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RESIDENT ENGINEER

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David L. Narver, Jr. Monumenting and Referencing Triangulation Stations

March 13, 1953

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The nature of the proposed tests indicate the probability of disturbance of the surface at the location of many of the horizontal control stations. As replacing these stations would indicate an extensive survey, anything that can be done to perpetuate the existing stations is easily justified. It is recommended that this be accomplished by establishing sub-surface markers at all primary stations and respective reference markers of the control networks at the Eniwetok and Bikini areas.

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The following procedure is suggested:

- a. Stations should be located at least 50 feet inland from the high tide line. However, where an existing station of an earlier survey can be included in the scheme it is desirable to include it even though it may be less than 50 feet from the high tide line. The location can be held by suitable referencing.
- b. Reference monuments should be at least 100 feet inland from the high tide line. They should form a triangle with the station marker with all sides and angles measured and the angle determined to a line of the survey. The value of this method was demonstrated at Bogallua island when the station marker was destroyed by erosion. The accurate relation of a reference marker was known, and its position computed as an eccentric station.
- c. As surface markers may be moved or destroyed by wave action and have been in the past by construction operations, a practical solution of this problem is by sub-surface markers at the station and the reference points. The depth of the markers will depend on soil conditions and while it is desirable that they be set in solid coral, they should be at least below high tide level if in loose soil. Where heavy concrete blocks are in place as station markers the sub-surface markers at the reference points should be satisfactory.
- d. The structure at Station Coral in the Enwetok Lagoon may be destroyed by test operations. A study has been made by the Chief of Surveys of the possibility of replacing destroyed stations around the perimeter of the lagoon without occupying Station Coral. This study reveals that sufficient triangle strength cannot be obtained to replace some of the stations without excessive distances between the stations used as a base

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884

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Page Two

March 13, 1953

Station Coral is the hub of the network and with its use as one point of a triangle, replacing any station, is a comparatively simple operation. Therefore, it is again recommended that reference markers be established which will permit re-establishing this station in its original location if destroyed by future operations. Reference is made to the memorandum dated January 25, 1952 from the Chief of Surveys to the Chief Engineer which included this subject and suggested the following method of referencing the station.

The station is located on a coral head with one pinnacle exposed above high water. A tie was obtained some time ago to a point on this pinnacle but a much stronger fix can be obtained by establishing a second reference point. It is suggested that a steel piling be driven in the coral head at a location which will make a strong intersection at the station for a second reference point. If this piling is cut off a little above mean low water level, it will be accessible at suitable tides and should be stable enough to withstand any anticipated wave action.

- e. A similar problem is found at Bikini Atoll where station Coca is being constructed in the lagoon and forms the hub of the network. There is no obvious method of referencing this station and the cost would be excessive to construct a structure which would withstand any anticipated wave action. If extensive use is made of this area, it may become necessary to replace this station if it is damaged, locate it by observations from existing stations and compute its relation to the other stations of the network.

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