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**NATIONAL RADIO ASTRONOMY OBSERVATORY**  
Socorro, New Mexico

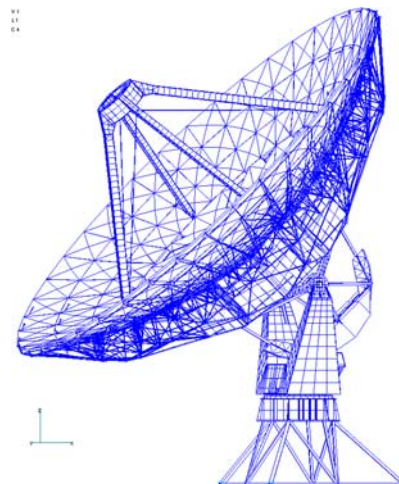
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VLBA Antenna Memo Series No.38

**North Liberty Rail Repair**

J. E. Thunborg  
June 14, 2002



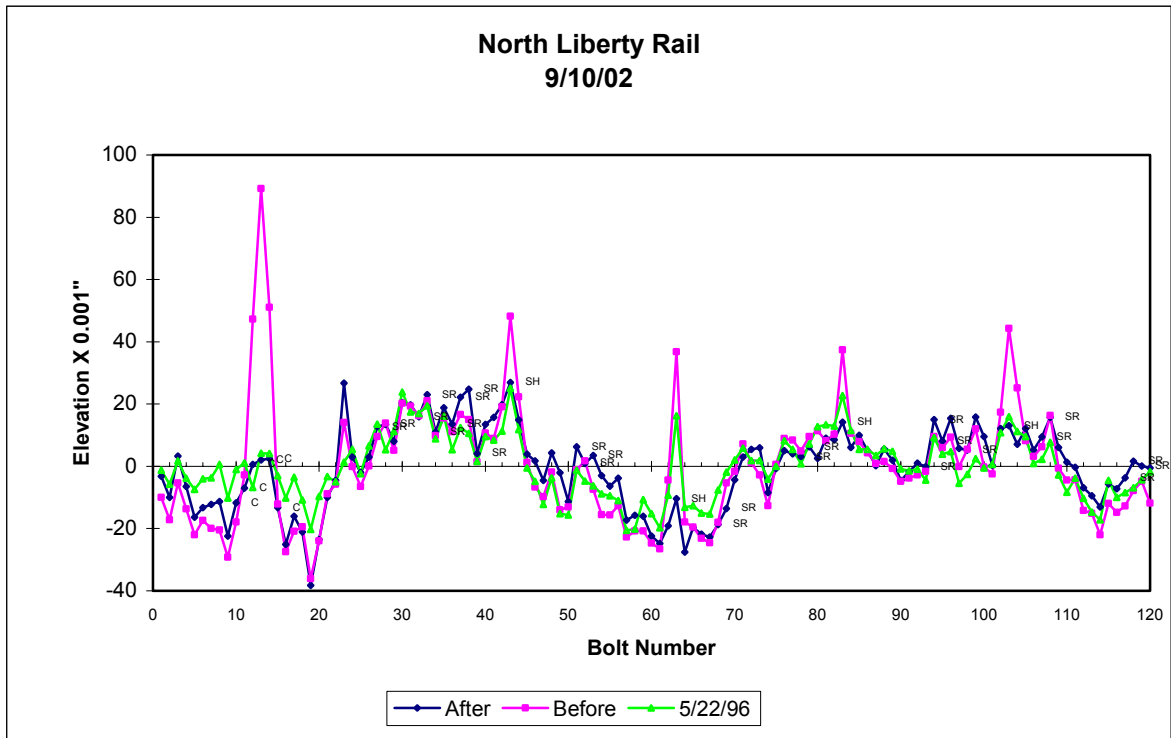
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The grout under the azimuth rail on the North Liberty, Iowa VLBA antenna had degraded to such an extent that the antenna pointing was being adversely effected. On June 3 – June 9 a maintenance team consisting of Phillip Sanchez, Marlin Smith, Jon Thunborg and Adrian Zamora were dispatched to Iowa to repair the rail with the help of the site technicians D.J. Beard and Mike Burgert. An initial measurement of the rail showed that the section of rail between bolts 10 and 16 deflected excessively when under load. The grout under this section of rail was severely degraded (Figure 1). Heavy-duty hammer drills were then used to remove this section of grout (Figures 2 and 3). After the grout was removed, the anchor bolts were inspected. Three of these bolts were broken. The broken bolts were then sawed off and thread chased with a tap. Coupling nuts were used to attach new studs to the sawed off anchor bolts. The rail plates were then repositioned and Burke High Strength Epoxy Grout was poured under the rail and rail plates as shown in Figure 4.

In addition to the major repair above, the grout was spot repaired at several other locations along the rail. An example of grout in need of spot repair is shown in figure 5. In a spot repair, the old grout between the rail plates and under the rail is removed to a depth of approximately 3 inches. New grout is then poured in the hole under the rail. In a few places, the bolts that hold the rail clips to the rail plates were broken. These were repaired by removing enough grout from below the rail plate to remove the broken bolt and insert a new one. A typical spot repair is shown in figure 6. Spot repairs were made between the following bolts; 27-28, 28-29, 32-33, 33-34, 36-37, 37-38, 38-39, 39-40, 51-52, 52-53, 78-79, 79-80, 93-94, 94-95, 95-96, 98-99, 107-108, 108-109, 117-118, 118-119, 119-120.

Rail measurements showed that the rail was deflecting at the splices under load. A dial indicator was used to determine that the movement was occurring between the splice plate and the rail. Brass shims were then placed under the rail at the splices to eliminate this movement.

All of the rail clip and splice bar bolts were tightened during this trip. The splice bar bolts were extremely loose.



SH – Marks places where shim was added between rail and splice plates.  
 SR – Marks places where spot repairs were done.  
 C -- Marks place where complete gout repair was done.

**Burke G.P. Epoxy Grout Specifications:**

Manufacturer

Burke By Edoco  
 22039 South Westward Avenue  
 Long Beach, CA 90810  
 Telephone: (310) 834-3401  
 (888) BURKEUSA  
<http://www.burkebyedoco.com>

Handling Characteristics

Gel Time ASTM C-882 Neat (Part A mixed with Part B)  
 72°F in. - 34 min. 90°F in. - 16 min.  
 In 5 gal. bucket (0.5 cubic feet of grout dimension .Æ 11"x 9.1")  
 Temp/Consistency - Flowable - Workable - Gelled  
 72°F - 50 min. - 75 min. - 92 min.  
 90°F - 22 min. - 34 min. - 41 min.

Compressive Strength PSI, ASTM C-579

Temp./Time 24hr. 7 day 14 days

45°F\* - 1000 - 13,000 - 14,000

72°F - 11,500 - 14,000 - 14,500

90°F - 14,500 - 14,750 - 14,750

\*Initial temp. of grout components 70°F.

Modulus of elasticity ASTM D-695 7 days 1.4 x 10<sup>6</sup> psi

Tensile Strength ASTM C-307 14 days 1900 psi

Shear Bond to concrete ASTM C-882 14 days

3050 psi

Shore Hardness D 7 days 90 ± 5

% Linear Change ASTM C-531 28 days .00015

inch/inch of elasticity, compressive, bond and tensile strength for foundation plates and high stress anchoring applications.



Figure 1. Degraded grout near bolt #13.



Figure 2. Hammer drills used to remove old grout.



Figure 3. Rail section with grout removed.



Figure 4. Rail section near bolt 13 repaired with high strength epoxy grout.



Figure 5. Candidate for spot repair.



Figure 6. Typical spot repair with rail clip bolts replaced.