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the southern electric system

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United States Nuclear Regulatory Commission
Region II
Suite 2900
101 Marietta Street, Northwest
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File: X7BG03-M83
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Reference: Vogtle Electric Generating Plant-Units 1 and 2; 50-424, 50-425; Westinghouse Flux Mapping System; Letter GN-699 dated 9/5/85.

Attention: Mr. J. Nelson Grace

In previous correspondence on this subject, Georgia Power Company indicated that the NRC would be informed of the results of the evaluation of this condition by January 31, 1986.

An engineering evaluation of this condition has been performed by Westinghouse and Bechtel Power Corporation. This evaluation concluded that without restraints, the Flux Mapping System (FMS) could collapse and possibly fall on the seal table/bottom-mounted instrumentation (BMI). The collapse of the flux mapping system could result in the failure of the incore instrumentation thimble guide tubes and a subsequent loss of coolant accident. Based upon the results of this evaluation, Georgia Power Company has concluded that a reportable condition as defined by Parts 10 CFR 50.55(e) and 10 CFR 21 does exist. Based upon NRC guidance in NUREG-0302 Revision 1 and other documents concerning duplicate reporting, Georgia Power Company is reporting this condition per the reporting criteria of Part 10 CFR 50.55(e). Enclosed is a summary of our evaluation.

This response contains no proprietary information and may be placed in the NRC Public Document Room.

Yours truly,

D. O. Foster

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REF/DOF/tdm

Enclosure



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EVALUATION OF A POTENTIALLY REPORTABLE CONDITION

WESTINGHOUSE FLUX MAPPING SYSTEM

Initial Report: On August 9, 1985, Mr. C. W. Hayes, Vogtle Project Quality Assurance Manager, notified Mr. W. H. Rankin of the USNRC-Region II of a potentially reportable condition concerning the Westinghouse Flux Mapping System. In subsequent correspondence from Georgia Power Company, the NRC was informed that they would be notified of the results of the evaluation of this condition by January 31, 1986.

Information Received From I & E Notice 85-45 and Westinghouse: On June 6, 1985, the United States Nuclear Regulatory Commission, Office of Inspection and Enforcement, issued IE Information Notice No. 85-45: Potential Seismic Interaction Involving the Movable In-Core Flux Mapping Systems Used in Westinghouse Designed Plants. The following information was provided:

"On June 22, 1984, Carolina Power and Light (CP&L) Company informed the Nuclear Regulatory Commission (NRC) of a potentially reportable item per the provisions of 10CFR50.55(e) and 10CFR21 at their Shearon Harris Nuclear Power Plant (SHNPP) Unit 1. The NRC was informed that interactions between the nonsafety related portions of the flux mapping system and the tubing/seal table during a seismic event had not been adequately considered by Westinghouse. At that time CP&L was waiting for Westinghouse to perform a structural integrity analysis for the portion of the in-core flux mapping system that is located above the in-core instrumentation tubing/seal table. In a letter dated February 12, 1985, CP&L informed the NRC that the potential seismic interactions were indeed reportable."

"The potential interactions exist because portions of the flux mapping system that have not been seismically analyzed are located directly above the in-core instrumentation tubing/seal table. Failure during a seismic event could possibly cause multiple failures in the flux mapping tubing or fittings that would produce a small break loss of coolant accident. Recent discussions with Westinghouse have revealed that the potential seismic interactions could exist at other Westinghouse plants, including operating plants. Furthermore, multiple failures of flux mapping tubing and/or fittings constitute an unanalyzed small break loss of coolant accident because the break flow would effectively be from the bottom of the reactor vessel. Thus, the consequences could be beyond the licensing design basis for loss of coolant accidents. It should be noted that any loss of reactor coolant system pressure boundary integrity caused by seismically induced failures in the flux mapping system would be outside the design basis of a plant and, therefore, unacceptable regardless of whether the consequences were within those for loss of coolant accidents analyzed in safety analysis reports."

Additionally, Westinghouse conducted an internal Safety Review Committee meeting to review the potential for system interaction between the Flux Mapping System and the Seal Table/Bottom Mounted Instrumentation (BMI) resulting from a postulated seismic event. The Committee found this

item to be a potential unreviewed safety question as defined in 10CFR50.59. Westinghouse identified the issue for two plants, Diablo Canyon and Shearon Harris. Investigations for those plants were limited to the structural capability of the Flux Mapping System under seismic loads. The investigations showed that without adequate restraints, the Flux Mapping Systems could collapse and possibly fall on the Seal Table/BMI.

Westinghouse stated that only two of the many designs of the flux mapping system had been investigated. Westinghouse advised that among the various systems; some have no parts above the seal table, some are totally above the seal table, while others lie somewhere between these two conditions. Westinghouse recommended that an investigation be conducted of the adequacy of the restraints provided for the Flux Mapping System under seismic loads. A review of this condition for the Vogtle Electric Generating Plant determined that an additional evaluation was required because the 10-path rotory transfer assembly was located directly above the seal table. After receipt of this information, Georgia Power Company reported this condition to the NRC as a potentially reportable condition.

Background Information: Neutron flux mapping of the reactor core is performed using movable neutron detectors which are inserted into the core through guide tubes in the bottom of the reactor vessel. These guide tubes are terminated at the seal table, with the RCS pressure barrier provided by mechanical seals. The detector thimbles are positioned into the guide tubes using the 10-path transfer assembly which is located directly over the seal table, and then driven through the guide tubes into the reactor core. The transfer assembly does not provide a safety function. The guide tubes are safety related; however, as they form a portion of the reactor coolant pressure boundary. The 10-path transfer assembly was designed as seismic Category 2. As such, the design requirements did not include functionality or structural integrity following a seismic event. The rails on which the assembly travels have been designed to withstand seismic loads. However, If the assembly slides, swings, or collapses during a seismic event the resultant loads on the detector thimble guide tubes may result in the failure of the RCS pressure boundary and a loss of coolant accident (LOCA).

Engineering Evaluation: A seismic analysis of the Vogtle Flux Mapping System (FMS) was performed by Westinghouse to address the concern that it may interact with and jeopardize the seal table pressure boundary during a seismic event. The analysis was performed in accordance with the recommended practices of IEEE 344-1975 to determine if the FMS would maintain its structural integrity during a seismic event. The equipment analyzed is the moveable FMS defined in Teleflex Inc. drawing number 43872 Rev. F. The FMS is mounted to I-Beams above the seal table at elevation 205'-0.44" in the containment building. The FMS is composed of structural steel which supports drive assemblies, transfer devices, and thimble tubing.

Finite element computer models were developed using the verified WECAN computer code. Preliminary analyses were performed to determine the required boundary conditions to be applied to the model. The analyses

revealed that vertical liftoff of the wheel assemblies could occur if the system is not positively attached to the I-Beams at the ends of each of the four (4) wheel assemblies. Vertical liftoff would result in high impact loads which could cause the wheel assembly to fail or could cause derailment which would allow the FMS to fall on the seal table. Therefore, the wheel assemblies were attached to the I-Beams at the four locations in modeling the structure. Constraints in both horizontal directions were also included at the bottom of the structure at the isolation valve frame. These restraints were included since previous seismic analyses on similar FMS structures with similar seismic levels revealed that these restraints were required to preclude large seismic displacements which could jeopardize the thimble tubing seals at the seal table.

A modal Required Response Spectrum (RRS) analysis for modes between 0.0 and 33.0 Hz was performed to derive loads and stresses in each principal axis of the FMS. The Vogtle 3% damping SSE RRS curves for containment building elevation 220'-0", were used for the RRS analysis. The results from each mode were combined by the square-root-of-the-sum-of-the-squares (SRSS) method, except for closely spaced modes (within 10% of each other) which were combined absolutely. Static analyses were also performed to derive stresses and loads due to structure deadweight and Zero Period Acceleration (ZPA) levels in each of the equipment principal axes as defined by the Vogtle RRS. For each principal direction, the RRS analysis results were combined absolutely with the ZPA results to account for the effects of rigid body modes above 33.0 Hz. The two horizontal principal direction RRS plus ZPA results and the vertical direction RRS plus ZPA results were combined by the SRSS method. Finally, an absolute sum method was used to combine these results with the deadweight results. The final results were considered to determine the acceptability of the structure when subjected to seismic loading. These resulting member stresses were evaluated for acceptability based on American Institute of Steel Contruction (AISC) specifications. Results of the stress evaluation revealed that the only element which was stressed beyond the AISC allowable levels were the anchor angles. All other members were found to be stressed within allowable levels when the Vogtle required seismic levels are considered. The collapse of the FMS could result in a failure of the in-core instrumentation thimble guide tubes and result in a small loss of coolant accident.

Evaluation of Quality Assurance Program Breakdown: A review of the quality assurance programs of both Bechtel Power Corporation and Westinghouse Electric Corporation were performed and it was concluded that a quality assurance program breakdown had not occurred.

Conclusion: Georgia Power Company had Bechtel Power Corporation and Westinghouse review the condition associated with the potential seismic interaction involving the movable in-core flux mapping system. As a result of the evaluation supplied to Georgia Power Company, it has been concluded that a reportable condition as defined by the reporting criteria of Parts 10CFR50.55(e) and 10CFR21 does exist. Based upon guidance in NUREG-0302 Rev. 1 and other NRC documents, this condition is being reported per the criteria of Part 10CFR50.55(e).

Corrective Action: Based on the results, of the evaluation , the following actions will be taken to eliminate the overstress conditions:

1. Add a 3" x 5" x 1/4" triangular plate stiffener to the moveable frame anchor angle using a 3/16" fillet weld as shown in Figure 1.

2. Place the modified anchor angle assemblies described above at the ends of each of the four (4) wheel assemblies as shown in Figures 2 and 3 to prevent possible liftoff and lateral movement along the rail direction. The anchor angle shown in Figure 1 are to be bolted to the I-Beams and to the anchor brackets shown in Figure 4.

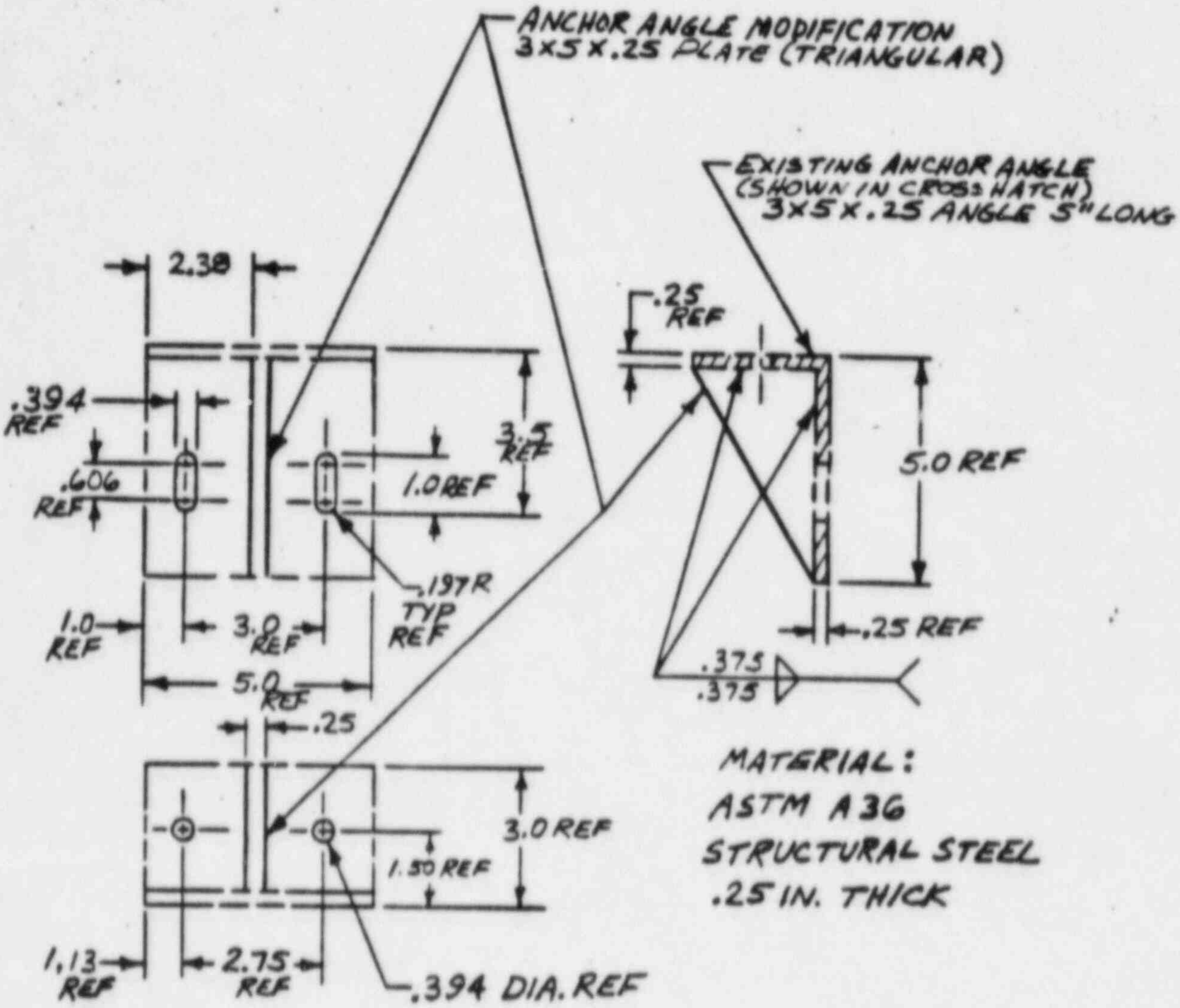


FIGURE 1: MOVEABLE FRAME ANCHOR ANGLE STIFFENER

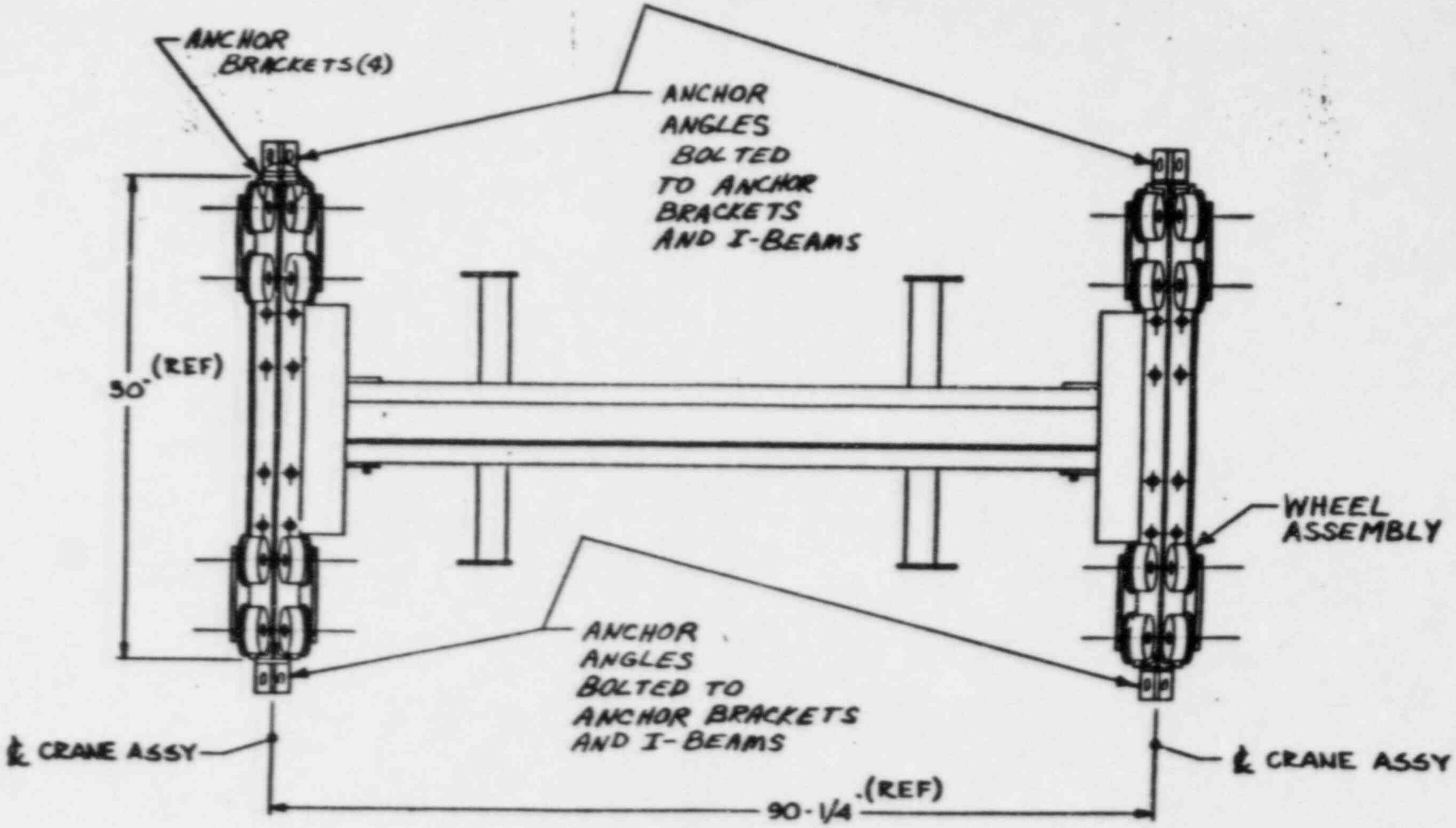


FIGURE 2: LOCATIONS OF ANCHOR ANGLE ASSEMBLIES - TOP VIEW

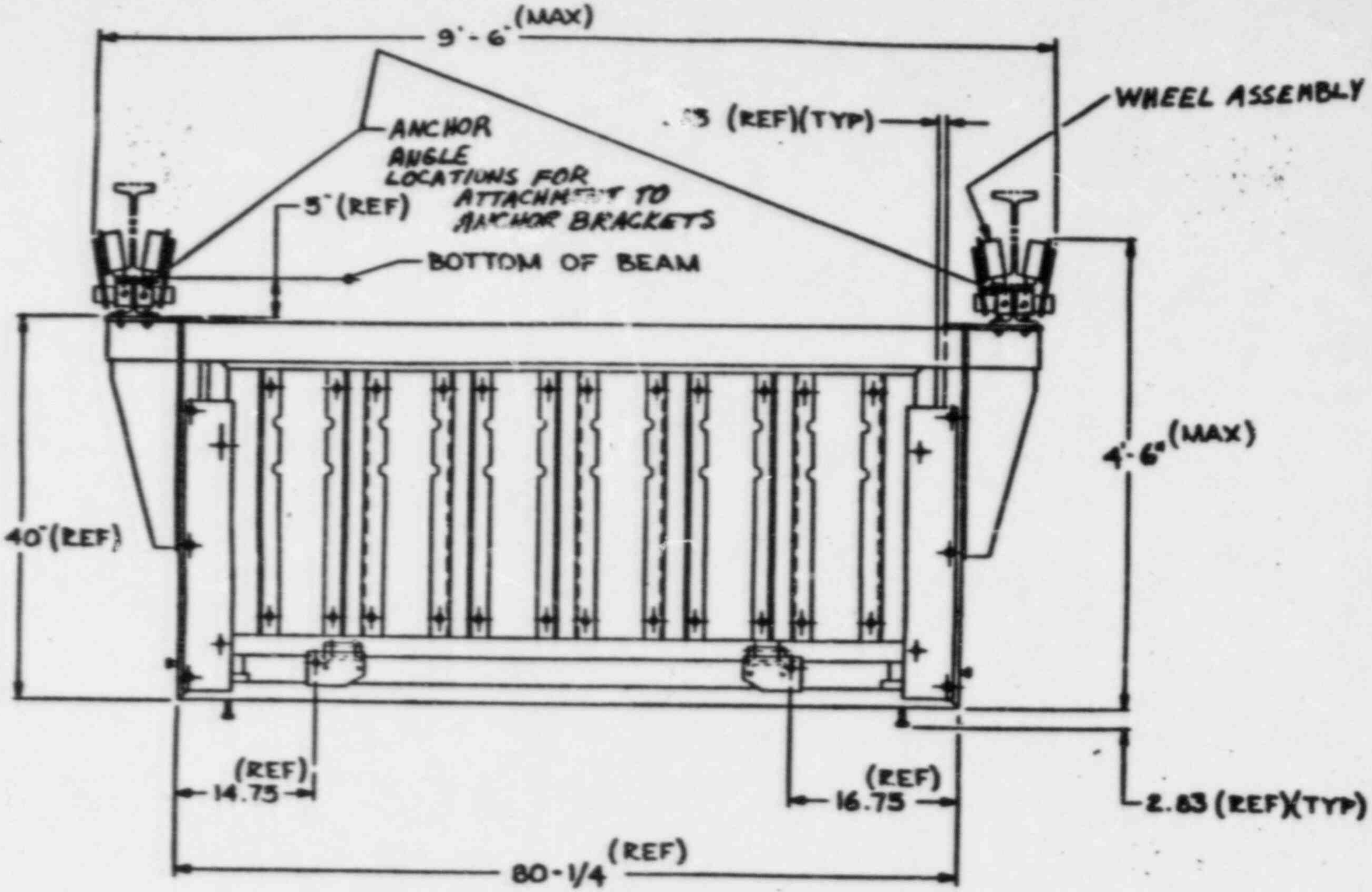


FIGURE 3: LOCATIONS OF ANCHOR ANGLE ASSEMBLIES - FRONT VIEW

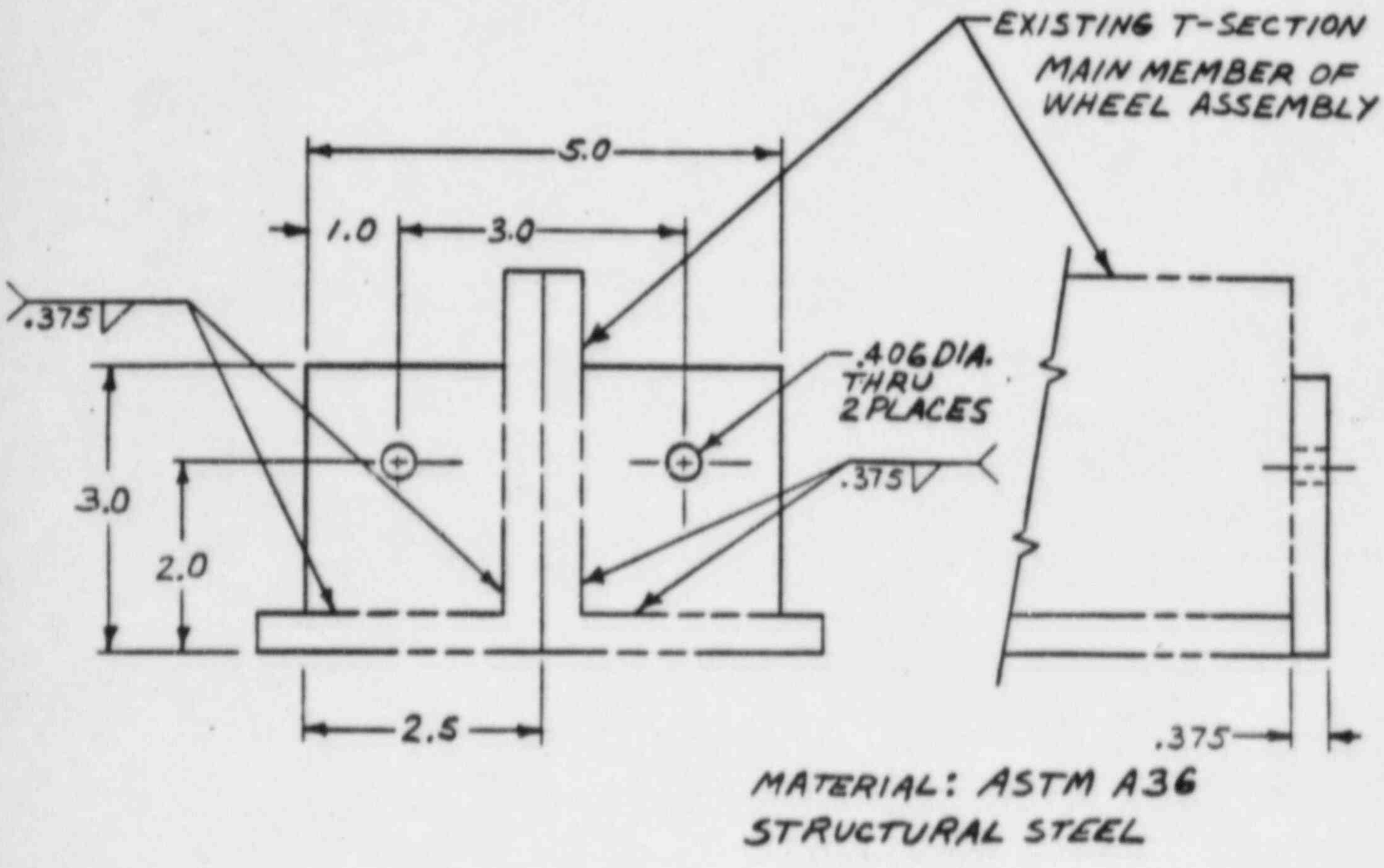


FIGURE 4: ANCHOR BRACKET TO WHICH ANCHOR ANGLE ASSEMBLY IS BOLTED