 34·26 *h* 33·72 *h* 34·16	*h* 33·44 *h* 33·64 *h* 32·80	*h* 36·04 *h* 33·48 *h* 33·28 *h* 34·26	*h* 33·58 *h* 33·02 *h* 34·02	*h* 33·60 *l* 34·14 *l* 35·00 *l* 35·66	*l* 34·74 *h* 33·28 *h* 34·48	*h* 34·40 *h* 33·64 *h* 33·82	*h* 34·24 *h* 34·80 *h* 33·94	$M = 34''\cdot19$ $w = 19\cdot52$ $\frac{1}{w} = 0\cdot05$
	34·30	35·42	34·05	33·29	34·27	33·54	34·60	34·17	33·95	34·33	$C = 58°\,5'\,34''\cdot22$
X (Bhitala) and VIII (Kanakotri)	*h* 51·46 *h* 51·74 *h* 50·60	*h* 53·22 *h* 49·30 *h* 50·96 *h* 49·62 *h* 51·20	*h* 50·58 *h* 49·86 *h* 50·68	*h* 50·98 *h* 51·92 *h* 51·40	*h* 50·70 *h* 50·06 *h* 50·30 *h* 49·50	*h* 51·88 *h* 49·64 *h* 51·58	*h* 51·40 *l* 48·80 *l* 49·64 *l* 51·42	*l* 49·76 *h* 48·72 *h* 50·68	*h* 51·16 *h* 49·42 *h* 50·26	*h* 49·36 *h* 48·98 *h* 50·94	$M = 50''\cdot52$ $w = 16\cdot80$ $\frac{1}{w} = 0\cdot06$
	51·27	50·86	50·37	51·43	50·14	51·03	50·32	49·72	50·28	49·76	$C = 48°\,43'\,50''\cdot52$

At VII (Rupihar)—(*Continued*).

Circle readings, telescope being set on VI (Hatodan)

M = Mean of Groups
w = Relative Weight
C = Concluded Angle

Angle between	0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
VIII (Kanakotri) and V (Bhádi)	*h* 56·32 *h* 55·72 *h* 56·24 *h* 55·34	*h* 55·56 *h* 55·50 *h* 54·76	*h* 55·66 *h* 55·66 *h* 55·44	*h* 56·90 *h* 57·58 *h* 55·86	*h* 55·88 *h* 58·04 *h* 56·66 *h* 56·46	*h* 56·80 *h* 56·86 *h* 56·92	*h* 57·46 *l* 56·62 *l* 57·30	*l* 56·60 *l* 56·04 *h* 57·36 *h* 56·82	*h* 56·68 *h* 58·02 *h* 56·86	*h* 57·02 *h* 54·68 *h* 56·40 *h* 57·28	$M = 56''·45$ $w = 18·60$ $\frac{1}{w} = 0·05$
	55·91	55·27	55·59	56·78	56·76	56·86	57·13	56·70	57·19	56·35	$C = 68° 56′ 56''·45$
V (Bhádi) and IV (Narithal)	*h* 38·22 *h* 42·12 *h* 40·84 *h* 43·10 *l* 40·76 *h* 44·02 *h* 40·82	*h* 40·58 *h* 42·00 *h* 41·70	*h* 41·60 *h* 43·34 *h* 42·50	*h* 41·68 *h* 43·10 *h* 40·18 *h* 41·56	*h* 41·82 *h* 41·94 *h* 41·38	*h* 41·80 *h* 42·34 *h* 40·36	*h* 42·02 *l* 41·38 *l* 41·94	*l* 40·88 *l* 42·76 *h* 41·94 *h* 41·42	*h* 41·90 *h* 41·58 *h* 42·08	*h* 42·08 *h* 42·54 *h* 42·10	$M = 41''·78$ $w = 25·95$ $\frac{1}{w} = 0·04$
	41·41	41·43	42·48	41·63	41·71	41·50	41·78	41·75	41·85	42·24	$C = 73° 39′ 41''·75$
IV (Narithal) and VI (Hatodan)	*h* 22·32 *h* 18·84 *h* 22·34 *h* 19·84 *l* 22·52	*h* 19·60 *h* 20·18 *h* 20·60	*h* 19·26 *h* 18·04 *h* 19·76	*h* 18·20 *h* 19·92 *h* 18·96	*h* 20·30 *h* 19·38 *h* 21·24	*h* 20·18 *h* 19·40 *h* 18·82	*h* 18·54 *l* 17·94 *l* 20·18 *l* 20·54	*l* 20·22 *l* 21·54 *l* 20·14 *l* 19·76	*h* 20·50 *h* 20·98 *h* 17·54 *h* 19·90 *h* 18·86	*h* 20·38 *h* 19·80 *h* 19·24	$M = 19''·82$ $w = 13·58$ $\frac{1}{w} = 0·07$
	21·17	20·13	19·02	19·03	20·31	19·47	19·30	20·42	19·56	19·81	$C = 61° 59′ 19''·84$

At VIII (Kanakotri)

***December* 1876; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24*-inch Theodolite No.* 2.**

Circle readings, telescope being set on V (Bhádi)

M = Mean of Groups
w = Relative Weight
C = Concluded Angle

Angle between	0° 0′	179° 59′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	
	″	″	″	″	″	″	″	″	″	″	
V (Bhádi) and VII (Rupihar)	*h* 58·66 *h* 59·02 *h* 58·12	*h* 57·14 *h* 58·32 *h* 59·34 *h* 58·94	*h* 57·78 *h* 58·86 *h* 58·82	*h* 55·86 *h* 58·12 *h* 55·32 *h* 57·66	*h* 57·26 *h* 56·70 *h* 56·98	*h* 57·50 *h* 58·34 *h* 57·74	*h* 58·56 *h* 58·06 *h* 58·24	*h* 57·24 *h* 59·20 *h* 59·46 *h* 56·64	*h* 59·52 *h* 58·28 *h* 58·20	*h* 57·12 *h* 57·78 *h* 58·32	$M = 58''·00$ $w = 16·01$ $\frac{1}{w} = 0·06$
	58·60	58·44	58·49	56·74	56·98	57·86	58·29	58·13	58·67	57·74	$C = 65° 33′ 58''·00$

At VIII (Kanakotri)—(*Continued*).

Angle between	Circle readings, telescope being set on V (Bhádi) 0° 0′	179° 59′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
VII (Rupihar) and X (Bhitala)	″ h 47·08 h 46·78 h 47·60	″ h 46·10 h 47·56 h 47·42	″ h 47·30 h 46·58 h 46·28	″ h 44·16 h 46·98 h 48·76 h 45·94 h 47·12 h 46·40	″ h 45·62 h 44·86 h 48·02 h 44·38 h 45·90	″ h 47·32 h 45·58 h 47·24	″ h 48·86 h 47·88 h 48·80	″ h 46·52 h 47·68 h 47·44	″ h 48·38 h 46·02 h 46·28 h 46·78	″ h 47·38 h 46·78 h 47·04	$M = 46''{\cdot}96$ $w = 14{\cdot}17$ $\frac{1}{w} = 0{\cdot}07$
	47·15	47·03	46·72	46·56	45·76	46·71	48·51	47·21	46·87	47·07	$C = 71^\circ 47' 46''{\cdot}93$

At IX (Mangtor)

January 1877 ; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XI (Narhar) 0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XI (Narhar) and XII (Thakur)	″ h 17·06 h 19·78 h 19·48 h 21·00 h 18·64	″ h 17·14 h 17·48 h 17·88	″ h 19·10 h 18·30 h 17·86	″ l 17·92 l 17·88 l 16·22 h 16·42	″ l 16·56 l 15·54 l 17·40	″ l 18·22 l 17·00 l 17·96	″ h 17·58 h 18·36 h 19·08	″ h 16·88 l 17·00 l 17·58	″ l 17·26 l 18·50 l 16·22 l 19·98 l 18·82	″ l 18·50 l 18·10 l 18·70	$M = 17''{\cdot}85$ $w = 11{\cdot}74$ $\frac{1}{w} = 0{\cdot}09$
	19·19	17·50	18·42	17·11	16·50	17·73	18·34	17·15	18·16	18·43	$C = 49^\circ 41' 17''{\cdot}86$
XII (Thakur) and X (Bhitala)	h 35·88 h 32·88 h 32·70 h 34·72 h 33·34	h 33·40 h 34·74 h 34·68	h 33·10 h 32·76 h 33·42	l 32·60 l 33·78 l 33·00 h 33·20 h 34·10	l 33·12 l 35·38 l 33·56 l 34·28	l 33·18 l 35·58 l 34·28 l 34·38	h 33·66 h 33·00 h 33·34	h 33·18 l 33·70 l 35·50 l 33·36	l 33·60 l 36·76 l 33·84 l 34·88 l 34·58	l 33·30 l 32·56 l 33·64	$M = 33''{\cdot}82$ $w = 20{\cdot}22$ $\frac{1}{w} = 0{\cdot}05$
	33·90	34·27	33·09	33·34	34·09	34·35	33·33	33·94	34·73	33·17	$C = 43^\circ 6' 33''{\cdot}84$
X (Bhitala) and VII (Rupihar)	h 7·66 h 4·46 h 6·60 h 4·74 h 6·34	h 6·64 h 5·32 h 4·64	h 6·40 h 5·06 h 4·74	l 5·16 l 7·58 l 4·42 h 3·94 h 5·06	h 3·76 h 4·92 h 4·16	h 4·38 h 5·38 h 5·36	h 4·74 h 5·00 h 5·76 h 5·02	h 6·14 h 5·02 l 5·16 l 4·92	l 7·80 l 4·54 l 6·96 l 4·74 l 5·74	l 4·98 l 4·90 l 5·10	$M = 5''{\cdot}28$ $w = 21{\cdot}84$ $\frac{1}{w} = 0{\cdot}05$
	5·96	5·53	5·40	5·23	4·28	5·04	5·13	5·31	5·96	4·99	$C = 57^\circ 15' 5''{\cdot}31$

At IX (Mangtor)—(*Continued*).

Angle between	Circle readings, telescope being set on XI (Narhar) 0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
VII (Rupihar) and VI (Hatodan)	″ *h* 49·66 *h* 49·78 *h* 48·82	″ *h* 49·06 *h* 49·12 *h* 49·50	″ *h* 50·18 *h* 51·10 *h* 50·08	″ *l* 48·38 *l* 50·04 *l* 50·40 *l* 48·46	″ *h* 50·06 *h* 50·18 *h* 48·92	″ *h* 49·54 *h* 49·34 *h* 49·54	″ *h* 50·28 *h* 49·20 *h* 49·28 *h* 49·76	″ *h* 49·58 *h* 50·38 *l* 47·92 *l* 50·14	″ *l* 49·48 *l* 49·04 *l* 49·24	″ *l* 49·76 *l* 49·52 *l* 49·68	$M = 49''\cdot57$ $w = 43\cdot47$ $\frac{1}{w} = 0\cdot02$
	49·42	49·23	50·45	49·32	49·72	49·47	49·63	49·51	49·25	49·65	$C = 55^\circ 23' 49''\cdot56$

At X (Bhitala)

January 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on VIII (Kanakotri) 0° 1′	180° 1′	79° 13′	259° 13′	158° 24′	338° 24′	237° 36′	57° 36′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
VIII (Kanakotri) and VII (Rupihar)	″ *h* 23·08 *h* 24·16 *h* 24·46	″ *h* 23·46 *h* 22·76 *h* 22·28 *d* 22·56	″ *h* 24·16 *h* 23·48 *h* 22·42	″ *h* 23·96 *h* 22·10 *h* 22·76	″ *l* 22·90 *l* 22·74 *l* 22·30	″ *h* 23·02 *h* 22·08 *h* 21·96	″ *h* 23·18 *h* 22·20 *h* 22·40	″ *h* 23·22 *h* 22·00 *h* 22·80	″ *h* 23·36 *h* 23·00 *h* 23·22	″ *h* 23·20 *h* 23·20 *h* 23·02	$M = 22''\cdot96$ $w = 34\cdot76$ $\frac{1}{w} = 0\cdot03$
	23·90	22·77	23·35	22·94	22·65	22·35	22·59	22·67	23·19	23·14	$C = 59^\circ 28' 22''\cdot95$
VII (Rupihar) and IX (Mangtor)	*h* 21·92 *h* 19·46 *h* 19·14 *h* 20·54	*h* 20·74 *h* 21·18 *h* 22·22 *d* 21·11	*l* 24·12 *l* 22·00 *l* 21·52 *l* 21·28 *l* 22·34 *l* 21·72 *d* 22·87	*h* 20·58 *l* 21·36 *l* 21·62	*l* 21·44 *l* 21·14 *l* 21·10	*h* 21·86 *h* 20·76 *h* 21·54	*h* 21·30 *h* 21·62 *h* 22·02	*h* 21·02 *h* 22·32 *h* 20·92	*h* 22·84 *h* 22·48 *h* 21·60	*h* 20·68 *h* 22·12 *h* 21·12	$M = 21''\cdot43$ $w = 21\cdot22$ $\frac{1}{w} = 0\cdot05$ $C = 64^\circ 39' 21''\cdot44$
	20·27	21·31	22·26	21·19	21·23	21·39	21·65	21·42	22·31	21·31	
IX (Mangtor) and XI (Narhar)	*h* 42·48 *h* 41·64 *h* 39·00 *h* 40·04 *h* 40·18 *d* 40·37	*h* 39·88 *h* 39·16 *h* 38·76	*l* 40·38 *l* 39·74 *l* 40·10 *d* 40·78	*h* 42·38 *l* 40·06 *l* 41·24 *l* 40·26	*l* 40·72 *l* 40·26 *l* 39·44	*h* 39·38 *h* 40·32 *h* 41·28	*h* 40·36 *h* 40·20 *h* 39·98	*h* 39·64 *h* 40·16 *h* 40·44	*l* 39·78 *l* 39·62 *l* 40·54	*h* 39·64 *h* 40·32 *l* 39·54	$M = 40''\cdot17$ $w = 28\cdot41$ $\frac{1}{w} = 0\cdot04$
	40·62	39·27	40·25	40·99	40·14	40·33	40·18	40·08	39·98	39·83	$C = 41^\circ 12' 40''\cdot19$

At X (Bhitala)—(*Continued*).

Angle between	Circle readings, telescope being set on VIII (Kanakotri) 0° 1′	180° 1′	79° 13′	259° 13′	158° 24′	338° 24′	237° 36′	57° 36′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XI (Narhar) and XII (Thakur)	″ h 31·22 h 29·56 h 30·86 d 30·25	″ h 30·70 h 31·18 h 29·28	″ l 29·00 l 29·68 l 30·60	″ h 29·26 l 30·52 l 29·64 l 30·10	″ l 29·72 l 30·12 l 30·26	″ h 30·40 h 31·62 h 29·92	″ h 28·66 h 30·68 h 29·90 h 29·26	″ h 30·40 h 30·20 h 30·06	″ l 29·82 l 30·52 l 30·08	″ h 29·56 h 29·68 h 29·74	$M = 30''·08$ $w = 46·85$ $\frac{1}{w} = 0·02$
	30·47	30·39	29·76	29·88	30·03	30·65	29·63	30·22	30·14	29·66	$C = 41°\ 19'\ 30''·08$

At XI (Narhar)

January 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XIII (Jeysulmere) 0° 0′	180° 0′	79° 12′	259° 12′	158° 25′	338° 25′	237° 36′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XIII (Jeysulmere) and XIV (Malar)	″ h 49·26 h 47·82 h 47·80	″ h 46·68 h 48·66 h 47·06	″ h 46·24 l 46·94 l 46·52	″ l 46·82 l 46·78 l 47·70	″ l 47·42 l 48·86 l 48·44	″ h 46·42 h 47·10 h 46·40	″ h 45·76 h 44·30 h 47·10 h 46·56	″ h 46·44 h 47·06 h 47·86	″ h 44·82 h 48·16 h 46·68 h 47·84 h 46·64	″ h 45·74 l 47·02 l 45·84 l 46·70	$M = 47''·05$ $w = 12·80$ $\frac{1}{w} = 0·08$
	48·29	47·47	46·57	47·10	48·24	46·64	45·93	47·12	46·83	46·33	$C = 46°\ 38'\ 47''·04$
XIV (Malar) and XII (Thakur)	h 61·88 h 62·12 h 60·44	h 61·68 h 59·96 h 61·34	h 60·12 l 61·40 l 61·96	l 59·58 l 60·34 l 59·64	l 62·06 l 60·10 l 60·32	h 61·42 h 60·58 h 61·06	h 62·00 h 60·18 h 62·26 h 61·06	h 60·26 h 59·76 h 61·00	h 61·48 h 60·74 h 61·36	h 60·18 l 60·98 l 61·26	$M = 60''·91$ $w = 26·53$ $\frac{1}{w} = 0·04$
	61·48	60·99	61·16	59·85	60·83	61·02	61·38	60·34	61·19	60·81	$C = 60°\ 41'\ 0''·90$
XII (Thakur) and X (Bhitala)	h 22·32 h 22·18 h 22·00	h 23·28 h 20·86 h 21·88 h 21·78	h 23·26 l 22·28 l 22·68	l 22·82 l 22·76 l 22·36	l 22·12 l 21·72 l 21·98	h 22·40 h 21·58 h 22·58	h 23·92 h 22·82 h 21·88 h 22·06	h 22·38 h 21·02 h 21·62	h 22·36 h 21·60 h 22·20	l 22·54 l 22·78 l 22·04	$M = 22''·25$ $w = 46·40$ $\frac{1}{w} = 0·02$
	22·17	21·95	22·74	22·65	21·94	22·19	22·67	21·67	22·05	22·45	$C = 36°\ 15'\ 22''·25$
X (Bhitala) and IX (Mangtor)	h 29·56 h 28·64 h 29·64	h 27·88 h 28·52 h 28·30	l 29·72 l 27·96 l 29·42	l 30·74 l 29·38 l 29·16	l 29·52 l 29·88 l 28·56	h 29·58 h 29·86 h 29·82	h 30·14 h 29·94 h 29·24	h 28·90 h 30·38 h 29·92	h 29·72 h 29·24 h 30·54	l 29·00 l 28·62 l 29·28	$M = 29''·37$ $w = 28·60$ $\frac{1}{w} = 0·03$
	29·28	28·23	29·03	29·76	29·32	29·75	29·77	29·73	29·83	28·97	$C = 45°\ 59'\ 29''·37$

At XII (Thakur)

January 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on X (Bhitala) 133° 1′	313° 1′	212° 13′	32° 13′	291° 24′	111° 24′	10° 37′	190° 37′	89° 48′	269° 48′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
X (Bhitala) and IX (Mangtor)	*h* 17·32 *h* 16·50 *h* 16·32	*h* 18·62 *h* 15·88 *h* 17·12 *h* 17·30	*l* 19·96 *l* 16·68 *l* 18·04 *l* 18·82 *l* 18·02 *h* 15·38 *h* 17·96 *h* 18·18	*h* 18·02 *h* 17·84 *h* 15·86 *h* 17·38	*h* 15·92 *l* 16·26 *l* 17·78	*h* 17·00 *h* 16·60 *h* 17·50	*l* 18·04 *l* 16·00 *l* 17·20 *l* 18·46	*l* 18·36 *l* 15·72 *l* 16·82 *l* 15·90	*l* 16·34 *l* 16·32 *l* 15·48	*l* 16·66 *l* 16·78 *l* 16·38	$M = 16''·96$ $w = 20·37$ $\frac{1}{w} = 0·05$ $C = 54° 21' 17''·01$
	16·71	17·23	17·88	17·28	16·65	17·03	17·42	16·70	16·05	16·61	
IX (Mangtor) and XI (Narhar)	*h* 51·28 *h* 52·52 *h* 54·44 *h* 51·64 *h* 52·52	*h* 52·38 *h* 53·14 *h* 52·18 *h* 54·08	*l* 48·82 *l* 54·56 *l* 54·72 *l* 49·92 *h* 49·54 *h* 49·14	*h* 53·62 *h* 51·38 *l* 52·36 *l* 52·42	*h* 52·76 *l* 53·20 *l* 51·86	*h* 52·54 *h* 52·02 *h* 53·12	*l* 50·98 *l* 51·92 *l* 51·68	*l* 50·26 *l* 52·70 *l* 52·36 *l* 51·76	*l* 51·94 *l* 51·72 *l* 52·42	*l* 50·94 *l* 50·78 *l* 51·28	$M = 52''·05$ $w = 11·74$ $\frac{1}{w} = 0·09$ $C = 48° 3' 52''·04$
	52·48	52·95	51·12	52·44	52·61	52·56	51·53	51·77	52·03	51·00	
XI (Narhar) and XIV (Malar)	*h* 26·26 *h* 29·12 *h* 28·22 *h* 29·60 *h* 27·64	*h* 30·56 *h* 28·38 *h* 29·22 *h* 26·60 *h* 30·14	*l* 31·30 *l* 27·36 *l* 26·44 *l* 29·66 *h* 29·14 *h* 29·78	*h* 29·20 *h* 30·54 *l* 28·62 *l* 29·74	*h* 29·42 *l* 27·74 *l* 28·74	*h* 27·04 *h* 27·52 *h* 27·00	*l* 28·34 *l* 27·64 *l* 27·64	*l* 27·52 *l* 26·10 *l* 26·90 *l* 26·70	*l* 28·02 *l* 27·48 *l* 28·96	*l* 29·26 *l* 28·32 *l* 28·54	$M = 28''·30$ $w = 10·16$ $\frac{1}{w} = 0·10$ $C = 67° 31' 28''·32$
	28·17	28·98	28·95	29·53	28·63	27·19	27·87	26·80	28·15	28·71	
XIV (Malar) and XV (Badhor)	*h* 27·86 *h* 27·06 *h* 25·72 *h* 23·76 *h* 26·48 *h* 27·14	*h* 27·20 *h* 26·16 *h* 27·90	*l* 28·90 *l* 29·80 *l* 26·64 *l* 28·58 *h* 25·84 *h* 26·06 *h* 25·08	*h* 28·24 *l* 26·66 *l* 26·66 *l* 27·88	*h* 25·04 *h* 25·28 *h* 26·30	*h* 25·84 *h* 24·78 *h* 24·74	*l* 25·72 *l* 26·60 *l* 24·52 *l* 26·56	*l* 25·50 *l* 28·34 *l* 27·60 *l* 27·80	*l* 25·10 *l* 26·34 *l* 25·66	*l* 27·46 *l* 26·70 *l* 26·32	$M = 26''·64$ $w = 9·48$ $\frac{1}{w} = 0·11$ $C = 57° 3' 26''·65$
	26·34	27·09	27·27	27·36	25·54	25·12	25·85	27·31	25·70	26·83	

At XIII (Jeysulmere)

January 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XVI (Ramsar) 232° 17′	52° 17′	311° 29′	131° 28′	30° 41′	210° 40′	109° 52′	289° 52′	189° 5′	9° 5′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XVI (Ramsar) and XIV (Malar)	*h* 24·66 *h* 24·10 *h* 26·50 *h* 26·76	*h* 27·34 *h* 26·30 *h* 26·50	*h* 27·70 *h* 26·92 *h* 26·96	*h* 26·16 *h* 27·98 *h* 28·16	*h* 26·74 *h* 26·02 *h* 26·88	*h* 25·80 *h* 26·12 *h* 26·64	*h* 26·08 *h* 28·94 *h* 25·94 *h* 26·20 *h* 26·62	*h* 26·84 *h* 27·10 *h* 25·88	*h* 24·16 *h* 25·74 *h* 25·74 *h* 25·42	*h* 27·00 *h* 28·84 *h* 26·68 *h* 27·48	$M = 26''·57$ $w = 13·62$ $\frac{1}{w} = 0·07$ $C = 61° 11' 26''·56$
	25·51	26·71	27·19	27·43	26·55	26·19	26·76	26·61	25·26	27·50	

At XIII (Jeysulmere)—(*Continued*).

Angle between	232° 17′	52° 17′	311° 29′	131° 28′	30° 41′	210° 40′	109° 52′	289° 52′	189° 5′	9° 5′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	Circle readings, telescope being set on XVI (Ramsar)										
XIV (Malar) and XI (Narhar)	″ h 20·40 h 21·76 h 20·66	″ h 21·12 h 21·40 h 21·66	″ h 21·30 h 21·18 h 20·64	″ h 22·74 h 19·88 h 20·56 h 20·88	″ h 20·88 h 20·96 h 20·18	″ h 20·50 h 20·20 h 20·44	″ h 19·50 h 19·14 h 19·66	″ h 21·40 h 20·86 h 21·44	″ h 20·06 h 20·16 h 21·30	″ h 21·26 h 20·08 h 21·06	$M = 20''\cdot74$ $w = 25\cdot13$ $\frac{1}{w} = 0\cdot04$
	20·94	21·39	21·04	21·02	20·67	20·38	19·43	21·23	20·51	20·80	$C = 66°\ 32'\ 20''\cdot74$

At XIV (Malar)

January 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	Circle readings, telescope being set on XVI (Ramsar)										
XVI (Ramsar) and XVII (Sinaba)	″ h 31·60 h 30·68 h 32·04 h 32·60	″ h 32·00 l 33·76 l 34·60 l 31·46 h 32·74	″ h 29·34 l 28·32 l 31·38 l 33·12 l 30·30 l 31·34	″ l 29·70 l 31·74 h 30·56 h 31·76	″ h 31·06 h 31·76 l 31·44	″ h 30·58 l 31·08 l 32·86 l 32·16	″ h 31·06 h 31·36 h 32·20	″ h 32·30 h 30·12 h 30·74 h 32·16	″ h 31·70 l 31·62 l 32·16	″ h 31·58 h 31·18 h 31·60	$M = 31''\cdot55$ $w = 16\cdot77$ $\frac{1}{w} = 0\cdot06$
	31·73	**32·91**	**30·63**	**30·94**	**31·42**	**31·67**	**31·54**	**31·33**	**31·83**	**31·45**	$C = 56°\ 8'\ 31''\cdot55$
XVII (Sinaba) and XV (Badhor)	h 50·68 h 50·88 h 51·60 h 48·32 h 49·16	h 48·38 l 46·80 l 47·86 h 48·70 h 49·02 h 50·14	h 50·02 l 51·50 l 50·48 l 50·04	l 52·68 h 48·82 h 53·12 h 49·86 h 51·02 h 49·10	h 49·50 h 52·00 l 49·62 l 49·02	h 50·88 l 50·76 l 50·30	h 49·96 h 50·50 h 50·54	h 50·06 h 50·58 h 51·22	h 50·52 h 51·54 l 49·92	h 48·78 h 50·08 h 50·44 h 50·82	$M = 50''\cdot22$ $w = 13\cdot97$ $\frac{1}{w} = 0\cdot07$
	50·13	**48·48**	**50·51**	**50·77**	**50·04**	**50·65**	**50·33**	**50·62**	**50·66**	**50·03**	$C = 64°\ 1'\ 50''\cdot19$
XV (Badhor) and XII (Thakur)	h 34·98 h 34·80 h 33·96	h 33·42 l 35·22 l 33·64	l 34·82 l 34·42 l 34·16	l 34·88 l 33·18 h 35·28 h 35·72	h 33·42 h 33·64 l 34·72	h 34·64 l 35·62 l 33·48	h 34·94 h 35·10 h 33·94	h 33·90 h 34·18 h 34·60	h 34·52 h 33·74 l 34·42	h 34·44 h 34·02 h 33·38	$M = 34''\cdot35$ $w = 46\cdot22$ $\frac{1}{w} = 0\cdot02$
	34·58	**34·09**	**34·47**	**34·77**	**33·93**	**34·58**	**34·66**	**34·23**	**34·23**	**33·95**	$C = 62°\ 44'\ 34''\cdot36$
XII (Thakur) and XI (Narhar)	h 31·48 h 31·52 h 32·30	h 32·26 l 33·38 l 31·08 l 30·34 l 32·28	l 33·90 l 32·44 l 32·52	l 31·74 l 33·94 h 31·62 h 32·24	h 33·04 h 31·60 l 32·32	l 32·00 l 32·30 l 34·26 h 31·56	h 31·80 h 32·60 h 32·30	h 31·70 h 31·26 h 31·96 h 30·12	h 32·44 h 32·32 l 32·22	h 30·84 h 31·92 h 32·22	$M = 32''\cdot13$ $w = 24\cdot73$ $\frac{1}{w} = 0\cdot04$
	31·77	**31·87**	**32·95**	**32·39**	**32·32**	**32·53**	**32·23**	**31·26**	**32·33**	**31·66**	$C = 51°\ 47'\ 32''\cdot12$

At XIV (Malar)—(*Continued*).

Angle between	Circle readings, telescope being set on XVI (Ramsar) 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XI (Narhar)	h 52·16	h 53·40	h 51·02	l 52·38	h 53·74	l 53·00	h 53·42	h 51·12	h 51·90	h 52·00	$M = 52''\cdot68$
and	h 54·36	l 52·42	l 52·92	l 55·30	h 53·20	l 52·38	h 52·38	h 52·38	h 52·84	h 53·42	$w = 18\cdot32$
XIII (Jeysulmere)	h 52·68	l 53·98	l 52·90	h 51·90	l 53·38	h 53·46	h 52·36	h 50·54	l 52·80	h 52·82	$\frac{1}{w} = 0\cdot05$
	h 51·90			h 51·48							
	52·78	53·27	52·28	52·76	53·44	52·95	52·72	51·35	52·51	52·75	$C = 66°\ 48'\ 52''\cdot68$
XIII (Jeysulmere)	h 36·74	h 40·06	h 38·46	l 38·28	h 37·58	l 38·12	h 37·56	h 38·04	h 38·28	h 38·36	$M = 38''\cdot16$
and	h 37·16	l 38·48	h 39·76	h 37·98	h 37·14	l 38·22	h 37·92	h 38·42	h 38·84	h 39·14	$w = 27\cdot80$
XVI (Ramsar)	h 37·68	l 38·40	l 37·94	h 38·36	l 37·68	h 37·90	h 37·96	h 38·46	l 37·70	h 38·10	$\frac{1}{w} = 0\cdot04$
	37·19	38·98	38·72	38·21	37·47	38·08	37·81	38·31	38·27	38·53	$C = 58°\ 28'\ 38''\cdot16$
XVI (Ramsar)	h 42·68	h 40·74	h 41·50	l 40·76	h 43·04	l 40·70	h 41·58	l 42·36	h 42·04	h 41·66	$M = 42''\cdot22$
and	h 42·62	l 42·88	h 42·36	l 42·30	h 42·46	l 41·70	h 42·32	l 41·36	h 41·96	h 43·04	$w = 18\cdot48$
R.M.	h 45·00	l 42·70	l 42·26	l 42·58	l 42·50	l 42·32	h 41·86	l 41·52	l 42·48	h 41·66	$\frac{1}{w} = 0\cdot05$
	h 44·82	l 42·88									
	43·78	42·30	42·04	41·88	42·67	41·57	41·92	41·75	42·16	42·12	$C = 29°\ 14'\ 42''\cdot23$

At XV (Badhor)

February 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XII (Thakur) 0° 0′	180° 0′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XII (Thakur)	h 59·84	h 61·16	h 59·34	h 59·60	l 60·32	l 60·72	l 60·32	l 59·06	h 60·04	h 58·96	$M = 60''\cdot21$
and	h 61·90	h 60·38	h 60·00	l 59·94	l 60·62	l 60·18	l 61·24	h 59·64	h 60·82	h 59·40	$w = 30\cdot50$
XIV (Malar)	h 61·12	h 60·46	h 60·30	l 59·32	l 59·90	l 60·36	l 60·02	h 60·32	h 60·68	h 60·18	$\frac{1}{w} = 0\cdot03$
	h 61·18										
	61·01	60·67	59·88	59·62	60·28	60·42	60·53	59·67	60·51	59·51	$C = 60°\ 12'\ 0''\cdot22$
XIV (Malar)	h 57·76	h 56·22	h 56·14	l 55·42	l 55·28	l 56·80	l 56·18	l 56·44	h 56·54	h 55·88	$M = 56''\cdot45$
and	h 55·76	h 56·86	h 55·50	l 56·72	l 57·58	l 57·14	l 56·62	l 57·42	h 58·56	h 56·80	$w = 31\cdot68$
XVII (Sinaba)	h 56·04	h 56·46	h 55·94	l 56·56	l 55·70	l 57·42	l 56·76	l 56·54	h 56·38	h 54·92	$\frac{1}{w} = 0\cdot03$
	h 55·50				l 57·52				h 55·80		
	56·27	56·51	55·86	56·23	56·52	57·12	56·52	56·80	56·82	55·87	$C = 55°\ 49'\ 56''\cdot45$

NOTE.—R.M. denotes Referring Mark.

At XVI (Ramsar)

February 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XVIII (Potanawári)										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	180° 0′	79° 12′	259° 12′	158° 24′	338° 24′	237° 37′	57° 36′	316° 49′	136° 48′	
	″	″	″	″	″	″	″	″	″	″	
XVIII (Potanawári) and XIX (Joganali)	h 60·10 h 60·08 h 60·86	h 60·04 h 59·96 h 60·88	h 59·56 h 61·16 l 59·28	l 60·20 l 58·70 l 60·12	l 60·32 l 59·22 h 60·32	h 60·88 h 60·68 h 61·58	h 61·00 h 61·00 h 61·22	h 58·54 h 60·78 h 61·54 h 60·92	h 60·10 l 60·36 l 60·32	h 60·06 h 60·84 h 59·36	$M = 60''{\cdot}32$ $w = 30{\cdot}60$ $\frac{1}{w} = 0{\cdot}03$
	60·35	60·29	60·00	59·67	59·95	61·05	61·07	60·45	60·26	60·09	$C = 45^\circ\, 32'\, 0''{\cdot}32$
XIX (Joganali) and XVII (Sinaba)	h 26·80 h 26·52 h 26·44	h 25·94 h 26·22 h 25·66	h 24·14 h 25·50 l 25·70	l 23·86 l 25·98 l 24·46 l 25·40	l 25·20 l 24·78 h 25·42	h 24·36 h 25·42 h 25·80	h 23·90 h 24·84 h 24·30 h 24·34	h 24·72 h 24·42 h 24·94 h 25·14	l 24·60 h 23·56 h 24·40	h 25·46 h 24·28 h 24·10	$M = 25''{\cdot}08$ $w = 16{\cdot}85$ $\frac{1}{w} = 0{\cdot}06$
	26·59	25·94	25·11	24·93	25·13	25·19	24·34	24·81	24·19	24·61	$C = 77^\circ\, 11'\, 25''{\cdot}08$
XVII (Sinaba) and XIV (Malar)	h 26·90 h 27·72 h 27·34	h 27·12 h 27·34 h 27·42	h 27·10 h 27·50 h 27·62	l 27·36 l 29·22 l 28·02	l 28·84 l 28·16 h 27·16	h 28·84 h 27·80 h 27·44	h 26·70 h 28·82 h 27·50 h 27·82	h 28·24 h 26·32 h 28·54 h 29·16	l 27·18 h 27·54 h 28·00	h 27·62 h 27·44 h 27·50	$M = 27''{\cdot}72$ $w = 41{\cdot}10$ $\frac{1}{w} = 0{\cdot}02$
	27·32	27·29	27·41	28·20	28·05	28·03	27·71	28·07	27·57	27·52	$C = 66^\circ\, 30'\, 27''{\cdot}72$
XIV (Malar) and XIII (Jeysulmere)	h 55·26 h 55·58 h 55·08	h 56·46 h 55·76 h 56·46	h 55·74 h 56·24 h 56·04	l 57·22 l 56·94 l 55·42	l 57·14 h 56·48 h 55·66	h 55·44 h 56·54 h 55·92	h 55·30 h 54·60 h 55·56	h 56·64 h 56·00 h 54·94	h 56·10 l 56·60 l 55·80	h 56·80 h 55·28 h 56·02	$M = 55''{\cdot}97$ $w = 35{\cdot}70$ $\frac{1}{w} = 0{\cdot}03$
	55·31	56·23	56·01	56·53	56·43	55·97	55·15	55·86	56·17	56·03	$C = 60^\circ\, 19'\, 55''{\cdot}97$

At XVII (Sinaba)

February 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XV (Badhor)										M = Mean of Groups w = Relative Weight C = Concluded Angle
	0° 0′	180° 0′	79° 12′	259° 12′	158° 24′	338° 24′	237° 36′	57° 36′	316° 49′	136° 49′	
	″	″	″	″	″	″	″	″	″	″	
XV (Badhor) and XIV (Malar)	l 14·26 l 15·50 l 14·66	l 14·32 l 14·56 l 15·16	l 13·42 h 14·66 h 14·60	h 12·46 h 14·14 h 13·94	h 13·76 h 13·88 h 14·22	h 13·88 h 13·62 h 14·08	l 14·52 l 13·22 l 14·08	l 13·74 l 15·76 l 13·46 l 14·14	l 14·18 l 14·40 l 13·58	l 15·66 h 14·18 h 13·98	$M = 14''{\cdot}19$ $w = 35{\cdot}98$ $\frac{1}{w} = 0{\cdot}03$
	14·81	14·68	14·23	13·51	13·95	13·86	13·94	14·28	14·05	14·61	$C = 60^\circ\, 8'\, 14''{\cdot}19$

At XVII (Sinaba)—(*Continued*).

Angle between	Circle readings, telescope being set on XV (Badhor) 0° 0′	180° 0′	79° 12′	259° 12′	158° 24′	338° 24′	237° 36′	57° 36′	316° 49′	136° 49′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XIV (Malar) and XVI (Ramsar)	* h 63·14 h 61·66 h 63·26	* h 62·54 h 60·38 h 61·02 h 62·12	* h 62·36 h 60·56 h 61·24	* h 60·82 h 62·46 h 62·00	* h 63·40 h 61·44 h 62·96	* h 61·00 h 61·60 h 62·46	* l 61·56 l 62·34 l 61·40	* l 61·92 l 62·52 l 62·02	* l 62·96 l 61·96 l 61·86	* l 60·00 h 60·88 h 60·34	$M = 61''·82$ $w = 17·30$ $\frac{1}{w} = 0·06$
	62·69	61·52	61·39	61·76	62·60	61·69	61·77	62·15	62·26	60·41	$C = 57°\ 21'\ 1''·82$
XVI (Ramsar) and XIX (Joganali)	h 21·54 h 21·18 h 20·38 h 21·00	h 21·34 h 19·92 h 19·66 h 20·18	h 19·14 h 22·36 h 20·46 h 20·24	h 20·18 h 19·28 h 20·00	h 20·08 h 19·94 h 19·60	h 20·16 h 19·60 h 20·60	l 21·38 l 19·76 l 21·56	l 19·44 l 19·74 l 20·52	l 21·32 l 19·48 l 19·32	l 19·44 h 19·12 h 21·32 h 19·66	$M = 20''·24$ $w = 28·32$ $\frac{1}{w} = 0·04$
	21·03	20·27	20·55	19·82	19·87	20·12	20·90	19·90	20·04	19·89	$C = 55°\ 32'\ 20''·25$
XIX (Joganali) and XX (Kardo)	h 60·92 h 60·72 h 61·10	h 64·36 h 62·12 h 62·96 h 60·56 h 63·34 h 60·86	h 61·80 h 60·22 h 60·32	h 62·10 h 59·66 h 61·46	h 61·40 h 61·52 h 60·44	h 62·38 h 61·00 h 61·12	l 60·90 l 60·94 l 61·10	l 61·50 l 61·36 l 60·46	l 60·44 l 60·40 l 59·88	l 61·32 h 61·72 h 60·66	$M = 61''·13$ $w = 20·50$ $\frac{1}{w} = 0·05$
	60·91	62·37	60·78	61·07	61·12	61·50	60·98	61·11	60·24	61·23	$C = 41°\ 55'\ 1''·16$

At XVIII (Potanawári)

February 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No. 2.*

Angle between	Circle readings, telescope being set on XXI (Sanahu) 0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	335° 24′	237° 36′	57° 36′	316° 49′	136° 49′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XXI (Sanahu) and XIX (Joganali)	* h 28·10 h 27·78 h 27·32	* h 22·96 h 25·34 h 23·02 h 25·62 h 26·50 h 27·30	* h 23·60 h 26·14 h 23·90 h 27·24 h 25·64 h 25·76	* l 24·94 l 25·84 l 24·64 l 24·52 l 26·04	* l 24·88 l 26·28 l 28·34 l 27·18 l 25·16	* l 24·96 l 27·70 l 26·78 l 26·86	* l 30·42 l 26·96 l 28·24 l 30·12 l 27·54 l 25·76	* h 27·60 h 25·92 h 27·02	* h 28·04 h 27·76 h 27·40	* h 27·80 h 25·84 h 26·20	$M = 26''·57$ $w = 6·49$ $\frac{1}{w} = 0·15$
	27·73	25·12	25·38	25·20	26·37	26·58	28·17	26·85	27·73	26·61	$C = 54°\ 43'\ 26''·53$
XIX (Joganali) and XVI (Ramsar)	h 56·62 h 56·30 h 56·70	h 58·80 h 58·80 h 56·94 h 55·68 h 56·86	h 57·04 h 56·56 h 57·66	l 57·64 l 56·94 l 57·76	l 57·98 l 57·80 l 57·94	l 58·00 l 58·02 l 56·30	l 55·06 l 54·76 l 58·30 l 57·04 l 58·02	h 57·38 h 57·80 h 56·38	h 56·78 h 56·04 h 58·12 h 57·06	h 57·12 h 55·64 h 57·02	$M = 57''·13$ $w = 23·82$ $\frac{1}{w} = 0·04$
	56·54	57·42	57·09	57·45	57·91	57·44	56·64	57·19	57·00	56·59	$C = 72°\ 4'\ 57''·12$

At XIX (Joganali)

February 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

M = Mean of Groups; w = Relative Weight; C = Concluded Angle

Angle between	Circle readings, telescope being set on XXI (Sanahu): 0° 1′	180° 1′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	M, w, C
	″	″	″	″	″	″	″	″	″	″	
XXI (Sanahu) and XXII (Arrabhit)	h 5·28 h 1·42 h 2·92 h 2·48 h 3·68	h 2·38 l 4·02 l 2·56	l 2·60 h 2·72 h 4·98 h 1·98	h 2·14 h 1·78 h 2·46	h 3·66 h 2·02 h 3·28	h 2·94 h 3·52 h 2·04	h 2·16 h 3·36 h 3·02	h 3·40 h 2·98 h 2·46	h 2·42 h 2·60 h 2·92	h 2·38 l 3·62 l 1·84	M = 2″·82 w = 34·39 $\frac{1}{w}$ = 0·03
	3·16	2·99	3·07	2·13	2·99	2·83	2·85	2·95	2·65	2·61	C = 57° 5′ 2″·84
XXII (Arrabhit) and XX (Kardo)	h 8·52 h 6·66 h 6·42 h 7·86 h 8·14	h 7·58 l 7·66 l 8·28	l 7·26 h 7·42 h 4·46 h 7·18	h 5·88 h 7·86 h 5·30 h 7·18	h 6·16 h 8·10 h 6·56	h 7·38 h 6·78 h 7·56	h 6·54 h 7·90 h 7·14	h 6·18 h 7·60 h 7·28	h 6·96 h 7·32 h 7·16	h 6·82 l 6·44 l 6·68	M = 7″·07 w = 29·49 $\frac{1}{w}$ = 0·03
	7·52	7·84	6·58	6·56	6·94	7·24	7·19	7·02	7·15	6·65	C = 69° 3′ 7″·07
XX (Kardo) and XVII (Sinaba)	h 20·88 h 24·76 h 24·82 h 24·12 h 23·36	h 26·52 l 23·06 l 22·72 l 26·14 l 23·56	l 22·48 l 25·04 h 25·20 h 23·86	h 24·18 h 26·58 h 24·64 h 27·48 h 24·80	h 22·38 h 24·76 h 23·12 h 24·86	h 23·90 h 25·18 h 25·10	h 24·56 h 24·28 h 23·36	h 23·44 h 24·40 h 24·24	h 23·24 h 24·16 h 24·06	h 22·82 h 23·94 h 23·68	M = 24″·16 w = 14·40 $\frac{1}{w}$ = 0·07
	23·59	24·40	24·15	25·54	23·78	24·73	24·07	24·03	23·82	23·48	C = 51° 36′ 24″·18
XVII (Sinaba) and XVI (Ramsar)	h 17·36 h 15·12 h 15·30 h 16·44 h 16·16	h 15·86 l 17·08 l 14·26 l 15·06	l 15·56 l 16·54 h 16·08	h 16·42 h 16·22 h 16·80	h 16·80 h 15·92 h 17·18	h 14·84 h 16·74 h 15·82	h 17·28 h 15·24 h 16·02 h 16·22	h 16·06 h 15·78 h 15·42	h 16·30 h 15·34 h 17·40 h 15·48	h 16·54 h 15·64 l 15·94	M = 16″·07 w = 41·75 $\frac{1}{w}$ = 0·02
	16·08	15·57	16·06	16·48	16·63	15·80	16·19	15·75	16·13	16·04	C = 47° 16′ 16″·06
XVI (Ramsar) and XVIII (Potanawári)	h 3·26 h 5·66 h 4·12 h 1·48 h 4·10	h 2·86 h 4·24 l 4·30 l 5·30	l 4·74 l 4·36 h 3·98	h 2·58 h 1·92 h 2·60	h 3·34 h 2·96 h 3·52	h 3·00 h 2·60 h 2·24	h 2·84 h 2·70 h 2·78	h 3·26 h 2·34 h 3·72	h 2·54 h 2·74 h 2·58	h 3·26 h 2·94 l 3·34	M = 3″·22 w = 16·69 $\frac{1}{w}$ = 0·06
	3·72	4·18	4·36	2·37	3·27	2·61	2·77	3·11	2·62	3·18	C = 62° 23′ 3″·23
XVIII (Potanawári) and XXI (Sanahu)	h 4·52 h 4·38 h 4·64 h 5·04 h 8·06	h 4·12 h 3·84 h 6·22 h 5·30 h 7·82	l 5·14 l 5·76 h 5·86	h 6·98 h 7·48 h 6·10	h 5·86 h 6·14 h 5·66	h 5·64 h 4·78 h 5·36	h 6·08 h 7·38 h 7·30	h 6·78 h 6·36 h 6·62	h 6·70 h 7·64 h 6·94	h 6·26 h 6·98 h 7·66	M = 6″·20 w = 12·54 $\frac{1}{w}$ = 0·08
	5·33	5·46	5·59	6·85	5·89	5·26	6·92	6·59	7·09	6·97	C = 72° 36′ 6″·18

At XX (Kardo)

February 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XVII (Sinaba) 0° 0′	180° 0′	79° 13′	259° 10′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XVII (Sinaba) and XIX (Joganali)	*h* 35·48 *h* 36·46 *h* 35·48	*h* 35·86 *h* 35·90 *h* 37·34	*h* 35·46 *h* 36·52 *h* 36·20	*h* 34·26 *h* 35·82 *h* 36·02 *h* 38·62 *h* 37·58 *h* 35·28	*h* 34·48 *h* 37·12 *h* 36·66 *h* 36·30	*h* 35·64 *h* 36·66 *h* 35·58	*h* 37·10 *h* 36·88 *h* 34·24 *h* 35·72	*h* 35·72 *h* 36·86 *h* 35·30	*h* 37·22 *l* 37·58 *l* 37·02	*l* 36·36 *l* 37·00 *l* 35·42	$M = 36''\cdot21$ $w = 24\cdot45$ $\frac{1}{w} = 0\cdot04$ $C = 86° 28' 36''\cdot21$
	35·81	36·37	36·06	36·26	36·14	35·96	35·99	35·96	37·27	36·26	
XIX (Joganali) and XXII (Arrabhit)	*h* 44·88 *h* 45·58 *h* 46·36	*h* 46·12 *h* 46·32 *h* 45·56	*h* 43·94 *h* 45·60 *h* 45·36	*h* 45·08 *h* 43·36 *h* 44·58	*h* 44·62 *h* 44·64 *h* 44·84	*h* 46·02 *h* 45·22 *h* 46·30	*h* 45·74 *h* 45·06 *h* 46·22	*h* 44·38 *h* 45·50 *h* 45·04	*h* 45·94 *l* 46·36 *l* 45·20	*l* 42·50 *l* 45·14 *l* 45·92 *l* 45·78 *l* 45·42	$M = 45''\cdot29$ $w = 21\cdot10$ $\frac{1}{w} = 0\cdot05$ $C = 56° 58' 45''\cdot29$
	45·61	46·00	44·97	44·34	44·70	45·85	45·67	44·97	45·83	44·95	

At XXI (Sanahu)

February and March 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXIII (Harnáo) 143° 6′	323° 6′	222° 20′	42° 20′	301° 31′	121° 31′	20° 43′	200° 43′	99° 55′	279° 55′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXIII (Harnáo) and XXIV (Dhanono)	*h* 36·26 *h* 39·40 *h* 41·02 *h* 39·06 *h* 37·94 *h* 37·98	*h* 38·82 *h* 41·26 *h* 38·42 *h* 40·00	*h* 40·38 *l* 40·82 *l* 40·14	*l* 43·76 *h* 40·40 *h* 41·66 *h* 39·64 *h* 40·74 *h* 39·32	*h* 42·16 *h* 40·54 *h* 39·04 *h* 40·36 *h* 39·42	*h* 41·30 *h* 39·64 *h* 41·40	*h* 41·46 *h* 40·70 *h* 39·70	*h* 40·08 *h* 39·66 *h* 40·04	*h* 38·40 *h* 39·48 *h* 39·60	*h* 39·54 *h* 39·28 *h* 39·70	$M = 39''\cdot99$ $w = 11\cdot47$ $\frac{1}{w} = 0\cdot09$ $C = 53° 51' 39''\cdot98$
	38·61	39·63	40·45	40·92	40·30	40·78	40·62	39·93	39·16	39·51	
XXIV (Dhanono) and XXII (Arrabhit)	*h* 42·70 *h* 40·04 *h* 36·54 *h* 39·60 *h* 39·56	*h* 41·12 *h* 40·32 *h* 39·96	*h* 40·12 *h* 39·32 *h* 38·88	*l* 38·28 *h* 40·34 *h* 40·68 *h* 41·72 *h* 39·54	*h* 39·46 *h* 40·86 *h* 40·34	*h* 37·64 *h* 39·54 *h* 39·84 *h* 39·84	*h* 39·82 *h* 40·72 *h* 40·24	*h* 39·96 *h* 39·56 *h* 40·56	*h* 40·40 *h* 40·14 *h* 40·14	*h* 39·16 *h* 40·32 *h* 40·02	$M = 39''\cdot95$ $w = 22\cdot28$ $\frac{1}{w} = 0\cdot04$ $C = 45° 32' 39''\cdot93$
	39·69	40·47	39·44	40·11	40·22	39·22	40·26	40·03	40·23	39·83	

At XXI (Sanahu)—(*Continued*).

Angle between	Circle readings, telescope being set on XXIII (Harnáo) 143° 6′	323° 6′	222° 20′	42° 20′	301° 31′	121° 31′	20° 43′	200° 43′	99° 55′	279° 55′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXII (Arrabhit) and XIX (Joganali)	h 44·72 h 46·02 h 46·16 h 46·28 h 47·40	h 46·16 h 46·72 h 46·72	h 45·70 l 45·58 l 47·86 l 48·22	l 48·06 h 46·04 h 47·34 h 45·56	h 46·10 h 45·86 h 47·10	h 46·06 h 45·88 h 46·82	h 46·64 h 45·64 h 46·10	h 45·64 h 45·52 h 45·92	h 46·40 h 46·18 h 45·96	h 46·16 h 46·44 h 45·66	$M = 46''\cdot29$ $w = 37\ \cdot88$ $\frac{1}{w} = 0\ \cdot03$
	46·12	46·53	46·84	46·75	46·35	46·25	46·13	45·69	46·18	46·09	$C = 64^\circ 48' 46''\cdot30$
XIX (Joganali) and XVIII (Potanawári)	h 27·60 h 28·68 h 27·66 h 28·26 h 28·00	h 27·82 h 27·76 h 28·82	h 27·96 l 28·34 l 29·98 l 29·18	l 27·86 h 28·96 h 28·44	h 27·52 h 28·36 h 28·84	h 27·30 h 27·70 h 28·54	h 28·30 h 27·64 h 28·62	h 29·50 h 28·86 h 29·42	h 28·50 h 28·60 h 28·02	h 28·60 h 28·72 h 27·52	$M = 28''\cdot37$ $w = 40\ \cdot90$ $\frac{1}{w} = 0\ \cdot02$
	28·04	28·13	28·87	28·42	28·24	27·85	28·19	29·26	28·37	28·28	$C = 52^\circ 40' 28''\cdot36$

At XXII (Arrabhit)

February 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XX (Kardo) 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XX (Kardo) and XIX (Joganali)	h 9·46 h 8·10 h 6·94 h 7·94	h 9·08 h 6·94 h 7·32	h 6·98 h 8·20 h 8·06	l 5·32 l 7·76 l 7·72 l 6·44	l 7·48 l 7·88 l 8·48	h 7·14 h 8·56 h 7·28	h 8·36 h 8·10 h 7·24	h 7·64 h 7·94 h 7·56	h 7·58 h 8·06 h 7·42	h 7·40 h 7·80 h 7·38	$M = 7''\cdot69$ $w = 38\ \cdot34$ $\frac{1}{w} = 0\ \cdot03$
	8·11	7·78	7·75	6·81	7·95	7·66	7·90	7·71	7·69	7·53	$C = 53^\circ 58' 7''\cdot68$
XIX (Joganali) and XXI (Sanahu)	h 8·74 h 11·72 h 13·22 h 14·24 h 12·72 h 12·94 h 12·52	h 11·08 h 12·64 h 11·14	h 12·42 h 10·82 h 11·66	l 11·08 l 11·00 l 12·14	l 11·00 l 12·10 l 12·46	h 12·58 h 13·00 h 11·36	h 10·96 h 13·66 h 10·76 h 13·50 h 10·56	h 12·16 h 14·36 h 11·12 h 11·54 h 12·02	h 13·56 h 11·34 h 12·84 h 12·42	h 12·28 h 11·54 h 12·38	$M = 11''\cdot99$ $w = 23\ \cdot15$ $\frac{1}{w} = 0\ \cdot04$
	12·30	11·62	11·63	11·41	11·85	12·31	11·89	12·24	12·54	12·07	$C = 58^\circ 6' 12''\cdot03$
XXI (Sanahu) and XXIII (Harnáo)	h 29·72 h 26·80 h 28·94 h 28·40	h 28·56 h 27·96 h 27·50 h 27·48	h 27·14 h 27·86 h 28·46	l 28·04 l 28·30 l 29·22	l 26·88 l 27·60 l 26·58	h 28·56 h 28·32 h 29·60	h 27·80 h 28·92 h 28·86	h 27·46 h 29·40 h 27·96	h 29·18 h 28·32 h 28·94	h 27·80 h 27·00 h 27·52	$M = 28''\cdot16$ $w = 20\ \cdot66$ $\frac{1}{w} = 0\ \cdot05$
	28·47	27·87	27·82	28·52	27·02	28·83	28·53	28·27	28·81	27·44	$C = 42^\circ 21' 28''\cdot16$

At XXII (Arrabhit)—(*Continued*).

Angle between	Circle readings, telescope being set on XX (Kardo) 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 48′	136° 48′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXIII (Harnáo) and XXIV (Dhanono)	*h* 25·42 *h* 26·84 *h* 23·74 *h* 23·76 *h* 22·88	*h* 23·08 *h* 23·00 *h* 24·18	*h* 25·48 *h* 24·50 *h* 23·44 *l* 23·96	*l* 25·32 *l* 23·40 *l* 23·42	*l* 23·86 *l* 24·84 *l* 23·38	*h* 24·14 *h* 23·38 *h* 24·54	*h* 25·28 *h* 23·68 *h* 26·04 *h* 23·70	*h* 24·74 *h* 25·90 *h* 24·84	*h* 25·84 *h* 23·38 *h* 24·24	*h* 24·16 *h* 23·38 *h* 23·56	$M = 24''\cdot24$ $w = 20\cdot65$ $\frac{1}{w} = 0\cdot05$
	24·53	23·42	24·35	24·05	24·03	24·02	24·67	25·16	24·49	23·70	$C = 54^\circ\ 26'\ 24''\cdot25$

At XXIII (Harnáo)

***March* 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XXV (Bándri) 0° 1′	180° 1′	79° 12′	259° 12′	158° 24′	338° 24′	237° 36′	57° 37′	316° 48′	136° 48′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXV (Bándri) and XXVI (Ráviláhu)	*h* 57·52 *h* 56·14 *h* 56·20 *h* 54·88 *h* 55·28	*h* 54·62 *h* 53·56 *h* 52·34 *h* 53·54	*h* 56·12 *h* 54·02 *h* 55·22 *h* 55·02	*h* 52·62 *h* 52·82 *h* 54·42	*l* 53·62 *h* 53·48 *h* 54·84	*h* 53·90 *h* 54·04 *h* 54·42	*h* 53·68 *h* 53·90 *h* 52·52	*h* 52·64 *h* 53·02 *h* 53·16	*h* 54·46 *h* 54·42 *h* 53·82	*h* 54·70 *h* 53·02 *h* 53·86	$M = 54''\cdot04$ $w = 10\cdot34$ $\frac{1}{w} = 0\cdot10$
	56·00	53·52	55·09	53·29	53·98	54·12	53·37	52·94	54·23	53·86	$C = 59^\circ\ 41'\ 54''\cdot06$
XXVI (Ráviláhu) and XXIV (Dhanono)	*h* 46·46 *h* 47·60 *h* 46·78	*h* 48·04 *h* 47·32 *h* 48·30 *h* 47·62	*h* 46·90 *h* 47·16 *h* 45·18	*h* 45·36 *h* 46·22 *h* 45·80	*l* 47·54 *h* 49·88 *h* 46·34 *h* 46·26 *h* 46·10	*h* 46·80 *h* 46·12 *h* 47·10	*h* 45·86 *h* 44·70 *h* 45·94	*h* 44·24 *h* 46·46 *h* 44·28 *h* 45·22	*h* 46·84 *h* 45·52 *h* 47·12	*h* 45·24 *h* 46·02 *h* 45·60	$M = 46''\cdot35$ $w = 10\cdot74$ $\frac{1}{w} = 0\cdot09$
	46·95	47·82	46·41	45·79	47·22	46·67	45·50	45·05	46·49	45·62	$C = 53^\circ\ 5'\ 46''\cdot36$
XXIV (Dhanono) and XXII (Arrabhit)	*h* 10·32 *h* 9·28 *h* 8·76	*h* 9·24 *h* 10·50 *h* 8·20 *h* 12·16 *h* 9·62	*h* 10·40 *h* 10·52 *h* 10·48	*h* 11·10 *h* 10·68 *h* 11·08	*h* 8·72 *h* 10·40 *h* 10·74	*h* 11·00 *h* 9·80 *h* 11·92 *h* 10·08	*h* 10·16 *h* 10·12 *h* 10·76	*h* 10·16 *h* 10·80 *h* 10·48	*h* 11·30 *h* 10·26 *h* 10·74	*h* 10·52 *h* 11·02 *h* 10·74	$M = 10''\cdot38$ $w = 26\cdot47$ $\frac{1}{w} = 0\cdot04$
	9·45	9·94	10·47	10·95	9·95	10·70	10·35	10·48	10·77	10·76	$C = 46^\circ\ 6'\ 10''\cdot37$
XXII (Arrabhit) and XXI (Sanahu)	*h* 11·86 *h* 13·36 *h* 11·94	*h* 12·08 *h* 11·78 *h* 12·46	*h* 11·92 *h* 12·40 *h* 12·72	*h* 12·00 *h* 12·12 *h* 12·34	*h* 12·18 *h* 12·80 *h* 12·46	*h* 12·08 *h* 11·68 *h* 12·48	*h* 12·72 *h* 13·02 *h* 12·00	*h* 11·96 *h* 12·36 *h* 12·72	*h* 12·66 *h* 12·10 *h* 11·92	*h* 12·66 *h* 11·28 *h* 12·80	$M = 12''\cdot30$ $w = 111\cdot50$ $\frac{1}{w} = 0\cdot01$
	12·39	12·11	12·35	12·15	12·48	12·08	12·58	12·35	12·23	12·25	$C = 38^\circ\ 14'\ 12''\cdot30$

At XXIV (Dhanono)

March 1877; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXII (Arrabhit) 179° 14′	359° 14′	258° 26′	78° 26′	337° 38′	157° 38′	56° 49′	236° 49′	136° 1′	316° 2′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXII (Arrabhit) and XXI (Sanahu)	″ h 26·02 h 28·66 h 28·70 h 29·74 h 27·86	″ h 28·92 h 28·82 h 28·30	″ h 29·38 h 29·76 l 29·16	″ l 28·30 h 28·88 h 28·92	″ h 28·70 h 27·36 h 29·34	″ h 29·00 h 28·58 h 29·74	″ h 28·20 h 28·22 h 28·30	″ h 29·12 h 28·56 h 28·64	″ h 27·14 h 28·18 h 27·76 h 29·06	″ h 29·70 h 28·86 h 28·46	$M = 28''{\cdot}67$ $w = 30{\cdot}42$ $\frac{1}{w} = 0{\cdot}03$
	28·20	28·68	29·43	28·70	28·47	29·11	28·24	28·77	28·04	29·01	$C = 37°\,39'\,28''{\cdot}64$
XXI (Sanahu) and XXIII (Harnáo)	h 58·94 h 59·28 h 59·12	h 58·66 h 58·66 h 59·94	h 58·96 h 58·38 l 59·34	l 57·64 h 59·06 h 58·34	h 58·98 h 58·34 h 59·80	h 58·66 h 57·72 h 59·14	h 57·78 h 56·58 h 59·96 h 59·00 h 58·90	h 58·66 h 58·12 h 58·74	h 59·90 h 57·20 h 57·72 h 59·24	h 56·36 h 57·54 h 58·62 h 57·88	$M = 58''{\cdot}61$ $w = 26{\cdot}17$ $\frac{1}{w} = 0{\cdot}04$
	59·11	59·09	58·89	58·35	59·04	58·51	58·44	58·51	58·52	57·60	$C = 41°\,47'\,58''{\cdot}59$
XXIII (Harnáo) and XXVI (Ráviláhu)	h 6·74 h 6·90 h 6·68	h 7·36 h 7·34 h 7·96	h 7·80 h 7·52 l 7·92	l 7·52 h 6·14 h 7·56	h 6·94 h 6·28 h 6·62	h 6·68 h 6·30 h 6·72	h 7·14 h 8·04 h 6·98	h 6·78 h 6·90 h 7·84	h 7·22 h 8·00 h 7·50	h 7·00 h 6·34 h 6·36	$M = 7''{\cdot}10$ $w = 41{\cdot}70$ $\frac{1}{w} = 0{\cdot}02$
	6·77	7·55	7·75	7·07	6·61	6·57	7·39	7·17	7·57	6·57	$C = 50°\,27'\,7''{\cdot}10$
XXVI (Ráviláhu) and XXIX (Máringra)	h 7·06 h 7·98 h 9·62 h 9·54 h 4·42 h 5·92 h 6·12	h 7·76 h 6·60 h 5·54 h 5·68	h 7·02 l 6·22 l 5·30	l 6·76 h 5·74 h 6·36	h 7·02 h 5·76 h 7·32	h 6·14 h 5·66 h 6·48	h 7·32 h 5·92 h 7·58	h 7·88 h 7·80 h 7·46	h 7·06 h 7·68 h 7·62	h 5·56 h 7·16 h 6·10	$M = 6''{\cdot}73$ $w = 16{\cdot}20$ $\frac{1}{w} = 0{\cdot}06$
	7·24	6·40	6·18	6·29	6·70	6·09	6·94	7·71	7·45	6·27	$C = 50°\,52'\,6''{\cdot}74$

At XXV (Bándri)

**March* 1877; and †*January* 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXVII (Máhu) 239° 41′	59° 41′	318 53′	138° 52′	38° 5′	218° 5′	117° 17′	297° 17′	196° 29′	16° 29′	M = Mean of Groups w = Relative Weight C = Concluded Angle
† XXVII (Máhu) and XXVIII (Girája)	″ h 33·84 h 32·84 h 31·78 h 31·60	″ h 34·02 h 33·18 h 33·16 h 32·78	″ h 32·84 h 32·80 h 33·00	″ h 31·30 h 33·86 h 31·98 h 32·66	″ l 30·70 l 34·16 l 31·78 l 32·76 l 33·50	″ l 31·98 l 32·02 l 32·10	″ h 31·48 h 32·36 h 31·48	″ h 32·22 h 32·86 h 32·06	″ h 33·02 h 33·14 h 32·44	″ h 32·10 h 32·08 h 32·94	$M = 32''{\cdot}51$ $w = 30{\cdot}30$ $\frac{1}{w} = 0{\cdot}03$
	32·52	33·28	32·88	32·45	32·58	32·03	31·77	32·38	32·87	32·37	$C = 70°\,10'\,32''{\cdot}52$

At XXV (Bándri)—(*Continued*).

Angle between	Circle readings, telescope being set on XXVII (Máhu) 239° 41′	59° 41′	318° 53′	138° 52′	38° 5′	218° 5′	117° 17′	297° 17′	196° 29′	16° 29′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
† XXVIII (Giràja) and XXVI (Ráviláhu)	*h* 6·96 *h* 4·60 *h* 4·46 *h* 4·64	*h* 2·56 *h* 5·02 *h* 3·02 *h* 2·46	*h* 3·52 *h* 3·76 *h* 4·32	*h* 5·14 *h* 2·00 *h* 4·52 *h* 3·36	*l* 4·38 *l* 3·26 *l* 3·46	*l* 3·06 *l* 3·24 *l* 3·72	*h* 1·92 *h* 2·48 *h* 3·08 *h* 4·20	*h* 3·60 *h* 4·24 *h* 5·14 *h* 3·94	*h* 3·44 *h* 3·24 *h* 2·26	*h* 4·28 *h* 4·58 *h* 3·58	*M* = 3″·74 *w* = 15·56 $\frac{1}{w}$ = 0·06
	5·17	3·26	3·87	3·76	3·70	3·34	2·92	4·23	2·98	4·15	*C* = 50° 9′ 3″·74
* XXVI (Rávilàhu) and XXIII (Harnáo)	*h* 16·02 *h* 15·26 *h* 15·12	*h* 13·12 *h* 14·10 *h* 15·66 *h* 17·76 *h* 14·12 *h* 13·94	*h* 13·14 *h* 15·20 *h* 13·18 *h* 14·34	*h* 15·14 *h* 14·80 *h* 14·88	*h* 15·58 *h* 14·00 *h* 14·78	*h* 12·66 *h* 14·48 *h* 13·86 *h* 15·44	*h* 15·22 *h* 14·30 *h* 15·10	*h* 14·70 *h* 14·20 *h* 13·60	*h* 14·40 *h* 14·70 *h* 14·22	*h* 14·14 *h* 14·08 *h* 13·74	*M* = 14″·55 *w* = 22·10 $\frac{1}{w}$ = 0·05
	15·47	14·78	13·97	14·94	14·79	14·11	14·87	14·17	14·44	13·99	*C* = 49° 49′ 14″·54

At XXVI (Rávilàhu)

**March* 1877; *and* †*January* 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXV (Bándri) 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 37′	316° 49′	136° 49′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
† XXV (Bándri) and XXVIII (Giràja)	*h* 30·84 *h* 31·44 *h* 31·06 *h* 30·66	*h* 28·80 *h* 29·18 *h* 28·24	*l* 29·58 *l* 26·70 *l* 28·36 *l* 25·54 *l* 29·66 *h* 29·02	*l* 30·08 *h* 28·22 *h* 27·90 *h* 28·38	*h* 28·60 *h* 29·32 *h* 30·28	*l* 28·70 *l* 28·90 *l* 29·24	*h* 30·74 *h* 30·06 *h* 30·44	*h* 31·04 *h* 29·52 *h* 31·52	*h* 30·60 *h* 29·80 *h* 29·64	*h* 30·42 *h* 29·44 *h* 27·88 *h* 30·20	*M* = 29″·55 *w* = 8·85 $\frac{1}{w}$ = 0·11
	31·00	28·74	28·14	28·65	29·40	28·95	30·41	30·69	30·01	29·48	*C* = 66° 17′ 29″·54
† XXVIII (Giràja) and XXIX (Máringra)	*h* 11·68 *h* 10·58 *h* 12·22	*h* 13·72 *h* 11·48 *h* 13·06 *h* 10·44 *l* 11·10	*l* 11·80 *l* 11·82 *l* 13·16	*l* 12·32 *h* 11·98 *h* 15·50 *h* 12·12	*h* 12·24 *h* 12·84 *h* 12·34	*h* 10·98 *h* 11·58 *h* 12·12	*h* 10·42 *h* 11·16 *h* 12·66 *h* 11·82	*h* 12·62 *h* 10·94 *h* 12·04	*h* 12·04 *h* 11·92 *h* 11·52	*h* 13·76 *h* 11·26 *h* 13·10 *h* 12·26	*M* = 12″·05 *w* = 20·62 $\frac{1}{w}$ = 0·05
	11·49	11·96	12·26	12·98	12·47	11·56	11·52	11·87	11·83	12·59	*C* = 64° 59′ 12″·06

At XXVI (Ráviláhu)—(*Continued*).

Angle between	Circle readings, telescope being set on XXV (Bándri) 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 37′	316° 49′	136° 49′	*M* = Mean of Groups; *w* = Relative Weight; *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
†	*h* 20·34	*h* 19·12	*l* 18·80	*l* 20·14	*h* 18·24	*h* 20·46	*h* 20·66	*h* 17·86	*h* 19·74	*h* 20·12	$M = 19''\cdot46$
XXIX (Máringra)	*h* 19·52	*h* 20·02	*l* 19·86	*h* 18·40	*h* 17·90	*h* 20·02	*h* 22·00	*h* 18·64	*h* 19·06	*h* 20·02	$w = 14\cdot42$
and	*h* 18·74	*h* 19·60	*l* 20·56	*h* 19·32	*h* 18·12	*h* 19·50	*h* 20·18	*h* 19·14	*h* 20·00	*h* 20·00	$\frac{1}{w} = 0\cdot07$
XXIV (Dhanono)				*h* 17·70			*h* 19·58				
	19·53	19·58	19·74	18·89	18·09	19·99	20·61	18·55	19·60	20·05	$C = 81° 47′ 19''\cdot46$
*	*h* 8·98	*h* 7·02	*h* 7·40	*h* 7·50	*l* 8·00	*l* 6·96	*h* 8·04	*h* 7·10	*l* 7·52	*l* 8·16	$M = 7''\cdot44$
XXIV (Dhanono)	*h* 6·46	*h* 7·06	*h* 7·32	*h* 7·68	*l* 7·84	*l* 7·42	*h* 7·94	*h* 7·12	*l* 7·68	*l* 7·40	$w = 59\cdot68$
and	*h* 7·16	*h* 7·14	*h* 6·98	*h* 6·62	*l* 7·76	*l* 6·94	*h* 7·62	*h* 7·06	*l* 7·12	*l* 7·92	$\frac{1}{w} = 0\cdot02$
XXIII (Harnáo)	*h* 8·00										
	7·65	7·07	7·23	7·27	7·87	7·11	7·87	7·09	7·44	7·83	$C = 76° 27′ 7''\cdot44$
*	*h* 48·38	*h* 51·92	*h* 51·86	*h* 51·60	*l* 51·68	*l* 52·92	*h* 53·30	*l* 50·96	*l* 51·96	*l* 51·58	$M = 51''\cdot85$
XXIII (Harnáo)	*h* 51·34	*h* 52·42	*h* 51·92	*h* 50·92	*l* 52·56	*l* 52·10	*h* 53·16	*l* 52·32	*l* 51·94	*l* 51·70	$w = 22\cdot43$
and	*h* 49·72	*h* 50·78	*h* 51·72	*h* 52·52	*l* 51·90	*l* 51·62	*l* 51·46	*l* 53·38	*l* 51·78	*l* 51·98	$\frac{1}{w} = 0\cdot04$
XXV (Bándri)	*h* 52·38							*l* 51·80			
	h 51·44										
	50·65	51·71	51·83	51·68	52·05	52·21	52·64	52·12	51·89	51·75	$C = 70° 28′ 51''\cdot83$

At XXVII (Máhu)

***February* 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XXX (Singra) 0° 0′	180° 0′	79° 12′	259° 11′	158° 25′	338° 24′	237° 36′	57° 36′	316° 48′	136° 48′	*M* = Mean of Groups; *w* = Relative Weight; *C* = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
	h 7·20	*h* 6·54	*h* 5·40	*h* 4·34	*h* 6·04	*h* 6·16	*h* 5·96	*h* 4·96	*h* 5·82	*l* 4·18	$M = 6''\cdot30$
XXX (Singra)	*h* 6·18	*h* 5·60	*h* 6·64	*h* 7·32	*h* 6·72	*h* 7·88	*h* 7·58	*h* 5·88	*h* 6·60	*l* 6·74	
and	*h* 9·24	*h* 6·60	*h* 6·96	*h* 4·50	*h* 6·74	*h* 7·06	*h* 6·76	*h* 5·36	*l* 5·58	*l* 5·20	$w = 18\cdot13$
XXVIII (Girája)	*h* 5·48		*d* 6·55	*h* 7·06						*l* 6·38	$\frac{1}{w} = 0\cdot06$
	h 7·42			*h* 7·16							
				h 5·10							
	7·10	6·25	6·39	5·91	6·50	7·03	6·77	5·40	6·00	5·63	$C = 51° 10′ 6''\cdot30$
	h 41·98	*h* 40·78	*h* 39·04	*h* 36·82	*h* 39·62	*h* 39·68	*h* 38·30	*h* 39·18	*h* 39·02	*l* 39·04	
	h 40·86	*h* 39·90	*h* 39·10	*h* 40·22	*h* 37·94	*h* 38·28	*h* 38·58	*h* 42·12	*h* 39·30	*l* 39·32	$M = 39''\cdot23$
XXVIII (Girája)	*h* 37·68	*h* 39·22	*h* 36·92	*h* 41·16	*h* 37·26	*h* 37·40	*h* 37·18	*h* 39·94	*l* 39·24	*l* 40·30	
and	*h* 39·76		*h* 37·04	*h* 36·74	*h* 39·24	*h* 41·34		*h* 40·44		*l* 40·38	$w = 9\cdot38$
XXV (Bándri)	*h* 40·44		*d* 38·25	*h* 38·30		*h* 41·08					$\frac{1}{w} = 0\cdot11$
	h 39·84			*h* 38·82							
	40·09	39·97	38·07	38·68	38·52	39·56	38·02	40·42	39·19	39·76	$C = 56° 10′ 39''\cdot23$

At XXVIII (Girája)

February 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXIX (Máringra) 0° 0′	180° 0′	79° 13′	259° 13′	158° 24′	338° 24′	237° 36′	57° 36′	316° 48′	136° 48′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XXIX (Máringra) and XXVI (Rávilâhu)	″ *l* 12·34 *l* 12·60 *l* 12·52	″ *l* 12·78 *l* 11·98 *l* 12·02	″ *h* 12·04 *h* 12·26 *l* 11·98 *l* 12·50	″ *l* 13·08 *l* 11·54 *l* 11·92	″ *h* 13·02 *h* 12·28 *h* 12·16	″ *h* 11·94 *h* 12·42 *h* 12·70	″ *h* 11·86 *h* 13·14 *h* 11·46	″ *h* 11·74 *h* 12·04 *l* 11·62	″ *l* 11·66 *l* 13·50 *l* 12·48	″ *l* 10·32 *h* 12·12 *h* 11·52	$M = 12''\cdot18$ $w = 45\cdot95$ $\frac{1}{w} = 0\cdot02$
	12·49	12·26	12·20	12·18	12·49	12·35	12·15	11·80	12·55	11·32	$C = 62°\ 56'\ 12''\cdot18$
XXVI (Rávilâhu) and XXV (Bándri)	*l* 26·74 *l* 27·90 *l* 26·34	*l* 26·74 *l* 29·10 *l* 29·92 *l* 27·02 *l* 27·48	*h* 27·82 *h* 28·34 *h* 29·68	*l* 27·98 *l* 28·92 *l* 28·96	*h* 27·84 *h* 27·48 *h* 27·18	*h* 26·10 *h* 27·06 *h* 27·06	*h* 27·10 *h* 26·34 *h* 26·44	*h* 27·28 *h* 26·50 *l* 27·74	*l* 28·14 *l* 26·68 *l* 27·16	*l* 26·06 *l* 27·02 *l* 27·96	$M = 27''\cdot47$ $w = 14\cdot25$ $\frac{1}{w} = 0\cdot07$
	26·99	28·05	28·61	28·62	27·50	26·74	26·63	27·17	27·33	27·01	$C = 63°\ 33'\ 27''\cdot48$
XXV (Bándri) and XXVII (Máhu)	*l* 50·10 *l* 49·06 *l* 49·14	*l* 48·64 *l* 45·26 *l* 46·34 *l* 47·34 *l* 48·88	*h* 47·64 *h* 48·64 *h* 47·70	*h* 49·48 *h* 49·46 *h* 47·86 *h* 48·76	*h* 50·02 *h* 48·50 *h* 49·66	*h* 48·12 *h* 49·22 *h* 46·44 *h* 49·04	*h* 49·92 *h* 49·64 *h* 48·92	*h* 49·50 *h* 49·86 *h* 49·08	*l* 49·34 *l* 48·26 *l* 49·92	*l* 47·70 *l* 49·66 *l* 48·62	$M = 48''\cdot80$ $w = 12\cdot86$ $\frac{1}{w} = 0\cdot08$
	49·43	47·29	47·99	48·89	49·39	48·21	49·49	49·48	49·17	48·66	$C = 53°\ 38'\ 48''\cdot78$
XXVII (Máhu) and XXX (Singra)	*h* 25·34 *h* 21·90 *h* 23·08 *h* 23·76 *h* 22·28 *h* 21·48	*h* 25·30 *h* 23·64 *h* 20·64 *h* 21·62 *h* 21·52 *h* 22·04	*h* 22·56 *h* 21·76 *h* 20·32 *h* 20·98	*h* 19·36 *h* 22·48 *h* 20·46 *h* 22·58 *h* 20·90	*h* 21·12 *h* 21·36 *h* 22·08	*h* 20·62 *h* 22·02 *h* 21·74	*h* 22·12 *h* 20·82 *h* 21·50	*h* 21·80 *h* 21·18 *h* 21·12	*l* 21·94 *l* 22·98 *l* 21·62	*l* 22·34 *l* 21·20 *l* 21·20	$M = 21''\cdot76$ $w = 16\cdot11$ $\frac{1}{w} = 0\cdot06$
	22·97	22·46	21·41	21·16	21·52	21·46	21·48	21·37	22·18	21·58	$C = 68°\ 17'\ 21''\cdot80$
XXX (Singra) and XXXI (Asu)	*h* 30·54 *h* 29·42 *h* 27·72 *h* 31·44 *h* 32·38 *h* 30·02 *h* 29·52	*h* 30·48 *h* 30·72 *h* 32·80 *h* 32·04 *h* 30·64 *h* 31·20 *h* 31·26	*h* 31·40 *h* 31·54 *l* 29·18 *l* 30·66 *l* 29·36	*l* 29·54 *l* 27·28 *l* 29·06 *l* 30·08	*h* 29·22 *h* 30·68 *h* 30·00	*h* 29·70 *h* 28·90 *h* 29·94	*h* 29·86 *h* 30·98 *h* 30·94	*h* 29·56 *h* 30·20 *l* 29·24	*l* 30·90 *l* 30·94 *l* 30·58	*l* 30·20 *l* 29·98 *l* 30·98	$M = 30''\cdot18$ $w = 15\cdot02$ $\frac{1}{w} = 0\cdot07$ $C = 55°\ 22'\ 30''\cdot20$
	30·15	31·31	30·43	28·99	29·97	29·51	30·59	29·67	30·81	30·39	
XXXI (Asu) and XXIX (Máringra)	*h* 39·12 *h* 38·30 *h* 41·78 *h* 37·66 *h* 38·28	*h* 38·62 *h* 38·68 *h* 40·06 *h* 39·20 *h* 36·30	*h* 40·86 *h* 40·30 *h* 38·70 *l* 40·80	*l* 39·22 *l* 40·60 *l* 41·36 *l* 40·40	*h* 38·76 *h* 38·78 *h* 38·50	*h* 39·06 *h* 38·12 *h* 38·84	*h* 38·62 *h* 38·44 *h* 38·36	*h* 40·52 *h* 39·50 *l* 38·34 *l* 40·02	*l* 40·06 *l* 40·90 *l* 39·18	*h* 38·48 *h* 39·68 *h* 38·42	$M = 39''\cdot25$ $w = 13\cdot00$ $\frac{1}{w} = 0\cdot08$
	39·03	38·57	40·17	40·39	38·68	38·67	38·47	39·60	40·05	38·86	$C = 56°\ 11'\ 39''\cdot26$

At XXIX (Máringra)

***February* 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XXIV (Dhanono) 0° 1′	180° 0′	79° 13′	259° 13′	158° 25′	338° 24′	237° 36′	57° 36′	316° 49′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXIV (Dhanono) and XXVI (Ráviláhu)	″ h 36·58 h 36·32 h 35·72	″ h 33·64 h 34·30 h 34·76	″ l 33·38 l 34·80 l 33·44	″ l 36·10 l 35·30 l 37·16	″ l 36·08 l 34·88 l 35·56	″ l 34·28 l 34·66 l 34·30	″ l 34·76 l 36·30 l 34·72	″ l 34·86 l 35·40 l 34·96	″ l 33·76 l 35·16 l 35·22	″ l 33·76 l 33·68 l 34·56	$M = 34''\cdot95$ $w = 12\cdot20$ $\frac{1}{w} = 0\cdot08$
	36·21	34·23	33·87	36·19	35·51	34·41	35·26	35·07	34·71	34·00	$C = 47^\circ\, 20'\, 34''\cdot95$
XXVI (Ráviláhu) and XXVIII (Girája)	h 37·60 h 36·46 h 38·98 h 36·22	h 38·26 h 36·46 h 37·50	l 37·20 l 35·42 l 36·60	l 35·68 l 36·90 l 34·40 l 36·62	l 35·72 l 35·20 l 36·50	l 35·92 l 36·72 l 35·42	l 36·90 l 36·22 l 36·38	l 34·94 l 35·52 l 35·00	l 37·10 l 36·72 l 36·30	l 35·52 l 35·42 l 35·20	$M = 36''\cdot26$ $w = 13\cdot86$ $\frac{1}{w} = 0\cdot07$
	37·32	37·41	36·41	35·90	35·81	36·02	36·50	35·15	36·71	35·38	$C = 52^\circ\, 4'\, 36''\cdot26$
XXVIII (Girája) and XXXI (Asu)	h 36·76 h 35·66 h 35·30	h 37·02 h 35·82 h 37·16	l 35·38 l 35·08 l 36·68	l 36·86 l 38·24 l 35·38 l 35·60	l 35·78 l 35·06 l 35·44	l 34·76 l 35·44 l 36·48	l 36·20 l 35·30 l 36·26	l 36·02 l 34·00 l 35·96 l 35·58	l 35·94 l 36·02 l 36·02	l 35·70 l 36·70 l 36·80	$M = 35''\cdot95$ $w = 28\cdot50$ $\frac{1}{w} = 0\cdot04$
	35·91	36·67	35·71	36·52	35·43	35·56	35·92	35·39	35·99	36·40	$C = 70^\circ\, 11'\, 35''\cdot95$

At XXX (Singra)

***February* 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XXXII (Bitri) 0° 0′	180° 0′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 35′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXXII (Bitri) and XXXIII (Parethal)	″ h 12·50 h 12·34 h 14·02 h 13·64 h 15·68	″ h 12·54 h 12·52 h 15·76 h 13·28 h 11·96	″ h 12·66 h 13·78 h 12·86	″ h 13·32 h 12·48 h 11·96	″ l 12·74 l 11·30 l 11·74	″ l 11·66 l 11·54 l 10·42	″ l 13·34 l 12·78 l 11·38 l 10·92	″ h 11·56 h 10·68 h 11·10	″ h 10·32 h 12·44 h 12·46 h 12·76	″ h 11·42 h 11·82 h 9·18 h 12·38 h 11·72	$M = 12''\cdot22$ $w = 9\cdot67$ $\frac{1}{w} = 0\cdot10$
	13·64	13·21	13·10	12·59	11·93	11·21	12·11	11·11	11·99	11·30	$C = 49^\circ\, 35'\, 12''\cdot23$
XXXIII (Parethal) and XXXI (Asu)	h 38·90 h 34·92 h 39·08 h 37·60 h 37·34 h 38·22	h 39·28 h 36·74 h 35·72 h 35·18 h 36·46 h 38·12	h 38·50 h 36·14 h 37·56 h 37·22	h 36·52 h 37·76 h 37·22	l 38·00 l 38·30 l 37·58	l 37·34 l 40·30 l 38·80 l 39·40	l 35·76 l 35·70 l 38·78 h 38·18 h 37·38	h 38·48 h 37·62 h 37·38	h 38·30 h 38·92 h 40·06	h 38·68 h 36·96 h 38·12	$M = 37''\cdot80$ $w = 12\cdot00$ $\frac{1}{w} = 0\cdot08$
	37·68	36·92	37·36	37·17	37·96	38·96	37·16	37·83	39·09	37·92	$C = 67^\circ\, 44'\, 37''\cdot77$

At XXX (Singra)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXII (Bitri) 0° 0′	180° 0′	79° 13′	259° 13′	158° 25′	338° 25′	237° 36′	57° 35′	316° 49′	136° 49′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XXXI (Asu) and XXVIII (Giràja)	″ *h* 49·90 *h* 51·26 *h* 51·16	″ *h* 50·96 *h* 51·80 *h* 50·86 *h* 52·50	″ *h* 51·70 *h* 51·30 *h* 50·96	″ *h* 51·76 *h* 52·78 *h* 51·62	″ *l* 52·24 *l* 51·70 *l* 51·88	″ *l* 51·64 *l* 51·14 *l* 50·76 *l* 52·36	″ *l* 53·80 *l* 51·68 *l* 53·38 *l* 52·38	″ *h* 51·28 *h* 51·20 *h* 50·76	″ *h* 50·72 *h* 50·90 *h* 51·94	″ *h* 52·52 *h* 52·62 *h* 52·38	$M = 51''·67$ $w = 19·56$ $\frac{1}{w} = 0·05$
	50·77	51·53	51·32	52·05	51·94	51·48	52·81	51·08	51·19	52·51	$C = 68° \; 2' \; 51''·68$
XXVIII (Giràja) and XXVII (Máhu)	*h* 31·96 *h* 33·56 *h* 33·80	*h* 33·10 *h* 35·66 *h* 34·80 *h* 34·18	*h* 33·06 *h* 33·92 *h* 32·72	*h* 34·08 *h* 33·92 *h* 33·98	*l* 33·80 *l* 32·34 *l* 32·90	*l* 32·38 *l* 32·04 *l* 34·64 *l* 31·88	*l* 33·30 *l* 33·64 *l* 33·94	*h* 34·74 *h* 33·02 *h* 34·10	*h* 33·32 *h* 32·86 *h* 33·76	*h* 31·74 *h* 32·32 *h* 32·02	$M = 33''·34$ $w = 15·82$ $\frac{1}{w} = 0·06$
	33·11	34·44	33·23	33·99	33·01	32·73	33·63	33·95	33·31	32·03	$C = 60° \; 32' \; 33''·34$

At XXXI (Asu)

February 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXIX (Máringra) 153° 29′	333° 29′	232° 45′	52° 45′	311° 57′	131° 57′	31° 9′	211° 9′	110° 20′	290° 20′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XXIX (Máringra) and XXVIII (Giràja)	″ *h* 42·26 *h* 43·72 *h* 46·30 *h* 43·44 *h* 43·56 *h* 43·82	″ *h* 45·04 *l* 46·84 *l* 43·24 *l* 43·84 *l* 43·52	″ *l* 43·68 *l* 45·76 *l* 42·54 *l* 43·86 *l* 44·54	″ *l* 44·34 *l* 42·98 *h* 43·82	″ *h* 46·36 *l* 45·36 *l* 46·62	″ *l* 45·62 *l* 46·46 *l* 44·54	″ *l* 45·14 *l* 44·44 *l* 46·90 *l* 46·42	″ *l* 45·96 *h* 43·92 *h* 46·46 *h* 46·24	″ *h* 46·04 *h* 46·08 *h* 46·20	″ *h* 47·54 *h* 44·38 *h* 44·90 *h* 44·38 *h* 44·64 *h* 45·58	$M = 45''·05$ $w = 8·86$ $\frac{1}{w} = 0·11$
	43·85	44·50	44·08	43·71	46·11	45·54	45·73	45·64	46·11	45·24	$C = 53° \; 36' \; 45''·02$
XXVIII (Giràja) and XXX (Singra)	*h* 39·28 *h* 38·80 *h* 38·28 *h* 36·92	*h* 39·24 *l* 38·32 *l* 41·06 *l* 40·92	*l* 37·90 *l* 39·02 *l* 38·34	*l* 41·32 *h* 38·18 *h* 39·06 *h* 39·82 *h* 38·78 *d* 39·69	*h* 38·18 *l* 39·04 *l* 38·66	*l* 37·96 *l* 38·96 *l* 38·18	*l* 38·06 *l* 38·52 *l* 37·96	*l* 39·68 *h* 38·34 *h* 39·28 *h* 37·82	*h* 38·00 *h* 38·62 *h* 39·52	*h* 38·52 *h* 39·16 *h* 39·12	$M = 38''·77$ $w = 22·16$ $\frac{1}{w} = 0·05$
	38·32	39·89	38·42	39·47	38·63	38·37	38·18	38·78	38·71	38·93	$C = 56° \; 34' \; 38''·80$
XXX (Singra) and XXXIII (Parethal)	*h* 19·46 *h* 19·98 *h* 21·76 *h* 21·74 *h* 20·64	*h* 20·32 *h* 19·58 *h* 20·22	*l* 20·12 *l* 19·44 *l* 19·38	*l* 18·62 *h* 20·38 *h* 20·06 *d* 19·95	*h* 20·76 *l* 20·88 *l* 20·52	*l* 20·90 *l* 21·04 *l* 20·14	*l* 20·40 *l* 20·72 *l* 20·12	*l* 18·32 *h* 20·70 *h* 20·78 *h* 19·28	*h* 20·92 *h* 21·18 *h* 20·78	*h* 20·44 *h* 19·98 *h* 21·02	$M = 20''·32$ $w = 29·61$ $\frac{1}{w} = 0·03$
	20·72	20·04	19·65	19·75	20·72	20·69	20·41	19·77	20·96	20·48	$C = 53° \; 10' \; 20''·32$

At XXXI (Asu)—(*Continued*).

Angle between	Circle readings, telescope being set on XXIX (Máringra) 153° 29′	333° 29′	232° 45′	52° 45′	311° 57′	131° 57′	31° 9′	211° 9′	110° 20′	290° 20′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XXXIII (Parethal) and XXXIV (Kolu)	″ *h* 11·16 *h* 8·02 *h* 11·10 *h* 11·64 *h* 10·96	″ *h* 12·08 *h* 13·12 *h* 12·60	″ *l* 14·46 *l* 10·88 *l* 11·76 *l* 12·30 *l* 11·36 *l* 11·04	″ *l* 11·94 *l* 10·44 *h* 10·10 *h* 11·58	″ *h* 9·02 *l* 10·12 *l* 12·24 *l* 12·72 *l* 11·96	″ *l* 11·06 *l* 11·76 *l* 11·28	″ *l* 13·74 *l* 12·78 *l* 13·24	″ *l* 13·14 *h* 11·12 *h* 12·78 *h* 10·32	″ *h* 11·34 *h* 8·98 *h* 11·42 *h* 10·40	″ *h* 10·86 *h* 11·72 *h* 11·94	$M = 11''\cdot59$ $w = 9\cdot88$ $\frac{1}{w} = 0\cdot10$
	10·58	12·60	11·97	11·02	11·21	11·37	13·25	11·84	10·53	11·51	$C = 43^\circ\ 6'\ 11''\cdot57$
XXXIV (Kolu) and R.M.	*h* 52·84 *h* 52·52 *h* 52·24	*h* 53·42 *h* 52·26 *h* 50·80	*l* 51·78 *l* 53·42 *l* 53·34	*l* 52·38 *l* 54·82 *h* 52·72 *h* 52·46	*h* 50·80 *l* 51·90 *l* 52·26	*l* 54·14 *l* 51·42 *l* 52·62 *l* 51·38	*l* 51·56 *l* 50·52 *l* 51·52	*l* 52·82 *h* 53·56 *h* 51·74	*h* 50·78 *h* 52·14 *h* 53·26 *h* 51·80	*h* 52·94 *h* 51·98 *h* 51·92	$M = 52''\cdot29$ $w = 18\cdot53$ $\frac{1}{w} = 0\cdot05$
	52·53	52·16	52·85	53·10	51·65	52·39	51·20	52·71	51·99	52·28	$C = 21^\circ\ 32'\ 52''\cdot30$

At XXXII (Bitri)

***February* 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.**

Angle between	Circle readings, telescope being set on XXXV (Chauki) 179° 11′	359° 11′	258° 23′	78° 23′	337° 34′	157° 34′	56° 47′	236° 47′	135° 58′	315° 57′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XXXV (Chauki) and XXXVI (Kháro)	″ *h* 56·84 *h* 56·20 *h* 58·12	″ *h* 56·66 *h* 57·14 *h* 58·26	″ *h* 58·20 *h* 57·16 *h* 56·60	″ *h* 57·24 *h* 57·12 *h* 57·02	″ *h* 55·20 *h* 57·38 *h* 55·92 *l* 56·70	″ *l* 55·90 *l* 56·22 *l* 56·76	″ *l* 56·68 *l* 54·90 *l* 56·40	″ *l* 56·18 *l* 54·60 *l* 56·86 *l* 56·16	″ *l* 55·22 *l* 56·50 *l* 56·44	″ *h* 57·96 *h* 57·76 *h* 56·66	$M = 56''\cdot69$ $w = 18\cdot72$ $\frac{1}{w} = 0\cdot05$
	57·05	57·35	57·32	57·13	56·30	56·29	55·99	55·95	56·05	57·46	$C = 53^\circ\ 8'\ 56''\cdot68$
XXXVI (Kháro) and XXXIII (Parethal)	*h* 3·46 *h* 5·68 *h* 2·10 *h* 3·00 *h* 2·96	*h* 4·00 *h* 4·42 *h* 2·16 *h* 3·40	*h* 5·04 *h* 3·50 *h* 3·30	*h* 3·00 *h* 2·40 *h* 3·08	*h* 2·38 *h* 2·88 *h* 2·70	*l* 2·26 *l* 3·54 *l* 2·66	*l* 2·50 *l* 2·72 *l* 2·82	*l* 3·32 *l* 1·90 *l* 2·46	*l* 4·16 *l* 3·88 *l* 1·40 *l* 2·54	*h* 4·46 *h* 3·48 *h* 3·36	$M = 3''\cdot12$ $w = 23\cdot24$ $\frac{1}{w} = 0\cdot04$
	3·44	3·50	3·95	2·83	2·65	2·82	2·68	2·56	2·99	3·77	$C = 54^\circ\ 14'\ 3''\cdot13$
XXXIII (Parethal) and XXX (Singra)	*h* 41·12 *h* 38·42 *h* 39·98 *h* 40·74 *h* 42·78 *h* 39·64	*h* 41·26 *h* 41·82 *h* 42·06	*h* 39·32 *h* 41·68 *h* 42·98 *h* 41·88 *h* 42·80	*h* 41·52 *h* 43·12 *h* 41·16	*h* 42·60 *h* 40·94 *h* 41·82	*l* 44·60 *l* 40·88 *l* 39·88 *l* 40·94 *l* 40·30 *l* 41·46	*l* 41·36 *l* 41·34 *l* 42·32	*l* 42·80 *l* 42·00 *l* 41·02	*l* 41·90 *l* 43·92 *l* 41·66 *l* 41·96	*h* 42·38 *h* 41·14 *h* 42·04	$M = 41''\cdot68$ $w = 17\cdot83$ $\frac{1}{w} = 0\cdot06$
	40·45	41·71	41·73	41·93	41·79	41·34	41·67	41·94	42·36	41·85	$C = 73^\circ\ 26'\ 41''\cdot63$

NOTE.—R. M. denotes Referring Mark.

At XXXIII (Parethal)

March 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXVI (Kháro) 359° 59′	179° 59′	79° 12′	259° 12′	158° 25′	338° 24′	237° 36′	57° 36′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXXVI (Kháro) and XXXIV (Kolu)	″ h 12·70 h 14·16 h 14·80 h 15·16 h 13·70	″ h 15·68 h 15·20 h 14·30	″ h 14·04 l 17·06 l 16·18 l 16·78 l 14·86	″ l 17·14 l 14·94 l 15·34 l 14·20	″ h 13·92 h 13·02 h 12·34	″ h 13·14 h 14·30 h 13·94	″ h 14·44 h 15·76 h 15·28	″ h 14·36 h 13·98 h 16·60 h 15·48	″ h 15·90 h 15·64 h 15·32	″ h 15·68 h 14·46 h 15·88	$M = 14''·85$ $w = 10·20$ $\frac{1}{w} = 0·10$
	14·10	15·06	15·78	15·41	13·09	13·79	15·16	15·10	15·62	15·34	$C = 74° 10' 14''·85$
XXXIV (Kolu) and XXXI (Asu)	h 55·76 h 58·30 h 59·04 h 58·34 h 59·20	h 57·82 h 59·18 h 60·70 h 57·38 h 57·22	h 58·58 l 58·90 l 57·32	l 59·48 l 57·72 l 59·10	h 57·38 h 59·06 h 57·74	h 56·90 h 58·42 h 59·74 h 58·92	h 56·72 h 59·42 h 58·08 h 58·44	h 57·96 h 58·44 h 57·94	h 57·08 h 57·42 h 57·44	h 58·64 h 57·78 h 58·04	$M = 58''·19$ $w = 25·80$ $\frac{1}{w} = 0·04$
	58·13	58·46	58·27	58·77	58·06	58·50	58·16	58·11	57·31	58·15	$C = 84° 38' 58''·20$
XXXI (Asu) and XXX (Singra)	h 3·68 h 5·24 h 3·08 h 2·14 h 3·16	h 2·26 h 1·70 h 1·24 h 4·42 h 3·10	h 3·04 l 5·08 l 1·60 l 3·68 l 2·84	l 2·14 l 2·76 l 3·50	h 3·32 h 4·16 h 2·82	h 3·46 h 2·28 h 3·66 d 3·11	h 3·38 h 2·60 h 3·20	h 3·02 h 3·04 h 3·10	h 1·92 h 2·42 h 2·68	h 1·98 h 2·04 h 2·96	$M = 2''·94$ $w = 28·29$ $\frac{1}{w} = 0·04$
	3·46	2·54	3·25	2·80	3·43	3·13	3·06	3·05	2·34	2·33	$C = 59° 5' 2''·95$
XXX (Singra) and XXXII (Bitri)	h 4·18 h 8·06 h 9·04 h 8·36	h 4·78 h 7·02 h 8·18 h 4·68 h 9·10 h 6·92	h 7·50 h 4·34 l 8·80 l 8·02 l 6·74 l 6·78	l 7·08 l 8·46 l 6·54	h 8·20 h 6·96 h 8·18	h 7·74 h 7·34 h 8·42 d 7·81	h 6·86 h 6·72 h 6·76	h 6·14 h 7·52 h 6·34	h 8·20 h 7·84 h 6·58	h 7·64 h 7·60 h 6·24	$M = 7''·23$ $w = 18·96$ $\frac{1}{w} = 0·05$
	7·41	6·78	7·03	7·36	7·78	7·83	6·78	6·67	7·54	7·16	$C = 56° 58' 7''·21$
XXXII (Bitri) and XXXVI (Kháro)	h 34·96 h 37·70 h 34·06 h 35·44 h 33·90	h 38·18 h 37·86 h 36·10 h 37·26	h 34·50 h 34·74 l 37·14 l 33·48 l 33·96	l 35·30 l 35·82 l 36·56	h 37·88 h 36·72 h 38·98 h 36·16	h 37·68 h 35·00 h 35·40 h 33·50 h 35·82 h 37·90	h 35·68 h 36·76 h 35·48	h 38·60 h 37·60 h 36·44 h 36·64	h 36·02 h 38·16 h 36·64 h 36·90	h 36·20 h 36·10 h 35·10	$M = 36''·25$ $w = 8·38$ $\frac{1}{w} = 0·12$
	35·21	37·35	34·76	35·89	37·44	35·88	35·97	37·32	36·93	35·80	$C = 85° 7' 36''·24$

At XXXIV (Kolu)

March 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXI (Asu) 216° 19′	36° 19′	295° 31′	115° 31′	14° 42′	194° 42′	93° 55′	273° 55′	173° 8′	353° 7′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXXI (Asu) and XXXIII (Parethal)	″ *h* 55·46 *h* 54·64 *h* 52·26 *h* 51·62 *h* 53·20	″ *h* 53·70 *h* 51·16 *h* 52·64 *h* 52·08	″ *h* 50 78 *h* 51·02 *h* 52·32	″ *h* 53·88 *h* 52·06 *h* 53·00	″ *l* 52·26 *l* 50·88 *l* 48·98 *l* 50·50 *l* 51·10	″ *h* 51·00 *h* 50·00 *h* 51·32	″ *h* 51·64 *h* 51·66 *h* 50·84	″ *h* 51·88 *h* 49·06 *h* 52·00 *h* 51·14	″ *h* 52·14 *h* 52·26 *h* 52·72	″ *h* 51·54 *h* 53·32 *h* 51·52	$M = 51''\cdot86$ $w = 8\cdot68$ $\frac{1}{w} = 0\cdot12$ $C = 52^\circ\ 14'\ 51''\cdot86$
	53·44	52·40	51·37	52·98	50·74	50·77	51·38	51·02	52·37	52·13	
XXXIII (Parethal) and XXXVI (Kháro)	*h* 45·12 *h* 47·06 *h* 45·94 *h* 46·80 *h* 46·90	*h* 47·00 *h* 46·94 *h* 47·64 *h* 46·14	*h* 48·50 *h* 48·50 *h* 46·98	*h* 47·56 *h* 45·94 *h* 46·34	*l* 45·60 *l* 47·04 *l* 46·36	*h* 46·40 *h* 46·42 *h* 46·86	*h* 45·42 *h* 46·04 *h* 47·68 *h* 47·90	*h* 47·52 *h* 48·12 *h* 48·68	*h* 46·98 *h* 45·04 *h* 45·78	*h* 47·60 *h* 47·04 *h* 47·88	$M = 46''\cdot91$ $w = 14\cdot84$ $\frac{1}{w} = 0\cdot07$ $C = 52^\circ\ 32'\ 46''\cdot90$
	46·36	46·93	47·99	46·61	46·33	46·56	46·76	48·11	45·93	47·51	
XXXVI (Kháro) and XXXVII (Morgich)	*h* 58·22 *h* 62·58 *h* 59·70 *h* 59·64 *h* 58·86 *h* 60·40	*h* 59·96 *h* 60·44 *h* 58·34 *h* 60·64	*h* 60·16 *h* 59·94 *h* 60·14	*h* 59·12 *l* 59·76 *l* 59·74	*l* 60·38 *l* 59·08 *l* 59·74	*h* 58·50 *h* 60·56 *h* 59·94 *h* 59·28	*h* 58·60 *h* 60·00 *h* 58·56	*h* 60·58 *h* 59·74 *h* 61·22	*h* 61·18 *h* 58·58 *h* 60·42 *h* 60·32	*h* 60·06 *h* 60·34 *h* 60·06	$M = 59''\cdot85$ $w = 28\cdot02$ $\frac{1}{w} = 0\cdot04$ $C = 38^\circ\ 53'\ 59''\cdot85$
	59·90	59·85	60·08	59·54	59·73	59·57	59·05	60·51	60·12	60·15	

At XXXV (Chauki)

**March* 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

†*December* 1880; *observed by Lieut.-Colonel B. R. Branfill, with Troughton and Simm's* 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XXXIX (Thar Muhári) 0° 1′	180° 1′	79° 13′	259° 13′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
† XXXIX (Thar Muhári) and XL (Kiraríwáro)	″ *h* 36·09 *h* 36·79 *h* 36·94	″ *h* 38·01 *h* 38·00 *h* 38·50	″ *l* 35·95 *l* 35·71 *l* 35·85	″ *l* 36·58 *l* 36·58 *l* 36·72	″ *h* 35·68 *h* 36·38 *h* 35·84	″ *h* 36·55 *h* 36·48 *l* 36·95	″ *l* 36·84 *l* 35·99 *l* 37·51	″ *l* 37·31 *l* 37·25 *l* 38·04	″ *h* 37·63 *h* 37·41 *h* 37·37	″ *h* 37·08 *h* 37·65 *h* 37·43	$M = 36''\cdot91$ $w = 17\cdot90$ $\frac{1}{w} = 0\cdot06$ $C = 43^\circ\ 45'\ 36''\cdot91$
	36·61	38·17	35·84	36·63	35·97	36·66	36·78	37·53	37·47	37·39	

At XXXV (Chauki)—(*Continued*).

Angle between	Circle readings, telescope being set on XL (Kiraríwáro) 0° 1′	180° 0′	79° 13′	259° 12′	158° 25′	338° 24′	237° 36′	57° 36′	316° 49′	136° 48′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
* XL (Kiraríwáro) and XXXVIII (Trisingh)	h 46·26	h 45·80	h 44·54	h 44·50	h 43·54	h 45·12	l 46·00	l 45·58	l 45·56	l 45·94	$M = 45''·08$
	h 44·46	h 46·32	h 45·66	h 44·22	h 45·30	h 45·02	l 46·18	l 45·60	l 44·00	l 44·34	$w = 23·80$
	h 44·40	h 45·32	h 44·26	h 45·20	h 44·44	h 43·84	l 46·28	l 44·96	l 45·46	l 44·18	$\frac{1}{w} = 0·04$
	45·04	45·81	44·82	44·64	44·43	44·66	46·15	45·38	45·01	44·82	$C = 67° 48′ 45''·08$
* XXXVIII (Trisingh) and XXXVI (Kháro)	h 55·40	h 54·76	h 54·84	h 54·54	h 55·26	h 55·36	l 54·40	l 54·90	l 55·16	l 55·60	$M = 54''·84$
	h 54·50	h 54·94	h 54·88	h 54·78	h 55·42	h 55·30	l 54·18	l 54·28	l 54·86	l 54·62	$w = 38·82$
	h 55·56	h 52·70	h 55·66	h 54·36	h 55·04	h 55·32	l 54·86	l 53·88	l 54·24	l 55·60	$\frac{1}{w} = 0·03$
		h 54·18									
	55·15	54·15	55·13	54·56	55·24	55·33	54·48	54·35	54·75	55·27	$C = 44° 31′ 54''·83$
* XXXVI (Kháro) and XXXII (Bitri)	h 41·10	h 39·78	h 41·18	h 40·80	h 39·70	h 40·60	l 39·42	l 40·04	l 39·28	l 40·36	$M = 40''·31$
	h 41·56	h 40·48	h 40·36	h 41·64	h 40·18	l 41·22	l 40·20	l 39·92	l 40·02	l 39·80	$w = 29·40$
	h 41·20	h 39·80	h 40·70	h 40·10	h 39·68	l 40·60	l 40·14	l 39·66	l 40·06	l 39·82	$\frac{1}{w} = 0·03$
	41·29	40·02	40·75	40·85	39·85	40·81	39·92	39·87	39·79	39·99	$C = 69° 15′ 40''·31$

At XXXVI (Kháro)

March 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXIII (Parethal) 0° 0′	180° 0′	79° 12′	259° 12′	158° 24′	338° 24′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXIII (Parethal) and XXXII (Bitri)	h 21·54	h 18·76	h 21·98	l 20·72	h 21·40	h 20·62	h 20·46	h 20·50	h 24·22	l 20·84	$M = 20''·75$
	h 20·52	h 20·82	h 20·62	l 20·30	h 20·82	h 21·34	h 21·60	h 20·52	h 20·82	l 20·28	$w = 32·36$
	h 21·18	h 20·52	l 20·36	l 20·64	h 20·16	h 21·28	h 20·58	h 20·54	h 20·46	l 20·98	$\frac{1}{w} = 0·03$
		h 19·50				d 20·17			h 20·50		
						d 20·03			h 20·80		
	21·08	19·90	20·99	20·55	20·79	20·69	20·88	20·52	21·36	20·70	$C = 40° 38′ 20''·75$
XXXII (Bitri) and XXXV (Chauki)	h 26·76	h 25·52	h 23·10	l 24·74	h 23·50	h 24·76	h 23·56	h 24·20	h 22·12	l 23·12	$M = 24''·35$
	h 26·14	h 23·88	h 26·40	l 24·08	h 24·06	h 25·10	h 24·44	h 23·88	h 23·94	l 23·54	$w = 16·22$
	h 26·88	h 25·14	l 24·28	l 25·24	h 24·00	h 25·20	h 24·72	h 25·12	h 24·12	l 23·80	$\frac{1}{w} = 0·06$
	h 25·04	h 24·46	l 23·28								
	h 23·72		l 24·20								
	h 24·02										
	d 25·47										
	25·43	24·75	24·25	24·69	23·85	25·02	24·24	24·40	23·39	23·49	$C = 57° 35′ 24''·38$

At XXXVI (Khâro)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXIII (Parethal) 0° 0′	180° 0′	79° 12′	259° 12′	158° 24′	338° 24′	237° 36′	57° 36′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXXV (Chauki) and XXXVIII (Trisingh)	″ h 59·16 h 58·72 h 59·86 d 59·29	″ h 58·18 h 57·66 h 56·90	″ h 59·76 h 57·58 l 59·48 l 58·66	″ l 59·14 l 59·30 l 58·44	″ h 57·98 h 59·74 h 57·72 h 61·80 h 58·18 h 59·16	″ h 60·28 h 58·46 h 61·30 h 59·02	″ h 60·30 h 59·28 h 60·40	″ h 59·80 h 58·44 h 59·26	″ h 57·88 h 58·82 h 59·20	″ l 59·66 l 58·40 l 59·38	$M = 59''\cdot05$ $w = 15\cdot68$ $\frac{1}{w} = 0\cdot06$
	59·26	57·58	58·87	58·96	59·10	59·77	59·99	59·17	58·63	59·15	$C = 80^\circ 54' 59''\cdot06$
XXXVIII (Trisingh) and XXXVII (Morgich)	h 1·92 h 2·36 h 3·76	h 6·04 h 7·18 h 5·30 h 2·54 h 4·94 h 3·82	h 3·50 h 2·08 l 3·60	l 4·30 l 2·56 l 3·54	h 2·82 h 4·90 h 3·62 h 4·16	h 5·38 h 3·20 h 1·48 h 5·56 h 4·32 h 4·88	h 3·60 h 2·98 h 3·40	h 3·48 h 3·70 h 4·44	h 4·02 h 4·24 h 3·56	l 2·70 l 3·94 l 4·72 l 3·42	$M = 3''\cdot70$ $w = 15\cdot04$ $\frac{1}{w} = 0\cdot07$
	2·68	4·97	3·06	3·47	3·88	4·14	3·33	3·87	3·94	3·69	$C = 73^\circ 21' 3''\cdot75$
XXXVII (Morgich) and XXXIV (Kolu)	h 14·14 h 12·96 h 13·38	h 14·34 h 13·96 h 14·72	h 13·84 h 14·90 h 14·08	l 14·70 l 14·62 l 13·68	h 15·76 h 13·78 h 13·74 h 13·58	h 15·96 h 15·58 h 11·76 h 13·62 h 14·84 h 13·20	h 13·42 h 14·74 h 13·28	h 13·08 h 14·34 h 13·52	h 15·26 h 13·30 h 14·54	l 14·50 l 14·18 l 14·72	$M = 14''\cdot11$ $w = 31\cdot64$ $\frac{1}{w} = 0\cdot03$
	13·49	14·34	14·27	14·33	14·22	14·16	13·81	13·65	14·37	14·47	$C = 54^\circ 13' 14''\cdot11$
XXXIV (Kolu) and XXXIII (Parethal)	h 59·68 h 59·44 h 58·86	h 58·26 h 59·34 h 58·28	h 58·54 h 59·18 h 59·70	l 58·74 l 58·86 l 58·76	h 59·00 h 58·92 h 59·20	h 59·76 h 59·06 h 56·50 h 59·92 d 57·90 d 57·76	h 58·84 h 58·72 h 59·62	h 59·40 h 58·66 h 60·16	h 58·76 h 58·72 h 59·14	l 58·40 l 58·80 l 59·30	$M = 58''\cdot96$ $w = 47\cdot21$ $\frac{1}{w} = 0\cdot02$
	59·33	58·63	59·14	58·79	59·04	58·48	59·06	59·41	58·87	58·83	$C = 53^\circ 16' 58''\cdot94$

At XXXVII (Morgich)

March 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

Angle between	Circle readings, telescope being set on XXXIV (Kolu) 0° 0′	180° 0′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 36′	316° 49′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XXXIV (Kolu) and XXXVI (Khâro)	″ h 48·46 h 46·74 h 46·68	″ h 47·04 h 46·50 h 48·46	″ h 45·88 h 48·48 h 45·96 h 47·24	″ h 47·80 h 47·98 h 47·30	″ h 44·92 h 45·74 h 45·86	″ h 46·14 h 46·94 h 47·00	″ h 43·62 h 44·74 h 48·08 h 47·22 h 46·52 h 45·12	″ h 46·28 l 47·12 l 46·82	″ l 45·12 l 45·90 l 46·34	″ l 45·04 l 46·56 l 47·54 l 46·84	$M = 46''\cdot63$ $w = 13\cdot01$ $\frac{1}{w} = 0\cdot08$
	47·29	47·33	46·89	47·69	45·51	46·69	45·88	46·74	45·79	46·50	$C = 86^\circ 52' 46''\cdot62$

At XXXVII (Morgich)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXIV (Kolu) 0° 0′	180° 0′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 36′	316° 49′	136° 48′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
XXXVI (Kháro) and XXXVIII (Trisingh)	″ *h* 60·62 *h* 60·30 *h* 60·20 *h* 59·92	″ *h* 59·44 *h* 59·68 *h* 58·82	″ *h* 58·20 *h* 59·70 *h* 58·32 *h* 59·20	″ *h* 57·52 *h* 59·14 *h* 58·50	″ *h* 58·96 *h* 58·20 *h* 57·90	″ *h* 59·12 *h* 59·50 *h* 58·76	″ *h* 59·24 *h* 58·22 *h* 59·00	″ *l* 57·52 *l* 58·42 *l* 58·22	″ *l* 58·52 *l* 59·12 *l* 59·48	″ *l* 59·30 *l* 59·96 *l* 58·78	$M = 58''\cdot96$ $w = 21\ \cdot90$ $\frac{1}{w} = 0\ \cdot05$
	60·26	59·31	58·86	58·39	58·35	59·13	58·82	58·05	59·04	59·35	$C = 59°\ 51'\ 58''\cdot97$

At XXXVIII (Trisingh)

******March* 1880; *observed by Captain M. W. Rogers, R.E., with Barrow's* 24-*inch Theodolite No.* 2.

†*December* 1880; *observed by Lieut.-Colonel B. R. Branfill, with Troughton and Simms'* 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XXXVII (Morgich) 313° 13′	133° 13′	32° 26′	212° 25′	111° 38′	291° 38′	190° 50′	10° 49′	270° 2′	90° 2′	*M* = Mean of Groups *w* = Relative Weight *C* = Concluded Angle
* XXXVII (Morgich) and XXXVI (Kháro)	″ *h* 56·44 *h* 57·04 *h* 60·80 *h* 57·44 *h* 56·20 *h* 57·80	″ *h* 56·02 *h* 57·84 *h* 56·58	″ *h* 55·20 *h* 57·48 *h* 56·78 *h* 56·94	″ *h* 57·78 *h* 57·54 *h* 57·80	″ *h* 57·78 *h* 57·66 *h* 57·58	″ *h* 56·44 *h* 56·70 *h* 57·04	″ *h* 57·60 *h* 56·94 *h* 57·18	″ *l* 58·12 *l* 58·60 *l* 57·40	″ *l* 57·24 *l* 57·80 *l* 58·68	″ *l* 58·80 *l* 57·82 *h* 57·92	$M = 57''\cdot45$ $w = 18\ \cdot87$ $\frac{1}{w} = 0\ \cdot05$
	57·62	56·81	56·60	57·71	57·67	56·73	57·24	58·04	57·91	58·18	$C = 46°\ 46'\ 57''\cdot44$
* XXXVI (Kháro) and XXXV (Chauki)	*l* 7·38 *l* 7·00 *l* 6·74	*l* 7·88 *l* 7·34 *l* 8·70	*h* 6·74 *h* 6·74 *h* 6·34	*h* 7·88 *h* 7·30 *h* 7·32	*h* 6·88 *h* 7·02 *h* 6·74	*h* 7·38 *h* 8·42 *h* 7·34	*h* 5·68 *h* 8·40 *h* 7·28 *h* 6·28	*l* 7·06 *l* 7·82 *l* 7·00	*l* 7·88 *l* 7·08 *l* 8·94	*l* 7·58 *l* 6·84 *l* 6·30	$M = 7''\cdot28$ $w = 28\ \cdot87$ $\frac{1}{w} = 0\ \cdot03$
	7·04	7·97	6·61	7·50	6·88	7·71	6·91	7·29	7·97	6·91	$C = 54°\ 33'\ 7''\cdot28$
* XXXV (Chauki) and XL (Kirariwáro)	*l* 27·16 *l* 25·44 *l* 25·78	*l* 26·14 *l* 27·28 *l* 25·40	*h* 26·02 *h* 24·08 *h* 25·10 *h* 26·12 *h* 26·38	*h* 23·54 *h* 24·64 *h* 25·56 *h* 24·52 *h* 25·94 *h* 26·14 *h* 27·16	*h* 26·44 *h* 26·22 *h* 27·20	*h* 26·30 *h* 25·88 *h* 26·90	*h* 26·92 *h* 25·80 *l* 26·06	*l* 26·96 *l* 25·18 *l* 25·50	*l* 27·84 *l* 26·32 *l* 26·32	*l* 26·16 *l* 25·94 *l* 26·94	
	26·13	26·27	25·54	25·36	26·62	26·36	26·26	25·88	26·83	26·35	$M = 26''\cdot16$ $w = 25\ \cdot88$
	Circle readings, telescope being set on XXXV (Chauki) 102° 48′	282° 48′	182° 0′	2° 0′	261° 12′	81° 12′	340° 25′	160° 25′	59° 36′	239° 36′	
† XXXV (Chauki) and XL (Kirariwáro)	″ *h* 27·11 *h* 26·19 *l* 25·57	″ *h* 25·28 *h* 26·64 *h* 27·20	″ *l* 25·98 *l* 28·06 *l* 27·12 *l* 26·79	″ *l* 28·23 *l* 27·81 *l* 27·50	″ *h* 24·14 *h* 26·16 *h* 24·58	″ *h* 25·32 *h* 25·51 *h* 25·31	″ *l* 27·08 *l* 27·30 *l* 27·99	″ *l* 28·13 *l* 25·36 *l* 25·19	″ *l* 26·69 *h* 24·73 *h* 25·95	″ *h* 27·15 *h* 26·90 *h* 27·32	$w = 35\ \cdot73$ $\frac{1}{w} = 0\ \cdot03$ $C = 51°\ 2'\ 26''\cdot21$
	26·29	26·37	26·99	27·85	24·96	25·38	27·46	26·23	25·79	27·12	$M = 26''\cdot44$ $w = 9\ \cdot85$

At XXXVIII (Trisingh)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXV (Chauki): 102° 48′	282° 48′	182° 0′	2° 0′	261° 12′	81° 12′	340° 25′	160° 25′	59° 36′	239° 36′	*M* = Mean of Groups; *w* = Relative Weight; *C* = Concluded Angle
† XL (Kiraríwáro) and XLIII (Núrpír)	″	″	″	″	″	″	″	″	″	″	$M = 15''\cdot26$
	h 14·89	h 14·95	l 15·69	l 13·40	h 17·16	h 15·69	l 15·13	l 13·87	h 16·27	h 15·89	$w = 14\cdot90$
	h 17·35	h 15·11	l 14·56	l 14·49	h 15·07	h 14·56	l 14·65	l 14·57	h 14·91	h 15·86	$\frac{1}{w} = 0\cdot07$
	h 16·92	h 15·02	l 14·12	l 14·80	h 16·24	h 15·92	l 14·11	l 15·53	l 14·74	h 16·36	
	16·39	15·03	14·79	14·23	16·16	15·39	14·63	14·66	15·31	16·04	$C = 51° 45' 15''\cdot26$

At XXXIX (Thar Muhári)

December 1880; *observed by Lieut.-Colonel B. R. Branfill, with Troughton and Simms'* 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLI (Mári): 104° 50′	284° 50′	184° 2′	4° 1′	263° 14′	83° 14′	342° 26′	162° 25′	61° 38′	241° 38′	*M* = Mean of Groups; *w* = Relative Weight; *C* = Concluded Angle
XLI (Mári) and XL (Kiraríwáro)	″	″	″	″	″	″	″	″	″	″	$M = 37''\cdot60$
	h 39·29	h 38·04	l 38·43	l 36·94	h 37·38	h 37·63	l 38·85	l 36·96	h 37·95	h 36·84	$w = 22\cdot20$
	h 36·97	h 37·57	l 37·17	l 37·56	h 36·78	h 35·99	l 38·41	l 38·05	h 37·40	l 36·99	$\frac{1}{w} = 0\cdot05$
	h 38·44	h 37·52	l 39·02	l 37·95	h 37·48	h 36·32	l 38·54	l 36·88	h 37·05	l 37·61	
	38·23	37·71	38·21	37·48	37·21	36·65	38·60	37·30	37·47	37·15	$C = 46° 27' 37''\cdot60$
XL (Kiraríwáro) and XXXV (Chauki)	h 12·92	h 12·50	l 14·17	l 15·27	h 13·92	h 13·39	l 14·62	l 14·75	h 12·85	h 14·38	$M = 13''\cdot94$
	h 14·03	h 13·16	l 14·56	l 14·40	h 15·37	h 13·56	l 14·04	l 13·76	h 12·66	l 13·71	$w = 22\cdot70$
	h 13·60	h 13·61	l 14·68	l 14·37	h 14·73	h 14·43	l 13·42	l 14·24	h 13·21	l 13·79	$\frac{1}{w} = 0\cdot04$
	13·52	13·09	14·47	14·68	14·67	13·79	14·03	14·25	12·91	13·96	$C = 58° 21' 13''\cdot94$

At XL (Kiraríwáro)

December 1880; *observed by Lieut.-Colonel B. R. Branfill, with Troughton and Simms'* 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLII (Yáru): 0° 1′	180° 1′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 48′	136° 48′	*M* = Mean of Groups; *w* = Relative Weight; *C* = Concluded Angle
XLII (Yáru) and XLIII (Núrpír)	″	″	″	″	″	″	″	″	″	″	$M = 12''\cdot52$
	h 14·01	l 13·20	h 11·19	h 13·24	l 12·30	h 12·32	l 11·95	l 12·29	h 12·76	l 12·94	$w = 20\cdot40$
	l 12·89	l 10·99	h 12·32	l 12·96	l 13·49	h 12·91	l 12·23	l 11·57	h 12·30	l 11·70	$\frac{1}{w} = 0\cdot05$
	h 14·18	l 12·50	h 12·88	l 13·23	l 12·19	l 12·77	l 10·26	l 13·77	l 12·06	l 12·17	
	13·69	12·23	12·13	13·14	12·66	12·67	11·48	12·54	12·37	12·27	$C = 51° 3' 12''\cdot52$
XLIII (Núrpír) and XXXVIII (Trisingh)	h 40·41	l 42·68	h 41·54	h 39·52	l 41·84	h 42·53	l 41·05	l 40·34	h 42·57	l 40·52	$M = 41''\cdot19$
	h 41·93	l 42·14	h 40·32	l 40·07	l 40·45	h 41·15	l 41·34	l 40·78	l 41·67	l 41·73	$w = 17\cdot50$
	l 42·80	l 41·04	h 39·23	l 41·22	l 41·74	l 40·70	l 42·26	l 39·85	h 40·79	l 41·61	$\frac{1}{w} = 0\cdot06$
	41·71	41·95	40·36	40·27	41·34	41·46	41·55	40·32	41·68	41·29	$C = 59° 49' 41''\cdot19$

At XL (Kiraríwáro)—(*Continued*).

Angle between	Circle readings, telescope being set on XLII (Yáru) 0° 1′	180° 1′	79° 12′	259° 12′	158° 25′	338° 25′	237° 37′	57° 37′	316° 48′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XXXVIII (Trisingh) and XXXV (Chauki)	h 49·70 h 49·02 l 49·23	l 48·42 l 50·53 l 50·04	h 50·99 h 50·51 h 49·21	h 51·32 l 50·15 l 50·32	l 48·90 l 50·48 l 49·98	h 48·91 h 48·22 l 49·94	l 50·92 l 50·66 l 52·22	l 50·50 l 50·92 l 50·90	h 48·80 h 51·27 h 49·95	l 50·28 l 48·57 l 49·53	M = 50″·01 w = 15·20 1/w = 0·07
	49·32	49·66	50·24	50·60	49·79	49·02	51·27	50·77	50·01	49·46	C = 61° 8′ 50″·01
XXXV (Chauki) and XXXIX (Thar Muhári)	h 8·95 h 10·24 l 8·89	l 12·14 l 10·73 h 9·90	h 11·54 h 9·76 h 10·39	h 9·08 l 10·80 l 9·53	l 10·49 l 8·64 l 9·28	h 10·92 h 12·54 l 10·07	l 9·01 l 8·35 l 8·80	l 9·02 l 8·69 l 8·82	h 10·65 h 11·40 l 10·27	l 9·82 l 11·44 l 10·53	M = 10″·02 w = 10·40 1/w = 0·10
	9·36	10·92	10·56	9·80	9·47	11·18	8·72	8·84	10·77	10·60	C = 77° 53′ 10″·02
XXXIX (Thar Muhári) and XLI (Mári)	h 34·81 h 33·26 l 34·99	l 33·57 l 34·80 l 34·19	h 33·04 h 33·68 h 33·55	h 34·32 l 33·21 l 34·74	l 35·15 l 34·33 l 34·75	h 33·46 l 34·83 h 34·38	l 34·50 l 34·87 l 34·48	l 35·29 l 34·58 l 34·76	h 33·00 l 34·35 h 34·93	l 32·76 l 33·65 l 32·18	M = 34″·15 w = 21·30 1/w = 0·05
	34·35	34·19	33·42	34·09	34·74	34·22	34·62	34·88	34·09	32·86	C = 69° 17′ 34″·15
XLI (Mári) and XLII (Yáru)	h 31·44 h 30·96 l 31·14	l 29·04 l 30·16 l 29·98	h 32·90 h 32·59 h 32·58	h 31·62 l 31·37 l 31·24	l 30·75 l 32·37 l 32·20	h 31·60 h 32·73 l 31·49	l 31·52 l 32·01 l 31·85	l 32·00 l 32·10 l 31·96	h 30·91 h 31·78 l 31·80	l 34·28 l 34·23 h 32·65	M = 31″·78 w = 8·90 1/w = 0·11
	31·18	29·73	32·69	31·41	31·77	31·94	31·79	32·02	31·50	33·72	C = 40° 47′ 31″·78

At XLI (Mári)

December 1880; *observed by Lieut.-Colonel B. R. Branfill, with Troughton and Simms'* 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLII (Yáru) 0° 1′	180° 0′	79° 13′	259° 12′	158° 24′	338° 24′	227° 37′	47° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
XLII (Yáru) and XL (Kiraríwáro)	h 55·07 l 56·48 l 55·57	l 56·16 l 55·33 l 54·82	h 56·19 h 56·62 h 56·29	h 57·01 h 56·15 h 56·44	l 57·08 l 54·42 h 55·44	l 55·99 l 56·75 l 55·88	l 56·93 h 55·51 h 55·49	h 55·50 h 56·04 h 56·06	h 56·82 h 56·09 h 56·27	l 55·93 l 55·87 l 55·32	M = 55″·99 w = 41·70 1/w = 0·02
	55·71	55·44	56·37	56·53	55·65	56·21	55·98	55·87	56·39	55·71	C = 77° 3′ 55″·99
XL (Kiraríwáro) and XXXIX (Thar Muhári)	h 49·89 l 49·45 l 48·62	l 48·81 l 46·72 l 47·69	h 50·28 h 48·25 h 48·84	h 47·75 h 48·84 l 48·22	l 49·85 l 49·74 h 49·63	l 48·45 l 47·99 h 49·49	l 48·95 l 50·00 h 49·22	h 49·52 h 50·25 h 49·33	h 48·11 h 48·71 l 47·28	l 47·43 l 49·99 l 48·63	M = 48″·86 w = 15·90 1/w = 0·06
	49·32	47·74	49·12	48·27	49·74	48·64	49·39	49·70	48·03	48·68	C = 64° 14′ 48″·86

At XLII (Yáru)

December 1880; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLIV (Vijnot) 224° 10′	44° 10′	303° 21′	123° 21′	22° 34′	202° 34′	101° 46′	281° 45′	180° 58′	0° 57′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
XLIV (Vijnot) and XLV (Longwáli)	″ h 45·49 h 48·13 h 47·28	″ h 48·56 l 49·09 l 49·00	″ l 46·68 l 49·14 l 48·42	″ h 49·84 h 49·21 h 49·50	″ h 48·04 l 47·36 l 47·48	″ l 47·19 l 48·30 l 46·66	″ h 48·52 h 49·38 h 47·90	″ h 49·77 h 48·92 l 48·48	″ l 47·72 l 48·19 l 47·44	″ l 47·45 l 47·76 l 48·43	$M = 48''\cdot 18$ $w = 12\cdot 70$ $\frac{1}{w} = 0\cdot 08$
	46·97	48·88	48·08	49·52	47·63	47·38	48·60	49·06	47·78	47·88	$C = 39° 23' 48''\cdot 18$
XLV (Longwáli) and XLIII (Núrpír)	h 16·22 h 17·42 h 16·29	h 15·38 l 15·44 l 16·29	l 16·36 l 15·66 l 14·22	h 13·67 h 14·80 h 14·90	h 17·40 l 15·91 l 18·43	l 14·61 l 15·74 l 15·96	h 14·05 h 14·83 h 14·91	h 15·42 h 17·09 l 16·34	l 15·31 l 15·55 l 16·90	l 17·02 l 15·49 l 16·09	$M = 15''\cdot 79$ $w = 11\cdot 00$ $\frac{1}{w} = 0\cdot 09$
	16·64	15·70	15·41	14·46	17·25	15·44	14·60	16·28	15·92	16·20	$C = 39° 4' 15''\cdot 79$
XLIII (Núrpír) and XL (Kiraríwáro)	h 2·98 h 2·11 h 3·91 h 5·57	h 2·91 l 2·18 l 3·12	l 1·88 l 0·94 l 1·46	h 2·48 h 1·27 h 2·33	h 2·52 l 2·48 l 1·61	l 3·48 l 1·87 l 2·40	h 3·56 h 2·40 h 3·44	h 1·24 l 0·77 l 1·87	l 3·24 l 2·55 l 2·24	l 4·21 l 2·02 h 3·46	$M = 2''\cdot 50$ $w = 13\cdot 58$ $\frac{1}{w} = 0\cdot 07$
	3·64	2·74	1·43	2·03	2·20	2·58	3·13	1·29	2·68	3·23	$C = 83° 32' 2''\cdot 51$
XL (Kiraríwáro) and XLI (Mári)	h 32·56 h 31·58 h 31·87	h 31·69 l 33·38 l 30·33	l 32·29 l 32·18 l 34·33	h 33·05 h 32·88 h 32·79	h 33·10 l 33·02 l 31·14	l 31·02 l 32·24 l 33·00	h 30·85 h 32·45 h 32·29	h 34·74 l 35·03 l 34·55	l 32·96 l 31·55 l 32·09	l 31·36 l 34·06 l 33·26	$M = 32''\cdot 59$ $w = 10\cdot 00$ $\frac{1}{w} = 0\cdot 10$
	32·00	31·80	32·93	32·91	32·42	32·09	31·86	34·77	32·20	32·89	$C = 62° 8' 32''\cdot 59$

At XLIII (Núrpír)

December 1880; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XXXVIII (Trisingh) 0° 1′	180° 1′	79° 13′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 48′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
XXXVIII (Trisingh) and XL (Kiraríwáro)	″ h 5·47 h 3·60 h 5·01	″ h 5·28 h 5·07 l 5·90	″ l 4·41 l 4·25 l 3·27	″ h 5·53 h 4·90 h 4·84	″ h 4·02 l 3·94 l 4·06	″ l 3·66 l 4·01 l 4·79	″ h 4·45 h 3·82 h 4·55	″ h 4·20 h 3·97 h 3·87	″ l 4·93 l 4·39 l 4·41	″ h 5·90 h 5·53 h 4·58	$M = 4''\cdot 55$ $w = 27\cdot 00$ $\frac{1}{w} = 0\cdot 04$
	4·69	5·42	3·98	5·09	4·01	4·15	4·27	4·01	4·58	5·34	$C = 68° 25' 4''\cdot 55$

At XLIII (Núrpír)—(*Continued*).

Angle between	Circle readings, telescope being set on XXXVIII (Trisingh) 0° 1′	180° 1′	79° 13′	259° 12′	158° 24′	338° 24′	237° 37′	57° 37′	316° 49′	136° 48′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XL (Kiraríwáro) and XLII (Yáru)	″ h 43·27 h 44·09 h 43·72	″ h 43·41 h 44·31 l 44·85	″ l 43·20 l 42·54 l 43·73	″ h 44·69 h 43·67 h 44·75	″ h 43·75 l 43·43 l 42·97	″ l 44·62 l 43·52 l 45·55	″ h 43·15 h 44·20 h 43·37	″ h 43·82 h 45·32 h 44·37	″ l 44·73 l 44·26 l 44·21	″ l 45·38 h 44·10 h 43·53	$M = 44''\cdot02$ $w = 27\cdot80$ $\frac{1}{w} = 0\cdot04$
	43·69	44·19	43·16	44·37	43·38	44·56	43·57	44·50	44·40	44·34	$C = 45^\circ\ 24'\ 44''\cdot02$
XLII (Yáru) and XLIV (Vijnot)	h 50·29 h 50·97 h 50·90	h 51·00 h 50·90 l 49·66	l 51·20 l 50·92 l 50·25	h 49·62 h 51·16 h 49·73	h 49·55 l 51·14 l 49·52	l 48·76 l 49·67 l 49·94	h 51·05 h 50·55 h 51·19	h 50·94 h 50·37 h 50·46	l 49·94 l 50·51 l 50·86	l 50·22 h 50·34 h 50·30 h 50·48	$M = 50''\cdot40$ $w = 40\cdot17$ $\frac{1}{w} = 0\cdot02$
	50·72	50·52	50·79	50·17	50·07	49·46	50·93	50·59	50·44	50·34	$C = 43^\circ\ 10'\ 50''\cdot40$
XLIV (Vijnot) and XLV (Longwáli)	h 49·01 h 49·34 h 48·66	h 48·47 h 47·59 l 47·81	l 48·56 l 49·13 l 49·07	h 48·23 h 49·03 h 49·43	h 48·17 l 48·52 l 48·33	l 51·10 l 49·43 l 48·73	h 48·80 h 47·71 h 48·85	h 49·57 h 49·41 l 49·54	l 47·55 l 48·21 l 49·10	l 49·70 h 48·40 h 49·20	$M = 48''\cdot82$ $w = 24\cdot40$ $\frac{1}{w} = 0\cdot04$
	49·00	47·96	48·92	48·90	48·34	49·75	48·45	49·51	48·29	49·10	$C = 47^\circ\ 46'\ 48''\cdot82$

At XLIV (Vijnot)

December 1880 *and January* 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLVIII (Dewari) 0° 1′	180° 1′	79° 13′	259° 13′	158° 24′	338° 25′	237° 36′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLVIII (Dewari) and R. M.	″ h 48·26 h 46·48 h 47·24 h 46·47	″ h 48·67 l 49·23 h 47·97	″ h 47·53 h 48·09 h 46·05	″ h 48·13 l 49·34 h 47·83	″ h 49·15 h 47·60 l 47·87	″ h 49·70 h 50·10 l 48·51	″ h 48·98 h 48·15 h 47·34	″ h 48·45 l 46·85 h 48·34	″ h 49·81 h 49·31 h 50·47	″ h 49·32 l 47·25 l 48·81	$M = 48''\cdot34$ $w = 11\cdot06$ $\frac{1}{w} = 0\cdot09$
	47·11	48·62	47·22	48·43	48·21	49·44	48·16	47·88	49·86	48·46	$C = 36^\circ\ 31'\ 48''\cdot33$
XLVIII (Dewari) and XLVI (Vín)	h 39·93 h 38·96 h 39·47 h 40·34	h 39·13 l 39·15 h 39·19	h 39·86 h 40·46 h 38·55	h 38·75 l 42·05 l 40·18	h 41·19 h 38·12 h 38·99 l 38·32	h 40·35 h 41·72 l 39·47	h 40·14 h 40·10 h 39·62	h 39·15 h 38·31 h 38·28	h 39·61 h 40·09 h 40·13	h 39·70 l 41·98 h 39·16	$M = 39''\cdot72$ $w = 16\cdot76$ $\frac{1}{w} = 0\cdot06$
	39·68	39·16	39·62	40·33	39·16	40·51	39·95	38·58	39·94	40·28	$C = 61^\circ\ 37'\ 39''\cdot71$

NOTE.—R. M. denotes Referring Mark.

At XLIV (Vijnot)—(*Continued*).

Angle between	Circle readings, telescope being set on XLVIII (Dewari) 0° 1′	180° 1′	79° 13′	259° 13′	158° 24′	338° 25′	237° 36′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLVI (Vín) and XLV (Longwáli)	″ *h* 27·66 *h* 26·72 *h* 26·07	″ *h* 27·07 *l* 27·63 *h* 28·60	″ *h* 26·52 *h* 26·36 *h* 25·87	″ *h* 27·71 *l* 27·42 *h* 28·06	″ *h* 26·53 *h* 26·74 *h* 27·60	″ *h* 27·91 *h* 27·06 *l* 28·70	″ *h* 27·57 *h* 27·16 *h* 26·69	″ *h* 27·19 *l* 30·09 *h* 27·52	″ *h* 29·38 *h* 28·58 *h* 28·30	″ *h* 28·36 *h* 29·19 *h* 30·15	$M = 27''\cdot68$ $w = 10\cdot20$ $\frac{1}{w} = 0\cdot10$
	26·82	27·77	26·25	27·73	26·96	27·89	27·14	28·27	28·75	29·23	$C = 46°\ 16'\ 27''\cdot68$
XLV (Longwáli) and XLIII (Núrpír)	*h* 32·42 *h* 30·39 *h* 31·30	*h* 31·77 *h* 30·59 *h* 31·08 *h* 31·82	*h* 32·52 *h* 30·43 *h* 31·85	*h* 29·61 *l* 29·49 *h* 28·62	*h* 30·42 *h* 31·39 *h* 30·62	*h* 29·24 *h* 31·37 *h* 31·94	*h* 30·93 *h* 31·11 *h* 29·63	*h* 31·95 *l* 30·17 *h* 30·09	*h* 29·85 *h* 29·73 *h* 29·54	*h* 30·63 *l* 29·44 *h* 29·48	$M = 30''\cdot61$ $w = 13\cdot07$ $\frac{1}{w} = 0\cdot08$
	31·37	31·32	31·60	29·24	30·81	30·85	30·56	30·74	29·71	29·85	$C = 45°\ 33'\ 30''\cdot60$
XLIII (Núrpír) and XLII (Yáru)	*h* 5·26 *h* 8·26 *h* 5·34 *h* 5·25	*h* 4·73 *h* 4·72 *h* 4·29	*h* 7·35 *h* 7·90 *h* 7·23	*h* 8·27 *l* 7·02 *h* 6·96	*h* 5·66 *h* 5·71 *h* 5·94	*h* 6·55 *h* 5·32 *l* 7·62	*h* 5·93 *h* 6·43 *h* 8·01	*h* 5·26 *l* 8·45 *h* 6·90	*h* 6·55 *h* 5·84 *h* 6·75	*h* 6·00 *l* 6·82 *l* 5·77	$M = 6''\cdot40$ $w = 10\cdot86$ $\frac{1}{w} = 0\cdot09$
	6·03	4·58	7·49	7·42	5·77	6·50	6·79	6·87	6·38	6·20	$C = 58°\ 21'\ 6''\cdot40$

At XLV (Longwáli)

January 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLIII (Núrpír) 185° 6′	5° 6′	264° 18′	84° 18′	343° 30′	163° 29′	62° 42′	242° 42′	141° 54′	321° 54′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLIII (Núrpír) and XLII (Yáru)	″ *h* 7·44 *h* 6·82 *l* 6·28	″ *h* 6·05 *l* 6·10 *l* 5·84 *l* 5·42	″ *h* 3·88 *h* 5·87 *h* 4·44	″ *h* 5·16 *h* 4·32 *h* 4·38	″ *l* 6·98 *l* 7·03 *l* 6·17	″ *h* 4·49 *l* 5·03 *l* 3·80	″ *h* 6·54 *h* 4·09 *h* 6·09	″ *h* 4·75 *h* 4·01 *l* 4·65	″ *l* 5·43 *l* 6·40 *h* 5·24	″ *l* 7·79 *h* 7·82 *h* 6·15	$M = 5''\cdot62$ $w = 8\cdot12$ $\frac{1}{w} = 0\cdot12$
	6·85	5·85	4·73	4·62	6·73	4·44	5·57	4·47	5·69	7·25	$C = 49°\ 58'\ 5''\cdot62$
XLII (Yáru) and XLIV (Vijnot)	*h* 35·14 *h* 35·36 *l* 34·01	*h* 35·12 *l* 35·96 *l* 36·91 *l* 36·24	*h* 34·43 *h* 34·88 *h* 33·29	*h* 34·78 *h* 34·98 *h* 34·92	*l* 34·59 *l* 35·36 *l* 35·34	*l* 38·14 *l* 38·17 *h* 36·99	*h* 34·94 *h* 34·60 *h* 34·46	*h* 37·14 *h* 36·13 *l* 36·50	*l* 37·06 *l* 35·30 *l* 36·29	*l* 35·95 *h* 34·92 *h* 33·60	$M = 35''\cdot52$ $w = 7\cdot51$ $\frac{1}{w} = 0\cdot13$
	34·84	36·06	34·20	34·89	35·10	37·77	34·67	36·59	36·22	34·82	$C = 36°\ 41'\ 35''\cdot52$

At XLV (Longwáli)—(*Continued*).

Angle between	Circle readings, telescope being set on XLIII (Núrpír) 185° 6′	5° 6′	264° 18′	84° 18′	343° 30′	163° 29′	62° 42′	242° 42′	141° 54′	321° 54′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLIV (Vijnot) and XLVI (Vín)	″ *h* 44·22 *h* 44·13 *l* 45·56	″ *h* 44·93 *l* 46·16 *l* 44·95 *l* 44·97	″ *h* 45·47 *h* 45·94 *h* 45·33	″ *h* 45·32 *h* 45·33 *h* 46·19	″ *l* 46·06 *l* 45·52 *l* 45·82	″ *l* 44·97 *l* 45·36 *l* 44·72	″ *h* 44·77 *h* 45·81 *h* 44·49	″ *h* 45·31 *h* 43·84 *l* 44·15	″ *l* 44·67 *l* 45·31 *l* 45·49	″ *l* 44·09 *h* 44·12 *h* 45·35	$M = 45''\cdot10$ $w = 33\cdot54$ $\frac{1}{w} = 0\cdot03$
	44·64	45·25	45·58	45·61	45·80	45·02	45·02	44·43	45·16	44·52	$C = 47^\circ 39' 45''\cdot10$
XLVI (Vín) and XLVII (Got Mír Muhammad)	*h* 53·32 *h* 53·19 *h* 54·17	*h* 52·58 *l* 53·13 *l* 52·47	*h* 52·98 *h* 53·98 *h* 52·81	*h* 53·57 *h* 53·53 *h* 51·93	*l* 52·01 *l* 51·98 *l* 51·76	*l* 51·07 *l* 52·68 *l* 52·62	*h* 52·60 *h* 53·18 *h* 53·71	*h* 52·88 *h* 54·52 *l* 55·48	*l* 52·69 *l* 52·90 *l* 53·19	*l* 53·80 *h* 53·32 *h* 53·42	$M = 53''\cdot05$ $w = 16\cdot90$ $\frac{1}{w} = 0\cdot06$
	53·56	52·73	53·26	53·01	51·92	52·12	53·16	54·29	52·93	53·51	$C = 50^\circ 45' 53''\cdot05$

At XLVI (Vín)

January 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLV (Longwáli) 0° 1′	180° 1′	79° 12′	259° 13′	158° 25′	338° 25′	237° 37′	57° 37′	316° 48′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLV (Longwáli) and XLIV (Vijnot)	″ *h* 46·86 *h* 47·45 *h* 47·79	″ *l* 46·19 *l* 46·76 *l* 51·20 *h* 49·62	″ *h* 48·32 *h* 47·56 *h* 48·24	″ *h* 47·26 *l* 45·67 *l* 47·20	″ *h* 46·65 *h* 46·75 *d* 47·63	″ *h* 46·93 *l* 45·07 *l* 45·27	″ *l* 45·31 *l* 46·84 *l* 47·27	″ *h* 50·52 *h* 47·37 *h* 46·00	″ *h* 47·86 *h* 48·16 *h* 48·41	″ *h* 50·70 *l* 47·75 *l* 48·13 *h* 47·74	$M = 47''\cdot45$ $w = 7\cdot74$ $\frac{1}{w} = 0\cdot13$
	47·37	48·44	48·04	46·71	47·01	45·76	46·47	47·96	48·14	48·58	$C = 86^\circ\ 3' 47''\cdot47$
XLIV (Vijnot) and XLVIII (Dewari)	*h* 4·86 *h* 6·01 *h* 5·85	*l* 3·54 *l* 2·84 *h* 3·02	*h* 5·07 *h* 3·16 *h* 2·48 *h* 3·48	*h* 5·26 *l* 2·22 *h* 5·00	*h* 5·28 *h* 5·64 *l* 5·02	*h* 5·47 *h* 5·91 *h* 6·33	*l* 5·85 *l* 3·80 *l* 2·76 *h* 5·97	*h* 2·34 *h* 5·74 *h* 1·81 *d* 5·28	*h* 5·94 *h* 5·16 *h* 4·58	*h* 5·74 *h* 3·63 *h* 3·68	$M = 4''\cdot56$ $w = 8\cdot48$ $\frac{1}{w} = 0\cdot12$
	5·57	3·13	3·55	4·16	5·31	5·90	4·60	3·79	5·23	4·35	$C = 71^\circ 45'\ 4''\cdot55$
XLVIII (Dewari) and XLIX (Kot Sabzal)	*h* 24·75 *h* 23·13 *h* 22·67	*l* 24·37 *l* 25·16 *h* 24·02	*h* 24·42 *h* 25·08 *h* 23·97	*h* 24·93 *l* 25·23 *l* 24·93	*h* 23·33 *h* 23·92 *h* 24·14	*h* 23·78 *h* 24·15 *h* 23·92	*l* 24·13 *l* 25·44 *h* 23·87	*h* 25·94 *h* 23·77 *h* 23·77	*h* 23·47 *h* 23·55 *h* 24·20	*l* 25·69 *h* 23·29 *h* 24·51 *h* 24·18 *h* 25·22	$M = 24''\cdot26$ $w = 28\cdot25$ $\frac{1}{w} = 0\cdot04$
	23·52	24·52	24·49	25·03	23·80	23·95	24·48	24·49	23·74	24·58	$C = 54^\circ 51' 24''\cdot27$

At XLVI (Vín)—(*Continued*).

Angle between	Circle readings, telescope being set on XLV (Longwáli) 0°1′	180°1′	79°12′	259°13′	158°25′	338°25′	237°37′	57°37′	316°48′	136°49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLIX (Kot Sabzal) and XLVII (Got Mír Muhammad)	″ h 53·51 h 53·06 h 51·35	″ l 51·15 l 54·00 l 52·61	″ h 50·66 h 52·51 h 54·04	″ h 54·73 l 55·81 l 53·64	″ h 51·35 h 52·62 h 51·88	″ h 53·59 h 53·99 h 55·93	″ l 53·74 h 52·56 h 52·64	″ h 48·22 h 52·51 d 49·99	″ h 51·41 h 53·51 h 52·15	″ h 51·81 h 53·21 h 54·61 d 52·15	$M = 52''\cdot73$ $w = 5\cdot03$ $\frac{1}{w} = 0\cdot20$
	52·64	52·59	52·40	54·73	51·95	54·50	52·98	50·24	52·36	52·95	$C = 80°\ 34'\ 52''\cdot73$
XLVII (Got Mír Muhammad) and XLV (Longwáli)	h 49·81 h 51·25 h 49·96	l 51·06 l 49·49 l 50·98	h 52·58 h 51·96 h 50·69	h 50·85 l 51·12 l 52·62	h 51·35 h 51·17 h 50·91	h 48·96 h 49·97 h 47·97	l 48·64 l 49·85 d 52·53	h 51·67 h 52·89 h 50·55	h 50·98 h 50·29 h 51·79	h 49·98 l 47·89 h 54·73 d 51·53	$M = 50''\cdot83$ $w = 8\cdot40$ $\frac{1}{w} = 0\cdot12$
	50·34	50·51	51·74	51·53	51·14	48·97	50·34	51·70	51·02	51·03	$C = 66°\ 44'\ 50''\cdot83$

At XLVII (Got Mír Muhammad)

January 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms*' 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLV (Longwáli) 0°1′	180°1′	79°13′	259°13′	158°24′	338°24′	237°37′	57°37′	316°49′	136°49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLV (Longwáli) and XLVI (Vín)	″ h 15·65 h 15·79 h 13·80	″ h 16·72 h 14·37 h 16·20	″ h 15·82 l 18·10 l 17·70	″ l 18·01 l 16·36 l 17·73	″ h 15·35 h 14·29 h 16·01	″ h 16·50 h 16·06 h 16·67	″ h 16·90 h 17·14 l 15·80	″ l 18·10 l 16·40 h 17·28	″ l 13·89 l 15·22 l 15·52	″ h 15·06 h 15·52 h 16·46	$M = 16''\cdot15$ $w = 9\cdot20$ $\frac{1}{w} = 0\cdot11$
	15·08	15·76	17·21	17·37	15·22	16·41	16·61	17·26	14·88	15·68	$C = 62°\ 29'\ 16''\cdot15$
XLVI (Vín) and XLIX (Kot Sabzal)	h 48·82 h 49·48 h 49·07	h 52·81 h 50·33 h 50·98	h 48·27 l 45·48 h 51·62	l 46·26 l 46·56 h 51·68	h 48·62 h 48·73 h 47·38	h 48·85 h 50·93 h 50·80	h 48·27 h 48·05 l 48·86	l 49·61 l 48·38 h 51·58	l 49·05 l 49·93 l 49·38	h 51·60 h 50·23 h 51·79	$M = 49''\cdot45$ $w = 5\cdot00$ $\frac{1}{w} = 0\cdot20$
	49·12	51·37	48·46	48·17	48·24	50·19	48·39	49·86	49·45	51·21	$C = 55°\ 49'\ 49''\cdot45$

At XLVIII (Dewari)

January 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms*' 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on L (Kubba) 224°17′	44°17′	303°29′	123°30′	22°42′	202°42′	101°54′	281°54′	181°5′	1°5′	M = Mean of Groups w = Relative Weight C = Concluded Angle
L (Kubba) and LI (Ghundi)	″ h 35·89 h 35·58 h 36·85	″ h 36·61 h 37·79 h 37·09	″ l 37·02 h 36·95 h 36·69	″ h 38·35 h 37·35 h 38·12	″ h 38·00 l 35·80 h 36·34 d 35·86	″ l 37·22 l 36·78 h 36·55	″ h 35·93 h 37·13 h 37·06	″ h 36·43 l 33·79 l 32·49 d 34·48	″ h 33·55 h 37·40 h 36·49 h 36·91	″ h 36·21 h 37·22 h 37·73	$M = 36''\cdot56$ $w = 8\cdot62$ $\frac{1}{w} = 0\cdot12$
	36·11	37·16	36·89	37·94	36·50	36·85	36·71	34·30	36·09	37·05	$C = 63°\ 42'\ 36''\cdot55$

At XLVIII (Dewari)—(*Continued*).

Angle between	Circle readings, telescope being set on L (Kubba)										M = Mean of Groups w = Relative Weight C = Concluded Angle
	224° 17′	44° 17′	303° 29′	123° 30′	22° 42′	202° 42′	101° 54′	281° 54′	181° 5′	1° 5′	
	″	″	″	″	″	″	″	″	″	″	
LI (Ghundi)	*h* 14·99	*h* 14·28	*h* 12·34	*h* 14·57	*h* 13·13	*l* 18·21	*h* 15·23	*h* 14·50	*h* 19·16	*h* 14·95	$M = 15''\cdot 40$
and	*h* 14·37	*h* 15·73	*h* 12·85	*h* 15·45	*l* 15·38	*l* 16·13	*h* 14·03	*l* 15·61	*h* 17·01	*h* 14·80	$w = 7\cdot 48$
XLIX (Kot Sabzal)	*h* 14·16	*h* 15·60	*h* 16·39	*h* 14·44	*h* 17·02	*h* 16·08	*h* 14·98	*l* 18·07	*h* 15·22	*h* 15·41	$\frac{1}{w} = 0\cdot 13$
		d 15·26	*d* 15·42					*d* 17·80	*h* 16·23		
	14·51	15·22	14·25	14·82	15·18	16·81	14·75	16·50	16·91	15·05	$C = 60° 29' 15''\cdot 41$
XLIX (Kot Sabzal)	*h* 37·99	*h* 39·69	*h* 40·03	*h* 37·42	*h* 41·92	*l* 39·97	*h* 39·75	*h* 40·82	*h* 42·82	*h* 37·58	$M = 39''\cdot 59$
and	*h* 40·60	*h* 38·88	*h* 38·28	*h* 40·31	*h* 41·88	*l* 39·01	*h* 39·56	*h* 39·64	*h* 40·15	*h* 37·77	$w = 6\cdot 60$
XLVI (Vín)	*h* 39·09	*l* 41·45	*h* 37·91	*h* 37·41	*l* 40·83	*l* 39·86	*h* 39·88	*l* 39·45	*h* 39·76	*h* 36·92	$\frac{1}{w} = 0\cdot 15$
	d 38·41	*h* 39·51		*h* 41·55		*h* 40·14			*h* 39·95		
	39·02	39·88	38·74	39·17	41·54	39·75	39·73	39·97	40·67	37·42	$C = 53° 27' 39''\cdot 59$
XLVI (Vín)	*h* 17·73	*h* 15·54	*h* 16·38	*h* 15·96	*h* 15·96	*l* 12·98	*h* 17·13	*h* 16·03	*h* 12·13	*h* 18·73	$M = 16''\cdot 32$
and	*h* 17·91	*h* 14·54	*h* 17·26	*h* 17·81	*h* 15·89	*l* 13·83	*h* 18·48	*h* 17·91	*h* 18·49	*h* 17·50	$w = 5\cdot 15$
XLIV (Vijnot)	*h* 17·59	*l* 14·85	*h* 16·07	*h* 17·76	*l* 15·47	*l* 16·79	*h* 12·94	*l* 13·37	*h* 18·29	*h* 18·16	$\frac{1}{w} = 0\cdot 19$
		h 13·35				*h* 17·11	*l* 16·80	*d* 14·06	*h* 16·53		
	17·74	14·57	16·57	17·18	15·77	15·18	16·34	15·34	16·36	18·13	$C = 46° 37' 16''\cdot 28$

At XLIX (Kot Sabzal)

January 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms'* 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLVII (Got Mír Muhammad)										M = Mean of Groups w = Relative Weight C = Concluded Angle
	216° 24′	36° 24′	295° 36′	115° 36′	14° 48′	194° 48′	94° 0′	274° 0′	173° 12′	353° 12′	
	″	″	″	″	″	″	″	″	″	″	
XLVII (Got Mír Muhammad)	*h* 18·32	*h* 17·69	*h* 17·82	*h* 18·79	*l* 16·76	*h* 19·40	*h* 17·32	*h* 16·21	*h* 18·15	*h* 17·03	$M = 17''\cdot 73$
and	*h* 17·27	*l* 17·76	*h* 16·97	*h* 20·03	*l* 15·68	*h* 19·61	*h* 17·48	*l* 17·82	*h* 16·93	*h* 17·71	$w = 12\cdot 50$
XLVI (Vín)	*l* 16·98	*l* 18·96	*h* 18·13	*l* 18·52	*h* 17·17	*h* 18·11	*h* 18·32	*l* 17·17	*h* 16·85	*h* 16·77	$\frac{1}{w} = 0\cdot 08$
	17·52	18·14	17·64	19·11	16·54	19·04	17·71	17·07	17·31	17·17	$C = 43° 35' 17''\cdot 73$
XLVI (Vín)	*h* 57·36	*h* 57·98	*h* 56·08	*h* 53·75	*l* 56·92	*h* 58·12	*h* 54·58	*l* 57·08	*h* 57·23	*h* 57·79	$M = 56''\cdot 77$
and	*h* 57·10	*l* 58·74	*h* 56·10	*h* 54·93	*l* 58·37	*h* 54·84	*h* 55·07	*l* 57·63	*h* 57·61	*h* 56·85	$w = 5\cdot 10$
XLVIII (Dewari)	*h* 59·11	*l* 59·41	*h* 54·88	*l* 54·70	*h* 56·98	*h* 56·33	*h* 54·99	*l* 56·43	*h* 57·98	*l* 57·76	$\frac{1}{w} = 0\cdot 20$
							l 55·33				
	57·86	58·71	55·69	54·46	57·42	56·43	54·99	57·05	57·61	57·47	$C = 71° 40' 56''\cdot 77$

At XLIX (Kot Sabzal)—(*Continued*).

Angle between	Circle readings, telescope being set on XLVII (Got Mír Muhammad) 216° 24′	36° 24′	295° 36′	115° 36′	14° 48′	194° 48′	94° 0′	274° 0′	173° 12′	353° 12′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLVIII (Dewari) and LI (Ghundi)	″ h 53·20 h 52·67 h 53·46	″ h 52·27 l 52·12 h 53·49	″ h 55·03 h 53·91 h 55·75	″ h 55·12 h 54·28 l 54·29	″ l 52·52 l 51·40 h 54·15	″ h 54·47 h 54·87 h 53·97	″ h 54·80 h 54·49 h 53·54	″ h 51·39 l 50·79 l 52·82	″ l 52·21 h 57·73 h 54·10 h 51·87	″ h 52·63 h 54·29 d 52·93	M = 53″·55 w = 6·94 1/w = 0·14
	53·11	52·63	54·90	54·56	52·69	54·44	54·28	51·67	53·98	53·28	C = 55° 24′ 53″·55
LI (Ghundi) and LXII (Dáowála)	h 27·45 h 26·41 h 26·55	h 26·01 l 24·04 l 26·35	h 28·93 h 29·05 h 27·05	h 25·87 h 27·11 l 25·30	l 27·81 l 27·99 h 27·86	h 27·36 h 26·42 h 27·09	h 26·98 h 27·83 h 26·88	h 26·25 l 26·41 l 27·88	l 26·82 h 25·74 h 27·75	h 28·08 h 27·34 h 27·62	M = 27″·01 w = 11·60 1/w = 0·09
	26·80	25·47	28·34	26·09	27·89	26·96	27·23	26·85	26·77	27·68	C = 45° 42′ 27″·01

At L (Kubba)

January and February 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on LIX (Máchka) 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
LIX (Máchka) and LI (Ghundi)	″ h 13·49 h 13·63 l 16·08	″ h 15·76 h 14·98 l 14·87	″ l 14·61 l 16·38 h 13·43 l 16·34	″ l 15·29 h 14·46 h 12·75	″ h 15·21 h 14·56 h 14·77	″ h 13·53 h 15·31 h 14·96	″ h 14·03 h 12·76 h 13·26	″ l 14·36 l 14·10 l 14·76	″ l 16·62 l 12·40 h 13·14	″ l 14·11 h 13·00 h 13·70	M = 14″·38 w = 14·66 1/w = 0·07
	14·40	15·20	15·19	14·17	14·85	14·60	13·35	14·41	14·05	13·60	C = 71° 50′ 14″·39
LI (Ghundi) and XLVIII (Dewari)	h 45·47 h 45·08 l 44·04	h 43·75 h 44·75 h 46·95	h 44·04 h 40·05 l 40·79 h 44·71	l 39·63 h 44·76 h 46·01 h 44·60	h 42·76 h 43·98 h 43·79	h 45·74 h 44·33 h 46·31	h 46·18 h 46·77 h 45·57	l 44·53 l 44·33 l 44·56	l 42·91 l 42·81 l 42·15	l 44·35 h 44·97 h 45·64	M = 44″·34 w = 4·88 1/w = 0·20
	44·86	45·15	42·40	43·75	43·51	45·46	46·17	44·47	42·62	44·99	C = 57° 5′ 44″·32

At LI (Ghundi)

February 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLVIII (Dewari) 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLVIII (Dewari) and L (Kubba)	″ h 40·58 h 41·04 h 40·39	″ l 38·18 h 39·50 h 40·69 h 38·28	″ h 41·46 h 38·41 l 40·59 d 38·90	″ h 39·61 h 38·03 l 38·05	″ h 40·66 h 40·80 d 39·40	″ h 40·08 h 39·86 h 38·79	″ h 38·02 h 39·33 h 40·75 l 37·75	″ h 38·20 h 38·47 h 39·19	″ l 39·82 l 39·92 l 41·11	″ h 39·32 h 39·95 h 40·10	M = 39″·58 w = 13·53 1/w = 0·07
	40·67	39·16	39·84	38·56	40·29	39·58	38·96	38·62	40·28	39·79	C = 59° 11′ 39″·57

NOTE.—Stations LIX and LXII appertain to the Great Indus Series.

At LI (Ghundi)—(*Continued*).

Angle between	Circle readings, telescope being set on XLVIII (Dewari) 0° 1′	180° 1′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
L (Kubba)	*h* 43·21	*l* 42·13	*h* 43·12	*h* 45·68	*h* 43·86	*h* 41·53	*h* 43·21	*h* 44·84	*l* 44·74	*h* 43·39	M = 43″·63
and	*h* 42·90	*l* 40·72	*h* 43·61	*h* 44·98	*h* 42·59	*h* 43·21	*h* 44·93	*h* 45·80	*l* 43·35	*h* 45·35	w = 8·88
LIX (Máchka)	*l* 42·50	*h* 44·34	*l* 44·64	*l* 42·62	*l* 40·83	*l* 42·61	*h* 43·02	*h* 44·23	*l* 43·74	*h* 44·47	$\frac{1}{w}$ = 0·11
		l 46·02									
	42·87	43·30	43·79	44·43	42·43	42·45	43·72	44·96	43·94	44·40	C = 64° 38′ 43″·63
LIX (Máchka)	*h* 59·70	*l* 60·55	*h* 62·38	*h* 58·84	*h* 59·00	*h* 63·80	*h* 60·39	*h* 61·38	*l* 59·81	*h* 63·50	M = 60″·61
and	*h* 61·98	*l* 60·31	*h* 59·66	*h* 59·95	*h* 56·97	*h* 61·14	*h* 58·29	*h* 59·82	*l* 61·05	*h* 61·64	w = 6·85
LXII (Dáowála)	*h* 59·36	*h* 59·87	*h* 61·20	*h* 59·56	*h* 60·08	*l* 62·62	*l* 62·00	*h* 61·81	*l* 59·97	*h* 58·57	$\frac{1}{w}$ = 0·15
	l 59·53		*l* 63·51		*l* 65·03			*h* 59·84		*h* 58·63	
	60·14	60·24	61·69	59·45	60·27	62·52	60·23	60·71	60·28	60·59	C = 85° 58′ 0″·62
LXII (Dáowála)	*h* 45·82	*l* 45·91	*h* 42·53	*h* 45·20	*h* 45·46	*h* 42·76	*h* 44·68	*h* 43·25	*l* 45·78	*h* 44·51	M = 44″·71
and	*h* 46·35	*h* 44·11	*h* 42·98	*h* 43·92	*h* 46·01	*h* 43·93	*h* 46·67	*h* 44·67	*l* 45·11	*h* 44·11	w = 7·80
XLIX (Kot Sabzal)	*l* 46·02	*h* 44·90	*h* 43·23	*l* 45·31	*h* 46·17	*l* 43·42	*l* 45·84	*h* 43·24	*l* 44·87	*h* 44·52	$\frac{1}{w}$ = 0·13
	46·06	44·97	42·91	44·81	45·88	43·37	45·73	43·72	45·25	44·38	C = 86° 5′ 44″·71
XLIX (Kot Sabzal)	*h* 51·39	*l* 52·73	*h* 52·76	*h* 50·56	*h* 51·92	*h* 52·21	*h* 52·82	*h* 51·73	*l* 49·44	*h* 51·83	M = 51″·49
and	*h* 51·03	*h* 52·48	*h* 51·35	*h* 51·98	*h* 50·26	*h* 50·95	*h* 54·70	*h* 52·65	*l* 49·31	*h* 51·22	w = 12·72
XLVIII (Dewari)	*l* 51·25	*h* 50·16	*h* 52·37	*l* 50·17	*h* 52·46	*l* 49·54	*h* 51·49	*h* 51·28	*l* 50·95	*h* 50·77	$\frac{1}{w}$ = 0·08
	d 52·27	*d* 52·27		*l* 53·37			*l* 50·02				
	51·49	51·91	52·16	51·52	51·55	50·90	52·26	51·89	49·90	51·27	C = 64° 5′ 51″·49

At LIX (Máchka)

February 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No.* 1.

Angle between	Circle readings telescope being set on LXII (Dáowála) 79° 21′	259° 21′	158° 33′	338° 33′	237° 45′	57° 45′	316° 58′	136° 58′	36° 10′	216° 10′	M = Mean of Groups, w = Relative Weight, C = Concluded Angle
	″	″	″	″	″	″	″	″	″	″	
LXII (Dáowála)	*h* 57·82	*h* 56·34	*h* 55·25	*h* 56·26	*h* 56·61	*h* 56·58	*h* 56·98	*h* 57·56	*h* 54·35	*l* 53·44	M = 55″·28
and	*h* 56·93	*h* 54·47	*h* 52·66	*h* 56·55	*h* 55·50	*h* 53·45	*h* 54·98	*h* 53·38	*l* 55·18	*l* 54·39	w = 7·96
LI (Ghundi)	*h* 56·69	*h* 56·63	*d* 54·61	*h* 54·58	*l* 53·36	*h* 54·32	*h* 55·72	*h* 54·40	*l* 54·20	*h* 54·20	$\frac{1}{w}$ = 0·13
								d 56·28			
	57·15	55·81	54·17	55·80	55·16	54·78	55·89	55·41	54·58	54·01	C = 35° 49′ 55″·28
LI (Ghundi)	*h* 62·43	*h* 59·82	*h* 64·22	*h* 60·64	*h* 61·76	*h* 59·71	*h* 63·28	*h* 61·01	*h* 61·80	*l* 64·65	M = 62″·25
and	*h* 62·62	*h* 60·05	*h* 63·97	*h* 59·56	*l* 63·09	*h* 59·57	*h* 62·40	*h* 64·24	*l* 64·32	*h* 64·80	w = 4·64
L (Kubba)	*h* 61·25	*h* 62·45	*h* 61·48	*h* 63·01	*h* 63·78	*h* 59·52	*h* 61·84	*h* 62·09	*l* 64·70	*h* 61·91	$\frac{1}{w}$ = 0·22
				d 62·31					*d* 64·31		
	62·10	60·77	63·22	61·38	62·88	59·60	62·51	62·45	63·78	63·79	C = 43° 31′ 2″·25

NOTE.—Stations LIX and LXII appertain to the Great Indus Series.

At LXII (Dáowála)

February 1881; *observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms'* 24-*inch Theodolite No.* 1.

Angle between	Circle readings, telescope being set on XLIX (Kot Sabzal) 0° 1′	180° 0′	79° 13′	259° 13′	158° 25′	338° 25′	237° 37′	57° 37′	316° 49′	136° 49′	M = Mean of Groups w = Relative Weight C = Concluded Angle
XLIX (Kot Sabzal) and LI (Ghundi)	″ *h* 48·49 *l* 50·23 *h* 49·11	″ *h* 48·80 *h* 49·69 *h* 50·53	″ *h* 47·58 *h* 47·07 *h* 49·72	″ *h* 49·43 *h* 48·37 *h* 49·38	″ *h* 47·21 *h* 47·64 *l* 47·28	″ *h* 49·65 *h* 50·33 *h* 49·58	″ *h* 47·81 *h* 47·90 *h* 48·00	″ *h* 48·53 *h* 49·36 *h* 47·79	″ *h* 49·08 *h* 48·99 *h* 48·26	″ *h* 47·72 *h* 48·30 *h* 46·96	$M = 48''\cdot63$ $w = 11\cdot90$ $\frac{1}{w} = 0\cdot08$
	49·28	49·67	48·12	49·06	47·38	49·85	47·90	48·56	48·78	47·66	$C = 48^\circ\ 11'\ 48''\cdot63$
LI (Ghundi) and LIX (Máchka)	*h* 5·94 *l* 4·28 *h* 5·64	*h* 3·27 *h* 3·00 *h* 4·32	*h* 5·95 *h* 5·59 *h* 4·61	*h* 5·06 *h* 5·48 *h* 3·80 *h* 3·77	*h* 3·50 *h* 5·59 *l* 4·57	*h* 5·65 *h* 4·19 *h* 3·96	*h* 4·72 *h* 5·43 *h* 5·63	*h* 4·80 *h* 3·50 *h* 4·00	*h* 4·06 *h* 2·41 *h* 3·58	*h* 5·03 *h* 4·57 *h* 3·59	$M = 4''\cdot50$ $w = 15\cdot70$ $\frac{1}{w} = 0\cdot06$
	5·29	3·53	5·38	4·53	4·55	4·60	5·26	4·10	3·35	4·40	$C = 58^\circ\ 12'\ 4''\cdot50$
LI (Ghundi) and R. M.	*l* 21·54 *h* 22·39 *h* 23·28	*h* 22·09 *h* 22·64 *h* 23·21	*h* 24·87 *h* 23·68 *h* 23·84	*h* 21·65 *l* 21·87 *h* 22·18	*h* 23·49 *h* 22·23 *l* 22·33	*h* 22·94 *h* 23·10 *h* 21·94	*h* 22·32 *h* 22·01 *h* 22·28	*h* 22·87 *h* 23·14 *l* 22·83	*h* 23·12 *h* 21·22 *h* 23·82	*h* 23·67 *h* 23·47 *l* 21·87	$M = 22''\cdot73$ $w = 21\cdot30$ $\frac{1}{w} = 0\cdot05$
	22·40	22·65	24·13	21·90	22·68	22·66	22·20	22·95	22·72	23·00	$C = 0^\circ\ 5'\ 22''\cdot73$

NOTES.—Stations LIX (Máchka) and LXII (Dáowála) appertain to the Great Indus Series. R. M. denotes Referring Mark.

February, 1885.

W. H. COLE,
In charge of Computing Office.

EASTERN SIND MERIDIONAL SERIES.

Sums of Squares of Apparent Errors of Single Observations, and of Apparent Errors of Single Zeros.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
LXXV	I & LXXVIII	40	50·79	10	1·97	Barrow's 24-inch No. 2.
„	LXXVIII & V	38	39·61	10	8·66	
LXXVIII	LXXV & I	38	34·80	10	3·23	
„	I & II	33	20·52	10	3·73	
„	II & III	37	26·75	10	8·41	
„	III & IV	38	23·64	10	2·97	
„	IV & V	37	30·27	10	2·21	
„	V & LXXV	38	29·61	10	1·26	
I	II & LXXVIII	30	5·68	10	2·15	
„	LXXVIII & LXXV	31	8·98	10	1·95	
II	III & LXXVIII	34	25·68	10	1·80	
„	LXXVIII & I	31	9·84	10	1·32	
III	IV & LXXVIII	35	25·63	10	4·10	
„	LXXVIII & II	30	8·95	10	3·80	
IV	VI & VII	41	60·08	10	7·18	
„	VII & V	36	20·56	10	2·61	
„	V & LXXVIII	34	22·64	10	3·44	
„	LXXVIII & III	34	15·84	10	3·71	
V	LXXV & LXXVIII	35	24·40	10	2·57	
„	LXXVIII & IV	35	13·28	10	0·67	
„	IV & VII	38	25·26	10	2·98	
„	VII & VIII	40	42·68	10	2·72	

Note.—Stations LXXV and LXXVIII appertain to the Karáchi Longitudinal Series.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
VI	IX & VII	40	43·83	10	5·28	Barrow's 24-inch No. 2.
„	VII & IV	36	18·70	10	2·52	
VII	VI & IX	37	31·37	10	1·78	
„	IX & X	36	21·42	10	3·03	
„	X & VIII	34	25·67	10	3·25	
„	VIII & V	34	11·52	10	3·88	
„	V & IV	36	33·03	10	1·06	
„	IV & VI	36	32·68	10	4·24	
VIII	V & VII	33	17·84	10	4·06	
„	VII & X	36	28·36	10	4·24	
IX	XI & XII	35	24·69	10	5·79	
„	XII & X	39	26·48	10	2·82	
„	X & VII	38	29·51	10	2·15	
„	VII & VI	33	10·14	10	1·13	
X	VIII & VII	31	7·38	10	1·85	
„	VII & IX	36	16·33	10	2·98	
„	IX & XI	35	16·19	10	1·89	
„	XI & XII	33	10·00	10	1·11	
XI	XIII & XIV	34	19·38	10	5·36	
„	XIV & XII	31	12·51	10	2·16	
„	XII & X	32	8·38	10	1·20	
„	X & IX	30	7·70	10	2·38	
XII	X & IX	39	31·07	10	2·41	
„	IX & XI	38	54·56	10	4·02	
„	XI & XIV	39	38·93	10	6·37	
„	XIV & XV	40	44·20	10	6·72	
XIII	XVI & XIV	35	20·91	10	5·02	
„	XIV & XI	31	8·40	10	2·77	
XIV	XVI & XVII	39	33·75	10	3·27	
„	XVII & XV	41	41·74	10	4·03	
„	XV & XII	31	11·65	10	0·82	
„	XII & XI	35	19·42	10	2·17	
„	XI & XIII	32	21·06	10	2·98	
„	XIII & XVI	30	5·65	10	2·70	
„	XVI & R. M.	32	14·58	10	3·53	
XV	XII & XIV	31	6·34	10	2·32	
„	XIV & XVII	33	15·94	10	1·48	
XVI	XVIII & XIX	31	11·97	10	1·82	
„	XIX & XVII	33	8·08	10	4·68	
„	XVII & XIV	32	11·95	10	1·06	
„	XIV & XIII	30	7·57	10	1·75	

Note.—R. M. denotes Referring Mark.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Error of single Observations.	Number of Zeros.	Sum of Squares of Error of single Zeros.	Remarks.
XVII	XV & XIV	31	10·14	10	1·52	Barrow's 24-inch No. 2.
"	XIV & XVI	31	12·65	10	3·95	
"	XVI & XIX	34	16·72	10	1·77	
"	XIX & XX	33	18·99	10	2·67	
XVIII	XXI & XIX	44	60·50	10	10·78	
"	XIX & XVI	35	25·93	10	1·79	
XIX	XXI & XXII	33	20·90	10	0·81	
"	XXII & XX	34	18·49	10	1·54	
"	XX & XVII	38	44·29	10	3·35	
"	XVII & XVI	35	16·36	10	0·91	
"	XVI & XVIII	33	14·41	10	4·13	
"	XVIII & XXI	34	24·54	10	5·13	
XX	XVII & XIX	35	27·81	10	1·50	
"	XIX & XXII	32	15·11	10	2·91	
XXI	XXIII & XXIV	39	41·74	10	5·14	
"	XXIV & XXII	35	33·28	10	1·43	
"	XXII & XIX	34	16·02	10	1·04	
"	XIX & XVIII	33	8·04	10	1·53	
XXII	XX & XIX	32	13·62	10	1·10	
"	XIX & XXI	39	43·43	10	1·21	
"	XXI & XXIII	32	12·02	10	3·27	
"	XXIII & XXIV	34	25·89	10	2·27	
XXIII	XXV & XXVI	34	15·11	10	7·51	
"	XXVI & XXIV	34	20·54	10	6·65	
"	XXIV & XXII	33	16·47	10	1·96	
"	XXII & XXI	30	5·09	10	0·23	
XXIV	XXII & XXI	33	14·00	10	1·73	
"	XXI & XXIII	34	19·12	10	1·89	
"	XXIII & XXVI	30	3·87	10	1·83	
"	XXVI & XXIX	35	32·55	10	3·00	
XXV	XXVII & XXVIII	35	16·81	10	1·68	
"	XXVIII & XXVI	35	21·09	10	4·11	
"	XXVI & XXIII	35	24·11	10	2·20	
XXVI	XXV & XXVIII	36	26·12	10	8·19	
"	XXVIII & XXIX	35	27·43	10	2·29	
"	XXIX & XXIV	32	11·64	10	5·09	
"	XXIV & XXIII	31	5·03	10	0·99	
"	XXIII & XXV	33	19·37	10	2·36	
XXVII	XXX & XXVIII	37	28·33	10	2·94	
"	XXVIII & XXV	43	54·43	10	6·71	
XXVIII	XXIX & XXVI	31	7·62	10	1·26	

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
XXVIII	XXVI & XXV	32	16·32	10	4·75	Barrow's 24-inch No. 2.
"	XXV & XXVII	34	22·68	10	5·15	
"	XXVII & XXX	39	39·60	10	3·02	
"	XXX & XXXI	41	30·77	10	4·12	
"	XXXI & XXIX	37	29·40	10	4·84	
XXIX	XXIV & XXVI	30	8·46	10	6·49	
"	XXVI & XXVIII	32	14·42	10	5·11	
"	XXVIII & XXXI	32	14·68	10	1·83	
XXX	XXXII & XXXIII	38	32·79	10	7·15	
"	XXXIII & XXXI	40	43·32	10	4·83	
"	XXXI & XXVIII	33	9·38	10	3·79	
"	XXVIII & XXVII	32	14·59	10	4·34	
XXXI	XXIX & XXVIII	42	42·18	10	7·81	
"	XXVIII & XXX	36	19·67	10	2·62	
"	XXX & XXXIII	34	12·29	10	2·06	
"	XXXIII & XXXIV	40	40·60	10	6·64	
"	XXXIV & R. M.	33	21·73	10	2·93	
XXXII	XXXV & XXXVI	32	14·24	10	3·51	
"	XXXVI & XXXIII	34	19·91	10	2·26	
"	XXXIII & XXX	39	43·93	10	2·26	
XXXIII	XXXVI & XXXIV	36	24·44	10	6·98	
"	XXXIV & XXXI	36	29·66	10	1·32	
"	XXXI & XXX	37	22·16	10	1·58	
"	XXX & XXXII	38	49·36	10	1·56	
"	XXXII & XXXVI	41	46·43	10	8·08	
XXXIV	XXXI & XXXIII	36	31·57	10	7·99	
"	XXXIII & XXXVI	34	15·36	10	4·80	
"	XXXVI & XXXVII	36	24·29	10	1·48	
XXXV	XXXIX & XL	30	2·76	10	4·78	Troughton and Simms' 24-inch No. 1.
"	XL & XXXVIII	30	10·63	10	2·69	Barrow's 24-inch No. 2.
"	XXXVIII & XXXVI	31	6·16	10	1·70	
"	XXXVI & XXXII	30	3·40	10	2·69	
XXXVI	XXXIII & XXXII	35	18·49	10	1·37	
"	XXXII & XXXV	37	23·09	10	3·83	
"	XXXV & XXXVIII	36	24·85	10	3·84	
"	XXXVIII & XXXVII	38	35·67	10	3·56	
"	XXXVII & XXXIV	34	22·35	10	1·02	
"	XXXIV & XXXIII	33	12·75	10	0·79	
XXXVII	XXXIV & XXXVI	35	28·33	10	4·67	
"	XXXVI & XXXVIII	32	6·59	10	3·55	
XXXVIII	XXXVII & XXXVI	34	21·35	10	2·93	

NOTE.—R. M. denotes Referring Mark.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
XXXVIII	XXXVI & XXXV	31	9·50	10	2·14	Barrow's 24-inch No. 2.
"	XXXV & XL	36	21·47	10	1·86	
"	XXXV & XL	31	15·85	10	7·58	Troughton and Simms' 24-inch No. 1.
"	XL & XLIII	30	12·58	10	4·81	
XXXIX	XLI & XL	30	8·73	10	3·15	
"	XL & XXXV	30	5·22	10	3·45	
XL	XLII & XLIII	30	12·10	10	3·18	
"	XLIII & XXXVIII	30	15·20	10	3·62	
"	XXXVIII & XXXV	30	13·99	10	4·50	
"	XXXV & XXXIX	30	14·13	10	7·22	
"	XXXIX & XLI	30	8·77	10	3·33	
"	XLI & XLII	30	5·85	10	9·46	
XLI	XLII & XL	30	8·54	10	1·23	
"	XL & XXXIX	30	12·36	10	4·41	
XLII	XLIV & XLV	30	11·61	10	5·90	
"	XLV & XLIII	30	13·50	10	6·74	
"	XLIII & XL	31	14·64	10	5·24	
"	XL & XLI	30	19·12	10	6·99	
XLIII	XXXVIII & XL	30	5·47	10	2·83	
"	XL & XLII	30	8·94	10	2·37	
"	XLII & XLIV	31	6·67	10	1·62	
"	XLIV & XLV	30	7·54	10	2·86	
XLIV	XLVIII & R. M.	31	15·11	10	6·64	
"	XLVIII & XLVI	32	22·26	10	3·33	
"	XLVI & XLV	30	12·56	10	7·53	
"	XLV & XLIII	31	15·01	10	5·43	
"	XLIII & XLII	31	19·31	10	6·50	
XLV	XLIII & XLII	31	11·02	10	9·95	
"	XLII & XLIV	31	10·32	10	10·97	
"	XLIV & XLVI	31	7·01	10	2·02	
"	XLVI & XLVII	30	9·40	10	4·31	
XLVI	XLV & XLIV	32	41·09	10	7·92	
"	XLIV & XLVIII	33	34·19	10	7·68	
"	XLVIII & XLIX	32	12·49	10	2·04	
"	XLIX & XLVII	31	35·89	10	14·33	
"	XLVII & XLV	31	45·27	10	6·30	
XLVII	XLV & XLVI	30	16·72	10	8·10	
"	XLVI & XLIX	30	52·23	10	12·82	
XLVIII	L & LI	33	24·82	10	8·24	
"	LI & XLIX	34	42·72	10	8·55	
"	XLIX & XLVI	35	32·56	10	11·17	

Note.—R. M. denotes Referring Mark.

Station of Observation.	Observed Angle.	Number of Observations.	Sum of Squares of Errors of single Observations.	Number of Zeros.	Sum of Squares of Errors of single Zeros.	Remarks.
XLVIII	XLVI & XLIV	35	75·18	10	11·72	Troughton and Simms' 24-inch No. 1.
XLIX	XLVII & XLVI	30	9·93	10	6·19	
„	XLVI & XLVIII	31	13·77	10	16·45	
„	XLVIII & LI	31	34·09	10	9·72	
„	LI & LXII	30	12·89	10	6·39	
L	LIX & LI	31	28·05	10	3·42	
„	LI & XLVIII	32	51·27	10	13·73	
LI	XLVIII & L	33	21·88	10	4·81	
„	L & LIX	31	35·61	10	6·66	
„	LIX & LXII	35	80·86	10	6·91	
„	LXII & XLIX	30	8·04	10	10·73	
„	XLIX & XLVIII	34	33·77	10	4·30	
LIX	LXII & LI	31	33·66	10	8·03	
„	LI & L	32	36·51	10	16·15	
LXII	XLIX & LI	30	10·72	10	6·48	
„	LI & LIX	31	13·47	10	4·41	
„	LI & R. M.	30	10·57	10	3·17	

NOTES.—Stations LIX and LXII appertain to the Great Indus Series. R. M. denotes Referring Mark.

From the preceding data of the sums of squares of apparent errors, in the measurement of each angle, we may ascertain the *e.m.s.* (error of mean square) *of observation* of a single measure of an angle, and the *e.m.s. of graduation and observation*, of the mean of the measures on a single zero, for each group of angles, measured with the same instrument, by the same observer, and under similar circumstances.

The instruments employed were Barrow's 24-inch Theodolite No. 2 and Troughton and Simms' 24-inch No. 1, both having 5 microscopes to read the azimuthal circle; observations were taken on 5 pairs of zeros (*face right* and *face left*) giving circle readings at 7° 12′ apart.

The *e.m.s. of observation* of a single measure of an angle $= \sqrt{\dfrac{\text{Sum of squares of apparent errors of observations.}}{\text{No. of observations} - \text{No. of angle} \times \text{No. of changes of zero.}}}$

The *e.m.s. of graduation and observation* of the mean of the measures on a single zero $= \sqrt{\dfrac{\text{Sum of squares of apparent errors of zero.}}{\text{No. of angles} \times (\text{No. of changes of zero} - 1).}}$

Group	Instrument and Observer	Position of stations	Interval between microscope readings of circle	Number of: Measures on each zero (average)	Angles	Single measures	Single zeros	*e. m. s.* of observation of a single measure	*e. m. s.* of graduation and observation of a single zero
			° ′						
I	Barrow's 24-inch Theodolite No. 2; Capt. M. W. Rogers, R.E.	Hills	7 12	3·48	146	5082	1460	$\left\{\dfrac{3294 \cdot 84}{5082-1460}\right\}^{\frac{1}{2}} = \pm\ 0''\cdot 954$	$\left\{\dfrac{475 \cdot 83}{1460-146}\right\}^{\frac{1}{2}} = \pm\ 0''\cdot 602$
II	Troughton and Simms' 24-inch Theodolite No. 1; Lieut.-Col. B. R. Branfill.	„	7 12	3·02	27	816	270	$\left\{\dfrac{330 \cdot 27}{816-270}\right\}^{\frac{1}{2}} = \pm\ 0\ \cdot 778$	$\left\{\dfrac{143 \cdot 44}{270-27}\right\}^{\frac{1}{2}} = \pm\ 0\ \cdot 768$
III	Ditto.	Plains	7 12	3·18	30	953	300	$\left\{\dfrac{863 \cdot 55}{953-300}\right\}^{\frac{1}{2}} = \pm\ 1\ \cdot 150$	$\left\{\dfrac{234 \cdot 93}{300-30}\right\}^{\frac{1}{2}} = \pm\ 0\ \cdot 933$

February, 1885.

W. H. COLE,
In charge of Computing Office.

EASTERN SIND MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. REDUCTION OF FIGURES.

Figure No. 1.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	68	39	56·66	·04
2	60	25	37·49	·13
3	50	54	27·65	·05
4	66	39	2·43	·05
5	49	53	30·63	·02
6	63	27	28·30	·06
7	38	25	36·68	·05
8	67	53	28·01	·06
9	73	40	56·00	·07
10	60	1	8·78	·11
11	35	12	13·27	·05
12	84	46	38·03	·04
13	81	16	52·98	·06
14	59	29	14·07	·03
15	39	13	53·43	·03
16	44	57	21·83	·06
17	88	14	51·09	·03
18	46	47	48·19	·06

Equations to be satisfied

Equations to be satisfied	Factor
$x_1 + x_2 + x_3 \;\ldots\;\ldots\;\ldots = e_1 = -0·267,$	λ_1
$x_4 + x_5 + x_6 \;\ldots\;\ldots\;\ldots = e_2 = -0·591,$	λ_2
$x_7 + x_8 + x_9 \;\ldots\;\ldots\;\ldots = e_3 = -0·400,$	λ_3
$x_{10} + x_{11} + x_{12} \;\ldots\;\ldots\;\ldots = e_4 = -0·769,$	λ_4
$x_{13} + x_{14} + x_{15} \;\ldots\;\ldots\;\ldots = e_5 = -0·284,$	λ_5
$x_{16} + x_{17} + x_{18} \;\ldots\;\ldots\;\ldots = e_6 = +0·090,$	λ_6
$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16} = e_7 = -0·64,$	λ_7
$\left.\begin{array}{l} 17x_3 - 12x_2 + 11x_6 - 18x_5 + 6x_9 - 9x_8 \\ + 2x_{12} - 30x_{11} + 26x_{15} - 12x_{14} + 20x_{18} - 0x_{17} \end{array}\right\} = e_8 = -88·0,$	λ_8

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	− 0·267	+0·22	...	...	...	...	...	+0·04	− 0·71
2	− 0·591		+0·13	...	...	...	...	+0·05	+ 0·30
3	− 0·400			+0·18	...	...	...	+0·05	− 0·12
4	− 0·769				+0·20	...	...	+0·11	− 1·42
5	− 0·284					+0·12	...	+0·06	+ 0·42
6	+ 0·090				*		+0·15	+0·06	+ 1·20
7	− 0·64							+0·37	...
8	−88·0								+148·05

Values of the Factors

$\lambda_1 = -3·9634$

$\lambda_2 = -3·4885$

$\lambda_3 = -3·2144$

$\lambda_4 = -10·1593$

$\lambda_5 = -0·6154$

$\lambda_6 = +5·9143$

$\lambda_7 = +1·7656$

$\lambda_8 = -0·7526$

Angular errors in seconds

$x_1 = -·088$	$x_7 = -·072$	$x_{13} = +·069$
$x_2 = +·659$	$x_8 = +·213$	$x_{14} = +·252$
$x_3 = -·838$	$x_9 = -·541$	$x_{15} = -·605$
$x_4 = -·086$	$x_{10} = -·923$	$x_{16} = +·461$
$x_5 = +·201$	$x_{11} = +·621$	$x_{17} = +·177$
$x_6 = -·706$	$x_{12} = -·467$	$x_{18} = -·548$

$[wx^2] = 78·03$

* In the tables of the equations between the factors the co-efficients of the terms below the diagonal are omitted for convenience, the co-efficient of the *pth* term in the *qth* line being always the same as the co-efficient of the *qth* term in the *pth* line.

Figure No. 2.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	73	39	41·75	·04
2	54	30	56·98	·05
3	51	49	22·12	·05
4	68	56	56·45	·05
5	45	29	6·20	·06
6	65	33	58·00	·06
7	48	43	50·52	·06
8	71	47	46·93	·07
9	59	28	22·95	·03
10	58	5	34·22	·05
11	64	39	21·44	·05
12	57	15	5·31	·05
13	48	34	37·32	·04
14	55	23	49·56	·02
15	76	1	33·83	·09
16	61	59	19·84	·07
17	68	36	34·62	·04
18	49	24	6·60	·12

Equations to be satisfied

Equations							Factor
x_1	$+x_2$	$+x_3$	...	...	...	$= e_1 = -0·897,$	λ_1
x_4	$+x_5$	$+x_6$	...	...	...	$= e_2 = -0·728,$	λ_2
x_7	$+x_8$	$+x_9$	...	...	...	$= e_3 = -0·559,$	λ_3
x_{10}	$+x_{11}$	$+x_{12}$	...	...	...	$= e_4 = -0·313,$	λ_4
x_{13}	$+x_{14}$	$+x_{15}$	...	...	...	$= e_5 = -0·323,$	λ_5
x_{16}	$+x_{17}$	$+x_{18}$	...	...	...	$= e_6 = -0·205,$	λ_6
x_1	$+x_4$	$+x_7$	$+x_{10}$	$+x_{13}$	$+x_{16}$	$= e_7 = +0·10,$	λ_7
$17x_3$ $+13x_{12}$	$-15x_2$ $-10x_{11}$	$+9x_6$ $+5x_{15}$	$-21x_5$ $-15x_{14}$	$+12x_9$ $+18x_{18}$	$-7x_8$ $-8x_{17}$	$= e_8 = +7·9,$	λ_8

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	−0·897	+0·14	...	...	...	...	...	+0·04	+ 0·10
2	−0·728		+0·17	...	...	...	...	+0·05	− 0·72
3	−0·559			+0·16	...	...	...	+0·06	− 0·13
4	−0·313				+0·15	...	...	+0·05	+ 0·15
5	−0·323					+0·15	...	+0·04	+ 0·15
6	−0·205			*			+0·23	+0·07	+ 1·84
7	+0·10							+0·31	...
8	+7·9								+126·01

Values of the Factors

$\lambda_1 = -7·9057$
$\lambda_2 = -5·3922$
$\lambda_3 = -5·3082$
$\lambda_4 = -3·8495$
$\lambda_5 = -3·5810$
$\lambda_6 = -3·1177$
$\lambda_7 = +5·0272$
$\lambda_8 = +0·0871$

Angular errors in seconds

$x_1 = -·115$	$x_7 = -·017$	$x_{13} = +·058$
$x_2 = -·461$	$x_8 = -·414$	$x_{14} = -·098$
$x_3 = -·321$	$x_9 = -·128$	$x_{15} = -·283$
$x_4 = -·018$	$x_{10} = +·059$	$x_{16} = +·133$
$x_5 = -·433$	$x_{11} = -·236$	$x_{17} = -·152$
$x_6 = -·277$	$x_{12} = -·136$	$x_{18} = -·186$

$[wx^2] = 18·18$

Figure No. 8.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	54	21	17·01	·05
2	41	19	30·08	·02
3	41	12	40·19	·04
4	43	6	33·84	·05
5	49	41	17·86	·09
6	45	59	29·37	·03
7	36	15	22·25	·02
8	48	3	52·04	·09

Equations to be satisfied — **Factor**

$$x_1 + x_2 + x_3 + x_4 = e_1 = -0{\cdot}075, \qquad \lambda_1$$
$$x_2 + x_4 + x_5 + x_6 = e_2 = -0{\cdot}051, \qquad \lambda_2$$
$$x_5 + x_6 + x_7 + x_8 = e_3 = +0{\cdot}299, \qquad \lambda_3$$
$$\left.\begin{array}{l} -16x_1 + 3x_2 - 21x_3 \\ +17x_6 - 3x_7 + 19x_8 \end{array}\right\} = e_4 = +8{\cdot}8, \qquad \lambda_4$$

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4
1	− 0·075	+0·16	+0·09	...	− 1·58
2	− 0·051		+0·21	+0·12	− 0·33
3	+ 0·299		*	+0·23	+ 2·16
4	+ 8·8				+ 71·96

Values of the Factors

$\lambda_1 = +1{\cdot}3492$

$\lambda_2 = -0{\cdot}9344$

$\lambda_3 = +0{\cdot}5584$

$\lambda_4 = +0.1309$

Angular errors in seconds

$x_1 = -{\cdot}037$	$x_5 = -{\cdot}034$
$x_2 = +{\cdot}035$	$x_6 = +{\cdot}056$
$x_3 = -{\cdot}093$	$x_7 = +{\cdot}003$
$x_4 = +{\cdot}020$	$x_8 = +{\cdot}274$

$[wx^2] = 1{\cdot}27$

Figure No. 4.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	51	47	32·12	·04
2	60	41	0·90	·04
3	67	31	28·32	·10
4	62	44	34·36	·02
5	57	3	26·65	·11
6	60	12	0·22	·03
7	64	1	50·19	·07
8	55	49	56·45	·03
9	60	8	14·19	·03
10	56	8	31·55	·06
11	57	21	1·82	·06
12	66	30	27·72	·02
13	58	28	38·16	·04
14	60	19	55·97	·03
15	61	11	26·56	·07
16	66	48	52·68	·05
17	66	32	20·74	·04
18	46	38	47·04	·08

Equations to be satisfied

Equations		Factor
$x_1 + x_2 + x_3$	$= e_1 = +0{\cdot}045,$	λ_1
$x_4 + x_5 + x_6$	$= e_2 = -0{\cdot}107,$	λ_2
$x_7 + x_8 + x_9$	$= e_3 = -0{\cdot}418,$	λ_3
$x_{10} + x_{11} + x_{12}$	$= e_4 = +0{\cdot}080,$	λ_4
$x_{13} + x_{14} + x_{15}$	$= e_5 = -0{\cdot}253,$	λ_5
$x_{16} + x_{17} + x_{18}$	$= e_6 = -0{\cdot}813,$	λ_6
$x_1 + x_4 + x_7 + x_{10} + x_{13} + x_{16}$	$= e_7 = -0{\cdot}94,$	λ_7
$\left.\begin{matrix} 8x_3 - 11x_2 + 12x_6 - 13x_5 + 12x_9 - 14x_8 \\ +\ 9x_{12} - 14x_{11} + 11x_{15} - 12x_{14} + 20x_{18} - 10x_{17} \end{matrix}\right\}$	$= e_8 = +21{\cdot}9,$	λ_8

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	+ 0·045	+0·18	...	...	...	...	...	+0·04	+ 0·36
2	− 0·107		+0·16	...	...	...	...	+0·02	− 1·07
3	− 0·418			+0·13	...	...	...	+0·07	− 0·06
4	+ 0·080				+0·14	...	...	+0·06	− 0·66
5	− 0·253					+0·14	...	+0·04	+ 0·41
6	− 0·813				*		+0·17	+0·05	+ 1·20
7	− 0·94							+0·28	...
8	+21·9								+106·52

Values of the Factors

$\lambda_1 = +\ 0{\cdot}1051$
$\lambda_2 = +\ 1{\cdot}7638$
$\lambda_3 = -\ 1{\cdot}8585$
$\lambda_4 = +\ 3{\cdot}0503$
$\lambda_5 = -\ 2{\cdot}1084$
$\lambda_6 = -\ 6{\cdot}3938$
$\lambda_7 = -\ 2{\cdot}2441$
$\lambda_8 = +\ 0{\cdot}3218$

Angular errors in seconds

$x_1 = -\ {\cdot}086$	$x_7 = -\ {\cdot}287$	$x_{13} = -\ {\cdot}174$
$x_2 = -\ {\cdot}137$	$x_8 = -\ {\cdot}191$	$x_{14} = -\ {\cdot}179$
$x_3 = +\ {\cdot}268$	$x_9 = +\ {\cdot}060$	$x_{15} = +\ {\cdot}100$
$x_4 = -\ {\cdot}009$	$x_{10} = +\ {\cdot}048$	$x_{16} = -\ {\cdot}432$
$x_5 = -\ {\cdot}266$	$x_{11} = -\ {\cdot}087$	$x_{17} = -\ {\cdot}384$
$x_6 = +\ {\cdot}168$	$x_{12} = +\ {\cdot}119$	$x_{18} = +\ {\cdot}003$

$[wx^2] = 15{\cdot}73$

Figure No. 5.

Observed Angles

No.	Value			Reciprocal Weight
	°	′	″	
1	47	16	16·06	·02
2	77	11	25·08	·06
3	55	32	20·25	·04
4	51	36	24·18	·07
5	41	55	1·16	·05
6	86	28	36·21	·04
7	69	3	7·07	·03
8	56	58	45·29	·05
9	53	58	7·68	·03
10	57	5	2·84	·03
11	58	6	12·03	·04
12	64	48	46·30	·03
13	72	36	6·18	·08
14	52	40	28·36	·02
15	54	43	26·53	·15
16	62	23	3·23	·06
17	72	4	57·12	·04
18	45	32	0·32	·03

Equations to be satisfied

Equations to be satisfied							Factor
x_1	$+x_2$	$+x_3$	...	...	...	$= e_1 = +0·202,$	λ_1
x_4	$+x_5$	$+x_6$	...	...	...	$= e_2 = +0·546,$	λ_2
x_7	$+x_8$	$+x_9$	...	...	...	$= e_3 = -0·790,$	λ_3
x_{10}	$+x_{11}$	$+x_{12}$	...	...	...	$= e_4 = +0·444,$	λ_4
x_{13}	$+x_{14}$	$+x_{15}$	...	...	...	$= e_5 = +0·316,$	λ_5
x_{16}	$+x_{17}$	$+x_{18}$	...	...	...	$= e_6 = -0·239,$	λ_6
x_1	$+x_4$	$+x_7$	$+x_{10}$	$+x_{13}$	$+x_{16}$	$= e_7 = -0·44,$	λ_7
$15x_3$	$-5x_2$	$+x_6$	$-24x_5$	$+15x_9$	$-14x_8$	$= e_8 = +38·0,$	λ_8
$+10x_{12}$	$-13x_{11}$	$+15x_{15}$	$-16x_{14}$	$+21x_{18}$	$-7x_{17}$		

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	+ 0·202	+0·12	...	...	...	...	...	+0·02	+ 0·30
2	+ 0·546		+0·16	...	...	...	...	+0·07	− 1·16
3	− 0·790			+0·11	...	...	...	+0·03	− 0·25
4	+ 0·444				+0·10	...	...	+0·03	− 0·22
5	+ 0·316					+0·25	...	+0·08	+ 1·93
6	− 0·239				*		+0·13	+0·06	+ 0·35
7	− 0·44							+0·29	...
8	+38·0								+119·71

Values of the Factors

$\lambda_1 = +1·1502$

$\lambda_2 = +7·6600$

$\lambda_3 = -5·4526$

$\lambda_4 = +6·2195$

$\lambda_5 = -0·9534$

$\lambda_6 = -1·5852$

$\lambda_7 = -2·9337$

$\lambda_8 = +0·4088$

Angular errors in seconds

$x_1 = -·036$	$x_7 = -·252$	$x_{13} = -·311$
$x_2 = -·053$	$x_8 = -·558$	$x_{14} = -·150$
$x_3 = +·291$	$x_9 = +·020$	$x_{15} = +·777$
$x_4 = +·331$	$x_{10} = +·099$	$x_{16} = -·271$
$x_5 = -·108$	$x_{11} = +·036$	$x_{17} = -·178$
$x_6 = +·323$	$x_{12} = +·309$	$x_{18} = +·210$

$[wx^2] = 28·39$

Figure No. 6.

Observed Angles

No.	°	′	″	Reciprocal Weight
1	37	39	28·64	·03
2	54	26	24·25	·05
3	42	21	28·16	·05
4	45	32	39·93	·04
5	53	51	39·98	·09
6	38	14	12·30	·01
7	46	6	10·37	·04
8	41	47	58·59	·04

Equations to be satisfied — Factor

$$x_1 + x_2 + x_3 + x_4 = e_1 = +0{\cdot}060, \qquad \lambda_1$$

$$x_3 + x_4 + x_5 + x_6 = e_2 = -0{\cdot}481, \qquad \lambda_2$$

$$x_5 + x_6 + x_7 + x_8 = e_3 = +0{\cdot}108, \qquad \lambda_3$$

$$\left.\begin{matrix} -27x_1 & -3x_2 & -27x_3 \\ +25x_6 & -2x_7 & +24x_8 \end{matrix}\right\} = e_4 = -14{\cdot}3, \qquad \lambda_4$$

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4
1	+ 0·060	+0·17	+0·09	...	− 2·31
2	− 0·481		+0·19	+0·10	− 1·10
3	+ 0·108		*	+0·18	+ 1·13
4	−14·3				+ 88·22

Values of the Factors

$\lambda_1 = -0{\cdot}0841$

$\lambda_2 = -8{\cdot}7666$

$\lambda_3 = +7{\cdot}8154$

$\lambda_4 = -0{\cdot}3737$

Angular errors in seconds

$x_1 = +{\cdot}300$	$x_5 = -{\cdot}086$
$x_2 = +{\cdot}052$	$x_6 = -{\cdot}103$
$x_3 = +{\cdot}062$	$x_7 = +{\cdot}343$
$x_4 = -{\cdot}354$	$x_8 = -{\cdot}046$

$[wx^2] = 10{\cdot}40$

Figure No. 7.

Observed Angles

No.	°	′	″	Reciprocal Weight	No.	°	′	″	Reciprocal Weight	No.	°	′	″	Reciprocal Weight
1	76	27	7·44	·02	10	66	17	29·54	·11	19	55	22	30·20	·07
2	53	5	46·36	·09	11	63	33	27·48	·07	20	56	34	38·80	·05
3	50	27	7·10	·02	12	50	9	3·74	·06	21	68	2	51·68	·05
4	81	47	19·46	·07	13	70	28	51·83	·04	22	68	17	21·80	·06
5	50	52	6·74	·06	14	49	49	14·54	·05	23	60	32	33·34	·06
6	47	20	34·95	·08	15	59	41	54·06	·10	24	51	10	6·30	·06
7	64	59	12·06	·05	16	56	11	39·26	·08	25	53	38	48·78	·08
8	52	4	36·26	·07	17	70	11	35·95	·04	26	56	10	39·23	·11
9	62	56	12·18	·02	18	53	36	45·02	·11	27	70	10	32·52	·03

Equations to be satisfied

Equation		Factor
$x_1 + x_2 + x_3$	$= e_1 = +\ 0{\cdot}025,$	λ_1
$x_4 + x_5 + x_6$	$= e_2 = +\ 0{\cdot}176,$	λ_2
$x_7 + x_8 + x_9$	$= e_3 = -\ 0{\cdot}333,$	λ_3
$x_{10} + x_{11} + x_{12}$	$= e_4 = -\ 0{\cdot}110,$	λ_4
$x_{13} + x_{14} + x_{15}$	$= e_5 = -\ 0{\cdot}494,$	λ_5
$x_{16} + x_{17} + x_{18}$	$= e_6 = -\ 0{\cdot}814,$	λ_6
$x_{19} + x_{20} + x_{21}$	$= e_7 = -\ 0{\cdot}407,$	λ_7
$x_{22} + x_{23} + x_{24}$	$= e_8 = +\ 0{\cdot}205,$	λ_8
$x_{25} + x_{26} + x_{27}$	$= e_9 = -\ 0{\cdot}527,$	λ_9
$x_1 + x_4 + x_7 + x_{10} + x_{13}$	$= e_{10} = +\ 0{\cdot}33,$	λ_{10}
$x_9 + x_{11} + x_{16} + x_{19} + x_{22} + x_{25}$	$= e_{11} = -\ 0{\cdot}30,$	λ_{11}
$17x_3 - 16x_2 + 19x_6 - 17x_5 + 10x_9 - 16x_8 + 18x_{12} - 11x_{11} + 12x_{15} - 18x_{14}$	$= e_{12} = -\ 15{\cdot}4,$	λ_{12}
$\left.\begin{array}{l} 16x_8 - 10x_7 + 15x_{18} - 8x_{17} + 8x_{21} - 14x_{20} \\ +17x_{24} - 12x_{23} + 8x_{27} - 14x_{26} + 9x_{10} - 18x_{12} \end{array}\right\}$	$= e_{13} = +\ 49{\cdot}8,$	λ_{13}

Figure No. 7—(Continued).

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8	λ_9	λ_{10}	λ_{11}	λ_{12}	λ_{13}
1	+ 0·025	+0·13	...	...	...	...	...	...	...	...	+0·02	...	− 1·10	...
2	+ 0·176		+0·21	...	...	...	...	...	...	...	+0·07	...	+ 0·50	...
3	− 0·333			+0·14	...	...	...	...	...	...	+0·05	+0·02	− 0·92	+ 0·62
4	− 0·110				+0·24	...	...	...	...	...	+0·11	+0·07	+ 0·31	− 0·09
5	− 0·494					+0·19	...	...	...	...	+0·04	...	+ 0·30	...
6	− 0·814						+0·23	...	...	...	...	+0·08	...	+ 1·33
7	− 0·407							+0·17	...	...	...	+0·07	...	− 0·30
8	+ 0·205					*			+0·18	...	...	+0·06	...	+ 0·30
9	− 0·527									+0·22	...	+0·08	...	− 1·30
10	+ 0·33										+0·29	...	...	+ 0·49
11	− 0·30											+0·38	− 0·57	...
12	−15·4												+153·47	− 37·36
13	+49·8													+141·04

Values of the Factors

$\lambda_1 = -\ 0·3648$

$\lambda_2 = +\ 0·0145$

$\lambda_3 = -\ 5·5220$

$\lambda_4 = -\ 2·0043$

$\lambda_5 = -\ 3·1188$

$\lambda_6 = -\ 6·5650$

$\lambda_7 = -\ 2·4152$

$\lambda_8 = -\ 0·1583$

$\lambda_9 = -\ 0·6148$

$\lambda_{10} = +\ 2·6031$

$\lambda_{11} = +\ 1·8237$

$\lambda_{12} = -\ 0·0185$

$\lambda_{13} = +\ 0·4136$

Angular errors in seconds

$x_1 = +\ ·045$	$x_{10} = +\ ·475$	$x_{19} = -\ ·042$
$x_2 = -\ ·006$	$x_{11} = +\ ·002$	$x_{20} = -\ ·410$
$x_3 = -\ ·014$	$x_{12} = -\ ·587$	$x_{21} = +\ ·045$
$x_4 = +\ ·183$	$x_{13} = -\ ·021$	$x_{22} = +\ ·100$
$x_5 = +\ ·020$	$x_{14} = -\ ·139$	$x_{23} = -\ ·307$
$x_6 = -\ ·027$	$x_{15} = -\ ·334$	$x_{24} = +\ ·412$
$x_7 = -\ ·353$	$x_{16} = -\ ·379$	$x_{25} = +\ ·097$
$x_8 = +\ ·098$	$x_{17} = -\ ·395$	$x_{26} = -\ ·705$
$x_9 = -\ ·078$	$x_{18} = -\ ·040$	$x_{27} = +\ ·081$

$[wx^2] = 31·41$

Figure No. 8.

Observed Angles

No.	Value	Reciprocal Weight	No.	Value	Reciprocal Weight	No.	Value	Reciprocal Weight
	° ′ ″			° ′ ″			° ′ ″	
1	59 5 2·95	·04	10	85 7 36·24	·12	19	73 21 3·75	·07
2	67 44 37·77	·08	11	40 38 20·75	·03	20	59 51 58·97	·05
3	53 10 20·32	·03	12	54 14 3·13	·04	21	46 46 57·44	·05
4	84 38 58·20	·04	13	56 58 7·21	·05	22	80 54 59·06	·06
5	43 6 11·57	·10	14	73 26 41·63	·06	23	54 33 7·28	·03
6	52 14 51·86	·12	15	49 35 12·23	·10	24	44 31 54·83	·03
7	74 10 14·85	·10	16	54 13 14·11	·03	25	57 35 24·38	·06
8	52 32 46·90	.07	17	38 53 59·85	·04	26	69 15 40·31	·03
9	53 16 58·94	·02	18	86 52 46·62	·08	27	53 8 56·68	·05

Equations to be satisfied		Factor
$x_1 + x_2 + x_3$	$= e_1 = + 0{\cdot}042,$	λ_1
$x_4 + x_5 + x_6$	$= e_2 = + 0{\cdot}473,$	λ_2
$x_7 + x_8 + x_9$	$= e_3 = - 0{\cdot}267,$	λ_3
$x_{10} + x_{11} + x_{12}$	$= e_4 = - 0{\cdot}668,$	λ_4
$x_{13} + x_{14} + x_{15}$	$= e_5 = + 0{\cdot}400,$	λ_5
$x_{16} + x_{17} + x_{18}$	$= e_6 = - 0{\cdot}158,$	λ_6
$x_{19} + x_{20} + x_{21}$	$= e_7 = - 0{\cdot}491,$	λ_7
$x_{22} + x_{23} + x_{24}$	$= e_8 = + 0{\cdot}245,$	λ_8
$x_{25} + x_{26} + x_{27}$	$= e_9 = + 0{\cdot}297,$	λ_9
$x_1 + x_4 + x_7 + x_{10} + x_{13}$	$= e_{10} = - 0{\cdot}55,$	λ_{10}
$x_9 + x_{11} + x_{16} + x_{19} + x_{22} + x_{25}$	$= e_{11} = + 0{\cdot}99,$	λ_{11}
$16x_3 - 9x_2 + 17x_6 - 22x_5 + 16x_9 - 16x_8 + 15x_{12} - 25x_{11} + 18x_{15} - 7x_{14}$	$= e_{12} = + 55{\cdot}6,$	λ_{12}
$\left.\begin{matrix} 16x_8 - 6x_7 + x_{18} - 26x_{17} + 20x_{21} - 12x_{20} \\ +22x_{24} - 15x_{23} + 15x_{27} - 8x_{26} + 2x_{10} - 15x_{12} \end{matrix}\right\}$	$= e_{13} = + 53{\cdot}4,$	λ_{13}

Figure No. 8—(Continued).

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8	λ_9	λ_{10}	λ_{11}	λ_{12}	λ_{13}
1	+ 0·042	+0·15	...	...	...	...	...	...	...	...	+0·04	...	− 0·24	...
2	+ 0·473		+0·26	...	...	...	...	...	...	...	+0·04	...	− 0·16	...
3	− 0·267			+0·19	...	...	...	...	...	...	+0·10	+0·02	− 0·80	+ 0·52
4	− 0·668				+0·19	...	...	...	...	...	+0·12	+0·03	− 0·15	− 0·36
5	+ 0·400					+0·21	...	...	...	...	+0·05	...	+ 1·38	...
6	− 0·158						+0·15	...	...	...	...	+0·03	...	− 0·96
7	− 0·491							+0·17	...	...	...	+0·07	...	+ 0·40
8	+ 0·245					*			+0·12	...	...	+0·06	...	+ 0·21
9	+ 0·297									+0·14	...	+0·06	...	+ 0·51
10	− 0·55										+0·35	...	...	− 0·36
11	+ 0·99											+0·27	− 0·43	...
12	+55·6												+183·37	− 26·92
13	+53·4													+119·76

Values of the Factors

$\lambda_1 = + 0{\cdot}6370$
$\lambda_2 = + 1{\cdot}9006$
$\lambda_3 = - 2{\cdot}7861$
$\lambda_4 = - 4{\cdot}0787$
$\lambda_5 = - 1{\cdot}0161$
$\lambda_6 = + 1{\cdot}0841$
$\lambda_7 = - 7{\cdot}7377$
$\lambda_8 = - 3{\cdot}1876$
$\lambda_9 = - 3{\cdot}6371$
$\lambda_{10} = + 1{\cdot}0910$
$\lambda_{11} = + 8{\cdot}3736$
$\lambda_{12} = + 0{\cdot}4049$
$\lambda_{13} = + 0{\cdot}5957$

Angular errors in seconds

$x_1 = + 0{\cdot}069$	$x_{10} = - {\cdot}216$	$x_{19} = + {\cdot}045$
$x_2 = - 0{\cdot}241$	$x_{11} = - {\cdot}175$	$x_{20} = - {\cdot}744$
$x_3 = + 0{\cdot}214$	$x_{12} = - {\cdot}277$	$x_{21} = + {\cdot}208$
$x_4 = + 0{\cdot}120$	$x_{13} = + {\cdot}004$	$x_{22} = + {\cdot}311$
$x_5 = - 0{\cdot}701$	$x_{14} = - {\cdot}231$	$x_{23} = - {\cdot}364$
$x_6 = + 1{\cdot}054$	$x_{15} = + {\cdot}627$	$x_{24} = + {\cdot}298$
$x_7 = - 0{\cdot}527$	$x_{16} = + {\cdot}284$	$x_{25} = + {\cdot}284$
$x_8 = + 0{\cdot}019$	$x_{17} = - {\cdot}576$	$x_{26} = - {\cdot}252$
$x_9 = + 0{\cdot}241$	$x_{18} = + {\cdot}134$	$x_{27} = + {\cdot}265$

$[wx^2] = 67{\cdot}77$

Figure No. 9.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	61	8	50·01	·07
2	67	48	45·08	·04
3	51	2	26·21	·03
4	59	49	41·19	·06
5	51	45	15·26	·07
6	68	25	4·55	·04
7	51	3	12·52	·05
8	45	24	44·02	·04
9	83	32	2·51	·07
10	40	47	31·78	·11
11	62	8	32·59	·10
12	77	3	55·99	·02
13	69	17	34·15	.05
14	64	14	48·86	·06
15	46	27	37·60	·05
16	77	53	10·02	·10
17	58	21	13·94	·04
18	43	45	36·91	·06

Equations to be satisfied

Equation		Factor
$x_1 + x_2 + x_3 \dots \dots \dots$	$= e_1 = -0{\cdot}014,$	λ_1
$x_4 + x_5 + x_6 \dots \dots \dots$	$= e_2 = -0{\cdot}304,$	λ_2
$x_7 + x_8 + x_9 \dots \dots \dots$	$= e_3 = -1{\cdot}660,$	λ_3
$x_{10} + x_{11} + x_{12} \dots \dots \dots$	$= e_4 = -0{\cdot}028,$	λ_4
$x_{13} + x_{14} + x_{15} \dots \dots \dots$	$= e_5 = -0{\cdot}016,$	λ_5
$x_{16} + x_{17} + x_{18} \dots \dots \dots$	$= e_6 = -0{\cdot}131,$	λ_6
$x_1 + x_4' + x_7 + x_{10} + x_{13} + x_{16}$	$= e_7 = -0{\cdot}33,$	λ_7
$\left.\begin{array}{l} 17x_3 - 8x_2 + 8x_6 - 17x_5 + 2x_9 - 21x_8 \\ +5x_{12} - 11x_{11} + 20x_{15} - 10x_{14} + 21x_{18} - 13x_{17} \end{array}\right\}$	$= e_8 = +33{\cdot}6,$	λ_8

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7	λ_8
1	− 0·014	+0·14	...	...	...	...	...	+0·07	+ 0·19
2	− 0·304		+0·17	...	...	...	...	+0·06	− 0·87
3	− 1·660			+0·16	...	...	...	+0·05	− 0·70
4	− 0·028				+0·23	...	...	+0·11	− 1·00
5	− 0·016					+0·16	...	+0·05	+ 0·40
6	− 0·131				*		+0·20	+0·10	+ 0·74
7	− 0·33							+0·44	...
8	+33·6								+123·76

Values of the Factors

$\lambda_1 = -0{\cdot}9950$
$\lambda_2 = -1{\cdot}0281$
$\lambda_3 = -9{\cdot}7378$
$\lambda_4 = +0{\cdot}3157$
$\lambda_5 = -1{\cdot}0378$
$\lambda_6 = -2{\cdot}0868$
$\lambda_7 = +1{\cdot}1682$
$\lambda_8 = +0{\cdot}2291$

Angular errors in seconds

$x_1 = +{\cdot}012$	$x_7 = -{\cdot}428$	$x_{13} = +{\cdot}007$
$x_2 = -{\cdot}113$	$x_8 = -{\cdot}582$	$x_{14} = -{\cdot}200$
$x_3 = +{\cdot}087$	$x_9 = -{\cdot}650$	$x_{15} = +{\cdot}177$
$x_4 = +{\cdot}008$	$x_{10} = +{\cdot}163$	$x_{16} = -{\cdot}092$
$x_5 = -{\cdot}344$	$x_{11} = -{\cdot}220$	$x_{17} = -{\cdot}203$
$x_6 = +{\cdot}032$	$x_{12} = +{\cdot}029$	$x_{18} = +{\cdot}164$

$[wx^2] = 24{\cdot}09$

Figure No. 10.

Observed Angles

No.	Value			Reciprocal Weight
	°	′	″	
1	49	58	5·62	·12
2	47	46	48·82	·04
3	43	10	50·40	·02
4	39	4	15·79	·09
5	39	23	48·18	·08
6	58	21	6·40	·09
7	45	33	30·60	·08
8	36	41	35·52	·13

Equations to be satisfied — **Factor**

$$x_1 + x_2 + x_3 + x_4 = e_1 = -0{\cdot}012, \qquad \lambda_1$$

$$x_3 + x_4 + x_5 + x_6 = e_2 = +0{\cdot}155, \qquad \lambda_2$$

$$x_5 + x_6 + x_7 + x_8 = e_3 = +0{\cdot}180, \qquad \lambda_3$$

$$\left.\begin{matrix} -17x_1 & -0x_2 & -23x_3 \\ +18x_6 & +5x_7 & +29x_8 \end{matrix}\right\} = e_4 = +18{\cdot}3, \qquad \lambda_4$$

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4
1	− 0·012	+0·27	+0·11	...	− 2·50
2	+ 0·155		+0·28	+0·17	+ 1·16
3	+ 0·180		*	+0·38	+ 5·79
4	+18·3				+185·75

Values of the Factors

$\lambda_1 = + 1{\cdot}5041$

$\lambda_2 = + 1{\cdot}0513$

$\lambda_3 = - 3{\cdot}2499$

$\lambda_4 = + 0{\cdot}2135$

Angular errors in seconds

$x_1 = -\ {\cdot}255$	$x_5 = -\ {\cdot}176$
$x_2 = +\ {\cdot}060$	$x_6 = +\ {\cdot}148$
$x_3 = -\ {\cdot}047$	$x_7 = -\ {\cdot}174$
$x_4 = +\ {\cdot}230$	$x_8 = +\ {\cdot}382$

$[wx^2] = 3{\cdot}47$

Figure No. 11.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	86	3	47·47	·13
2	46	16	27·68	·10
3	47	39	45·10	·03
4	66	44	50·83	·12
5	50	45	53·05	·06
6	62	29	16·15	·11
7	80	34	52·73	·20
8	55	49	49·45	·20
9	43	35	17·73	·08
10	54	51	24·27	·04
11	71	40	56·77	·20
12	53	27	39·59	·15
13	71	45	4·55	·12
14	46	37	16·28	·19
15	61	37	39·71	·06

Equations to be satisfied — **Factor**

$$x_1 + x_2 + x_3 \quad \ldots \quad \ldots \quad = e_1 = -0{\cdot}055, \qquad \lambda_1$$
$$x_4 + x_5 + x_6 \quad \ldots \quad \ldots \quad = e_2 = -0{\cdot}210, \qquad \lambda_2$$
$$x_7 + x_8 + x_9 \quad \ldots \quad \ldots \quad = e_3 = -0{\cdot}360, \qquad \lambda_3$$
$$x_{10} + x_{11} + x_{12} \quad \ldots \quad \ldots \quad = e_4 = +0{\cdot}313, \qquad \lambda_4$$
$$x_{13} + x_{14} + x_{15} \quad \ldots \quad \ldots \quad = e_5 = +0{\cdot}181, \qquad \lambda_5$$
$$x_1 + x_4 + x_7 + x_{10} + x_{13} = e_6 = -0{\cdot}15, \qquad \lambda_6$$
$$\left.\begin{matrix} 19x_3 - 20x_2 + 11x_6 - 17x_5 + 22x_9 \\ -14x_8 + 15x_{12} - 7x_{11} + 12x_{15} - 20x_{14} \end{matrix}\right\} = e_7 = -25{\cdot}6, \qquad \lambda_7$$

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7
1	− 0·055	+0·26	...	...	...	...	+0·13	− 1·43
2	− 0·210		+0·29	...	...	...	+0·12	+ 0·19
3	− 0·360			+0·48	...	...	+0·20	− 1·04
4	+ 0·313				+0·39	...	+0·04	+ 0·85
5	+ 0·181			*		+0·37	+0·12	− 3·08
6	− 0·15						+0·61	...
7	−25·6							+287·59

Values of the Factors

$$\lambda_1 = -1{\cdot}1279$$
$$\lambda_2 = -0{\cdot}9199$$
$$\lambda_3 = -1{\cdot}2525$$
$$\lambda_4 = +0{\cdot}9720$$
$$\lambda_5 = -0{\cdot}6192$$
$$\lambda_6 = +0{\cdot}6442$$
$$\lambda_7 = -0{\cdot}1080$$

Angular errors in seconds

$x_1 = -\cdot063$	$x_6 = -\cdot232$	$x_{11} = +\cdot345$
$x_2 = +\cdot103$	$x_7 = -\cdot122$	$x_{12} = -\cdot097$
$x_3 = -\cdot095$	$x_8 = +\cdot052$	$x_{13} = +\cdot003$
$x_4 = -\cdot033$	$x_9 = -\cdot290$	$x_{14} = +\cdot293$
$x_5 = +\cdot055$	$x_{10} = +\cdot065$	$x_{15} = -\cdot115$

$$[wx^2] = 3{\cdot}57$$

Figure No. 12.

Observed Angles

No.	Value °	′	″	Reciprocal Weight
1	64	5	51·49	·08
2	60	29	15·41	·13
3	55	24	53·55	·14
4	86	5	44·71	·13
5	45	42	27·01	·09
6	48	11	48·63	·08
7	85	58	0·62	·15
8	58	12	4·50	·06
9	35	49	55·28	·13
10	64	38	43·63	·11
11	43	31	2·25	·22
12	71	50	14·39	·07
13	59	11	39·57	·07
14	57	5	44·32	·20
15	63	42	36·55	·12

Equations to be satisfied

Equations	Factor
$x_1 + x_2 + x_3 \ldots \ldots = e_1 = +0·179,$	λ_1
$x_4 + x_5 + x_6 \ldots \ldots = e_2 = +0·045,$	λ_2
$x_7 + x_8 + x_9 \ldots \ldots = e_3 = -0·024,$	λ_3
$x_{10} + x_{11} + x_{12} \ldots \ldots = e_4 = -0·135,$	λ_4
$x_{13} + x_{14} + x_{15} \ldots \ldots = e_5 = +0·179,$	λ_5
$x_1 + x_4 + x_7 + x_{10} + x_{13} = e_6 = +0·02,$	λ_6
$\left.\begin{matrix} 14x_3 - 11x_2 + 19x_6 - 21x_5 + 29x_9 \\ -13x_8 + 7x_{12} - 22x_{11} + 10x_{15} - 14x_{14} \end{matrix}\right\} = e_7 = +8·7,$	λ_7

Equations between the Factors

No. of e	Value of e	Co-efficients of λ_1	λ_2	λ_3	λ_4	λ_5	λ_6	λ_7
1	+0·179	+0·35	...	...	...	...	+0·08	+ 0·53
2	+0·045		+0·30	...	...	...	+0·13	− 0·37
3	−0·024			+0·34	...	...	+0·15	+ 2·99
4	−0·135				+0·40	...	+0·11	− 4·35
5	+0·179					+0·39	+0·07	− 1·60
6	+0·02						+0·54	...
7	+8·7							+392·32

Values of the Factors

$\lambda_1 = +0·4918$

$\lambda_2 = +0·2182$

$\lambda_3 = -0·2590$

$\lambda_4 = -0·0353$

$\lambda_5 = +0·5794$

$\lambda_6 = -0·0843$

$\lambda_7 = +0·0257$

Angular errors in seconds

$x_1 = +·033$	$x_6 = +·057$	$x_{11} = -·132$
$x_2 = +·027$	$x_7 = -·052$	$x_{12} = +·010$
$x_3 = +·119$	$x_8 = -·035$	$x_{13} = +·035$
$x_4 = +·017$	$x_9 = +·063$	$x_{14} = +·044$
$x_5 = -·029$	$x_{10} = -·013$	$x_{15} = +·100$

$[wx^2] = 0·43$

May, 1885.

W. H. COLE,
In charge of Computing Office.

EASTERN SIND MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. TRIANGLES.

No. of triangle: Circuit	No. of triangle: Non-circuit	Number and Name of Station	Spherical Excess	Corrections to Observed Angle: Figure	Corrections to Observed Angle: Circuit	Corrections to Observed Angle: Non-circuit	Corrections to Observed Angle: Total	Corrected Plane Angle	Distance: Log. feet	Distance: Feet	Distance: Miles
			"	"	"	"	"	° ' "			
1		LXXV (Rojhra)	·689	− ·659	+ ·880		+ ·221	60 25 37·022	5·0107656,2	102509·86	19·415
		LXXVIII (Sandohar)	·689	+ ·088	+ ·090		+ ·178	68 39 56·149	5·0405528,1	109787·48	20·793
		V (Bhádi)	·689	+ ·838	− ·970		− ·132	50 54 26·829	4·9613162,0	91477·90	17·325
			2·067				+ ·267	180 0 0·000			
2		LXXVIII (Sandohar)	·651	+ ·086	+ ·484		+ ·570	66 39 2·349	5·0220268,9	105202·71	19·925
		V (Bhádi)	·650	− ·201	+ ·112		− ·089	49 53 29·891	4·9426977,8	87639·08	16·598
		IV (Narithal)	·650	+ ·706	− ·596		+ ·110	63 27 27·760	5·0107656,2	102509·86	19·415
			1·951				+ ·591	180 0 0·000			
	40	LXXV (Rojhra)	·340	+ ·548		+ ·336	+ ·884	46 47 48·734	4·8242059,7	66712·30	12·635
		LXXVIII (Sandohar)	·340	− ·461		− ·272	− ·733	44 57 20·757	4·8106688,9	64664·94	12·247
		I (Fulrár)	·340	− ·177		− ·064	− ·241	88 14 50·509	4·9613162,0	91477·90	17·325
			1·020				− ·090	180 0 0·000			
	41	I (Fulrár)	·254	+ ·605		+ ·497	+1·102	39 13 54·278	4·6899756,1	48975·14	9·276
		LXXVIII (Sandohar)	·255	− ·069		− ·232	− ·301	81 16 52·424	4·8838957,4	76541·29	14·496
		II (Chánga)	·255	− ·252		− ·265	− ·517	59 29 13·298	4·8242059,7	66712·30	12·635
			·764				+ ·284	180 0 0·000			
	42	II (Chánga)	·283	+ ·467		+ ·296	+ ·763	84 46 38·510	4·9273847,5	84602·80	16·023
		LXXVIII (Sandohar)	·283	+ ·923		+ ·049	+ ·972	60 1 9·469	4·8668065,1	73587·92	13·937
		III (Patatonk)	·283	− ·621		− ·345	− ·966	35 12 12·021	4·6899756,1	48975·14	9·276
			·849				+ ·769	180 0 0·000			

NOTES.—1. The values of the side are given in the same line with the opposite angle.
2. Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series.

No. of triangle: Circuit	No. of triangle: Non-circuit	Number and Name of Station	Spherical Excess	Corrections to Observed Angle: Figure	Circuit	Non-circuit	Total	Corrected Plane Angle	Distance: Log. feet	Feet	Miles
			"	"	"	"	"	° ' "			
	43	III (Patatonk)	·364	+ ·541		+ ·209	+ ·750	73 40 56·386	4·9426977,7	87639·07	16·598
		LXXVIII (Sandohar)	·363	+ ·072		− ·118	− ·046	38 25 36·271	4·7540043,7	56755·04	10·749
		IV (Narithal)	·363	− ·213		− ·091	− ·304	67 53 27·343	4·9273847,5	84602·80	16·023
			1·090				+ ·400	180 0 0·000			
3		IV (Narithal)	·582	+ ·461	+ ·637		+1·098	54 30 57·496	4·9507019,2	89269·25	16·907
		V (Bhádi)	·582	+ ·321	− ·077		+ ·244	51 49 21·782	4·9354085,1	86180·40	16·322
		VII (Rupihar)	·583	+ ·115	− ·560		− ·445	73 39 40·722	5·0220268,9	105202·71	19·925
			1·747				+ ·897	180 0 0·000			
4		V (Bhádi)	·459	+ ·433	+ ·876		+1·309	45 29 7·050	4·8445842,7	69917·24	13·242
		VII (Rupihar)	·460	+ ·018	− ·230		− ·212	68 56 55·778	4·9614543,9	91507·02	17·331
		VIII (Kanakotri)	·459	+ ·277	− ·646		− ·369	65 33 57·172	4·9507019,2	89269·25	16·907
			1·378				+ ·728	180 0 0·000			
5		VIII (Kanakotri)	·320	+ ·414	+ ·450		+ ·864	71 47 47·474	4·8870873,0	77105·84	14·603
		VII (Rupihar)	·319	+ ·017	+ ·062		+ ·079	48 43 50·280	4·7853817,0	61007·28	11·554
		X (Bhitala)	·320	+ ·128	− ·512		− ·384	59 28 22·246	4·8445842,7	69917·24	13·242
			·959				+ ·559	180 0 0·000			
6		VII (Rupihar)	·428	− ·059	+ ·564		+ ·505	58 5 34·297	4·8911247,0	77826·00	14·740
		X (Bhitala)	·428	+ ·236	+ ·079		+ ·315	64 39 21·327	4·9183152,4	82854·33	15·692
		IX (Mangtor)	·427	+ ·136	− ·643		− ·507	57 15 4·376	4·8870873,0	77105·84	14·603
			1·283				+ ·313	180 0 0·000			
	44	IV (Narithal)	·421	+ ·186		+1·331	+1·517	49 24 7·696	4·8468162,4	70277·49	13·310
		VII (Rupihar)	·422	− ·133		− ·230	− ·363	61 59 19·055	4·9122944,5	81713·61	15·476
		VI (Hatodan)	·422	+ ·152		−1·101	− ·949	68 36 33·249	4·9354085,1	86180·40	16·322
			1·265				+ ·205	180 0 0·000			
	45	VI (Hatodan)	·345	+ ·283		+ ·738	+1·021	76 1 34·506	4·9183152,4	82854·33	15·692
		VII (Rupihar)	·344	− ·058		+ ·394	+ ·336	48 34 37·312	4·8063335,8	64022·64	12·126
		IX (Mangtor)	·344	+ ·098		−1·132	−1·034	55 23 48·182	4·8468162,4	70277·49	13·310
			1·033				+ ·323	180 0 0·000			
7		X (Bhitala)	·399	+ ·058	+ ·314		+ ·372	82 32 10·243	4·9775321,9	94958·13	17·984
		IX (Mangtor)	·398	− ·020	+ ·223		+ ·203	43 6 33·645	4·8158980,4	65448·25	12·396
		XII (Thakur)	·398	+ ·037	− ·537		− ·500	54 21 16·112	4·8911247,0	77826·00	14·740
			1·195				+ ·075	180 0 0·000			
8		IX (Mangtor)	·407	+ ·034	+ ·482		+ ·516	49 41 17·969	4·8637805,9	73076·98	13·840
		XII (Thakur)	·407	− ·274	− ·144		− ·418	48 3 51·215	4·8530312,6	71290·44	13·502
		XI (Narhar)	·407	− ·059	− ·338		− ·397	82 14 50·816	4·9775321,9	94958·13	17·984
			1·221				− ·299	180 0 0·000			
	46	IX (Mangtor)	·437	+ ·014		+ ·705	+ ·719	92 47 51·982	5·0337370,7	108077·95	20·469
		X (Bhitala)	·437	+ ·093		− ·143	− ·050	41 12 39·703	4·8530312,6	71290·44	13·502
		XI (Narhar)	·437	− ·056		− ·562	− ·618	45 59 28·315	4·8911247,0	77826·00	14·740
			1·311				+ ·051	180 0 0·000			
9		XI (Narhar)	·432	+ ·137	+ ·484		+ ·621	60 41 1·089	4·9089662,3	81089·80	15·358
		XII (Thakur)	·432	− ·268	+ ·130		− ·138	67 31 27·750	4·9341767,2	85936·32	16·276
		XIV (Malar)	·431	+ ·086	− ·614		− ·528	51 47 31·161	4·8637805,9	73076·98	13·840
			1·295				− ·045	180 0 0·000			
10		XII (Thakur)	·445	+ ·266	+ ·424		+ ·690	57 3 26·895	4·8944387,3	78422·15	14·853
		XIV (Malar)	·446	+ ·009	− ·034		− ·025	62 44 33·889	4·9194465,6	83070·45	15·733
		XV (Badhor)	·446	− ·168	− ·390		− ·558	60 11 59·216	4·9089662,3	81089·80	15·358
			1·337				+ ·107	180 0 0·000			

Note.—Station LXXVIII (Sandohar) appertains to the Karáchi Longitudinal Series.

No. of triangle		Number and Name of Station	Spherical Excess	Corrections to Observed Angle				Corrected Plane Angle	Distance		
Circuit	Non-circuit			Figure	Circuit	Non-circuit	Total		Log. feet	Feet	Miles
			″	″	″	″	″	° ′ ″			
		XV (Badhor)	·416	+ ·191	+ ·450		+ ·641	55 49 56·675	4·8740247,1	74821·21	14·171
11		XIV (Malar)	·416	+ ·287	− ·045		+ ·242	64 1 50·016	4·9100831,8	81298·62	15·397
		XVII (Sinaba)	·416	− ·060	− ·405		− ·465	60 8 13·309	4·8944387,3	78422·15	14·853
			1·248				+ ·418	180 0 0·000			
		XIV (Malar)	·336	− ·048	+ ·303		+ ·255	56 8 31·469	4·8309009,3	67748·69	12·831
12		XVII (Sinaba)	·337	+ ·087	+ ·025		+ ·112	57 21 1·595	4·8369072,0	68692·16	13·010
		XVI (Ramsar)	·337	− ·119	− ·328		− ·447	66 30 26·936	4·8740247,1	74821·21	14·171
			1·010				− ·080	180 0 0·000			
		XI (Narhar)	·424	− ·003		+ ·556	+ ·553	46 38 47·169	4·8332637,4	68118·29	12·901
	47	XIV (Malar)	·425	+ ·432		+ ·120	+ ·552	66 48 52·807	4·9350780,3	86114·85	16·310
		XIII (Jeysulmere)	·424	+ ·384		− ·676	− ·292	66 32 20·024	4·9341767,2	85936·32	16·276
			1·273				+ ·813	180 0 0·000			
		XIII (Jeysulmere)	·315	− ·100		+ ·338	+ ·238	61 11 26·483	4·8369072,0	68692·16	13·010
	48	XIV (Malar)	·314	+ ·174		+ ·270	+ ·444	58 28 38·290	4·8249501,5	66826·72	12·657
		XVI (Ramsar)	·314	+ ·179		− ·608	− ·429	60 19 55·227	4·8332637,4	68118·29	12·901
			·943				+ ·253	180 0 0·000			
		XVI (Ramsar)	·396	+ ·053	+ ·231		+ ·284	77 11 24·968	4·9539220,0	89933·60	17·033
13		XVII (Sinaba)	·396	− ·291	+ ·198		− ·093	55 32 19·761	4·8810634,6	76043·73	14·402
		XIX (Joganali)	·396	+ ·036	− ·429		− ·393	47 16 15·271	4·8309009,3	67748·69	12·831
			1·188				− ·202	180 0 0·000			
		XVII (Sinaba)	·334	+ ·108	+ ·345		+ ·453	41 55 1·279	4·7795551,0	60194·26	11·400
14		XIX (Joganali)	·335	− ·331	− ·171		− ·502	51 36 23·343	4·8489289,4	70620·20	13·375
		XX (Kardo)	·335	− ·323	− ·174		− ·497	86 28 35·378	4·9539220,0	89933·60	17·033
			1·004				− ·546	180 0 0·000			
		XX (Kardo)	·277	+ ·558	+ ·303		+ ·861	56 58 45·874	4·7952602,9	62410·88	11·820
15		XIX (Joganali)	·277	+ ·252	− ·004		+ ·248	69 3 7·041	4·8420730,0	69514·11	13·166
		XXII (Arrabhit)	·276	− ·020	− ·299		− ·319	53 58 7·085	4·7795551,0	60194·26	11·400
			·830				+ ·790	180 0 0·000			
		XIX (Joganali)	·242	− ·099	+ ·168		+ ·069	57 5 2·667	4·7626542,1	57896·75	10·965
16		XXII (Arrabhit)	·242	− ·036	+ ·032		− ·004	58 6 11·784	4·7675582,6	58554·22	11·090
		XXI (Sanahu)	·242	− ·309	− ·200		− ·509	64 48 45·549	4·7952602,9	62410·88	11·820
			·726				− ·444	180 0 0·000			
		XVI (Ramsar)	·303	− ·210		+ ·217	+ ·007	45 32 0·024	4·7561449,8	57035·46	10·802
	49	XIX (Joganali)	·303	+ ·271		+ ·165	+ ·436	62 23 3·363	4·8501258,3	70815·09	13·412
		XVIII (Potanawári)	·303	+ ·178		− ·382	− ·204	72 4 56·613	4·8810634,6	76043·73	14·402
			·909				+ ·239	180 0 0·000			
		XVIII (Potanawári)	·251	− ·777		+ ·196	− ·581	54 43 25·698	4·7675582,6	58554·22	11·090
	50	XIX (Joganali)	·252	+ ·311		+ ·271	+ ·582	72 36 6·510	4·8353292,7	68443·04	12·963
		XXI (Sanahu)	·251	+ ·150		− ·467	− ·317	52 40 27·792	4·7561449,8	57035·46	10·802
			·754				− ·316	180 0 0·000			
		XXII (Arrabhit)	·307	− ·114	+ ·113		− ·001	96 47 52·102	4·9735898,1	94100·05	17·822
17		XXI (Sanahu)	·307	+ ·354	+ ·181		+ ·535	45 32 40·158	4·8302268,6	67643·62	12·811
		XXIV (Dhanono)	·306	− ·300	− ·294		− ·594	37 39 27·740	4·7626542,1	57896·75	10·965
			·920				− ·060	180 0 0·000			
		XXI (Sanahu)	·377	+ ·086	+ ·086		+ ·172	53 51 39·775	4·8829031,8	76366·56	14·463
18		XXIV (Dhanono)	·377	+ ·046	+ ·005		+ ·051	41 47 58·264	4·7995299,5	63027·49	11·937
		XXIII (Harnáo)	·378	− ·240	− ·091		− ·331	84 20 21·961	4·9735898,1	94100·05	17·822
			1·132				− ·108	180 0 0·000			

No. of Triangle: Circuit	No. of Triangle: Non-circuit	Number and Name of Station	Spherical Excess	Corrections to Observed Angle: Figure	Corrections to Observed Angle: Circuit	Corrections to Observed Angle: Non-circuit	Corrections to Observed Angle: Total	Corrected Plane Angle	Distance: Log. feet	Distance: Feet	Distance: Miles
			″	″	″	″	″	° ′ ″			
	51	XXI (Sanahu)	·284	+ ·440		+ ·267	+ ·707	99 24 20·333	4·9651481,1	92288·62	17·479
		XXII (Arrabhit)	·284	− ·062		+ ·018	− ·044	42 21 27·832	4·7995299,4	63027·48	11·937
		XXIII (Harnáo)	·283	+ ·103		− ·285	− ·182	38 14 11·835	4·7626542,1	57896·75	10·965
			·851				+ ·481	180 0 0·000			
19		XXIII (Harnáo)	·292	+ ·006	+ ·104		+ ·110	53 5 46·178	4·7980561,7	62813·95	11·897
		XXIV (Dhanono)	·291	+ ·014	+ ·012		+ ·026	50 27 6·835	4·7822645,1	60570·97	11·472
		XXVI (Ráviláhu)	·292	− ·045	− ·116		− ·161	76 27 6·987	4·8829031,8	76366·56	14·463
			·875				− ·025	180 0 0·000			
20		XXIV (Dhanono)	·325	− ·020	+ ·117		+ ·097	50 52 6·512	4·8212126,4	66254·08	12·548
		XXVI (Ráviláhu)	·325	− ·183	+ ·011		− ·172	81 47 18·963	4·9270438,6	84536·42	16·011
		XXIX (Máringra)	·324	+ ·027	− ·128		− ·101	47 20 34·525	4·7980561,7	62813·95	11·897
			·974				− ·176	180 0 0·000			
21		XXVI (Ráviláhu)	·278	+ ·353	+ ·005		+ ·358	64 59 12·140	4·8288055,6	67422·61	12·769
		XXIX (Máringra)	·277	− ·098	+ ·054		− ·044	52 4 35·939	4·7685622,2	58689·75	11·115
		XXVIII (Girája)	·278	+ ·078	− ·059		+ ·019	62 56 11·921	4·8212126,4	66254·08	12·548
			·833				+ ·333	180 0 0·000			
22		XXIX (Máringra)	·348	+ ·395	+ ·010		+ ·405	70 11 36·007	4·8965140,6	78797·79	14·924
		XXVIII (Girája)	·348	+ ·379	+ ·031		+ ·410	56 11 39·322	4·8425614,0	69592·33	13·180
		XXXI (Asu)	·348	+ ·040	− ·041		− ·001	53 36 44·671	4·8288055,6	67422·61	12·769
			1·044				+ ·814	180 0 0·000			
23		XXVIII (Girája)	·362	+ ·042	− ·052		− ·010	55 22 29·828	4·8445434,0	69910·66	13·241
		XXXI (Asu)	·362	+ ·410	+ ·044		+ ·454	56 34 38·892	4·8506972,9	70908·34	13·430
		XXX (Singra)	·363	− ·045	+ ·008		− ·037	68 2 51·280	4·8965140,6	78797·79	14·924
			1·087				+ ·407	180 0 0·000			
	52	XXIII (Harnáo)	·308	+ ·334		+ ·120	+ ·454	59 41 54·206	4·8353578,7	68447·54	12·964
		XXVI (Ráviláhu)	·308	+ ·021		+ ·078	+ ·099	70 28 51·621	4·8734507,3	74722·38	14·152
		XXV (Bándri)	·308	+ ·139		− ·198	− ·059	49 49 14·173	4·7822645,1	60570·97	11·472
			·924				+ ·494	180 0 0·000			
	53	XXVI (Rávilahu)	·290	− ·475		+ ·021	− ·454	66 17 28·796	4·8450561,7	69993·25	13·256
		XXV (Bándri)	·290	+ ·587		+ ·060	+ ·647	50 9 4·097	4·7685622,2	58689·75	11·115
		XXVIII (Girája)	·290	− ·002		− ·081	− ·083	63 33 27·107	4·8353578,7	68447·54	12·964
			·870				+ ·110	180 0 0·000			
	54	XXV (Bándri)	·353	− ·081		− ·019	− ·100	70 10 32·067	4·8990445,9	79258·27	15·011
		XXVIII (Girája)	·352	− ·097		+ ·084	− ·013	53 38 48·415	4·8315765,0	67854·16	12·851
		XXVII (Máhu)	·352	+ ·705		− ·065	+ ·640	56 10 39·518	4·8450561,7	69993·25	13·256
			1·057				+ ·527	180 0 0·000			
	55	XXVII (Máhu)	·411	− ·412		− ·008	− ·420	51 10 5·469	4·8506972,9	70908·34	13·430
		XXVIII (Girája)	·412	− ·100		+ ·077	− ·023	68 17 21·365	4·9272107,8	84568·92	16·017
		XXX (Singra)	·412	+ ·307		− ·069	+ ·238	60 32 33·166	4·8990445,9	79258·27	15·011
			1·235				− ·205	180 0 0·000			
24		XXXI (Asu)	·332	− ·214	− ·082		− ·296	53 10 19·692	4·8144244,5	65226·56	12·354
		XXX (Singra)	·333	+ ·241	+ ·047		+ ·288	67 44 37·725	4·8774718,9	75417·45	14·284
		XXXIII (Parethal)	·333	− ·069	+ ·035		− ·034	59 5 2·583	4·8445434,0	69910·66	13·241
			·998				− ·042	180 0 0·000			
25		XXX (Singra)	·223	− ·627	− ·123		− ·750	49 35 11·257	4·7144157,0	51810·25	9·813
		XXXIII (Parethal)	·223	− ·004	+ ·033		+ ·029	56 58 7·016	4·7562481,6	57049·02	10·805
		XXXII (Bitri)	·224	+ ·231	+ ·090		+ ·321	73 26 41·727	4·8144244,5	65226·56	12·354
			·670				− ·400	180 0 0·000			

No. of Triangle		Number and Name of Station	Spherical Excess	Corrections to Observed Angle				Corrected Plane Angle	Distance		
Circuit	Non-circuit			Figure	Circuit	Non-circuit	Total		Log. feet	Feet	Miles
			″	″	″	″	″	° ′ ″			
26		XXXIII (Parethal)	·263	+ ·216	− ·104		+ ·112	85 7 36·089	4·8990669,7	79262·36	15·012
		XXXII (Bitri)	·263	+ ·277	− ·010		+ ·267	54 14 3·134	4·8098816,6	64547·83	12·225
		XXXVI (Kháro)	·262	+ ·175	+ ·114		+ ·289	40 38 20·777	4·7144157,0	51810·25	9·813
			·788				+ ·668	180 0 0·000			
27		XXXII (Bitri)	·357	− ·265	− ·173		− ·438	53 8 55·885	4·8313570,1	67819·88	12·845
		XXXVI (Kháro)	·358	− ·284	+ ·030		− ·254	57 35 23·768	4·8546230,9	71552·22	13·552
		XXXV (Chauki)	·358	+ ·252	+ ·143		+ ·395	69 15 40·347	4·8990669,7	79262·36	15·012
			1·073				− ·297	180 0 0·000			
28		XXXVI (Kháro)	·309	− ·311	− ·154		− ·465	80 54 58·286	4·9149085,4	82206·95	15·569
		XXXV (Chauki)	·308	− ·298	+ ·034		− ·264	44 31 54·258	4·7662962,0	58384·32	11·058
		XXXVIII (Trisingh)	·308	+ ·364	+ ·120		+ ·484	54 33 7·456	4·8313570,1	67819·88	12·845
			·925				− ·245	180 0 0·000			
	56	XXXI (Asu)	·385	+ ·701		− ·167	+ ·534	43 6 11·719	4·8141024,0	65178·21	12·344
		XXXIII (Parethal)	·386	− ·120		+ ·046	− ·074	84 38 57·740	4·9775848,7	94969·66	17·987
		XXXIV (Kolu)	·386	−1·054		+ ·121	− ·933	52 14 50·541	4·8774718,9	75417·45	14·284
			1·157				− ·473	180 0 0·000			
	57	XXXIII (Parethal)	·319	+ ·527		− ·010	+ ·517	74 10 15·048	4·8933571,5	78227·08	14·816
		XXXIV (Kolu)	·319	− ·019		− ·037	− ·056	52 32 46·525	4·8098816,6	64547·83	12·225
		XXXVI (Kháro)	·319	− ·241		+ ·047	− ·194	53 16 58·427	4·8141024,0	65178·21	12·344
			·957				+ ·267	180 0 0·000			
	58	XXXIV (Kolu)	·246	+ ·576		− ·093	+ ·483	38 54 0·087	4·6919358,5	49196·69	9·318
		XXXVI (Kháro)	·246	− ·284		+ ·016	− ·268	54 13 13·596	4·8031682,7	63557·72	12·037
		XXXVII (Morgich)	·246	− ·134		+ ·077	− ·057	86 52 46·317	4·8933571,5	78227·08	14·816
			·738				+ ·158	180 0 0·000			
	59	XXXVII (Morgich)	·217	+ ·744		− ·079	+ ·665	59 51 59·418	4·7662962,0	58384·32	11·058
		XXXVI (Kháro)	·217	− ·045		− ·053	− ·098	73 21 3·435	4·8107520,6	64677·32	12·249
		XXXVIII (Trisingh)	·217	− ·208		+ ·132	− ·076	46 46 57·147	4·6919358,5	49196·69	9·318
			·651				+ ·491	180 0 0·000			
29		XXXV (Chauki)	·438	+ ·113	− ·173		− ·060	67 48 44·582	4·9390613,9	86908·32	16·460
		XXXVIII (Trisingh)	·438	− ·087	− ·033		− ·120	51 2 25·652	4·8632235,3	72983·31	13·823
		XL (Kiraríwáro)	·438	− ·012	+ ·206		+ ·194	61 8 49·766	4·9149085,4	82206·95	15·569
			1·314				+ ·014	180 0 0·000			
30		XXXVIII (Trisingh)	·434	+ ·344	− ·324		+ ·020	51 45 14·846	4·8656989,4	73400·48	13·902
		XL (Kiraríwáro)	·435	− ·008	+ ·168		+ ·160	59 49 40·915	4·9074047,9	80798·78	15·303
		XLIII (Núrpír)	·435	− ·032	+ ·156		+ ·124	68 25 4·239	4·9390613,9	86908·32	16·460
			1·304				+ ·304	180 0 0·000			
31		XL (Kiraríwáro)	·237	+ ·428	− ·272		+ ·156	51 3 12·439	4·7593005,6	57451·39	10·881
		XLIII (Núrpír)	·236	+ ·582	+ ·069		+ ·651	45 24 44·435	4·7210583,2	52608·80	9·964
		XLII (Yáru)	·237	+ ·650	+ ·203		+ ·853	83 32 3·126	4·8656989,4	73400·48	13·902
			·710				+1·660	180 0 0·000			
	60	XXXV (Chauki)	·333	− ·164		− ·087	− ·251	43 45 36·326	4·7730187,1	59295·08	11·230
		XL (Kiraríwáro)	·334	+ ·092		− ·026	+ ·066	77 53 9·752	4·9233583,3	83822·06	15·875
		XXXIX (Thar Muhári)	·334	+ ·203		+ ·113	+ ·316	58 21 13·922	4·8632235,3	72983·31	13·823
			1·001				+ ·131	180 0 0·000			
	61	XXXIX (Thar Muhári)	·208	− ·177		− ·077	− ·254	46 27 37·138	4·6787272,4	47722·95	9·038
		XL (Kiraríwáro)	·209	− ·007		− ·022	− ·029	69 17 33·912	4·7894476,9	61581·14	11·663
		XLI (Mári)	·209	+ ·200		+ ·099	+ ·299	64 14 48·950	4·7730187,1	59295·08	11·230
			·626				+ ·016	180 0 0·000			

No. of triangle		Number and Name of Station	Spherical Excess	Corrections to Observed Angle				Corrected Plane Angle	Distance		
Circuit	Non-Circuit			Figure	Circuit	Non-Circuit	Total		Log. feet	Feet	Miles
			"	"	"	"	"	° ′ "			
	62	XLI (Mári)	·130	− ·029		− ·020	− ·049	77 3 55·811	4·7210583,2	52608·80	9·964
		XL (Kiraríwáro)	·129	− ·163		− ·054	− ·217	40 47 31·434	4·5473431,5	35264·94	6·679
		XLII (Yáru)	·129	+ ·220		+ ·074	+ ·294	62 8 32·755	4·6787272,4	47722·95	9·038
			·388				+ ·028	180 0 0·000			
32		XLIII (Núrpír)	·214	− ·013	− ·185		− ·198	90 57 38·808	4·8751873,0	75021·78	14·209
		XLII (Yáru)	·214	− ·230	− ·022		− ·252	39 4 15·324	4·6747832,2	47291·51	8·957
		XLV (Longwáli)	·214	+ ·255	+ ·207		+ ·462	49 58 5·868	4·7593005,6	57451·39	10·881
			·642				+ ·012	180 0 0·000			
33		XLII (Yáru)	·173	+ ·176	− ·423		− ·247	39 23 47·760	4·6906722,2	49053·75	9·290
		XLV (Longwáli)	·173	− ·382	+ ·239		− ·143	36 41 35·204	4·6644730,1	46182·03	8·747
		XLIV (Vijnot)	·174	+ ·026	+ ·184		+ ·210	103 54 37·036	4·8751873,0	75021·78	14·209
			·520				− ·180	180 0 0·000			
	63	XLII (Yáru)	·205	− ·054		− ·445	− ·499	78 28 3·266	4·8203681,0	66125·36	12·524
		XLIII (Núrpír)	·205	+ ·047		+ ·287	+ ·334	43 10 50·529	4·6644730,1	46182·03	8·747
		XLIV (Vijnot)	·205	− ·148		+ ·158	+ ·010	58 21 6·205	4·7593005,6	57451·39	10·881
			·615				− ·155	180 0 0·000			
34		XLV (Longwáli)	·102	+ ·095	− ·459		− ·364	47 39 44·634	4·5604538,0	36345·76	6·884
		XLIV (Vijnot)	·101	− ·103	+ ·289		+ ·186	46 16 27·765	4·5506311,3	35532·94	6·730
		XLVI (Vín)	·102	+ ·063	+ ·170		+ ·233	86 3 47·601	4·6906722,2	49053·75	9·290
			·305				+ ·055	180 0 0·000			
35		XLIV (Vijnot)	·120	+ ·115	− ·408		− ·293	61 37 39·297	4·6434435,6	43999·08	8·333
		XLVI (Vín)	·120	− ·003	− ·173		− ·176	71 45 4·254	4·6766103,8	47490·90	8·994
		XLVIII (Dewari)	·119	− ·293	+ ·581		+ ·288	46 37 16·449	4·5604538,0	36345·76	6·884
			·359				− ·181	180 0 0·000			
36		XLVI (Vín)	·106	− ·065	− ·443		− ·508	54 51 23·656	4·5786281,5	37899·03	7·178
		XLVIII (Dewari)	·105	+ ·097	+ ·212		+ ·309	53 27 39·794	4·5709869,6	37238·06	7·053
		XLIX (Kot Sabzal)	·106	− ·345	+ ·231		− ·114	71 40 56·550	4·6434435,6	43999·08	8·333
			·317				− ·313	180 0 0·000			
	64	XLV (Longwáli)	·080	− ·055		− ·542	− ·597	50 45 52·373	4·4918011,5	31031·38	5·877
		XLVI (Vín)	·080	+ ·033		+ ·289	+ ·322	66 44 51·072	4·5659585,8	36809·39	6·971
		XLVII (Got Mír Muhammad)	·080	+ ·232		+ ·253	+ ·485	62 29 16·555	4·5506311,3	35532·94	6·730
			·240				+ ·210	180 0 0·000			
	65	XLVII (Got Mír Muhammad)	·090	− ·052		− ·590	− ·642	55 49 48·718	4·5709869,6	37238·06	7·053
		XLVI (Vín)	·090	+ ·122		+ ·157	+ ·279	80 34 52·919	4·6473891,2	44400·62	8·409
		XLIX (Kot Sabzal)	·090	+ ·290		+ ·433	+ ·723	43 35 18·363	4·4918011,5	31031·38	5·877
			·270				+ ·360	180 0 0·000			
37		XLVIII (Dewari)	·090	− ·027	− ·310		− ·337	60 29 14·983	4·5642506,6	36664·91	6·944
		XLIX (Kot Sabzal)	·090	− ·119	− ·092		− ·211	55 24 53·249	4·5401566,3	34686·19	6·569
		LI (Ghundi)	·091	− ·033	+ ·402		+ ·369	64 5 51·768	4·5786281,5	37899·03	7·178
			·271				− ·179	180 0 0·000			
38		XLIX (Kot Sabzal)	·101	+ ·029	− ·788		− ·759	45 42 26·150	4·5466178,2	35206·09	6·668
		LI (Ghundi)	·102	− ·017	+ ·170		+ ·153	86 5 44·761	4·6908284,5	49071·40	9·294
		LXII (Dáowála)	·102	− ·057	+ ·618		+ ·561	48 11 49·089	4·5642506,6	36664·91	6·944
			·305				− ·045	180 0 0·000			
39		LI (Ghundi)	·142	+ ·052	− ·354		− ·302	85 58 0·176	4·7780782,6	59989·91	11·362
		LXII (Dáowála)	·141	+ ·035	− ·466		− ·431	58 12 3·928	4·7085244,3	51112·18	9·680
		LIX (Máchka)	·141	− ·063	+ ·820		+ ·757	35 49 55·896	4·5466178,2	35206·09	6·668
			·424				+ ·024	180 0 0·000			

NOTE.—Stations LIX (Máchka) and LXII (Dáowála) appertain to the Great Indus Series.

No. of triangle: Circuit	No. of triangle: Non-Circuit	Number and Name of Station	Spherical Excess	Corrections to Observed Angle: Figure	Corrections to Observed Angle: Circuit	Corrections to Observed Angle: Non-Circuit	Corrections to Observed Angle: Total	Corrected Plane Angle	Distance: Log. Feet	Distance: Feet	Distance: Miles
			″	″	″	″	″	° ′ ″			
	66	XLVIII (Dewari)	·087	− ·100		− ·991	−1·091	63 42 35·372	4·5686746,6	37040·31	7·015
		LI (Ghundi)	·087	− ·035		+ ·042	+ ·007	59 11 39·490	4·5500412,9	35484·71	6·721
		L (Kubba)	·087	− ·044		+ ·949	+ ·905	57 5 45·138	4·5401566,3	34686·19	6·569
			·261				− ·179	180 0 0·000			
	67	L (Kubba)	·135	− ·010		−1·046	−1·056	71 50 13·199	4·7085244,3	51112·18	9·680
		LI (Ghundi)	·135	+ ·013		− ·260	− ·247	64 38 43·248	4·6867335,4	48610·88	9·207
		LIX (Máchka)	·135	+ ·132		+1·306	+1·438	43 31 3·553	4·5686746,6	37040·31	7·015
			·405				+ ·135	180 0 0·000			

NOTE.—Station LIX (Máchka) appertains to the Great Indus Series.

W. H. COLE,
In charge of Computing Office.

May, 1885.

EASTERN SIND MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. LATITUDES, LONGITUDES AND AZIMUTHS.

Station A				Side AB			Station B
Circuit No.	Number and Name of Station	Latitude North	Longitude East of Greenwich	Azimuth at A	Log. feet	Azimuth at B	Number and Name of Station
		° ′ ″	° ′ ″	° ′ ″		° ′ ″	
1	LXXV (Rojhra)	24 57 26·28	70 16 45·08	111 55 37·09	4·9613162,0	291 49 6·99	LXXVIII (Sandohar)
"	" "	"	"	65 7 48·01	4·8106688,9	245 3 19·54	I (Fulrár)
"	" "	"	"	172 21 14·80	5·0405528,1	352 20 7·28	V (Bhádi)
	LXXVIII (Sandohar)	25 3 3·89	70 1 22·18	336 46 28·09	4·8242059,7	156 48 28·69	I (Fulrár)
	" "	"	"	58 3 20.77	4·6899756,1	238 0 9·76	II (Chánga)
	" "	"	"	118 4 30·52	4·9273847,5	297 58 45·76	III (Patatonk)
	" "	"	"	156 30 7·15	4·9426977,8	336 27 25·28	IV (Narithal)
	" "	"	"	223 9 10·15	5·0107656,2	43 14 34·80	V (Bhádi)
	I (Fulrár)	24 52 56·48	70 6 7·90	117 34 34·16	4·8838957,4	297 29 23·31	II (Chánga)
	II (Chánga)	24 58 47·00	69 53 50·47	153 13 30·96	4·8668065,1	333 10 58·06	III (Patatonk)
	III (Patatonk)	25 9 37·71	69 47 49·63	224 17 49·01	4·7540043,7	44 20 52·99	IV (Narithal)
	IV (Narithal)	25 16 19·94	69 55 1·47	272 59 56·87	5·0220268,9	93 8 5·34	V (Bhádi)
	" "	"	"	169 4 50·68	4·9122944,5	349 3 38·26	VI (Hatodan)
	" "	"	"	218 28 58·80	4·9354085,1	38 33 9·48	VII (Rupihar)
2	V (Bhádi)	25 15 24·18	70 14 5·95	144 57 27·70	4·9507019,2	324 53 28·17	" "
"	" "	"	"	190 26 35·21	4·9614543,9	10 27 52·82	VIII (Kanakotri)
	VI (Hatodan)	25 29 34·72	69 52 12·52	280 27 4·59	4·8468162,4	100 32 28·96	VII (Rupihar)
	" "	"	"	204 25 29·73	4·8063335,8	24 27 34·63	IX (Mangtor)
	VII (Rupihar)	25 27 27·90	70 4 46·65	255 56 31·94	4·8445842,7	76 1 50·45	VIII (Kanakotri)
	" "	"	"	149 7 6·61	4·9183152,4	329 3 46·11	IX (Mangtor)

Note.—Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series.

Station A				Side AB			Station B
Circuit No.	Number and Name of Station	Latitude North	Longitude East of Greenwich	Azimuth at A	Log. Feet	Azimuth at B	Number and Name of Station
		° ′ ″	° ′ ″	° ′ ″		° ′ ″	
	VII (Rupihar)	25 27 27·90	70 4 46·65	207 12 41·34	4·8870873,0	27 15 27·54	X (Bhitala)
3	VIII (Kanakotri)	25 30 15·61	70 17 7·01	147 49 38·24	4·7853817,0	327 47 4·98	" "
	IX (Mangtor)	25 39 12·08	69 57 1·86	271 48 41·30	4·8911247,0	91 54 49·30	" "
	" "	"	"	179 0 48·89	4·8530312,6	359 0 43·05	XI (Narhar)
	" "	"	"	228 42 7·26	4·9775321,9	48 47 46·37	XII (Thakur)
4	X (Bhitala)	25 38 47·02	70 11 11·99	133 7 29·44	5·0337370,7	313 1 14·30	XI (Narhar)
"	" "	"	"	174 26 59·94	4·8158980,4	354 26 29·86	XII (Thakur)
	XI (Narhar)	25 50 58·14	69 56 48·43	276 45 51·83	4·8637805,9	96 51 37·99	" "
	" "	"	"	169 26 2·71	4·9350780,3	349 24 46·87	XIII (Jeysulmere)
	" "	"	"	216 4 50·30	4·9341767 2	36 8 53·10	XIV (Malar)
5	XII (Thakur)	25 49 32·28	70 10 2·71	164 23 6·17	4·9089662,3	344 21 21·50	" "
"	" "	"	"	221 26 33·51	4·9194465,6	41 30 56·86	XV (Badhor)
	XIII (Jeysulmere)	26 4 56·64	69 53 55·22	282 52 26·43	4·8332637,4	102 57 46·33	XIV (Malar)
	" "	"	"	221 40 59·63	4·8249501,5	41 44 34·73	XVI (Ramsar)
	XIV (Malar)	26 2 25·80	70 6 3·37	281 36 47·17	4·8944387,3	101 42 56·52	XV (Badhor)
	" "	"	"	161 26 24·93	4·8369072,0	341 24 39·19	XVI (Ramsar)
	" "	"	"	217 34 56·74	4·8740247,1	37 38 37·35	XVII (Sinaba)
6	XV (Badhor)	25 59 48·75	70 20 5·37	157 32 53·61	4·9100831,8	337 30 23·63	" "
	XVI (Ramsar)	26 13 10·75	70 2 3·26	274 54 11·91	4·8309009,3	94 59 39·28	" "
	" "	"	"	152 10 46·22	4·8501258,3	332 8 5·14	XVIII (Potanawári)
	" "	"	"	197 42 46·55	4·8810634,6	17 44 39·39	XIX (Joganali)
7	XVII (Sinaba)	26 12 12·87	70 14 24·45	150 31 59·44	4·9539220,0	330 28 23·73	" "
"	" "	"	"	192 27 1·05	4·8489289,4	12 28 15·24	XX (Kardo)
	XVIII (Potanawári)	26 23 30·96	69 55 59·78	260 3 8·22	4·7561449,8	80 7 43·06	XIX (Joganali)
	" "	"	"	205 19 42·27	4·8353292,7	25 22 6·06	XXI (Sanahu)
	XIX (Joganali)	26 25 8·18	70 6 17·78	278 52 0·05	4·7795551,0	98 56 50·96	XX (Kardo)
	" "	"	"	152 43 49·82	4·7675582,6	332 41 38·02	XXI (Sanahu)
	" "	"	"	209 48 52·73	4·7952602,9	29 51 25·20	XXII (Arrabhit)
8	XX (Kardo)	26 23 35·87	70 17 11·90	155 55 37·11	4·8420730,0	335 53 17·84	" "
	XXI (Sanahu)	26 33 43·59	70 1 22·28	267 52 52·22	4·7626542,1	87 57 37·23	" "
	" "	"	"	168 28 31·61	4·7995299,5	348 27 29·31	XXIII (Harnáo)
	" "	"	"	222 20 11·76	4·9735898,1	42 25 25·46	XXIV (Dhanono)
9	XXII (Arrabhit)	26 34 4·40	70 11 59·57	130 19 5·35	4·9651481,1	310 13 17·19	XXIII (Harnáo)
"	" "	"	"	184 45 29·64	4·8302268,6	4 45 57·42	XXIV (Dhanono)
	XXIII (Harnáo)	26 43 55·23	69 59 3·38	264 7 6·97	4·8829031,8	84 13 24·10	" "
	" "	"	"	151 19 25·99	4·8734507,3	331 16 27·24	XXV (Bándri)
	" "	"	"	211 1 20·50	4·7822645,1	31 3 55·97	XXVI (Ráviláhu)
10	XXIV (Dhanono)	26 45 12·05	70 13 1·48	134 40 31·23	4·7980561,7	314 36 48·69	" "
"	" "	"	"	185 32 38·07	4·9270438,6	5 33 18·87	XXIX (Máringra)
	XXV (Bándri)	26 54 44·36	69 52 27·24	281 27 12·76	4·8353578,7	101 32 47·90	XXVI (Ráviláhu)

Station A				Side AB			Station B
Circuit No.	Number and Name of Station	Latitude North	Longitude East of Greenwich	Azimuth at A	Log. Feet	Azimuth at B	Number and Name of Station
		° ′ ″	° ′ ″	° ′ ″		° ′ ″	
	XXV (Bándri)	26 54 44·36	69 52 27·24	161 7 35·95	4·8315765,0	341 5 45·68	XXVII (Máhu)
	„ „	„	„	231 18 8·37	4·8450561,7	51 22 42·40	XXVIII (Girája)
	XXVI (Rávilláhu)	26 52 29·21	70 4 48·15	167 50 16·99	4·7685622,2	347 49 15·00	„ „
	„ „	„	„	232 49 29·40	4·8212126,4	52 53 53·72	XXIX (Máringra)
	XXVII (Máhu)	27 5 20·19	69 48 24·36	284 55 5·81	4·8990445,9	105 1 31·16	XXVIII (Girája)
	„ „	„	„	233 44 59·93	4·9272107,8	53 50 44·81	XXX (Singra)
	XXVIII (Girája)	27 1 57·40	70 2 31·40	284 53 2·80	4·8288055,6	104 58 29·94	XXIX (Máringra)
	„ „	„	„	173 18 52·94	4·8506972,9	353 18 11·24	XXX (Singra)
	„ „	„	„	228 41 23·13	4·8965140,6	48 46 21·76	XXXI (Asu)
11	XXIX (Máringra)	26 59 5·37	70 14 31·76	175 10 6·29	4·8425614,0	355 9 36·74	„ „
	XXX (Singra)	27 13 34·87	70 0 59·95	285 15 19·59	4·8445434,0	105 21 1·01	„ „
	„ „	„	„	167 55 30·06	4·7562481,6	347 54 29·32	XXXII (Bitri)
	„ „	„	„	217 30 41·54	4·8144244,5	37 34 3·60	XXXIII (Parethal)
12	XXXI (Asu)	27 10 32·14	70 13 26·85	158 31 21·04	4·8774718,9	338 29 0·68	„ „
„	„ „	„	„	201 37 33·14	4·9775848,7	21 40 31·28	XXXIV (Kolu)
	XXXII (Bitri)	27 22 47·33	69 58 47·55	274 27 47·37	4·7144157,0	94 32 10·83	XXXIII (Parethal)
	„ „	„	„	167 4 47·73	4·8546230,9	347 3 25·70	XXXV (Chauki)
	„ „	„	„	220 13 43·98	4·8990669,7	40 18 6·28	XXXVI (Kháro)
13	XXXIII (Parethal)	27 22 7·08	70 8 20·54	253 50 2·55	4·8141024,0	73 55 22·21	XXXIV (Kolu)
„	„ „	„	„	179 39 47·19	4·8098816,6	359 39 45·24	XXXVI (Kháro)
	XXXIV (Kolu)	27 25 6·31	70 19 55·29	126 28 9·05	4·8933571,5	306 22 46·50	„ „
	„ „	„	„	165 22 9·38	4·8031682,7	345 20 46·98	XXXVII (Morgich)
	XXXV (Chauki)	27 34 17·96	69 55 49·75	277 47 45·00	4·8313570,1	97 53 30·41	XXXVI (Kháro)
	„ „	„	„	233 15 50·43	4·9149085,4	53 21 30·50	XXXVIII (Trisingh)
	„ „	„	„	121 41 28·75	4·9233583,3	301 35 20·72	XXXIX (Thar Muhári)
	„ „	„	„	165 27 5·41	4·8632235,3	345 25 30·63	XL (Kiraríwáro)
14	XXXVI (Kháro)	27 32 46·30	70 8 16·32	252 9 32·65	4·6919358,5	72 13 33·54	XXXVII (Morgich)
„	„ „	„	„	178 48 29·00	4·7662962,0	358 48 22·74	XXXVIII (Trisingh)
	XXXVII (Morgich)	27 35 15·29	70 16 56·85	132 5 33·18	4·8107520,6	312 1 25·37	„ „
15	XXXVIII (Trisingh)	27 42 24·35	70 8 2·81	104 23 56·59	4·9390613,9	284 16 40·43	XL (Kiraríwáro)
„	„ „	„	„	156 9 11·87	4·9074047,9	336 6 21·98	XLIII (Núrpír)
	XXXIX (Thar Muhári)	27 41 33·40	69 42 36·23	243 14 6·47	4·7730187,1	63 18 40·72	XL (Kiraríwáro)
	„ „	„	„	196 46 29·12	4·7894476,9	16 48 1·40	XLI (Mári)
	XL (Kiraríwáro)	27 45 57·48	69 52 25·64	132 36 14·84	4·6787272,4	312 33 12·24	„ „
	„ „	„	„	173 23 46·40	4·7210583,2	353 23 14·91	XLII (Yáru)
	„ „	„	„	224 26 59·08	4·8656989,4	44 31 26·66	XLIII (Núrpír)
	XLI (Mári)	27 51 17·24	69 45 54·26	235 29 16·30	4·5473431,5	55 31 47·79	XLII (Yáru)
	XLII (Yáru)	27 54 34·99	69 51 18·20	269 51 11·54	4·7593005,6	89 56 11·33	XLIII (Núrpír)
	„ „	„	„	191 23 8·07	4·6644730,1	11 23 55·80	XLIV (Vijnot)
	„ „	„	„	230 46 56·01	4·8751873,0	50 52 0·31	XLV (Longwáli)

Station A				Side AB			Station B
Circuit No.	Number and Name of Station	Latitude North	Longitude East of Greenwich	Azimuth at A	Log. Feet	Azimuth at B	Number and Name of Station
		° ′ ″	° ′ ″	° ′ ″		° ′ ″	
16	XLIII (Núrpír)	27 54 36·03	70 1 58·65	133 7 2·06	4·8203681,0	313 2 49·39	XLIV (Vijnot)
"	" "	"	"	180 53 50·35	4·6747832,2	0 53 54·23	XLV (Longwáli)
	XLIV (Vijnot)	28 2 3·30	69 52 59·95	267 29 18·59	4·6906722,2	87 33 35·69	" "
	" "	"	"	221 12 50·72	4·5604538,0	41 14 56·58	XLVI (Vín)
	" "	"	"	159 35 11·30	4·6766103,8	339 33 44·14	XLVIII (Dewari)
17	XLV (Longwáli)	28 2 24·28	70 2 6·92	135 13 20·42	4·5506311,3	315 11 8·88	XLVI (Vín)
"	" "	"	"	185 59 13·88	4·5659585,8	5 59 34·07	XLVII (Got Mír Muhammad)
18	XLVI (Vín)	28 6 33·96	69 57 27·40	248 26 17·72	4·4918011,5	68 28 50·71	" "
"	" "	"	"	113 0 0·95	4·6434435,6	292 56 27·57	XLVIII (Dewari)
"	" "	"	"	167 51 24·71	4·5709869,6	347 50 43·39	XLIX (Kot Sabzal)
	XLVII (Got Mír Muhammad)	28 8 26·79	70 2 49·81	124 18 39·52	4·6473891,2	304 15 24·94	" "
	XLVIII (Dewari)	28 9 24·00	69 49 54·87	239 28 47·68	4·5786281,5	59 31 40·05	" "
	" "	"	"	115 16 57·14	4·5500412,9	295 14 7·79	L (Kubba)
	" "	"	"	178 59 32·60	4·5401566,3	358 59 29·38	LI (Ghundi)
19	XLIX (Kot Sabzal)	28 12 34·44	69 55 59·83	114 56 33·38	4·5642506,6	294 53 37·52	" "
"	" "	"	"	160 38 59·64	4·6908284,5	340 37 33·44	LXII (Dáowála)
	L (Kubba)	28 11 53·93	69 43 56·23	238 8 22·57	4·5686746,6	58 11 8·96	LI (Ghundi)
	" "	"	"	166 18 9·23	4·6867335,4	346 17 8·23	LIX (Máchka)
	LI (Ghundi)	28 15 7·41	69 49 48·05	122 49 52·34	4·7085244,3	302 46 4·55	" "
	" "	"	"	208 47 52·66	4·5466178,2	28 49 22·63	LXII (Dáowála)
	LIX (Máchka)	28 19 41·57	69 41 47·41	266 56 8·51	4·7780782,6	87 1 26·70	" "
	LXII (Dáowála)	28 20 12·87	69 52 57·86				

Note.—Stations LIX (Máchka) and LXII (Dáowála) appertain to the Great Indus Series.

W. H. COLE,
In charge of Computing Office.

June, 1885.

EASTERN SIND MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. HEIGHTS ABOVE MEAN SEA LEVEL.

The following table gives, first, the usual data of the observed vertical angles and the heights of the signal and instrument, &c., in pairs of horizontal lines, the first line of which gives the data for the 1st or the fixed station, and the second line the data for the 2nd or the deduced station. This is followed by the arc contained between the two stations, and then by the terrestrial refraction, and the height of the 2nd station above or below the 1st, as computed from the vertical angles in the usual manner. This difference of height applied to the given height above mean sea level of the fixed station, gives that of the deduced station. Usually there are two or three independent values of the height of the deduced station; the details are so arranged as to show these consecutively and their mean in the columns of "Trigonometrical Results." The mean results thus obtained are however liable to receive corrections for the errors generated in the trigonometrical operations, which are shown up by the spirit leveling operations, whenever a junction between the two has been effected. The spirit leveled determinations, when available, are always accepted as final, and the trigonometrical heights of stations, lying between other stations fixed by the leveling operations, are adjusted—usually by simple proportion—to accord with the latter.

The heights of Eastern Sind Meridional Series have been adjusted between the values of Rojhra H.S. and Sandohar H.S. of the Karáchi Longitudinal Series, and those of Máchka T.S. and Dáowála T.S. of the Great Indus Series as finally determined in connection with the general reduction of the North-West Quadrilateral. The fixed heights are as follows :—

LXXV	(Rojhra)	... 518	feet above Mean Sea Level at Karáchi from Karáchi Longitudinal Series.
LXXVIII	(Sandohar)	... 408	
LIX	(Máchka)	... 273	" " from Great Indus Series.
LXII	(Dáowála)	... 282	

The trigonometrical heights always refer to the upper mark-stone, or to the upper surface of the pillar on which the theodolite stood. When the pillar of the station is perforated, the height given in the last column, is that between the upper surface of pillar and ground level mark-stone in floor of passage; otherwise it is the approximate height of the structure above the ground at the base of the station.

Astronomical Date 1876		Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
		h. m.		° ′ ″				″							feet
Nov.	26	2 24	LXXV (Rojhra)	D 0 7 10·9	12	2·5	5·3	638	32	·050	− 41·9	476·1			
Dec.	4,5	2 25	I (Fulrár)	D 0 2 42·8	16	2·7	5·3						475·4	475	0†
"	1	2 16	LXXVIII (Sandohar)	D 0 1 30·9	12	2·6	5·3	659	41	·062	+ 66·7	474·7			
"	5	2 20	I (Fulrár)	D 0 8 23·0	12	2·8	5·3								
Nov.	30	2 18	LXXVIII (Sandohar)	D 0 7 42·9	12	2·6	5·3	484	33	·068	− 57·2	350·8			
Dec.	7	2 22	II (Chánga)	E 0 0 20·1	12	2·7	5·3						351·2	351	0†

NOTE.—Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series.
† The pillar is sunk having its upper surface flush with the ground.

Astronomical Date 1876		Astronomical Date: Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
		h. m.		° ′ ″				″							feet
Dec.	4	2 45	I (Fulrár)	D 0 11 15·4	12	2·6	5·3	756	43	·057	−123·8	351·6			
„	7	2 43	II (Chánga)	D 0 0 8·4	12	2·6	5·3								
Nov.	30	2 34	LXXVIII (Sandohar)	D 0 9 45·6	12	2·8	5·3	836	53	·063	− 87·9	320·1			
Dec.	10	2 34	III (Patatonk)	D 0 2 37·4	12	2·7	5·3						320·4	320	o†
„	7	2 31	II (Chánga)	D 0 6 54·0	12	2·8	5·3	727	42	·058	− 30·4	320·8			
„	10	2 31	III (Patatonk)	D 0 4 4·0	12	2·6	5·3								
Nov.	30	2 54	LXXVIII (Sandohar)	D 0 9 44·2	12	2·6	5·3	866	50	·058	− 82·8	325·2			
Dec.	12	2 35	IV (Narithal)	D 0 3 13·9	12	2·7	5·3								
„	10	2 42	III (Patatonk)	D 0 3 58·7	12	2·6	5·3	561	30	·053	+ 6·2	326·6	326·4	326	o†
„	12, 13	2 43	IV (Narithal)	D 0 4 43·4	16	2·6	5·3								
„	21	2 12	V (Bhádi)	D 0 12 11·4	12	2·6	5·3	1040	62	·060	−136·6	327·3			
„	13	2 11	IV (Narithal)	D 0 3 15·5	12	2·6	5·3								
Nov.	22	2 35	LXXV (Rojhra)	D 0 9 23·9	12	2·6	5·3	1084	76	·070	− 49·5	468·5			
Dec.	20	2 35	V (Bhádi)	D 0 6 17·5	12	2·7	5·3								
Nov.	30	3 13	LXXVIII (Sandohar)	D 0 5 51·6	12	2·6	5·3	1013	58	·057	+ 51·2	459·2	463·4	463	o†
Dec.	20	3 13	V (Bhádi)	D 0 9 16·1	12	3·3	5·3								
„	13	2 11	IV (Narithal)	D 0 3 15·5	12	2·6	5·3	1040	62	·060	+136·6	462·5			
„	21	2 12	V (Bhádi)	D 0 12 11·4	12	2·6	5·3								
„	13	2 52	IV (Narithal)	D 0 6 10·3	12	2·6	5·3	851	50	·059	+ 5·6	332·0			
„	26, 27	2 52	VII (Rupihar)	D 0 6 36·9	12	2·6	5·3						330·8	330	o†
„	20, 21	2 33	V (Bhádi)	D 0 11 43·1	16	2·7	5·3	882	53	·060	−133·8	329·6			
„	26, 27	2 36	VII (Rupihar)	D 0 1 24·7	12	2·7	5·3								
„	12	3 7	IV (Narithal)	D 0 7 11·9	12	2·6	5·3	807	45	·056	− 26·0	300·4			
„	30	2 42	VI (Hatodan)	D 0 5 0·6	12	2·6	5·3						299·7	299	o†
„	26, 27	2 22	VII (Rupihar)	D 0 6 43·4	12	2·6	5·3	694	46	·066	− 31·9	298·9			
„	30	2 23	VI (Hatodan)	D 0 3 35·5	12	2·7	5·3								
„	20	2 55	V (Bhádi)	D 0 7 1·4	12	2·6	5·3	904	57	·063	− 9·1	454·3			
„	24	2 54	VIII (Kanakotri)	D 0 6 19·8	12	2·7	5·3						454·7	454	o†
„	26, 27	2 53	VII (Rupihar)	E 0 0 56·5	12	2·6	5·3	691	44	·064	+124·2	455·0			
„	24	2 53	VIII (Kanakotri)	D 0 11 15·8	12	2·7	5·3								
1876-77															
Dec.	30, 31	2 45	VI (Hatodan)	D 0 5 10·3	12	2·7	5·3	633	40	·063	− 7·7	292·0			
Jan.	4, 5	2 45	IX (Mangtor)	D 0 4 21·4	12	2·6	5·3								
Dec.	26, 27	2 17	VII (Rupihar)	D 0 7 49·4	12	2·7	5·3	818	49	·060	− 41·3	289·5	290·8	290	o†
Jan.	3, 4	2 17	IX (Mangtor)	D 0 4 23·7	12	2·7	5·3								

NOTE.—Stations LXXV (Rojhra) and LXXVIII (Sandohar) appertain to the Karáchi Longitudinal Series.
† The pillar is sunk having its upper surface flush with the ground.

Astronomical Date 1877	Astronomical Date: Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Jan. 7, 8, 9	2 36	X (Bhitala)	D 0 8 51·5	12	2·6	5·3	769	50	·065	− 71·5	291·0			
„ 5	2 36	IX (Mangtor)	D 0 2 31·7	12	2·7	5·3								
1876-77 Dec. 26, 27	2 46	VII (Rupihar)	D 0 4 21·3	12	2·6	5·3	762	42	·055	+ 31·9	362·7			
Jan. 8, 9	2 47	X (Bhitala)	D 0 7 11·3	16	2·8	5·3								
Dec. 24	2 40	VIII (Kanakotri)	D 0 9 46·7	12	2·6	5·3	602	35	·058	− 92·3	362·4	362·5	362	0†
Jan. 7, 9	2 40	X (Bhitala)	E 0 0 37·2	12	2·6	5·3								
1877 Jan. 5	2 36	IX (Mangtor)	D 0 2 31·7	12	2·7	5·3	769	50	·065	+ 71·5	362·3			
„ 7, 8, 9	2 36	X (Bhitala)	D 0 8 51·5	12	2·6	5·3								
„ 4, 5	2 36	IX (Mangtor)	D 0 6 18·3	12	2·7	5·3	704	34	·048	− 18·3	272·5			
„ 17, 18	2 36	XI (Narhar)	D 0 4 33·0	12	2·6	5·3								
„ 8, 9	2 31	X (Bhitala)	D 0 10 53·8	16	2·7	5·3	1068	54	·051	− 88·7	273·8	272·8	272	0†
„ 17, 18	2 35	XI (Narhar)	D 0 5 15·9	12	2·6	5·3								
„ 12, 13	2 44	XII (Thakur)	D 0 9 0·5	12	2·7	5·3	722	42	·058	− 75·8	272·1			
„ 17	2 41	XI (Narhar)	D 0 1 52·1	12	2·8	5·3								
„ 4, 5	3 1	IX (Mangtor)	D 0 4 52·2	16	2·7	5·3	938	58	·062	+ 57·4	348·2			
„ 12, 13	3 2	XII (Thakur)	D 0 9 1·9	16	2·6	5·3								
„ 8, 9	2 33	X (Bhitala)	D 0 5 38·6	12	2·7	5·3	647	41	·063	− 14·8	347·7	348·3	348	0†
„ 12, 13	2 33	XII (Thakur)	D 0 4 5·8	12	2·6	5·3								
„ 17	2 41	XI (Narhar)	D 0 1 52·1	12	2·8	5·3	722	42	·058	+ 75·8	348·9			
„ 12, 13	2 44	XII (Thakur)	D 0 9 0·5	12	2·7	5·3								
„ 17, 18	2 55	XI (Narhar)	D 0 4 34·6	12	2·6	5·3	849	25	·029	+ 55·4	328·2			
„ 26, 28	2 55	XIV (Malar)	D 0 9 0·3	12	2·6	5·3						328·8	328	0†
„ 12, 13	2 44	XII (Thakur)	D 0 6 51·9	12	2·6	5·3	801	44	·055	− 19·0	329·3			
„ 26, 27	2 44	XIV (Malar)	D 0 5 15·1	12	2·6	5·3								
„ 17, 18, 19	2 39	XI (Narhar)	D 0 4 57·1	16	2·8	5·3	851	38	·045	+ 40·4	313·2			
„ 22	2 39	XIII (Jeysulmere)	D 0 8 11·3	16	2·6	5·3						313·4	313	0†
„ 26, 27, 28	2 25	XIV (Malar)	D 0 5 50·4	16	2·7	5·3	673	40	·059	− 15·1	313·7			
„ 22	2 24	XIII (Jeysulmere)	D 0 4 19·9	12	2·6	5·3								
„ 13, 15	2 23	XII (Thakur)	D 0 0 37·1	16	2·6	5·3	821	37	·045	+ 138·4	486·7			
Feb. 4	2 37	XV (Badhor)	D 0 12 4·5	12	2·6	5·3						485·5	485	0†
Jan. 26, 27, 30	2 40	XIV (Malar)	E 0 1 1·5	16	2·6	5·3	775	48	·062	+ 155·6	484·4			
Feb. 8	2 40	XV (Badhor)	D 0 12 36·2	16	2·8	5·3								
Jan. 22	2 34	XIII (Jeysulmere)	D 0 4 29·5	12	2·7	5·3	660	33	·050	+ 11·5	324·9			
Feb. 10, 11	2 34	XVI (Ramsar)	D 0 5 41·1	12	2·6	5·3								

† The pillar is sunk having its upper surface flush with the ground.

Astronomical Date 1877	Astronomical Date: Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station – 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Jan. 25, 26, 27	2 32	XIV (Malar)	D 0 5 31·1	12	2·7	5·3	679	30	·044	− 4·5	324·3	324·5	324	0†
Feb. 10, 11	2 32	XVI (Ramsar)	D 0 5 3·3	12	2·8	5·3								
„ 7, 8	2 42	XVII (Sinaba)	D 0 9 24·4	12	2·8	5·3	669	37	·055	− 84·9	324·2			
„ 10, 11	2 41	XVI (Ramsar)	D 0 0 48·2	12	2·6	5·3								
Jan. 25, 26, 27, 28	2 56	XIV (Malar)	D 0 2 12·2	20	2·6	5·3	739	28	·038	+ 78·9	407·7			
Feb. 7, 8	2 49	XVII (Sinaba)	D 0 9 26·8	16	2·8	5·3								
„ 8	2 51	XV (Badhor)	D 0 9 18·8	12	2·6	5·3	803	40	·050	− 75·0	410·5	409·2	408	0†
„ 7, 8	2 48	XVII (Sinaba)	D 0 2 58·2	12	2·6	5·3								
„ 10, 11	2 41	XVI (Ramsar)	D 0 0 48·2	12	2·6	5·3	669	37	·055	+ 84·9	409·5			
„ 7, 8	2 42	XVII (Sinaba)	D 0 9 24·4	12	2·8	5·3								
„ 10, 11	2 45	XVI (Ramsar)	D 0 2 53·6	16	5·9	5·3	751	21	·028	+ 66·3	390·8			
„ 17, 18	2 45	XIX (Joganali)	D 0 8 53·7	16	5·7	5·3						390·2	389	0†
„ 7, 8	2 39	XVII (Sinaba)	D 0 7 34·7	16	2·7	5·3	888	40	·045	− 19·7	389·5			
„ 17, 18	2 39	XIX (Joganali)	D 0 6 4·9	16	2·6	5·3								
„ 10, 11	2 59	XVI (Ramsar)	D 0 5 38·6	12	2·7	5·3	699	33	·047	− 5·0	319·5			
„ 14	2 58	XVIII (Potanawári)	D 0 5 8·8	12	2·8	5·3						319·0	318	0†
„ 17	2 27	XIX (Joganali)	D 0 8 42·7	12	2·7	5·3	563	27	·048	− 71·6	318·6			
„ 14	2 26	XVIII (Potanawári)	D 0 0 4·6	12	2·7	5·3								
„ 7, 8	2 45	XVII (Sinaba)	D 0 1 34·5	12	2·6	5·3	698	36	·052	+ 77·7	486·9			
„ 22	2 47	XX (Kardo)	D 0 9 8·3	12	2·6	5·3						486·8	486	0†
„ 18	2 48	XIX (Joganali)	E 0 0 59·6	12	2·6	5·3	595	36	·061	+ 96·4	486·6			
„ 22	2 49	XX (Kardo)	D 0 10 0·6	12	2·7	5·3								
„ 14	2 49	XVIII (Potanawári)	D 0 4 28·4	16	2·6	5·3	676	19	·028	+ 19·4	338·4			
„ 27	2 50	XXI (Sanahu)	D 0 6 25·0	16	2·7	5·3								
„ 18	2 43	XIX (Joganali)	D 0 7 24·7	12	2·6	5·3	578	28	·050	− 49·4	340·8	339·5	338	0†
„ 27	2 43	XXI (Sanahu)	D 0 1 36·4	12	2·7	5·3								
„ 24	2 58	XXII (Arrabhit)	D 0 9 31·0	12	2·8	5·3	572	21	·037	− 83·6	339·2			
„ 27	2 59	XXI (Sanahu)	E 0 0 23·9	12	2·6	5·3								
„ 17	3 14	XIX (Joganali)	D 0 3 10·2	12	2·6	5·3	617	21	·034	+ 32·5	422·7			
„ 24	3 15	XXII (Arrabhit)	D 0 6 44·4	12	2·7	5·3								
„ 22	2 18	XX (Kardo)	D 0 8 31·6	12	2·6	5·3	687	30	·044	− 63·8	423·0	423·0	422	0†
„ 24	2 18	XXII (Arrabhit)	D 0 2 12·9	12	2·6	5·3								
„ 27	2 59	XXI (Sanahu)	E 0 0 23·9	12	2·6	5·3	572	21	·037	+ 83·6	423·2			
„ 24	2 58	XXII (Arrabhit)	D 0 9 31·0	12	2·8	5·3								

† The pillar is sunk having its upper surface flush with the ground.

Astronomical Date 1877	Astronomical Date: Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Feb. 27	2 13	XXI (Sanahu)	D 0 4 1·4	12	2·6	5·3	623	20	·032	+ 18·2	357·7			
Mar. 4	2 39	XXIII (Harnáo)	D 0 5 59·6	12	2·7	5·3								
Feb. 25	2 40	XXII (Arrabhit)	D 0 9 41·3	12	5·4	5·3	912	22	·024	− 65·9	357·1	356·9	356	0†
Mar. 3, 4	2 45	XXIII (Harnáo)	D 0 4 47·0	16	5·4	5·3								
„ 15	3 2	XXIV (Dhanono)	D 0 9 26·5	12	2·6	5·3	754	35	·046	− 80·7	355·8			
„ 3	3 1	XXIII (Harnáo)	D 0 2 10·6	12	2·6	5·3								
„ 1	2 23	XXI (Sanahu)	D 0 4 6·2	12	2·6	5·3	930	8	·009	+ 98·8	438·3			
„ 15	2 23	XXIV (Dhanono)	D 0 11 12·0	12	5·9	5·3								
Feb. 24	2 41	XXII (Arrabhit)	D 0 5 0·0	12	2·6	5·3	668	6	·009	+ 11·7	434·7	437·0	436	0†
Mar. 15	2 45	XXIV (Dhanono)	D 0 6 11·5	12	2·6	5·3								
„ 3	3 1	XXIII (Harnáo)	D 0 2 10·6	12	2·6	5·3	754	35	·046	+ 80·7	438·1			
„ 15	3 2	XXIV (Dhanono)	D 0 9 26·5	12	2·6	5·3								
„ 3	2 48	XXIII (Harnáo)	D 0 3 9·8	12	2·7	5·3	598	20	·033	+ 28·6	385·5			
„ 10	2 48	XXVI (Ráviláhu)	D 0 6 25·5	12	2·6	5·3						385·4	384	0†
„ 15	2 35	XXIV (Dhanono)	D 0 7 48·5	12	2·7	5·3	621	21	·034	− 51·7	385·3			
„ 10	2 32	XXVI (Ráviláhu)	D 0 2 9·4	12	2·6	5·3								
„ 3	3 15	XXIII (Harnáo)	D 0 7 17·5	12	2·6	5·3	738	30	·041	− 32·8	324·1			
„ 7	3 15	XXV (Bándri)	D 0 4 16·6	12	2·6	5·3						324·1	323	0†
(1)	3 1	XXVI (Ráviláhu)	D 0 8 15·6	8	2·6	5·3	676	35	·052	− 61·3	324·1			
(2)	3 1	XXV (Bándri)	D 0 2 6·0	12	2·6	5·3								
1877 Mar. 15	2 40	XXIV (Dhanono)	D 0 5 34·3	16	2·6	5·3	835	24	·029	+ 27·6	464·6			
1880 Feb. 12, 13	2 56	XXIX (Máringra)	D 0 7 48·6	16	2·7	5·3						465·9	465	0†
(3)	2 58	XXVI (Ráviláhu)	D 0 0 52·6	24	2·0	5·3	655	31	·047	+ 81·7	467·1			
1880 Feb. 12	3 0	XXIX (Máringra)	D 0 9 19·3	12	2·6	5·3								
Jan. 30, 31	2 53	XXV (Bándri)	D 0 3 8·1	12	2·7	5·3	692	30	·043	+ 45·9	370·0			
Feb. 8	2 54	XXVIII (Girája)	D 0 7 39·1	12	2·6	5·3								
Jan. 27, 28	2 30	XXVI (Ráviláhu)	D 0 5 27·6	12	2·7	5·3	580	28	·048	− 16·0	369·4	369·7	368	0†
Feb. 8	2 30	XXVIII (Girája)	D 0 3 35·6	12	2·6	5·3								
„ 12, 13	3 1	XXIX (Máringra)	D 0 10 6·5	12	2·6	5·3	666	29	·044	− 96·3	369·6			
„ 8	3 0	XXVIII (Girája)	D 0 0 16·9	12	2·7	5·3								
Jan. 30, 31	2 38	XXV (Bándri)	D 0 5 8·7	12	2·5	5·3	670	30	·045	+ 1·7	325·8			
Feb. 2, 4	2 38	XXVII (Máhu)	D 0 5 18·2	12	2·6	5·3						325·1	324	0†
„ 8	2 49	XXVIII (Girája)	D 0 8 0·2	12	2·6	5·3	783	37	·047	− 45·3	324·4			
„ 2	2 48	XXVII (Máhu)	D 0 4 3·9	12	2·7	5·3								

† The pillar is sunk having its upper surface flush with the ground. (1). The mean of observations taken on 10th March 1877 and 27th January 1880. (2). The mean of observations taken on 7th March 1877 and 30th, 31st January 1880. (3). The mean of observations taken on 11th March 1877 and 27th, 28th January 1880.

Astronomical Date 1880		Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
		h. m.		° ′ ″				″							feet
Feb.	2	2 5	XXVII (Máhu)	D 0 3 46·6	12	2·6	5·3	835	40	·048	+ 65·1	390·2			
„	24	2 4	XXX (Singra)	D 0 9 4·0	12	2·6	5·3								
„	8	2 55	XXVIII (Girája)	D 0 4 26·8	12	2·6	5·3	700	28	·040	+ 21·9	391·6	390·9	389	o†
„	24	2 55	XXX (Singra)	D 0 6 34·0	12	2·6	5·3								
„	18, 19	2 31	XXXI (Asu)	D 0 9 37·0	12	2·6	5·3	690	41	·059	− 89·7	390·9			
„	24	2 31	XXX (Singra)	D 0 0 47·3	12	2·7	5·3								
„	8	2 59	XXVIII (Girája)	D 0 1 14·1	12	2·7	5·3	778	33	·042	+110·4	480·1			
„	18	3 0	XXXI (Asu)	D 0 10 52·4	12	2·6	5·3								
„	13	2 39	XXIX (Máringra)	D 0 4 40·4	12	2·7	5·3	687	25	·036	+ 15·3	481·2	480·6	479	o†
„	19, 20	2 45	XXXI (Asu)	D 0 6 11·0	12	2·7	5·3								
„	24	2 31	XXX (Singra)	D 0 0 47·3	12	2·7	5·3	690	41	·059	+ 89·7	480·6			
„	18, 19	2 31	XXXI (Asu)	D 0 9 37·0	12	2·6	5·3								
„	24	2 33	XXX (Singra)	D 0 2 21·8	12	2·7	5·3	644	18	·028	+ 54·0	444·9			
Mar.	1	2 34	XXXIII (Parethal)	D 0 8 4·2	12	2·5	5·3						443·7	442	o†
Feb.	18, 20	2 11	XXXI (Asu)	D 0 7 31·7	12	2·7	5·3	745	32	·043	− 38·1	442·5			
Mar.	1, 2	2 13	XXXIII (Parethal)	D 0 4 3·4	12	2·7	5·3								
Feb.	24	2 34	XXX (Singra)	D 0 5 50·2	12	2·6	5·3	563	23	·041	− 22·6	368·3			
„	27	2 34	XXXII (Bitri)	D 0 3 7·0	12	2·6	5·3						368·7	367	o†
Mar.	1	1 59	XXXIII (Parethal)	D 0 9 0·3	12	2·6	5·3	512	23	·045	− 74·6	369·1			
Feb.	27	1 58	XXXII (Bitri)	E 0 0 52·8	12	2·5	5·3								
„	18, 20, 21	2 30	XXXI (Asu)	D 0 8 44·0	16	2·7	5·3	938	−7	·007	− 19·9	460·7			
Mar.	4	2 31	XXXIV (Kolu)	D 0 7 17·0	12	2·8	5·3						461·0	459	o†
„	1	2 43	XXXIII (Parethal)	D 0 4 8·4	12	2·7	5·3	644	27	·042	+ 17·6	461·3			
„	4	2 44	XXXIV (Kolu)	D 0 6 0·3	12	2·6	5·3								
Feb.	27	1 41	XXXII (Bitri)	D 0 3 1·8	12	2·7	5·3	783	27	·034	+ 73·1	441·8			
Mar.	9, 10	1 41	XXXVI (Kháro)	D 0 9 22·6	12	2·6	5·3								
„	1	2 10	XXXIII (Parethal)	D 0 5 15·2	12	2·7	5·3	637	24	·038	− 3·7	440·0	440·0	438	o†
„	8, 9	2 12	XXXVI (Kháro)	D 0 4 52·2	12	2·5	5·3								
„	4	1 57	XXXIV (Kolu)	D 0 7 4·0	12	2·7	5·3	773	30	·039	− 22·8	438·2			
„	9, 10	1 58	XXXVI (Kháro)	D 0 5 4·0	12	2·7	5·3								
„	4	2 51	XXXIV (Kolu)	D 0 4 29·3	12	2·7	5·3	628	10	·016	+ 13·1	474·1			
„	6	2 51	XXXVII (Morgich)	D 0 5 53·7	12	2·8	5·3						475·1	473	o†
„	9, 10	1 54	XXXVI (Kháro)	D 0 1 34·9	12	2·7	5·3	486	7	·014	+ 36·1	476·1			
„	6	1 53	XXXVII (Morgich)	D 0 6 37·2	12	2·7	5·3								

† The pillar is sunk having its upper surface flush with the ground.

Astronomical Date 1880	Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Feb. 27	1 21	XXXII (Bitri)	D 0 6 30·9	12	2·6	5·3	707	19	·027	− 16·8	351·9			
Mar. 15	1 21	XXXV (Chauki)	D 0 4 54·4	12	2·6	5·3								
„ 8	2 30	XXXVI (Kháro)	D 0 10 2·7	12	2·6	5·3	670	11	·016	− 89·1	350·9	350·1	348	0†
„ 15	2 29	XXXV (Chauki)	D 0 1 0·9	12	2·6	5·3								
„ 13	4 23	XXXVIII (Trisingh)	D 0 9 26·1	12	5·5	5·3	812	34	·042	− 77·9	347·6			
„ 15	4 24	XXXV (Chauki)	D 0 2 55·8	12	5·4	5·3								
„ 15	4 24	XXXV (Chauki)	D 0 2 55·8	12	5·4	5·3	812	34	·042	+ 77·9	429·3			
„ 13	4 23	XXXVIII (Trisingh)	D 0 9 26·1	12	5·5	5·3								
„ 8	2 47	XXXVI (Kháro)	D 0 5 26·2	12	2·6	5·3	577	19	·033	− 13·0	427·0	426·8	425	0†
„ 11	2 47	XXXVIII (Trisingh)	D 0 3 54·6	12	2·6	5·3								
„ 6	1 25	XXXVII (Morgich)	D 0 7 55·4	12	2·6	5·3	639	17	·027	− 51·1	424·0			
„ 12, 13	1 41	XXXVIII (Trisingh)	D 0 2 29·0	12	2·7	5·3								
Dec. 9, 10, 11	1 37	XXXV (Chauki)	D 0 7 51·2	12	2·5	5·2	721	20	·028	− 43·4	306·7			
„ 15, 16	1 39	XL (Kiraríwáro)	D 0 3 24·8	8	9·8	5·2								
„ 17, 18, 19	1 28	XXXVIII (Trisingh)	D 0 11 32·4	16	2·5	5·2	858	33	·038	−121·8	305·0	305·9	304	0†
„ 14, 15, 16	1 27	XL (Kiraríwáro)	D 0 1 54·0	12	2·5	5·2								
„ 9, 10, 11	1 27	XXXV (Chauki)	D 0 7 59·6	12	2·5	5·2	828	33	·040	− 37·2	312·9			
„ 6, 7, 8	1 27	XXXIX (Thar Muhári)	D 0 4 56·5	12	2·5	5·2								
„ 12, 13, 15, 16	1 20	XL (Kiraríwáro)	D 0 4 12·0	16	2·5	5·2	586	22	·038	+ 8·4	314·3	313·6	312	0†
„ 6, 7, 8	1 19	XXXIX (Thar Muhári)	D 0 5 10·6	12	2·5	5·2								
„ 6, 7, 8	1 10	XXXIX (Thar Muhári)	D 0 6 26·4	12	2·5	5·2	608	20	·033	− 27·8	285·8			
„ 2, 4, 5	1 11	XLI (Mári)	D 0 3 20·3	12	2·5	5·2								
„ 13, 15, 16	1 37	XL (Kiraríwáro)	D 0 5 16·2	12	2·5	5·2	471	15	·032	− 19·2	286·7	286·2	284	0†
„ 2, 4, 5	1 36	XLI (Mári)	D 0 2 30·7	12	2·5	5·2								
„ 12, 13, 14, 15, 16	1 16	XL (Kiraríwáro)	D 0 5 2·0	20	6·1	5·2	519	4	·008	− 12·6	293·3			
„ 25, 26, 27, 28	1 15	XLII (Yáru)	D 0 3 51·4	16	2·4	8·6								
„ 2, 4, 5	1 23	XLI (Mári)	D 0 2 17·1	12	6·1	5·2	348	2	·006	+ 5·1	291·3	291·8	290	0†
„ 25, 26, 27, 28	1 22	XLII (Yáru)	D 0 3 57·7	16	2·5	8·6								
„ 21, 22, 23, 24	1 12	XLIII (Núrpír)	D 0 7 39·3	16	7·4	5·2	567	23	·041	− 57·6	290·9			
„ 25, 26, 27, 28	1 12	XLII (Yáru)	D 0 0 57·1	16	7·7	8·6								
„ 17, 18, 19	1 20	XXXVIII (Trisingh)	D 0 9 31·1	12	2·5	5·2	798	36	·045	− 78·5	348·3			
„ 21, 22, 23, 24	1 27	XLIII (Núrpír)	D 0 2 41·1	16	6·0	5·2								
„ 13, 15, 16	1 36	XL (Kiraríwáro)	D 0 3 49·0	12	2·5	5·2	725	22	·030	+ 42·7	348·6	348·9	347	0†
„ 21, 22, 23, 24	1 36	XLIII (Núrpír)	D 0 7 49·8	16	2·4	5·2								

† The pillar is sunk having its upper surface flush with the ground.

Astronomical Date 1880-81	Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station – 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Dec. 25, 26, 27, 28	1 12	XLII (Yáru)	D 0 0 57·1	16	7·7	8·6	567	23	·041	+ 57·6	349·9			
„ 21, 22, 23, 24	1 12	XLIII (Núrpír)	D 0 7 39·3	16	7·4	5·2								
„ 25, 26, 27, 28	1 30	XLII (Yáru)	D 0 4 48·6	16	11·1	8·6	456	– 6	·013	– 14·7	277·1			
„ 30, 31, Jan. 4, 5	1 32	XLIV (Vijnot)	D 0 2 15·7	16	12·5	5·2								
Dec. 21, 22, 23, 24	1 28	XLIII (Núrpír)	D 0 8 38·3	16	11·2	5·2	653	9	·014	– 70·3	278·6	277·9	276	13
„ 30, Jan. 4, 5	1 28	XLIV (Vijnot)	D 0 1 30·0	12	8·0	5·2								
Jan. 8, 9, 10, 11	1 44	XLV (Longwáli)	D 0 7 14·1	16	9·0	5·2	484	5	·010	– 50·8	277·9			
Dec. 30, 31, Jan. 4, 5	1 43	XLIV (Vijnot)	D 0 0 35·0	16	2·5	5·2								
Dec. 25, 26, 27, 28	1 22	XLII (Yáru)	D 0 4 51·1	16	2·5	8·6	741	0	·000	+ 35·2	327·0			
Jan. 8, 9, 10, 11	1 22	XLV (Longwáli)	D 0 7 26·7	16	12·8	5·2								
Dec. 21, 22, 23, 24	1 39	XLIII (Núrpír)	D 0 5 18·7	16	2·5	5·2	467	8	·017	– 18·4	330·5	328·7	326	10
Jan. 9, 10, 11	1 39	XLV (Longwáli)	D 0 2 14·0	12	8·0	5·2								
Dec. 30, 31, Jan. 4, 5	1 43	XLIV (Vijnot)	D 0 0 35·0	16	2·5	5·2	484	5	·010	+ 50·8	328·6			
„ 8, 9, 10, 11	1 44	XLV (Longwáli)	D 0 7 14·1	16	9·0	5·2								
Dec. 30, 31, Jan. 4, 5	1 13	XLIV (Vijnot)	D 0 5 22·0	16	3·0	5·2	359	–52	·145	– 13·6	264·3			
„ 12, 13, 14, 15, 16	1 13	XLVI (Vín)	D 0 2 50·6	20	2·5	5·2						263·5	261	12·2
„ 8, 9, 10, 11	1 14	XLV (Longwáli)	D 0 9 36·2	16	2·9	5·2	351	– 3	·009	– 66·0	262·7			
„ 12, 13, 14, 15, 16	1 15	XLVI (Vín)	E 0 3 37·5	20	7·7	5·2								
„ 8, 9, 10, 11	1 23	XLV (Longwáli)	D 0 8 26·0	16	3·0	5·2	364	1	·003	– 55·8	272·9			
„ 18, 19, 20	1 22	XLVII (Got Mír Muhammad)	E 0 2 27·4	12	8·0	5·2						272·3	270	0†
„ 12, 13, 14, 15, 16	1 30	XLVI (Vín)	D 0 2 37·5	20	2·5	5·2	307	–39	·127	+ 8·2	271·7			
„ 18, 19, 20	1 30	XLVII (Got Mír Muhammad)	D 0 3 1·1	12	15·2	5·2								
Dec. 30, 31, Jan. 4, 5	1 34	XLIV (Vijnot)	D 0 5 25·0	16	2·5	5·2	469	–53	·113	– 5·9	272·0			
„ 25, 26, 27, 28	1 35	XLVIII (Dewari)	D 0 4 2·3	16	9·7	5·2								
„ 15, 16, 17	1 42	XLVI (Vín)	D 0 3 14·7	20	13·3	5·2	434	–61	·141	+ 9·8	273·3	272·0	270	16
„ 25, 26, 27, 28	1 42	XLVIII (Dewari)	D 0 4 38·2	16	15·0	5·2								
„ 21, 22, 23, 24	1 17	XLIX (Kot Sabzal)	D 0 3 30·4	16	9·7	5·2	374	–21	·056	– 5·0	270·6			
„ 26, 27, 28	1 17	XLVIII (Dewari)	D 0 2 22·8	12	12·1	5·2								
„ 12, 13, 14, 15, 16	1 30	XLVI (Vín)	D 0 3 28·5	20	2·5	5·2	368	–65	·177	+ 9·9	273·4			
„ 21, 22, 23, 24	1 30	XLIX (Kot Sabzal)	D 0 4 11·0	16	14·7	5·2								
„ 18, 19, 20	1 37	XLVII (Got Mír Muhammad)	D 0 3 44·6	12	9·9	5·2	439	–52	·118	+ 5·4	277·7	276·2	274	28
„ 21, 22, 23, 24	1 37	XLIX (Kot Sabzal)	D 0 4 12·5	16	14·6	5·2								
„ 26, 27, 28	1 17	XLVIII (Dewari)	D 0 2 22·8	12	12·1	5·2	374	–21	·056	+ 5·0	277·6			
„ 21, 22, 23, 24	1 17	XLIX (Kot Sabzal)	D 0 3 30·4	16	9·7	5·2								

† The pillar is sunk having its upper surface flush with the ground.

Astronomical Date 1881	Astronomical Date: Mean of Times of observation	Number and Name of Station	Observed Vertical Angle	Number of observations	Height in feet: Signal	Height in feet: Instrument	Contained Arc	Terrestrial Refraction: In seconds	Terrestrial Refraction: Decimals of Contained Arc	Height of 2nd Station − 1st Station in feet	Height in feet of 2nd Station above Mean Sea Level: Trigonometrical Results: By each deduction	Trigonometrical Results: Mean	Final Result	Height of Pillar or Tower
	h. m.		° ′ ″				″							feet
Jan. 25, 26, 27, 28	1 25	XLVIII (Dewari)	D 0 2 34·8	16	8·7	5·2	343	−17	·050	+ 2·3	274·3	274·0	271	18·8
Feb. 3, 4, 5, 6	1 26	LI (Ghundi)	D 0 2 30·0	16	14·0	5·2								
Jan. 21, 22, 23, 24	1 23	XLIX (Kot Sabzal)	D 0 3 13·3	16	8·7	5·2	362	−18	·050	− 2·4	273·8			
Feb. 3, 4, 5, 6	1 23	LI (Ghundi)	D 0 2 27·4	16	12·1	5·2								
Jan. 25, 26, 27, 28	1 23	XLVIII (Dewari)	D 0 2 56·6	16	9·6	5·2	351	− 9	·026	− 3·1	268·9	269·1	267	20·9
„ 30, 31, Feb. 2	1 23	L (Kubba)	D 0 1 56·6	12	13·8	5·2								
Feb. 3, 4, 5, 6	1 20	LI (Ghundi)	D 0 3 12·4	16	12·8	5·2	366	−25	·068	− 4·8	269·2			
Jan. 30, 31, Feb. 2	1 20	L (Kubba)	D 0 2 42·3	12	8·7	5·2								
„ 30, 31, Feb. 2	1 33	L (Kubba)	D 0 3 36·5	16	12·8	5·2	480	−48	·100	+ 9·1	278·2	278·0	273	23·8
Feb. 8, 9, 10	1 35	LIX (Máchka)	D 0 4 50·8	20	13·4	5·2								
„ 3, 4, 5, 6	1 28	LI (Ghundi)	D 0 4 25·0	28	12·8	5·2	505	−58	·115	+ 3·8	277·8			
„ 8, 9, 10	1 28	LIX (Máchka)	D 0 4 42·4	24	16·0	5·2								
Jan. 21, 22, 23, 24	1 44	XLIX (Kot Sabzal)	D 0 3 21·2	16	14·1	5·2	484	−27	·056	+ 7·3	283·5	282·3	282	22·4
Feb. 14, 15, 16, 17	1 44	LXII (Dáowála)	D 0 4 30·7	16	12·1	5·2								
„ 3, 4, 5, 6	1 30	LI (Ghundi)	D 0 1 24·4	16	15·9	5·2	348	−15	·043	+ 7·2	281·2			
„ 14, 15, 16, 17	1 30	LXII (Dáowála)	D 0 2 48·0	16	16·0	5·2								

NOTE.—Stations LIX (Máchka) and LXII (Dáowála) appertain to the Great Indus Series.

June, 1885.

W. H. COLE,
In charge of Computing Office.

EASTERN SIND MERIDIONAL SERIES.

PRINCIPAL TRIANGULATION. AZIMUTHAL OBSERVATIONS.

At XIV (Malar)

Lat. N. 26° 2′ 25″·80; Long. E. 70° 6′ 3″·37 = $4^h\ 40^m\ 24^s{\cdot}2$; Height above Mean Sea Level, 328 feet.
January 1877; observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No. 2.

Stars observed	α Ursæ Minoris (West)	and No. 1612† (East).
Mean Right Ascension 1877·0	$1^h\ 13^m\ 41^s$	$13^h\ 45^m\ 56^s$
Mean North Polar Distance 1877·0	1° 20′ 48″·11	6° 37′ 50″·84
Local Mean Times of Elongation, January 25	Western $10^h\ 50^m$	Eastern $11^h\ 38^m$

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark – Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark – Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark – Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark – Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Jan. 25	W.	209 16	+ 12 10 33·26	1 47	+ 0 0·16	+ 12 10 33·42	+ 12 10 27·24	9 12	+ 0 4·32	+ 12 10 31·56
		&	10 32·08	4 57	0 1·25	33·33	10 25·64	6 39	0 2·26	27·90
		29 16	10 13·46	21 15	0 23·04	36·50	10 22·40	10 46	0 5·91	28·31
			10 4·42	23 19	0 27·70	32·12	10 19·78	14 55	0 11·36	31·14
			9 32·30	35 44	1 4·95	37·25	9 41·30	31 50	0 51·60	32·90
„ 25	E.	209 16	+ 3 17 34·92	0 5	− 0 0·00	+ 3 17 34·92	+ 3 17 46·88	7 55	− 0 15·74	+ 3 17 31·14
		&	17 35·42	2 25	0 1·48	33·94	17 37·02	5 53	0 8·69	28·33
		29 16	18 58·70	17 59	1 21·58	37·12	17 48·00	8 21	0 17·58	30·42
			19 16·10	20 16	1 43·72	32·38	17 55·40	10 31	0 27·83	27·57
			21 31·66	30 28	3 54·69	36·97	20 31·78	26 48	3 1·58	30·20
„ 26	W.	288 28	+ 12 10 31·78	5 45	+ 0 1·69	+ 12 10 33·47	+ 12 10 15·04	18 24	+ 0 17·30	+ 12 10 32·34
		&	10 33·88	1 10	0 0·07	33·95	10 15·22	16 7	0 13·26	28·48
		108 28	10 24·08	13 45	0 9·65	33·73	10 29·54	4 38	0 1·09	30·63
			10 19·84	16 5	0 13·19	33·03	10 24·06	8 26	0 3·64	27·70
			9 57·12	27 22	0 38·18	35·30	10 6·94	21 38	0 23·88	30·82
„ 28	E.	288 28	+ 3 17 53·16	8 50	− 0 19·54	+ 3 17 33·62	+ 3 18 30·28	15 30	− 1 0·09	+ 3 17 30·19
		&	17 36·36	3 53	0 3·78	32·58	18 16·28	14 0	0 49·13	27·15
		108 28	18 5·24	10 34	0 28·18	37·06	17 31·14	3 2	0 2·32	28·82
			18 19·32	13 52	0 48·48	30·84	17 33·88	4 43	0 5·58	28·30
			20 25·44	25 43	2 47·10	38·34	19 19·66	21 13	1 53·69	25·97

† Of Greenwich New Seven-year Catalogue of 2,760 Stars for 1864.

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark − Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark − Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Jan. 29	W.	7 39	+ 12 10 27·96	9 12	+ 0 4·33	+ 12 10 32·29	+ 12 10 11·42	19 41	+ 0 19·80	+ 12 10 31·22
		&	10 28·26	7 10	0 2·62	30·88	10 14·20	17 13	0 15·13	29·33
		187 39	10 33·60	9 5	0 4·21	37·81	10 32·00	0 43	0 0·03	32·03
			10 24·92	12 3	0 7·41	32·33	10 31·16	2 50	0 0·41	31·57
			10 1·14	25 2	0 31·95	33·09	10 11·44	20 1	0 20·45	31·89
„ 29	E	7 39	+ 3 18 26·84	13 53	− 0 48·31	+ 3 17 38·53	+ 3 17 53·44	8 54	− 0 19·83	+ 3 17 33·61
		&	17 34·30	2 25	0 1·46	32·84	17 42·58	7 5	0 12·61	29·97
		187 39	17 29·24	0 29	0 0·06	29·18	17 43·16	7 21	0 13·60	29·56
			18 28·50	15 0	0 56·77	31·73	17 47·88	9 0	0 20·42	27·46
			18 42·66	16 47	1 11·13	31·53	19 37·62	22 26	2 7·17	30·45
„ 30	W	86 51	+ 12 10 24·40	15 32	+ 0 12·32	+ 12 10 36·72	+ 12 10 28·16	9 50	+ 0 4·94	+ 12 10 33·10
		&	10 33·70	2 39	0 0·36	34·06	10 25·72	8 6	0 3·35	29·07
		266 51	10 32·58	0 48	0 0·03	32·61	10 31·08	5 52	0 1·75	32·83
			10 23·66	14 39	0 10·95	34·61	10 28·74	7 35	0 2·94	31·68
			10 20·28	16 44	0 14·30	34·58	10 5·34	22 12	0 25·14	30·48
„ 30	E	86 51	+ 3 18 45·92	16 48	− 1 10·68	+ 3 17 35·24	+ 3 18 8·98	12 28	− 0 38·91	+ 3 17 30·07
		&	17 38·84	3 43	0 3·48	35·36	17 53·12	10 7	0 25·69	27·43
		266 51	17 31·64	1 40	0 0·70	30·94	17 48·74	8 40	0 18·89	29·85
			18 27·72	14 45	0 54·81	32·91	17 55·56	10 14	0 26·37	29·19
			18 38·70	16 23	1 7·69	31·01	19 34·26	22 13	2 4·61	29·65
„ 31	W	166 4	+ 12 10 21·54	17 25	+ 0 15·51	+ 12 10 37·05	+ 12 10 24·96	12 35	+ 0 8·08	+ 12 10 33·04
		&	10 34·62	1 34	0 0·12	34·74	10 23·90	10 46	0 5·93	29·83
		346 4	10 33·88	0 5	0 0·00	33·88	10 31·92	5 52	0 1·76	33·68
			10 21·94	13 59	0 9·97	31·91	10 25·96	7 53	0 3·17	29·13
			10 16·38	15 46	0 12·68	29·06	10 8·54	22 5	0 24·87	33·41
„ 31	E	166 4	+ 3 18 59·74	18 35	− 1 26·39	+ 3 17 33·35	+ 3 18 16·76	13 45	− 0 47·40	+ 3 17 29·36
		&	17 37·68	4 38	0 5·39	32·29	17 57·34	10 57	0 30·05	27·29
		346 4	17 26·96	2 21	0 1·38	25·58	17 33·72	3 13	0 2·61	31·11
			18 11·30	12 20	0 38·31	32·99	17 34·88	5 10	0 6·74	28·14
			18 23·68	14 24	0 52·29	31·39	19 35·90	22 23	2 6·60	29·30

Abstract of Astronomical Azimuth observed at XIV (Malar) 1877.

1. By Eastern Elongation of No. 1612†.

Face	L	R	L	R	L	R	L	R	L	R
Zero	209°	29°	288°	108°	8°	188°	87°	267°	166°	346°
Date	January 25		January 28		January 29		January 30		January 31	
	"	"	"	"	"	"	"	"	"	"
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	34·92	31·14	33·62	30·19	38·53	33·61	35·24	30·07	33·35	29·36
	33·94	28·33	32·58	27·15	32·84	29·97	35·36	27·43	32·29	27·29
	37·12	30·42	37·06	28·82	29·18	29·56	30·94	29·85	25·58	31·11
	32·38	27·57	30·84	28·30	31·73	27·46	32·91	29·19	32·99	28·14
	36·97	30·20	38·34	25·97	31·53	30·45	31·01	29·65	31·39	29·30
Means	35·07	29·53	34·49	28·09	32·76	30·21	33·09	29·24	31·12	29·04
	° ′ "		"		"		"		"	
Means of both faces	+ 3 17 32·30		31·29		31·49		31·17		30·08	
Level Corrections	− 0·52		− 0·89		+ 1·21		+ 1·10		+ 0·24	
Corrected Means	+ 3 17 31·78		30·40		32·70		32·27		30·32	
Az. of Star fr. S., by W.	187 23 32·74		32·70		32·69		32·68		32·67	
Az. of Ref. M. „	190 41 4·52		3·10		5·39		4·95		2·99	

2. By Western Elongation of α Ursæ Minoris.

Face	L	R	L	R	L	R	L	R	L	R
Zero	209°	29°	288°	108°	8°	188°	87°	267°	166°	346°
Date	January 25		January 26		January 29		January 30		January 31	
	"	"	"	"	"	"	"	"	"	"
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	33·42	31·56	33·47	32·34	32·29	31·22	36·72	33·10	37·05	33·04
	33·33	27·90	33·95	28·48	30·88	29·33	34·06	29·07	34·74	29·83
	36·50	28·31	33·73	30·63	37·81	32·03	32·61	32·83	33·88	33·68
	32·12	31·14	33·03	27·70	32·33	31·57	34·61	31·68	31·91	29·13
	37·25	32·90	35·30	30·82	33·09	31·89	34·58	30·48	29·06	33·41
Means	34·52	30·36	33·90	29·99	33·28	31·21	34·52	31·43	33·33	31·82
	° ′ "		"		"		"		"	
Means of both faces	+ 12 10 32·44		31·95		32·25		32·98		32·58	
Level Corrections	− 0·10		− 0·86		+ 0·11		+ 0·36		+ 0·08	
Corrected Means	+ 12 10 32·34		31·09		32·36		33·34		32·66	
Az. of Star fr S., by W.	178 30 32·29		32·18		32·07		31·96		31·74	
Az. of Ref. M. „	190 41 4·63		3·27		4·43		5·30		4·40	

		°	′	"
Astronomical Azimuth of Referring Mark	by Eastern Elongation	190	41	4·19
	by Western „	„		4·41
	Mean	„		4·30
Angle Referring Mark and XVI (Ramsar) *see page* 144 *ante*		− 29	14	42·23
Astronomical Azimuth of Ramsar by observation		161	26	22·07
Geodetical Azimuth of „ by calculation from that adopted (Vol. II, page 141) at Kaliánpur, *see page* 204 *ante*		161	26	24·93
Astronomical—Geodetical Azimuth at XIV (Malar)		−		2·86

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

At XXXI (Asu)

Lat. N. 27° 10′ 32″·14; Long. E. 70° 13′ 26″·85 = $4^h\ 40^m\ 53^s{\cdot}8$; Height above Mean Sea Level, 479 feet.
February 1880; observed by Captain M. W. Rogers, R.E., with Barrow's 24-inch Theodolite No. 2.

Stars observed	α Ursæ Minoris (West)	and No. 1612† (East).
Mean Right Ascension 1880·0	$1^h\ 14^m\ 45^s$	$13^h\ 45^m\ 49^s$
Mean North Polar Distance 1880·0	1° 19′ 51″·07	6° 38′ 44″·85
Local Mean Times of Elongation, February 17	Western $9^h\ 23^m$	Eastern $10^h\ 11^m$

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark – Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark – Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark – Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark – Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Feb. 17	W.	201 30	+ 44 39 40·16	7 30	+ 0 2·86	+ 44 39 43·02	+ 44 39 37·12	0 19	+ 0 0·01	+ 44 39 37·13
		&	39 35·62	9 31	0 4·62	40·24	39 36·06	1 6	0 0·06	36·12
		21 30	39 19·62	23 24	0 27·87	47·49	39 27·96	15 18	0 11·92	39·88
			39 6·70	25 28	0 32·97	39·67	39 25·78	17 6	0 14·90	40·68
„ 17	E.	201 30	+ 35 41 30·16	3 13	− 0 2·62	+ 35 41 27·54	+ 35 41 52·96	11 28	− 0 33·34	+ 35 41 19·62
		&	41 32·34	5 29	0 7·66	24·68	41 53·72	11 32	0 33·93	19·79
		21 30	43 9·70	19 43	1 39·41	30·29	42 5·78	13 44	0 48·17	17·61
			43 28·26	22 15	2 6·54	21·72				
„ 18	W.	280 45	+ 44 39 40·44	10 50	+ 0 5·98	+ 44 39 46·42	+ 44 39 40·84	3 4	+ 0 0·48	+ 44 39 41·32
		&	39 37·16	8 47	0 3·94	41·10	39 39·40	0 55	0 0·04	39·44
		100 45	39 44·40	5 24	0 1·49	45·89	39 32·02	13 37	0 9·45	41·47
			39 42·14	7 29	0 2·86	45·00	39 25·16	15 38	0 12·44	37·60
„ 18	E.	280 45	+ 35 41 57·96	9 47	− 0 24·28	+ 35 41 33·68	+ 35 41 22·16	1 28	− 0 0·54	+ 35 41 21·62
		&	41 42·62	7 40	0 14·89	27·73	41 21·60	0 16	0 0·02	21·58
		100 45	41 38·44	5 25	0 7·46	30·98	42 3·46	12 33	0 40·18	23·28
			41 39·18	7 22	0 13·83	25·35	42 11·86	14 19	0 52·35	19·51
„ 20	W.	79 10	+ 44 39 30·08	16 38	+ 0 14·11	+ 44 39 44·19	+ 44 39 40·32	7 52	+ 0 3·15	+ 44 39 43·47
		&	39 34·44	14 9	0 10·20	44·64	39 38·36	5 41	0 1·65	40·01
		259 10	39 48·14	2 44	0 0·38	48·52	39 34·50	10 26	0 5·54	40·04
			39 41·74	4 34	0 1·06	42·80	39 32·84	12 1	0 7·35	40·19
„ 20	E.	79 10	+ 35 41 53·76	9 45	− 0 24·11	+ 35 41 29·65	+ 35 42 33·78	16 47	− 1 11·31	+ 35 41 22·47
		&	41 39·82	7 1	0 12·52	27·30	41 20·56	0 16	0 0 02	20·54
		259 10	41 43·60	7 33	0 14·54	29·06	41 17·02	1 58	0 0·99	16·03
			41 50·52	9 32	0 23·21	27·31	42 22·24	15 10	0 58·77	23·47
„ 21	W.	158 20	+ 44 39 37·78	13 40	+ 0 9·53	+ 44 39 47·31	+ 44 39 40·28	5 27	+ 0 1·51	+ 44 39 41·79
		&	39 37·38	11 44	0 7·02	44·40	39 38·62	3 44	0 0·71	39·33
		338 20	39 45·04	2 20	0 0·28	45·32	39 36·12	10 40	0 5·80	41·92
			39 45·06	4 11	0 0·89	45·95	39 30·52	12 36	0 8·09	38·61

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark – Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark – Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark – Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark – Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Feb. 21	E.	158 20	+ 35 41 57·98	10 37	− 0 28·63	+ 35 41 29·35	+ 35 41 25·66	2 1	− 0 1·03	+ 35 41 24·63
		&	41 48·26	8 40	0 19·07	29·19	41 21·66	0 24	0 3·97	17·69
		338 20	41 35·98	5 32	0 7·82	28·16	42 7·46	13 4	0 43·53	23·93
			41 40·86	7 33	0 14·51	26·35	42 20·02	15 0	0 57·42	22·60
„ 22	W.	359 57	+ 44 39 36·16	13 47	+ 0 9·70	+ 44 39 45·86	+ 44 39 39·40	6 2	+ 0 1·86	+ 44 39 41·26
		&	39 37·70	11 42	0 6·98	44·68	39 36·30	4 27	0 1·01	37·31
		179 58	39 45·20	1 22	0 0·10	45·30	39 36·10	8 55	0 4·04	40·14
			39 45·74	3 15	0 0·54	46·28	39 32·22	10 25	0 5·53	37·75
„ 22	E.	359 57	+ 35 42 22·32	14 35	− 0 53·88	+ 35 41 28·44	+ 35 41 31·48	5 53	− 0 8·77	+ 35 41 22·71
		&	42 8·48	12 26	0 39·16	29·32	41 27·30	4 12	0 4·49	22·81
		179 58	41 29·92	1 24	0 0·50	29·42	41 56·60	11 42	0 34·97	21·63
			43 10·42	20 0	1 42·19	28·23	42 5·70	13 27	0 46·15	19·55

Abstract of Astronomical Azimuth observed at XXXI (Asu) 1880.

1. By Eastern Elongation of No. 1612†.

Face	L	R	L	R	L	R	L	R	L	R
Zero	202°	22°	281°	101°	79°	259°	158°	338°	0°	180°
Date	February 17		February 18		February 20		February 21		February 22	
	″	″	″	″	″	″	″	″	″	″
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	27·54	19·62	33·68	21·62	29·65	22·47	29·35	24·63	28·44	22·71
	24·68	19·79	27·73	21·58	27·30	20·54	29·19	17·69	29·32	22·81
	30·29	17·61	30·98	23·28	29·06	16·03	28·16	23·93	29·42	21·63
	21·72		25·35	19·51	27·31	23·47	26·35	22·60	28·23	19·55
Means	26·06	19·01	29·44	21·50	28·33	20·63	28·26	22·21	28·85	21·68
	° ′ ″		″		″		″		″	
Means of both faces	+ 35 41 22·54		25·47		24·48		25·24		25·27	
Level Corrections	+ 2·00		− 0·34		+ 0·57		+ 0·40		− 1·03	
Corrected Means	+ 35 41 24·54		25·13		25·05		25·64		24·24	
Az. of Star fr. S., by W.	187 28 60·18		59·95		59·62		59·50		59·28	
Az. of Ref. M. „	223 10 24·72		25·08		24·67		25·14		23·52	

† Of Greenwich New Seven-Year Catalogue of 2760 Stars for 1864.

Abstract of Astronomical Azimuth at XXXI (Asu) 1880—(*Continued*).

2. By Western Elongation of α Ursæ Minoris.

Face	L	R	L	R	L	R	L	R	L	R
Zero	202°	22°	281°	101°	79°	259°	158°	338°	0°	180°
Date	February 17		February 18		February 20		February 21		February 22	
	″	″	″	″	″	″	″	″	″	″
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	43·02	37·13	46·42	41·32	44·19	43·47	47·31	41·79	45·86	41·26
	40·24	36·12	41·10	39·44	44·64	40·01	44·40	39·33	44·68	37·31
	47·49	39·88	45·89	41·47	48·52	40·04	45·32	41·92	45·30	40·14
	39·67	40·68	45·00	37·60	42·80	40·19	45·95	38·61	46·28	37·75
Means	42·61	38·45	44·60	39·96	45·04	40·93	45·75	40·41	45·53	39·12
	° ′ ″		″		″		″		″	
Means of both faces	+ 44 39 40·53		42·28		42·99		43·08		42·33	
Level Corrections	+ 1·76		− 0·17		+ 0·23		+ 0·62		− 0·85	
Corrected Means	+ 44 39 42·29		42·11		43·22		43·70		41·48	
Az. of Star fr. S., by W.	178 30 42·48		42·26		41·81		41·58		41·36	
Az. of Ref. M. ,,	223 10 24·77		24·37		25·03		25·28		22·84	

		° ′ ″
Astronomical Azimuth of Referring Mark	by Eastern Elongation	223 10 24·63
	by Western ,, ...	,, 24·46
	Mean	,, 24·55
Angle Referring Mark and XXXIV (Kolu) *see page* 157 *ante*		− 21 32 52·30
Astronomical Azimuth of Kolu by observation		... 201 37 32·25
Geodetical Azimuth of ,, by calculation from that adopted (Vol. II, page 141) at Kaliánpur, *see page* 205 *ante*		... 201 37 33·14
Astronomical—Geodetical Azimuth at XXXI (Asu)		− 0·89

At XLIV (Vijnot)

Lat. N. 28° 2′ 8″·30; Long. E. 69° 52′ 59″·95 = 4^h 39^m 32^s·0; Height above Mean Sea Level, 276 feet.

December 1880 and January 1881; observed by Lt.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No. 1.

Stars observed	51 Cephei (East)	and λ Ursæ Minoris (West).
Mean Right Ascension 1881·0	6^h 44^m 17^s	19^h 43^m 9^s
Mean North Polar Distance 1881·0	2° 46′ 18″·96	1° 3′ 14″·33
Local Mean Times of Elongation, December 30	6^h 13^m	7^h 2^m

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT				FACE RIGHT			
			Observed Horizontal Angle: Diff. of Readings Ref. Mark – Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark – Star at Elongation	Observed Horizontal Angle: Diff. of Readings Ref. Mark – Star	Interval in Time from Elongation	Reduction in Arc to Time of Elongation	Reduced Observation Ref. Mark – Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Dec. 30	E.	323 29	+ 12 61 8·78	37 49	− 2 32·77	+ 12 58 36·01	+ 12 59 21·90	21 36	− 0 49·99	+ 12 58 31·91
		&	60 42·98	34 34	2 7·71	35·27	59 9·09	18 56	0 38·42	30·67
		143 29	58 46·26	11 14	0 13·53	32·73	58 32·05	0 1	0 0·00	32·05
			58 40·90	8 18	0 7·38	33·52	58 30·40	2 32	0 0·69	29·71
			58 48·10	12 12	0 16·01	32·09	60 15·40	31 15	1 45·20	30·20
			59 22·51	21 7	0 48·01	34·50	61 33·74	41 5	3 1·85	31·89
„ 30	W.	323 29	+ 17 17 46·80	32 41	+ 0 43·55	+ 17 18 30·35	+ 17 18 19·53	13 22	+ 0 7·30	+ 17 18 26·83
		&	17 55·13	29 58	0 36·62	31·75	18 23·14	10 37	0 4·60	27·74
		143 29	18 31·14	1 48	0 0·13	31·27	18 22·15	14 17	0 8·32	30·47
			18 30·79	5 6	0 1·06	31·85	18 16·52	16 48	0 11·51	28·03
			18 0·69	26 47	0 29·21	29·90	17 26·19	39 3	1 1·99	28·18
			17 57·61	29 27	0 35·31	32·92	17 20·59	42 13	1 12·41	33·00
„ 31	E.	42 41	+ 12 59 27·92	22 30	− 0 54·25	+ 12 58 33·67	+ 12 60 39·76	34 5	− 2 4·21	+ 12 58 35·55
		&	59 13·15	20 3	0 43·09	30·06	60 16·99	31 19	1 44·93	32·06
		222 41	58 36·12	3 6	0 1·04	35·08	58 44·83	10 25	0 11·64	33·19
			58 39·18	6 1	0 3·90	35·28	58 36·85	7 44	0 6·42	30·43
			60 44·30	34 52	2 10·94	33·36	59 5·92	17 6	0 31·46	34·46
			62 2·37	44 1	3 28·68	33·69	59 41·46	25 26	1 9·65	31·81
„ 31	W.	42 41	+ 17 18 26·15	10 32	+ 0 4·52	+ 17 18 30·67	+ 17 17 58·89	28 30	+ 0 33·13	+ 17 18 32·02
		&	18 30·29	7 8	0 2·07	32·36	18 1·60	25 47	0 27·12	28·72
		222 41	18 15·15	19 34	0 15·60	30·75	18 26·64	5 39	0 1·30	27·94
			18 5·46	22 53	0 21·32	26·78	18 22·88	9 22	0 3·57	26·45
			16 57·67	47 29	1 31·50	29·17	17 41·98	33 7	0 44·61	26·59
			16 45·81	50 17	1 42·55	28·36	17 31·76	35 59	0 52·65	24·41
Jan. 1	E.	121 53	+ 12 60 29·44	32 49	− 1 55·16	+ 12 58 34·28	+ 12 61 54·59	42 53	− 3 16·22	+ 12 58 38·37
		&	60 13·11	30 38	1 40·39	32·72	61 26·36	40 6	2 51·68	34·68
		301 53	58 52·53	12 37	0 17·07	35·46	59 33·24	23 10	0 57·49	35·75
			58 44·07	9 49	0 10·34	33·73	59 20·91	20 44	0 46·07	34·84
			59 3·23	16 23	0 28·88	34·35	58 39·00	1 38	0 0·28	38·72
			59 42·43	25 28	1 9·83	32·60	58 40·98	7 32	0 6·09	34·89

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark − Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark − Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Jan. 1	W.	121 53	+ 17 17 56·56	29 3	+ 0 34·43	+ 17 18 30·99	+ 17 17 8·23	46 24	+ 1 27·74	+ 17 18 35·97
		&	18 1·84	26 9	0 27·90	29·74	17 14·40	43 40	1 17·73	32·13
		301 53	18 31·49	1 34	0 0·10	31·59	18 31·86	11 51	0 5·73	37·59
			18 30·29	5 0	0 1·02	31·31	18 28·85	8 45	0 3·12	31·97
			17 40·67	35 1	0 49·87	30·54	18 16·34	19 40	0 15·75	32·09
			17 31·50	38 1	0 58·75	30·25	18 10·12	22 12	0 20·07	30·19
„ 2	E.	201 5	+ 12 59 19·29	20 17	− 0 44·10	+ 12 58 35·19	+ 12 60 8·16	29 17	− 1 31·78	+ 12 58 36·38
		&	59 5·27	16 42	0 29·91	35·36	59 54·71	27 7	1 18·73	35·98
		21 5	58 35·10	0 46	0 0·06	35·04	58 45·72	9 44	0 10·17	35·55
			58 34·58	1 24	0 0·21	34·37	58 40·03	6 57	0 5·18	34·85
			59 34·67	23 34	0 59·78	34·89	58 41·82	8 28	0 7·72	34·10
			60 26·14	32 8	1 51·19	34·95	59 3·39	16 26	0 29·11	34·28
„ 2	W.	201 5	+ 17 18 11·78	21 44	+ 0 19·29	+ 17 18 31·07	+ 17 17 34·99	37 24	+ 0 57·03	+ 17 18 32·02
		&	18 15·90	19 12	0 15·06	30·96	17 42·13	34 29	0 48·49	30·62
		21 5	18 31·35	4 2	0 0·66	32·01	18 30·02	7 54	0 2·55	32·57
			18 29·96	6 54	0 1·94	31·90	18 31·13	4 46	0 0·93	32·06
			17 41·67	34 20	0 47·97	29·64	18 19·99	16 56	0 11·69	31·68
			17 30·62	38 8	0 59·13	29·75	18 12·17	20 48	0 17·63	29·80
„ 8	E.	280 17	+ 12 59 23·59	22 10	− 0 52·64	+ 12 58 30·94	+ 12 60 53·62	36 6	− 2 19·26	+ 12 58 34·36
		&	59 13·36	19 41	0 41·52	31·84	60 19·10	31 19	1 44·90	34·20
		100 17	58 31·80	2 7	0 0·48	31·32	58 47·97	11 29	0 14·14	33·83
			58 33·31	1 15	0 0·17	33·14	58 41·75	9 5	0 8·85	32·90
			59 42·38	25 20	1 9·10	33·28	58 44·03	9 6	0 8·89	35·14
			60 29·98	33 1	1 57·41	32·57	59 4·19	17 13	0 31·89	32·30
„ 8	W.	280 17	+ 17 18 13·20	20 22	+ 0 16·92	+ 17 18 30·12	+ 17 17 39·23	36 20	+ 0 53·84	+ 17 18 33·07
		&	18 18·60	17 48	0 12·92	31·52	17 42·25	33 49	0 46·65	28·90
		100 17	18 27·36	6 9	0 1·54	28·90	18 28·29	6 16	0 1·61	29·90
			18 26·80	9 52	0 3·97	30·77	18 29·83	3 16	0 0·44	30·27
			17 40·06	35 27	0 51·12	31·18	18 11·62	21 39	0 19·10	30·72
			17 31·97	38 8	0 59·13	31·10	18 5·14	24 49	0 25·09	30·23

Abstract of Astronomical Azimuth observed at XLIV (Vijnot) 1880-81.

1. By Eastern Elongation of No. 51 Cephei.

Face	L	R	L	R	L	R	L	R	L	R
Zero	323°	143°	43°	223°	122°	302°	201°	21°	280°	100°
Date	December 30		December 31		January 1		January 2		January 3	
	″	″	″	″	″	″	″	″	″	″
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	36·01	31·91	33·67	35·55	34·28	38·37	35·19	36·38	30·94	34·36
	35·27	30·67	30·06	32·06	32·72	34·68	35·36	35·98	31·84	34·20
	32·73	32·05	35·08	33·19	35·46	35·75	35·04	35·55	31·32	33·83
	33·52	29·71	35·28	30·43	33·73	34·84	34·37	34·85	33·14	32·90
	32·09	30·20	33·36	34·46	34·35	38·72	34·89	34·10	33·28	35·14
	34·50	31·89	33·69	31·81	32·60	34·89	34·95	34·28	32·57	32·30
Means	34·02	31·07	33·52	32·92	33·86	36·21	34·97	35·19	32·18	33·79

	° ′ ″	″	″	″	″
Means of both faces	+ 12 58 32·55	33·22	35·04	35·08	32·99
Level Corrections	− 0·36	− 1·25	− 0·60	− 0·51	+ 2·59
Corrected Means	+ 12 58 32·19	31·97	34·44	34·57	35·58
Az. of Star fr. S., by W.	183 8 30·38	30·72	31·06	31·40	31·74
Az. of Ref. M. „	196 7 2·57	2·69	5·50	5·97	7·32

2. By Western Elongation of λ Ursæ Minoris.

Face	L	R	L	R	L	R	L	R	L	R
Zero	323°	143°	43°	223°	122°	302°	201°	21°	280°	100°
Date	December 30		December 31		January 1		January 2		January 3	
	″	″	″	″	″	″	″	″	″	″
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	30·35	26·83	30·67	32·02	30·99	35·97	31·07	32·02	30·12	33·07
	31·75	27·74	32·36	28·72	29·74	32·13	30·96	30·62	31·52	28·90
	31·27	30·47	30·75	27·94	31·59	37·59	32·01	32·57	28·90	29·90
	31·85	28·03	26·78	26·45	31·31	31·97	31·90	32·06	30·77	30·27
	29·90	28·18	29·17	26·59	30·54	32·09	29·64	31·68	31·18	30·72
	32·92	33·00	28·36	24·41	30·25	30·19	29·75	29·80	31·10	30·23
Means	31·34	29·04	29·68	27·69	30·74	33·32	30·89	31·46	30·60	30·52

	° ′ ″	″	″	″	″
Means of both faces	+ 17 18 30·19	28·69	32·03	31·18	30·56
Level Corrections	− 0·50	− 0·13	− 0·92	− 0·03	+ 2·19
Corrected Means	+ 17 18 29·69	28·56	31·11	31·15	32·75
Az. of Star fr S., by W.	178 48 32·59	32·25	31·91	31·46	31·12
Az. of Ref. M. „	196 7 2·28	0·81	3·02	2·61	3·87

		° ′ ″
Astronomical Azimuth of Referring Mark	by Eastern Elongation	196 7 4·81
	by Western „	„ 2·52
	Mean	„ 3·67
Angle Referring Mark and XLVIII (Dewari) *see page* 166 *ante*		− 36 31 48·33
Astronomical Azimuth of Dewari by observation		159 35 15·34
Geodetical Azimuth of „ by calculation from that adopted (Vol. II, page 141) at Kaliánpur, *see page* 206 *ante*		159 35 11·30
Astronomical—Geodetical Azimuth at XLIV (Vijnot)		+ 4·04

At LXII (Dáowála)*

Lat. N. 28° 20′ 12″·87; Long. E. 69° 52′ 57″·86 = 4^h 39^m 31^s·9; Height above Mean Sea Level, 282 feet.
February 1881; observed by Lieut.-Colonel B. R. Branfill with Troughton and Simms' 24-inch Theodolite No. 1.

Stars observed	δ Ursæ Minoris (East)	and 51 Cephei (West).
Mean Right Ascension 1881·0	18^h 10^m 43^s	6^h 44^m 17^s
Mean North Polar Distance 1881·0	3° 23′ 26″·67	2° 46′ 18″·96
Local Mean Times of Elongation, February 13	Eastern 14^h 41^m	Western 15^h 3^m

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark − Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark − Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Feb. 13	E.	30 55	− 154 52 28·53	43 21	− 4 5·73	− 154 56 34·26	− 154 54 47·00	28 44	− 1 48·34	− 154 56 35·34
		&	56 25·80	9 16	0 11·30	37·10	55 8·77	25 44	1 26·94	35·71
		210 56	56 29·11	5 1	0 3·31	32·42				
,, 13	W.	30 55	− 147 58 28·76	33 56	+ 2 4·19	− 147 56 24·57	− 147 59 48·09	43 24	+ 3 23·18	− 147 56 24·91
		&	57 13·50	21 28	0 49·74	23·76	56 38·58	10 58	0 12·98	25·60
		210 56	56 52·31	16 11	0 28·14	24·17	56 25·34	2 21	0 0·59	24·75
			57 44·00	27 23	1 20·41	23·59	59 19·90	40 25	2 54·68	25·22
,, 14	E.	110 8	− 154 55 50·10	19 0	− 0 47·48	− 154 56 37·58	− 154 53 13·90	39 17	− 3 22·07	− 154 56 35·97
		&	56 4·39	15 38	0 32·16	36·55	53 50·75	35 35	2 45·94	36·69
		290 8	55 49·99	18 50	0 46·93	36·92	56 36·53	0 35	0 0·05	36·58
			55 32·60	22 22	1 6·20	38·80	56 33·07	3 37	0 1·73	34·80
,, 14	W.	110 8	− 147 58 23·21	33 16	+ 1 59·43	− 147 56 23·78	− 147 57 26·97	24 8	+ 1 2·84	− 147 56 24·13
		&	56 26·61	5 42	0 3·50	23·11	56 44·54	14 31	0 22·73	21·81
		290 8	56 27·57	4 21	0 2·04	25·53	56 56·70	17 18	0 32 17	24·53
			59 28·26	41 16	3 1·97	26·29	58 1·64	30 5	1 37·02	24·62
,, 15	E.	189 20	− 154 56 13·20	13 31	− 0 24·06	− 154 56 37·26	− 154 54 30·54	31 4	− 2 6·65	− 154 56 37·19
		&	56 24·14	10 32	0 14·62	38·76	54 56·92	27 27	1 38·97	35·89
		9 20	55 10·14	25 56	1 28·98	39·12	56 34·30	5 0	0 3·30	37·60
			54 44·28	29 16	1 53·36	37·64	56 28·21	7 46	0 7·97	36·18
,, 15	W.	189 20	− 147 58 57·30	37 34	+ 2 32·25	− 147 56 25·05	− 147 57 6·42	19 19	+ 0 40·22	− 147 56 26·20
		&	57 53·77	28 30	1 27·61	26·16	56 33·11	8 31	0 7·80	25·31
		9 20	56 26·70	1 13	0 0·16	26·54	57 15·84	21 25	0 49·21	26·63
			56 36·96	10 55	0 12·80	24·16	58 10·73	31 28	1 46·06	24·67
,, 16	E.	268 32	− 154 56 18·71	11 18	− 0 16·80	− 154 56 35·51	− 154 53 59·16	34 44	− 2 38·09	− 154 56 37·25
		&	56 25·47	7 58	0 8·35	33·82	54 28·47	31 14	2 7·94	36·41
		88 32	54 46·15	28 49	1 49·85	36·00	56 24·90	8 34	0 9·68	34·58
			54 18·41	32 13	2 17·33	35·74	56 18·00	11 36	0 17·76	35·76

* This station appertains to the Great Indus Series.

Astronomical Date	Elongation	Zeros (Circle Readings of Referring Mark)	FACE LEFT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE LEFT: Interval in Time from Elongation	FACE LEFT: Reduction in Arc to Time of Elongation	FACE LEFT: Reduced Observation Ref. Mark − Star at Elongation	FACE RIGHT: Observed Horizontal Angle: Diff. of Readings Ref. Mark − Star	FACE RIGHT: Interval in Time from Elongation	FACE RIGHT: Reduction in Arc to Time of Elongation	FACE RIGHT: Reduced Observation Ref. Mark − Star at Elongation
		° ′	° ′ ″	m s	′ ″	° ′ ″	° ′ ″	m s	′ ″	° ′ ″
Feb. 16	W.	268 32 & 88 32	− 147 58 49·60	37 9	+ 2 28·84	− 147 56 20·76	− 147 56 49·41	16 1	+ 0 27·68	− 147 56 21·73
			57 32·62	25 35	1 10·64	21·98	56 28·87	6 42	0 4·84	24·03
			56 26·55	4 7	0 1·82	24·73	57 29·20	24 29	1 4·31	24·89
			56 45·53	14 22	0 22·19	23·34	58 33·58	34 32	2 7·70	25·88
„ 17	E.	311 44 & 131 44	− 154 56 36·35	4 1	− 0 2·13	− 154 56 38·48	− 154 54 1·92	34 29	− 2 35·92	− 154 56 37·84
			56 36·10	1 1	0 0·14	36·24	54 52·57	28 14	1 44·66	37·23
			53 32·05	37 46	3 8·67	40·72	56 0·29	17 4	0 38·52	38·81
			52 54·34	40 57	3 41·86	36·20	55 45·45	19 43	0 51·42	36·87
„ 17	W	311 44 & 131 44	− 147 57 57·12	29 5	+ 1 31·29	− 147 56 25·83	− 147 56 34·11	7 52	+ 0 6·67	− 147 56 27·44
			57 2·32	18 28	0 36·79	25·53	56 26·28	2 40	0 0·77	25·51
			57 19·16	22 34	0 54·67	24·49	60 11·48	46 15	3 48·28	23·20

Abstract of Astronomical Azimuth observed at LXII (Dáowála) 1881.

1. By Eastern Elongation of δ Ursæ Minoris.

Face	L	R	L	R	L	R	L	R	L	R
Zero	31°	211°	110°	290°	189°	9°	269°	89°	312°	132°
Date	February 13		February 14		February 15		February 16		February 17	
	″	″	″	″	″	″	″	″	″	″
Observed difference of Circle-Readings, Ref. M.—Star reduced to Elongation	34·26	35·34	37·58	35·97	37·26	37·19	35·51	37·25	38·48	37·84
	37·10	35·71	36·55	36·69	38·76	35·89	33·82	36·41	36·24	37·23
	32·42		36·92	36·58	39·12	37·60	36·00	34·58	40·72	38·81
			38·80	34·80	37·64	36·18	35·74	35·76	36·20	36·87
Means	34·59	35·53	37·46	36·01	38·20	36·72	35·27	36·00	37·91	37·69
	° ′ ″		″		″		″		″	
Means of both faces	− 154 56 35·06		36·74		37·46		35·64		37·80	
Level Corrections	− 0·32		− 0·06		+ 0·71		− 0·11		− 0·01	
Corrected Means	− 154 56 35·38		36·80		36·75		35·75		37·81	
Az. of Star fr. S., by W.	183 51 27·37		27·59		27·82		28·05		28·28	
Az. of Ref. M. „	28 54 51·99		50·79		51·07		52·30		50·47	

Abstract of Astronomical Azimuth observed at LXII (Dáowála) 1881—(*Continued*).

2. By Western Elongation of 51 Cephei.

Face	L	R	L	R	L	R	L	R	L	R
Zero	81°	211°	110°	290°	189°	9°	269°	89°	312°	132°
Date	February 13		February 14		February 15		February 16		February 17	
	"	"	"	"	"	"	"	"	"	"
Observed difference of Circle-Readings Ref. M.—Star reduced to Elongation	24·57	24·91	23·78	24·13	25·05	26·20	20·76	21·73	25·83	27·44
	23·76	25·60	23·11	21·81	26·16	25·31	21·98	24·03	25·53	25·51
	24·17	24·75	25·53	24·53	26·54	26·63	24·73	24·89	24·49	23·20
	23·59	25·22	26·29	24·62	24·16	24·67	23·34	25·88		
Means	24·02	25·12	24·68	23·77	25·48	25·70	22·70	24·13	25·28	25·38

	° ′ "	"	"	"	"
Means of both faces	− 147 56 24·57	24·23	25·59	23·42	25·33
Level Corrections	− 0·17	+ 0·25	+ 0·66	− 0·08	+ 0·14
Corrected Means	− 147 56 24·74	23·98	24·93	23·50	25·19
Az. of Star fr. S., by W.	176 51 13·33	13·67	13·90	14·12	14·35
Az. of Ref. M. „	28 54 48·59	49·69	48·97	50·62	49·16

		° ′ "
Astronomical Azimuth of Referring Mark	by Eastern Elongation	28 54 51·32
	by Western „	„ 49·41
	Mean	„ 50·37
Angle Referring Mark and LI (Ghundi) *see page* 173 *ante*		− 0 5 22·73
Astronomical Azimuth of Ghundi by observation		28 49 27·64
Geodetical Azimuth of „ by calculation from that adopted (Vol. II, page 141) at Kaliánpur: *see page* 206 *ante*		28 49 22·63
Astronomical—Geodetical Azimuth at LXII (Dáowála)		+ 5·01

July, 1885.

W. H. COLE,
In charge of Computing Office.

PLATE I.

EASTERN SIND MERIDIONAL SERIES.

Fig. No. 6

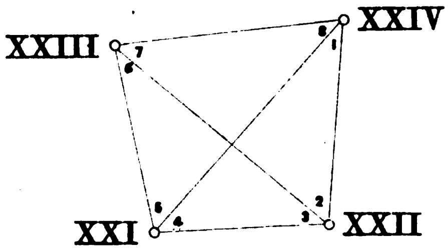


Fig. No. 5

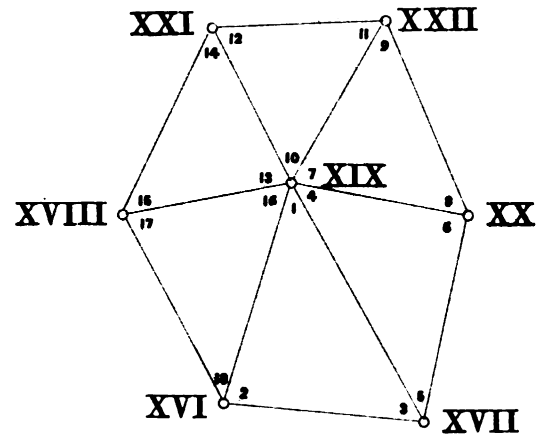


Fig. No. 4

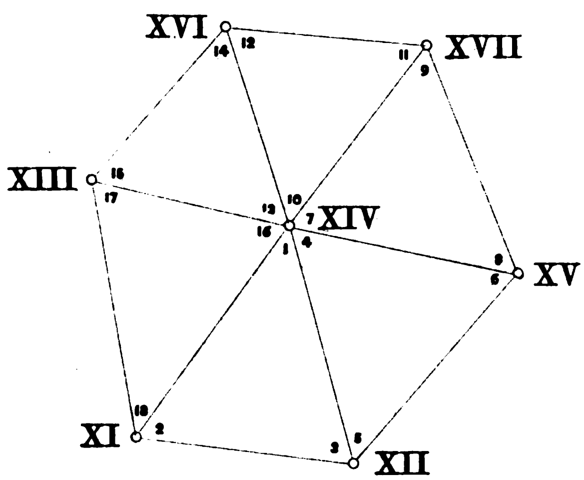


Fig. No. 3

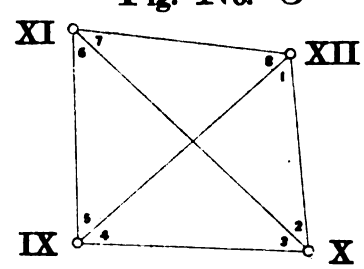


Fig. No. 2

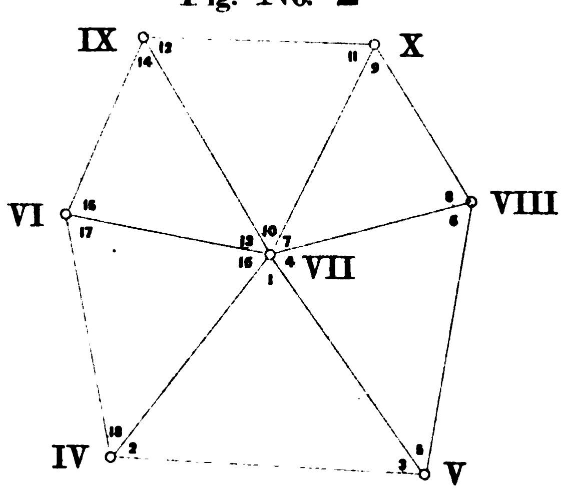
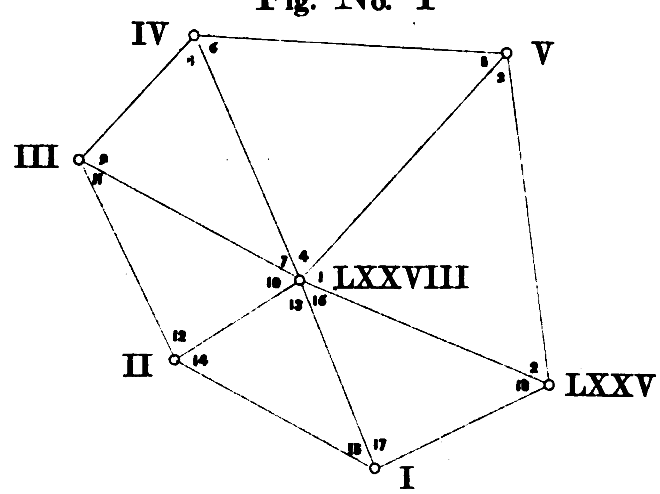


Fig. No. 1



Scale 1 Inch = 12 Miles or $\frac{1}{760320}$

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, March 1886.

Sobha Ram, Photo. C. G. Ollenbach, Zinco.

EASTERN SIND MERIDIONAL SERIES.

Fig. No. 12

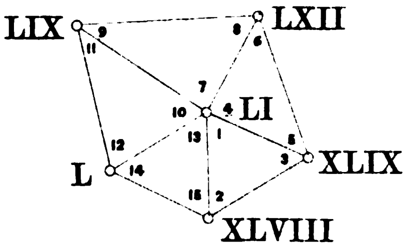


Fig. No. 11

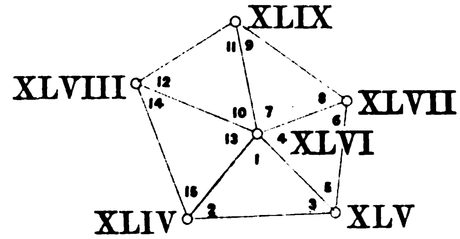


Fig. No. 10

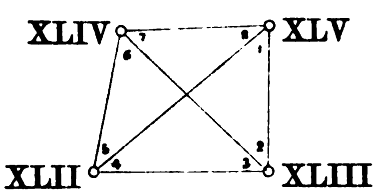


Fig. No. 9

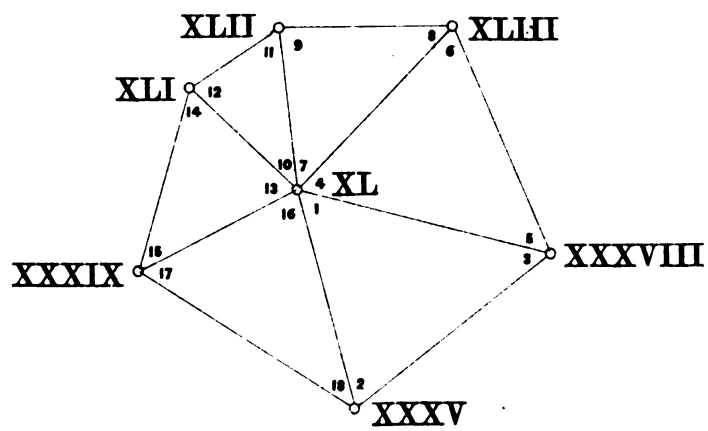


Fig. No. 8

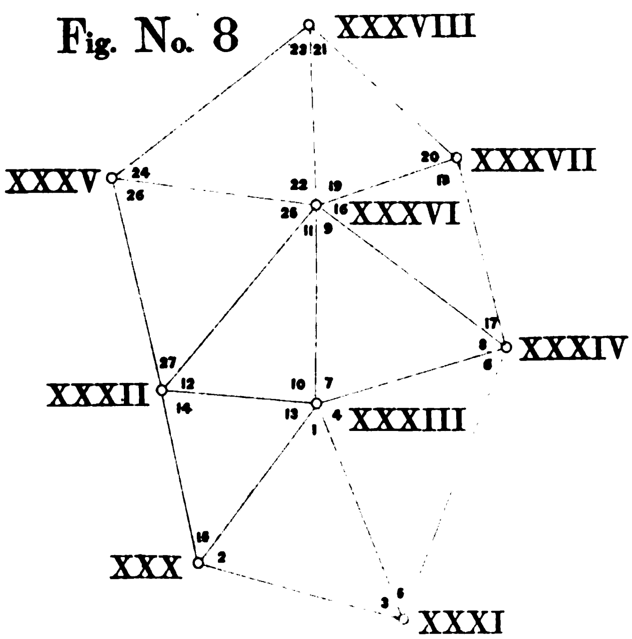
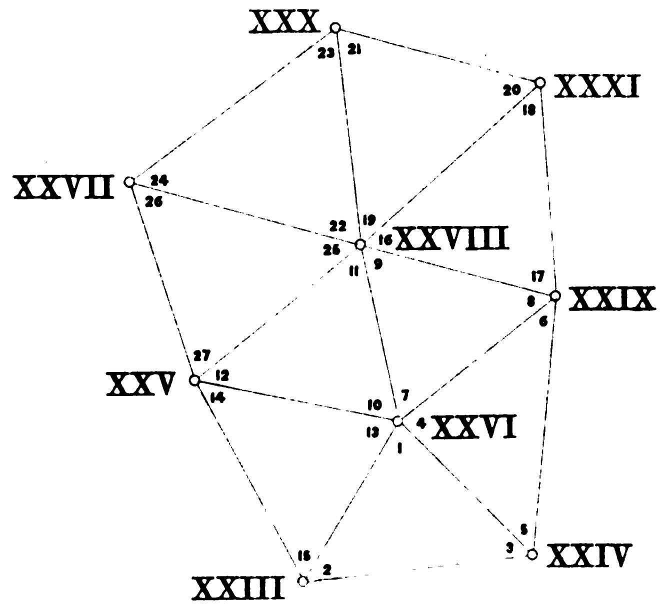


Fig. No. 7



Scale 1 Inch = 12 Miles or $\frac{1}{760320}$

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, March 1886.

Sibba Ram, Photo. C. G. Ollenbach, Zinco.

REDUCTION CHART OF THE PRINCIPAL TRIANGULATION OF THE JODHPORE MERIDIONAL SERIES OF THE GREAT TRIGONOMETRICAL SURVEY OF INDIA

C. F. Guthrie, Photo.

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, July 1882.

C. G. Ollenbach, Zinco.

REDUCTION CHART

OF THE

PRINCIPAL TRIANGULATION

OF

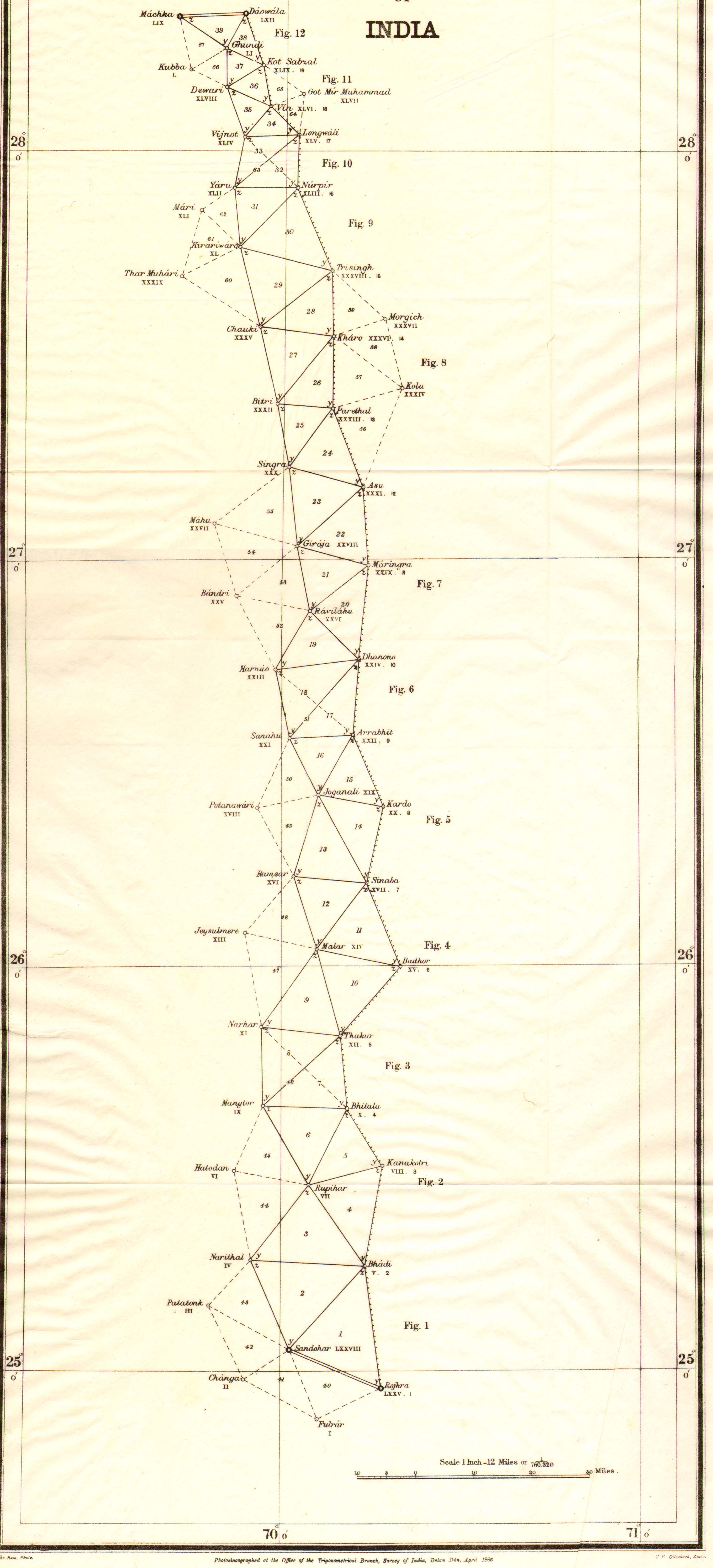
THE EASTERN SIND MERIDIONAL SERIES

OF THE

GREAT TRIGONOMETRICAL SURVEY

OF

INDIA



Sethu Ram, Photo.

Photozincographed at the Office of the Trigonometrical Branch, Survey of India, Dehra Dún, April 1886

C. G. Dittenbeck, Zinco.

India and Superintendent of the [illegible] Survey. Dehra Dun and Calcutta, 1879.

List of Published Works of the Great Trigonometrical Survey of India.

An Account of the Measurement of an Arc of the meridian between the parallels of 18° 3′ and 24° 7′, being a continuation of the Grand Meridional Arc of India as detailed by the late Lieutenant-Colonel Lambton in the Volumes of the Asiatic Society of Calcutta. By Captain George Everest, of the Bengal Artillery, F.R.S., &c. London, 1830.

An Account of the Measurement of two Sections of the Meridional Arc of India, bounded by the parallels of 18° 3′ 5″; 24° 7′ 11″; and 29° 30′ 18″. By Lieutenant-Colonel Everest, F.R.S., &c., late Surveyor General of India, and his Assistants. London, 1847.

Account of the Operations of the Great Trigonometrical Survey of India.

Volume I. The Standards of Measure and the Base-Lines, also an Introductory Account of the early Operations of the Survey, during the period of 1800-1830. By Colonel J. T. Walker, R.E., F.R.S., &c., &c., Superintendent of the Survey. Dehra Dún, 1870.

Do. II. History and General Description of the Principal Triangulation and of its Reduction. By Colonel J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1879.

Do. III. The Principal Triangulation, the Base-Line Figures, the Karáchi Longitudinal, N.W. Himalaya, and the Great Indus Series of the North-West Quadrilateral. By Colonel J. T. Walker, R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1873.

Do. IV. The Principal Triangulation, the Great Arc (Section 24°-30°), Rahún, Gurhágarh and Jogí-Tíla Meridional Series, and the Sutlej Series of the North-West Quadrilateral. By Colonel J. T. Walker, R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1876.

Do. IV A. The Principal Triangulation of the North-West Quadrilateral, including the Reduction and Details of the Jodhpore and Eastern Sind Meridional Series. Prepared in the Office of the Trigonometrical Branch, Survey of India, Colonel C. T. Haig, R.E., Offg. Deputy Surveyor General, in charge, and published under the orders of Colonel G. C. DePrée, S.C., Surveyor General of India. Dehra Dún, 1886.

Do. V. Details of the Pendulum Operations by Captains J. P. Basevi, R.E., and W. J. Heaviside, R.E., and of their Reduction. Prepared under the directions of Major-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Trigonometrical Survey. Dehra Dún and Calcutta, 1879.

Account of the Operations of the Great Trigonometrical Survey of India—(*Continued*).

Volume VI. The Principal Triangulation of the South-East Quadrilateral including the Great Arc—Section 18° to 24°, the East Coast Series, the Calcutta and the Bider Longitudinal Series, the Jabalpur and the Bilâspur Meridional Series, and the Details of their Simultaneous Reduction. Prepared under the directions of Major-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Trigonometrical Survey. Dehra Dún, 1880.

Do. VII. General Description of the Principal Triangulation of the North-East Quadrilateral including the Simultaneous Reduction and the Details of Five of the Component Series, the North-East Longitudinal, the Budhon Meridional, the Rangír Meridional, the Amua Meridional, and the Karára Meridional. Prepared under the directions of Lieutenant-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Trigonometrical Survey. Dehra Dún, 1882.

Do. VIII. Details of the Principal Triangulation of Eleven of the Component Series of the North-East Quadrilateral, including the following Series; the Gurwáni Meridional, the Gora Meridional, the Huríláong Meridional, the Chendwár Meridional, the North Párasnáth Meridional, the North Malúncha Meridional, the Calcutta Meridional, the East Calcutta Longitudinal, the Brahmaputra Meridional, the Eastern Frontier—Section 23° to 26°, and the Assam Longitudinal. Prepared under the directions of Lieut.-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Trigonometrical Survey. Dehra Dún, 1882.

Do. IX. Electro-Telegraphic Longitude Operations executed during the years 1875-77 and 1880-81, by Lieut.-Colonel W. M. Campbell, R.E., and Major W. J. Heaviside, R.E. Prepared under the directions of Lieut.-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Trigonometrical Survey. Dehra Dún, 1883.

Synopses of the Results of the Great Trigonometrical Survey of India, comprising Descriptions, Co-ordinates, &c., of the Principal and Secondary Stations and other Fixed Points, of the Several Series of Triangles, as follows:—

Volume I. The Great Indus Series, or Series *D* of the North-West Quadrilateral. By Colonel J. T. Walker, R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1874.

Do. $\frac{I}{A}$. (*Preliminary*) The Survey of India Operations in North and South Afghánistan. Prepared by Major T. H. Holdich, R.E., and Lieut.-Colonel E. P. Leach, R.E. Published at the Office of the Trigonometrical Branch, Survey of India, Colonel C. T. Haig, R.E., Offg. Deputy Surveyor General, in charge, and published under the orders of Colonel G. C. DePrée, S.C., Surveyor General of India. Dehra Dún, 1885.

Do. II. The Great Arc—Section 24° to 30°, or Series *A* of the North-West Quadrilateral. By Colonel J. T. Walker, R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1874.

Do. III. The Karáchi Longitudinal Series, or Series *B* of the North-West Quadrilateral. By Colonel J. T. Walker, R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1874.

Do. IV. The Gurhágarh Meridional Series, or Series *F* of the North-West Quadrilateral. By Colonel J. T. Walker R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1875.

Synopses of the Results of the G. T. Survey of India, &c.—(*Continued*).

Volume V. The Rahún Meridional Series, or Series *E* of the North-West Quadrilateral. By Colonel J. T. Walker, R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1875.

Do. VI. The Jogí-Tíla Meridional Series, or Series *G*, and the Sutlej Series, or Series *H* of the North-West Quadrilateral. By Colonel J. T. Walker, R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1875.

Do. VII. The North-West Himalaya Series, or Series *C* of the North-West Quadrilateral, and the Triangulation of the Kashmir Survey. By Major-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1879.

Do. VIII. The Great Arc—Section 18° to 24°, or Series *A* of the South-East Quadrilateral. By Colonel J. T. Walker, C.B., R.E., F.R.S., &c., &c., Superintendent of the Survey, and his Assistants. Dehra Dún, 1878.

Do. IX. The Jabalpur Meridional Series, or Series *E* of the South-East Quadrilateral. By Colonel J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1878.

Do. X. The Bider Longitudinal Series, or Series *D* of the South-East Quadrilateral. By Major-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1880.

Do. XI. The Biláspur Meridional Series, or Series *F* of the South-East Quadrilateral. By Major-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1880.

Do. XII. The Calcutta Longitudinal Series, or Series *B* of the South-East Quadrilateral. By Major-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1880.

Do. XIII. The East Coast Series, or Series *C* of the South-East Quadrilateral. By Major-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1880.

Do. XIII A. The South Párasnáth Meridional Series and the South Malúncha Meridional Series of the South-East Quadrilateral. Prepared in the Office of the Trigonometrical Branch, Survey of India, Colonel C. T. Haig, R.E., Offg. Deputy Surveyor General, in charge, and published under the orders of Colonel G. C. DePrée, S.C., Surveyor General of India. Dehra Dún, 1885.

Do. XIV. The Budhon Meridional Series, or Series *J* of the North-East Quadrilateral. By Lieutenant-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1883.

Do. XV. The Rangír Meridional Series, or Series *K* of the North-East Quadrilateral. By Lieutenant-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1883.

Do. XVI. The Amua Meridional Series, or Series *L*, and the Karára Meridional Series, or Series *M* of the North-East Quadrilateral. By Lieutenant-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1883.

Do. XVII. The Gurwáni Meridional Series, or Series *N*, and the Gora Meridional Series, or Series *O* of the North-East Quadrilateral. By Lieutenant-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1883.

Do. XVIII. The Huríláong Meridional Series, or Series *P*, and the Chendwár Meridional Series, or Series *Q* of the North-East Quadrilateral. By Lieutenant-General J. T. Walker, C.B., R.E., F.R.S., &c., &c., Surveyor General of India and Superintendent of the Survey, and his Assistants. Dehra Dún, 1883.

Synopses of the Results of the G. T. Survey of India, &c.—(*Continued*).

Volume XIX. The North Párasnáth Meridional Series, or Series *R*, and the North Malúncha Meridional Series, or Series *S* of the North-East Quadrilateral. Prepared by J. B. N. Hennessey, Esq., M.A., F.R.S., &c., &c., Offg. Deputy Surveyor General, in charge of Trigonometrical Surveys, and his Assistants, and published under the orders of Colonel G. C. DePrée, S.C., Offg. Surveyor General of India. Dehra Dún, 1883.

Do. XX. The Calcutta Meridional Series, or Series *T*, and the Brahmaputra Meridional Series, or Series *V* of the North-East Quadrilateral. Prepared by J. B. N. Hennessey, Esq., M.A., F.R.S., &c., &c., Offg. Deputy Surveyor General, in charge of Trigonometrical Surveys, and his Assistants, and published under the orders of Colonel G. C. DePrée, S.C., Offg. Surveyor General of India. Dehra Dún, 1883.

Do. XXI. The East Calcutta Longitudinal Series, or Series *U*, and the Eastern Frontier Series—Section 23° to 26°, or Series *W* of the North-East Quadrilateral. Prepared by J. B. N. Hennessey, Esq., M.A., F.R.S., &c., &c., Offg. Deputy Surveyor General, in charge of Trigonometrical Surveys, and his Assistants, and published under the orders of Colonel G. C. DePrée, S.C., Offg. Surveyor General of India. Dehra Dún, 1883.

March, 1886.