586-1.01 Drilling and Grouting Bolts or Reinforcing Bars

Materials
These items allow only polymer grouts to ensure greater pullout strength. Not all approved grouts are compatible with all concretes. Therefore, certain specifications recommend that the contractor load test enough reinforcement bars and anchor bolts to ensure concrete/grout compatibility before production grouting begins. The contractor is responsible for performing this testing and determining compatibility.

Construction Details

Preparation
Improper preparation of the anchor hole is the principal reason for anchor failure. Care must be taken to ensure that the hole is cleaned, the walls scoured and all debris removed, and the hole is dried before grouting. The grout manufacturer should provide instructions for cleaning the hole, including a description as to how dry the hole must be to obtain maximum grout performance. The manufacturer shall also provide a method for determining when this degree of dryness has been reached. (Example: Place the compressed air “wand” to the bottom of the hole and release air for a minimum of two minutes.)

The typical cleaning procedure for a dry hole is to first blow out the dust and debris with compressed air using a “wand” placed at the bottom of the hole. This is followed by brushing the sides of the hole with a wire brush and then another compressed air cleaning similar to the first.

The EIC should check 30 percent of the holes in each lot to make sure the hole depth is in accordance with the contract documents. Because each size and type of anchor requires a different diameter drilled hole, the hole diameter should be carefully checked for each type of anchor specified. The contractor must use the hole diameter recommended by the grout manufacturer for the type and size of anchor being installed.

Grout Storage and Handling
Grout must be stored in accordance with the manufacturer’s instructions. The manufacturer should provide any information needed to safely handle the grout, and any required Material Safety Data Sheets.

Grout products requiring drill mixing must be thoroughly mixed to prevent incomplete material cure and substandard strength. The contractor should use the mixing time recommended by the manufacturer. For the products contained in caulking tubes using static mixers, sufficient material should be wasted before using material for anchor installation. This practice is necessary each time the material tubes are changed. The amount of material to be wasted should be the amount recommended by the manufacturer.

If capsule type materials are used, the manufacturer’s recommendation on spinning the anchor when mixing the grout materials should be followed. Care must be taken to prevent “overspinning”, which may result in no bond between the anchor and the adhesive material.

Load Testing When Required
Drilling and grouting of anchor bolts and reinforcing bars in portland cement concrete under these items include load testing as one of the requirements for acceptance. When load testing anchors, the jacking system is not specifically described in the contract documents. However, the contractor is provided the basic parameters for the jacking system. The object is to allow the contractor freedom to approach the task. The location of some anchors will require ingenuity in the design of the jacking systems.
The contractor determines the lot size of the anchor bolts to be load tested according to the requirements of the specification. When the lot has been selected, the Engineer chooses the location of the bolts to be tested in the lot by random selection. For all selection methods, the bolts must first be numbered, in a manner determined by the Engineer. Then, to identify the bolts for testing, the EIC can use either standard sampling procedures, such as random number tables found in statistics textbooks, or a computer program for selection of bolts to be load tested, obtainable from the Regional Construction Group Microcomputer Coordinator.

If the bolt pulls out before reaching load test level, it has failed. Failure cause is likely to be inadequate embedment length, insufficient concrete strength, grout incompatibility, or improper hole preparation. Also, if at any time during the load testing of an anchor, a crack(s) appears in the concrete within one foot (.3 meters) of the anchor, the test shall be considered a failure. In this case, failure is likely to be insufficient embedment length or inadequate concrete strength. If both are within the contract requirements, the designer should be contacted.

Concrete Repair at a Failed Anchor
The failed anchor must be pulled free from the concrete and the damaged concrete surface repaired. In many cases, a one-to-two-inch (25-50 mm) thick cone of concrete will be pulled from the surface. The outer edge of the cone will break off flush with the base concrete surface. The concrete grout cannot be effectively tapered out to a zero thickness. Therefore, the periphery of the area where the cone broke out must be bush hammered. The area should be bush hammered to the point that the minimum thickness of grout used to patch the area will be ¼ inch (6 mm). Sandblasting of the entire area must be done before grouting is begun. The contractor should use a grout meeting NYS Standard Specification 701-05 Concrete Grouting Material. When the grout is applied there is no need to fill the hole into which the anchor was grouted.

After the grout has cured to at least 3000 psi (25 MPa) (grout strengths obtained from the grout manufacturer’s instructions) the hole should be redrilled to at least the original diameter. After the hole is redrilled, the process originally prescribed for installing the anchor will be used to reinstall it. At this point it may be advisable to contact the grout manufacturer for advice about re-installation of the bolt.

References
1) Engineering Instruction 97-007 - Specification 16586.20XXYYM and 16586.20XXYY “Drilling and Grouting Anchor Bolts and Rebars in Concrete.”
2) NYSDOT Standard Specification 586.01
3) Special Specifications based on 1) or 2) above.