

mile; in the comparisons of the standard work in fifty-one districts in Otago covered by meridional circuit, the error at closing over a distance of 195 miles was found to be 11.0 inches per mile; and of six districts, 15.84 inches per mile. Hence the systems in accuracy are nearly co-equal, and both far within what is necessary for governing actual survey.

By the adoption of meridional circuit as a standard system instead of secondary triangulation, while we practically do not deteriorate the work in accuracy, we attain an end fraught with the most important significance to the settlers and land purchasers—viz., we place their holdings on true bearing *ab initio*, thus giving their boundaries a fixity and certainty in relation to the general scheme. Their title descriptions are also thus made an integral portion of a mathematical system which secures them against boundary disputes, and the law expenses connected therewith.

Governed by meridional circuit, unless where delay admits of major triangulation, there will follow the actual processes of minor triangulation and settlement survey. I may further mention that each circuit will have its initial station on true meridian, and whose latitude and longitude will be determined by astronomical observation and electric signal. But this need not be commenced until the settlement surveys of the colony are fully under control, and the general system in operation in due routine.

Speaking of major triangulation and meridional circuit in relation to pure geodetic or meridian arc survey, such as those undertaken by primary triangulation, neither can be classed with these. Primary triangulation is measured with an approximation equal to half an inch per mile, and in its base lines to half the breadth of a sharp-pointed needle in each 100 feet. Nevertheless, though the standard operations of a colonial settlement survey cannot be called highly scientific, that is, microscopically exact, this in no way militates against their usefulness, nor prevents their stations ultimately being embodied in the more abstruse and refined analyses which the future wealth and leisure of the country may many years hence support and undertake.

NATIONAL SYSTEM OF SURVEY.

The survey of Great Britain may be termed geodetic,* astronomical, and triangular; of Canada, astronomical, geodesical, and quadrilateral; of New Zealand, such as I propose it to be, astronomical, geodesical, triangular, and polygonal. And in support of my recommendation I have to state that the system has been in successful operation in the southern part of the colony for twenty years. The system has also been recently adopted in the Colony of Victoria, in lieu of what was there called the geodetic or meridian and parallel survey,† as well as in Western Australia.‡ Its recommendation, therefore, does not now rest solely on local opinion or experience.

ADMITTED ERROR.

As every national or colonial survey has a limit of error assigned to it beyond which the work should be rejected, and as the public can have no confidence in surveys whose accuracy is not attested and duly reported thereon, it now becomes me to enter on this branch of the actual operations. In British India the admitted error is eight links to the mile,§ and this latter is very generally adopted in New Zealand; also in various parts of the world. I may mention, however, that the best and most experienced surveyors here in fair country have no difficulty in bringing down the error of their field closings to two links per mile. But it is the gross or accumulated error allowed to creep into the work that is the most important consideration, and this is evidently affected for the better or for the worse by triangulation—in other words by the closeness or wideness of trigonometrical points. In Canada, where no triangulation is executed, owing to the nature of the surface, the allowed gross error in blocks (there called townships), six miles square, in actual survey is 200 links.|| In the southern portion of New Zealand, by means of having the trigonometrical points on an average $2\frac{1}{2}$ miles apart, the gross error is reduced to 10 or 20 links at the most. On the inspection of various traverses in the north portion of the colony, where the country is sometimes difficult, sometimes easy, gross or accumulated error, which I extract from a table in the Wanganui District, varies as follows:—

In a 2-mile traverse	...	...	...	accumulated error	92 links
„ 9-mile „	...	...	...	„ „	54 „
„ 3-mile „	...	...	...	„ „	42 „
„ 5-mile „	...	...	...	„ „	130 „
„ 4-mile „	...	...	...	„ „	72 „
„ 4-mile „	...	...	...	„ „	134 „

In the traverses of some of the districts which extend fifteen and twenty miles without check, the gross error must greatly exceed any of the above, and in the course of time, when land becomes valuable, must induce law disputes between settlers. I would thus suggest that closer check of the chainages by the trigonometrical and standard operations should be by every effort applied.

INSPECTION.

To this end, field inspection is of far more value than office correction, a subject on which I have already touched. I am strongly of opinion that errors in field cannot be rectified in the office, nor can radical faultiness be eliminated by interpolation. As an example of this, I may allude to a traverse at Awahuri corrected by office interpolation, but which on being revised in the field, the error of a

* I use the term “geodetic” as meaning operations which independently solve the form of the globe; “geodesical” as meaning operations which derive their data from the former.

† Inspector-General Allen's report. Melbourne, December, 1873.

‡ *Vide the Perth Gazette.* August, 1873.

§ Manual by Thuillier and Smyth. Calcutta, 1846.

|| Manual of Public Surveys. Ottawa, 1871.