

1873.

NEW ZEALAND.

CONFERENCE OF CHIEF SURVEYORS.

(REPORT OF THE CONFERENCE HELD AT WELLINGTON, APRIL 12, 1873.)

Presented to both Houses of the General Assembly by command of His Excellency.

No. 1.

CIRCULAR to SUPERINTENDENTS of PROVINCES convening the Meeting of CHIEF SURVEYORS.

SIR,—

Colonial Secretary's Office, Wellington, 28th January, 1873.

The Government have had under their consideration the question of the present state of the surveys of the Crown lands, of lands alienated by the Crown, of confiscated lands, and of Native lands in the Colony; and considering the magnitude of the interests, public as well as private, involved in the question, have arrived at the conclusion that the best course that can be adopted at the present time is to invite a meeting, to be held at Wellington, of all the Chief Surveyors, who should prepare a report for the consideration of Parliament upon the actual condition of existing surveys, and suggest any steps which may appear to them to be necessary for the introduction of an improved and uniform system of conducting such surveys.

I have therefore to request that your Honor would be so good as to instruct the Chief Surveyor of the Province of to proceed to Wellington by the first opportunity in April next, for the purpose of being present at the proposed meeting, and affording the Government and the other Chief Surveyors in the Colony the benefit of his experience, towards the end the Government have in view.

All reasonable expenses connected with his visit to and detention in Wellington will be defrayed by the General Government.

I have, &c.,

G. M. WATERHOUSE,
(for Colonial Secretary).

Present at the Conference:

- J. S. Williams, Esq., Registrar-General of Land.—(Left 16th April, 1873.)
 T. Heale, Esq., Inspector of Surveys.
 D. A. Tole, Esq., Chief Surveyor of the Province of Auckland.
 T. Humphries, Esq., Chief Surveyor of the Province of Taranaki.
 C. Weber, Esq., Chief Surveyor of the Province of Hawke's Bay.—(Left 15th April, 1873.)
 H. Jackson, Esq., Chief Surveyor of the Province of Wellington.
 A. D. Dobson, Esq., Chief Surveyor of the Province of Nelson.
 H. G. Clarke, Esq., Chief Surveyor of the Province of Marlborough.
 S. Hewlings, Esq., Chief Surveyor of the Province of Canterbury.—(Left 16th April, 1873.)
 G. Mueller, Esq., Chief Surveyor of the County of Westland.
 T. Cass, Esq., formerly Chief Surveyor of the Province of Canterbury.

No. 2.

Mr. T. HEALE to the Hon. the COLONIAL SECRETARY.

SIR,—

Wellington, 19th April, 1873.

In accordance with your circular of the 28th January last, the Chief Surveyors of all the Provinces, with the exception of Mr. Thomson, of Otago, who was detained by serious illness in his family, and with the addition of Mr. Cass, formerly Chief Surveyor of the Province of Canterbury, the Registrar-General of Land, and the Inspector of Surveys, met in Wellington on the 12th instant, and have continued in earnest discussion of the subjects submitted to them to the present day.

It is clear that the first of these subjects,—“The actual condition of existing surveys in the several Provinces,”—could only be arrived at, in detail and with certainty, after a lengthened investigation; but it was thought that sufficient information to serve as a basis for suggestions for the improvement of the system of surveys might be obtained without such close scrutiny; and each Chief Surveyor was requested to furnish a return setting out, under certain heads, the actual condition of existing surveys in his Province.

The information thus obtained affords abundant proof that the surveys in most parts of the Colony, and especially in those which were first settled, have not been conducted throughout on any consistent plan sufficiently sound and accurate to form a safe basis for defining and establishing the boundaries

and relative position of estates granted by the Crown, or to determine in any satisfactory manner the geography of the country. Very creditable efforts, it is true, have been made in some Provinces to remedy the defects of their earlier surveys, and to place them on a safe geodetic basis; but these attempts, though to a great extent successful, have been embarrassed,—in some cases by the vast arrears of faulty or wholly neglected work,—in others by the pressure of immediate requirements compelling them to confine their efforts to the land required at the moment for settlement, to the exclusion of the larger area of their territory,—while in most cases the means available to the Survey Departments have been, as formerly, barely sufficient to enable their officers to meet the current demands upon them, by marking out lands as they were required, by the readiest and most perfunctory method that could be found; and, in all, the want of any established standard of qualification necessary to authorize any one to act as a surveyor, and the low status of professional capacity which has arisen from the mechanical way in which surveys have been conducted in the Colony generally, has been a source of difficulty, and has led to doubts as to the trustworthiness of much of the work of detail.

It is clear that the difficulties which the greater part, if not all, of the Survey Departments in the Colony have had to contend with, have not arisen solely from the shortcomings of surveyors, but that they have flowed necessarily from the political circumstances of the Colony. Detached communities,—beset with urgent want of lands subdivided to different dimensions, according to the nature of the country and of the agricultural or pastoral requirements of the settlers,—each necessarily had to deal with the difficulty according to the means in its power, and the mode of survey was not, in most cases, based on any previously thought-out system or design, but rather grew out of the force of circumstances. A bad system once introduced, no skill or energy could struggle against it; and even had the systems in the several localities been good, they would inevitably have been discordant, and would have been found deficient now that they are coalescing into a whole.

The Conference has been irresistibly led to the conclusion that the only remedy must lie in the establishment of a general system applicable to the whole Colony, and in so co-ordinating the work of the several Provinces that they will fit into and form part of a connected whole.

In making this general recommendation, they are urging no untried novelty or scientific theory; they only insist on the necessity of extending to this Colony the system which has been found necessary in every part of the civilized world. Not only every State in Europe, but the vast Asiatic possessions of Russia, and the whole territory of India, have been covered with a complete system of triangulation, far more elaborate and exact than is now proposed for these comparatively small islands; and although the ultimate expense of the work now proposed will no doubt be great, the Conference is satisfied that, far from involving an additional and gratuitous expense, the system proposed will actually greatly diminish the cost of surveying, besides affording a security as to boundaries of properties, and a completeness to the geography of the country, utterly unobtainable by any other means.

The Conference, moreover, is satisfied that, sooner or later, such a system must inevitably be extended to this Colony, and that the longer its introduction is delayed, the larger will be the mass of faulty surveys with which it will have to deal, and the greater will be the expense ultimately incurred, apart altogether from the confusion and possible litigation which may result, and the certainty of greatly increased expense in the conduct of detail surveys from the want of it in the meanwhile.

The Conference has abstained from entering into the details of the system of triangulations it has recommended, and from discussing the heads of the code of instructions the necessity of which it has indicated.

It has been felt that the preparation of the plan of works of such magnitude and future importance would require a degree of elaboration, and an unity of design, not to be looked for from a body of officers burdened with other duties to which they are anxious to return.

It trusts that, should the Government think proper to adopt its general recommendations, it will certainly not fail to place the construction of a system of rules for carrying it out into competent hands, and that full opportunity will be given for the consideration of them; and that, in simply indicating the necessity of an early change in the system of surveys, and the general direction which remedial measures should take, the Conference has carried out the duty with which the Government has intrusted it.

The resolutions come to by the Conference are appended.

I have, &c.,

THEOP. HEALE,
Chairman.

The Hon. the Colonial Secretary, Wellington.

Enclosure in No. 2.

RESOLUTIONS PASSED AT CONFERENCE OF CHIEF SURVEYORS, HELD AT WELLINGTON.

I. That the following subjects be taken into consideration in the order given:—

- (a.) The actual condition of existing surveys in the several Provinces.
- (b.) The necessity of basing all surveys upon triangulation, and the mode in which such triangulation should be carried out.
- (c.) Ought the sectional surveys to be, as heretofore, under the direction of the Provincial Governments, or should the General Government undertake the whole charge of these surveys?
- (d.) Whether a code of instructions should be published for the general guidance of all survey staffs in the Colony; and whether there should not be an "Inspector of Surveys" appointed by the General Government to see that such instructions are carried out in the various Provinces?

- (e.) Is it advisable or not that lands granted on faulty surveys should be resurveyed prior to the completion of the triangulation?
- (f.) Should there not be periodical examinations held for the purpose of granting certificates of competency to surveyors; and should not a prohibition be made against any person practising the profession without such certificate of competency?

2. That each Chief Surveyor be requested to furnish a statement of the actual condition of existing surveys in his Province, to embrace the following heads:—

What area of land has been triangulated?—defining major triangulation from minor triangulation.

What area of land has been completed in sectional surveys, and what area still remains to be surveyed, of sold lands?

What sums of money have been placed on the Provincial Estimates during the past year for surveys, and whether such sums are adequate to the requirements of the service?

What is the acreage of granted lands—and also of sold lands in the Province?

3. That each Chief Surveyor be requested to furnish a return showing the total cost, cost per acre and relative cost in forest and open country, of the triangulation executed in his Province; and also the date of commencement of such survey, together with a statement as to whether such triangulation has been systematically applied to the connection, correction and determination of the true position of ordinary block and sectional surveys in his Province; and, if so, to what extent, in acres, in each instance. Also, the number of Crown grants of erroneously surveyed lands, the defects in which have been disclosed and remedied by the aid of such triangulation.

4. That in the opinion of the Conference it is necessary, in order to insure greater accuracy in all future surveys, that the method of prosecuting them should be based upon an accurate system of triangulation—wherever the nature of the country admits of such a process being performed.

5. That wherever practicable, a careful system of major triangulation (the sides to average between eight and fourteen miles) should be undertaken over the whole area of the Colony—this work to be undertaken by the General Government at the cost of the Colony.

6. That minor triangulation, to be conducted under the direction of the Provincial Governments if practicable, ought to be based thereon, in so far, in such parts, and at such times as may be necessary to enable the boundaries of any land intended to be granted by the Crown, or heretofore granted, to be properly determined.

7. That to establish and secure certainty in the boundaries of all granted estates, it is essential that no Crown grant should in future be issued, until the survey of the land has been properly connected with the triangulation and the land delineated upon a record map. And to enable grants based on former faulty surveys to be gradually corrected, all areas of land, including lands so granted, ought to be triangulated, so that truly fixed points shall be accessible, in relation to which future surveys can be made, and the lands then delineated on the record map.

8. That where, from the densely wooded character and other physical obstacles of any part of the country, a minor triangulation is found to be impracticable, a system of main or circuit traverse, carefully connected with and executed from the meridian of one (at least) or more of the nearest previously triangulated points, should then in such cases be adopted.

9. That all sectional surveys of lands subject to the administration of the respective Provinces should, as heretofore, be carried out under the direction of the Provincial Governments.

10. That detailed rules should be prepared accurately defining a system for the conduct of minor triangulation where it may be required, and for connecting therewith, or in some cases with the major triangulations, the surveys of all lands comprised in or intended to be comprised in any Crown grant. Also, for the construction from the triangulation of record maps of uniform character, and for laying down thereon the survey of every parcel of land prior to the issue of a Crown grant thereof.

11. That such rules, after due consideration by the heads of the Survey Departments throughout the Colony, and after approval of the majority of them, should be made binding and imperative; and that thereafter no Crown grant ought to be issued until the land comprised in it shall have been surveyed and laid down on the record map in strict conformity with those rules, and to the satisfaction of the Secretary for Crown Lands.

12. That after the record maps hereinbefore referred to shall have been prepared, no land ought to be brought under the operation of the Land Transfer Acts until the map of the Crown grant in which it is contained shall have been correctly delineated on the record map by the proper local officer.

13. That, in the opinion of the Conference, a Board, to be comprised of Chief Surveyors or other qualified professional persons in the Colony, should hold periodical sittings for the purpose of examining candidates for diplomas in the profession.

14. That after a certain date no survey ought to be received as the foundation of a Crown grant, or for any public purpose, except it shall have been executed by a surveyor holding such a diploma from the Board.

15. That there should be two or more grades of surveyors, each grade to be required to have passed a separate examination before the Board; and that the number of different grades in the profession, and the degree of examination required to pass for each, should be determined upon by the above-mentioned Board of Examiners. But,

16. That the foregoing should not apply to Government staff surveyors, nor to any surveyor at present in possession of a diploma issued prior to the 1st January, 1873, and granted by the "Surveyors' Association of the Province of Auckland," or by any previous or existing Chief Surveyor, or other competent authority of any Province in the Colony: Provided that holders of such diplomas or certificates shall be required to forward the same for registration to the Board of Examiners, within a certain time, to be fixed by the said Board.

17. That, in the opinion of the Conference [with reference to the papers relative to preparation of Crown grants referred to it], it is advisable that every Crown grant—in addition to a distinct reference by number to the record map—should contain the fullest possible survey details

necessary, not only for the proper description of the boundaries of the land thereby granted, but also for the determination of the true position of the same upon the ground. It is therefore recommended that, in all cases where practicable, the linkages and bearings of the boundaries of each estate, and where a trigonometrical station or stations (or points fixed from the triangulation) are erected within the boundaries thereof, or adjacent thereto, a bearing and distance also, from such point or points should be fully delineated on the marginal plan.

18. That the Conference believes that the faithful carrying out of its previous resolutions will fully meet the requirements suggested by the Registrar-General in his memorandum presented to the Conference, as well as the difficulty referred to in the papers relating to the Crown grant for the "Karakā Block," referred to the Conference.

The proposal of Mr. Williams, that the assistance of the Provincial Survey Offices should be available to the Registrars, appears to be one desirable to be met in many cases, but the Conference apprehends that it must be left for departmental arrangement.

19. That, in the opinion of the Conference, the question involved in the consideration of this subject [relative to the laying down of roads through the lands of Natives and Europeans,] is one especially deserving the attention of the Legislature of the Colony, with the view to either enlarging or removing the limits as to time fixed by statute; but failing that, it is recommended that steps be taken to lay down the general direction of required roads (without actual survey) upon the official plan of each parcel of sold or granted lands; leaving the best lines of road to be subsequently determined upon, and exchanged hereafter, with the consent of the owners of the land, for those formerly taken.

20. That the Chairman be requested to draw up a report, embodying the foregoing resolutions, to be presented at the next sitting of the Conference.

21. That the experience already gained in this Colony, as well as that of many other countries, leads the Conference to believe that the cost of the proposed triangulation would not exceed $\frac{1}{2}$ d. per acre, at least over those portions of the Colony over which triangulation is likely to be early required.

22. That returns in form of the draft this day approved of, together with that moved for by Mr. Tole on the second day of meeting of the Conference, be prepared by each surveyor, and forwarded to the Honorable Colonial Secretary for the purpose of being appended to the other papers of the Conference.

23. That the report of the Chairman, with the verbal alterations agreed to, be adopted.

24. That the Chairman be instructed to forward to the Honorable Colonial Secretary the report as agreed to, with the interim returns and copy of the resolutions passed, together with the minutes of the proceedings.

APPROXIMATE RETURN showing the STATE of SURVEYS conducted under the INSPECTOR of SURVEYS.

Province.	Area of Province.	Area of Confiscated Lands.	Native Land Claims Surveys passed.	Triangulated.
	Acres.	Acres.	Acres.	Acres.
Auckland ...	17,000,000	1,873,237	1,828,796	3,017,500
Auckland ...	...	Sectionally surveyed, 1,300,000	...	...
Hawke's Bay...	...	...	1,233,239	1,020,000
Wellington ...	...	...	833,577	743,750

APPROXIMATE RETURN showing the STATE of the SURVEYS in the respective PROVINCES.

PROVINCE.	Area of Province.			Lands alienated.		Major Triangulation.		Minor Triangulation.		Reconnaissance.	Amount appropriated by Provincial Legislature for current year.
	Forest.	Open.	Lake.	Sectionally surveyed.	Survey not yet completed.	Finished.	In progress.	Finished.	In progress.		
Auckland*	...	...	...	1,167,827	395,171	...	...	70,000	...	...	£ 1,000 0
Taranaki ...	...	...	...	167,775	7,700	...	...	16,000	...	...	280 0
Hawke's Bay	...	...	...	726,500	24,000	...	...	420,000	...	...	1,200 0
Wellington...	5,700,000	1,270,000	30,000	789,921	480,857	2,496,000	1,420,800	2,000,000	426,240	...	12,500 0
Nelson ...	...	...	...	985,000	...	...	...	20,000	...	...	4,000 0
Marlborough	750,400	2,224,000	5,230	...	...	...	...	...	...	...	...
Westland ...	2,843,141	172,800	29,759	10,500	...	554,160	...	100,880	...	...	3,125 0
Canterbury ...	...	...	...	1,093,000	97,000	...	...	...	...	5,800,000	14,934 15

* This return merely embraces a period from 1856 to 1870.

MINUTES OF PROCEEDINGS.

The Conference met in the Provincial Library, Wellington, on Saturday, the 12th April, 1873, at noon.

Present :

Mr. Cass, Mr. Clarke, Mr. Dobson, Mr. Heale, Mr. Hewlings,	|	Mr. Humphries, Mr. Jackson, Mr. Tole, Mr. Weber, Mr. Williams.
--	--	--

Moved by Mr. Jackson, seconded by Mr. Hewlings, That Mr. Heale do take the chair. Carried.

Mr. Heale opened the Conference by suggesting that to-day the Conference should take into consideration the order to be adopted with a view to bringing the various subjects for consideration regularly before the Conference.

Mr. Williams presented a memorandum, which was, on motion put, read by the Chairman.

Mr. Jackson submitted a set of draft propositions as a basis for the proceedings of the Conference.

After some discussion on each head separately, it was resolved, That the following subjects be taken into consideration in the order given :—

1. The actual condition of existing surveys in the several Provinces.
2. The necessity of basing all surveys upon triangulation, and the mode in which such triangulation should be carried out.
3. Ought the sectional surveys to be, as heretofore, under the direction of the Provincial Governments, or should the General Government undertake the whole charge of these surveys ?
4. Whether a code of instructions should be published for the general guidance of all Survey Staffs in the Colony ; and whether there should not be an Inspector of Surveys appointed by the General Government to see that such instructions are carried out in the various Provinces ?
5. Is it advisable or not that lands granted on faulty surveys should be resurveyed prior to the completion of the triangulation ?
6. Should there not be periodical examinations held for the purpose of granting certificates of competency to surveyors ; and should not a prohibition be made against any person practising the profession without such certificate of competency ?

Moved by Mr. Humphries, seconded by Mr. Jackson, and carried, That each Chief Surveyor be requested to furnish a statement of the actual condition of existing surveys in his Province, to embrace the following heads :—

1. What area of land has been triangulated—defining major triangulation from minor triangulation ?
2. What area of land has been completed in sectional surveys ? and
3. What area still remains to be surveyed of sold lands ?
4. What sums of money have been placed on the Provincial Estimates during the past year for surveys ? and
5. Whether such sums are adequate to the requirements of the service ?
6. What is the acreage of granted lands, and also that of sold lands in the Province ?

Moved by Mr. Cass, seconded by Mr. Tole, and carried, That the Conference do now adjourn until Monday, at 11 a.m., at the same place.

The Conference met in the Provincial Library, Wellington, on Monday, the 14th April, 1873, at 11 a.m.

Present :

Mr. Cass, Mr. Clarke, Mr. Dobson, Mr. Heale, Mr. Hewlings,	|	Mr. Humphries, Mr. Jackson, Mr. Tole, Mr. Weber, Mr. Williams.
--	--	--

Moved by Mr. Jackson, seconded by Mr. Weber, and carried, That Mr. Heale do act as Chairman during the Conference.

The minutes of the previous meeting were read by the Secretary, and confirmed.

SUBJECT FOR CONSIDERATION.

I.—*The actual Condition of existing Surveys in the various Provinces.*

Mr. Tole presented an approximate statement of the condition of surveys in the Province of Auckland, accompanying the same with certain explanatory remarks.

Mr. Hewlings presented an approximate statement of the condition of surveys in the Province of Canterbury, accompanying the same with certain explanatory remarks.

Mr. Jackson presented an approximate statement of the condition of surveys in the Province of Wellington, accompanying the same with certain explanatory remarks.

Mr. Jackson presented a return showing approximate areas of forest, open lands, and lakes, within the Province of Wellington.

The Chairman stated that he had telegraphed to Auckland for information necessary to complete a report of the condition of surveys conducted under the Native Lands Court, and craved the indulgence of the Conference.

Mr. Humphries presented an approximate statement of the condition of surveys in the Province of Taranaki, accompanying the same with certain explanatory remarks.

Mr. Dobson presented an approximate statement of the condition of surveys in the Province of Nelson, accompanying the same with certain explanatory remarks.

Mr. Clarke presented an approximate statement of the condition of surveys in the Province of Marlborough; and also showing area of forest lands, lakes, and open country.

Mr. Weber presented an approximate statement of the condition of surveys in the Province of Hawke's Bay, accompanying the same with certain explanatory remarks.

Mr. Jackson stated that he had received a telegram from Mr. Thomson, expressing his regret at being detained from attending the Conference, by serious illness in his family.

The Chairman introduced the second subject for consideration, viz:—

II.—*The necessity of basing all Surveys upon Triangulation, and the mode in which such Triangulation should be carried out.*

Moved by Mr. Tole, seconded by Mr. Dobson, and carried, That each Chief Surveyor be requested to furnish a return showing the total cost, cost per acre, and relative cost in forest and open country, of the triangulation executed in his Province; and also the date of commencement of such survey, together with a statement as to whether such triangulation has been systematically applied to the connection, correction, and determination of the true position of ordinary block and sectional surveys in his Province, and if so, to what extent in each instance; also the number of Crown grants of erroneously surveyed lands, the defects in which have been disclosed and remedied by the aid of such triangulation.

Moved by Mr. Jackson, seconded by Mr. Weber,—

A. That, in the opinion of the Conference, it is necessary, in order to insure greater accuracy in all future surveys, that the method of prosecuting them should be based upon an accurate system of triangulation,—wherever the nature of the country admits of such a process being performed.

B. That wherever practicable, a careful system of major triangulation (the sides to average between eight and fourteen miles) should be undertaken over the whole area of the Colony.

C. That a minor triangulation (the sides to average between two and four miles) should be performed simultaneously with, or as soon as possible after, the major triangulation; such minor triangulation to be based upon the sides of the major triangulation, and to be prosecuted over all lands (admitting of the performance of such a process) that have been sold, or likely to become shortly sold, throughout the Colony; excepting only such lands over which minor triangulation has already been executed accurately, or is in course of execution, by the Provincial Governments. (*Negatived.*)

D. That in order to secure a uniform and a harmonious system in carrying out the details of these triangulations, the entire direction of the works should be undertaken by and at the expense of the General Government, and that, for the performance of the works, a special staff should be appointed and controlled from a central office. (*Withdrawn.*)

Moved by Mr. Hewlings, seconded by Mr. Cass, That the Conference do adjourn for one hour.

The Conference reassembled at 2.45 p.m., when the consideration of Mr. Jackson's set of resolutions was resumed.

After some discussion, Mr. Jackson asked and obtained leave to amend his resolutions as follows, namely:—

Expunge resolution "D," and substitute as follows:—

That no lands should become granted in future, unless the surveys shall have been based upon triangulation. (*Negatived.*)

That every triangulated point ought to be connected with the marks of existing surveys. (*Negatived.*)

Moved by Mr. Dobson, seconded by Mr. Tole, and carried, That after the word "Colony," in resolution B, all the following words be omitted.

Moved by Mr. Dobson, seconded by Mr. Tole, and carried, That after the word "Colony," in resolution B, the following words be added:—"This work to be undertaken by the General Government at the cost of the Colony."

The resolutions A and B (as amended) were then put and carried.

Moved by Mr. Jackson, seconded by Mr. Humphries:—

A. That a minor triangulation, the sides to average between two and four miles, should be performed simultaneously with, or as soon as possible after the major triangulation, such minor triangulation to be based upon the sides of the major triangulation, and to be prosecuted over all lands (admitting of the performance of such a process) that have been sold, or likely to become shortly sold, throughout the Colony, excepting only such lands over which minor triangulation has already been executed accurately, or is in course of execution by the Provincial Governments. (*Withdrawn.*)

B. That no lands should become granted in future unless the surveys have been based upon triangulation. (*Withdrawn.*)

C. That any triangulated point ought to be connected with the marks of existing surveys. (*Withdrawn.*)

After some discussion, Mr. Jackson obtained leave to withdraw his resolutions.

Moved by Mr. Humphries, seconded by Mr. Dobson, That to establish and secure certainty in the boundaries of all granted estates, it is essential that no Crown grant should in future be issued until the survey of the land has been properly connected with the triangulation, and the land delineated upon a record map; and to enable grants based upon former faulty surveys to be gradually cor-

rected, all areas of land, including land so granted, ought to be triangulated, so that truly fixed points shall be accessible, in relation to which future surveys can be made, and the lands then delineated on the record map.

Moved by Mr. Hewlings as an amendment, seconded by Mr. Jackson, That the following words be introduced before the motion of Mr. Humphries:—

That minor triangulation ought to be based thereon, in so far, in such part, and at such times as may be necessary to enable the boundaries of any land intended to be granted by the Crown, or heretofore granted, to be properly determined.

After some discussion this amendment was carried, on division, by the casting vote of the Chairman.

<p style="text-align: center;"><i>Ayes, 5.</i></p> <p>Mr. Cass, Mr. Hewlings, Mr. Jackson, Mr. Williams, The Chairman.</p>	|	<p style="text-align: center;"><i>Noes, 4.</i></p> <p>Mr. Clarke, Mr. Dobson, Mr. Humphries, Mr. Tole.</p>
--	--	--

Moved, as a further amendment, by Mr. Tole, seconded by Mr. Clarke, and carried, That after the word "triangulation" the following words be added:—"To be conducted under the direction of the Provincial Governments, if practicable."

The original motion of Mr. Humphries, as amended, carried.

Moved by Mr. Humphries, seconded by Mr. Jackson, and carried, That the Conference do now adjourn until Tuesday, at 11 a.m., at the same place.

The Conference met in the Provincial Library, Wellington, on Tuesday, the 15th April, at 11 a.m

Present :

<p>Mr. Cass, Mr. Clarke, Mr. Dobson, Mr. Hewlings,</p>	|	<p>Mr. Humphries, Mr. Jackson, Mr. Tole, Mr. Williams.</p>
Mr. Heale, Chairman.		

The minutes of the previous meeting having been confirmed,

The Chairman laid on the table papers referred by the Government to the Conference.

Moved by Mr. Tole, seconded by Mr. Dobson, and carried, That all sectional surveys of lands subject to the administration of the respective Provinces should, as heretofore, be carried out under the direction of the Provincial Governments.

Moved by Mr. Tole, seconded by Mr. Dobson, That with the view to secure uniformity of system, a code of instructions, to be rigidly adhered to in the execution of all trigonometrical surveys, should be prepared and published for the general guidance of survey staffs throughout the Colony.

Moved, as an amendment, by Mr. Jackson, seconded by Mr. Humphries, and carried—

That detailed rules should be prepared accurately defining a system for the conduct of minor triangulation where it may be required, and for connecting therewith, or in some cases with the major triangulations, the surveys of all lands comprised in, or intended to be comprised in, any Crown grant. Also for the construction from the triangulation of record maps of uniform character, and for laying down thereon the survey of every parcel of land, prior to the issue of a Crown grant thereof.

That such rules, after due consideration by the heads of the Survey Departments throughout the Colony, and after approval of the majority of them, should be made binding and imperative; and that thereafter no Crown grant ought to be issued until the land comprised in it shall have been surveyed and laid down on the record map in strict conformity with those rules.

Mr. Tole's previous motion was therefore negatived on division.

<p style="text-align: center;"><i>Ayes, 3.</i></p> <p>Mr. Clarke, Mr. Dobson, Mr. Tole.</p>	|	<p style="text-align: center;"><i>Noes, 5.</i></p> <p>Mr. Cass, Mr. Hewlings, Mr. Humphries, Mr. Jackson, Mr. Williams.</p>
---	--	---

Moved by Mr. Jackson, seconded by Mr. Humphries, That an Inspector of Surveys should be appointed by the General Government to visit periodically each Province, and to report to Government whether such instructions are being carried out.

After some discussion, Mr. Jackson obtained leave to withdraw the motion.

Moved by Mr. Humphries, seconded by Mr. Jackson, That the attention of the Crown Lands Office be called to the necessity of appointing an Inspector of Surveys to visit periodically each Province, and to report to Government that such instructions are being carried out.

Moved (as amendment) by Mr. Tole, seconded by Mr. Dobson, and carried on division, That, in lieu of the preceding motion of Mr. Jackson, the following words be added to the last resolution:—"and to the satisfaction of the Secretary for Crown Lands." Carried on division.

<p style="text-align: center;"><i>Ayes, 4.</i></p> <p>Mr. Clarke, Mr. Dobson, Mr. Hewlings, Mr. Tole.</p>	|	<p style="text-align: center;"><i>Noes, 2.</i></p> <p>Mr. Humphries, Mr. Jackson.</p>
<i>Did not vote.</i>		
Mr. Cass,	|	Mr. Williams.

Moved by Mr. Tole, seconded by Mr. Dobson, and carried, That after the record maps hereinbefore referred to shall have been prepared, no land ought to be brought under the operation of the Land Transfer Acts until the map of the Crown grant in which it is contained shall have been correctly delineated on the record map by the proper local officer.

Moved by Mr. Cass, seconded by Mr. Dobson, and carried—

A. That, in the opinion of the Conference, a Board to be composed of Chief Surveyors, or other qualified professional persons in the Colony, should hold periodical sittings for the purpose of examining candidates for diplomas in the profession.

B. That after a certain date no survey ought to be received as the foundation of a Crown grant, or for any public purpose, except it shall have been executed by a surveyor holding such a diploma from the Board.

C. That there should be two or more grades of surveyors, each grade to be required to have passed a separate examination before the Board; and that the number of different grades in the profession, and the degree of examination required to pass for each, should be determined upon by the above-mentioned Board of Examiners.

Moved by Mr. Tole, seconded by Mr. Clarke, and carried, But that the foregoing should not apply to Government Staff Surveyors, nor to any surveyor at present in possession of a diploma issued prior to the 1st January, 1873, and granted by the "Surveyors' Association of the Province of Auckland," or by any previous or existing Chief Surveyor or other competent authority of any Province in the Colony.

Moved by Mr. Dobson, seconded by Mr. Humphries, and carried, That the Conference do adjourn until 2 p.m. on Wednesday, 16th April, 1873 (at the same place), for the purpose of considering the papers referred to it.

The Conference met in the Provincial Library, Wellington, on Wednesday, the 16th April, 1873, at 2 p.m.

Present :

Mr. Cass,	|	Mr. Humphries,
Mr. Clarke,	|	Mr. Jackson,
Mr. Dobson,	|	Mr. Mueller,
Mr. Heale (Chairman),	|	Mr. Tole.

The minutes of the previous meeting were read by the Secretary, and confirmed.

The Secretary read a telegram received from Mr. Thompson, stating that he would leave Dunedin for Wellington as soon as possible.

Subject—Consideration of Papers respecting preparation of Crown Grants.

Moved by Mr. Tole, seconded by Mr. Jackson, and carried, That, in the opinion of the Conference, it is advisable that every Crown grant, in addition to a distinct reference by number to the Record Map, should contain the fullest possible survey details, necessary, not only for the proper description of the land thereby granted, but also for the determination of the true position of the same upon the ground. It is therefore recommended that, in all cases where practicable, the linkages and bearings of the boundaries of each estate, and, where a trigonometrical station or stations (or points fixed from the triangulation) are erected within the boundaries thereof, or adjacent thereto, a bearing and distance also from such point or points should be fully delineated on the marginal plan.

The Secretary read a memorandum presented by the Registrar-General of Land.

Moved by Mr. Humphries, seconded by Mr. Mueller, and carried, That the Conference, believes that the faithful carrying out of its previous resolutions will fully meet the requirements suggested by the Registrar-General in his memorandum presented to the Conference, as well as the difficulty referred to in the papers relating to the Crown grant for the "Karaka Block," referred to the Conference. The proposal of Mr. Williams, that the assistance of the Provincial Survey Offices should be available to the Registrars, appears to be one desirable to be met in many cases, but the Conference apprehends that it must be left for departmental arrangement.

Subject—Papers relative to laying down Roads through lands granted to Natives and Europeans.

Moved by Mr. Tole, seconded by Mr. Clarke, and carried, That, in the opinion of the Conference, the question involved in the consideration of this subject is one especially deserving the attention of the Legislature of the Colony, with the view to either enlarging or removing the limit as to time fixed by Statute; but failing that, it is recommended that steps be taken to lay down the general direction of required roads (without actual survey) upon the official plan of each parcel of sold or granted lands, leaving the best lines of road to be subsequently determined upon, and exchanged hereafter, with the consent of the owners of the land, for those formerly taken.

Moved by Mr. Tole, seconded by Mr. Dobson, and carried, That the Chairman be requested to draw up a report embodying the foregoing resolutions, to be presented at the next sitting of the Conference.

Moved by Mr. Humphries, seconded by Mr. Jackson, and carried, That the Conference do now adjourn until Friday, the 18th April, at 11 a.m. (at the same place), to allow time for the Chairman to comply with the last resolution.

The Conference met in the Provincial Library, Wellington, on Friday, the 18th April, 1873, at 11 a.m.

Present :

Mr. Cass,	|	Mr. Humphries,
Mr. Clarke,	|	Mr. Jackson,
Mr. Dobson,	|	Mr. Mueller,
Mr. Heale (Chairman),	|	Mr. Tole.

The minutes of the previous meeting were read by the Secretary, and confirmed.

The Chairman brought up a report embodying the foregoing resolutions, in compliance with the request of the Conference; after the reading of which, it was moved by Mr. Tole, seconded by Mr. Jackson, and carried, That the draft report be laid on the table of the Conference, and taken into consideration next sitting day.

Moved by Mr. Dobson, seconded by Mr. Tole, That the Conference estimates the cost of the major triangulation, including connection with the trigonometrical work already completed, at $\frac{1}{2}$ d. per acre over the whole Colony, and that this amount, in round numbers, will be about £150,000.

After some discussion, Mr. Dobson asked leave to amend his former motion, by omitting therefrom all the words after "Colony." But it was moved by Mr. Jackson, seconded by Mr. Mueller, and carried on division (as an amendment), That the experience already gained in this Colony, as well as that of many other countries, leads the Conference to believe that the cost of the proposed triangulation would not exceed $\frac{1}{2}$ d. per acre, at least over those portions of the Colony in which triangulation is likely to be early required.

<i>Ayes, 4.</i>	|	<i>Noes, 3.</i>
Mr. Cass,	|	Mr. Clarke,
Mr. Humphries,	|	Mr. Dobson,
Mr. Jackson,	|	Mr. Tole.
Mr. Mueller.	|	

Mr. Mueller presented a return showing the actual condition of existing surveys in the County of Westland.

Moved by Mr. Tole, seconded by Mr. Mueller, and carried, That the following words be added after Mr. Humphries' motion of 14th April, (That no grant should be issued until the land has been connected by triangulation):—"That where, from the densely wooded character or other physical obstacles of any part of the country, a minor triangulation is found to be impracticable, a system of main or circuit traverse, carefully connected with and executed from the meridian of one (at least) or more of the nearest previously triangulated points, should then, in such cases, be adopted."

Moved by Mr. Mueller, seconded by Mr. Jackson, and carried, That the following words be added after Mr. Tole's motion of 15th April (respecting exemption of certain surveyors from examination):—"Provided that holders of such diplomas or certificates shall be required to forward the same for registration to the Board of Examiners within a certain time, to be fixed by the said Board."

Moved by Mr. Cass, seconded by Mr. Jackson, and carried, That the Conference do now adjourn until Saturday, the 19th April, at 10 a.m., at the same place.

The Conference met in the Provincial Library, Wellington, on Saturday, the 19th April, 1873, at 10 a.m.

Present :

Mr. Cass,	|	Mr. Humphries,
Mr. Clarke,	|	Mr. Jackson,
Mr. Dobson,	|	Mr. Mueller,
Mr. Heale (Chairman),	|	Mr. Tole.

The minutes of the previous meeting were read by the Secretary, and confirmed.

A draft form of "Return of Condition of Surveys" was approved.

Moved by Mr. Tole, seconded by Mr. Dobson, and carried, That returns in form of the draft this day approved of, together with that moved for by Mr. Tole on the second day of meeting of the Conference, be prepared by each Chief Surveyor and forwarded to the Honorable Colonial Secretary for the purpose of being appended to the other papers of the Conference.

Moved by Mr. Tole, seconded by Mr. Mueller, and carried, That the draft report presented by the Chairman yesterday be read, and considered paragraph by paragraph.

Moved by Mr. Mueller, seconded by Mr. Tole, and carried, That the draft report, with the verbal alterations agreed to, be adopted.

Moved by Mr. Cass, seconded by Mr. Mueller, and carried, That the Chairman be instructed to forward to the Honorable Colonial Secretary the report as agreed to, with the interim returns and copy of the resolutions passed, together with the minutes of the proceedings.

Moved by Mr. Tole, seconded by Mr. Humphries, and carried, That the thanks of the Conference be conveyed to His Honor the Superintendent of the Province of Wellington for the ample accommodation which he has afforded for its sittings.

Moved by Mr. Mueller, seconded by Mr. Cass and carried, That the Chairman be instructed to sign the necessary voucher for the payment of the Secretary, Mr. Samuel.

Moved by Mr. Tole, seconded by Mr. Clarke, and carried, That the thanks of the Conference be accorded to Mr. Heale for the ability, courtesy, and forbearance which have characterized his conduct in the chair.

The minutes of the present meeting were read by the Secretary, and confirmed.

There being no further business before the meeting, the Chairman declared the Conference at an end.

Mr. J. T. THOMSON to the Hon. the SECRETARY for CROWN LANDS.

SIR,—

Dunedin, 13th May, 1873.

I have the honor to acknowledge the receipt of your letter dated the 7th instant, and in reply beg to thank you for allowing me the privilege of adding my remarks to the Report of the recent Conference of Chief Surveyors, and at which, to my great regret, I was not able to be present.

Your courtesy very much relieves me from the reflection that untoward circumstances had prevented me from doing a public duty. The information that I have received from friends attending the Conference also suggests the fact that I could not have been of much service, as the officers holding opinions against change of system in their respective Provinces were in a large majority. It may be surmised from this that where only £250 or £1,000 are the sums total voted in a Province for survey, that amelioration of system to such officers would appear hopeless. Besides this, I would have stood in a position of unfairness to the Province which I represent, by the fact of my having only a single vote, while the operations under my control, and work executed, greatly exceed any Province in particular, and are immensely larger than the majority. I may also note that Canterbury (that is, the east portion of old Canterbury Province) had two votes. These remarks I merely make in extenuation, for I would have been most happy to have met my brother officers at any time as directed by Government.

I perceive that the Conference, under the circumstances, has come to no practical conclusion, which I have no doubt is due to the miscellaneous nature of its composition, as well as from the above causes.

Major Triangulation not sufficient.—One thing they suggest, a major triangulation for the Colony, but this, in the geographical sense, has no advantages without the higher and more scientific process of astronomical determinations of the absolute latitudes and longitudes governing the same; nor, in the sense of actual or section survey, without minor triangulation guaranteed systematically in connection therewith and subsequently thereto. Minor triangulation, I may say in passing, is the really essential part of Colonial survey, more necessary than all other processes to sectionizing and settlement. The Report of the Conference is thus evidently the disjointed enunciation of two distinct parties of surveyors—one endeavouring to institute system and completeness, the other obsolete and ineffective operations.

Political Position to be weighed.—In my humble opinion, the first object of a Survey Adviser is to weigh the position of political parties in New Zealand, and then advance a scheme of general operations that all (Central and Provincial) must perforce assent to. This, I think, can be done by a little mutual forbearance. Provincial susceptibilities must not be intruded on, but, on the contrary, be carefully regarded.

Settlement Survey to remain as Provincial.—Thus the actual settlement surveys might be perfectly well left to local administration as heretofore. In other words, the Provincial Executives could all direct what and how much is to be done, the General Government merely interfering with the scientific question of how, professionally, it is to be done. To this end, the whole Provincial staffs might remain permanently with the Provincial Councils, the only alteration being what has already been given effect to in the persons of the Chief Commissioners in the respective Land Offices: that is, the Chief Surveyors being placed as members of the general staff. This single act would, I think, be a sufficient guarantee to the Colony that detail or settlement surveys would be carried out with the same spirit as the general system, and with equal efficiency.

Varying nature of Provincial and General Government interests.—Taking a comprehensive and prospective view of the subject, it will appear that, as the Crown lands are parted with, the Provincial interest gets less and less as the revenue also thus decreases; but the Colonial interest, through the Land Transfer Act, becomes more and more. Thus the Central Government can never, if it were inclined, denude itself of all interest in settlement survey; on the contrary, its interest will be ever increasing, and the necessity of its taking measures for self-guarantee of more and more import. It is therefore incumbent on both parties (Centralising or Provincial) to come to a fair adjustment of the question, such adjustment in itself being so equitable that it will stand at least for some years to come. The future arrangements can alone be decided by events connected with the condition into which the ultimate colonizing operations will lead.

Provinces unable to carry out Standard Survey.—The area of the Colony is 67,500,000 acres, divided between nine Provinces. The standard branches of Colonial survey (over so extensive a geographical space), which govern and check all actual or sectional operations, cannot, of necessity, be undertaken or even partially attained to by the majority of those divisions; neither is it desirable, on professional grounds, that these works should be attempted by what would be disjointed and unregulated parties. The astronomical, geographical, and geodesical—which are the standard branches—are clearly a responsibility of the Colony at large, so should be set about as soon as possible; for without their application to and extension over plane or section survey, the latter cannot be accepted as sound or correct, and this fault, so long as it continues, will prejudicially affect the titles to property of all freehold settlers in New Zealand.

Now is the time to introduce one system.—The area actually surveyed, *i.e.* sectionized, is only 7,238,156 acres, or about one-ninth of the whole; thus the surveys may be said to have only commenced. Now, therefore, is the time, more than ever it was, to initiate a system that can bear inspection in its truth of principle and correctness of practice: in other words, to commence a Colonial work that will compare well with other colonies, and which can be adhered to for all time to come, just as much as the survey systems of the United States of America, Canada, and India are adhered to on account of their fitness and scientific soundness, however much they differ in detail.

Officers and Instruments ready for Work.—I submit that the Colony now possesses the officers and instruments, the experience and material, to commence and carry out a general scheme of survey on an approved and yet an economical system, and which at the same time will meet the approval and support of all political parties, if the object be fairly put to them, and the scheme need involve no material extra expense on the Colony, but more than probably a large saving. The officers, in the present

dormant state of the profession, are needlessly running as much to rust as the instruments in the Provincial stores. A small expense will be incurred in bringing out the talent amongst the officers, and carrying them to the front; and the palpable saving will consist in the suspension of useless work and progression of future proper direction of effort.

Savings.—The cost of all surveys now going on may be approximately estimated at £60,000 a year. Out of this expenditure I have no doubt that an experienced surveyor would soon make savings that would amply recoup apparent additions caused by the engagement of higher officers and the introduction of standard operations. These additions may be carried out on two principles: first, to let the officers retain their present appointments; or second, to relieve them from those.

New Establishment that is necessary.—The higher officers required would be—1. Surveyor-General, to devise and superintend the system, and prepare maps showing geographical results. 2. Astronomer and Geodesian, to observe latitudes and longitudes, and take charge of and work out geodetic operations. 3. Inspector of triangulations and reduced traverses, to see that a system were adhered to in field and office in all parts of the Colony. On the first principle, £600 a year would meet the extra cost, supposing each officer selected has now £600 a year; on the second principle, the cost would be £2,400. Out of the Provincial staff, when they could be spared, four officers would require to be selected to carry on major triangulation; they and their parties costing £1,200 a year each, or £4,800 a year. This process costs $\frac{1}{2}$ d. to 1d. per acre, according to country, and should be carried as Ray-traces from one geodesical station to another, as illustrated in the attached sketch.

New Operations of Standard Work.—This operation need only cover one-fifth part of the area of the Colony, and may be confined in the meantime to settled districts only. Its ultimate extent would be 13,400,000 acres, and cost £27,900 to £30,000, taking five or six years to complete; but probably half the Colony thus surveyed would suffice for many years, so that the cost may be reduced to £2,400 per annum for six years, or £4,800 per annum for three years, when the parties would be disbanded, the officers being merged again into the Provincial staffs.

Use of New Work.—The operation, when complete, would stand for ever for two purposes:—1. It would settle the geographical and geodetic questions. 2. Serve as a basis for Provincial work in the minor triangulation and section surveys. The benefit, at a small cost, would be incalculable. This done, the higher officers might return to their previous positions or not, according to Parliamentary direction. The work would be one of Colonial satisfaction, as being of high scientific as well as practical import, and which could be referred to in other parts of the world. It would give New Zealand, in this branch of her interests, a status amongst civilized nations, and the supreme authorities in their prescience would not be losers in foreign estimation.

Inspector of Triangulation's Duties.—While this was being carried out, the Inspector of Triangulations would be fully engaged in assisting the Provincial Surveyors in remodelling their staff (that is, where this was necessary), and in introducing system in minor triangulation and mathematically reduced traverses. Here he would be a watchman on the part of the Colony to support and guarantee good work—work that might be a little tiresome at first in some quarters, but which eventually would become as popular with all surveyors of every grade as it is in Otago, where the system has been in full operation in minor triangulation for seventeen years, and in section survey for eight. After this, all surveys would be done correctly, once and for all, based on unquestionable points, and reduced by checked calculations. The settler would be as safe in his boundaries as the Land Transfer Office would be in its responsibilities. The cost of obtaining this state of affairs would be as small as the ultimate economical saving would be large. Staffs once trained never lose their aptitude; slovenly work becomes obnoxious as strict habits are acquired; and honour, the most valuable attribute of the surveyor, would support the State-colonizing efforts, so that land settlement would be correct, rapid, and satisfactory to all parties.

Actual Cost of various branches of Survey.—To illustrate this subject as a Colonial money question, I will adduce the following information on practical data: In Otago we executed 358,400 acres of major triangulation, at $\frac{1}{2}$ d. per acre; 6,379,520 acres minor triangulation, at 1d. to 1 $\frac{1}{2}$ d. per acre; 2,297,633 acres section survey, at from 6d. to 1s. 6d. per acre; according to situation, size of sections, and nature of country.

Ultimate Cost of New Zealand Survey.—Now, taking all New Zealand at 67,000,000 acres, and considering the desultory mode of settlement operations called for by the Provinces, and especially those having gold fields, we cannot put down the average cost of settlement survey at less than 2s. an acre, as much has to be gone over where spotting survey is ordered—i.e., settlement before survey. Thus, before all New Zealand can be alienated from the Crown, £6,700,000 will have to be spent in survey operations. Then, that this be done efficiently for all time to come, surely the time and amounts required for standard operations, as shown in the preceding part of this memorandum, are a mere bagatelle.

Subject frequently mooted previously.—I may say that I have been in correspondence on this subject with various members of the General Government during the last ten years, and I am in a position now more than ever to make good my words, and which can be tested by the Land Transfer Office, for I have laid out (as stated above) 2,297,633 acres on the system I now wish to see applied to the whole Colony, and in which vast extent there has been no unrecordable work, no overlapping, all section survey on unquestionable trigonometrical points.

Details.—I have necessarily merely noticed the salient points. If it be the opinion of the Legislature that the proposition should have practical force, details could then be entered into.

These details consist principally in office assistants, topographical draftsmen, lithographic and photographic draftsmen and pressmen, all of whom and their appliances are to be had in the Otago Survey Department, and, I believe, in Wellington also.

Provincial Survey inspected on behalf of the General Government.—Rules for plane or actual survey would also have to be laid down by law. This would be a most essential part of the scheme, for this most important branch will remain with the Provinces, and so should be guaranteed correct in all its operations by the above measure. Such rules have been adhered to for seventeen years in this Province, and they have been followed and supported by all qualified surveyors. The watching of this

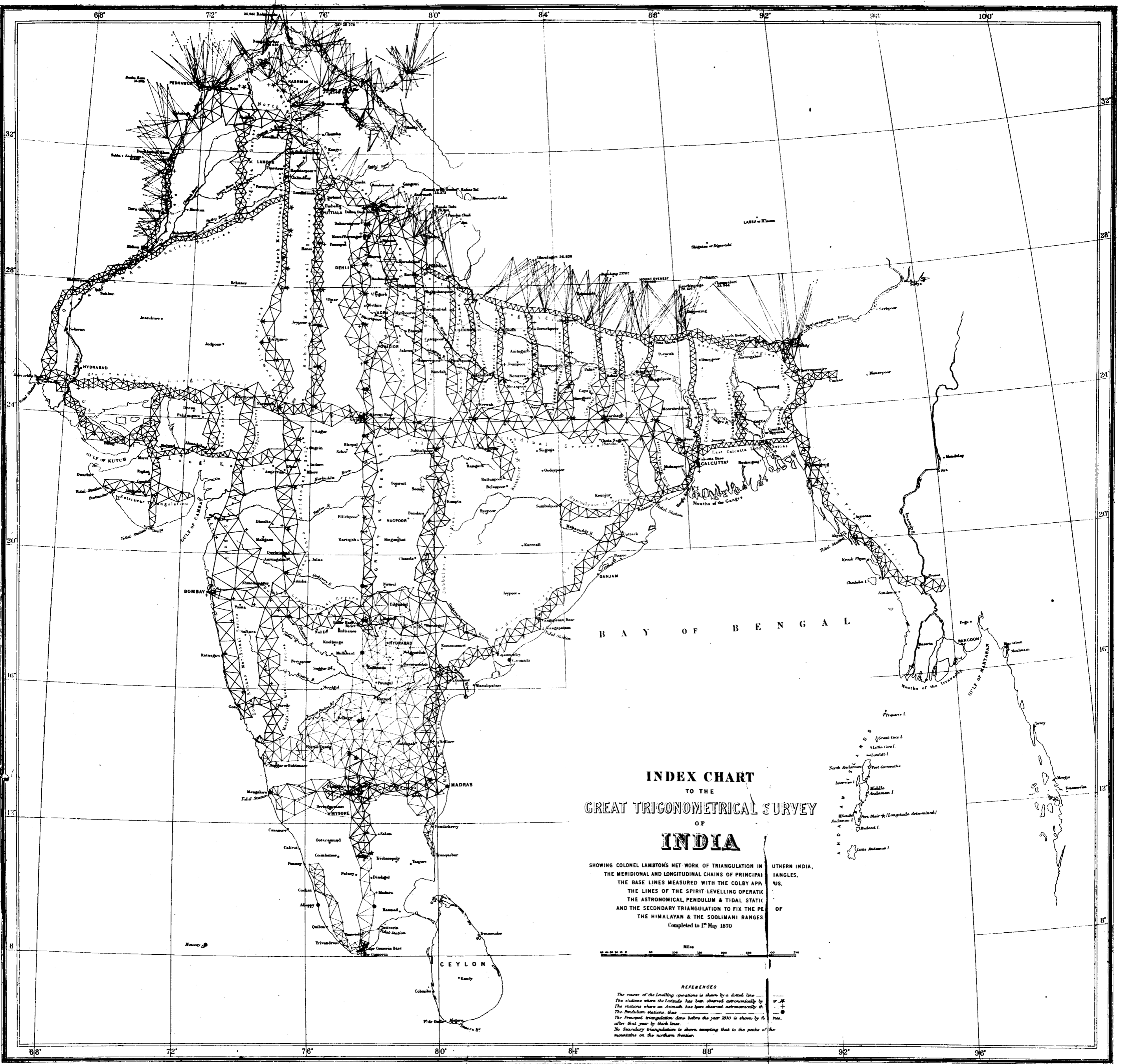
branch on behalf of the Colony would rest with the Inspector, who would report infringements to the various Superintendents and to the Surveyor-General for notification to the Secretary for Crown Lands. To help the more backward Provinces, whether professionally or by money assistance—if necessary by way of loan—cannot be a subject of jealousy on the part of more favoured and wealthy portions of New Zealand, for they are an integral part of the whole, and, as their condition will get worse and worse by time, the cost of revisal, that certainly must come sooner or later, will ultimately fall on the whole. Also, if families in some portions of the Colony become impoverished by doubtful boundaries which entail heavy lawsuits, that impoverishment is so much from the wealth of the whole as a body politic.

I have, &c.,

J. T. THOMSON,
Chief Surveyor of Otago and Commissioner
of Crown Lands.

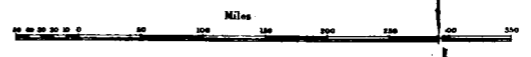
The Hon. the Secretary for Crown Lands,
Wellington.

P.S.—I beg to forward to you a copy of the Triangulation of India up to 1870, lately forwarded to me by Colonel Thuillier, Surveyor-General, under whom, for many years, I had the honor of conducting one of the eleven branch surveys that, prior to 1853, existed in the Bengal Presidency. If you take the East Coast of India, from Calcutta to Cape Comorin, you will see measures almost identical with those I recommend for New Zealand, substituting major for great triangulation only, major there standing as secondary triangulation. This map will also show at a glance the cause of the difference between my estimate (£30,000) and that of the Chief Surveyors' Conference (£150,000): Ray-trace or chain-major triangulation, in my opinion, meeting all scientific and practical requirements, minor triangulation being had recourse to to fill up the intervals, and this only as settlement goes on; no immediate, more than ordinary, expenditure being incurred.—J. T. T.

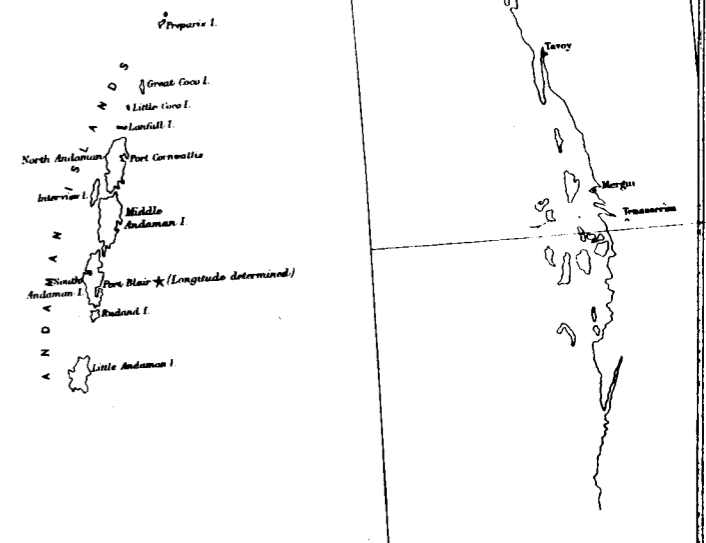


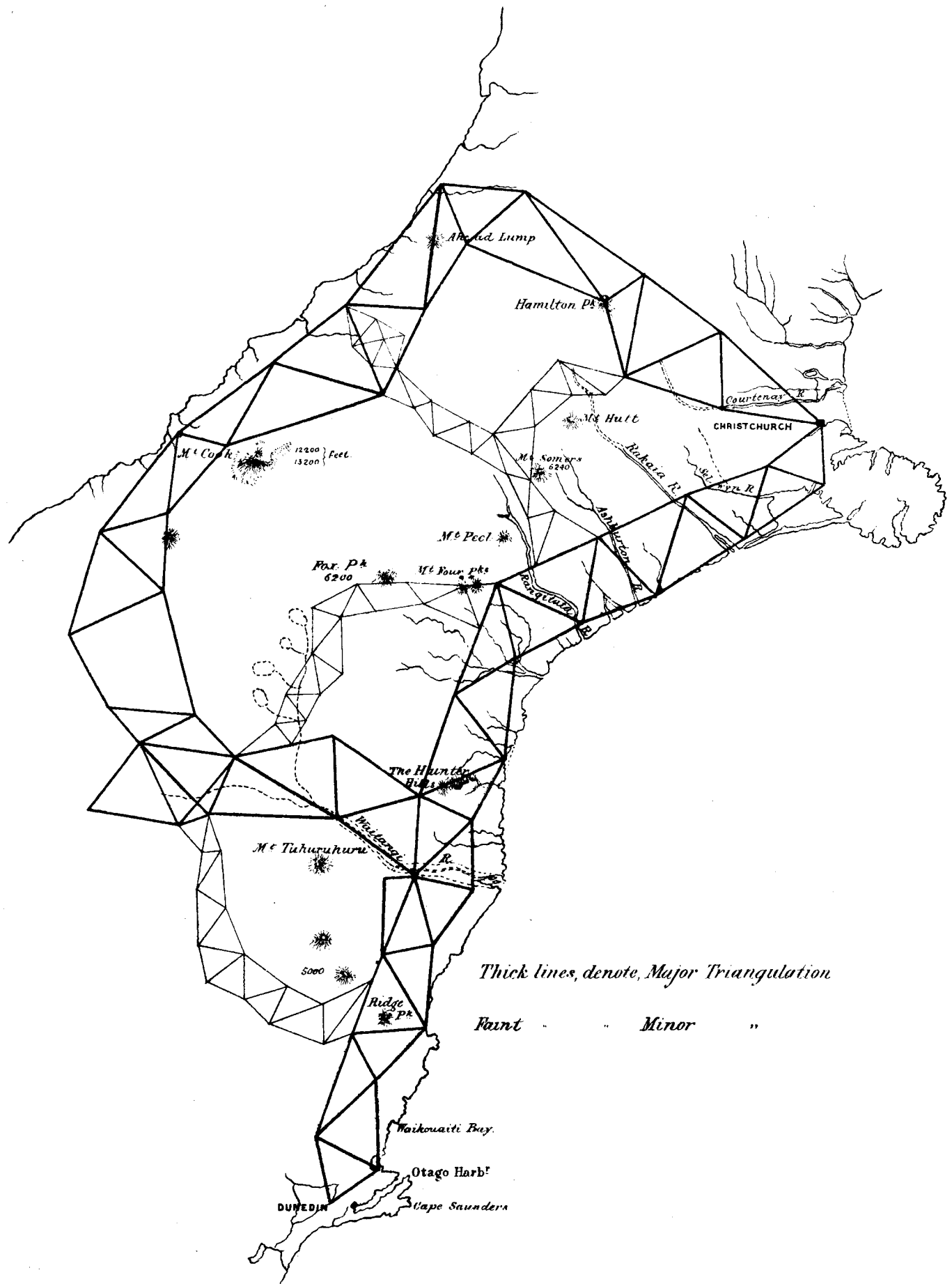
**INDEX CHART
TO THE
GREAT TRIGONOMETRICAL SURVEY
OF
INDIA**

SHOWING COLONEL LAMBTON'S NET WORK OF TRIANGULATION IN
THE MERIDIONAL AND LONGITUDINAL CHAINS OF PRINCIPAL
THE BASE LINES MEASURED WITH THE COLBY APP.
THE LINES OF THE SPIRIT LEVELLING OPERATIC
THE ASTRONOMICAL, PENDULUM & TIDAL STATIC
AND THE SECONDARY TRIANGULATION TO FIX THE PE
THE HIMALAYAN & THE SOOLIMANI RANGES.
Completed to 1st May 1870



REFERENCES
 The course of the levelling operations is shown by a dotted line
 The stations where the Latitude has been observed astronomically by
 The stations where an Azimuth has been observed astronomically by
 The meridian stations by
 The Principal triangulation done before the year 1850 is shown by a
 after that year by thick lines.
 No Secondary triangulation is shown excepting that to the peaks of
 the mountains on the northern frontier.





Thick lines, denote, Major Triangulation

Faint " " Minor " "

This will show the principle that can be rapidly carried all over New Zealand. Minor Triangulation would ultimately fill up all the intervening spaces between Major Triangulation.

J. T. T

APPROXIMATE RETURN showing the state of Surveys in the various Provinces of the Colony.

NOTE.—Surveys, conducted under the Inspector of Surveys, in Auckland, Hawke's Bay, and Wellington, are shown by Return H. 1, page 4.

PROVINCE.	AREA OF PROVINCE.			LANDS ALIENATED.		MAJOR TRIANGULATION.		MINOR TRIANGULATION.		RECONNAISSANCE.	AMOUNT APPROPRIATED BY PROVINCIAL LEGISLATURES FOR CURRENT YEAR.	
	Forest.	Open.	Lake.	Totals.	Sectionally Surveyed.	Survey not yet completed.	Totals.	Finished.	In progress.			Finished.	In progress.
	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	Acres.	£
Auckland (a)	...	...	...	17,000,000	1,174,027	404,444	1,575,471	...	...	...	...	1,000
Taranaki	1,927,000	210,000	...	2,137,000	167,775	17,700	185,475	...	8,000	...	...	280
Hawke's Bay (b)	493,700	2,517,100	33,200	3,050,000	1,032,750	28,450	1,061,200	384,000	36,000	...	1,375,800	1,200
Wellington	5,700,000	1,270,000	30,000	7,000,000	789,921	430,857	1,270,778	2,486,000	1,420,800	...	...	12,500
Nelson	4,936,000	2,000,000	64,000	7,000,000	(c) 985,000	...	985,000	...	...	(d) 20,000	7,000,000	3,000
Marlborough	750,400	2,224,000	5,230	3,000,000	201,883	319,225	521,108	...	...	(e) 39,045	...	1,000
Westland	2,843,141	172,800	29,759	3,045,760	12,285	11,065	44,591	554,160	...	...	1,536,000	(f) 2,700
Canterbury	270,000	(g) 8,320,000	100,000	8,690,000	1,093,000	97,000	1,190,000	...	...	2,890,000	(h) 5,800,000	14,985
Otago ... (i)	1,228,800	14,521,600	228,000	16,038,400	(j) 2,237,633	100,000	1,853,109	358,400	...	6,379,520	11,000,000	6,717

(a) This Return merely embraces a period from 1856 (the date of the general transference of lands to Provincial administration) to 1872.

(b) It is very probable that the Provincial Legislature will provide for the financial year 1873-74 not only sufficient funds to work off the arrears of surveys, but likewise to extend them considerably.

(c) The land being surveyed in all cases before purchase, there are no arrears in respect of land sold.

(d) A trigonometrical survey was commenced about seven years ago, but was discontinued through want of funds.

(e) The minor triangulation is confined to two sheep runs, with natural features for boundaries, and the stations were not of a permanent character.

(f) Since last session of the County Council (31st December, 1872), the departmental staff has been reduced to two officers, and the system of contract sectional survey initiated. No provision is likely to be made for any other description of surveys.

(g) Mountaneous, 6,320,000 acres; plains, 2,000,000 acres.

(h) This includes 100,000 acres returned as under minor triangulation.

(i) Salaried surveyors disbanded, and district surveyors paid by fees; otherwise by contract. Minor triangulations are, in bearings, governed by standard observations carried over their respective circuits; in distances, on separate base lines for each district.

(j) Area sectionally surveyed greatly in excess of that alienated.

APPROXIMATE RETURN showing Total Cost, Cost per Acre, Relative Cost in Forest and Open Country, &c., of the Triangulation executed under the Chief Surveyors of the various Provinces, and under the Inspector of Surveys.

TRIANGULATION.

CHIEF SURVEYOR OF THE PROVINCE OF	Total Area executed.		Total Cost.	Area over which it has been systematically applied to the Connection, Correction, and Determination of the true Position of ordinary Block and Sectional Surveys.		Cost per Acre.				Date of Commencement.	Number of Grants of Erroneously Surveyed Lands, the defects in which have been disclosed thereby.
	Major.	Minor.		Major.	Minor.	Forest.		Open.			
						Acres.	Acres.	Major.	Minor.		
Auckland ...	(a)	50,000	527	...	50,000	d.	2.5	d.	...	1871	None as yet issued within area of the triangulation.
Taranaki ...	(b)	12,000	25	...	320,000	...	...	...	...	1868	Thirty-five.
Hawke's Bay ...	(c)	320,000	3,666	384,000	2,000,000	...	...	...	...	1858	2,400 (being the number issued up to 1866; since 1866 there have been 1,258 grants issued altogether, based upon the triangulation).
Wellington ...	(d)	2,496,000	7,800	2,000,000	...	...	...	...	...	1866	Eighteen.
Nelson ...	(e)	No triangulation executed	...	...	...	...	...	...	...	...	All sectional surveys have been connected with and determined by the triangulation. A few trifling discrepancies only have been discovered.
Marlborough ...	(f)	39,045	650	...	2,265,520	...	...	...	...	1867	There are no sectional surveys in Westland requiring correction, owing to their having been based upon the triangulation.
Canterbury ...	(g)	2,890,000	{ 11,799 1,072 }	...	624,480	...	...	...	...	1849	No sectional survey allowed without connection with trig. points on true meridian, and results always mathematically reduced on meridian and perpendicular by way of check. No defects have been disclosed. The whole of the compiled sectional surveys have been found more or less distorted.
Westland ...	(h)	554,160	2,608	554,160	100,880	...	...	...	...	1868	There are no sectional surveys in Westland requiring correction, owing to their having been based upon the triangulation.
Otago ...	(i)	358,400	40,618	...	2,800,000	...	...	...	...	1856	There are no sectional surveys in Westland requiring correction, owing to their having been based upon the triangulation.
Inspector of Surveys	(j)	6,067,640	10,262	6,067,640	...	...	...	...	...	...	There are no sectional surveys in Westland requiring correction, owing to their having been based upon the triangulation.

* Average major and minor.

(a) This survey was conducted over a portion of country which is densely wooded and difficult of access.
 (b) The triangulation was commenced in 1868 and carried on throughout that year, but from various reasons has not been continued. Although its connection in many places with the block and sectional surveys proves their incorrectness, it is not sufficiently applied to them to determine and connect the faultily surveyed sections; a re-survey in connection with the triangulation will be necessary to do so.
 (c) The land triangulated is all open, and the cost of the major and minor triangulations, which have been carried on simultaneously without keeping distinct accounts for each, is at the rate of 1½d. per acre. The work has been done principally in 1858, 1859, and 1860, and a small portion in 1865 and 1866. It could be carried out much cheaper now. On discovering errors in existing surveys and Crown grants, the boundaries erroneously marked out were only altered where the error was of a certain magnitude, that is, about 1 per cent. of the area of the block or Crown grant. Where the error is less, the boundaries as originally given are not altered, but notes are taken of the error. The number of grants rectified (35) gives a very inadequate rate of the advantages conferred by triangulation.

† Average open and forest.

(d) The cost per acre is for triangulation performed over a mixture of bushed and open land.
 (e) This triangulation refers to a block of open hilly country comprised within the boundaries of two runs, a portion of which had been erroneously surveyed; and the cost per acre, 4d., includes the traverses of the boundary creeks, and a complete topographical map of the block, showing the natural features, with sectional divisions delineated thereon for the purposes of sale.
 (f) The total cost comprises major and minor triangulation and circuit traverse. The latter system of survey (at 2.5d. per acre) was had recourse to when the nature of the country did not admit of minor triangulation. The difficulties of carrying out a system of triangulation are probably greater in Westland than in any other part of New Zealand, owing to the densely wooded nature of the country.
 (g) Cost of minor triangulation varies from 2½d. to 2¼d., according to country and size of sides, from 1½ to 4 miles.
 (h) As every considerable survey embraces both forest and open land, it is impossible to distinguish the relative cost, as they are never separate. In heavily wooded country the cost would probably be double that in open.