

## DISCUSSION

BY DARRELL A. ROOT,\* *Member*

THE results of the survey work performed by Harry R. Feldman, Inc. were turned over to us in the form of two sets of photogrammetric sheets. The work sheets covered the whole area in which sewers, interceptors, pumping station and treatment facilities were to be constructed. These sheets showed all the necessary topographical features, and in addition the surveyors had plotted the elevations of the centerline of the streets at every 50 ft, or at shorter intervals where necessary, the elevations of the sills of all the buildings, and the rim and invert elevations of all manholes, catch basins, and culverts. The underground utilities as observed in the field and the information furnished by town officials were also shown on the work sheets. We were furnished a set of aerial photographs which were used occasionally to check the photogrammetry, and in some cases used to check topography by the use of stereoscopic glasses.

Before the field surveying was undertaken, we advised the Surveyor that we would need detailed topographical surveys along the interceptor routes. This work was included with the base line survey work, and the details were placed on the photogrammetric work sheets. In addition to the street profiles, we required some profiles cross-lots which had been selected with the initial sewer layout. These profiles were taken at the time the street profiles were made. This information was also included on the photogrammetric work sheets.

Previous to the receipt of the photogrammetric work sheets, we had laid out a map of the proposed sewer system on a street map with the scale of  $1'' = 400$  ft. By using the photogrammetric work sheets, we first checked the locations of various sewer lines and the ends of the various sewer lines and corrected the proposed layout to agree with the details furnished on the work sheets. Construction plans on plan and profile sheets were then laid out to cover the proposed system, and these plans were started by tracing the plan information from the work sheets. Prints were made from the con-

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struction drawings after the plan material had been completed, and these prints were then used as work sheets for designing the sewer system.

The first step in preparing the design work sheets was to plot the ground profile from the information on the photogrammetric work sheets. After the ground profile was plotted and the utilities shown on the profile, the size and location of the sewers was established and placed on the work sheets. At this time the information to be added to the plan was also included on each work sheet, such as the location of sewer line, manholes, and other information which was required to be added to the plan.

After a work sheet was completed, it was set aside until the work sheets that were tied into the sheet in question were completed. Such sheets covered upstream sewers, downstream sewers, and all lateral sewers which might come into any particular work sheet. All of the work sheets were then rechecked to ascertain that all the necessary and related changes were completed. The work sheet information was then transferred onto the construction drawing. This final construction drawing was the first time that a drawing, as such, had been prepared, because up to this time all the information was contained on either the photogrammetric work sheets or the sewer design work sheets.

During the development of the design sheets, it became apparent that minor changes were required in the overall layout. For example, a few lateral sewers were taken cross lots instead of around the block, and it was necessary to sewer a few additional streets. Because the photogrammetric work sheets contained information between the streets as well as along the streets, and because they showed all of the existing buildings, it was a simple matter to make adjustments in the sewer design work sheets because the information was available.

Before the preparation of the construction drawings was started, it had been decided that these plan and profile sheets would be reduced by half, so that the plans issued to the bidders for bidding purposes would be approximately 11" x 18". Considerable thought was given to the size, spacing of lettering, the weight of lines, and the presentation of material on the final drawing, so that when the sheet was reduced, we would have a legible, workable drawing on which contractors could base their bids. We also planned to use these same reduced drawings in the field for construction purposes.

A total of 93 plan and profile construction drawings, divided into two contracts, was prepared to cover the work on which bids were received. A total of 82,130 ft, or about 15.5 miles of intercepting and street sewers was laid out on these drawings. In addition to the sewers, these contracts called for the installation of 16,180 ft of house connections which were built within the street lines.

Low bid on the first contract was in the amount of \$372,000, and low bid on the second contract was in the amount of \$572,000.

We were particularly pleased with this method of developing the construction plans from the survey data furnished to us. The advantages to us were that the data was presented in a relatively short time from the date we authorized Harry Feldman, Inc. to proceed with this work, the photogrammetric work sheets contained more information than would have been developed from street surveys, we were furnished aerial photos of the area in which we were working, and that the cost of the survey work was reduced and we were able to pass this saving on to our client.

Mr. Chester C. Pease, Jr. was the Engineer in charge of the preparation of the construction plans on this project, and he is now Resident Engineer in charge of the construction. His principal assistant on both of these assignments is Manning S. Chellis.