Final Report

Anchorage and Seismic Support of
Safety Related Electrical Equipment

RG&E Project Number EWR-2831
12/31/80

1.0 Introduction

This report describes all RG&E and consultant activities associated with assuring that the anchorage systems associated with all safety related electrical equipment as well as any permanently mounted non safety related pieces of equipment (Ancillary) perform their design functions during a safe shutdown earthquake. All activities are consistant with the action plan submitted for NRC approval on February 11, 1980 and identified in reference 3.2. The purpose of this report is to document the results of the seismic evaluation program recently completed at the R.E. Ginna Nuclear Power Plant.

The Class IE electrical equipment was addressed separately from the Class IE cable trays and conduit (raceways). The work activities for both the electrical assemblies and the raceway system was performed in three phases as described in the following work outline.

2.0 Work Outline Sequence

2.1 Phase I consisted of preparing "as-built" drawings of all Class IE and non IE electrical assemblies. These drawings identified each assembly's location, size and weight. A field team obtained the following information on each assembly:

- Assembly size, geometry
- Assembly anchor locations
- Assembly anchor bolt types, quantities, spacing
- Assembly approximate mass distribution

Sufficient information was obtained to estimate the weight of each assembly. All information was documented on the equipment drawing.

Phase I also consisted of surveying the raceway systems (cable trays and conduit) in each safety related building, and preparing drawings which identified each support with a number. Each support type was then described by using generic sketches. Span lengths between supports were determined and recorded on appropriate cable tray or conduit drawings.

2.2 Phase II consisted of reviewing the equipment drawings for each assembly and performing an analysis to determine the adequacy of the existing anchor bolts. The results of this analysis compared the actual bolt load using the allowable working load for the specific types of bolts used.

Raceway testing was also included in Phase II and involved performing several anchor tests in each building location. The anchor types tested are described in Section 4.2. In addition, the strut members that rely on friction to suspend the lateral supports or trays were tested.

2.3 Phase III consisted of any modification or repair determined to be necessary by either analysis or test. Raceway supports found defective or missing were repaired. Electrical assemblies found to have inadequate anchors or anchors inaccessible for testing were modified.

3.0 Referenced Documents

3.1 IE Information Notice No. 79-( ), Anchorage and Support of Safety-Related Electrical Equipment issued by letter dated January 1, 1980 from Darrell G. Eisenhut, USNRC, to L. D. White, Jr., RG&E.

3.2 The Seismic Action Plan addressing the Anchorage and Support of Safety-Related Electrical Equipment, submitted by letter to Dennis L. Ziemann, USNRC, dated February 11, 1980.

3.3 Reference 3.1 reissued as IE Information Notice No. 80-21. Anchorage and Support of Safety-Related Electrical Equipment.

3.4 Letter to Leon D. White Jr. from Dennis M. Crutchfield, USNRC, dated July 28, 1980.

3.5 Gilbert Associates, Inc. Technical Specification SP-5375. Cable Trays and Electrical Circuits Power, Control and Instrumentation. Ginna Station Unit No. 1 dated 3-17-1967.

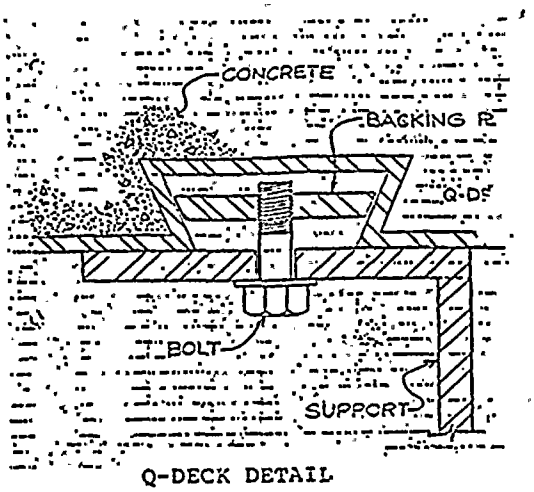
3.6 Unistrut General Engineering Catalog No. 9, Unistrut Corporation Wayne, Michigan.

3.7 Design Criteria, Rev. 1, Seismic Upgrade Program, submitted by letter dated November 4, 1980 from J. E. Maier, RG&E, to Dennis M. Crutchfield, USNRC.

4.0 Raceway Qualification

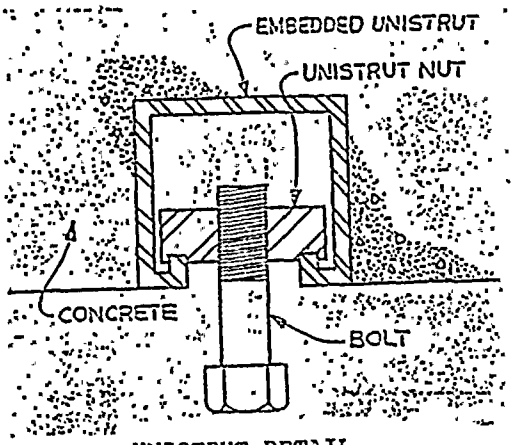
4.1 All trays and conduit runs in the safety related buildings have had the anchorages systems inspected, tested and, if required, reworked. No attempt was made to distinguish between Class IE and non IE raceways in any of the Category I structures. As outlined in the Seismic Action Plan, Reference 3.2, "As-Built" drawings were prepared for each elevation in each building. A system of identifying each support by number, type, and quantity of bolts was developed and is used on each drawing. In addition, maximum, minimum and average span lengths (tray lengths between supports) were determined and recorded on the drawings.

4.2 Test criteria were established detailing the information necessary to test the anchorage of the supports making up the raceway system. Specific test procedures were prepared, consistant with the test criteria, for each category of anchorage included in this program. The categories of anchorages and specific procedures required to test the following devices were: 1. expansion anchors for both conduit and tray supports in ceiling and/or wall locations, 2. Clips and unistrut hardware that rely on frictional resistance, and 3. Embedded hardware such as Keystone Q deck nuts, embedded unistrut and poured-in-place anchors. Detailed sketches of each of the category 3 type hardware are shown in figures 4-1, 4-2, & 4-3.



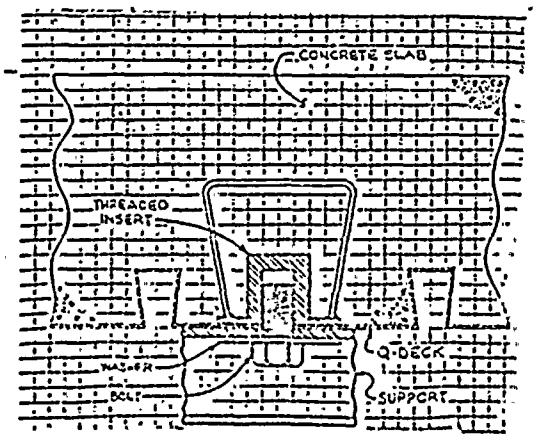
Q-DECK DETAIL

FIGURE 4-1



UNISTRUT DETAIL

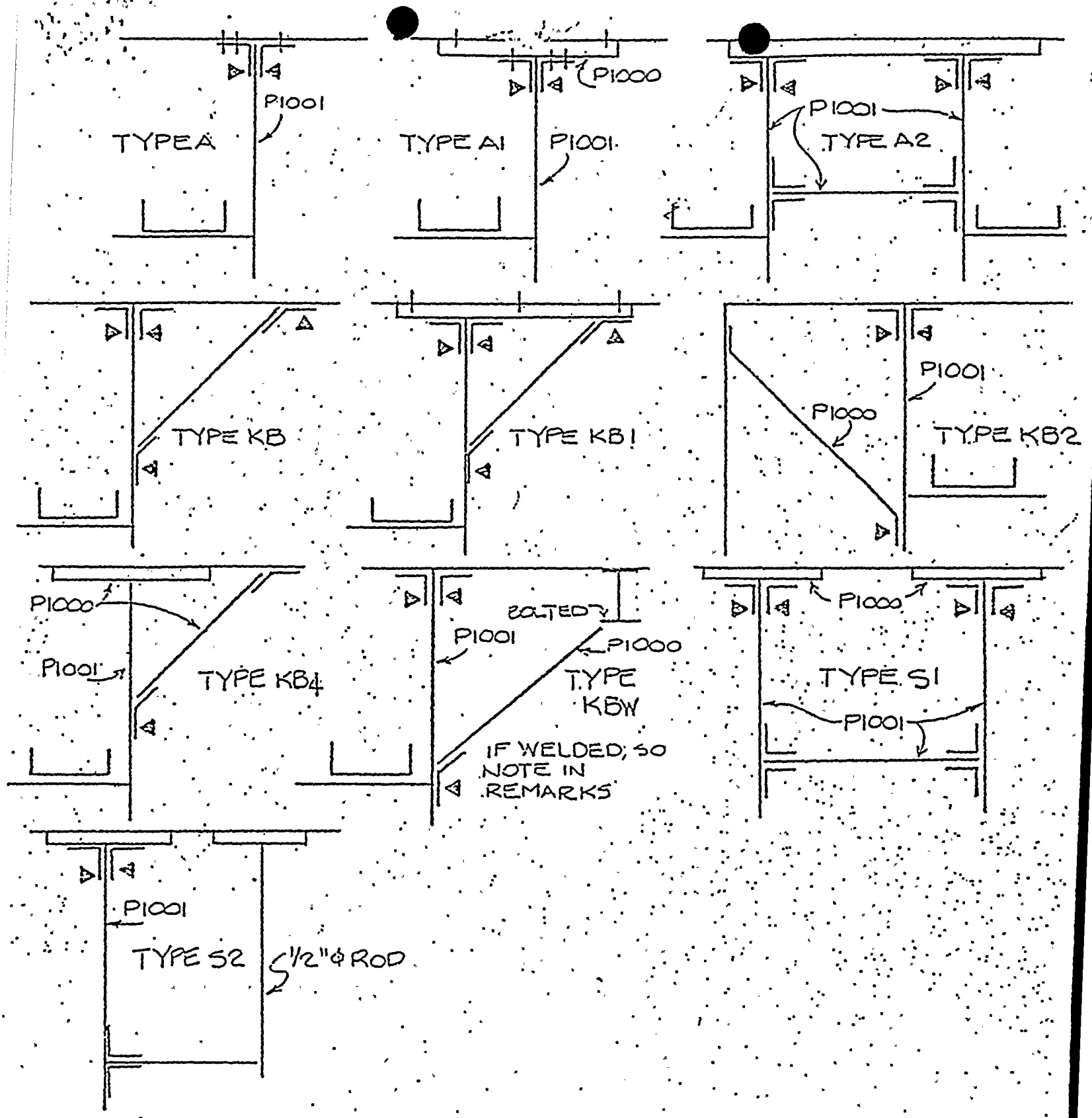
FIGURE 4-2



THREADED INSERT DETAIL

POURED IN PLACE ANCHOR

FIGURE 4-3



TRAY SUPPORT TYPES FOR FRICTION BOLT TESTING
FIGURE 4-4

4.3 It should be noted that the test program included all the hardware comprising the load path for each specific type of support. That is, the bolts suspending the strut members to the ceiling or wall section were tested on a generic bases if they were a category 3 type and sample tested if they were a shell anchor, category 1 type. The hardware used to attach the strut members to the anchor bolts and which rely on friction were also tested. Figure 4-4 shows the various generic strut support configurations in use at Ginna Station, that were part of the friction bolt testing program. Each type shows the bolts within the load path, including knee braces.

4.4 To establish test load per bolt requirements for the shell anchors and embedded anchors, the original plant Technical Specification for Cable Trays was consulted. Section 4 of Specification SP-5375, reference 3.5, specifies the design load for the cable tray type as 100 pounds per linear foot. This load, applied to any of the specified cable tray widths, should produce no more than 1/4 inch deflection at mid-span when calculated on a simple beam basis. In addition to the tray loads, the supports were designed to carry a 200 pound man standing at any position in the tray. The design span lengths were assumed to be eight feet. The eight foot span lengths carry a total load of 800 pounds between supports or 4000 pounds for a stack of five trays. Assuming two vertical members per support, a load of

800 pounds for each of five trays plus 200 pounds for the man results in a 1000 pound load per vertical support member. For conservatism, a 2000 pound test load was used on each vertical support member tested. In most cases each vertical support member is anchored by two or three bolts, however, only one bolt was assumed thus giving an anchor bolt test load of 2000 pounds.

4.5 The test load for the category 2 anchors, friction bolts, was based on the manufacturers design manual, Unistrut General Engineering Catalog No. 9, reference 3.6. The design torque values for various bolt sizes needed to maintain a resistance to slippage of at least 1500 pounds for a 1/2 inch bolt used on P1000 strut were determined to be as follows:

Bolt Size	1/4"	5/16"	3/8"	1/2"
Torque (ft. lbs)	6	11	9	50

The torque values shown above were used in the test procedures for qualifying the unistrut stud/nut hardware assemblies and includes a minimum safety factor of 3.

4.6 The test information below was required for developing the Expansion Anchor Testing Criteria (category 1 or shell type anchors):

4.6.1 Expansion anchors were selected for testing by inspecting and testing 25% of the cable tray vertical support members using shell type anchors and 10% of the rigid conduit supports using shell anchors. The lower sampling rate for conduit was used since all IE Conduit is rigid and has a very low design load. However, the 2000 pound test load was used on conduit anchors.

4.6.2 All expansion anchors were tested on each of the sample supports. Ceiling and wall section drawings have been prepared which identify all anchors by type and all supports by number.

4.6.3 The expansion type anchors are primarily used to support conduit from wall sections, though some tray supports use this type of anchor as well. The wall section drawings identify, by type and location, all expansion type anchors in safety related buildings. These identifying numbers were used on the test sheets.

4.6.4 Since all 1E Conduit is rigid, a single conduit support was completely disassembled thus exposing the shell anchors for testing. After testing, the supports were reassembled.

4.6.5 The selected anchors were inspected and load tested to 2000 pounds in accordance with RG&E Ginna Station Procedures. The acceptance criteria is that the shell anchors hold the required load without excessive movement.

4.6.6 Anchor parameters and test results were recorded in accordance with test procedures.

4.6.7 The location of unacceptable anchors was recorded and they were repaired. Section 4.6.10 details the repair of the unacceptable shell anchors.

4.6.8 Anchors used in block walls were not tested in this program. All such anchors were replaced with through bolt anchors.

4.6.9 Results

The results of the shell anchor testing program are summarized in Table 4-1.

TABLE 4-1
SHELL ANCHOR TEST SUMMARY

	TOTAL NO. OF ANCHORS	NO. OF ANCHORS THAT HELD LOAD	NO. OF ANCHORS THAT DID NOT HOLD LOAD	INACCESSIBLE
Aux. Bld. Basement Floor	11	11	0	0
Aux. Bld. Inter Floor	16	16	0	0
Screenhouse Bsmt Floor	9	9	0	0
Cable Tunnel Ceiling	5	5	0	0
Containment Bld. Bsmt.	2	2	0	0
Relay Room	6	5	0	1
Battery Rooms	4	4	0	0
Diesel Gen. Pits	22	21	1	0
Total	75	73	1	1

4.6.10 The supports shown below have had shell anchors or parts of the support that were unacceptable. The corresponding corrective action and building location is also shown.

Support No.	Build	Nature of Problem and Repair
AB-17	Aux. Build	Excessive shell movement was noted on one anchor. Relocated and installed new hilti type bolts, extended unistrut as necessary.
A-86	Aux. Build	Excessive shell movement was noted on one anchor. Relocated and installed new hilti type bolts, extended unistrut as necessary.
AB-57	Aux. Bldg.	Excessive shell movement was noted. Installed (1) new hilti bolt.
SH-11	Screenhouse	Found missing bolt. Installed (2) new hilti bolts and extended unistrut.
IB-39	Intermediate Bldg	Missing unistrut. Installed knee brace and vertical strut and hardware.
DGP-10	Diesel Generator Pit	Excessive shell movement (1) shell anchor failed - replaced by (1) hilti type bolt.

4.7 The Unistrut Stud/Nut Testing Criteria (Category 2 type anchors) used are outlined below:

4.7.1 All accessible unistrut stud nuts used for cable tray supports were tested. The total number of IE supports is shown in the summary, Table 4-2.

4.7.2 The unistrut nuts/bolts that were tested were those used to attach the strut members to the ceiling Q deck bolts or angle clips. These attachments rely on friction and must be torqued to at least a minimum value which was established to ensure a safety factor of at least 3. Figure 4.4 shows the various configuration of strut supports used throughout Ginna Station. The unistrut joints affected by the procedures are marked by an arrow.

4.7.3 The "as-found" torque of all the unistrut stud nuts on a particular support was recorded. All inaccessible bolts were identified and recorded. Torque wrench adapters (i.e., crow's foot) were used to reduce the number of inaccessible nuts or bolts. Those bolts still inaccessible were wrench tightened where possible.

4.7.4 The design torque values for the various bolt sizes were derived from manufacturer's data shown below:

Bolt Size	1/4"	5/16"	3/8"	1/2"
Torque (ft-lbs)	6	11	19	50

4.7.5 If the "as found" torque values were less than the minimum values specified above then the proper torque values were applied to each bolt. Both the as-found and final torque values were recorded.

4.7.6 All accessible supports were tested.

4.8 Results

Table 4-2 below summarizes the friction bolt testing program. The number of inaccessible bolts is less than 10% of the total number.

TABLE 4-2
FRICTION BOLT TEST RESULT SUMMARY

Location	Total No. Of Bolts	Acceptable Torque	Bolts Wrench Tightened	Bolts Not Accessible
Aux. Bldg. Bsmt Floor	227	217	1	9
Aux. Bld. Int. Floor	202	133	17	52
Inter. Bld. EL 271'-4"	28	14	2	12
Inter Bld. EL 278'-4"	320	305	11	4
Screenhouse Bsmt Floor	144	142	2	0
Cable Tunnel	649	532	15	102
Relay Room	361	315	1	45
Battery Rooms	215	213	0	2
Diesel Gen. Pits	84	84	0	0
Containment Bsmt Floor	112	112	0	0
Containment Inter Floor	338	337	0	1
Total	2680	2404	49	227

4.9 The Keystone Steel Decking Test Criteria (Category 3 anchors including embedded unistrut and poured in place anchors) was developed and the following generic testing program was completed:

4.9.1 A generic test was performed to ensure that the load capacity of the Q deck was sufficient to sustain the required loads. Fourteen (14) "in situ" tests were performed at different plant locations. These locations were in convenient open areas and not in an actual support location. Ten (10) "in situ" unistrut and twelve (12) poured in place anchor tests were also completed.

4.9.2 A single Q deck wedge was tested using a load cell and a 5/8" rod. The anchor held a 2000 pound tensile load. The zone of influence for a single bolt was maintained at 2 feet. The load cell was also operated at its limit of 5700 pounds to insure confidence in the 2000 pound test loads. No deformation was noted at the higher load. This same test procedure was used to determine the adequacy of the embedded unistrut anchors and the poured in place anchors.

4.10 Results

The results of the embedded anchor programs is summarized in Table 4-3 below.

TABLE 4-3
CATEGORY 3 ANCHORS TEST SUMMARY

Location	No. of Poured In-Place Tested	Unistrut Tests	Q-Deck Tests	Total Tests	Held Load	Did Not Hold Load
Aux. Bldg. Bsmt. Floor	0	2	0	2	2	0
Aux. Bld. Inter. Floor	0	2	0	2	2	0
Inter. Bldg. EL 271'-4"	0	0	2	2	2	0
Screenhouse Bsmt Floor	0	2	0	2	2	0
Containment Bsmt Floor	0	2	2	4	4	0
Containment Inter Floor	12	2	2	4	4	0
Relay Room	0	0	2	2	2	0
Battery Rooms	0	0	6	6	6	0
Total	12	10	14	24	24	0

5.0 Class IE Equipment Qualification Program

5.1 "As-Built" drawings were prepared for one hundred and fifteen electrical assemblies. These drawings represent all class IE and non IE equipment which are floor-mounted, mounted on structural steel, poured wall mounted or block wall mounted. Each drawing details the size, shape, number and type of existing anchor bolts for a particular assembly. This information was obtained from field measurements. Since shipping weights or assembly weights were not available, a weight assessment sheet was generated. These sheets show the surface area, gauge size of the enclosure steel and corresponding weights per square foot, linear feet of structural steel, and finally a list and corresponding weights of all the internally mounted components, including wire and terminal blocks. The total equipment weights were then determined including 25% of the enclosure weight for conservatism.

5.2 The objective of the analysis portion of this program was to determine the minimum loading that the existing anchorage must be capable of carrying during a seismic event (SSE) at Ginna Station. The calculated loads (tensil and shear) were compared to the published load capabilities for the specific anchors used on each assembly. If the calculated load values are within the published capability of the bolts used on a particular assembly (i.e., less than pullout for concrete anchors) then the calculated loads were used as the test loads for that assembly providing that the bolts were accessible. For wall mounted equipment that had safety factors in excess of ten (10), no modification or testing was performed. This is indicated as a category 4 on table 5-1, the Equipment Modification Summary Sheets. If it was determined that the existing anchorages were inadequate, then those assemblies were modified taking no credit for the existing anchors.

All modifications to existing equipment used current criteria for determining seismic anchor loads. The horizontal and vertical forces were determined by using one and a half times the peak acceleration shown on the floor response spectrum for each assembly location. All proposed expansion anchor bolts used a minimum safety factor of 5.7 in tension and 4 in shear. Specifically, the following interaction equations were used:

$$\text{SSE: } \frac{T_{act}}{T_{ult/4.0}} + \frac{V_{act}}{V_{ult/4.0}} \leq 1.0$$

$$\text{OBE: } \frac{T_{act}}{T_{ult/5.7}} + \frac{V_{act}}{V_{ult/4.0}} \leq 1.0$$

where: T_{act} - Actual tensile force
V_{act} - Actual shear force
T_{ult} - Ultimate tensile force
V_{ult} - Ultimate shear force

5.3 The assumptions used in performing the calculations were:

5.3.1 During a seismic event, vertical and horizontal accelerations of the earth give rise to vertical and horizontal forces acting on the center of mass of an object. These forces are proportional to the accelerations and opposite in direction. Floor response spectra used in the analysis were based on an 0.2 SSE and were developed under the RG&E Seismic Upgrade Program (Ref. 3.7).

5.3.2 The worst case combination of seismic forces for floor mounted equipment occurs when the vertical force is directed upward and the horizontal force is directed along the shortest dimension of the base of the object. When the assembly is wall mounted the worst combination occurs when the vertical force is directed downward and the horizontal force is away from the wall.

5.3.3 Since both the weight of the assemblies and the vertical seismic force are directed along the same line through the center of mass, the resultant vertical force on the

object may be considered to be a single force equal to the difference or sum between the weight and the vertical seismic force, depending on whether the assembly is floor or wall mounted.

5.3.4 The center of mass of each assembly is assumed to be located at the geometric centroid.

5.3.5 To determine the appropriate equipment damping all Class IE assemblies were assumed to be welded. Although conservative, some are bolted steel structures, and consequently a damping value of 3% of critical damping was used for the SSE and 2% of critical damping for OBE loading.

5.3.6 Zero friction is assumed between all assemblies and the floor. All restraining forces arise from expansion bolts imbedded in the concrete floor or through bolts depending on what type of anchor was used.

5.3.7 The concrete strength used in the floors at Ginna Station is 3000 PSI.

5.4 The results of the analysis indicated that 90% of the assemblies required modification to fully comply with current seismic criteria. Eight enclosures mounted on strut supports were found to comply with current criteria and only their friction bolts were torque tested.

Finally, five assemblies were not included in this program because they are being replaced by on going modifications. These assemblies have a category 3 designation on Table 5-1.

The structural configuration of each assembly was also reviewed to ensure that the load path associated with the anchorage system is continuous. In the majority of cases the enclosures are mounted on structural steel frames which were bolted to the floor. The enclosures were then examined to ensure that adequate hardware or welds exists securing the cabinets to the frames. Since no weld data was available, all the assemblies were stitch welded to their frames as part of the generic seismic modification. In all, twenty (20) different generic type modifications were used to modify the electrical equipment.

5.5 The final phase of this program involved the installation of generic modifications using specific construction drawings for each assembly to be modified. A typical generic modification included the welding of structural plates or angles to the outside of the enclosure frame, the installation of Hilti bolts or "through bolts" depending on location and the stitch welding of the enclosure cabinets to the frames. All enclosures modified in this way are listed in the Equipment Modification Summary Table 5-1 as type 1. Wall enclosures that do not have structural frames did not have the stitch welds. Block wall mounted enclosures were all modified with through bolts using criteria consistent with the Block Wall Program.

Category 2 refers to those assemblies tested and no modification was required. The through bolt anchors used on the block wall mounted assemblies provides adequate assurances that they will carry the anticipated seismic loads. This approach is consistent with the Block Wall Evaluation and Modification Programs being completed in response to IE Bulletin 80-11.

All non Class IE designations in Table 5-1 refer to those assemblies permanently mounted in Category I buildings that are not safety related. The Anchorage Criteria for these assemblies was the same as for the Class IE assemblies.

5.6 Internally mounted components were categorized and a generic design analysis was developed to evaluate the methods of attaching these components to the cabinets. If any one component is classified IE in an enclosure then all components were assumed to be Class IE.

Non Class IE enclosures were not surveyed assuming that the enclosure will retain any loose component during an SSE.

As a result of this investigation a number of internally mounted components were found to have missing attachment hardware. This hardware was replaced by plant personnel using corrective procedures. All components greater than 25 pounds, were analyzed individually as a separate assembly. All internal components were found to have adequate attachments.

5.7 Criteria for controlling ancilliary equipment not permanently mounted or attached has been developed and is being implemented by plant personnel. The seismic restraints of portable ancillary equipment in Category I structures will follow the guidelines below:

5.7.1 Compressed Gas Bottles

Since compressed gas bottles represent potential active missiles due to breaking off the valve neck during a seismic event, they shall at all times be secured in such a manner that they cannot fall or be impacted by other falling objects during a seismic event.

5.7.2 Rolling Stock

All wheel mounted equipment shall be secured against excessive movement during a seismic event when stored in Category I structures. When in use in Category I structures, such equipment shall have the wheels blocked, and be located a distance 1½ times its height from any safety related equipment. If the distance margin cannot be maintained, the equipment shall be secured from overturning with restraining hardware capable of supporting the equipment's dead weight.

5.7.3 Stationary Portable (Unanchored) Equipment

All stationary (not wheel mounted) equipment stored or in use in Category I structures shall be located a distance 1½ times its height from safety related equipment or be secured from overturning with restraining tackle capable of supporting the equipment dead weight.

5.7.4 Miscellaneous Portable Objects Stored Off the Floor

This includes portable instruments, hand tools, hard hats, procedure manuals, and other objects which could potentially damage safety related equipment on impact.

All such objects located in Category I structures shall be seismically restrained, or shall be located at a horizontal distance from any safety related equipment equal to or greater than that given by the formula.

$$S = \sqrt{h} + 1 \text{ ft}$$

S = horizontal distance from safety related equipment

h = height at which object is located

6.0 As a result of this program all safety related electrical equipment as well as all non safety related in seismically designed buildings have anchorage systems engineered with adequate seismic capacity, fabricated and installed to quality standards. In addition, procedures are being developed and implemented to ensure that ancillary items do not dislodge and render any Class IE equipment inoperable. The activities undertaken by this seismic program resolves any potential safety concerns relative to the anchorage and support of safety related electrical equipment.

TABLE 5-1
Equipment Modification Summary

EQUIPMENT NAME	REF. NO. 10906	LOCATION	CLASS IE/NON IE	QUALIFICATION CATEGORY*	GENERIC FIX NO.	ANCHOR TYPE	MOUNTING TYPE
Termination Box	1	Relay Rm.	Non IE	2	-	-	Unistrut
Termination Box	2	Relay Rm.	Non IE	2	-	-	Unistrut
Termination Box #338	3	Relay Rm.	Non IE	1	9	thr. bolt	Block Wall
Termination Box above #338	4	Relay Rm.	Non IE	1	9	thr. bolt	Block Wall
Termination Box 1080	5	Relay Rm.	Non IE	1	10	thr. bolt	Block Wall
Fire Panel	6	Relay Rm.	Non IE	3	-	-	Block Wall
Relay Racks (MCC-1K)	7	Relay Rm.	IE	1	**	hilti	Floor
Relay Racks (RLTR-1,RV-1, RB-1, RW-1, RR-1)	8	Relay Rm.	IE	1	1	hilti	Floor
Relay Racks (RPI #1,2,3)	9	Relay Rm.	IE	1	1	hilti	Floor
Relay Racks (RR-2, RW-2, RB-2 RY-2, RLTR-2)	10	Relay Rm.	IE	1	1	hilti	Floor
Relay Cabinets	11	Relay Rm.	IE	2	-	-	Unistrut
Relay Racks (SA, CVCX-1, CVCS-2, RCS-1, RCS-2)Cabinets	12	Relay Rm.	IE	1	1	hilti	Floor

* Qualification Category Key
1. Dwg. Issued With Generic Fix Which Is On File And Not Included In This Report
2. Anchors Were Torque Tested, No Modification Required
3. Equipment Being Replaced
4. Calc. - No Fix Req'd. Safety Factor > 10
5. Prior RG&E Design Analysis - Quality Anchorage System
6. Missing Or Duplicate As-Built Drawings

** Specific Not Generic Fix

TABLE 5-1 (Cont'd)

EQUIPMENT NAME	REF. NO. 10906	LOCATION	CLASS IE/NON IE	QUALIFICATION CATEGORY*	GENERIC FIX NO.	ANCHOR TYPE	MOUNTING TYPE
Relay Racks (SIA1, SI-A2)	13	Relay Rm.	IE	1	1	hilti	Floor
Solatron 15KVA X FORMER	14	Relay Rm.	Non IE	1	2	hilti	Floor
NY Telephone Cabinet	15	Relay Rm.	Non IE	1	11	hilti	Concr. Wall
Terminal Box 427	16	Relay Rm.	Non IE	2	-	-	Unistrut
Transformer EP Type	17	Relay Rm.	Non IE	2	-	-	Block Wall
Transformer EPT	18	Relay Rm.	Non IE	2	-	-	Block Wall
Twinco Power Units	19	Relay Rm.	IE	1	6	thr. bolt	Floor
Undervoltage Relay Cabinet 1A	20	Relay Rm.	IE	3	-	-	Unistrut
Undervoltage Relay Cabinet 1B	21	Relay Rm.	IE	3	-	-	Unistrut
Turbine Cabinet	22	Relay Rm.	Non IE	1	1,3	hilti	Floor
Battery Charger 1A	23	Battery Rm. A	IE	1	10	thr. bolt	Block Wall
1A1 Battery Charger	24	Battery Rm. A	IE	1	18	hilti	Floor
1A Battery Main Fuse Cab 1	25	Battery Rm. A	IE	1	10	thr. bolt	Block Wall
1A Battery Main Fuse Cab 2	26	Battery Rm. A	IE	1	10	thr. bolt	Block Wall
CTV-1A	27	Battery Rm. A	IE	5	-	-	Floor
Inverter/CVT	28	Battery Rm. A	IE	5	-	-	Floor
1A Main Distribution Cabinet	29	Battery Rm. A	IE	1	10	thr. bolt	Block Wall

* Qualification Category Key
1. Dwg. Issued With Generic Fix Which Is On File And Not Included In This Report
2. Anchors Were Torque Tested, No Modification Required
3. Equipment Being Replaced
4. Calc. - No Fix Req'd. Safety Factor > 10
5. Prior RG&E Design Analysis - Quality Anchorage System
6. Missing Or Duplicate As-Built Drawings

** Specific Not Generic Fix

TABLE 5-1 (Cont'd)

EQUIPMENT NAME	REF. NO. 10906	LOCATION	CLASS IE/NON IE	QUALIFICATION CATEGORY*	GENERIC FIX NO.	ANCHOR TYPE	MOUNTING TYPE
PA System Inverter	30	Battery Rm. A	Non IE	1	9	thr. bolt	Block Wall
Paging System Dist. Panel	31	Relay Rm.	Non IE	4	-	-	Block Wall
1B Battery Charger	32	Battery Rm. B	IE	1	11	hilti	Floor & Concr. Wall
Battery Charger 1B1	33	Battery Rm. B	IE	1	11	hilti	Floor & Concr. Wall
1B Battery Main Fuse	34	Battery Rm. B	IE	1	11	hilti	Conc. Wall
CVT-1B	35	Battery Rm. B	IE	5	-	-	Floor
1B Inverter/Cut	36	Battery Rm. B	IE	5	-	-	Floor
Main Battery Disconnect	37	Battery Rms. A & B	IE	1	10	thr. bolt	Block Wall
1B Main D.C. Distribution Panel	38	Battery Rm. 1B	IE	1	13	hilti	Conc. Wall
Panel 14D	39	DG Rm. 1A	IE	4	-	-	Conc. Wall
Transformer	40	DG Rm. 1A	IE	4	-	-	Conc. Wall
Air Comp. Terminal Box	41	DG Rms. 1A & 1B	Non IE	4	-	-	Conc. Wall
Control Panel	42	DG Rm. 1A	IE	1	1	hilti	Floor
D.C. Supply	43	DG Rm. 1A	IE	4	-	-	Conc. Wall
Diesel Fuel Pump 1A	44	DG Rm. 1A	IE	4	-	-	Conc. Wall
MCC-1H	45	DG Rm. 1A	IE	1	**	hilti	Floor
Exciter & Reg. Cabinet	46	DG Rm. 1A	IE	1	1	hilti	Floor

* Qualification Category Key
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3. Equipment Being Replaced
4. Calc. - No Fix Req'd. Safety Factor > 10
5. Prior RG&E Design Analysis - Quality Anchorage System
6. Missing Or Duplicate As-Built Drawings

** Specific Not Generic Fix

TABLE 5-1 (Cont'd)

EQUIPMENT NAME	REF. NO. 10906	LOCATION	CLASS IE/NON IE	QUALIFICATION CATEGORY*	GENERIC FIX NO.	ANCHOR TYPE	MOUNTING TYPE
Control Panel	47	DG Rm. 1B	IE	1	1	hilti	Floor
NOT USED	48	-	-	-	-	-	-
1B D.G. D.C. Supply Box	49	DG Rm. 1B	IE	4	-	-	Conc. Wall
Diesel Fuel Oil Pump 1B	50	DG Rm. 1B	IE	4	-	-	Conc. Wall
MCC 1J	51	DG Rm. 1B	IE	1	**	hilti	Floor
Exciter & Reg. Cabinet	52	DG Rm. 1B	IE	1	1	hilti	Floor
Panel 16D	53	DG Rm. 1B	IE	4	-	-	Conc. Wall
Transformer	54	Screen House	Non IE	1	7, 17	hilti	Floor
1B D.C. Distribution Panel	55	Screen House	IE	4	-	-	Steel Frame
Selector Switch 1A & 1C (SWP)	56	Screen House	IE	4	-	-	Steel Frame
MCC-1E	57	Aux. Bldg. Oper. Fl.	Non IE	1	14	hilti	Floor
MCC-1F	58	Water Treatment Area	Non IE	1	14	hilti	Floor
Cabinet Support	59	Inter. Bldg.	IE	1, 2	**	-	Unistrut
Motor Starter For TD Aux. F.W.P. D.C. Oil Pump	60 (59)	Inter. Bldg.	IE	4	-	-	Block Wall
Motor Starter To Aux. FWP Discharge	61 (59)	Inter. Bldg.	IE	4	-	-	Block Wall

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TABLE 5-1 (Cont'd)

EQUIPMENT NAME	REF. NO. 10906	LOCATION	CLASS IE/NON IE	QUALIFICATION CATEGORY*	GENERIC FIX NO.	ANCHOR TYPE	MOUNTING TYPE
Pressurizer Instrumentation Panel	62 (59)	Inter. Bldg.	IE	6	-	-	-
Transfer Switch Motor Dr. Aux. FW Pump 1A	63 (59)	Inter. Bldg.	IE	6	-	-	-
Transfer Switch Motor Dr. Aux. FW Pump 1B	64 (59)	Inter. Bldg.	IE	6	-	-	-
Transfer Switch Pressure Htr. Back-up Group	65 (59)	Inter. Bldg.	IE	6	-	-	-
Current Limiting Reactor	66	Aux. Bldg. Oper. Fl.	IE	1	14	hilti	Floor
MCC-1C Right Section	67	Aux. Bldg.	IE	1	14	hilti	Floor
MCC-1D	68	Aux. Bldg. Inter. Fl.	IE	1	14	hilti	Floor
Bus 16	69	Aux. Bldg. Inter. Fl.	IE	1	14	hilti	Floor
Control MCC-1C Left Section	70	Aux. Bldg.	IE	1	14	hilti	Floor
MCC-1M	71	Aux. Bldg. Oper. Fl.	IE	4	-	-	Floor
MCC-1D Right Side	72	Aux. Bldg. Oper. Fl.	IE	1	14	hilti	Floor
1B1 D.C. Dist. Panel	73	Aux. Bldg. Oper. Fl.	IE	6	-	-	-

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TABLE 5-1 (Cont'd)

EQUIPMENT NAME	REF. NO. 10906	LOCATION	CLASS IE/NON IE	QUALIFICATION CATEGORY*	GENERIC FIX NO.	ANCHOR TYPE	MOUNTING TYPE
Pressurizer Heat Control	74	Aux. Bldg. Inter. Fl.	IE	1	12	hilti	Conc. Wall
MCC-1G	75	Screen House	Non IE	1	14, 17	hilti	Floor
Fire Pump Controller	76	Screen House	Non IE	1	14, 17	hilti	Floor
1B D.C. Distribution Panel	77	Aux. Bldg.	IE	6	-	-	-
Main Battery Disconnect Switches	78	Battery Rms. A & B	IE	1	10	thr. bolt	Block Wall
1A1 and 1B1 Battery Charger Tie	79	Battery Rm. 1A	IE	4	-	-	Block Wall
Computer Battery Charger	80	Battery Rm. 1B	Non IE	4	-	-	Concrete Wall
1A1 D.C. Distribution	81	Aux. Bldg.	IE	1	11	hilti	Concrete Wall
1A D.C. Distribution Panel	82	Aux. Bldg. Inter. Fl.	IE	1	11	hilti	Concrete Wall
Pressure Heater Panels 1A1,1A2	83	Aux. Bldg. Inter. Fl.	IE	1	**	hilti	Unistrut
Pressure Heater Panels 1B1,1B2	84	Aux. Bldg. Inter. Fl.	IE	1	**	hilti	Unistrut
Bus 14	85	Aux. Bldg. Oper. Fl.	IE	1	14	hilti	Floor
1B D.C. Distribution Panels	86	Aux. Bldg. Inter. Fl.	IE	1	13	hilti	Conc. Wall
1B1 D.C. Distribution Panels	87	Aux. Bldg. Inter. Fl.	IE	1	13	hilti	Conc. Wall
Relay Cabinets B-1, B-2, Y-1, Y-2	88	Relay Rm.	IE	1	4	thr. bolt	Floor
Relay Cabinets R-1, R-2, W-1, W-2	89	Relay Rm.	IE	1	4	thr. bolt	Floor

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TABLE 5-1 (Cont'd)

EQUIPMENT NAME	REF. NO. 10906	LOCATION	CLASS IE/NON IE	QUALIFICATION CATEGORY*	GENERIC FIX NO.	ANCHOR TYPE	MOUNTING TYPE
Main Control Panel	90	Control Rm.	IE	1	**	thr. bolt	Floor
Diverse Containment Isolation Cabinet	91	Control Rm.	IE	5	-	-	Floor
Inst. Buses #1, 2, 3, 4	92	Control Rm.	IE	4	-	-	Conc. Wall
Instrument Panel	93	Screen House	IE	1	**	hilti	Floor
Instrument Panel	94	Screen House	IE	4	-	-	Floor
Buses 17, 18	95	Screen House	IE	1	**	-	Floor
Lubrication Panels	96	DG Rms. A & B	IE	1	**	-	Floor
Structure	97	DG Vault 1B	IE	4	-	-	Floor
Structure	98	DG Vaults 1A & 1B	IE	4	-	-	Floor
Structure	99	DG Vaults 1A & 1B	IE	4	-	-	Floor
Structure	100	DG Vault 1A	IE	4	-	-	Floor
Relay Cabinets F.W., RA-1	101	Relay Rm.	Non IE	1	1	hilti	Floor
Relay Cabinets RA-#2, RA-#3	102	Relay Rm.	IE	1	1	hilti	Floor
Relay Cabinets S1-B1, S1-B2, M-1,M-2	103	Relay Rm.	IE	1	1	hilti	Floor
115 kV Control Benchboard	104	Control Rm.	Non IE	1	**	hilti	Floor

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TABLE 5-1 (Cont'd)

EQUIPMENT NAME	REF. NO. 10906	LOCATION	CLASS IE/NON IE	QUALIFICATION CATEGORY*	GENERIC FIX NO.	ANCHOR TYPE	MOUNTING TYPE
Radiation Monitor Cabinet	105	Control Rm.	IE	1	4	thr. bolt	Floor
Incore Rack	106	Control Rm.	IE	1	8	thr. bolt	Floor
Instrument Rack	107	Control Rm.	IE	1	4	thr. bolt	Floor
Relay Cabinet RIL & PLP	108	Control Rm.	IE	1	4	thr. bolt	Floor
SD and RSC Relay Cabinets	109	Control Rm.	IE	1	4	thr. bolt	Floor
Operators Console	110	Control Rm.	Non IE	1	**	hilti	Floor
Air Conditioner	111	Relay Rm.	Non IE	1	**	hilti	Floor
Air Conditioner	112	Relay Rm.	Non IE	1	**	hilti	Floor
Inverter	113	Relay Rm.	IE	1	3	hilti	Floor
Battery Racks 1A, 1B	114	Battery Rms. A & B	IE				
Computer Batt. Rack	115	Battery Rm. A	Non IE				

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