

## FOREWORD

This report deals with precise measurements for ascertaining the horizontal and vertical displacement of underground concrete structures in various kinds of soil after these structures have been subjected to various sized charges of explosives set at varying depths, distances and angles from the targets (structures).

A second phase deals with like measurements for determining any relative movement of alignment or profile in tunnels drilled into sandstone and granite. In addition pre-blast precise alignment and profile was desired so as to make it possible to compute inverse distances between any point inside these tunnels to the center of any particular charge.

The project was generally known as the Dugway Underground Explosion Test Program and was conducted by the War Department, Corps of Engineers, Sacramento Office.

Unfortunately the desired final results as a whole were not obtained as the project was indefinitely suspended before it was developed to an extent making this possible.

### SITE NO. 3 DRY CLAY

The dry clay test site is located in the Dugway Valley about 12 miles S.W. of the base camp. This site consisted of a full set of tests, explosions against 0.1, 0.2, 0.5, and 1.0 scale targets. More effort was expended on this particular test site than on any other in the whole program, it being more extensive and requiring considerable time on preliminary work in laying out a design for the replacement points, foresights and theodolite stations. (A and B and M and N sta. see sketch).

The dry clay <sup>site</sup> was the one on which work was first initiated, starting about May 8th and continuing until July 10th at which <sup>time</sup> progress was such that the detailed operations of "tying in" fully emplaced targets could be accomplished on the 0.5 scale group. However for reasons not known or questioned by the writer the party was ordered to cease work on this site and the party ordered to the sandstone tunnel test site near Castle Dale, Utah, no further work other than the building of protective devices for the theodolite stations and foresights was ever done on this site thereafter by this unit.

As the four targets completely installed on the 0.5 scale group were the only set completely finished or that could be worked on <sup>with</sup> a view towards completion, a line of levels from the theodolite stations to the targets were finished before the party moved to Castle Dale, assumed elevations being used.

No "C" or replacement point was established at the full scale group (1.0) although the theodolite and foresight stations are completed and a temporary stake placed at the approximate desired intersection point.

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SITE NO. 8 SANDSTONE TUNNELS.

This site is located in Buckhorn Wash, 20 miles east of Castle Dale, Utah, and consists of three tunnels driven in sandstone, one 0.1 scale, one 0.2 scale and one combined 0.5 and 1.0 scale bores. The details of these can be had from a study of blueprints submitted with other project data.

Data required by the Corps of Engineers in so far as this bureau was concerned consisted of establishing replacement points by the same methods as used on the soil tests, precise alignment and profile at stated approximate intervals on both floor and surface centerlines and a connection from replacement point to floor centerline, the latter in case that in the future it be desired to redetermine the original centerline. Both surface and floor centerlines to be in the exact same vertical plane so that exact inverse distances could be computed from any point within the tunnel to the center of any particular charge.

As can be seen from the attached sketches the above requirements were completed for the two smaller tunnels. As the contractor was still working on the full scale bore at the time the party was ordered elsewhere no control other than running levels to the immediate vicinity of this tunnel was accomplished.

Operations were started on the sandstone site on July 12 and ended on Aug. 15 at which time the party was ordered back to the Dugway main camp for work on the wet clay site, it being the intention of the Corps of Engineers to finish ~~that~~ and explode that sight by early Fall.

All work on the sandstone sight was of first order accuracy and true elevation obtained by level lines from Coast & Geodetic Survey bench marks.

- - SITE NO. 4 WET CLAY

The wet clay site is located 30 miles west of the main Dugway camp, on the north side of and adjacent to the Old Lincoln Highway where it crosses the Old Lake Bonneville Lake Bed, or Salt Flats.

This is the only soil site at which all the "before the blast" measurements were completely determined, however the results are almost completely nullified as it was decided not to detonate the charges as originally planned this season and the targets were removed from their emplacements to protect them from the detrimental effects of long exposure to the highly alkaline water to which they were exposed.

Actual

Actual field work on this site was initiated on Aug. 18 and carried to a finished conclusion of a before the blast stage by Sept. 10th. Level lines were run from Coast & Geodetic Survey bench marks W 67 to all the "C" points and targets, ending on C.&G.S. B.M. X 67, however as the true elevation of these bench marks was not known an assumed elevation was used. On or about Sept. 11 the party was ordered to the Granite Tunnel sites near Grand Junction, Colo.

If and when this project is continued in the future it would be well to check the true intersection of the replacement points as the theodolite stations or foresights may settle a trifle in the type of soil in which they are set. Also the base line for the 0.1 scale group could be omitted and the outside targets controlled from the "C" point at target 1Aa 402 by using 300 ft. tape.

SITE NO. 6 GRANITE TUNNELS.

The granite tunnel sites are located in Unaweep Canyon about 30 miles South West of Grand Junction, Colo. The actual tunnel bores are near the summit of an exposed granite cliff and are reached by foot or by incline car from the canyon floor.

This party started work on this site on Sept. 12 and continued until the final suspension order of Oct. 21, 1948. During this period a "stand by" procedure was in effect during which time no actual construction was going on. As a result the site which consists of three tunnels on a 0.1, 0.2 and 0.5 scale was only partially completed, the 0.1 scale was finished and the bores for the other two only partly driven.

Control identical to that established at the sandstone site was desired and during the span of operations this party completed the 0.1 tunnel and established a replacement point for the 0.2 scale bore plus surface centerlines for all tunnels. The surface centerlines for the 0.2 and 0.5 tunnels will of course be subject to possible correction if and when the project is continued, in order that any slight correction be made to make the centerlines truly coincide.

No replacement point was established at the 0.5 scale tunnel. At this site rigid cement piers were not used due to the difficult proposition of conveying such heavy materials to the theodolite sites and foresights. In ~~place~~ lieu of this a well built wooden stand was used for the theodolite stations and the foresight stations consisted of bolts cemented in solid rock to which the signal lamp could be fastened.

As of Oct. 21 all work on the entire project was suspended and this party moved back to Tootle, Utah to complete records, sketches and reports. Members of the party were sent on their way to new assignments.

CONCLUSION

It can be readily seen from a perusal of the original instructions, this report and from the fact that as of this date no actual detonation was made against any target involved in which our control was to be used that in so far as this bureau is concerned there remains a very large amount of detailed work to be done, if and when it is continued. The dry sand test is not previously referred to as that site was not developed to the proper stage at which our organization found it feasible to perform the survey preliminaries. Of the four sketches sent to the Washington Office along with other project data, the Corps of Engineers have been furnished copies plus a condensed transcript of the numerical data thereof, except that numerical data as determined the "C" or replacement points. A separate letter concerning the latter and other matters will be mailed to you in the very near future.

Respectfully Submitted,

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Chief of Party.