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SSCL-Preprint-278
April 1993
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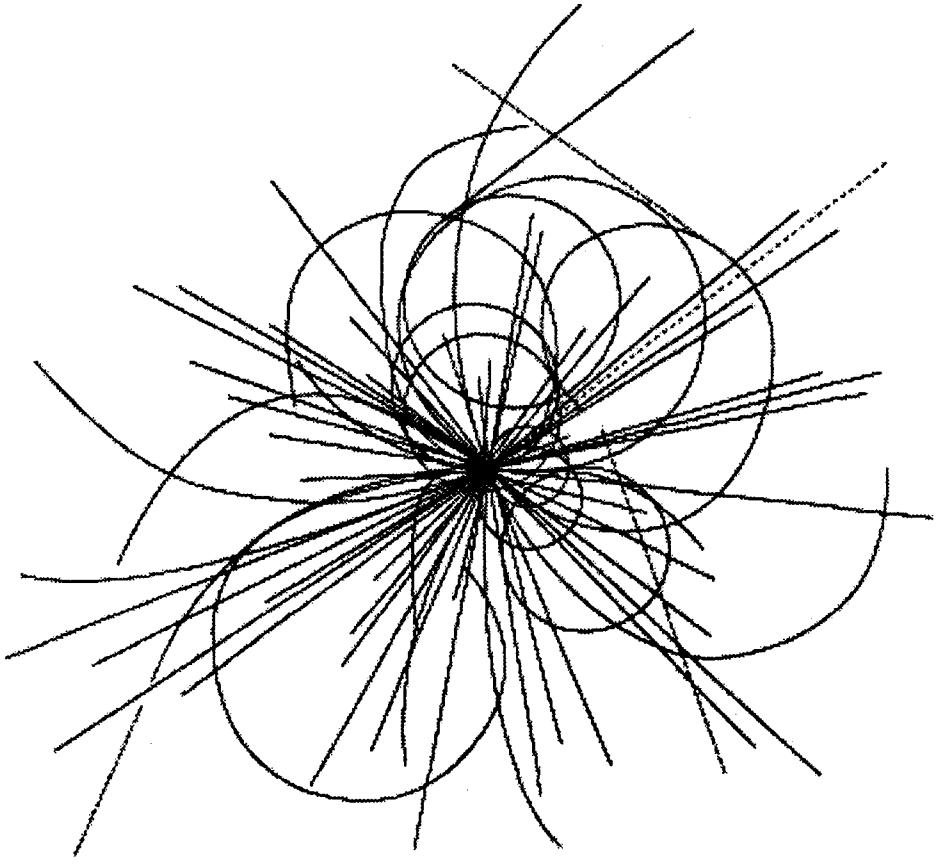

Superconducting Super Collider Laboratory

To be published in *Supercollider 5* SSCL-Preprint-278

Dynamic Analysis of Six-Strut Supporting System for Accelerator Magnet*

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April 1993

*Presented at the Fifth Annual International Symposium on the Super Collider, May 6–8, 1993 San Francisco, CA.
†Operated by the Universities Research Association, Inc., for the U.S. Department of Energy under Contract No. DE-AC35-89ER40486.

This calculation is of interest for three reasons: (1) the loading occurs when the horizontal (x) seismic force combining with the dead load of the girder producing a 30 kips downward force to a strut that is cantilevered out from the center of a steel plate, (2) the main bolt is held by the base plate in supporting the magnet system, (3) the anchor bolt and its tensile load must be compared with a limited number of separate field tests that gives experimentally measured values, of the the ultimate bond strength, of the anchor bolts in the concrete slab.

DESCRIPTION OF THE FINITE ELEMENT MODEL

A three dimensional Finite Element Model (FEM) is employed for LBL's ALS booster ring girder in order to calculate earthquake dynamic response. The booster ring girder is constructed by joining two (2) straight Wide Flange (WF) beams, with the web positioned parallel to the floor, then welding the center of the girder at approximately 10 degrees. A plate is then welded to one side of the top and bottom flange of the WF beam that serves as a top plate to support all the magnets. The steel girder model consists of plate elements with six (6) positions of adjustment in order for plane bending, moment connections and shear connections of load to be accomplished. The parameters controlling the booster ring girder system dynamic response, in the FEM are summarized as follows: a) lumped mass magnet locations, b) experimental compliance data of the magnet and girder supporting struts. The correct compliance for struts is critical in dynamic modelling.

Figure 1 presents the FEM of the booster ring magent and the supporting system. Figures 2 through 4 show the posts, the base plate and the main bolt. Figure 5 shows maximum stress in base plate, and Figure 6 shows maximum strut loads.

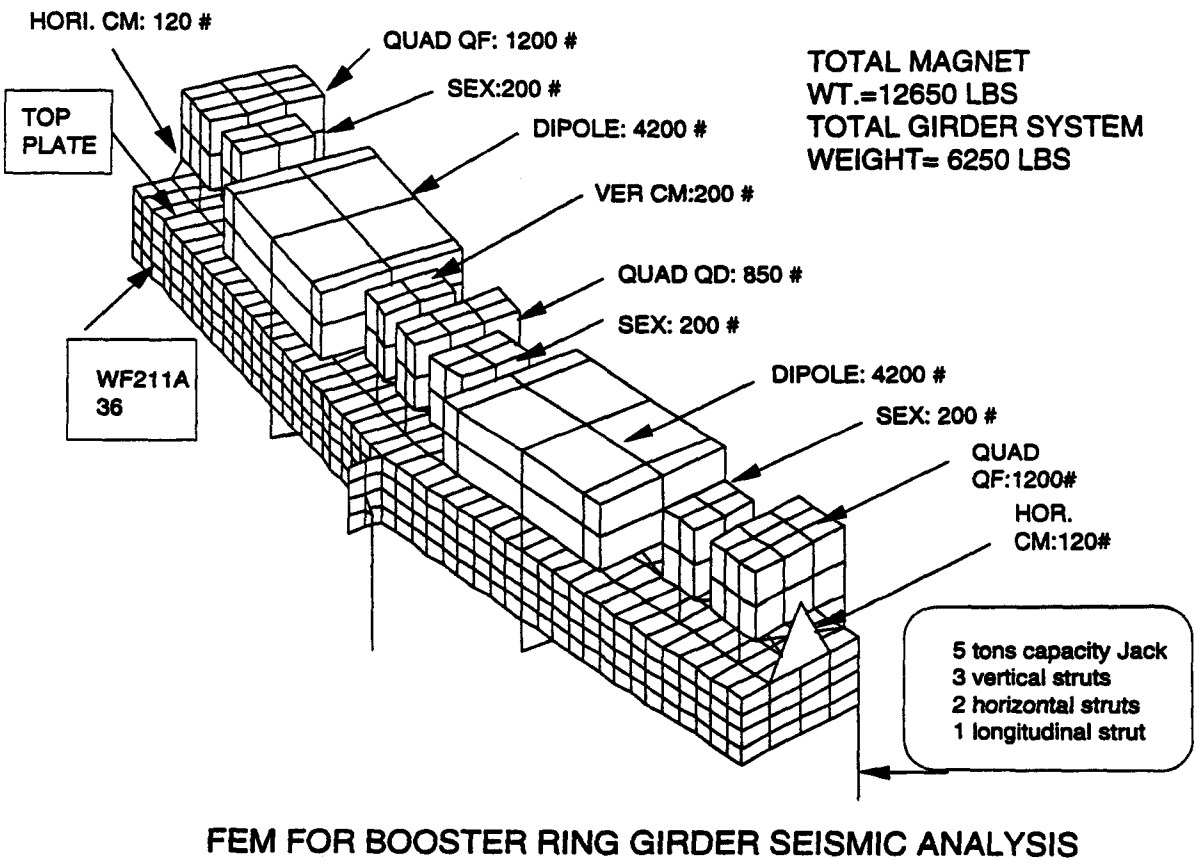

Figure 1. ALS Booster Ring Magnet and Supporting System of LBL

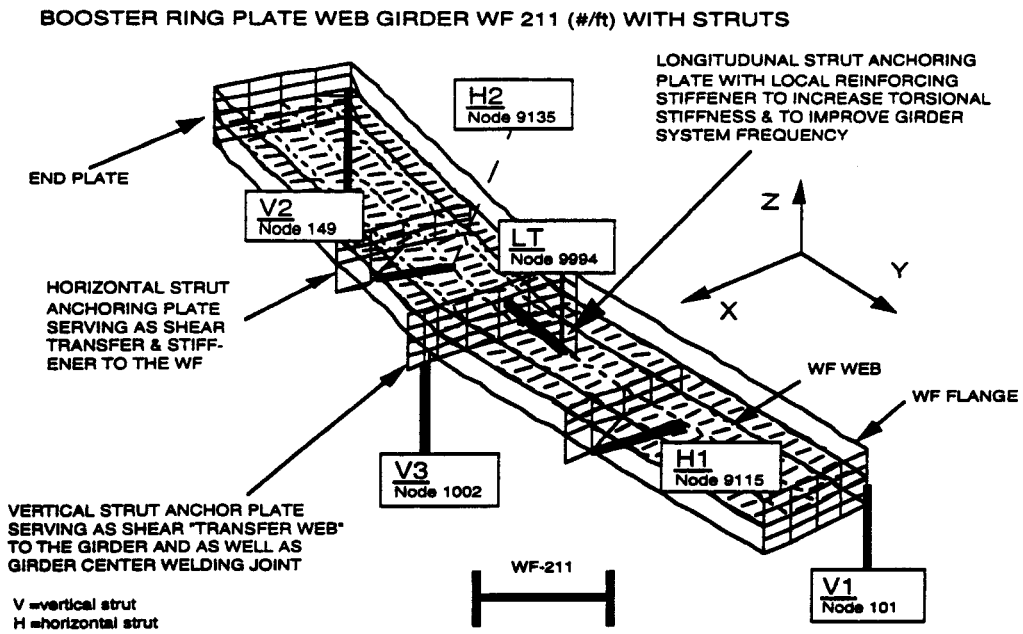

Figure 2. Magnet Support System

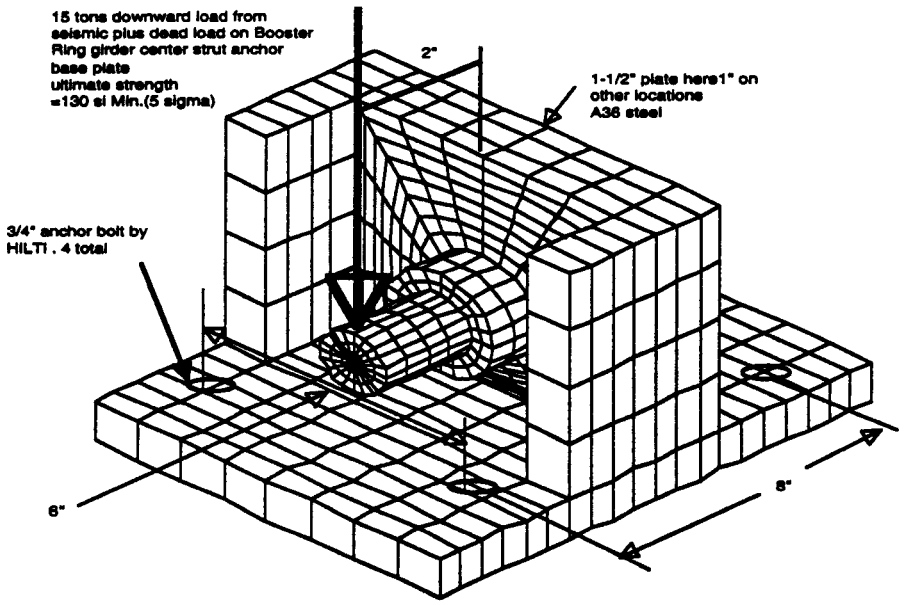

Figure 3. Base Plate

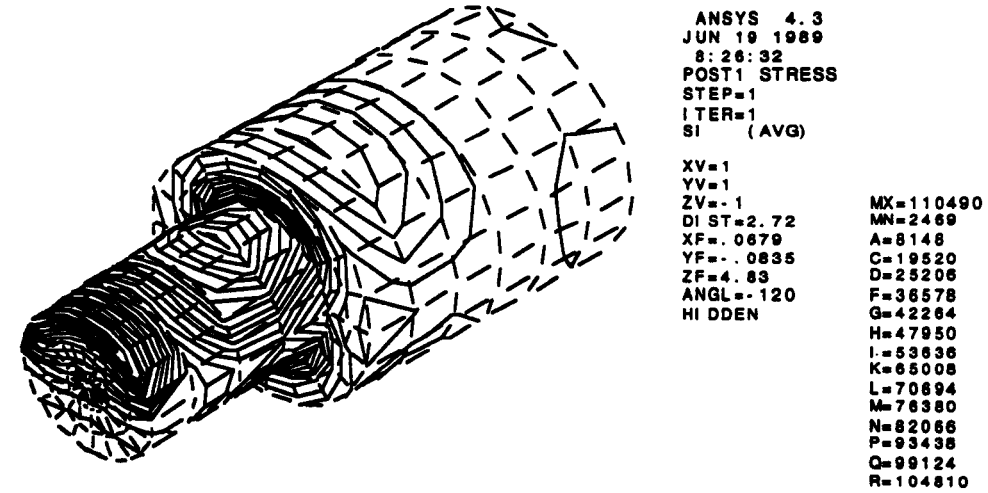

Figure 4. Maximum Stress in the Main Supporting Bolt

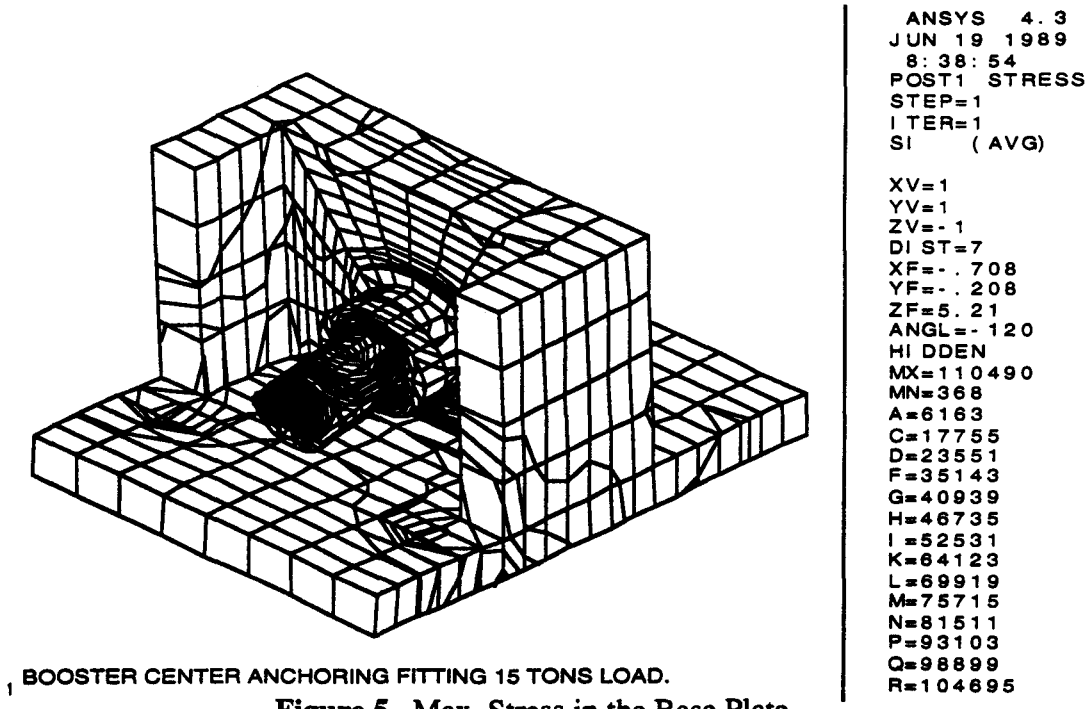

Figure 5. Max. Stress in the Base Plate

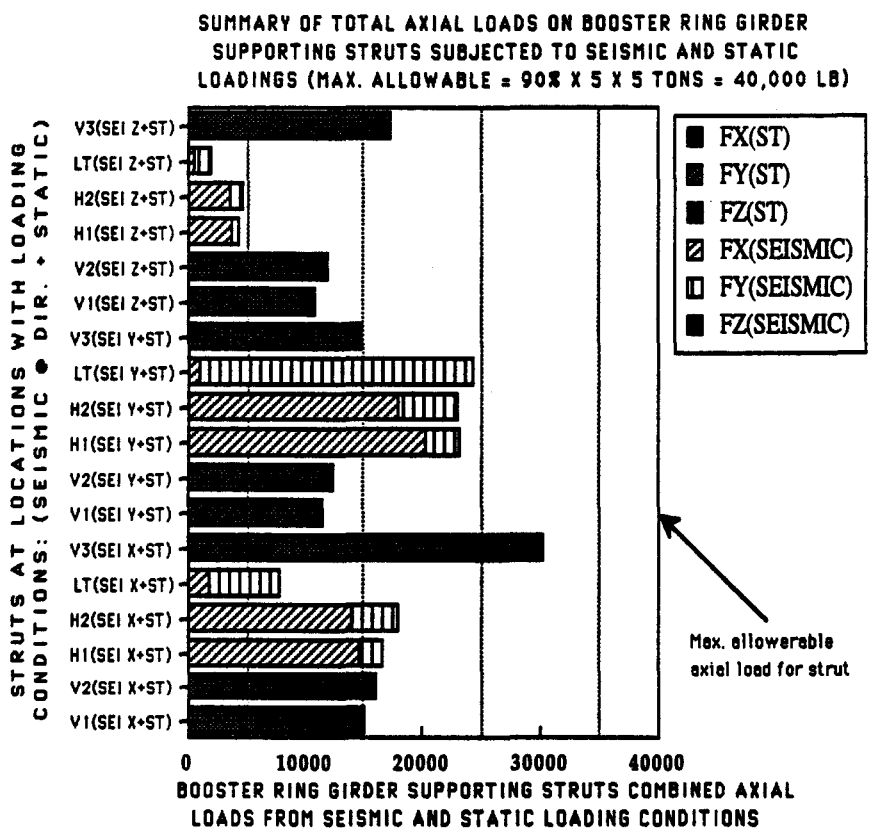

Figure 6. Max. Strut Loads

REFERENCES

1. B. A. Bolt. "Strong Seismic Ground Motion for Design Purpose at the Lawrence Berkeley Laboratory," Report LBL-17377 (July 1979)
2. K. Leung, A. Paterson. "ALS Seismic Design Procedures," LSME-135, May 17, 1989.

ACKNOWLEDGMENTS

The author wishs to thank A. Paterson, and T. Lauritzen of LBL for their support.