

1 (January 7, 2013)

2 **Rock Dowel Proof Testing**

3 At the discretion of the Engineer, up to five percent, but not less than three installed  
4 production rock dowels as selected by the Engineer shall be proof tested. The  
5 Contractor shall conduct the proof test, and the Engineer will interpret the results.

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7 The rock dowel shall be tensioned to 25 kips for Type 1 rock dowels, with a  
8 calibrated hollow-ram hydraulic jack using a bar extension and coupler attached to  
9 the rock dowel. The test load specified for the particular type of rock dowel shall be  
10 held for ten minutes. If no loss of load occurs over the ten minute hold period, the  
11 rock dowel is acceptable.

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13 The Engineer may require additional proof testing above the specified five percent  
14 maximum if rock dowels fail the proof testing. All failed rock dowels shall be  
15 replaced with an additional rock dowel installed in a separate hole at no additional  
16 expense to the Contracting Agency.

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18 Upon acceptance by the Engineer, the Contractor shall permanently stamp or etch  
19 the bearing plate of or otherwise label each rock dowel with a unique number  
20 assigned by the Engineer, the installation date and the total anchor length.

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22 **Rock Bolt Testing**

23 The Contractor shall conduct rock bolt testing in accordance with the requirements  
24 specified in this Section for permanent ground anchors, including testing  
25 equipment, and test load monitoring, recording and documentation.

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27 **Rock Bolt Performance Testing**

28 At the Engineer's discretion, the Contractor shall conduct up to three  
29 performance tests to demonstrate the effectiveness of the construction method  
30 for each rock bolt design, and when a significant change is proposed in the  
31 construction method.

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33 Rock bolts shall be tensioned to 120 percent of the design load of the rock bolt  
34 for a holding time period of not more than 60 minutes. The Contractor shall  
35 monitor the test load and shall document the results in accordance with the  
36 requirements specified in this Section.

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38 The Engineer will analyze the rock bolt performance test results and determine  
39 whether the rock bolt is acceptable. A rock bolt is acceptable if both the  
40 following conditions are satisfied:

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- 42 1. The total elastic movement obtained at the maximum test load  
43 exceeds 80 percent of the theoretical elastic elongation of the  
44 stressing length.
  - 45 2. The rock bolt carries the maximum test load with a creep rate that  
46 does not exceed 0.04 inches between one and ten minutes, or 0.08  
47 inches per log cycle of time between the six and 60 minute readings.  
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50 If the Contractor fails to successfully achieve these testing criteria, the  
51 Engineer may require additional rock bolt performance tests to be completed  
52 at no additional expense to the Contracting Agency.

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Production rock bolting shall not begin until the Contractor has completed performance testing of the design rock bolts and the test results have been accepted by the Engineer.

**Rock Bolt Proof Testing**

Each production rock bolt shall be proof tested. Proof testing shall consist of tensioning the rock bolt to 120 percent of the design load and holding that load for ten minutes. If no loss of load occurs in this time period, the rock bolt is accepted. If a rock bolt fails this proof test, the rock bolt shall be replaced with an additional rock bolt installed in a separate hole.

After tensioning and achieving a successful rock bolt proof test, the load shall be locked off at 100 percent of the design load and the remaining portion of the rock bolt grouted, if appropriate. The end of the completed rock bolt shall be trimmed to within six inches of the rock face.

Upon acceptance by the Engineer, the Contractor shall permanently stamp or etch the bearing plate of or otherwise label each rock bolt with a unique number assigned by the Engineer, the installation date, the stressing load, and the total anchor length.