



BRIDGE CONSTRUCTION MEMO 135-5.0

MISCELLANEOUS CONSTRUCTION MATERIALS

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Volume II

MECHANICAL ANCHORAGE DEVICES

Expansion anchorage devices seldom develop the full tensile strength of a stud or a bolt, and are therefore less desirable than cast-in-place bolts and inserts. For this reason, expansion anchorage devices are generally used only for attaching fixtures such as signs, ladders, utilities, and temporary railings to hardened concrete.

Inspections by Structures Maintenance Engineers have disclosed instances of loose anchorage devices for bridge-mounted signs. The lack of proper anchorage had gone undetected because a headed bolt was used instead of a threaded stud. When the bolt was tightened against the fixture mounting plate, it pulled the anchorage loose from the concrete. The anchorage then pressed against the other side of the plate, and further tightening gave the impression that the fixture was securely attached when actually it was loose.

In order to minimize this problem, plans call for a threaded stud instead of a headed bolt. The Standard Specifications require that the expansion anchor be recessed 1/2" to 1" below the concrete surface after it has been expanded. This allows the inspector to observe if the anchorage has been seated initially, and if it is properly holding at the time the fixture is attached. The plans also call out the diameter of the stud. Galvanizing requirements are given in the specifications.

In the event that the aforementioned details are not shown on the project plans, the Structure Representative should insist that studs and nuts be used instead of bolts. Note that the stud diameter should be 5/8" if the plans call for a 5/8" anchorage device. The other aspects of the expansion anchorage shall conform to the project plans and specifications.

Note that when anchorages are expanded by driving the expansion element over an expander plug, a sufficient thickness of concrete must be provided behind the plug to resist the driving force. The drilled hole for the anchorage must also be true to size and shape so to assure the fullest bearing of the expanded anchor against the concrete.

All concrete anchorage devices shall be subject to the approval of the Engineer. Current approval lists can be found at http://www.dot.ca.gov/hq/esc/approved_products_list/. On the page are 'Cartridge Epoxies' and 'Mechanical Expansion Anchors' that link to the latest approved products. If the proposed MEA does not appear on the working list, approval shall be contingent upon the submittal to the Engineer of sample concrete anchorage devices, manufacturer's instructions, and certified results of tests indicating compliance with specification requirements.

In summary, the Structures Representative should be sure that all expansion anchorage installations conform to the following:

1. Be sure the anchorage device is listed on the approved working list (Website given).
2. Proper size hole is drilled.
3. Use threaded studs and not headed bolts.
4. Use galvanized studs. (Not black steel)
5. Be sure the expansion part of the anchorage is properly recessed below the surface after it has been expanded.
6. Never accept a stud of smaller diameter than the stud or anchorage device size called for on the plans.

Another useful resource can be found in the Bridge Design Aids. Pages 81 through 92 of Chapter 5, Concrete Design, show a properly installed anchorage and indicates where anchors may be used and what will be shown on contract plans. The complete manual is available on Structure Design's website at the following address:

http://onramp.dot.ca.gov/hq/esc/sdsee/design_technical_services/publications/bridge_design_aids.shtml