

New Jersey Department of Transportation
QUALITY IMPROVEMENT ADVISORY

QUALITY MANAGEMENT SERVICES

Manager: Brian Strizki

Telephone: (609) 530-6363

QIA No. QIA007

Approved: Brian Strizki
Date: 9/23/97

Process Affected:

Scope Design Right of Way Utilities Environmental Historic Construction

Bureaus Affected: All CPM Units
All Design Consultants

Procedure(s) Affected: Project Delivery Schedule

Route & Section: Route 45, Section 2C & 3B

County/Municipality: Salem County, Mannington Twp.

Project Summary: This project was completed in January 1997. The scope included replacing the Route 45 bridge over Mannington Creek and related approach roadway work from M.P. 3.904 to M.P. 4.245. The bridge was replaced with a 36'-6" long, single span Pre-Stressed Concrete Voids Slab beam structure with steel sheeting retaining walls located at the four corners of the bridge. These sheetings are driven approximately 40' deep near the bridge and approximately 11' of the walls are exposed above the ground in the final condition. The steel sheetings were designed to retain the embankment and the surcharge which was added to stabilize the roadway approach.

Nature of Problem(s): Construction began and sheet piles were driven in the proper location to the depth indicated on the plans (cantilevered). Then the soil surcharge was placed and the soft soil stratum consolidated as anticipated. During the consolidation period, it was noted that the walls were out of alignment. After the surcharge was removed and the tops of the sheet piles were cut, the piles were observed to be leaning outward. The Contractor then provided survey data which indicated offsets of 2" near the ends of the walls and a maximum of 21" along the southwest wall within 50' of the bridge. Because of the magnitude of the offsets observed in the field, the consultant was asked to prepare and submit a Steel Sheet Pile Narrative Report. Upon comparison of the maximum field measured offsets of 21", with the maximum deflection of 11.5" calculated in the report, it was concluded that 9.5" of rotation may have occurred (a rotation of approximately one vertical degree in a pile length of 50 ft. would result in an offset of 9.5"). A tie and wale support system was installed as a change of plan to restrict further movement/rotation of these walls.

This problem has been observed in other projects as well.

Recommendation(s): Soil conditions play an important role in the deflection and rotation of sheet pile walls. Cantilever walls are expected to deflect but rotation of these walls is deemed undesirable. For a short design height (i.e. 12 ft max.) where steel sheet pile walls are driven sufficient depths into firm layers known to be very dense, and designs for the tops of the walls can be adjusted to accommodate small deflections, then cantilever walls may be an option. Also, considerations must include the design of a steel section that will accommodate bending stress, principal stress and acceptable deflections. For all other cases where soil conditions cannot be determined with absolute certainty, either a very extensive soil investigation must be performed to ensure that wall rotation will be extremely minimal, or a tie-back system must be considered. When tie-backs are introduced, bending and principal stresses must be evaluated.

Implementation: Effective immediately

Impact Assessment:

Schedule Quality Cost Scope

Cost Impact:

\$234,000.00