

OFFICE MEMORANDUM



MICHIGAN
DEPARTMENT OF STATE HIGHWAYS

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To: R. L. Greenman
Testing & Research Engineer

From: L. T. Oehler

Subject: Pull-Out Tests on RS-9 Expansion Anchors. Research Project
59 F-52. Research Report R-690.

This reports the results of the subject tests requested in a memorandum from J. C. Brehler on October 8, 1968. The RS-9 expansion anchors are manufactured by the Republic Steel Corporation. Samples were submitted by the manufacturer at the request of J. L. Vining of Jones and McKnight, Inc., Chicago. The following is reported by Manuel Chiunti of the Research Laboratory. Each expansion anchor consists of two grooved sleeves, held together by a bail (Fig. 1). The tapered threaded plug provides the means of expansion when the bolt is tightened. The expansion anchors were installed according to recommendations received, per our request, from B. J. Baughman of the Republic Steel Corporation. The recommendations were as follows:

1. Drill a hole into the concrete 1-1/4 in. in diam and 4 in. deep.
2. Be sure the shell is inserted so that it contacts the bottom of the hole.
3. Torque the expansion anchor assembly to 50 ft lb.

The anchors were installed 4-1/2 in. from the top of the vertical edge of a ten-year-old reinforced 9 in. slab located at the old Fowlerville Weigh Station. Anchors were set in the edge of the slab because of the vendors interest in using them for hook bolt installation. A drawbar was inserted into the threaded plug, torqued to the recommended value, and load was applied to the anchor by a hydraulic ram in a 20,000 lb capacity reaction frame (Fig. 2).

Three of the five anchors tested were installed per the manufacturer's recommendations. The remaining two anchors were installed in the same manner except the hole depth was increased to 5 in.

The ultimate load, hole depth and type of failure for each of the five anchors were as follows:

Specimen No.	Hole Depth, in.	Ultimate Load, kips	Type of Failure
1	4	10	All anchors tested failed by loss of anchorage due to 1/2 to 3/4 in. slippage followed by spalling of the concrete. Typical failure is shown in Figure 3.
2	4	14	
3	4	7	
4	5	15	
5	5	16	

Based on this limited number of tests, the average capacity of this type of anchor, installed as recommended, is approximately 10,000 lb. As the table shows, an increase of 1 in. in the hole depth results in approximately 50 percent in the average anchorage capacity. Moreover, past experience shows that an increase in the torque applied to the anchor assembly will usually reduce slippage and, therefore, increase the load an anchor can resist.

It should be noted that previously approved expansion anchors for hook-bolt installation were based on development of at least 13,000 lb, which was the design strength of the standard hook-bolts used at that time. However, hook bolt design has now been changed, requiring 16,000 lb capacity and a spacing of 40 in. Therefore, if expansion hook-bolt anchors are used with strength of 13,000 lb, the spacing would have to be reduced correspondingly to be compatible with present design criteria.

Although the RS-9 anchors that were installed as recommended, did not meet the 13,000 lb requirement, the test results seem to indicate that higher capacities can be obtained by deeper embedment.

TESTING AND RESEARCH DIVISION

L. R. T. Oahle

Director - Research Laboratory

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Figure 1. RS-9 expansion anchor.



Figure 2. Hydraulic ram and 20,000 lb capacity reaction frame.

Figure 3. Typical failure.

