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ENCLOSURE 2

APP-GW-GLR-045-NS, Revision 1

"Nuclear Island: Evaluation of Critical Sections"

Technical Report Number 57

Public Version

Redacted version of Enclosure I with sensitive unclassified non-safeguards information related to the physical protection of an AP1000 Nuclear Plant withheld from public disclosure pursuant to 10 CFR 2.390(d).

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Revision 1

October 2007

AP1000 Standard Combined License Technical Report

Nuclear Island: Evaluation of Critical Sections

Revision 1

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REVISION HISTORY

RECORD OF CHANGES

Revision	Author	Description	Completed
0	D. Tang, T. Iwasaki	Original Issue	March 2007
1	A. Scalzullo, M. Kawashima	Reconciled and updated critical sections design and analysis to conform to seismic analysis report APP-GW-S2R-010, Revision 1, "Extension of Nuclear Island Seismic Analysis to Soil Sites".	October 2007

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1.0 INTRODUCTION

The AP1000 design has been certified for application at a hard rock site. Seismic analyses of the AP1000 at soil sites are described in Reference 3. The design of Nuclear Island structures was reconciled, and if needed, updated to address the seismic analyses results of Reference 3.

This report contains the configuration of the containment interior structure (CIS) and auxiliary building (AB) 'Critical Sections' updated designs against the design loads generated from response spectra analyses. It summarizes the updated designs of the Nuclear Island 'Critical Sections', applicable to both hard rock and soil sites.

A brief description of the design of two critical sections, which are associated with the enhanced shield building design, is also included.

(Note: The designs of critical sections related to the Nuclear Island basemat were addressed in Topical Report APP-GW-GLR-044).

The purpose of this report is to close COL Information Item 3.7-4. The information in this report validates that the updated design of the subject structures is acceptable for the seismic spectra at COL application plant site.

2.0 TECHNICAL BACKGROUND

The nuclear island structures, consisting of the containment building, shield building, and auxiliary building, are founded on a common, cast-in-place, reinforced concrete basemat. Figure 2.2-1 shows a plan view of the AP1000 Nuclear Island and Figures 2.2-2 and 2.2-3 show cross section views at the containment center line.

The AP1000 plan view footprint is the same as for the AP600. The section views are also similar to the AP600. The height of the AP1000 containment vessel is increased by 25′-6″. The shield walls around the reactor coolant loop in the containment internal structures are a few feet higher.

2.1 Nuclear Island Containment Interior Structure (CIS):

The CIS are those concrete and steel structures inside the containment pressure boundary that support the reactor coolant system components and related piping systems and equipment. The CIS consist of the primary shield wall, reactor cavity, secondary shield walls, in-containment refueling water storage tank (IRWST), refueling cavity walls, operating floor, intermediate floors, and various platforms. However, CIS critical sections only includes; south west wall of the refueling cavity, south wall of west steam generator cavity, north east wall of IRWST, IRWST circular steel wall, and column supporting operating floor.

2.1.1 Description of CIS Critical Sections

The modeling and overall analyses procedure remains the same as specified in AP1000 Design Control Document (DCD) Section 3.8.3.4. For static loads of concrete filled steel modules, the analyses use the monolithic (uncracked) stiffness of each concrete element. For thermal and dynamic loads the analyses consider the extent of the concrete cracking. Stiffnesses are established based on analyses of the behavior and review of the test data related to concrete-filled structural modules. The stiffnesses directly affect the member forces resulting from restraint of thermal growth. The in-plane shear stiffness of the module influences the fundamental horizontal natural frequencies of the containment internal structures in the nuclear island seismic analyses. The out-of-plane flexural stiffness of the module influences the local wall frequencies in the seismic and hydrodynamic analyses of the IRWST. Member forces are evaluated against the strength of the section calculated as a reinforced concrete section with zero strength assigned to the concrete when it is in tension.

ACI-349 specifies an effective moment of inertia for calculating the deflection of reinforced concrete beams. For loads less than the cracking moment, the moment of inertia is the gross (uncracked) inertia of the section. The cracking moment is specified as the moment corresponding to a maximum flexural tensile stress of $7.5\sqrt{fc'}$. For large loads, the moment of inertia is that of the cracked section transformed to concrete. The effective moment of inertia provides a transition between these two dependent on the ratio of the cracking moment to the maximum moment in the beam at the stage the deflection is to be computed.

Structural wall modules without concrete fill, such as the west wall of the in-containment refueling water storage tank, are designed as steel structures, according to the requirements of AISC-N690. This code is applicable since the module is constructed entirely out of structural steel plates and shapes.

In local areas stresses due to restraint of thermal growth may exceed yield and the allowable stress intensity is $3S_{ml}$. This allowable is based on the allowable stress intensity for Service Level A loads given in ASME Code, Section III, Subsection NE, Paragraph NE-3221.4.

The concrete-filled steel module walls are designed for dead, live, thermal, pressure, safe shutdown earthquake, and loads due to postulated pipe breaks. The IRWST walls are also designed for the hydrostatic head due to the water in the tank and the hydrodynamic pressure effects of the water due to the safe shutdown earthquake, and automatic depressurization system pressure loads due to sparger operation. The walls of the refueling cavity are also designed for the hydrostatic head due to the safe shutdown earthquake.

Concrete-filled structural wall modules are designed as reinforced concrete structures in accordance with requirements of ACI-349. The steel plate modules are anchored to the reinforced concrete basemat by mechanical connections welded to the steel plate or by lap splices where the reinforcement overlaps shear studs on the steel plate.

2.1.2 Structural Wall Modules

- South west wall of the refueling cavity (4' 0" thick)
- South wall of west steam generator cavity (2' 6" thick)
- North east wall of in-containment refueling water storage tank (2' 6" thick)

The three walls extend from the floor of the in-containment refueling water storage tank (IRWST) at elevation 103' 0" to the operating floor at elevation 135' 3". The south west wall is also a boundary of the refueling cavity and has stainless steel plate on both faces. The other walls have stainless steel on one face and carbon steel on the other. Results are shown at the middle of the wall (mid span at mid height), at the base of the wall at its mid point (mid span at base) and at the base of the wall at the end experiencing greater demand (corner at base). The first part of each table shows the member forces due to individual loading. The governing load combinations are also shown. The steel plate thickness required to resist mechanical loads, maximum principal stress for the load combination are included.

The in-containment refueling water storage tank steel wall is the circular boundary of the IRWST. The steel wall extends from the floor of the IRWST at elevation 103' 0" to the operating floor at elevation 135' 3". The wall is a 5/8" thick stainless steel plate. It has internal vertical stainless steel T-section columns spaced 4'-8" apart and external hoop carbon steel (L-section) angles spaced 18" to 24" apart. The wall is fixed to the adjacent modules and floor except for the top columns which are free to slide radially and to rotate around the hoop direction. The wall is evaluated as vertical and horizontal beams. The vertical beams comprise the T-section columns plus the effective width of the plate. The horizontal beams comprise the L-section angles plus the effective width of the plate.

The use of the Nitronic steel has been replaced by Duplex 2101 (equivalent to ASTM/ASME A240/SA-240, UNS S32101). The stainless steel plates are used on modules in contact with water in the refueling canal and IRWST. Nitronic 33 was originally intended to meet this application, however, this material is not available in the required plate sizes (1/2" thick x 120" wide). Duplex 2101 is a lean duplex stainless steel designed for general-purpose use. Due to the unique composition of the Duplex 2101, this material provides high strength, excellent resistance to stress corrosion cracking, and economical alternative to 304 or 316L stainless steels. The Duplex 2101 has yield strength of 65 ksi. The corrosion resistance of Duplex 2101 is, in general terms, better than 304L stainless and in most cases comparable to 316L stainless steel.

2.2 Nuclear Island Auxiliary Building

The auxiliary building is a concrete shear-wall structure consisting of vertical shear/bearing walls and horizontal floor slabs. It wraps around approximately 50 percent of the circumference of the shield building. Walls are spaced 18 to 25 feet apart. The floor slabs and the structural walls of the auxiliary building are structurally connected to the cylindrical section of the shield building. The walls carry the vertical loads from the structure to the basemat. Lateral loads are transferred to the walls by the roof and floor slabs. The walls then transmit the loads to the basemat. The walls also provide stiffness to the basemat and distribute the foundation loads between them. This configuration of the structures above the basemat, in combination with the basemat, provides an efficient overall structure.

Adjoining buildings, such as the radwaste building, turbine building, and annex building are structurally separated from the nuclear island structures by a 2-inch gap at and below the grade. A 4-inch minimum gap is provided above grade. This provides space to prevent interaction between the nuclear island structures and the adjacent structures during a seismic event.

(Note: Plant north is defined toward the turbine building so that the wall on line number 11 (see Figure 2.2-1) is the north wall. The plant coordinate system is defined with X north, Y west, and Z vertical.)

2.2.1 Auxiliary Building Critical Sections

The Auxiliary Building critical sections are listed below and the corresponding location numbers are shown on Figure 2.2-4. The basis for their selection to this list is also provided in the following description for each structure.

1. South wall of auxiliary building (column line 1), elevation 66′-6″ to elevation 180′ 0″. (This exterior wall illustrates typical loads such as soil pressure, surcharge, temperature gradients, seismic, and tornado.) – see subsection 2.2.2.1.1 and Figures 2.2-5 and 2.2-6.

2. Interior wall of auxiliary building (column line 7.3), elevation 66′-6″ to elevation 160′ 6″. (This is one of the most highly stressed shear walls.) – see subsection 2.2.2.1.2 and Figures 2.2-5 and 2.2-7.

3. West wall of main control room in auxiliary building (column line L), elevation 117′ 6″ to elevation 153′-0″. (This illustrates design of a wall for sub-compartment pressurization.) – see subsection 2.2.2.1.3 and Figures 2.2-5 and 2.2-8.

4. North wall of MSIV east compartment (column line 11), elevation 117′ 6″ to elevation 153′ 0″. (The main steam line is anchored to this wall segment.) – see subsection 2.2.2.1.4 and Figures 2.2-9 and 2.2-16.

5. Shield building cylinder, elevation 160′ 6″ to elevation 200′ 0″. (This includes the connection of the roof slab at elevation 180′-0″ in (6) below.).

6. Roof slab at elevation 180′-0″ adjacent to shield building cylinder. (This is the connection between the two buildings at the highest elevation.) – see subsection 2.2.2.2.1.

7. Floor slab on metal decking at elevation 135′-3″. (This is a typical slab on metal decking and structural steel framing) – see subsection 2.2.2.2.2 and Figure 2.2-11.

8. 2′-0″ slab in auxiliary building (Operator Work Area (previously known as 'Tagging Room') ~~tagging room~~ ceiling) at elevation 135′-3″. (This illustrates the design of a typical 2′-0″ thick concrete slab) – see subsection 2.2.2.3.1 and Figure 2.2- 12.

9. Finned floor in the main control room at elevation 135′-3″. (This illustrates the design of the finned floors) – see subsection 2.2.2.4 and Figure 2.2-13.

10. Shield building roof/PCCS water storage tank. (This is a unique area of the roof and water tank.)

11. Shield building roof to cylinder location at columns. (This is the junction between the shield building roof and the cylindrical wall of the shield building.)

12. Divider wall between the spent fuel pool and the fuel transfer canal. (This wall is subjected to thermal and seismic sloshing loads) – see subsection 2.2.2.5.1 and Figures 2.2-14 and 2.2-15.

Withheld Under 10 CFR 2.390(d)

Figure 2.2-1: Nuclear Island Key Structural Dimensions

Plan at El. 66'-6"

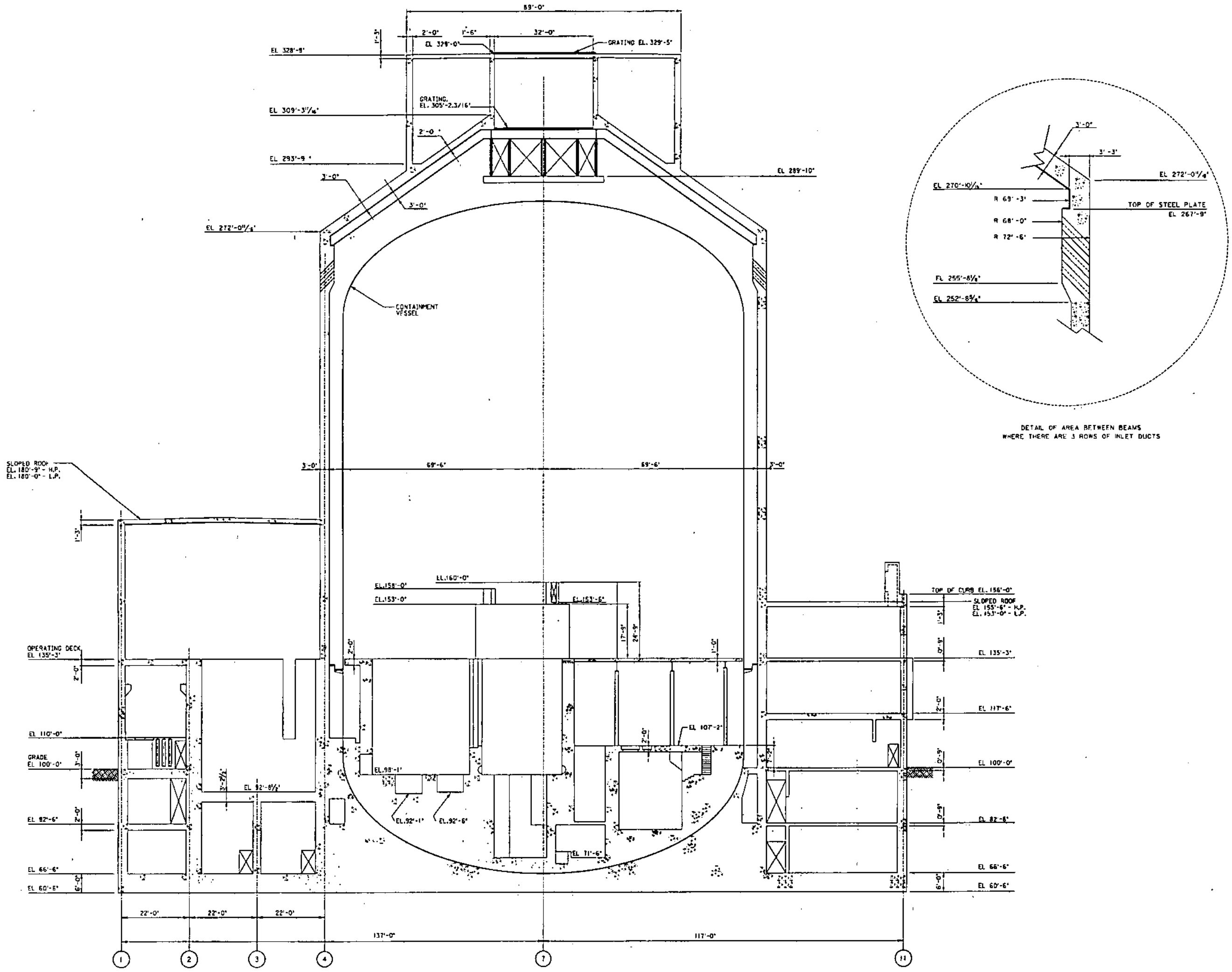


Figure 2.2-2: Nuclear Island Key Structural Dimensions

Section A-A

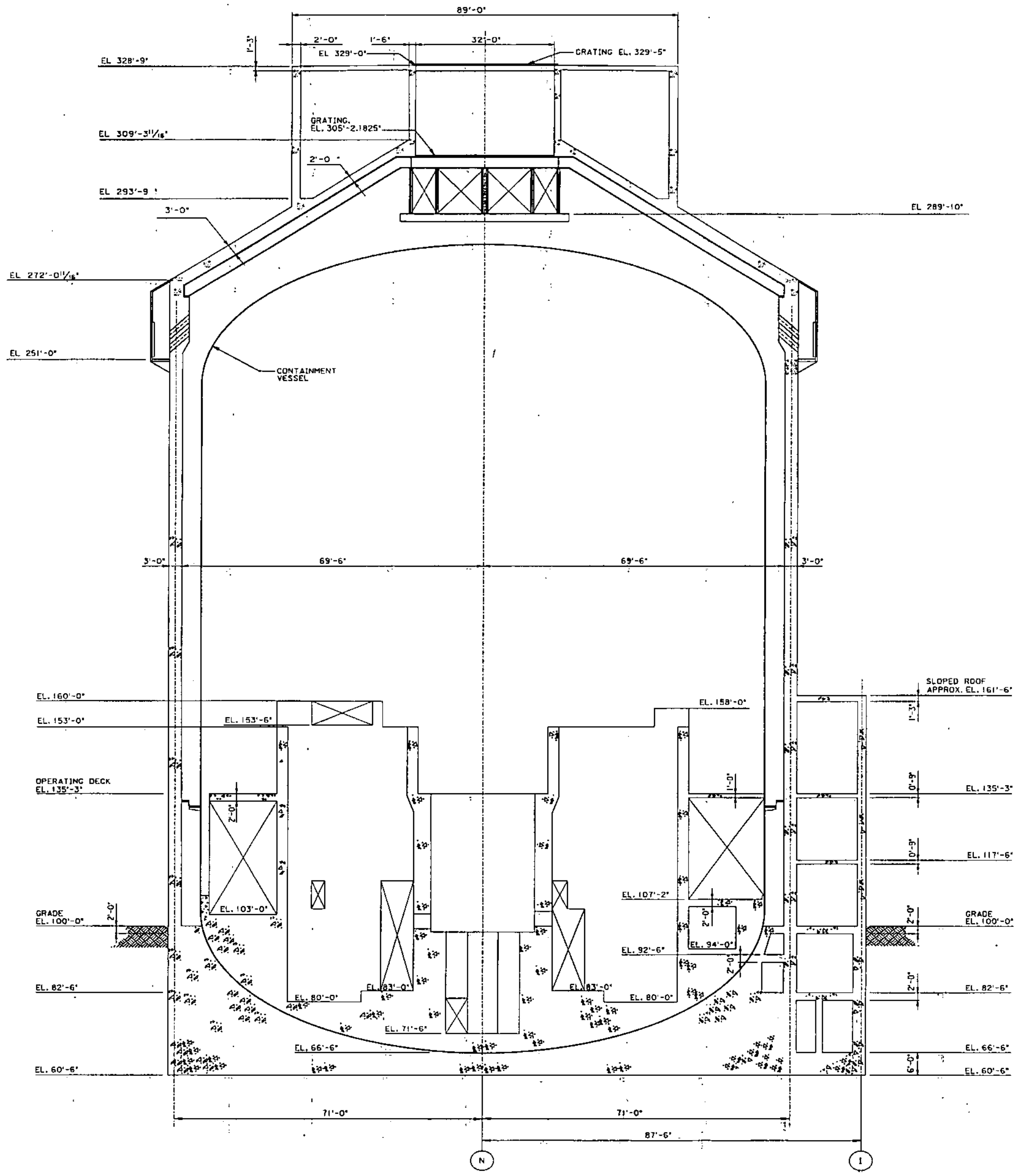


Figure 2.2-3: Nuclear Island Key Structural Dimensions Section B – B

Withheld Under 10 CFR 2.390(d)

Figure 2.2-4: Auxiliary Building Critical Sections Plan at EL 135'-3" (Sheet 1 of 3)

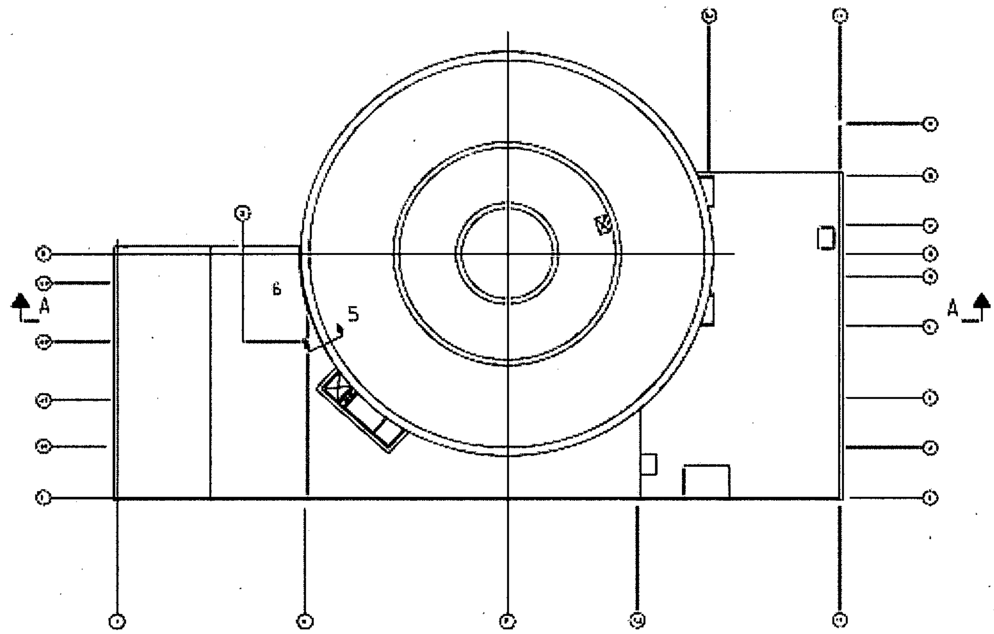


Figure 2.2-4: Auxiliary Building Critical Sections Plan at EL 135'-3" (Sheet 2 of 3)

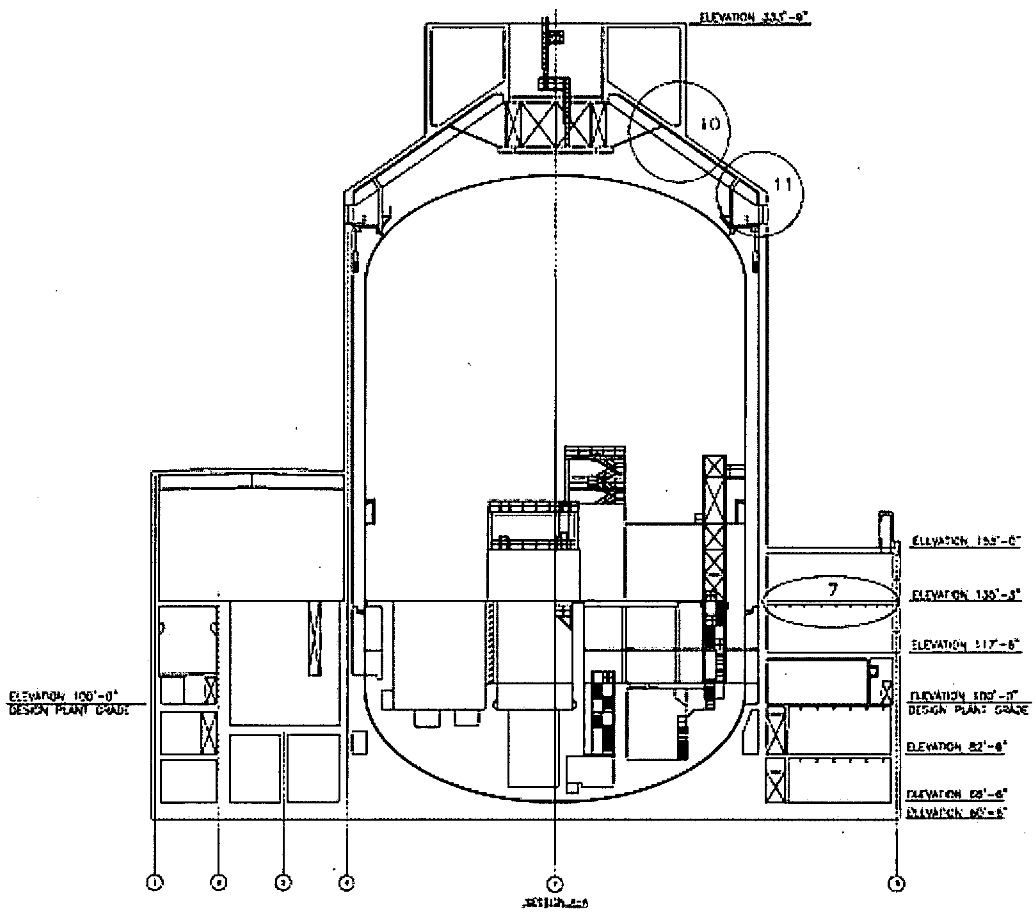


Figure 2.2-4: Auxiliary Building Critical Sections Plan at EL 135'-3" (Sheet 3 of 3)

2.2.2 Description of Critical Sections

2.2.2.1 Shear Walls

Shear walls in the auxiliary building vary in size, configuration, aspect ratio, and amount of reinforcement. The stress levels in shear walls depend on these parameters and the seismic acceleration level. The range of these parameters and the loads in various regions of the most severely stressed shear wall are described in the following paragraphs.

The height of the major structural shear walls in the auxiliary building ranges between 30 to 120 feet. The length ranges between 40 and 260 feet. The aspect ratio of these walls (full height/full length) is generally less than 1.0 and often less than 0.25. The walls are typically 2 to 5 feet thick, and are monolithically cast with the concrete floor slabs, which are 9 inches to 2 feet thick. Exterior shear walls are several stories high and do not have many large openings. Interior shear walls, however, are discontinuous in both vertical and horizontal directions. The in-plane behavior of these shear walls, including the large openings, is adequately represented in the analytical models for the global seismic response. Where the refinement of these finite element models is insufficient for design of the reinforcement, for example in walls with a large number of openings, detailed finite element models have been used for design of reinforcement.

The shear walls are used as the primary system for resisting the lateral loads, such as earthquakes. The auxiliary building shear walls are also evaluated for flexure and shear due to the out-of-plane loads.

Design Approach:

The auxiliary building shear walls are designed to withstand the loads and load combinations specified in the AP1000 Civil Structural Design Criteria. Besides dead, live, and other normal operating condition loads, the following loads are considered in the shear wall design:

- Seismic loads: The SSE loads for the wall are obtained from the seismic analyses of auxiliary/shield buildings.
- Calculations are performed by considering shear wall segments, bounded by the floors below and above the segment and the adjacent walls perpendicular to, on both sides of, the segment under consideration. Appropriate boundary conditions are assumed for the four edges of the segment. Natural frequency of wall segments are determined using finite element models or text book formulas for the frequency of plate structures. Corresponding spectral acceleration is determined from the applicable response spectrum.
- Exterior walls, below grade level, are also evaluated for dynamic earth pressure exerted during an SSE for two cases:

  - Dynamic earth pressure calculated in accordance with ASCE 4-98 (Reference 5)

  - Passive earth pressure

- Accident pressure load

  Shear walls of the main steam isolation valves (MSIV) rooms are designed for 6 pounds per square inch (psi) differential pressure acting in conjunction with the seismic loads. Member forces due to accident pressure and SSE are combined by absolute sum.

  The main control room wall of the east MSIV compartment is evaluated for the pressure and the jet load due to a postulated main steam line break.

- Tornado load

  For exterior walls above grade level, tornado loads are considered.

The wall sections are designed in accordance with the requirements of ACI 349- 01.

2.2.2.1.1 Exterior Wall at Column Line 1 (See Tables 2.2-1 and 2.2-2)

The wall at column line 1 is the exterior wall at the south end of the nuclear island. The reinforced concrete wall extends from the top of the basemat at elevation 66′-6″ to the roof at elevation 180′-0″. It is 3′-0″ thick below the grade and 2′-3″ thick above the grade.

The wall is designed for the applicable loads including dead load, live load, hydrostatic load, static and dynamic lateral soil pressure loads, seismic loads, and thermal loads.

2.2.2.1.2 Wall at Column Line 7.3 (See Tables 2.2-3 and 2.2-4)

The wall at column line 7.3 is a shear wall that connects the shield building and the nuclear island exterior wall at column line I. It extends from the top of the basemat at elevation 66′-6″ to the top of the roof. The wall is 3 feet thick below the grade at elevation 100′-0″ and 2 feet thick above the grade. Out-of-plane lateral support is provided to the wall by the floor slabs on either side of it and the roof at the top.

2.2.2.1.3 Wall at Column Line L (See Tables 2.2-5 and 2.2-6)

The wall at column line L is a shear wall on the west side of the Main Control Room. It extends from the top of the basemat at elevation 66′-6″ to the top of the roof. The wall is 2 feet thick. Out of-plane lateral support is provided to the wall by the floor slabs on either side of it and the roof at the top. The segment of the wall that is a part of the main control room boundary is from elevation 117′-6″ to elevation 135′-3″.

2.2.2.1.4 Wall at Column Line 11

The north wall of the MSIV west compartment, at column line 11 between elevation 117′-6″ and elevation 153′-0″, has been identified as a critical section.

The segment of the wall between elevation 117′-6″ and elevation 135′-3″ is 4 feet thick, and several pipes such as the main steam line, main feed water line, and the start-up feed water line are anchored to this wall at the interface with the turbine building.

The wall segment from elevation 135′-3″ to elevation 153′-0″ does not provide support to any high energy lines, and is 2 feet thick. This portion does not have to withstand reactions from high energy line breaks.

2.2.2.1.5 Shield Building Cylinder at Elevation 180′-0″

The shield building cylinder in the air inlet region is 4.5' thick, with high strength concrete contained within ½" steel liner plates on both faces. The liner plates, tied to concrete with shear connectors, behave as concrete reinforcement. Vertical angle stiffeners are provided to support the wet concrete load.

The design of cylindrical wall structure at Elevation 180'-0", below the air inlet region, is same as above except that the wall thickness is reduced to 3'-0.

Typical design details are shown in Figure 2.2-10.

2.2.2.2 Composite Structures (Floors and Roof)

These floors consist of a concrete slab on metal deck, which rests on structural steel floor beams. Several floors in the auxiliary building are designed as one-way reinforced concrete slabs supported continuously on steel beams. Typically, the beams span between two reinforced concrete walls. The beams are designed as composite with formed metal deck spanning perpendicular to the members. Unshored construction is used. For the floors, beams are typically spaced at about 6-feet intervals and spans are between 16 feet and 25 feet.

The metal deck rests on the top flange of the structural steel floor beam, with the longitudinal axes of the metal deck ribs and floor beams placed perpendicular to each other. The depth of the ribs for 9-inch concrete floor slabs and 15 inch deep concrete roof slabs are approximately 3 inches and 4.5 inches respectively. The concrete slab is tied to the structural steel floor beam by shear connectors, which are welded to the top flange of the floor beam. The concrete slab and the floor beams form a composite floor system. For the design loads after hardening of concrete, the transformed section is used to check the stresses.

Design Approach:

The floor design considers the dead, live, construction, extreme environmental, and other applicable loads. The design floor loading includes the equipment attached to the floor. The end condition for the steel beams is simply supported, or continuous. The seismic load is obtained using the applicable floor acceleration response spectrum (7 percent damping for the SSE loads). The load combinations applicable to the design of these floors are shown in DCD Appendix 3H.

The design of the floor system is performed in two parts:

- Design of structural steel beams
  The structural steel floor beams are evaluated to withstand the weight of wet concrete during the placement of concrete. The composite section is checked for the design loads during normal and extreme environment conditions. Shear connectors are also designed.

- Design of concrete slab
  The concrete slab and the steel reinforcement of the composite section are evaluated for normal and extreme environmental conditions. The slab concrete and the reinforcement is designed to meet the requirements of American Concrete Institute standard ACI 349 01 "Code Requirements for Nuclear Safety-Related Structures."

The slab design considers the in-plane and out-of-plane seismic forces. The global in-plane and out-of-plane forces are obtained from the equivalent static analysis of the 3D finite element model of the auxiliary and shield buildings. The out-of plane seismic forces due to floor self-excitation are determined by hand calculations using the applicable vertical seismic response spectrum and slab frequency.

2.2.2.2.1 Roof at Elevation 180′-0″, Area 6 (Critical Section is between Col. Lines N & K-2 and 3 & 4)

The concrete slab is 15 inches thick, plus the concrete in the metal deck ribs. It is composite with 5 feet deep plate girders, spaced 14′-2″ center to center, by using shear connectors. The girder flanges are 20″ x 2″ and the web is 56″ x 7/16″. The girders span approximately 64 feet in the north-south direction and are designed as simply supported. The concrete slab between the girders behaves as a one-way slab and is designed to span between the girders.

2.2.2.2.2 Floor at Elevation 135′-3″, Area 1 (Between Column Lines M and P)

The concrete slab is 9 inches thick, plus the concrete in the metal deck ribs. The floor beams are typically W14x26. (See Table 2.2-9)

2.2.2.3 Reinforced Concrete Slabs

Reinforced concrete floors in auxiliary building are 24 inch or 36 inch thick. These floors are constructed with 16″ or 28″ of reinforced concrete placed on the top of 8 inch thick precast concrete panels. The 8″ thick precast concrete panels are installed at the bottom to serve as the formwork and withstand the load of wet concrete slab. The main reinforcement is provided in the precast panels which are connected to the concrete placed above it by shear reinforcement. The precast panels and the cast-in-place concrete act together as a composite reinforced concrete slab. Examples of such floors are the Operator Work Area (previously known as 'Tagging Room') ~~Tagging Room~~ ceiling slab at elevation 135 ft 3 inches in Area 2, and the Area 5/6 elevation 100′-0″ slab between column lines 1 & 2.

2.2.2.3.1 Operator Work Area (previously known as 'Tagging Room') ~~Tagging Room~~ Ceiling

The Operator Work Area (previously known as 'Tagging Room') ~~Tagging Room~~ -size is 16′-0″ x 11′-10″. For the ceiling design, the boundary conditions are fixed at walls J and K. The maximum clear span is 16′-0″. The total slab thickness is 24 inches; the precast panels are 8" deep and the cast-in-place concrete is 16" deep.

The two precast concrete panels, each 5′-11″ wide and spanning over 16′-0″ clear span, are installed to serve as the formwork. (See Table 2.2-10)

2.2.2.4 Concrete Finned Floors (Control Room Ceiling)

The ceilings of the main control room and the instrumentation and control rooms in the auxiliary building are designed as finned-floor modules. A typical floor design is shown in Figure 2.2-13 (3 sheets). A finned floor consists of a 24 inch-thick concrete slab poured over a stiffened steel plate ceiling. The fins, welded to the underside of the steel plate stiffen, are half inch by 9 inch rectangular sections perpendicular to the plate. Shear studs are welded on the other side of the steel plate, and the steel and concrete act as a composite section. The fins are exposed to the environment of the room and enhance the heat-absorbing capacity of the ceiling. Several shop-fabricated steel panels, cut to room width and placed side by side perpendicular to the room length, are used to construct the stiffened plate ceiling in a modularized fashion. The stiffened plate with fins is designed to withstand construction loads prior to concrete hardening.

Design Methodology

The finned floors are designed as reinforced concrete slabs in accordance with ACI Standard 349. For positive bending, the steel plate is in tension. The steel plate with fin stiffeners serves the function of bottom rebars. For negative bending, the potential for buckling due to compression in this element is checked by using the criteria of American National Standards Institute/American Institute of Steel Construction standards ANSI/AISC N690-94. Twisting, and therefore lateral buckling of the stiffener, is restrained by the concrete.

The finned floors resist vertical and in-plane forces for both normal and extreme loading conditions. For positive bending, the concrete above the neutral axis carries compressive stresses and the stiffened steel plate resists tension. Negative bending compression is resisted by the stiffened plate and tension by top rebars in the concrete. The neutral axis for negative bending is located in the stiffened plate section, and the concrete in tension is assumed inactive. Horizontal in-plane forces are resisted by the stiffened plate and longitudinal rebars.

Minimum top reinforcement is provided in the slab in each direction for shrinkage and temperature crack control. In addition, top reinforcement located parallel to the stiffeners is used as tension reinforcement in negative bending. The stiffened plate provides crack control capability for the bottom of the slab in the transverse direction. (See Table 2.2-11)

Composite section properties, based on an all steel-transformed section, as detailed in Section Q1.11 of ANSI/AISC N690-94, are used to check the following:

- Weld strength between stiffener and the steel plate
- Spacing of the shear studs for the composite action

The stiffened plate alone is designed to resist all construction loads prior to the concrete hardening. The plate is checked against the criteria for bending and shear, specified in ANSI/AISC N690-94, Sections Q1.5.1.4 and Q1.5.1.2. In addition, the weld between the stiffener and the steel plate is checked to satisfy the code requirements.

2.2.2.5 Structural Modules

Structural modules are used for some of the structural elements on the south side of the auxiliary building. These structural modules are structural elements built up with welded steel structural shapes and plates. The modules consist of steel faceplates connected by steel trusses. The primary purpose of the trusses is to stiffen and hold together the faceplates during handling, erection, and concrete placement. The thickness of the steel faceplates is 0.5 inch except in a few local areas. The nominal spacing of the trusses is 30 inches. Shear studs are welded to the inside faces of the steel faceplates. Faceplates are welded to adjacent faceplates with full penetration welds so that the weld is at least as strong as the plate. The structural wall modules are anchored to the concrete base by reinforcing steel dowels or other types of connections embedded in the reinforced concrete below. After erection, concrete is placed between the faceplates.

These modules include the spent fuel pool, fuel transfer canal, and cask loading and cask washdown pits. The structural modules are similar to the structural modules for the containment internal. Figure 2.2-14 (5 sheets) shows the location of the structural modules in the auxiliary building. The structural modules extend from elevation 66′ 6″ to elevation 135′ 3″.

The design methodology of these modules in the auxiliary building is similar to the design of the structural modules in the containment internal structures.

2.2.2.5.1 West Wall of Spent Fuel Pool

The wall is a 4 feet thick concrete filled structural wall module.

Design Methodology:

A finite element analysis of the spent fuel building module is performed for seismic, thermal and hydrostatic loads with the following assumptions:

- The analysis model includes the structure between Lines 2 and 4, Lines I and N, and between El. 66′-6″ and 135′-3″, and is fixed at the base. There is no support at elevation 135′-3″.
- The seismic input consists of the equivalent static accelerations derived from the maximum acceleration results by the FE model time history analyses.
- The thermal loads are applied as linearly varying temperatures between the inner and outer faces of the walls and floors.
- The hydrostatic loads are applied to the spent fuel pool walls and floors, which is considered full with water. This provides the loads for the design of the divider wall.
- The seismic sloshing is modeled in the spent fuel pool.

The concrete filled structural wall modules are designed as reinforced concrete structures in accordance with the requirements of ACI-349. The face plates are treated as reinforcing steel.

Methods of analysis are based on accepted principles of structural mechanics and are consistent with the geometry and boundary conditions of the structures. Both computer codes and hand calculations are used.

2.2.2.6 Shield Building Roof

(Note: The detailed design of the critical sections associated with the Shield Building roof will be provided in a separate Technical Report APP-GW-GLR-144).

2.2.2.6.1 Tension Ring

(See 2.2.2.6; the design will be provided in Technical Report APP-GW-GLR-144)

2.2.2.6.2 Columns between Air Inlets

(See 2.2.2.6; the design will be provided in Technical Report APP-GW-GLR-144)

2.2.2.6.3 Exterior Wall of the Passive Containment Cooling System Tank

(See 2.2.2.6; the design will be provided in Technical Report APP-GW-GLR-144)

2.2.3 AP1000 Certified Design for Hard Rock Sites

The analyses and design of the Auxiliary Building 'Critical Section' structures for hard rock sites is described in Appendix 3H of the AP1000 DCD (Reference 1). The appendix summarizes the structural design and analysis of critical sections; and the design summaries include the following information:

- Description of critical sections
- Governing codes and regulations
- Structural loads and load combinations
- Global analyses
- Structural design of critical structural elements

2.2.4 Design of Critical Sections for Hard Rock and Soil Sites

As stated above, the AP1000 DCD (Reference 1) Appendix 3H Subsections 3H.2 through 3H.4 include a general description of the auxiliary building critical sections and a summary of the design criteria. Representative design details for these structures were included in subsection 3H.5. The description of these items remains unchanged for the soil sites. (Note: A summary of the critical sections description is included in sub-section 2.2.2 of this report for convenience of the readers of this report). The global analyses discussed in Subsections 3H.3 also is substantially the same, except that for the soil sites a more detailed finite element analysis model was used (see Figure 2.2-17). Examples of the structural design were reviewed for the same twelve critical sections (identified in subsection 3H.5 and shown in Figures 3H.5-1 of DCD Appendix 3H).

2.2.4.1 Reconciliation for Seismic Loads

The nuclear island dynamic model (combined stick model for hard rock and fixed base) was changed to address the parameters for the soil sites. This changed the seismic design response of the nuclear island. The revised seismic response was documented in Reference 3.

The design of critical sections was re-evaluated against seismic loads generated from response spectra analyses. The design was reviewed for the worst combination of seismic loads and soil properties. The analyses used the detailed model of the nuclear island (NI05).

The review performed has verified that the design of the critical sections, due to the revised seismic response spectra given in Reference 3, do not change significantly.

2.2.4.2 Critical Sections reinforcement design

The Nuclear Island reinforced concrete critical sections are designed in accordance with the American Concrete Institute (ACI) standard ACI 349-01, 'Code Requirements for Nuclear Safety Related Concrete Structures' (Reference 4). The reinforcement for critical section structures is reconfigured to improve constructability. It is checked for the design for soil sites to assure that the structures can resist the demand calculated by the equivalent static acceleration for uniform soil springs. The changes are shown in Tables and Figures at the end of this report.

The reinforcement required is calculated for the member forces for each of the load combinations described in DCD Appendix 3H. The tables and the figures also show the reinforcement provided for each critical section.

TABLE 2.2-1: EXTERIOR WALL AT COLUMN LINE 1 FORCES AND MOMENTS IN CRITICAL LOCATIONS (UNITS: KIPS, FT)						
Load Combination	M_X	M_Y	M_{XY}	T_X	T_Y	T_{XY}
Elevation 180′-0″ to 135′-3″						
D + L + H + Ta		177.8	3.1		115.5	8.8
1.05 D + 1.3 L + 1.3 H + 1.2 To	106.4		5.6	117.0		23.9
Elevation 135′-3″ to 100′-0″						
D + L + H + Ta		50.8	0.3		89.8	104.8
D + L + H + Ta	82.9		7.6	172.9		24.8
D + L + H + Ta	60.0		3.6	165.7		106.0
Elevation 100′-0″ to 82′-6″						
1.05 D + 1.3 L + 1.3 H + 1.2 To		48.1	8.4		106.1	17.3
D + L+ Es	1.8		5.4	15.6		58.6
Elevation 82′-6″ to 66′-6″						
D + L – Es		93.8	26.5		170.7	31.5
0.9 D + Es		32.7	27.2		182.1	42.4
0.9 D + Es	15.5		27.2	18.6		42.4

Note:
X is along the horizontal direction, and Y is in the vertical direction.

TABLE 2.2-2: EXTERIOR WALL AT COLUMN LINE 1 DETAILS OF WALL REINFORCEMENT (IN^2/FT)
(SEE FIGURE 2.2-5 FOR LOCATIONS OF WALL SECTIONS)

Wall Segment	Location	Required			Provided		
		Vertical	Horizontal	Shear	Vertical	Horizontal	Shear
WALL SECTION 1, 6							
Elevation 180′-0″ to 135′-3″				NR			None
	Outside Face	3.48	2.65		3.91	3.12	
	Inside Face	1.94	1.52		3.12	3.12	
WALL SECTION 2,3,7							
Elevation 135′-3″ to 100′-0″				NR			None
	Outside Face	1.88	3.04		3.12	3.12	
	Inside Face	1.77	2.23		3.12	3.12	
WALL SECTION 4,8							
Elevation 100′-0″ to 82′-6″				0.003			0.44
	Outside Face	1.42	0.70		3.12	1.56	
	Inside Face	1.01	0.70		3.12	1.27	
WALL SECTION 5,9							
Elevation 82′-6″ to 66′-6″				0.27			1.00
	Outside Face	2.29	0.87		4.39	1.27	
	Inside Face	1.87	0.87		3.12	1.27	
Note: NR – Not Required							

TABLE 2.2-3: INTERIOR WALL AT COLUMN LINE 7.3 FORCES AND MOMENTS IN CRITICAL LOCATIONS (UNITS: KIPS, FT)

Load Combination	M_X	M_Y	M_{XY}	T_X	T_Y	T_{XY}
From Roof to Elevation 155′-6″						
1.05 D + 1.3 L + 1.2 To		135.3	10.9		117.3	210.2
1.05 D + 1.3 L + 1.2 To	75.5		4.1	229.8		94.3
Elevation 155′-6″ to 135′-3″						
0.9 D – Es		14.1	1.3		160.8	228.7
D + L – Es	28.0		1.0	29.8		231.7
Elevation 135′-3″ to 117′-6″						
0.9 D – Es		3.3	1.3		142.2	140.9
D + L – Es	10.0		1.0	41.7		175.0
Elevation 117′-6″ to 100′-0″						
0.9 D – Es		4.7	2.8		143.9	184.9
D + L + Es	6.4		1.5	172.8		107.9
Elevation 100′-0″ to 82′-6″						
0.9 D – Es		15.4	2.6		90.4	169.8
D + L – Es	8.7		2.6	46.6		175.6
Elevation 82′-6″ to 66′-6″						
0.9 D – Es		23.5	1.3		80.9	49.3
D + L – Es	0.8		1.3	1.7		74.1

Note:
X is along the horizontal direction, and Y is in the vertical direction.

TABLE 2.2-4: INTERIOR WALL AT COLUMN LINE 7.3 DETAILS OF WALL REINFORCEMENT (SEE FIGURE 2.2-5 FOR LOCATIONS OF WALL SECTIONS)				
			Reinforcement on Each Face (in^2/ft)	
Wall Segment	**Location**	**Wall Section**	**Required**	**Provided**
From Roof to Elevation 155′-6″	Horizontal	1	3.96	4.12
	Vertical	7	3.60	3.72
Elevation 155′-6″ to 135′-3″	Horizontal	2	2.80	3.12
	Vertical	8	3.59	3.72
Elevation 135′-3″ to 117′-6″	Horizontal	3	2.03	2.54
	Vertical	9	2.63	3.12
Elevation 117′-6″ to 100′-0″	Horizontal	4	2.29	2.54
	Vertical	10	2.98	3.12
Elevation 100′-0″ to 82′-6″	Horizontal	5	1.69	2.54
	Vertical	11	2.08	3.12
Elevation 82′-6″ to 66′-6″	Horizontal	6	0.85	1.27
	Vertical	12	0.98	1.56
From Roof to Elevation 155′-6″	Standard hook or T headed bar	7	0.38	0.44

TABLE 2.2-5: INTERIOR WALL AT COLUMN LINE L FORCES AND MOMENTS IN CRITICAL LOCATIONS (UNITS: KIPS, FT)						
Load Combination	M_X	M_Y	M_{XY}	T_X	T_Y	T_{XY}
Elevation 154′-2″ to 135′-3″						
0.9 D + Es+ Pa + Yj		6.0	3.5		115.4	170.2
0.9 D + Es+ Pa + Yj	14.3		3.5	46.0		170.2
Elevation 135′-3″ to 117′-6″						
0.9 D + Es+ Pa + Yj		145.3	12.2		26.0	38.2
0.9 D + Es+ Pa + Yj	24.5		7.1	15.5		114.9
Note: X is along the horizontal direction, and Y is in the vertical direction.						

TABLE 2.2-6: INTERIOR WALL AT COLUMN LINE L DETAILS OF WALL REINFORCEMENT (SEE FIGURE 2.2-5 FOR LOCATIONS OF WALL SECTIONS)				
			Reinforcement on Each Face (in^2/ft)	
Wall Segment	**Location**	**Wall Section**	**Required**	**Provided**
Elevation 154′-2″ to 135′-3″	Horizontal	1	2.08	2.27
	Vertical	3	2.59	3.12
Elevation 135′-3″ to 117′-6″	Horizontal	2	1.36	4.39
	Vertical	4	2.02	5.66
Shear Reinforcement:				
Elevation 154′-2″ to 135′-3″	Standard hook or T headed bar	5	0.01	0.11
Elevation 135′-3″ to 117′-6″	Standard hook or T headed bar	6	0.33	2.00

TABLE 2.2-7: REINFORCEMENT MARGIN AT CRITICAL SECTIONS OF SB CYLINDER – CIRCUMFERENTIAL (SHEET 1 OF 2)

Elevation (ft)	Range (Clockwise)	Provided on Each Face (in²/ft)		Required (in²/ft)
180'-0"	0° to 360°	0.5" Steel Plate	6.00	3.78
100-0" to 145'-0"	0° to 56.1° and 337.3° to 360°	#11@6"	3.12	General area less than 3.12
100-0" to 154'-6"	56.1° to 180°	#11@6"	3.12	General area less than 3.12

TABLE 2.2-7: REINFORCEMENT MARGIN AT CRITICAL SECTIONS OF SB CYLINDER– VERTICAL (SHEET 2 OF 2)

Elevation (ft)	Range (Clockwise)	Provided on Each Face (in²/ft)		Required (in²/ft)
180'-0"	0° to 360°	0.5" Steel Plate	6.00	4.94
135-3" to 145'-0"	0° to 56.1° and 337.3° to 360 °	#11@0.375°	3.36	General area less than 3.36
135-3" to 154'-6"	56.1° to 180°	#11@0.375°	3.36	General area less than 3.36
100-0" to 135-3"	0° to 180° and 337.3° to 360°	#11@0.375° + #9@0.75°	4.43	General area less than 4.43
117-6" to 135-3"	35.9° to 50.9°	#11@0.375° + #9@0.75°	4.43	General area less than 4.43
100-0" to 135-3"	113.6° to 140°	#11@0.375° + #9@0.75°	4.43	General area less than 4.43
100-0" to 145-9"	110 ° to 120°	#11@0.375° + #11@0.75°	5.04	General area less than 5.04

TABLE 2.2-8: DESIGN SUMMARY OF ROOF AT ELEVATION 180′-0″, AREA 6 (NEAR SHIELD BUILDING INTERFACE)	
Governing Load Combination (Roof Girder)	
Combination Number	3 – Extreme Environmental Condition Downward Seismic Acceleration
Bending Moment	= 7125 kips-ft
Corresponding Stress	= 24.1 ksi
Allowable Stress	= 38.0 ksi
Shear Force	= 447 kips
Corresponding Stress	= 17.0 ksi
Allowable Stress	= 20.1 ksi
Governing Load Combination (Concrete Slab)	
Parallel to the Girders	
Combination Numbers	3 – Extreme Environmental Condition
Reinforcement (Each Face)	
Required	= 1.74 in²/ft
Provided	= 2.54 in²/ft
Perpendicular to the Girders	
Combination Numbers	3 – Extreme Environmental Condition
Reinforcement (Each Face)	
Required	= 1.68 in²/ft
Provided	= 3.12 in²/ft

TABLE 2.2-9: DESIGN SUMMARY OF FLOOR AT ELEVATION 135′-3″, AREA 1 (BETWEEN COLUMN LINES M AND P)

Governing Load Combination (Steel Beam)	
Load Combination	3 – Extreme Environmental Condition Downward Seismic
Bending Moment	= (-) 63.9 kips-ft
Corresponding Stress	= 17.0 ksi
Allowable Stress	= 33.26 ksi
Shear Force	= 30.7 kips
Corresponding Stress	= 8.7 ksi
Allowable Stress	= 20.1 ksi
Governing Load Combination (Concrete Slab)	
Parallel to the Beams	
Load Combination	3 – Extreme Environmental Condition Downward Seismic
Bending Moment	= (-) 16.0 kips-ft/ft
In-plane Shear	= 20.0 kips (per foot width of the slab)
Reinforcement (Each Face)	
Required	= 0.41 in^2/ft
Provided	= 0.44 in^2/ft
Perpendicular to the Beams	
Combination Number	Normal Condition
Bending Moment	= (+) 6.66 kips-ft (per foot width of the slab)
Reinforcement (Each Face)	
Required	= 0.28 in^2/ft
Provided	= 0.60 in^2/ft

TABLE 2.2-10: DESIGN SUMMARY OF FLOOR AT ELEVATION 135′-3″ (OPERATOR WORK AREA (PREVIOUSLY KNOWN AS 'TAGGING ROOM') ~~TAGGING ROOM~~ -CEILING)	
Design of Precast Concrete Panels	
Governing Load Combination	Construction
Design Bending Moment (Midspan)	= 14.53 kip-ft/ft
Bottom Reinforcement (E/W Direction)	
Required	= 0.58 in^2/ft
Provided	= 0.79 in^2/ft
Top Reinforcement (E/W Direction)	
Required	= (Minimum required by Code)
Provided	= 0.20 in^2/ft
Top and Bottom Reinforcement (N/S Direction)	
Required	= (Minimum required by Code)
Provided	= 0.20 in^2/ft
Design of 24-inch-Thick Slab	
Governing Load Combination	Extreme Environmental Condition (SSE)
Design Bending Moment (E/W Direction) Midspan	= 14.40 kips ft/ft
Design In-plane Shear	= 31.9 kips/ft
Design In-plane Tension	= 21.9 kips/ft
Bottom Reinforcement (E/W Direction)	
Required	= 0.53 in^2/ft
Provided	= 0.79 in^2/ft
Design Bending Moment (E/W Direction) at Support	= 28.81 kips-ft/ft
Design In-plane Shear	= 31.9 kips/ft
Design In-plane Tension	= 21.9 kips/ft
Top Reinforcement (E/W Direction)	
Required	= 0.93 in^2/ft
Provided	= 1.00 in^2/ft
Design Bending Moment (N/S Direction)	= 8.47 kips ft/ft
Design In-plane Shear	= 31.9 kips/ft
Design In-plane Tension	= 27.2 kips/ft
Top and Bottom Reinforcement (N/S Direction)	
Required	= 0.59 in^2/ft
Provided	= 0.79 in^2/ft

TABLE 2.2-11: DESIGN SUMMARY OF FLOOR AT ELEVATION 135′-3″, AREA 1 (MAIN CONTROL ROOM CEILING)
The design of the bottom plate with fins is governed by the construction load.
For the composite floor, the design forces used for the evaluation of a typical 9-inch-wide strip of the slab are as follows: Maximum bending moment = +35.0 (-24.4) kips-ft Maximum shear force = 22.3 kips
The design evaluation results are summarized below: • The actual area of the tension steel is 9.0 in^2, which provides a design strength of 518.5 kips-ft bending moment capacity. • The design shear strength is 23.22 kips. • The shear studs are spaced 9 inches c/c, in both directions. The calculated required spacing is 9.06 inches.

TABLE 2.2-12: DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA
ELEMENT NO. 20477 (SHEET 1 OF 3)

Load/Comb.	S_{xx} kip/ft	S_{yy} kip/ft	S_{xy} kip/ft	M_{xx} k-ft/ft	M_{yy} k-ft/ft	N_x kip/ft	N_y kip/ft	Comments
Dead (D)	-16.15	-22.92	-28.34	-1.34	-1.06	-0.32	-0.32	
Live (L)	1.46	0.32	-1.57	-0.06	-0.21	0.04	0.03	
Hydro (F)	37.52	12.36	-4.32	-100.50	-14.49	62.14	-9.95	
Seismic (Es)	46.21	56.51	183.20	81.72	28.70	103.00	14.79	
Thermal (To)	-561.80	-267.70	-51.15	-426.90	-145.50	90.32	-23.66	
Thermal (Ta)	-955.80	-444.60	-139.70	-1401.0	-450.00	227.50	-83.16	
LC(1a)	32.40	-14.25	-48.39	-142.68	-22.12	86.61	-14.33	1. 4D+1. 7L+1. 4F
LC(3a)	84.05	51.21	147.24	-60.38	7.15	189.71	0.56	D+L+F+Es
LC(3b)	84.05	51.21	-219.16	-223.82	-50.25	-16.29	-29.02	D+L+F-Es
LC(3e)	-267.08	-116.11	115.28	-327.19	-83.79	246.16	-14.22	D+L+F+Es+To
LC(3f)	-267.08	-116.11	-251.12	-490.63	-141.19	40.16	-43.80	D+L+F-Es+To
LC(3m)	84.20	53.18	151.64	-60.18	7.46	189.71	0.57	0. 9D+F+Es
LC(3n)	84.20	53.18	-214.76	-223.62	-49.94	-16.29	-29.01	0. 9D+F-Es
LC(3o)	-266.92	-114.13	119.68	-326.99	-83.47	246.16	-14.22	0. 9D+F+Es+To
LC(3p)	-266.92	-114.13	-246.72	-490.43	-140.87	40.16	-43.80	0. 9D+F-Es+To
LC(5a)	-574.55	-288.12	-121.54	-977.52	-297.00	204.04	-62.22	D+L+F+Ta
LC(7a)	-397.01	-211.45	-74.69	-427.19	-125.72	132.70	-28.49	1.05D+1.3L+1.05F+1.2To

Notes:

x- direction is horizontal; y- direction is vertical.
See Figure 2.2-15 for element location.

Plate thickness required for load combinations excluding thermal:	0.49 inches
Plate thickness provided:	0.50 inches
Maximum principal stress for load combination 5a including thermal:	46.33 ksi
Yield stress:	65.0 ksi
Maximum stress intensity range for load combination 5a including thermal:	N/A
Allowable stress intensity :	130.0 ksi

TABLE 2.2-12: DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA ELEMENT NO. 10529 (SHEET 2 OF 3)

Load/Comb.	S_{xx} kip/ft	S_{yy} kip/ft	S_{xy} kip/ft	M_{xx} k-ft/ft	M_{yy} k-ft/ft	N_x kip/ft	N_y kip/ft	Comments
Dead (D)	-24.40	-96.30	-20.71	-1.16	-2.27	-0.28	-0.34	
Live (L)	-0.44	-2.48	-0.55	-0.01	-0.24	0.01	0.08	
Hydro (F)	9.86	-5.49	6.22	8.37	-73.49	16.94	16.02	
Seismic (Es)	110.80	335.20	95.73	19.03	93.81	22.15	29.34	
Thermal (To)	-215.70	-479.30	-150.10	-99.69	-357.90	16.39	19.34	
Thermal (Ta)	-389.40	-883.60	-273.20	-364.10	-982.20	40.42	17.26	
LC(1a)	-21.10	-146.72	-21.23	10.09	-106.48	23.34	22.09	1. 4D+1. 7L+1. 4F
LC(3a)	99.77	228.74	83.17	29.58	-11.59	45.60	51.51	D+L+F+Es
LC(3b)	99.77	228.74	-108.29	-8.48	-199.21	1.30	-7.17	D+L+F−Es
LC(3e)	-35.05	-70.83	-10.64	-32.72	-235.28	55.84	63.60	D+L+F+Es+To
LC(3f)	-35.05	-70.83	-202.10	-70.78	-422.90	11.54	4.92	D+L+F−Es+To
LC(3m)	102.64	240.85	85.80	29.71	-11.12	45.61	51.47	0. 9D+F+Es
LC(3n)	102.64	240.85	-105.66	-8.35	-198.74	1.31	-7.21	0. 9D+F−Es
LC(3o)	-32.17	-58.72	-8.02	-32.60	-234.81	55.86	63.55	0. 9D+F+Es+To
LC(3p)	-32.17	-58.72	-199.48	-70.66	-422.43	11.56	4.87	0. 9D+F−Es+To
LC(5a)	-258.35	-656.52	-185.79	-220.36	-689.88	41.93	26.55	D+L+F+Ta
LC(7a)	-177.61	-469.58	-128.51	-67.20	-348.29	29.80	31.07	1.05D+1.3L+1.05F+1.2To

Notes:

x- direction is horizontal; y- direction is vertical.

See Figure 2.2-15 for element location.

Plate thickness required for load combinations excluding thermal:	0.47 inches
Plate thickness provided:	0.50 inches
Maximum principal stress for load combination 5a including thermal:	33.52 ksi
Yield stress:	65.0 ksi
Maximum stress intensity range for load combination 5a including thermal:	N/A
Allowable stress intensity :	130.0 ksi

TABLE 2.2-12: DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA ELEMENT NO. 10544 (SHEET 3 OF 3)

Load/Comb.	S_{xx} kip/ft	S_{yy} kip/ft	S_{xy} kip/ft	M_{xx} k-ft/ft	M_{yy} k-ft/ft	N_x kip/ft	N_y kip/ft	Comments
Dead (D)	-20.03	-75.69	-42.72	3.53	-2.18	-0.01	-1.93	
Live (L)	-0.64	-1.98	-1.22	0.36	-0.06	0.02	-0.07	
Hydro (F)	-4.13	-2.97	-4.10	39.78	3.54	0.99	-4.80	
Seismic (Es)	67.42	185.70	113.20	48.28	7.62	5.78	5.32	
Thermal (To)	-121.60	-387.30	-239.80	75.83	-107.40	39.64	49.91	
Thermal (Ta)	-215.20	-670.10	-416.60	184.20	-269.30	115.50	136.20	
LC(1a)	-34.91	-113.49	-67.62	61.25	1.81	1.40	-9.54	1. 4D+1. 7L+1. 4F
LC(3a)	40.97	103.87	63.52	107.86	10.34	7.18	-3.41	D+L+F+Es
LC(3b)	40.97	103.87	-162.88	11.30	-4.90	-4.39	-14.04	D+L+F−Es
LC(3e)	-35.03	-138.19	-86.36	155.26	-56.79	31.95	27.79	D+L+F+Es+To
LC(3f)	-35.03	-138.19	-312.76	58.70	-72.02	20.39	17.15	D+L+F−Es+To
LC(3m)	43.61	113.42	69.01	107.15	10.61	7.16	-3.14	0. 9D+F+Es
LC(3n)	43.61	113.42	-157.39	10.59	-4.62	-4.41	-13.78	0. 9D+F−Es
LC(3o)	-32.39	-128.64	-80.87	154.54	-56.51	31.93	28.05	0. 9D+F+Es+To
LC(3p)	-32.39	-128.64	-307.27	57.98	-71.75	20.37	17.41	0. 9D+F−Es+To
LC(5a)	-159.30	-499.45	-308.41	158.79	-167.01	73.19	78.32	D+L+F+Ta
LC(7a)	-117.40	-375.64	-230.60	102.82	-79.20	30.78	30.27	1.05D+1.3L+1.05F+1.2To

Notes:
x- direction is horizontal; y- direction is vertical.
See Figure 2.2-15 for element location.

Plate thickness required for load combinations excluding thermal:	0.31 inches
Plate thickness provided:	0.50 inches
Maximum principal stress for load combination 5a including thermal:	46.95 ksi
Yield stress:	65.0 ksi
Maximum stress intensity range for load combination 5a including thermal:	N/A
Allowable stress intensity :	130.0 ksi

TABLE 2.2-13 — SHIELD BUILDING ROOF REINFORCEMENT SUMMARY (TENSION RING) (LATER)				

(Table 2.2-13 deleted)

**TABLE 2.2-14: EXTERIOR WALL AT COLUMN LINE 11
FORCES AND MOMENTS IN CRITICAL LOCATIONS; (UNITS: KIPS, FT)
(SEE FIGURE 2.2-16 FOR ELEMENT LOCATIONS)**

Element No.	Load Combination	T_X	T_Y	T_{XY}	M_X	M_Y	M_{XY}	N_X	N_Y
MS Penetration Area (Radial)									
6964	LC77	60.7	60.6	113.6	51.4	280.8	330.3	64.7	287.3
6928	LC49	61.5	61.1	131.2	33.0	394.7	48.2	44.8	4.9
7713	LC49	67.3	64.3	114.8	31.3	330.6	44.5	4.8	15.0
MS Penetration Area (Circumferential)									
7119	LC73	60.1	77.6	114.5	33.7	919.4	27.4	343.4	77.1
7869	LC81	60.0	66.4	114.0	56.4	736.2	47.5	173.2	30.3
7871	LC81	60.0	66.7	113.3	39.5	607.8	47.0	83.7	20.1
7873	LC81	60.1	68.1	112.7	24.3	554.6	43.3	28.6	22.7
Other than MS Penetration Area (Horizontal)									
7817	LC97	73.4	51.8	160.6	210.0	8.4	129.4	25.9	17.7
Other than MS Penetration Area (Vertical)									
7807	LC73	141.9	104.0	144.0	89.2	162.0	134.3	42.1	39.3
For out-of-plane Force									
6973	LC99	-53.4	-60.0	95.5	40.3	438.4	244.8	79.0	324.1
7797	LC103	-45.4	-86.2	99.0	36.6	211.0	68.7	89.4	305.0

TABLE 2.2-15: EXTERIOR WALL AT COLUMN LINE 11 DETAILS OF WALL REINFORCEMENT (SEE FIGURE 2.2-16 FOR ELEMENT LOCATIONS)				
Wall Segment	**Location**	**Element No. or Zone No.**	**Reinforcement on Each Face**	
			Required	**Provided**
MS Penetration Area (Inside of a 94" radius)	Radial (R=56")	6964	3.00in²/11.25°	2#11@11.25° 3.12in²/11.25°
	Radial (R=62")	6928	3.26in²/11.25°	2#11+#5@11.25° 3.43in²/11.25°
	Radial (R=94")	7713	4.70in²/11.25°	2#11+2#9@11.25° 5.12in²/11.25°
	Circumferential(1)	Zone-3	23.48 in²	11#14 24.75 in²
Other than MS Penetration Area (Outside of a 94" radius)	Horizontal	7817	3.11 in²/ft	3.12 in²/ft
	Vertical	7807	3.10 in²/ft	3.12 in²/ft
Shear Reinforcement:				
MS Penetration Area (Inside of a 76" radius)	Standard hook or T headed bar	6973	1.95 in²/ft²	#8@6"x@5.625 ° 2.54 in²/ft²
Other than MS Penetration Area (Outside of a 76" radius)	Standard hook or T headed bar	7797	1.61 in²/ft²	#9@6"x@12" 2.00 in²/ft²

Note:
1. Total rebars from concrete edge of MS opening to R=94"

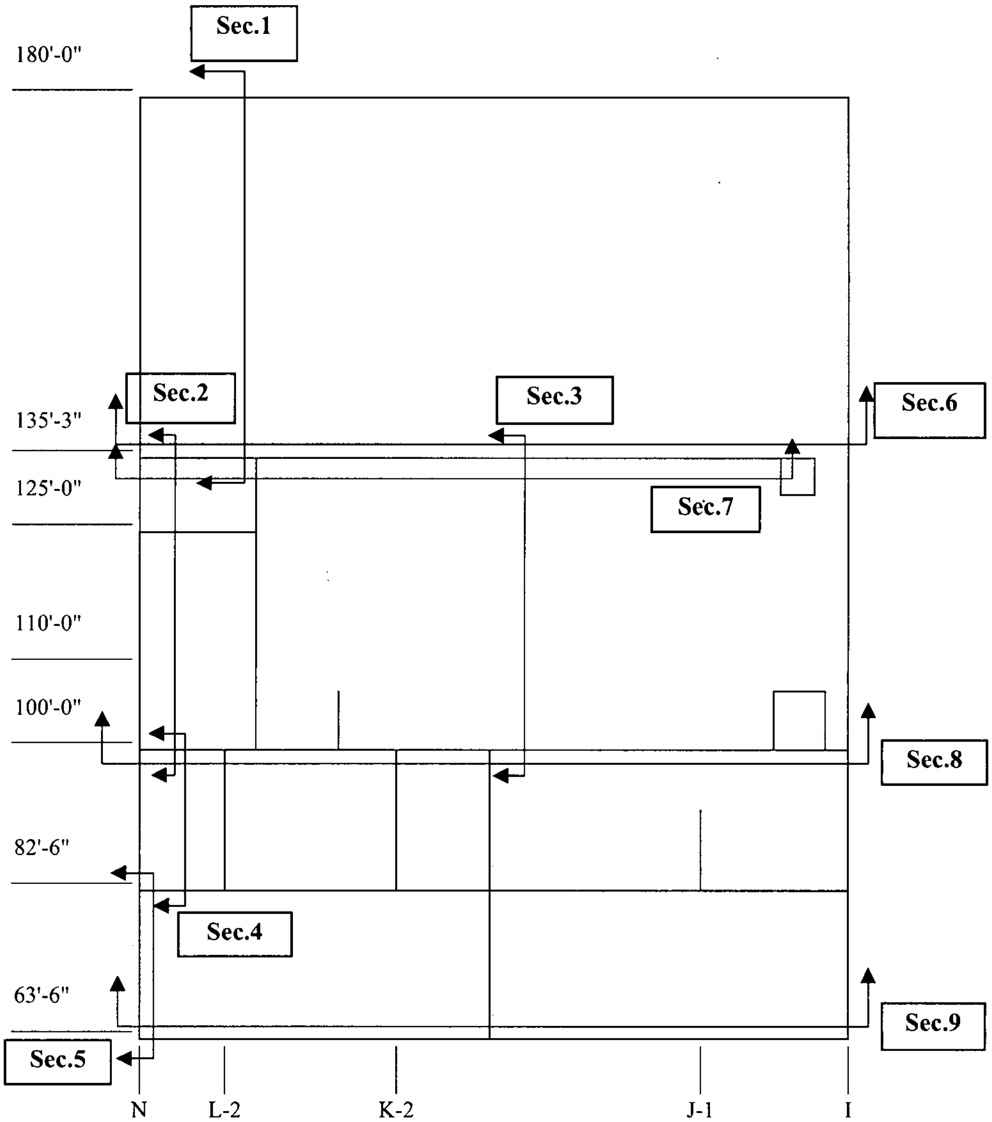


Figure 2.2-5: Wall on Column Line 1
(Sheet 1 of 3)

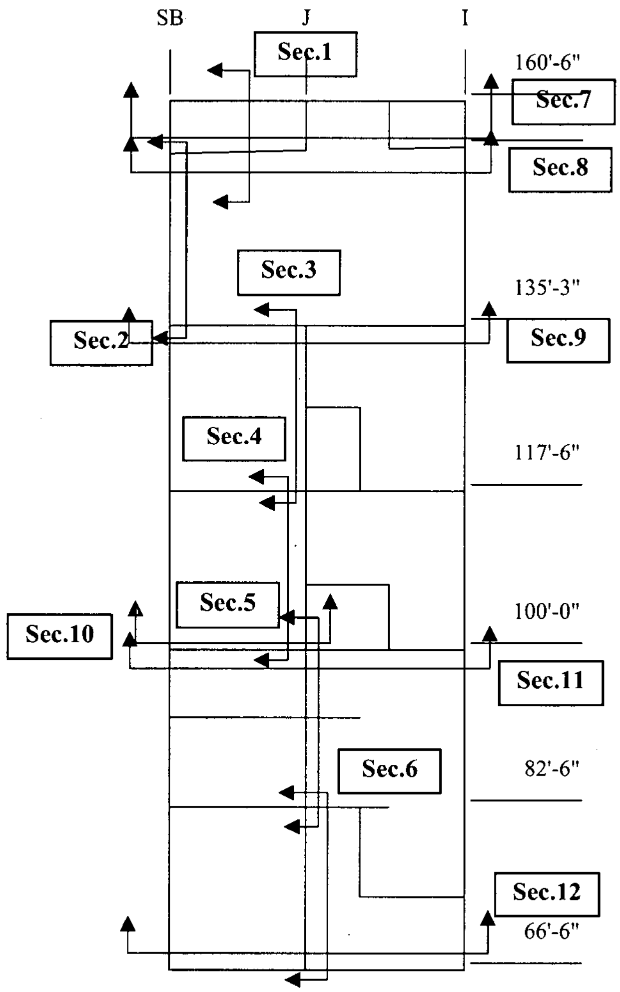


Figure 2.2-5: Wall on Column Line 7.3
(Sheet 2 of 3)

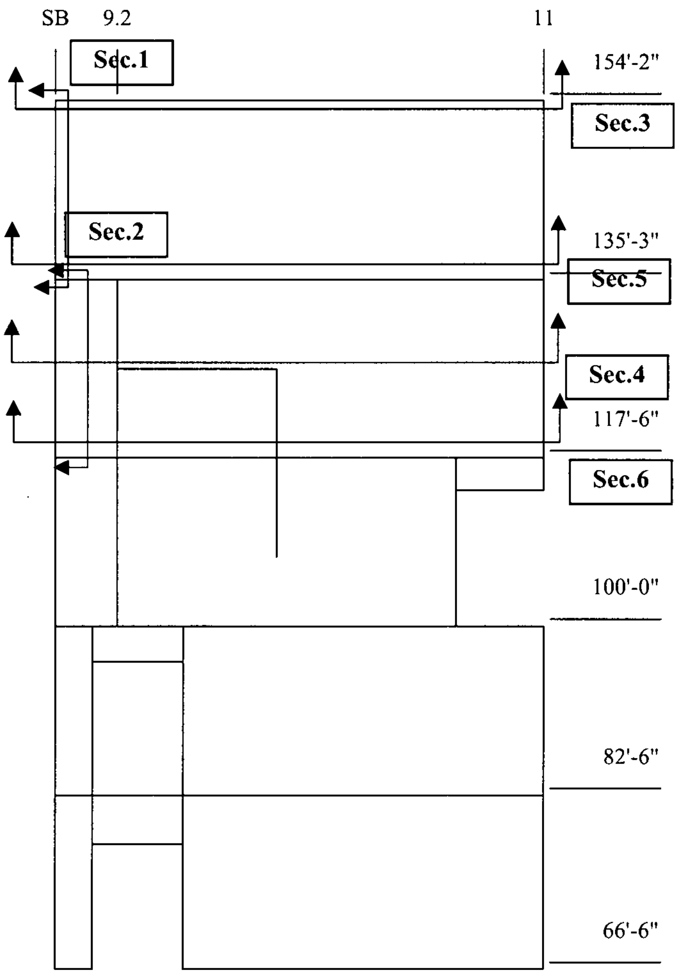


Figure 2.2-5: Wall on Column Line L
(Sheet 3 of 3)

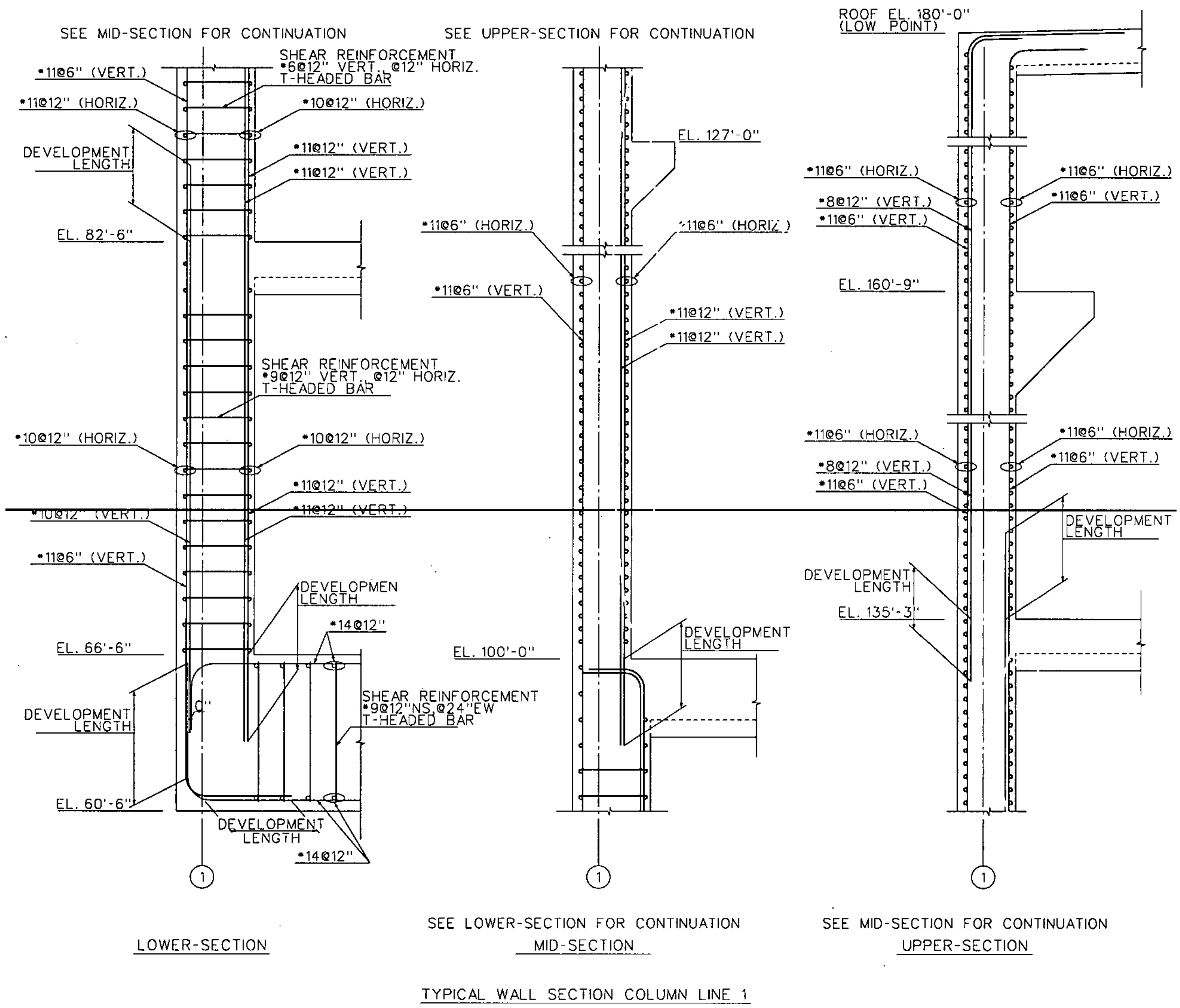
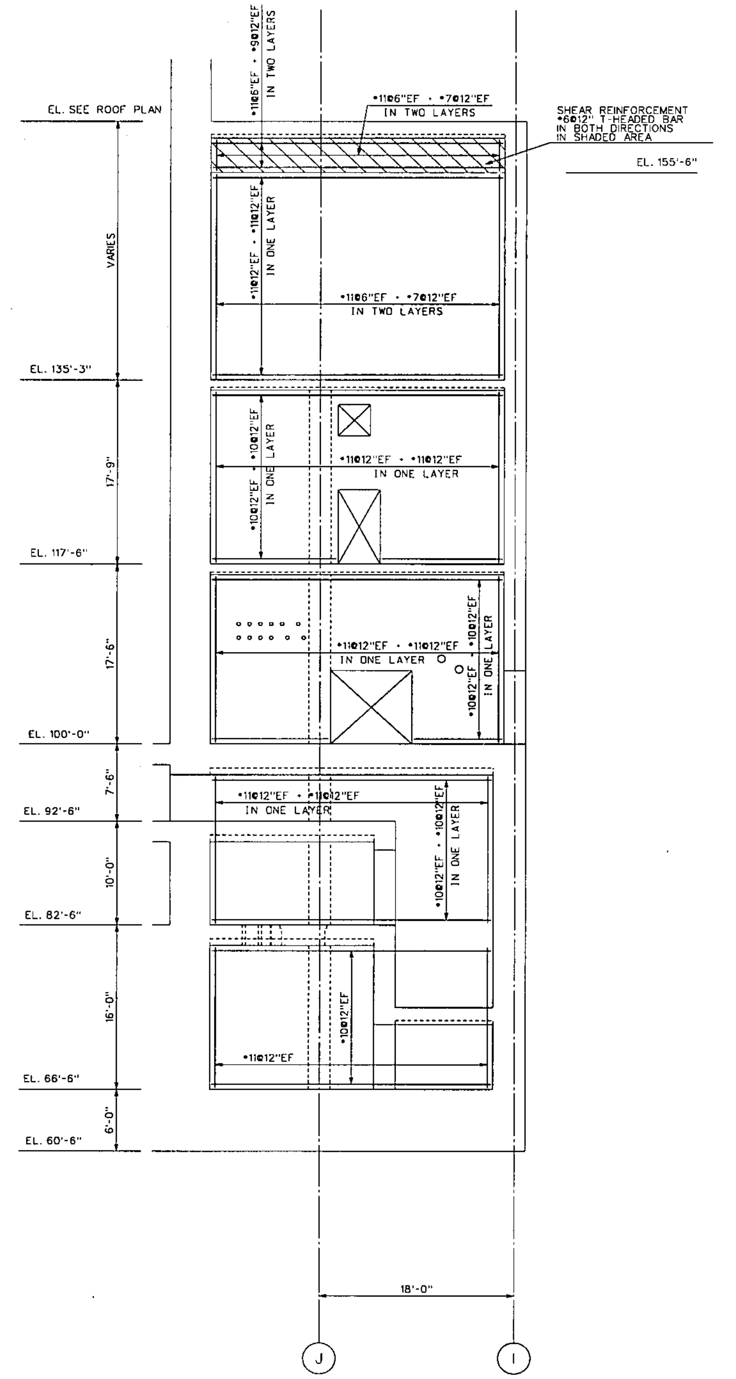


Figure 2.2-6: Typical Reinforcement in Wall on Column Line 1



WALL 7.3 (LOOKING NORTH)

Figure 2.2-7: Typical Reinforcement in Wall 7.3

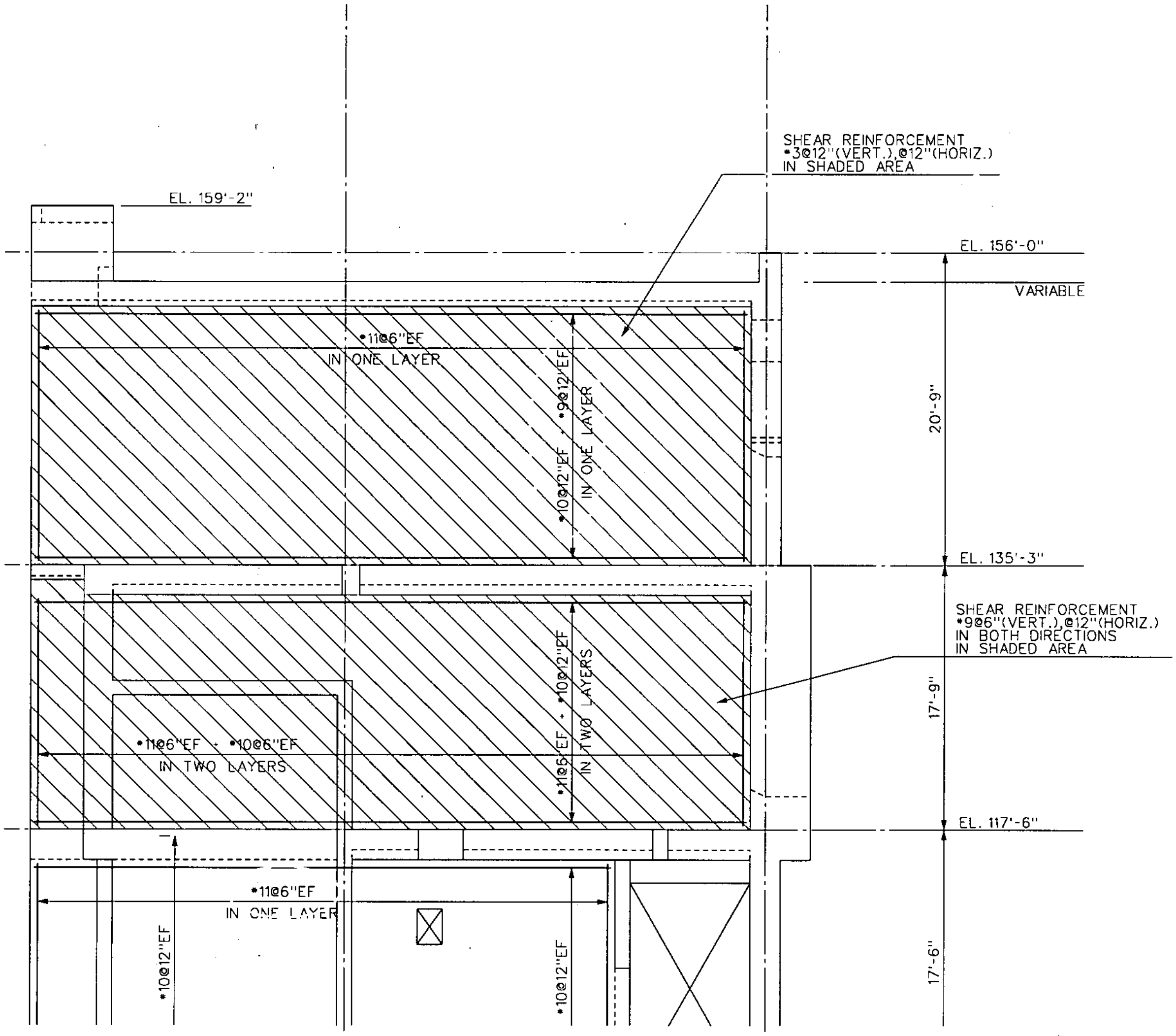


Figure 2.2-8: Typical Reinforcement in Wall L

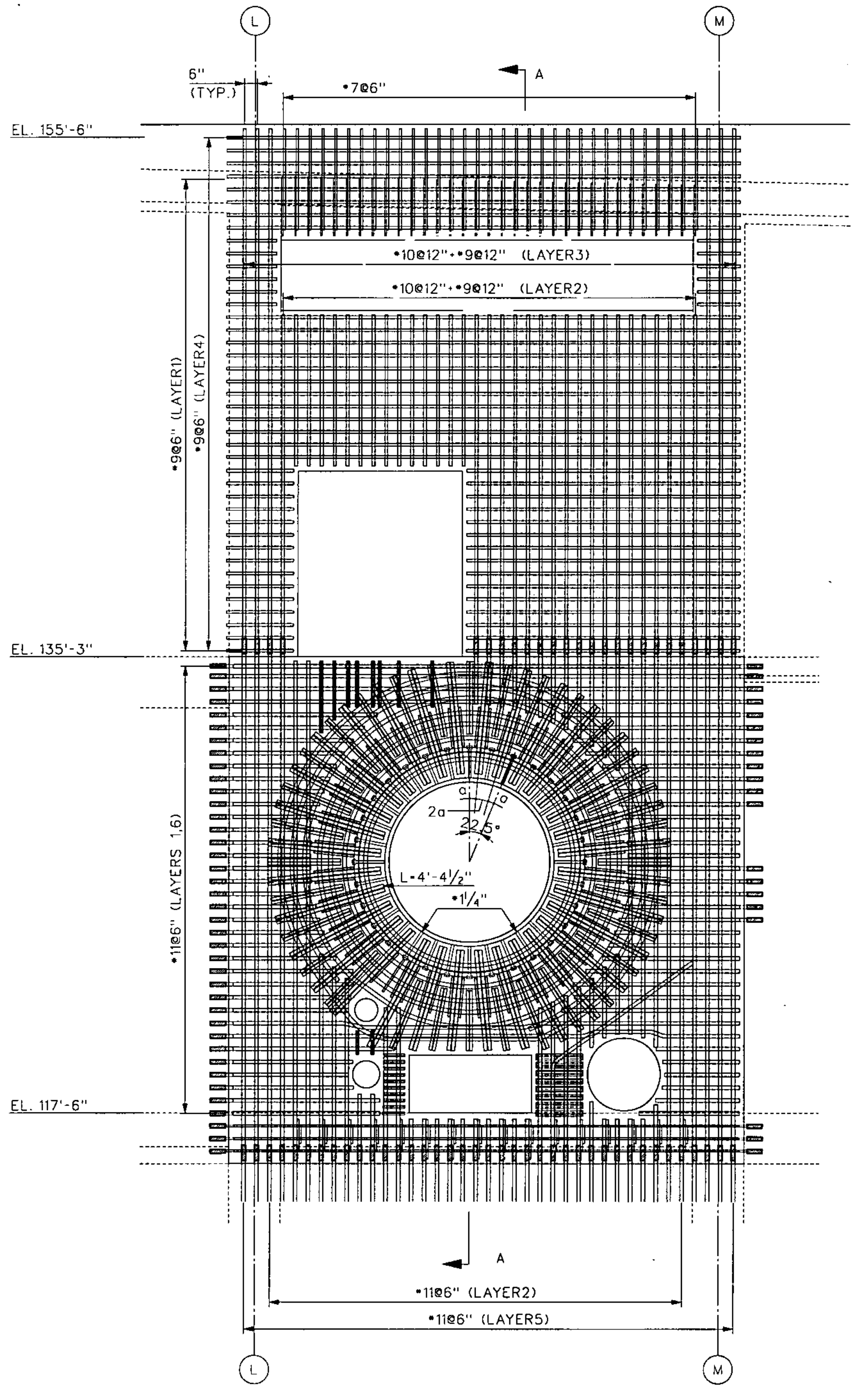


Figure 2.2-9: Concrete Reinforcement in Wall 11 (Sheet 1 of 3)

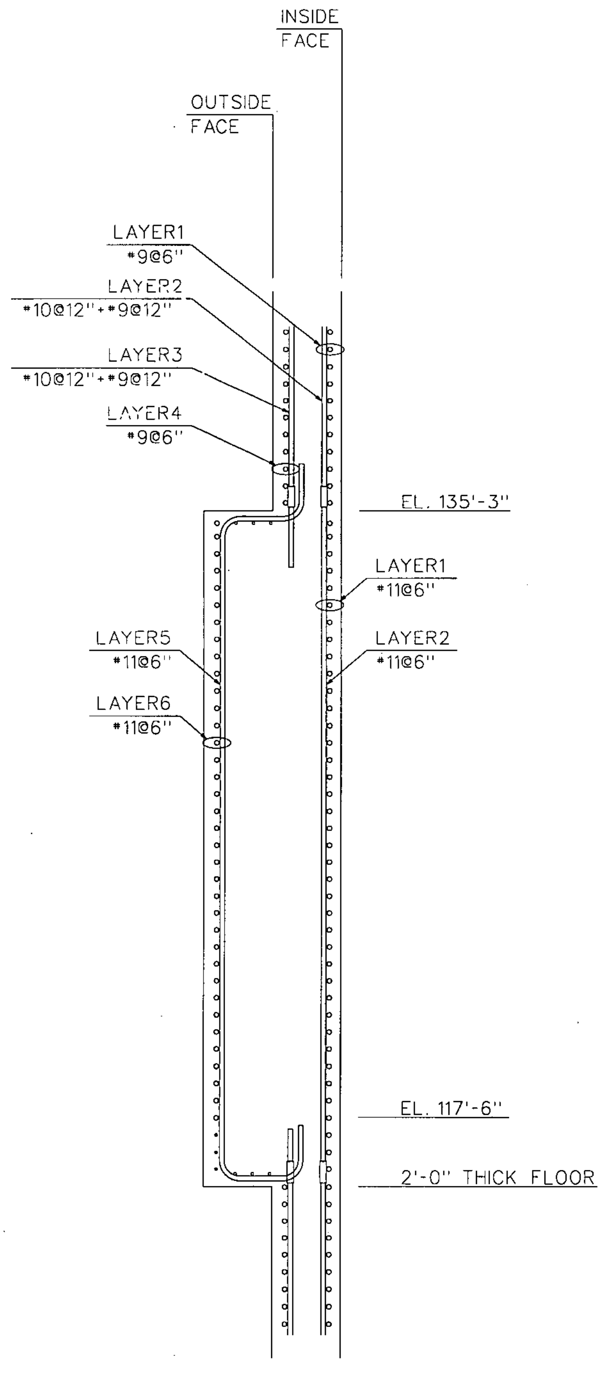


Figure 2.2-9: Concrete Reinforcement in Wall 11 (Sheet 2 of 3)

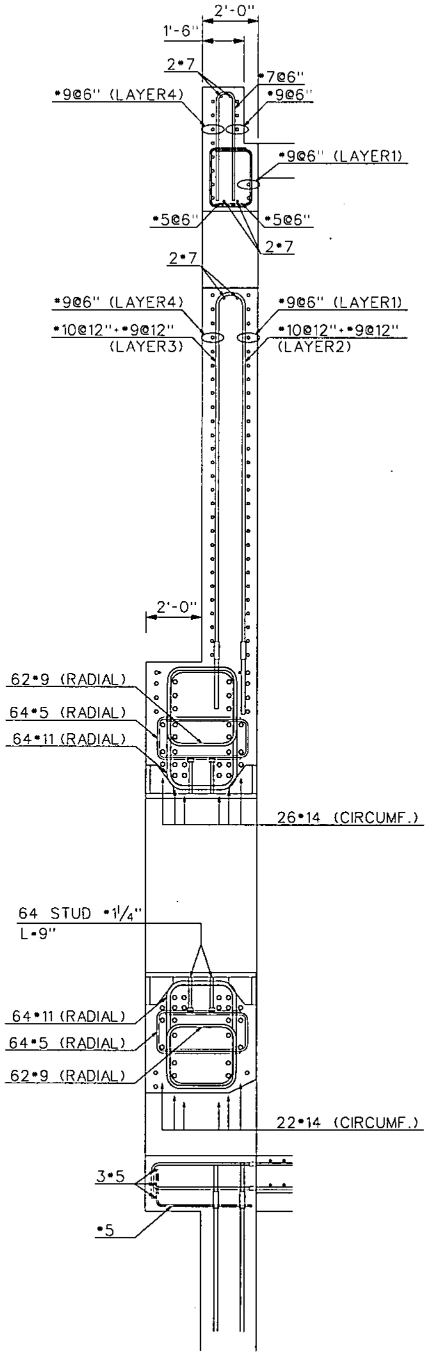


Figure 2.2-9: Concrete Reinforcement in Wall 11 (Sheet 3 of 3)

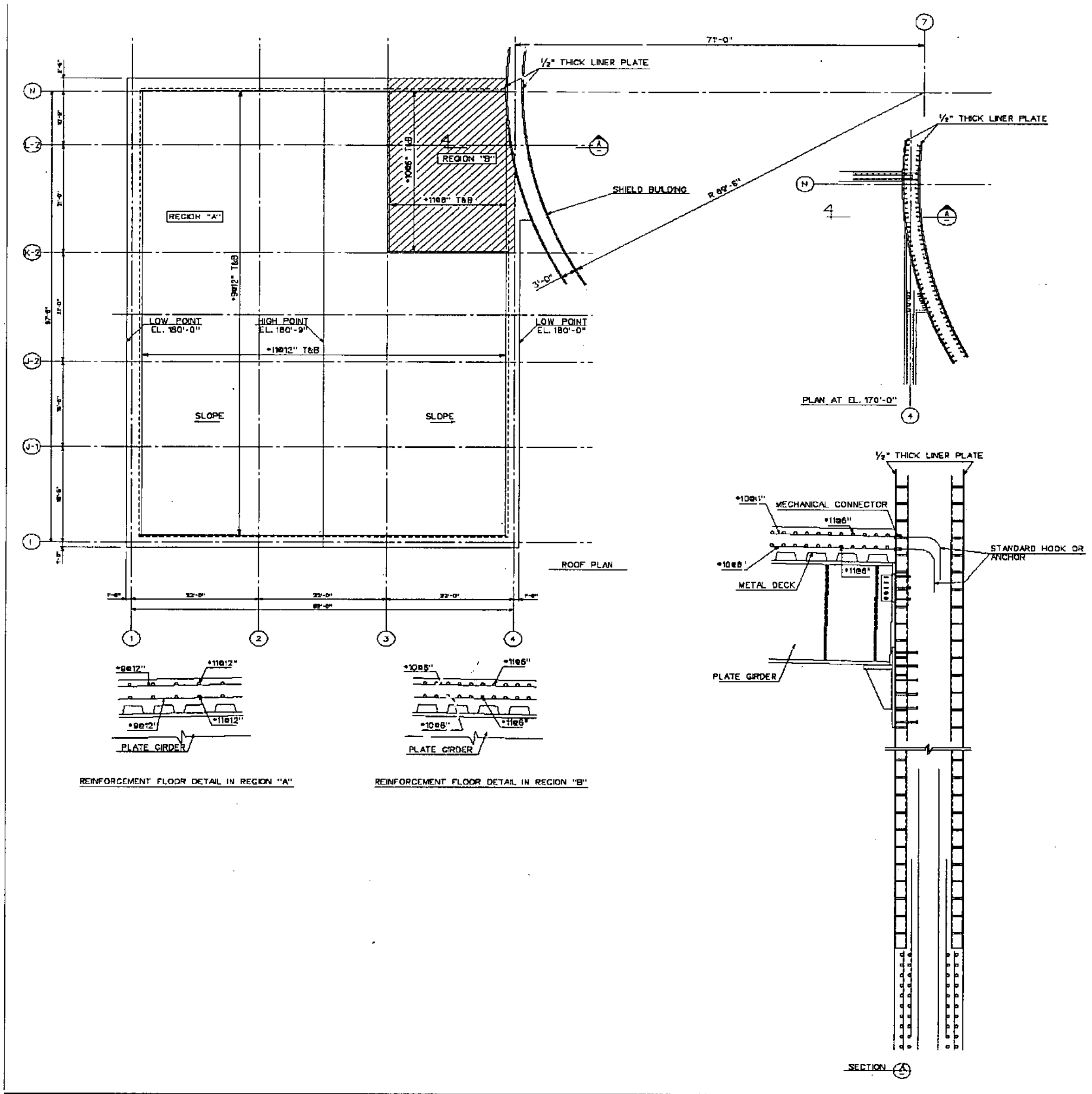
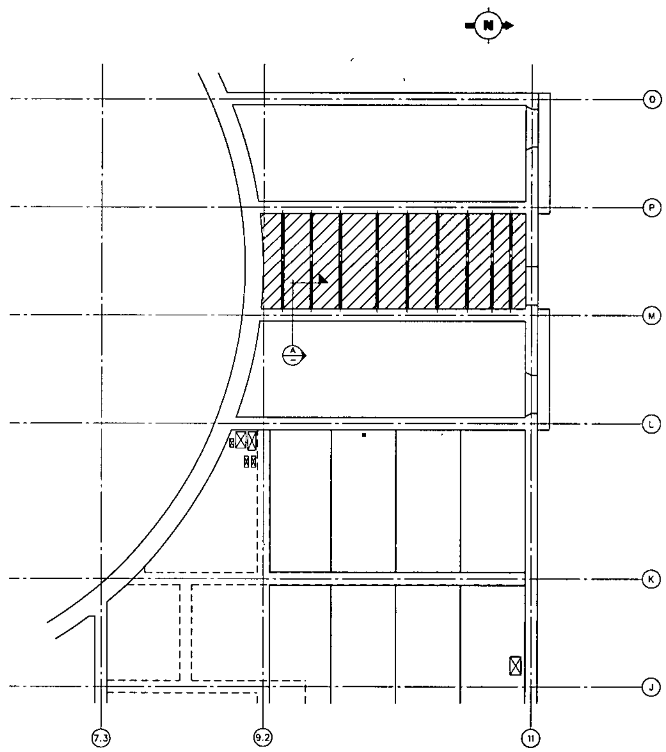
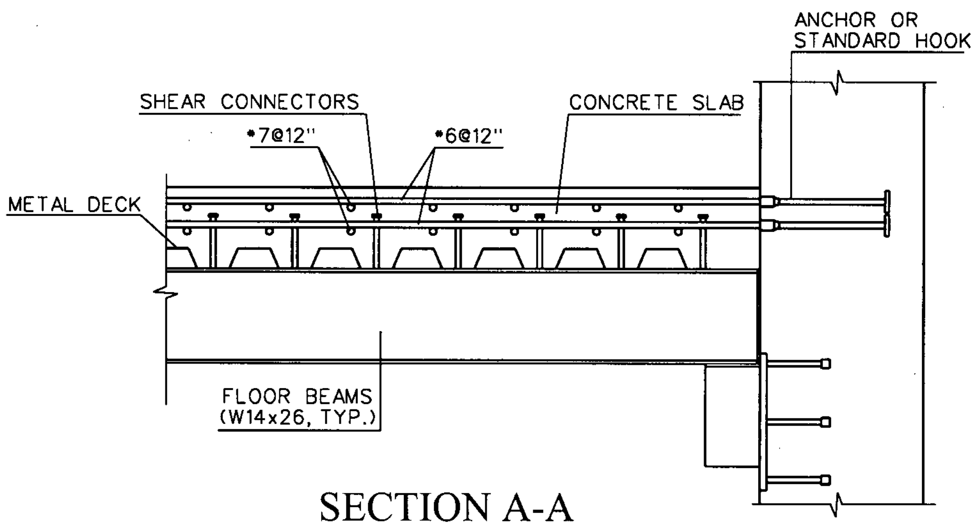


Figure 2.2-10: Typical Reinforcement and Connection to Shield Building



PLAN VIEW



SECTION A-A

Figure 2.2-11 Auxiliary Building Typical Composite Floor

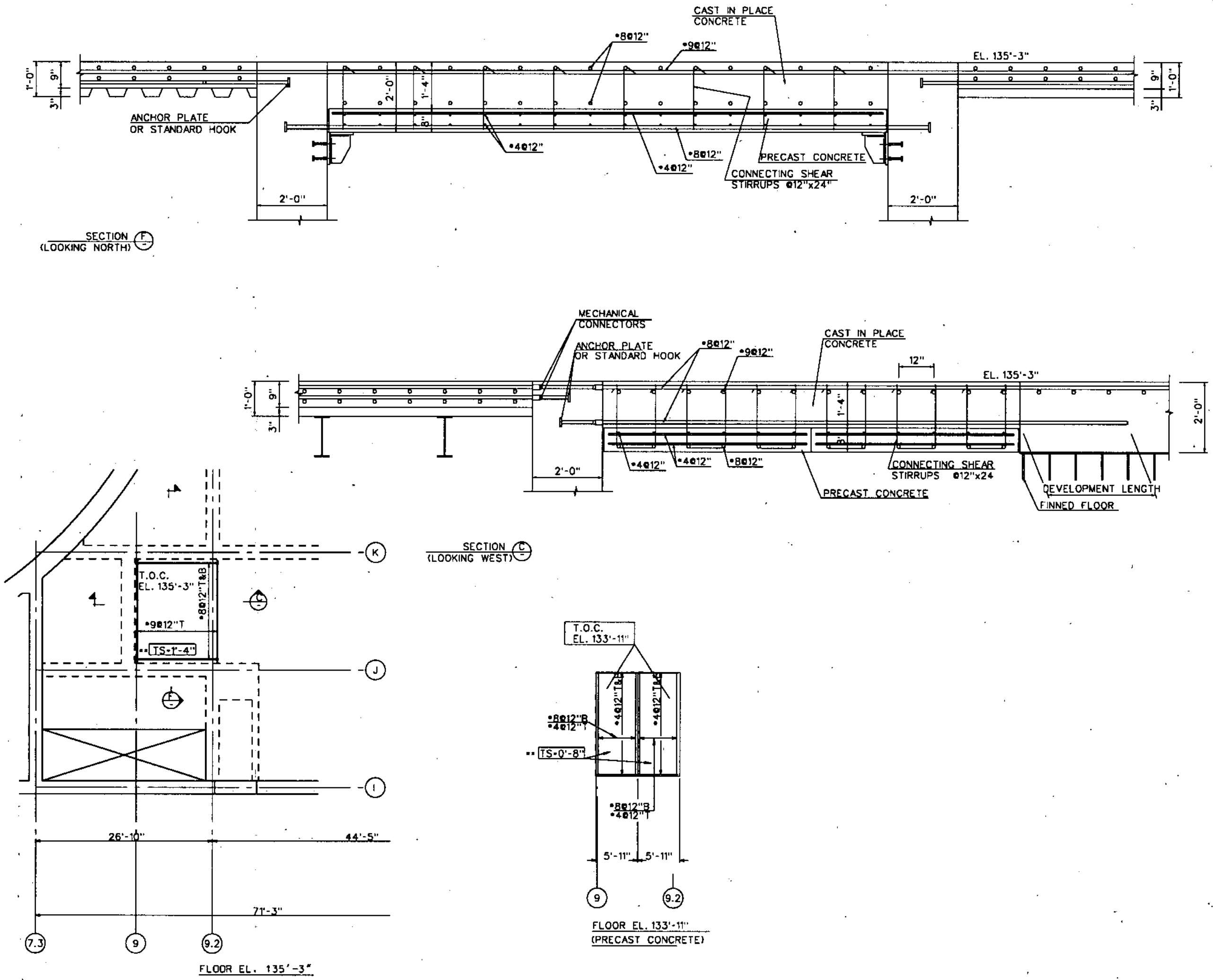


Figure 2.2-12: Auxiliary Building Operator Work Area (previously known as 'Tagging Room')~~Tagging Room~~ -Ceiling

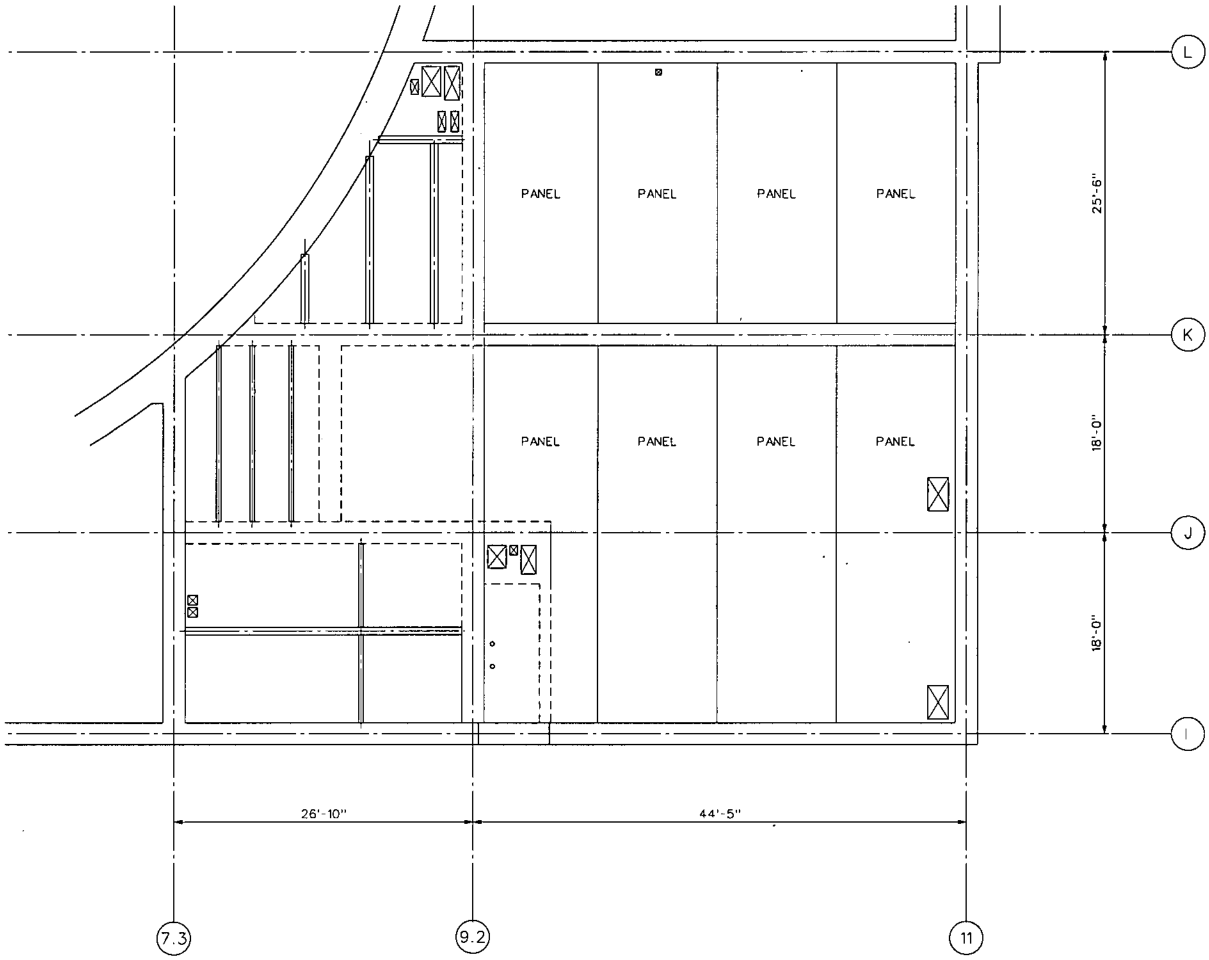


Figure 2.2-13: Auxiliary Building Finned Floor (Sheet 1 of 3)

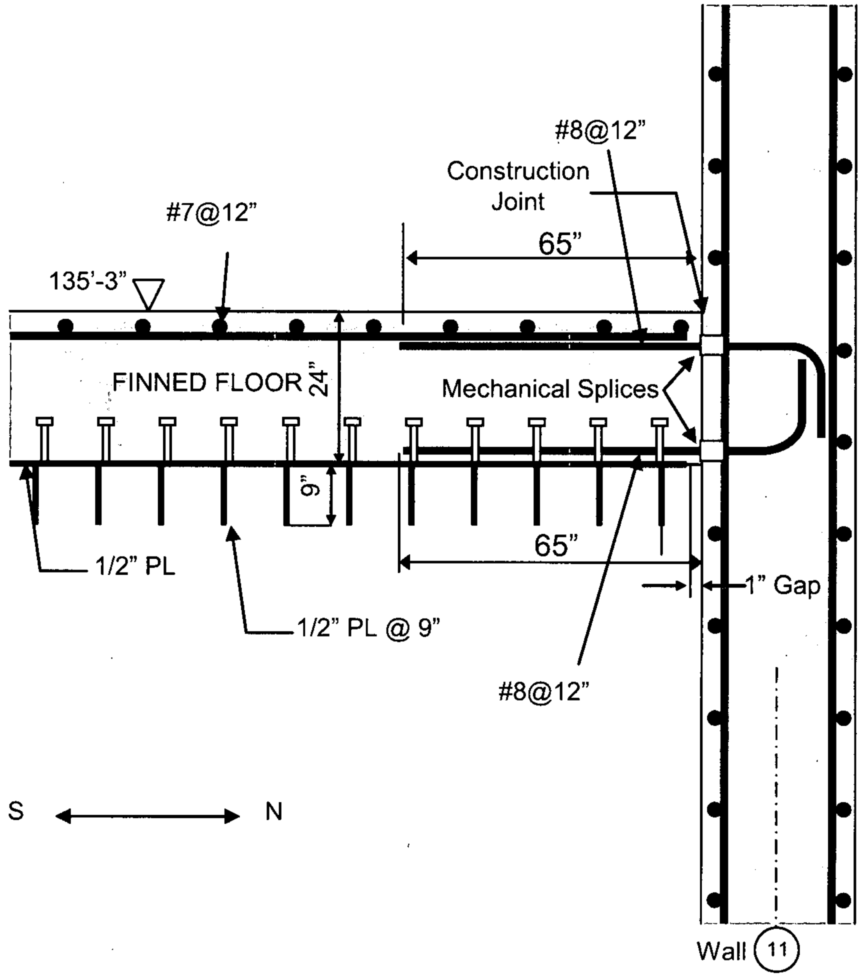


Figure 2.2-13: Auxiliary Building Finned Floor (Sheet 2 of 3)

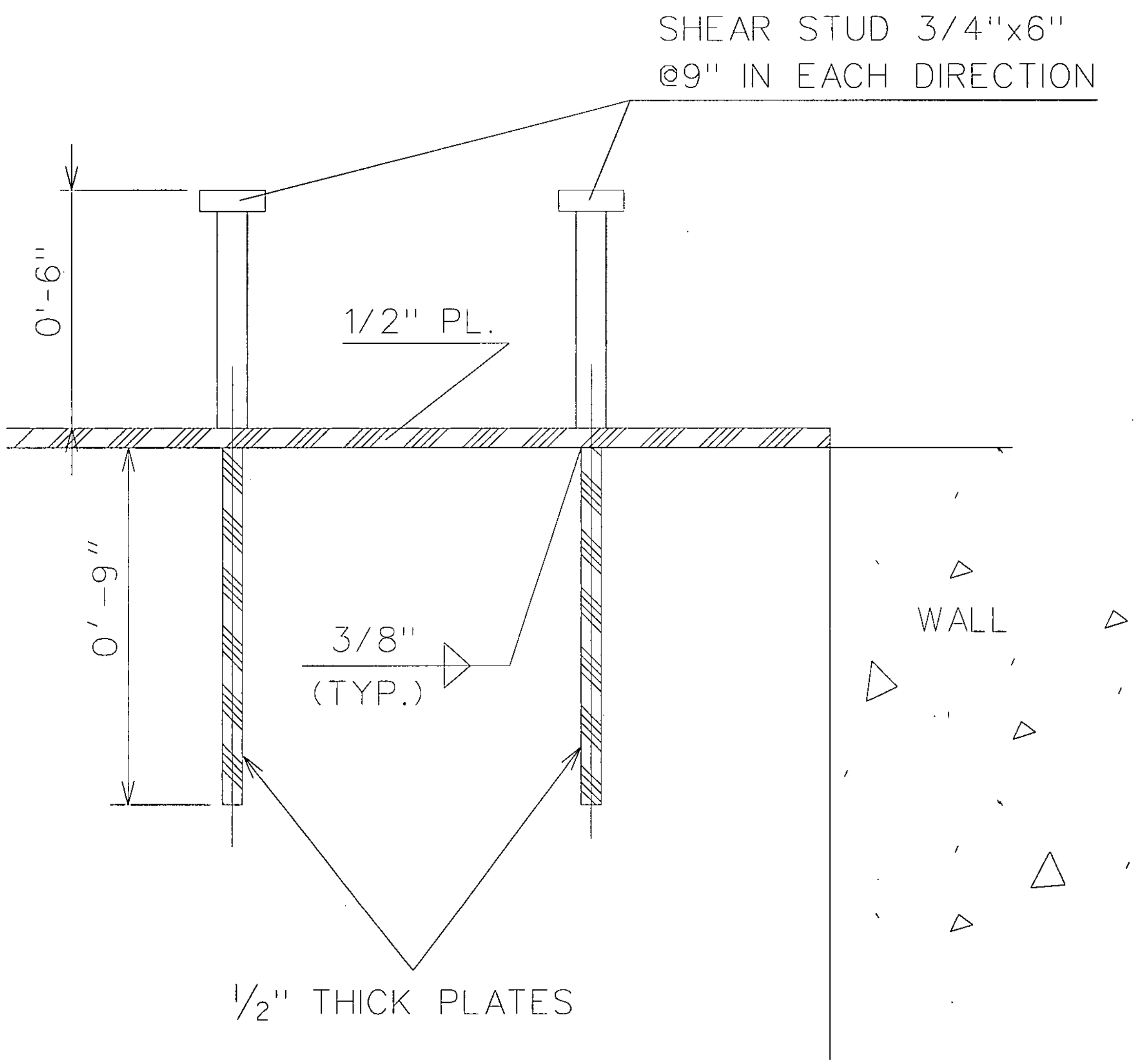


Figure 2.2-13: Auxiliary Building Finned Floor (Sheet 3 of 3)

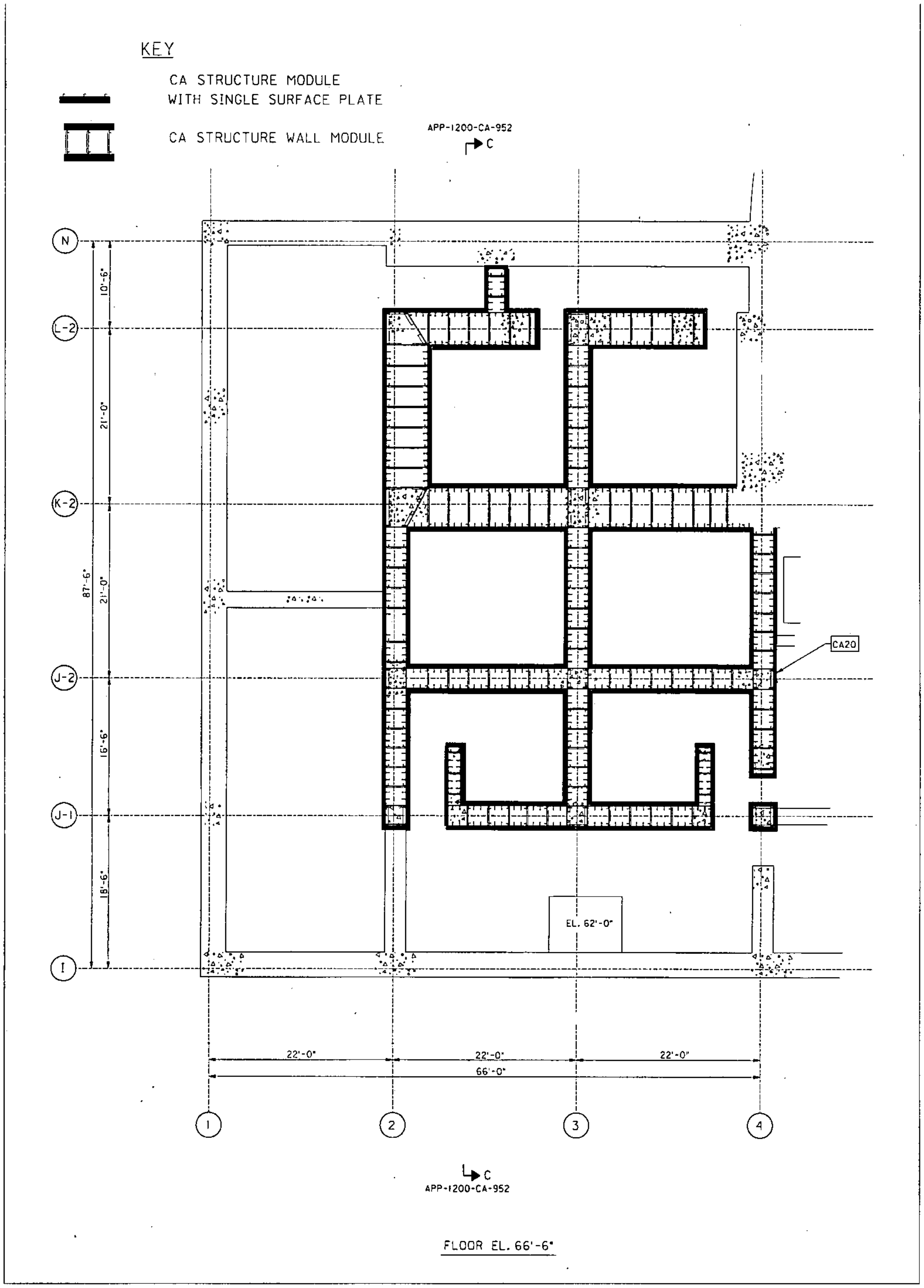


Figure 2.2-14: Structural Modules in Auxiliary Building (Sheet 1 of 5)

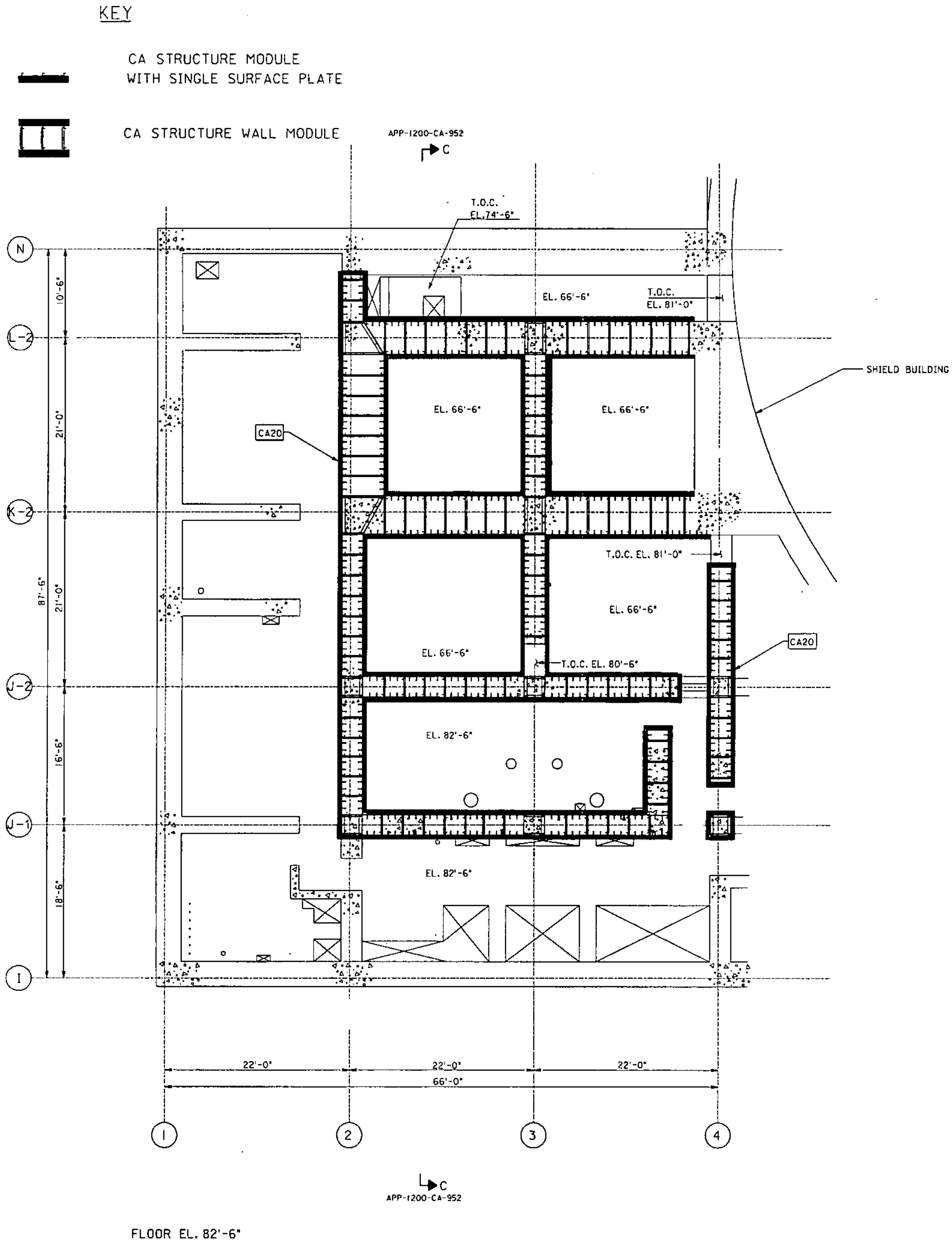


Figure 2.2-14: Structural Modules in Auxiliary Building (Sheet 2 of 5)

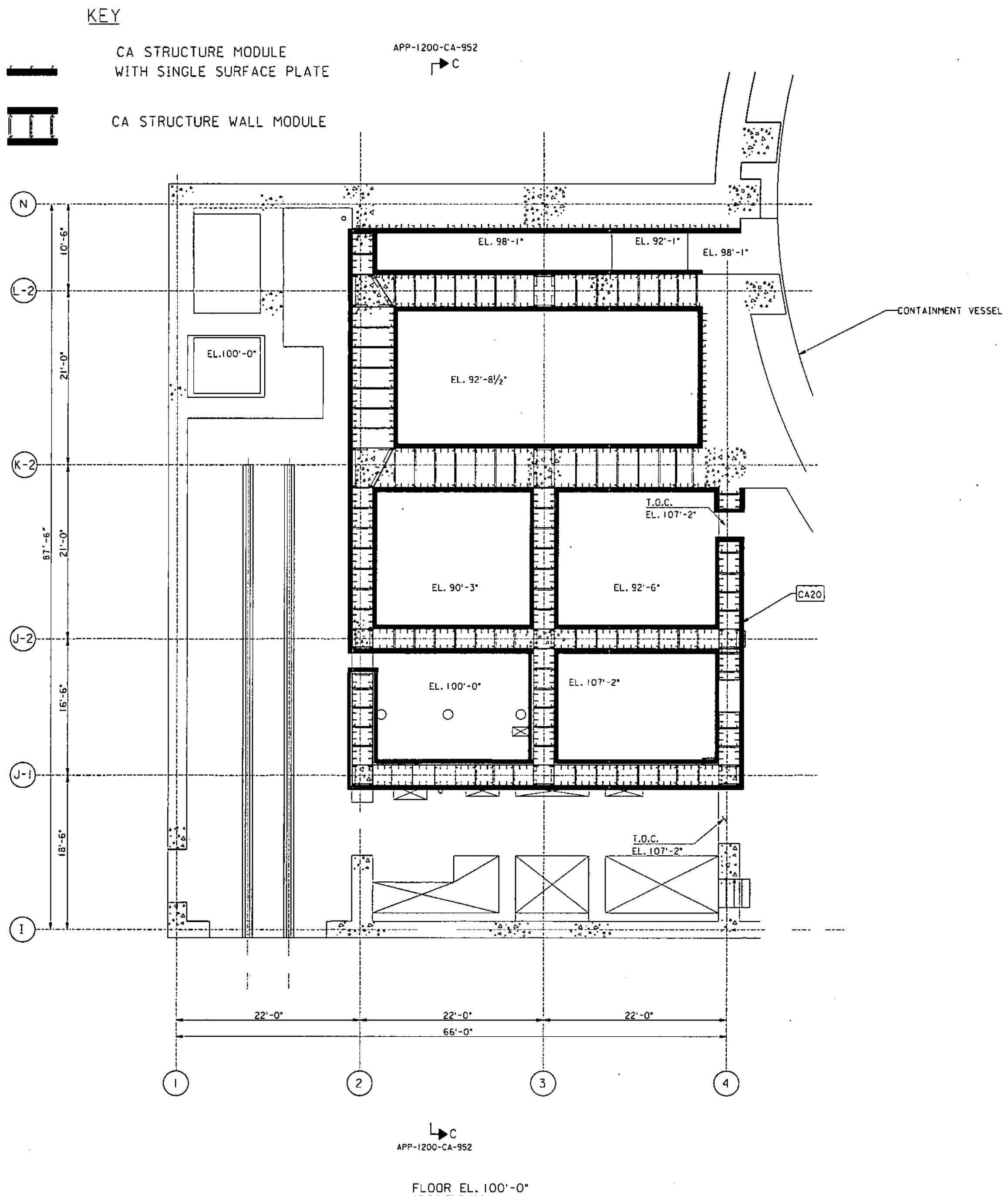


Figure 2.2-14: Structural Modules in Auxiliary Building (Sheet 3 of 5)

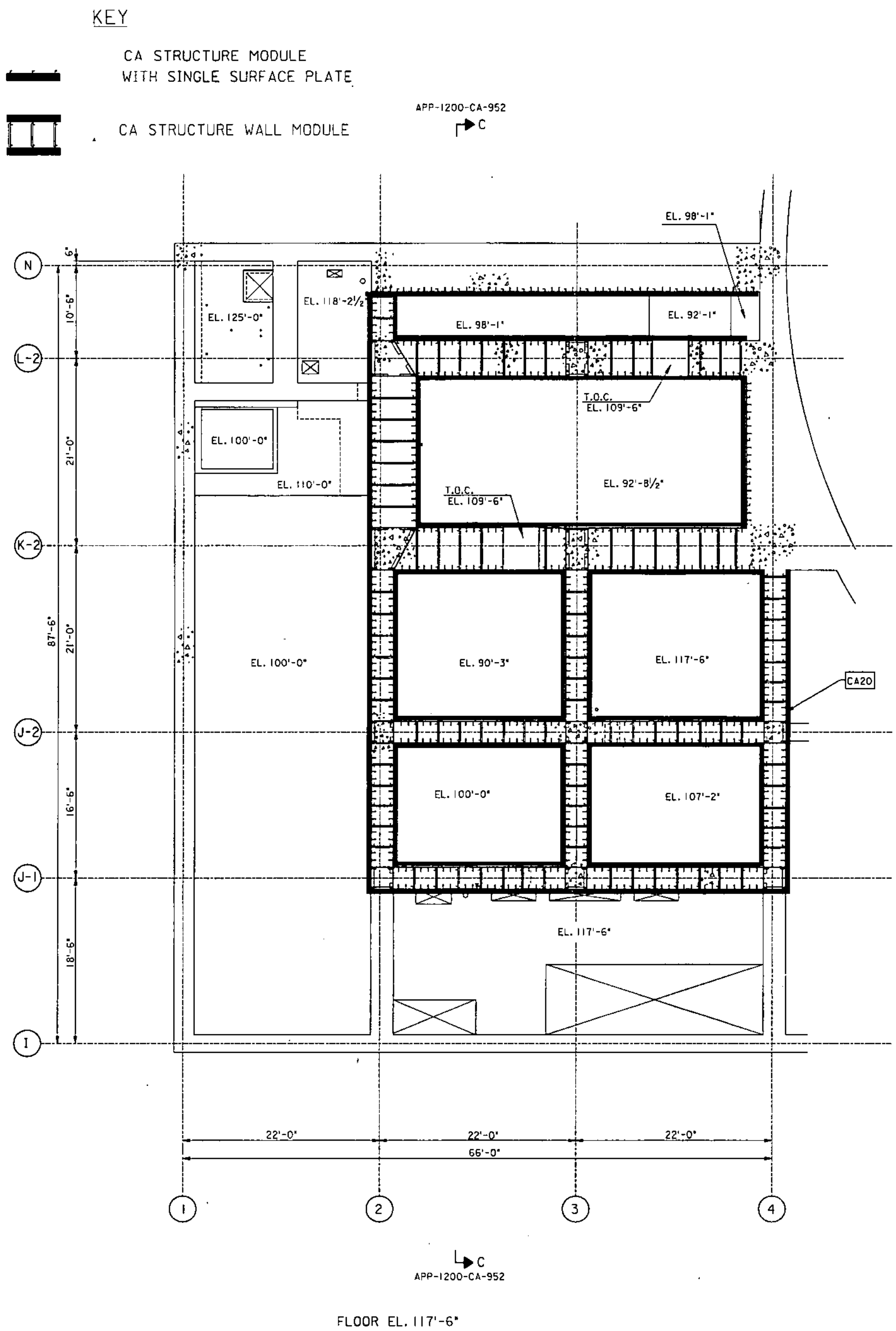


Figure 2.2-14: Structural Modules in Auxiliary Building (Sheet 4 of 5)

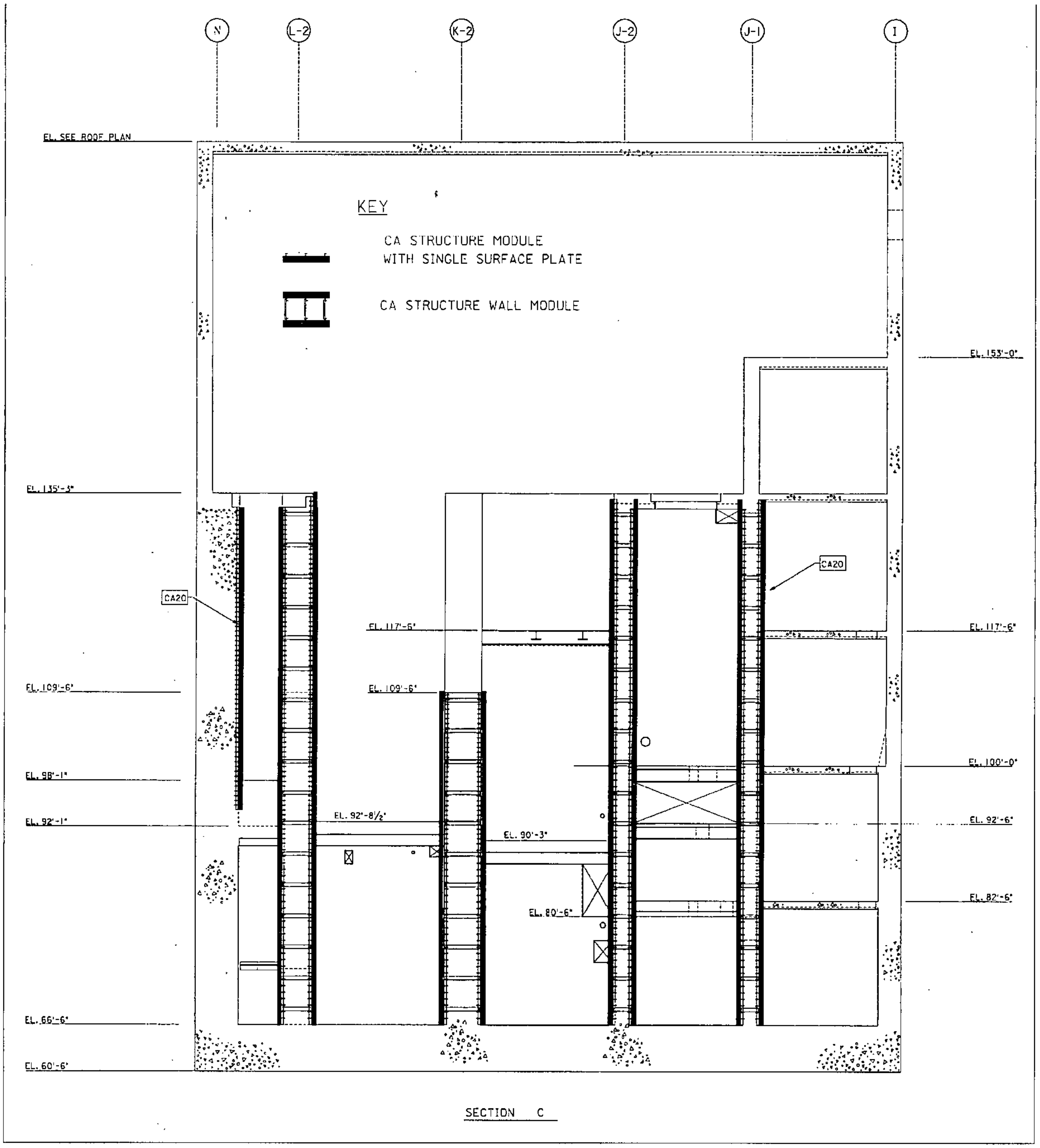


Figure 2.2-14: Structural Modules in Auxiliary Building (Sheet 5 of 5)

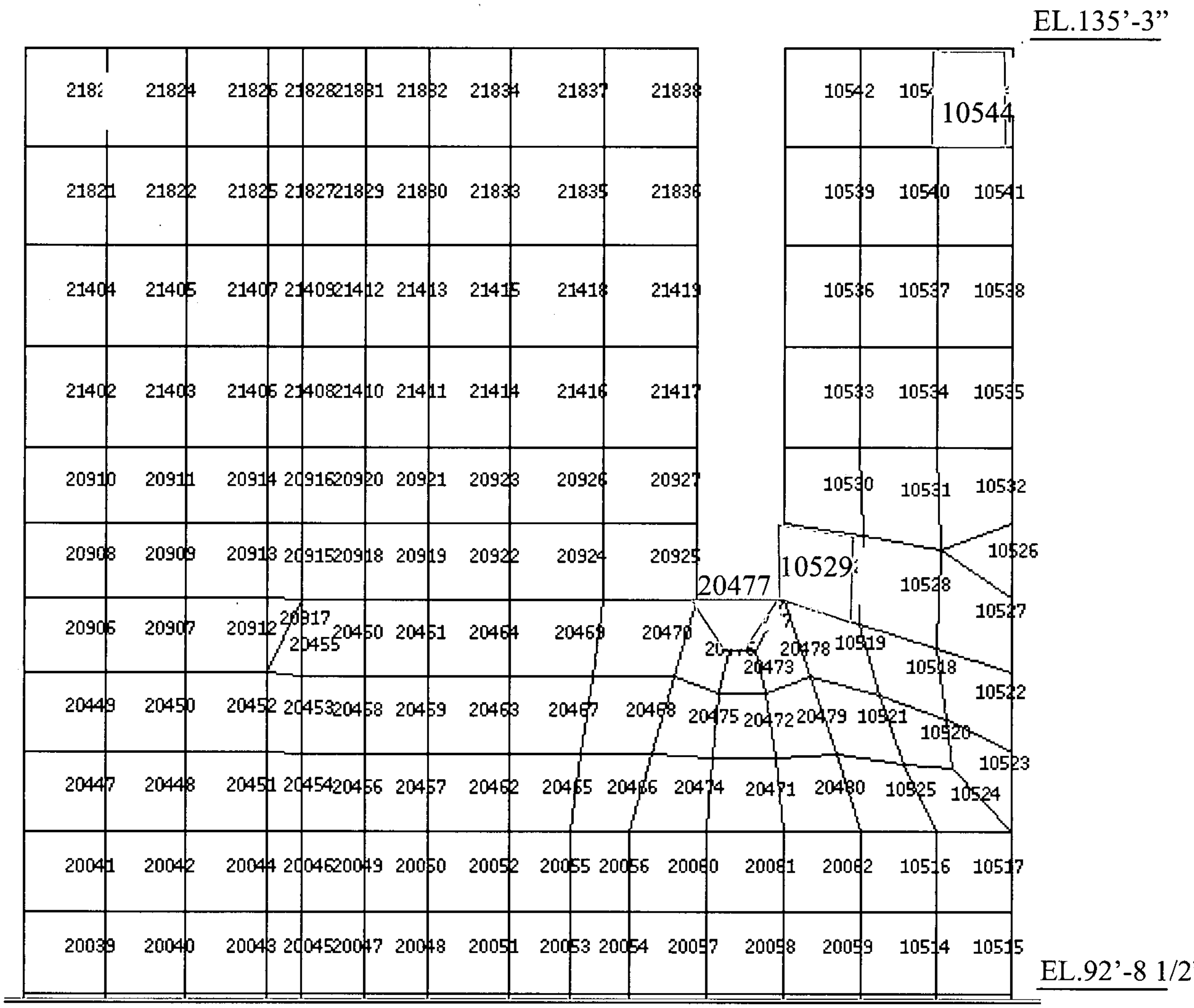


Figure 2.2-15: Spent Fuel Pool Wall Divider Wall Element Locations

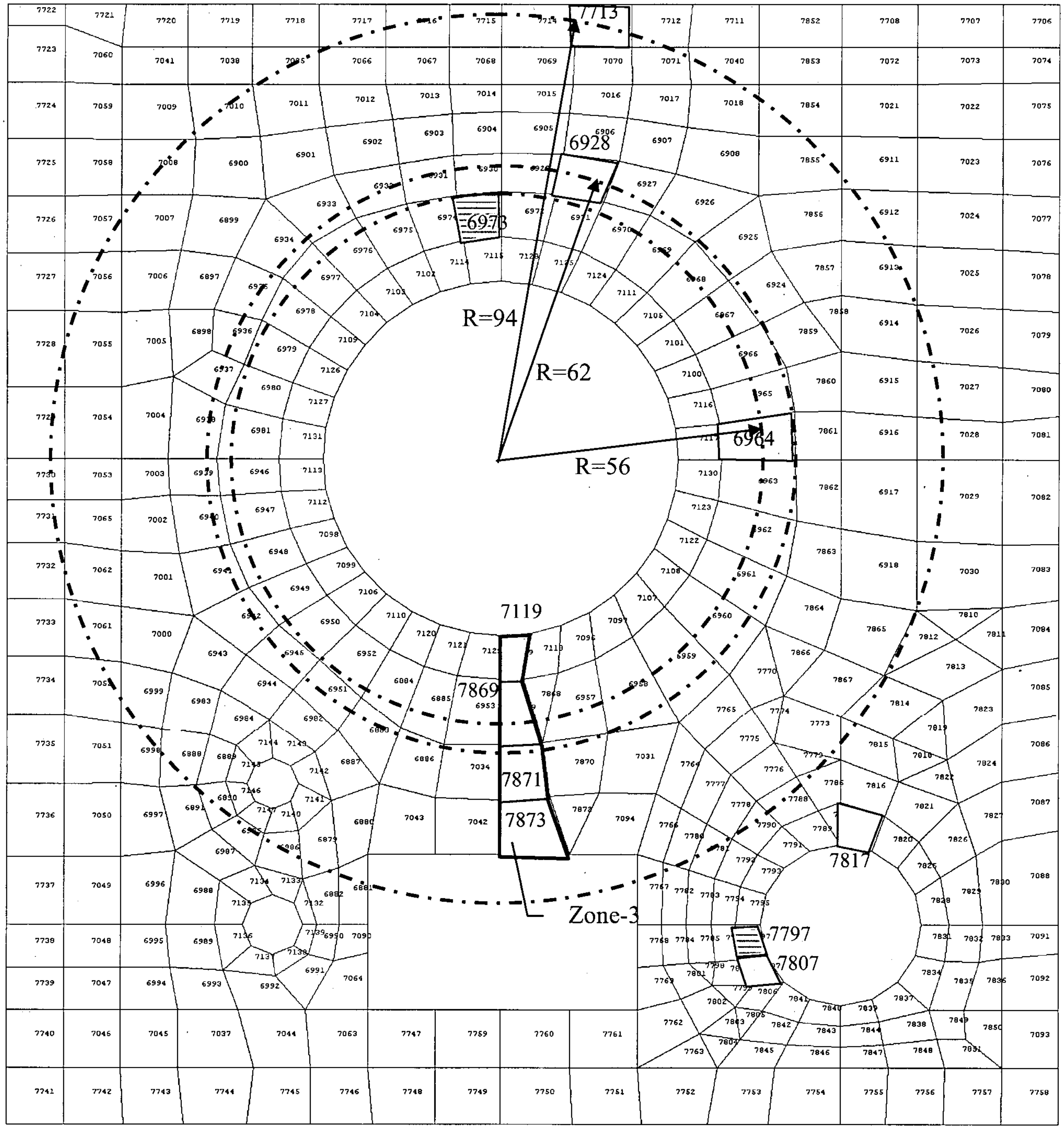


Figure 2.2-16: Exterior Wall at Column Line 11 Element Locations

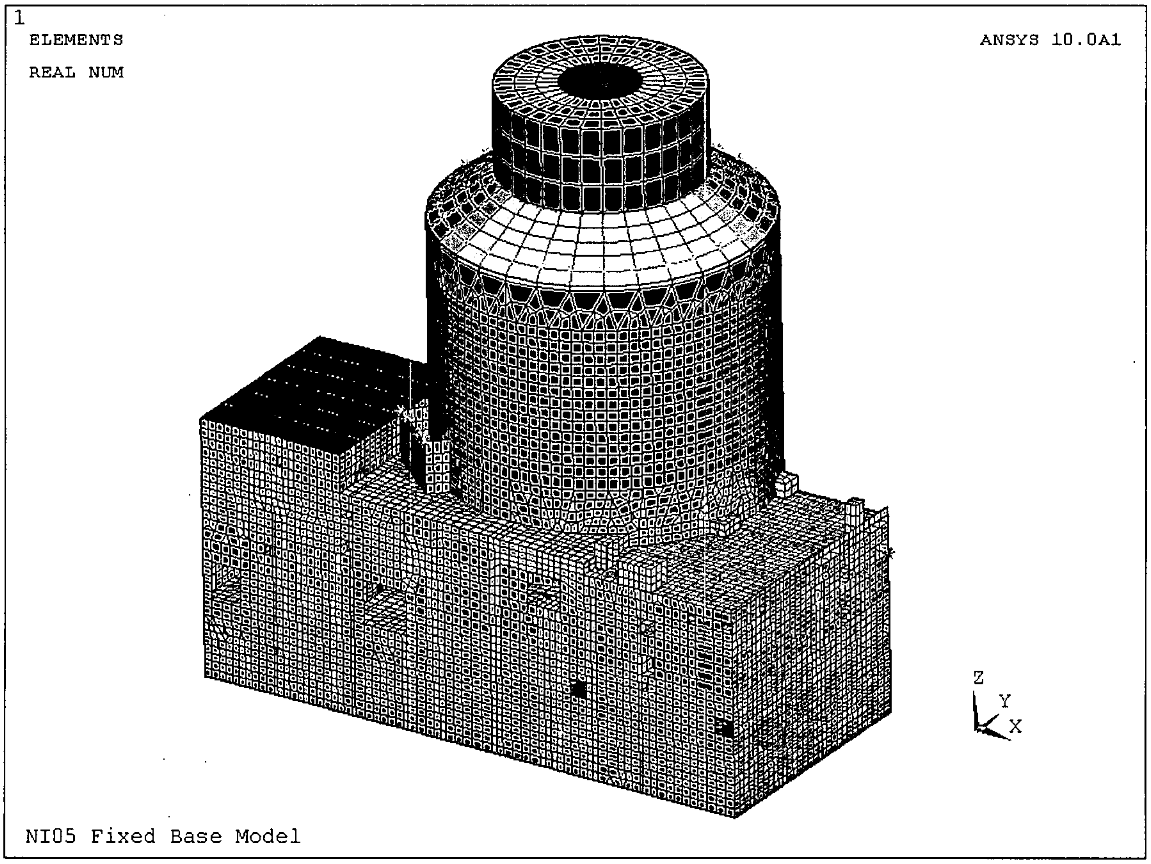


Figure 2.2-17: Nuclear Island Detailed Model (NI05) with Soil Springs

3.0 REGULATORY IMPACT

The design of the nuclear island critical sections is addressed in the NRC Final Safety Analysis Report (FSER, Reference 2) write-ups.

The changes to the DCD presented in this report do not represent an adverse change to the design functions, including the pressure boundary integrity functions and the access function, or to how design functions are performed or controlled. The analysis and design of the nuclear island critical sections for soil sites is consistent with the description of the AP1000 analysis in 3.8.3 of the AP1000 DCD (Reference 1). The changes to the DCD do not involve revising or replacing a DCD-described evaluation methodology. The changes to the DCD do not involve a test or experiment not described in the DCD. The design changes will not result in a significant decrease in the level of safety otherwise provided by the design. The Tier 2 DCD changes identified in this report do not require a license amendment per the criteria of VIII. B. 5.b. of Appendix D to 10 CFR Part 52.

The regulations included in 52 Appendix D VIII. A. identify that the design change will not result in a significant decrease in the level of safety otherwise provided by the design, the exemption must comply with the requirements of 10 CFR 50.12(a). The criteria of 10 CFR 50.12(a) require that special circumstances are present to grant an exemption. To permit application of the Standard AP1000 to a wider range of soils conditions is clearly needed to achieve applicability of the AP1000 to site currently being considered by COL applicants.

The DCD changes do not affect resolution of a severe accident issue and does not require a license amendment based on the criteria of VIII. B. 5.c of Appendix D to 10 CFR Part 52.

The DCD changes will not alter barriers or alarms that control access to protected areas of the plant. The DCD change will not alter requirements for security personnel. Therefore, the DCD change does not have an adverse impact on the security assessment of the AP1000.

4.0 REFERENCES

1. APP-GW-GL-700, AP1000 Design Control Document, Revision16.

2. Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design, September 2004.

3. APP-GW-S2R-010, Revision_1, Extension of Nuclear Island Seismic Analyses to Soil Sites.

4. American Concrete Institute Standard ACI 349-01, "Code Requirements for Nuclear Safety Related Concrete Structures", 2001.

5. ASCE Standard 4-98, "Seismic Analysis of Safety-Related Nuclear Structures and Commentary," American Society of Civil Engineers, 1998.

6. (Not used).

5.0 DCD MARK UP

A markup of the DCD for changes to the DCD in Chapter 3, resulting from the technical changes described in this report, is shown on the following pages.

It may be noted that this report also supports the removal of the design load summary tables in DCD Subsection 3.8.3 and 3.8.4 and the tables of member forces and moments in Appendix 3H.

The information in the tables on the following pages represents the results of detailed calculations and analyses. These results will change slightly during the design finalization~~ due to anticipated spectra changes resulting from resolution of the high frequency issues and plant security issues~~. Small changes in modeling and updates to software may also have a minor effect on the results. For these reasons it is not prudent to ~~lock in~~ provide these results in the DCD.

Subsection 3.8.3, 3.8.4, and Appendix 3H provide information on the criteria, design configuration, and concrete reinforcement. This is sufficient to lock-in the design for NRC review. Attempting to lock in the design loads results over specifies the design. Also, detailed results of the analyses of the critical structures are available for NRC audit.

The level of detail represented by the design summary tables of forces and moments is not consistent with the guidance of Regulatory Guide 1.70 and Standard Review Plan Section 3.8.4. The latest revision of SRP Section 3.8.3 and 3.8.4 do not suggest that this detailed information be included in the DCD.

Note: (1)
The Tables and the Figures, on the following pages, were Tier 2* in DCD Revision 15. All these pages will carry the following footnote in the next revision of the DCD.

*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

Note: (2)
- Revision 0 of this report was issued when the current revision of the DCD was Revision 15. Therefore, Section 5 (DCD Mark Up) of Revision 0 included changes that were needed in DCD Revision 15. Subsequently, those changes were incorporated in DCD Revision 16. Those changes are included, in this report, in subsection 5.1 "Mark Up for DCD Rev 15".

- This Revision 1 of the technical report also includes changes required in DCD Revision 16, identified as a result of the re-evaluation of the critical sections, to address the new seismic loads. Those changes are included, in this report, in sub-section 5.2 "Mark Up for DCD Rev 16".

5.1 "Mark Up for DCD Rev 15"

- Changes for DCD Rev 15 are described on the following pages.

- The tables and figures marked, in this sub-section 5.1, as 'To be deleted' were deleted in DCD Revision 16.

- The tables and figures marked, in this sub-section 5.1, as 'To be inserted' were inserted in DCD Revision 16.

3.8.3.6 Materials, Quality Control, and Special Construction Techniques *(DCD Tier 2, page 3.8-37)*

(DCD Revision 15 version)
Subsection 3.8.4.6 describes the materials and quality control program used in the construction of the containment internal structures. The structural steel modules are constructed using A36 plates and shapes. Nitronic 33 (American Society for Testing and Materials 240, designation S24000, Type XM-29) stainless steel plates are used on the surfaces of the modules in contact with water during normal operation or refueling.

(DCD Revision 16 version)

Subsection 3.8.4.6 describes the materials and quality control program used in the construction of the containment internal structures. The structural steel modules are constructed using carbon steel plates and shapes. However, Duplex 2101 (American Society for Testing and Materials A240, designation S32101) stainless steel plates are used on the surfaces of the modules in contact with water during normal operation or refueling.

(To be deleted)

Table 3.8.3-4 (Sheet 1 of 3)

[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT MID-HEIGHT]*

Load/Comb.	TX	TY	TXY	MX	MY	MXY	NX	NY	Comments
	k/ft	k/ft	k/ft	kft/ft	kft/ft	kft/ft	k/ft	k/ft	
Dead (D)	-1	-17	0	2	2	0	0	1	–
Hydro (F)	1	0	2	24	30	-2	0	0	–
Live (L)	0	-8	0	3	3	0	0	1	During refueling
Live (L_o)	0	-2	0	1	1	0	0	0	During operation
Live (ADS)	0	6	4	19	21	-3	0	1	–
E_s	10	16	71	15	10	16	1	2	–
Thermal (T_o)	-269	-125	-59	517	506	-15	10	-14	–
LC (1)	-1	-17	9	70	81	-9	0	3	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-1	-37	2	43	49	-3	0	2	$1.4D+1.4F+1.7Lr$
LC (3)	-1	-13	8	69	80	-9	0	3	$1.4D+1.4F+1.7ADS$
LC (4)	10	4	77	61	64	17	2	4	$D+F+L_o + \|ADS\|+E_s$
LC (5)	-11	-42	-73	-6	1	-21	-1	-3	$D+F+L_o - \|ADS\|-E_s$
LC (6)	-259	-121	18	577	570	2	12	-9	$D+F+L_o + \|ADS\|+T_o+E_s$
LC (7)	-281	-166	-132	511	507	-36	9	-16	$D+F+L_o - \|ADS\|+T_o-E_s$
LC (8)	10	7	76	60	63	10	1	4	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:

x-direction is horizontal, y-direction is vertical.
element number 1870

Plate thickness required for load combinations excluding thermal: *0.08 inches*
Plate thickness provided: *0.50 inches*

Maximum principal stress for load combinations 6 and 7 including thermal: *26.9 ksi*
Yield stress at temperature: *55.0 ksi*

Maximum stress intensity range for load combinations 6 and 7 including thermal: *26.9 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal: *110.0 ksi*

Table to be inserted

Table 3.8.3-4 (Sheet 1 of 3)
*[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL]**

Element number 1870

Plate thickness provided *= 0.50 inches*
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature *= 55.0 ksi*
Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 110.0 ksi
(Note: The maximum principal stress for load combinations 6 and 7, and the maximum stress intensity range for these load combinations is much lower than the allowable.)

(To be deleted)

Table 3.8.3-4 (Sheet 2 of 3)

[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT BASE]*

	TX	***TY***	***TXY***	***MX***	***MY***	***MXY***	***NX***	***NY***	
Load/Comb.	***k/ft***	***k/ft***	***k/ft***	***kft/ft***	***kft/ft***	***kft/ft***	***k/ft***	***k/ft***	***Comments***
Dead (D)	-3	-24	-1	0	-2	0	0	0	–
Hydro (F)	1	-1	4	-2	-40	-1	-1	16	–
Live (L)	-1	-7	0	0	-3	0	0	1	*During refueling*
Live (L_o)	0	-2	0	0	-1	0	0	0	*During operation*
Live (ADS)	1	4	5	-2	-29	-1	-1	10	–
E_s	11	24	78	8	50	3	3	8	–
Thermal (T_o)	-457	-72	-114	607	627	-12	-10	-21	–
LC (1)	-3	-31	13	-6	-111	-3	-3	41	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-5	-46	5	-4	-65	-2	-2	25	$1.4D+1.4F+1.7Lr$
LC (3)	-2	-28	12	-6	-109	-3	-3	40	$1.4D+1.4F+1.7ADS$
LC (4)	8	1	86	7	36	2	3	35	$D+F+L_o + \|ADS\|+E_s$
LC (5)	-14	-54	-79	-12	-122	-5	-5	0	$D+F+L_o - \|ADS\|-E_s$
LC (6)	-448	-71	-28	614	662	-10	-7	14	$D+F+L_o + \|ADS\|+T_o+E_s$
LC (7)	-470	-127	-193	596	504	-17	-15	-21	$D+F+L_o - \|ADS\|+T_o-E_s$
LC (8)	9	5	86	3	-22	0	1	34	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 1788

Plate thickness required for load combinations excluding thermal: *0.05 inches*
Plate thickness provided: *0.50 inches*

Maximum principal stress for load combinations 6 and 7 including thermal: *31.8 ksi*
Yield stress at temperature: *55.0 ksi*

Maximum stress intensity range for load combinations 6 and 7 including thermal: *32.9 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal: *110.0 ksi*

(To be inserted)

Table 3.8.3-4 (Sheet 2 of 3)
*[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL]**

Element number 1788

Plate thickness provided *= 0.50 inches*
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature *= 55.0 ksi*
Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 110.0 ksi
(Note: The maximum principal stress for load combinations 6 and 7, and the maximum stress intensity range for these load combinations is much lower than the allowable.)

(To be deleted)

Table 3.8.3-4 (Sheet 3 of 3)

[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA NORTH END BOTTOM CORNER]*

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	-4	-22	-2	-1	-2	0	0	0	–
Hydro (F)	2	0	5	-10	-16	3	1	3	–
Live (L)	-1	-4	0	0	-1	0	0	0	*During refueling*
Live (L_o)	0	-2	0	0	0	0	0	0	*During operation*
Live (ADS)	1	1	3	-7	-14	2	1	2	–
E_s	13	29	77	15	71	6	5	7	–
Thermal (T_o)	-435	-254	89	628	360	-30	9	74	–
LC (1)	-2	-31	9	-27	-49	8	4	8	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-5	-37	4	-16	-26	5	2	5	$1.4D+1.4F+1.7Lr$
LC (3)	-2	-28	9	-27	-49	8	4	8	$1.4D+1.4F+1.7ADS$
LC (4)	11	7	82	11	67	12	8	12	$D+F+L_o+/ADS/+E_s$
LC (5)	-16	-53	-78	-33	-103	-5	-5	-6	$D+F+L_o-/ADS/-E_s$
LC (6)	-424	-246	172	639	427	-19	16	86	$D+F+L_o+/ADS/+T_o+E_s$
LC (7)	-451	-307	12	595	256	-35	4	69	$D+F+L_o-/ADS/+T_o-E_s$
LC (8)	12	11	83	-2	39	12	7	12	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:

x-direction is horizontal, y-direction is vertical.
element number 1794

Plate thickness required for load combinations excluding thermal:	*0.08 inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations 6 and 7 including thermal:	*27.8 ksi*
Yield stress at temperature:	*55.0 ksi*
Maximum stress intensity range for load combinations 6 and 7 including thermal:	*28.9 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal:	*110.0 ksi*

(To be inserted)

Table 3.8.3-4 (Sheet 3 of 3)

DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL

Element number 1794

Plate thickness provided = 0.50 inches
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = 55.0 ksi
Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 110.0 ksi
(Note: The maximum principal stress for load combinations 6 and 7, and the maximum stress intensity range for these load combinations is much lower than the allowable.)

(To be deleted)

Table 3.8.3-5 (Sheet 1 of 3)

[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT MID-HEIGHT]*

Load/Comb.	*TX*	*TY*	*TXY*	*MX*	*MY*	*MXY*	*NX*	*NY*	*Comments*
	k/ft	*k/ft*	*k/ft*	*kft/ft*	*kft/ft*	*kft/ft*	*k/ft*	*k/ft*	
Dead (D)	0	-19	0	1	0	0	0	0	–
Hydro (F)	-2	2	-4	20	22	0	0	-1	–
Live (L)	0	-8	0	2	0	0	0	0	*During refueling*
Live (L_o)	0	-3	0	0	0	0	0	0	*During operation*
Live (ADS)	-1	9	-8	16	16	-1	0	1	–
E_s	13	60	57	40	30	7	1	5	–
Thermal (T_o)	-199	-196	7	406	392	14	-5	-6	–
LC (1)	-6	-15	-19	58	58	-1	1	1	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-3	-38	-6	33	31	-1	1	0	$1.4D+1.4F+1.7Lr$
LC (3)	-6	-10	-19	57	58	-1	1	1	$1.4D+1.4F+1.7ADS$
LC (4)	12	48	60	78	68	7	2	5	$D+F+L_o + /ADS/+E_s$
LC (5)	-17	-88	-69	-34	-25	-8	-1	-6	$D+F+L_o - /ADS/-E_s$
LC (6)	-187	-148	67	484	460	21	-3	-1	$D+F+L_o + /ADS/+T_o+E_s$
LC (7)	-216	-285	-61	372	367	6	-6	-12	$D+F+L_o - /ADS/+T_o-E_s$
LC (8)	9	53	45	77	68	6	2	5	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 4228

Plate thickness required for load combinations excluding thermal:	*0.14 inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations 6 and 7 including thermal:	*33.6 ksi*
Yield stress at temperature:	*36.0 ksi*
Maximum stress intensity range for load combinations 6 and 7 including thermal:	*33.6 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal:	*72.0 ksi*

(To be inserted)

Table 3.8.3-5 (Sheet 1 of 3)
*[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT]**

Element number 4228

Plate thickness provided = *0.50 inches*
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = *36.0 ksi*
Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 72.0 ksi
(Note: The maximum stress intensity range for these load combinations is much lower than the allowable.)

(To be deleted)

Table 3.8.3-5 (Sheet 2 of 3)

[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT BASE]*

Load/Comb.	*TX* k/ft	*TY* k/ft	*TXY* k/ft	*MX* kft/ft	*MY* kft/ft	*MXY* kft/ft	*NX* k/ft	*NY* k/ft	*Comments*
Dead (D)	-3	-23	0	0	0	0	0	0	–
Hydro (F)	1	3	-9	-4	-38	0	0	15	–
Live (L)	-1	-8	-1	0	-1	0	0	0	*During refueling*
Live (L_o)	0	-3	0	0	0	0	0	0	*During operation*
Live (ADS)	1	8	-10	-3	-27	0	0	9	–
E_s	11	66	47	14	98	1	1	21	–
Thermal (T_o)	-464	-83	89	424	446	12	12	-3	–
LC (1)	-1	-20	-31	-10	-99	-1	-1	36	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-5	-42	-15	-5	-54	-1	0	21	$1.4D+1.4F+1.7Lr$
LC (3)	-1	-15	-30	-10	-99	-1	-1	36	$1.4D+1.4F+1.7ADS$
LC (4)	10	50	47	13	88	1	1	45	$D+F+L_o + \|ADS\|+E_s$
LC (5)	-15	-98	-67	-20	-163	-2	-2	-15	$D+F+L_o - \|ADS\|-E_s$
LC (6)	-454	-33	137	437	534	13	13	42	$D+F+L_o + \|ADS\|+T_o+E_s$
LC (7)	-480	-182	22	404	283	10	10	-18	$D+F+L_o - \|ADS\|+T_o-E_s$
LC (8)	11	56	28	7	33	0	1	45	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 1943

Plate thickness required for load combinations excluding thermal:	*0.16 inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations 6 and 7 including thermal:	*42.3 ksi*
Yield stress at temperature:	*36.0 ksi*
Maximum stress intensity range for load combinations 6 and 7 including thermal:	*42.3 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal:	*72.0 ksi*

(To be inserted)

Table 3.8.3-5 (Sheet 2 of 3)
*[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT]**

Element number 1943

Plate thickness provided = *0.50 inches*
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = *36.0 ksi*
Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 72.0 ksi
(Note: The maximum stress intensity range for these load combinations is much lower than the allowable.)

(To be deleted)

Table 3.8.3-5 (Sheet 3 of 3)

[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA WEST END BOTTOM CORNER]*

Load/Comb.	TX k/ft	TY k/ft	TXY k/ft	MX kft/ft	MY kft/ft	MXY kft/ft	NX k/ft	NY k/ft	Comments
Dead (D)	-5	-32	2	-1	3	0	-1	-2	–
Hydro (F)	3	12	-9	-6	-13	3	1	3	–
Live (L)	-2	-14	1	0	1	0	0	-1	During refueling
Live (L_o)	-1	-6	0	0	1	0	0	-1	During operation
Live (ADS)	5	25	-9	-4	-11	2	2	2	–
E_s	42	247	52	11	88	3	12	34	–
Thermal (T_o)	-409	-276	259	398	669	12	-38	-179	–
LC (1)	5	3	-25	-16	-30	8	3	4	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-6	-51	-9	-10	-11	5	0	-1	1.4D+1.4F+1.7Lr
LC (3)	6	14	-24	-16	-32	8	4	5	1.4D+1.4F+1.7ADS
LC (4)	44	245	54	7	90	8	14	36	$D+F+L_o + /ADS/+E_s$
LC (5)	-50	-298	-68	-21	-107	-1	-13	-36	$D+F+L_o - /ADS/-E_s$
LC (6)	-364	-31	313	406	759	21	-24	-143	$D+F+L_o + /ADS/+T_o+E_s$
LC (7)	-459	-574	192	377	561	11	-51	-215	$D+F+L_o - /ADS/+T_o-E_s$
LC (8)	46	255	36	0	67	8	14	37	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:

x-direction is horizontal, y-direction is vertical.
element number 1933

Plate thickness required for load combinations excluding thermal:	*0.42 inches*
Plate thickness provided:	*0.50 inches*
Maximum principal stress for load combinations 6 and 7 including thermal:	*67.3 ksi*
Yield stress at temperature:	*36.0 ksi*
Maximum stress intensity range for load combinations 6 and 7 including thermal:	*67.3 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal:	*72.0 ksi*

(To be inserted)

Table 3.8.3-5 (Sheet 3 of 3)
*[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT]**

<u>Element number 1933</u>

Plate thickness provided = 0.50 inches
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = 36.0 ksi
Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 72.0 ksi
(Note: The maximum stress intensity range for these load combinations is much lower than the allowable.)

(To be deleted)

Table 3.8.3-6 (Sheet 1 of 3)

[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT MID-HEIGHT]*

	TX	*TY*	*TXY*	*MX*	*MY*	*MXY*	*NX*	*NY*	
Load/Comb.	***k/ft***	***k/ft***	***k/ft***	***kft/ft***	***kft/ft***	***kft/ft***	***k/ft***	***k/ft***	***Comments***
Dead (D)	*-1*	*-14*	*2*	*-1*	*-1*	*0*	*0*	*0*	–
Hydro (F)	*-4*	*-1*	*-3*	*20*	*22*	*3*	*0*	*-1*	–
Live (L)	*1*	*-12*	*0*	*-3*	*-2*	*0*	*0*	*-1*	*During refueling*
Live (L_o)	*0*	*-4*	*0*	*-1*	*0*	*0*	*0*	*0*	*During operation*
Live (ADS)	*-6*	*1*	*-4*	*21*	*21*	*4*	*0*	*1*	–
E_s	*16*	*22*	*49*	*19*	*24*	*6*	*1*	*3*	–
Thermal (T_o)	*-185*	*-84*	*90*	*348*	*356*	*1*	*-10*	*-12*	–
LC (1)	*-18*	*-25*	*-8*	*61*	*66*	*11*	*0*	*-1*	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	*-6*	*-42*	*0*	*22*	*27*	*3*	*0*	*-3*	*1.4D+1.4F+1.7Lr*
LC (3)	*-18*	*-19*	*-8*	*62*	*67*	*11*	*0*	*-1*	*1.4D+1.4F+1.7ADS*
LC (4)	*18*	*4*	*53*	*59*	*66*	*13*	*0*	*2*	$D+F+L_o+ \|ADS\|+E_s$
LC (5)	*-27*	*-41*	*-53*	*-22*	*-22*	*-8*	*-1*	*-5*	$D+F+L_o- \|ADS\|-E_s$
LC (6)	*-168*	*-79*	*143*	*407*	*422*	*14*	*-9*	*-11*	$D+F+L_o+ \|ADS\|+T_o+E_s$
LC (7)	*-213*	*-125*	*37*	*326*	*334*	*-7*	*-10*	*-17*	$D+F+L_o- \|ADS\|+T_o-E_s$
LC (8)	*5*	*9*	*43*	*59*	*66*	*13*	*1*	*2*	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 40026

Plate thickness required for load combinations excluding thermal: *0.10 inches*
Plate thickness provided: *0.50 inches*

Maximum principal stress for load combinations 6 and 7 including thermal: *37.6 ksi*
Yield stress at temperature: *36.0 ksi*

Maximum stress intensity range for load combinations 6 and 7 including thermal: *37.6 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal: *72.0 ksi*

(To be inserted)

Table 3.8.3-6 (Sheet 1 of 3)

*[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST]**

<u>Element number 40026</u>

Plate thickness provided = 0.50 inches
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = 36.0 ksi
Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 72.0 ksi
(Note: The maximum stress intensity range for these load combinations is much lower than the allowable.)

(To be deleted)

Table 3.8.3-6 (Sheet 2 of 3)

[*DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA MID-SPAN AT BOTTOM – ELEVATION 107'-2"*]*

	TX	TY	TXY	MX	MY	MXY	NX	NY	
Load/Comb.	**k/ft**	**k/ft**	**k/ft**	**kft/ft**	**kft/ft**	**kft/ft**	**k/ft**	**k/ft**	**Comments**
Dead (D)	-2	-18	3	0	3	1	0	0	–
Hydro (F)	-1	0	-5	2	-13	2	0	11	–
Live (L)	0	-10	1	0	3	0	0	-1	*During refueling*
Live (L_o)	0	-3	0	0	2	0	0	0	*During operation*
Live (ADS)	-1	2	-6	1	-13	2	1	8	–
E_s	16	31	58	4	37	3	1	10	–
Thermal (T_o)	-382	-35	184	419	479	11	3	-18	–
LC (1)	-5	-26	-12	6	-34	8	2	29	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-5	-41	-2	4	-9	4	0	14	$1.4D+1.4F+1.7Lr$
LC (3)	-5	-21	-12	5	-37	7	2	2	$1.4D+1.4F+1.7ADS$
LC (4)	14	13	63	8	41	8	2	29	$D+F+L_o+\|ADS\|+E_s$
LC (5)	-20	-53	-66	-3	-59	-3	-1	-7	$D+F+L_o-\|ADS\|-E_s$
LC (6)	-368	-22	247	427	520	20	5	11	$D+F+L_o+\|ADS\|+T_o+E_s$
LC (7)	-401	-88	119	416	420	9	2	-25	$D+F+L_o-\|ADS\|+T_o-E_s$
LC (8)	12	17	51	8	13	8	2	29	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:
x-direction is horizontal, y-direction is vertical.
element number 40006

Plate thickness required for load combinations excluding thermal: *0.09 inches*
Plate thickness provided: *0.50 inches*

Maximum principal stress for load combinations 6 and 7 including thermal: *50.0 ksi*
Yield stress at temperature: *36.0 ksi*

Maximum stress intensity range for load combinations 6 and 7 including thermal: *50.0 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal: *72.0 ksi*

(To be inserted)

Table 3.8.3-6 (Sheet 2 of 3)
[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST]

Element number 40006

Plate thickness provided = 0.50 inches

(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:

Yield stress at design temperature = 36.0 ksi

Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 72.0 ksi

(Note: The maximum stress intensity range for these load combinations is much lower than the allowable.)

(To be deleted)

Table 3.8.3-6 (Sheet 3 of 3)

[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISON TO ACCEPTANCE CRITERIA NORTH END BOTTOM CORNER – ELEVATION 107'-2"]*

	TX	TY	TXY	MX	MY	MXY	NX	NY	
Load/Comb.	k/ft	k/ft	k/ft	kft/ft	kft/ft	kft/ft	k/ft	k/ft	Comments
Dead (D)	0	-13	3	0	0	0	0	0	–
Hydro (F)	-1	17	6	10	17	14	-6	-14	–
Live (L)	0	-9	2	0	1	0	0	0	During refueling
Live (L_o)	0	-2	1	0	0	0	0	0	During operation
Live (ADS)	-1	27	7	12	24	14	-6	-17	–
E_s	5	57	41	15	41	12	7	17	–
Thermal (T_o)	-99	155	256	173	394	-65	24	70	–
LC (1)	-4	49	26	34	65	43	-18	-47	$1.4D+1.4F+1.7L_o+1.7ADS$
LC (2)	-2	-10	17	13	26	19	-9	-19	$1.4D+1.4F+1.7Lr$
LC (3)	-4	53	25	34	65	44	-18	-48	$1.4D+1.4F+1.7ADS$
LC (4)	5	86	58	37	83	40	7	20	$D+F+L_o+/ADS/+E_s$
LC (5)	-8	-82	-38	-18	-47	-12	-19	-48	$D+F+L_o-/ADS/-E_s$
LC (6)	-94	241	314	209	477	-25	30	90	$D+F+L_o+/ADS/+T_o+E_s$
LC (7)	-107	73	218	155	347	-77	4	22	$D+F+L_o-/ADS/+T_o-E_s$
LC (8)	2	90	57	37	82	40	-5	-13	$0.9D+1.0F+1.0ADS+1.0E_s$

Notes:

x-direction is horizontal, y-direction is vertical.
element number 40001

Plate thickness required for load combinations excluding thermal: *0.24 inches*
Plate thickness provided: *0.50 inches*

Maximum principal stress for load combinations 6 and 7 including thermal: *58.7 ksi*
Yield stress at temperature: *36.0 ksi*

Maximum stress intensity range for load combinations 6 and 7 including thermal: *61.6 ksi*
Allowable stress intensity range for load combinations 6 and 7 including thermal: *72.0 ksi*

(To be inserted)

Table 3.8.3-6 (Sheet 3 of 3)

*[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST]**

<u>Element number 40001</u>

Plate thickness provided *= 0.50 inches*

(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:

Yield stress at design temperature *= 36.0 ksi*

Allowable stress intensity range for load combinations 6 and 7 (including thermal) = 72.0 ksi

(Note: The maximum stress intensity range for these load combinations is much lower than the allowable.)

To be deleted

Table 3.8.3-7

DESIGN SUMMARY OF STEEL WALL OF IRWST

Mechanical Loads Only
AISC Interaction Ratio

Section Location and Element Number	T Section	L Section	Load Combination
TYPICAL COLUMN AT MIDDLE OF WALL			
Top (39701)	0.012	0.407	D + F + L_o + ADS (LC # 1)
	0.067	0.212	D + F + L_o + ADS + E_s (LC # 5)
Mid-height (39696)	0.105	0.337	D + F + L_o + ADS (LC # 1)
	0.082	0.111	D + F + L_o + ADS + E_s (LC # 5)
Bottom (39690)	0.387	0.064	D + F + L_o + ADS (LC # 1)
	0.330	0.067	D + F + L_o + ADS + E_s (LC # 5)
ENVELOPE OF ALL LOCATIONS AND LOAD COMBINATIONS			
	0.563	0.775	LC # 1 to 5 and 8

Mechanical Plus Thermal Loads
Ratio of Stress to AISC or ASME (2 * Sy = 80 ksi)

Section Location and Element Number	Flange of T Section	Flange of L Section	Plate	Load Combination
TYPICAL COLUMN AT MIDDLE OF WALL				
Top (39701)	0.103 AISC	0.314 AISC	–	D+F+L_o+ADS+E_s+T (LC # 7)
Mid-height (39696)	0.303 AISC	0.968 AISC	–	D+F+L_o+ADS+E_s+T (LC # 7)
Bottom (39690)	0.46 ASME	0.36 ASME	0.78	D+F+L_o+ADS+E_s+T (LC # 7)
ENVELOPE OF ALL LOCATIONS AND LOAD COMBINATIONS				
–	0.72 ASME	0.73 ASME	0.89	LC # 6, 7 and 9

Note:
Results of the evaluation of mechanical and thermal loads are shown against the AISC allowables when the stresses are less than yield. Portions of the steel wall at the end of the wall exceed yield due to the restraint provided by the adjacent concrete. These areas are evaluated against the ASME allowables as described in subsection 3.8.3.5.3.4.

(To be inserted)

Table 3.8.3-7

DESIGN SUMMARY OF STEEL WALL OF IRWST

Mechanical Loads Only AISC Interaction Ratio			
Section Location and Element Number	**T Section**	**L Section**	**Load Combination**
TYPICAL COLUMN AT MIDDLE OF WALL			
Top (39701)	< 1.0	< 1.0	$D + F + L_o + ADS$ (LC # 1)
	< 1.0	< 1.0	$D + F + L_o + ADS + E_s$ (LC # 5)
Mid-height (39696)	< 1.0	< 1.0	$D + F + L_o + ADS$ (LC # 1)
	< 1.0	< 1.0	$D + F + L_o + ADS + E_s$ (LC # 5)
Bottom (39690)	< 1.0	< 1.0	$D + F + L_o + ADS$ (LC # 1)
	< 1.0	< 1.0	$D + F + L_o + ADS + E_s$ (LC # 5)
ENVELOPE OF ALL LOCATIONS AND LOAD COMBINATIONS			
	<1.0	<1.0	LC # 1 to 5 and 8

Mechanical Plus Thermal Loads Ratio of Stress to AISC or ASME (2 * Sy = 80 ksi)				
Section Location and Element Number	**Flange of T Section**	**Flange of L Section**	**Plate**	**Load Combination**
TYPICAL COLUMN AT MIDDLE OF WALL				
Top (39701)	<1.0AISC	<1.0AISC	–	$D+F+L_o+ADS+E_s+T$ (LC # 7)
Mid-height (39696)	<1.0AISC	<1.0AISC	–	$D+F+L_o+ADS+E_s+T$ (LC # 7)
Bottom (39690)	<1.0AISC	<1.0AISC	<1.0	$D+F+L_o+ADS+E_s+T$ (LC # 7)
ENVELOPE OF ALL LOCATIONS AND LOAD COMBINATIONS				
–	<1.0 ASME	<1.0 ASME	<1.0	LC # 6, 7 and 9

Note:
Results of the evaluation of mechanical and thermal loads are shown against the AISC allowables when the stresses are less than yield. Portions of the steel wall at the end of the wall exceed yield due to the restraint provided by the adjacent concrete. These areas are evaluated against the ASME allowables as described in subsection 3.8.3.5.3.4.

DCD APPENDIX 3H Changes

Tables and Figures which are to be replaced are tabulated below.

Walls and Slabs	Replaced Tables and Figures	
	Delete	Insert
South wall of auxiliary building (column line 1), elevation 66′-6″ to elevation 180′-0″	Table 3H.5-2 (2 Sheets)	--
	Table 3H.5-3	Table 3H.5-3
	Figure 3H.5-2	Figure 3H.5-2, Sheet.1
	Figure 3H.5-3	Figure 3H.5-3
Interior wall of auxiliary building (column line 7.3), elevation 66′-6″ to elevation 160′-6″	Table 3H.5-4	--
	Table 3H.5-5	Table 3H.5-5
	-	Figure 3H.5-2, Sheet 2
	Figure 3H.5-4 (2 Sheets)	Figure 3H.5-4
West wall of main control room in auxiliary building (column line L), elevation 117′-6″ to elevation 153′-0″	Table 3H.5-6	--
	-	Figure 3H.5-2, Sheet 3
	Table 3H.5-7	Table 3H.5-7
	Figure 3H.5-12	Figure 3H.5-12
North wall of MSIV west compartment (column line 11), elevation 117′-6″ to elevation 153′-0″	Figure 3H.5-5 (3 Sheets)	Figure 3H.5-5 (3 Sheets)
Floor slab on metal decking at elevation 135′-3″	Table 3H.5-11	Table 3H.5-11
	Figure 3H.5-6	Figure 3H.5-6
2′-0″ slab in auxiliary building (tagging room ceiling) at elevation 135′-3″	Table 3H.5-12	Table 3H.5-12
	Figure 3H.5-8	Figure 3H.5-8
Finned floor in the main control room at elevation 135′-3″	Table 3H.5-13	Table 3H.5-13
	Figure 3H.5-9 (Sheet 1 of 3)	Figure 3H.5-9 (Sheet 1 of 3)
Divider wall between the spent fuel pool and the fuel transfer canal	Table 3H.5-8 (5 Sheets)	Table 3H.5-8 (2 Sheets)
	Figure 3H.5-10	Figure 3H.5-10

Modify 3H.5.1.1 thru 3H.5.1.3 as follows:

3H.5.1.1 Exterior Wall at Column Line 1

[*The wall at column line 1 is the exterior wall at the south end of the nuclear island. The reinforced concrete wall extends from the top of the basemat at elevation 66'-6" to the roof at elevation 180'-0". It is 3'-0" thick below the grade and 2'-3" thick above the grade.*

The wall is designed for the applicable loads including dead load, live load, hydrostatic load, static and dynamic lateral soil pressure loads, seismic loads, and thermal loads. For various segments of this wall, ~~the corresponding governing load combination and associated design loads are shown in Table 3H.5-2.~~ Table 3H.5-3 presents the details of the wall reinforcement. The sections where the required reinforcement is calculated are shown in Figure 3H.5-2 (sheet 1). The actual reinforcement provided is compared to the required reinforcement area for each wall segment. Typical wall reinforcement is also shown on Figure 3H.5-3.]*

3H.5.1.2 Wall at Column Line 7.3

[*The wall at column line 7.3 is a shear wall that connects the shield building and the nuclear island exterior wall at column line I. It extends from the top of the basemat at elevation 66'-6" to the top of the roof. The wall is 3 feet thick below the grade at elevation 100'-0" and 2 feet thick above the grade. Out-of-plane lateral support is provided to the wall by the floor slabs on either side of it and the roof at the top.*

~~*Wall 7.3 is designed for the applicable loads described in subsection 3H.3.3.*~~

~~*For various segments of this wall, the corresponding governing load combination and associated design loads are shown in Table 3H.5-4.*~~

Table 3H.5-5 presents the details of the wall reinforcement. The sections where the required reinforcement is calculated are shown in Figure 3H.5-2 (sheet 2). The actual reinforcement provided is compared to the required reinforcement area for each wall segment. Typical wall reinforcement is also shown on Figure 3H.5-4]*

3H.5.1.3 Wall at Column Line L

[*The wall at column line L is a shear wall on the west side of the Main Control Room. It extends from the top of the basemat at elevation 66'-6" to the top of the roof. The wall is 2 feet thick. Out-of-plane lateral support is provided to the wall by the floor slabs on either side of it and the roof at the top. The segment of the wall that is a part of the main control room boundary is from elevation 117'-6" to elevation 135'-3".*

The auxiliary building design loads are described in subsection 3H.3.3, and the wall is designed for the applicable loads. In addition to the dead, live and seismic loads, the *wall is designed to withstand a 6 pounds per square inch pressure load due to a pipe break in the MSIV room even though it is a break exclusion area. This wall segment is also designed to withstand a jet load due to the pipe break.*

The governing load combination and associated design loads are those due to the postulated pipe rupture and are shown in Table 3H.5-6.

Table 3H.5-7 and Figure 3H.5-12 present the details of the wall reinforcement. The sections where the required reinforcement is calculated are shown in Figure 3H.5-2 (sheet 3). The actual reinforcement provided is compared to the required reinforcement area for each wall segment.]*

Modify 3H.5.5.1 thru 3H.5.6.3 as follows:

3H.5.5.1 West Wall of Spent Fuel Pool

[Figure 3H.5-10 shows an elevation of the west wall of the spent fuel pool (column line L-2), and element numbers in the finite element model. The wall is a 4 feet thick concrete filled structural wall module.

A finite element analysis ~~of the spent fuel building module~~ is performed for seismic, thermal and hydrostatic loads with the following assumptions:

* ~~*The analysis model includes the structure between Lines 2 and 4, Lines I and N, and between El. 66'-6" and 135'-3", and is fixed at the base. There is no support at elevation 135'-3".*~~

* <u>*The seismic input consists of the equivalent static accelerations derived from the maximum acceleration results by the FE model time history analyses.*</u>

* *The thermal loads are applied as linearly varying temperatures between the inner and outer faces of the walls and floors.*

* *The hydrostatic loads are applied to the spent fuel pool walls and floors, which is considered full with water. This provides the loads for the design of the divider wall.*

* *The seismic sloshing is modeled in the spent fuel pool.*

The concrete filled structural wall modules are designed as reinforced concrete structures in accordance with the requirements of ACI-349. The face plates are treated as reinforcing steel.

Methods of analysis are based on accepted principles of structural mechanics and are consistent with the geometry and boundary conditions of the structures. Both computer codes and hand calculations are used.

*Table 3H.5-8 shows the magnitude of typical design loads, load combinations, and the required and provided plate thickness for certain critical locations. The steel plates are generally half inch thick. The plate thickness is increased close to the bottom of the gate through the wall where the opening results in high local member forces. The first part of the table shows the member forces due to individual loading. The lower part of the table shows the governing load combinations. The steel plate thickness required to resist mechanical loads is shown at the bottom of the table as well as the thickness provided. The maximum principal stress for the load combination including thermal is also tabulated. If this value exceeds the yield stress at temperature, a supplemental evaluation is performed. For these cases, the maximum stress intensity range is shown together with the allowable stress intensity range which is twice the yield stress at the temperature.]**

(To be deleted)

Table 3H.5-2 (Sheet 1 of 2)

***[EXTERIOR WALL ON COLUMN LINE 1
FORCES AND MOMENTS IN CRITICAL LOCATIONS]****

(See Figure 3H.5-2 for Locations of Wall Sections.)

Load Type	Load Description	Out-of-Plane Moment (k-ft/ft)						Out-of-Plane Shear (kips/ft)			
		Wall Section						Wall Section			
		1	2	3	4	5	6	1	3	4	6
D	DEAD LOAD										
	Wall Weight	-5.3	5.92	2.2	0.7	0.7	2.2	-1.4	-0.4	-0.4	0.6
	Static Surcharge	2.1	-1.7	0.5	0.4	-0.8	0.4	1.5	-1.9	2.2	-1.6
L	LIVE LOAD										
	Floor Live Load	-1.2	0.9	0.6	-0.1	-0.7	-0.3	-0.2	-0.2	-0.2	-0.2
	Crane/Cask Load	0	0	-0.1	-0.1	0.9	0.4	-0.2	-0.05	-0.2	-0.2
	Hydrostatic	29.2	-13.9	2.1	3.2	-1.3	1.2	14.4	-3.1	1.5	-0.5
H	LATERAL SOIL PRESSURE										
	At Rest Pressure	14.5	-6.9	2.1	2.5	-0.7	1.10	7.7	-1.6	0.6	-0.4
E_s	SEISMIC										
	Global Behavior	12.1	5.5	5.4	5.3	3.3	3.5	3.48	1.6	1.4	9.8
	Passive Soil Press.	-164.1	-76.5	7.4	11.2	-7.6	9.7	77.6	-19.8	-18.4	-3.6
	Dyn. Soil Press.	-103.1	-47.6	5.4	4.7	-15.1	-8.4	49.3	24.9	-9.0	-6.5
T_o	THERMAL										
	Operating	8.9	3.2	7.2	9.5	20.1	42.4	0.6	0.6	-1.5	-6.8

Notes:
Moment w/o sign indicates tension on the outside face of wall.
Moment w/- sign indicates tension on the inside face of wall.

Load Type	Load Description	In-Plane Axial and Shear Loads (kips/ft)(1)			
		Vertical		Horizontal	
		Tension/Compression	Shear	Tension/Compression	Shear
E_o	SEISMIC				
	El. 66.5' to 100.0'	154.8	93.8	23.0	93.8
	El. 100.0' to 180'	159.9	62.9	77.1	62.9

~~Note:~~
~~1. The in-plane loads provided in the table above are enveloping values for the wall panel at the elevations shown.~~

(To be deleted)

Table 3H.5-2 (Sheet 2 of 2)

[EXTERIOR WALL ON COLUMN LINE 1 FORCES AND MOMENTS IN CRITICAL LOCATIONS]*

Load Type	Load Description	Out-of-Plane Moment (k-ft/ft)						Out-of-Plane Shear (kips/ft)			
		Wall Section						Wall Section			
		7	8	9	10	11	12	7	9	10	12
D	DEAD LOAD										
	Wall Weight	-2.2	3.7	2.3	0.7	0.2	0.2	0.05	0.05	0.1	0.2
	Static Surcharge	0.3	0	0	0	0	0	0.03	0.03	0	0
L	LIVE LOAD										
	Floor Live Load	-1.6	2.0	1.3	1.4	-1.8	-0.6	0.3	-0.2	-1.6	-1.6
	Crane/Cask Load	0.4	-2.6	-2.9	9.8	0.9	-1.8	-0.2	-0.3	-0.4	-0.7
	Hydrostatic	-1.60	0	0.40	0.40	0	0	-0.1	0	0	0
H	LATERAL SOIL PRESSURE										
	At Rest Pressure	1.1	0	-0.30	-0.2	0	0	0	0	0	0
E_s	SEISMIC										
	Global Behavior	25.2	74.4	78.7	79.1	115.4	27.7	13.1	4.3	13.7	13.5
	Passive Soil Press.	8.6	0	-0.1	-0.3	0	0	0	0	0	0
	Dyn. Soil Press.	7.3	0	0	0	0	0	0	0	0	0
T_o	THERMAL										
	Operating	51.2	65.4	74.5	77.6	43.1	12.4	-0.6	-1.2	6.2	3.6

Notes:
Moment w/o sign indicates tension on the outside face of wall.
Moment w/- sign indicates tension on the inside face of wall.

(To be deleted)

Table 3H.5-3

[EXTERIOR WALL ON COLUMN LINE 1
DETAILS OF WALL REINFORCEMENT (in^2/ft)]*

(See Figure 3H.5-2 for Locations of Wall Sections.)

Load Combination	Location	Required			Provided		
		Vertical	Horizontal	Shear	Vertical	Horizontal	Shear
WALL SECTION 1, 2, 3							
				0.5			0.80
$1.0D+1.0L+1.0H+1.0E_s$	Outside Face	2.9	1.1		4.16	1.27	
	Inside Face	1.9	1.1		2.67	1.27	
WALL SECTION 4, 5, 6							
				0.25			0.40
$1.0D+1.0L+1.0H+T_o$	Outside Face	1.4	1.0		3.12	1.27	
	Inside Face	1.4	1.15		2.67	1.27	
WALL SECTION 7, 8, 9							
				NR			None
$1.0D+1.0L+1.0H+1.0T_o$	Outside Face	2.5	3.0		3.12	3.12	
	Inside Face	2.1	1.2		3.12	1.69	
WALL SECTION 10, 11, 12							
				NR			None
$1.0D+1.0L+1.0H+1.0T_a$	Outside Face	2.8	2.5		3.74	3.12	
	Inside Face	1.2	1.5		3.12	2.34	

~~Note:~~
~~NR – Not Required~~

To be inserted

Table 3H.5-3

**[*EXTERIOR WALL ON COLUMN LINE 1*
DETAILS OF WALL REINFORCEMENT (in^2/ft)]***

(See Figure 3H.5-2 for Locations of Wall Sections.)

Wall Segment	Location	Provided		
		Vertical	Horizontal	Shear
Elevation 180'-0" to 135'-3"				*None*
WALL SECTION 1, 6	*Outside Face*	*3.91*	*3.12*	
	Inside Face	*3.12*	*3.12*	
Elevation 135'-3" to 100'-0"				*None*
WALL SECTION 2,3,7	*Outside Face*	*3.12*	*3.12*	
	Inside Face	*3.12*	*1.56*	
Elevation 100'-0" to 82'-6"				*0.44*
WALL SECTION 4,8	*Outside Face*	*3.12*	*1.56*	
	Inside Face	*3.12*	*1.27*	
Elevation 82'-6" to 66'-6"				*1.00*
WALL SECTION 5,9	*Outside Face*	*4.39*	*1.27*	
	Inside Face	*3.12*	*1.27*	

Figure to be deleted

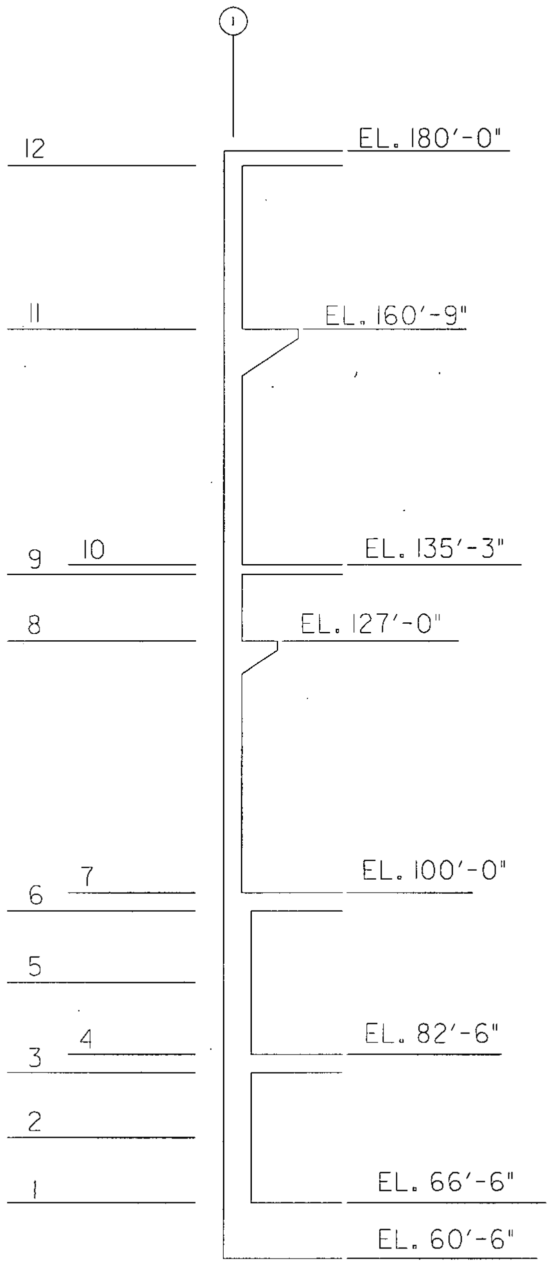


Figure 3H.5-2

[***Wall on Column Line 1***]*

Figure to be inserted

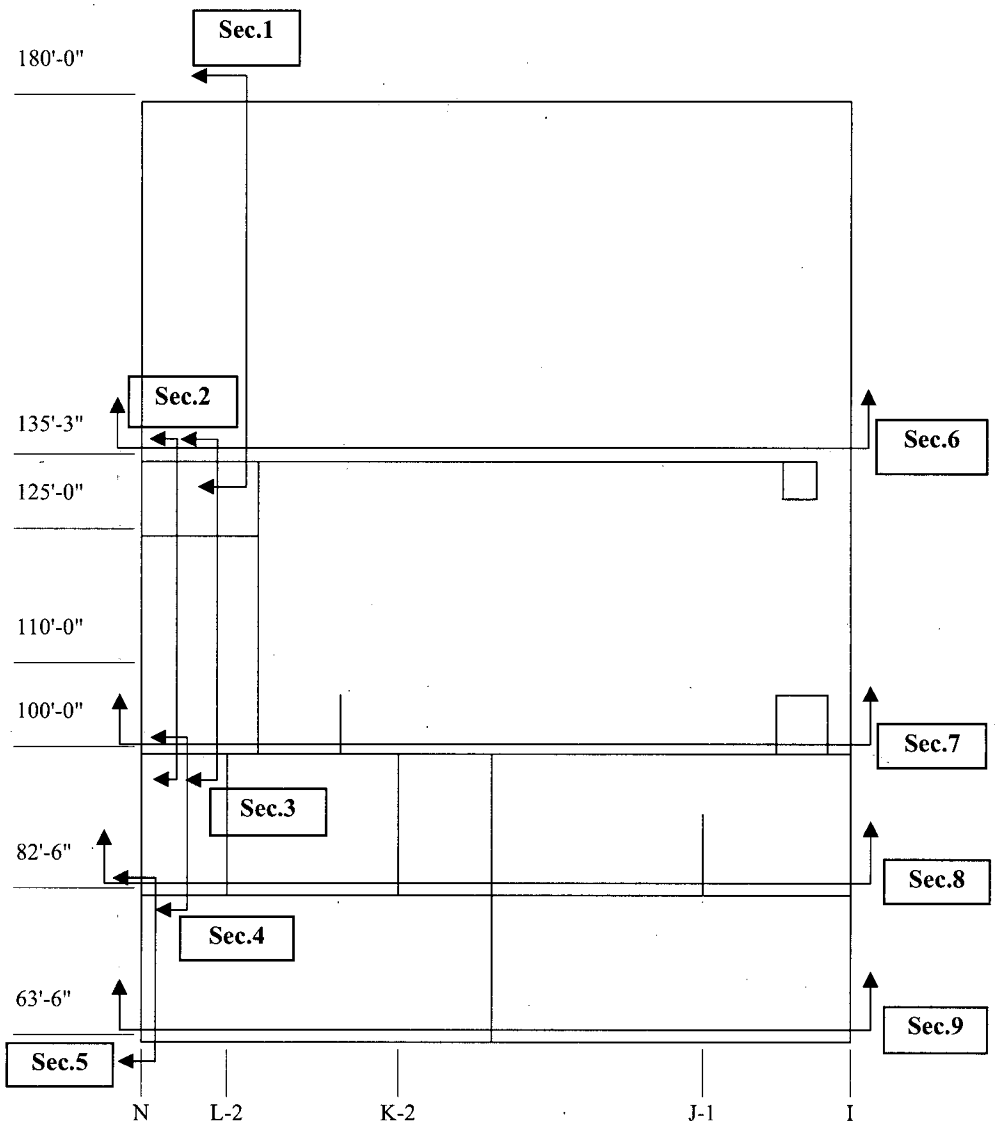


Figure 3H.5-2 (Sheet 1)

[***Wall on Column Line 1***]*

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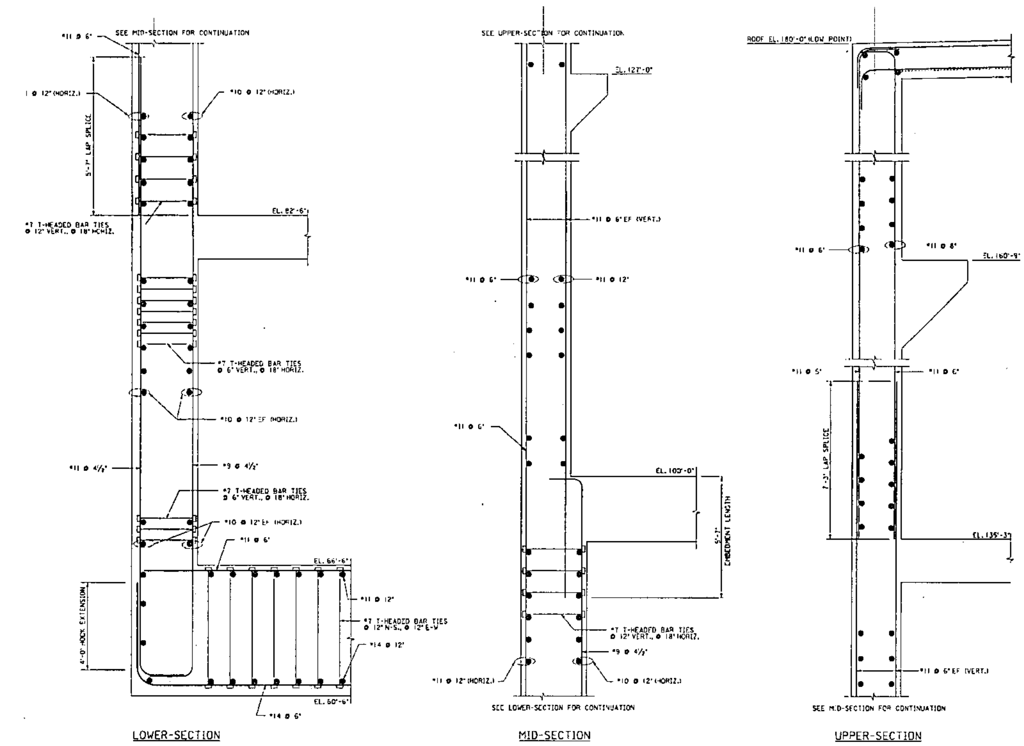


Figure 3H.5-3

*[Typical Reinforcement in Wall on Column Line 1]**

Figure to be inserted

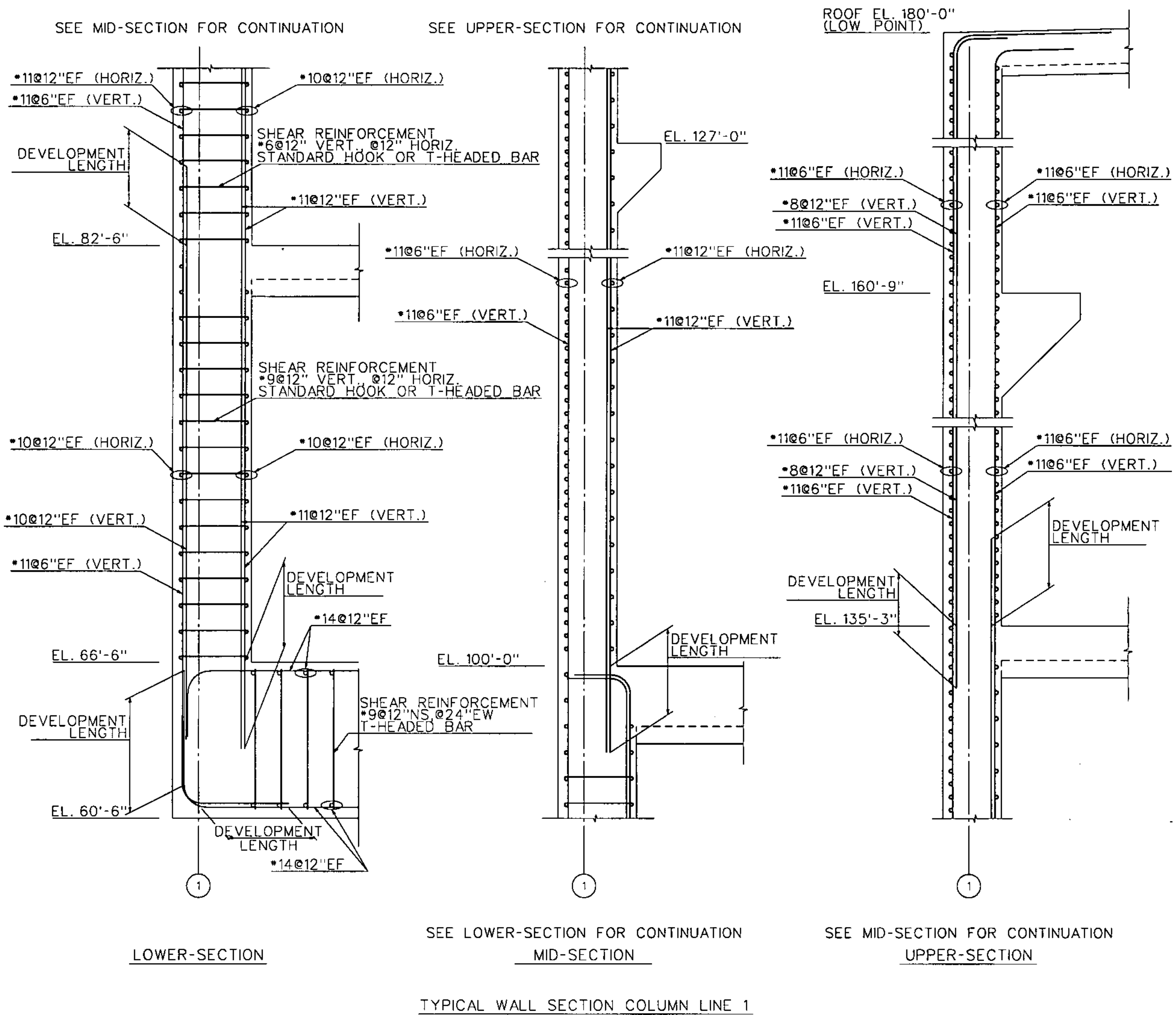


Figure 3H.5-3

[Typical Reinforcement in Wall on Column Line 1]*

(Table to be deleted)

Table 3H.5-4

***[INTERIOR WALL AT COLUMN LINE 7.3
FORCES AND MOMENTS IN CRITICAL LOCATIONS]****

(Units: kips, ft)

Load Combination	M_X	M_Y	M_{XY}	T_X	T_Y	T_{XY}
From Roof to Elevation 135'-3"						
$0.9D - E_s$		37.7	54.6		157.2	253.9
$0.9D + T_o + E_s$	265.5		56.2	488.3		160.5
Elevation 135'-3" to 117'-6"						
$0.9D + T_o + E_s$		3.5	0.6		208.8	68.7
$D + L - E_s$	0.7		0.7	35.4		160.4
Elevation 117'-6" to 100'-0"						
$D + T_o + E_s$		14.4	3.0		146.2	132.0
$D + L - E_s$	0.7		1.5	117.9		205.7
Elevation 100'-0" to 82'-6"						
$0.9D + T_o - E_s$		5.5	1.2		93.7	182.5
$0.9D + T_o - E_s$	9.6		1.2	42.8		182.5
Elevation 82'-6" to 66'-6"						
$0.9D + T_o + E_s$		20.9	2.9		86.8	41.0
$D + L - E_s$	5.3		1.7	40.5		8.7

~~Note:~~
~~X is along the horizontal direction, and Y is in the vertical direction.~~

(Table to be deleted)

Table 3H.5-5

[INTERIOR WALL ON COLUMN LINE 7.3 DETAILS OF WALL REINFORCEMENT]*

Wall Segment	*Location*	***Reinforcement on Each Face (in²/ft)***	
		Required	***Provided***
From Roof to Elevation 155'-6"	*Horizontal (1)*	3.67	6.24
	Vertical (1)	2.86	3.12
Elevation 155'-6" to 135'-3"	*Horizontal*	4.47	5.66
	Vertical	4.30	5.66
Elevation 135'-3" to 124'-0"	*Horizontal*	1.76	2.06
	Vertical	2.20	2.56
Elevation 124'-0" to 117'-6"	*Horizontal*	1.75	2.06
	Vertical	2.44	2.56
Elevation 117'-6" to 107'-0"	*Horizontal*	2.99	3.12
	Vertical	2.78	3.12
Elevation 107'-0" to 100'-0"	*Horizontal*	2.30	2.56
	Vertical	2.86	3.12
Elevation 100'-0" to 82'-6"	*Horizontal*	1.93	2.06
	Vertical	2.29	2.54
Elevation 82'-6" to 66'-6"	*Horizontal*	0.78	1.00
	Vertical	0.97	1.44
Wall Segment	***Location***	***Reinforcement (in²/ft²)***	
		Required	***Provided***
From Roof to Elevation 155'-6"	*Stirrups*	2.61	3.60
Elevation 155'-6" to 135'-3"	*Stirrups*	2.05	2.64

~~***Note:***~~

~~1. *Additional local reinforcement in this wall segment, at the interface with the shield building, is shown in the figure.*~~

Table to be inserted

Table 3H.5-5

[INTERIOR WALL ON COLUMN LINE 7.3 DETAILS OF WALL REINFORCEMENT]*

(SEE FIGURE 3H.5-2 FOR LOCATIONS OF WALL SECTIONS.)

Wall Segment	***Location***	***Wall Section***	***Reinforcement on Each Face (in^2/ft)***
			Provided
From Roof to Elevation 155'-6"	*Horizontal*	*1*	*2.54*
	Vertical	*7*	*2.54*
Elevation 155'-6" to 135'-3"	*Horizontal*	*2*	*2.54*
	Vertical	*8*	*2.54*
Elevation 135'-3" to 117'-6"	*Horizontal*	*3*	*2.00*
	Vertical	*9*	*2.54*
Elevation 117'-6" to 100'-0"	*Horizontal*	*4*	*2.54*
	Vertical	*10*	*2.54*
Elevation 100'-0" to 82'-6"	*Horizontal*	*5*	*1.56*
	Vertical	*11*	*1.56*
Elevation 82'-6" to 66'-6"	*Horizontal*	*6*	*1.00*
	Vertical	*12*	*1.56*
Shear Reinforcement:			
From Roof to Elevation 155'-6"	*Standard hook or T headed bar*	*7*	*0.20*

Figure to be inserted

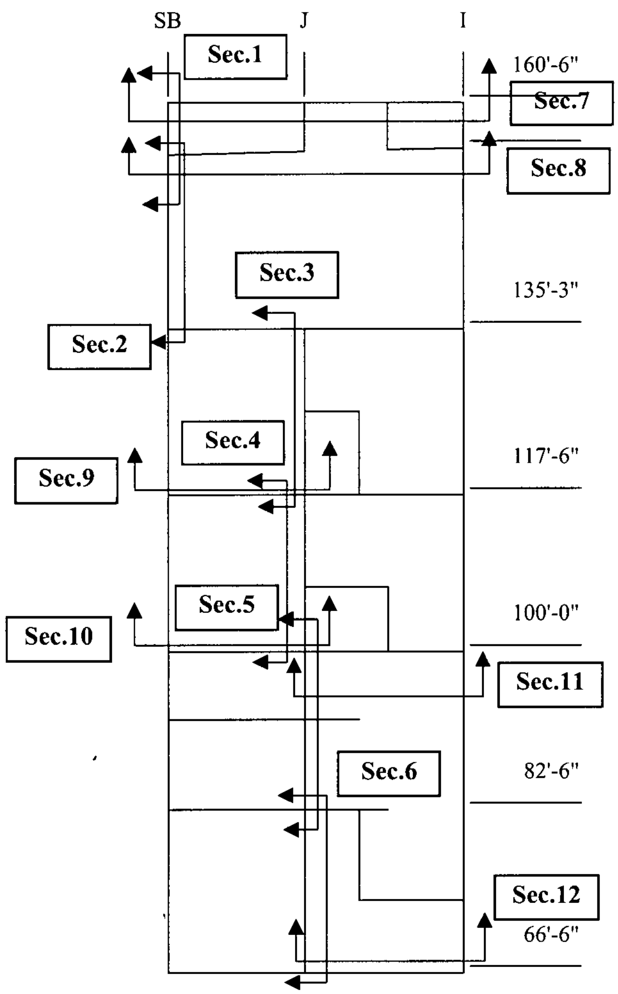


Figure 3H.5-2 (Sheet 2)

[*Wall on Column Line 7.3*]*

Figure to be deleted

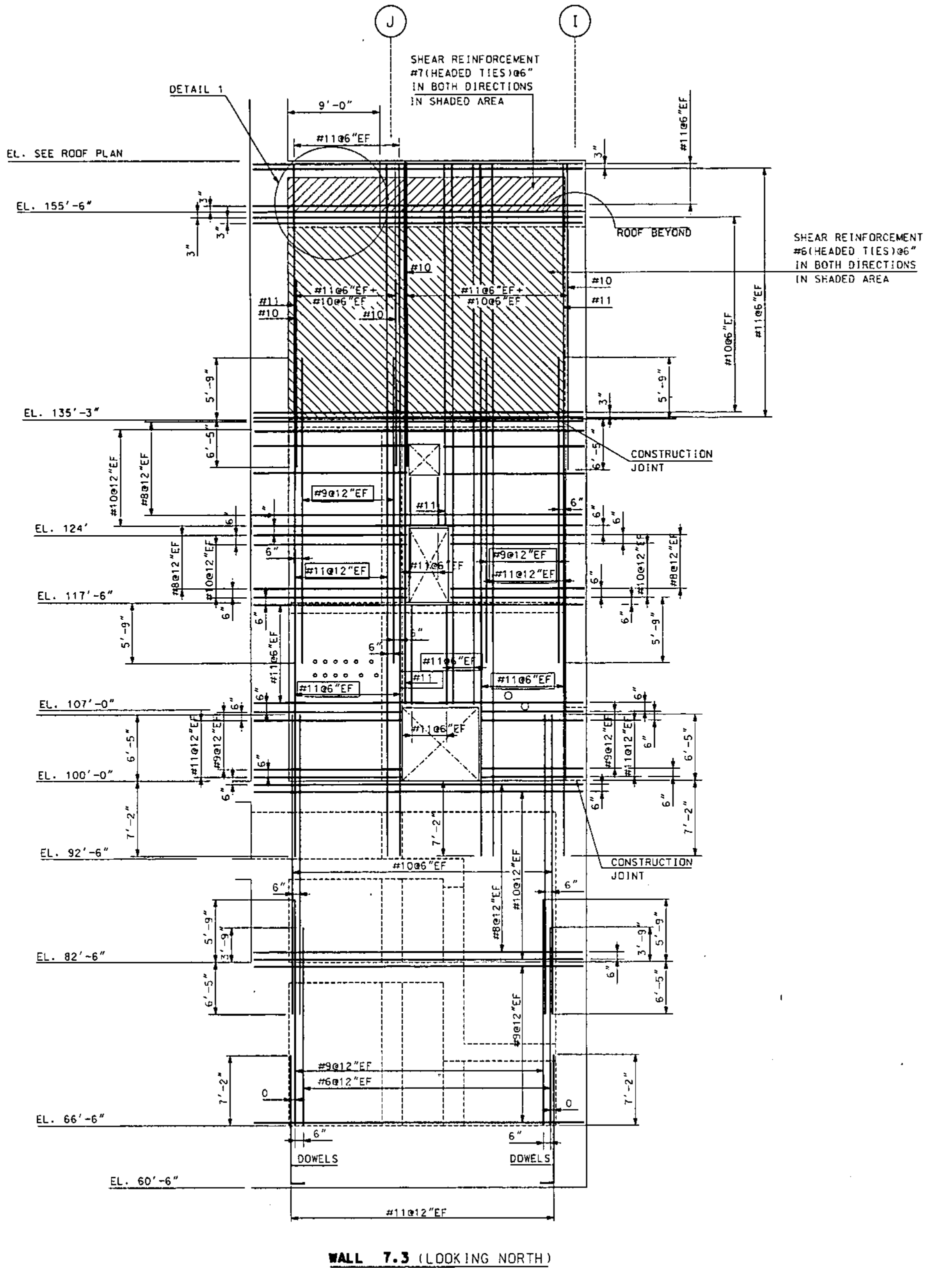
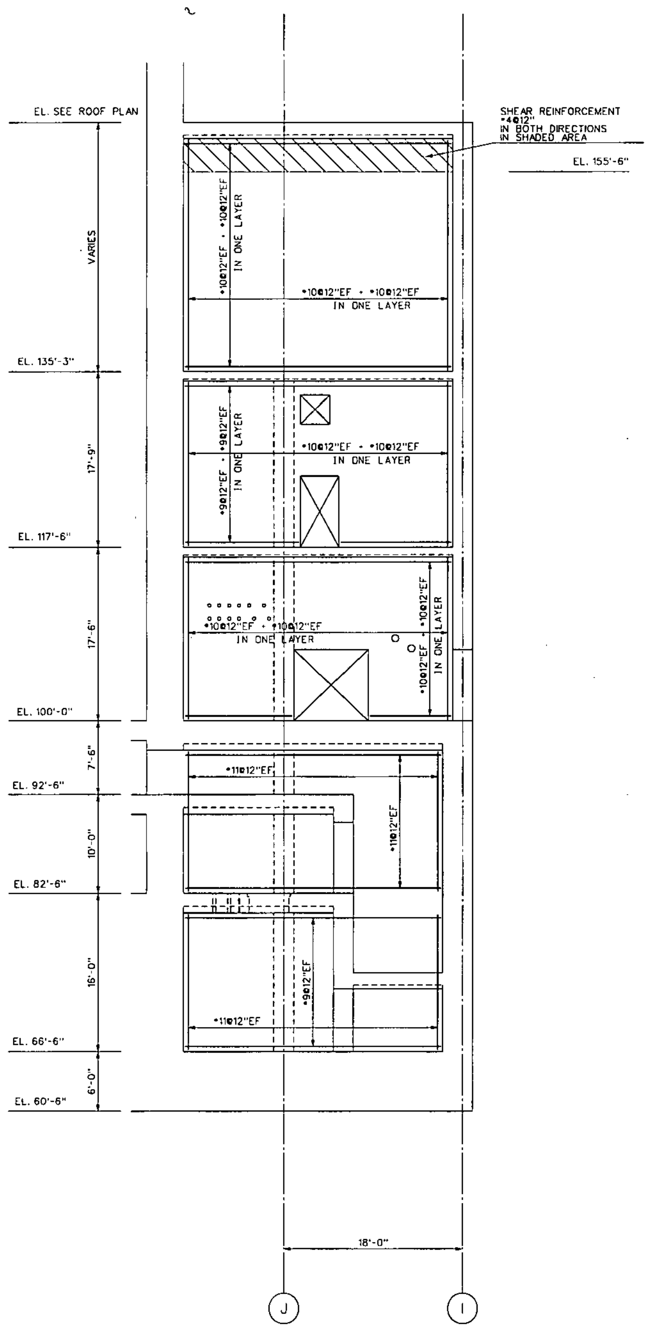


Figure 3H.5-4 (Sheet 1 of 2)

[*Typical Reinforcement in Wall 7.3*]*

Figure to be inserted

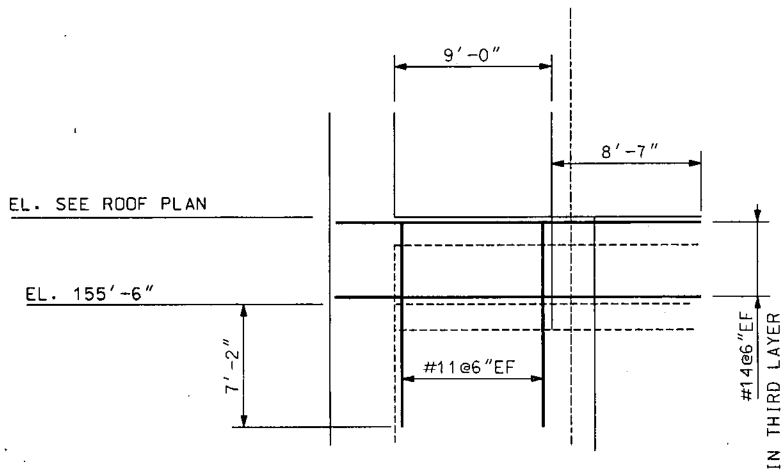


WALL 7.3 (LOOKING NORTH)

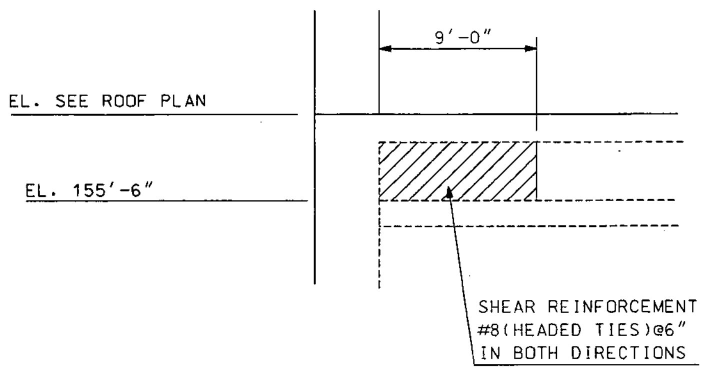
Figure 3H.5-4

[*Typical Reinforcement in Wall 7.3*]*

Figure to be deleted



DETAIL 1
ADDITIONAL REINFORCEMENT



DETAIL 1
ADDITIONAL SHEAR REINFORCEMENT

Figure 3H.5-4 (Sheet 2 of 2)

[***Typical Reinforcement in Wall 7.3 (Additional Details)***]*

(Table to be deleted)

Table 3H.5-6

[INTERIOR WALL AT COLUMN LINE L
FORCES AND MOMENTS IN CRITICAL LOCATIONS]*

(Units: kips, ft)

Load Combination	M_X	M_Y	M_{XY}	T_X	T_Y	T_{XY}
Elevation 117'-6" to 135'-3"						
$0.9D + E_s + R_a + P_a + Y_j$		256.9	65.0		40.3	118.0
$D + L + E_s + R_a + P_a + Y_j$	194.4		71.1	15.4		107.3

Note:
X is along the horizontal direction, and Y is in the vertical direction.

Figure to be inserted

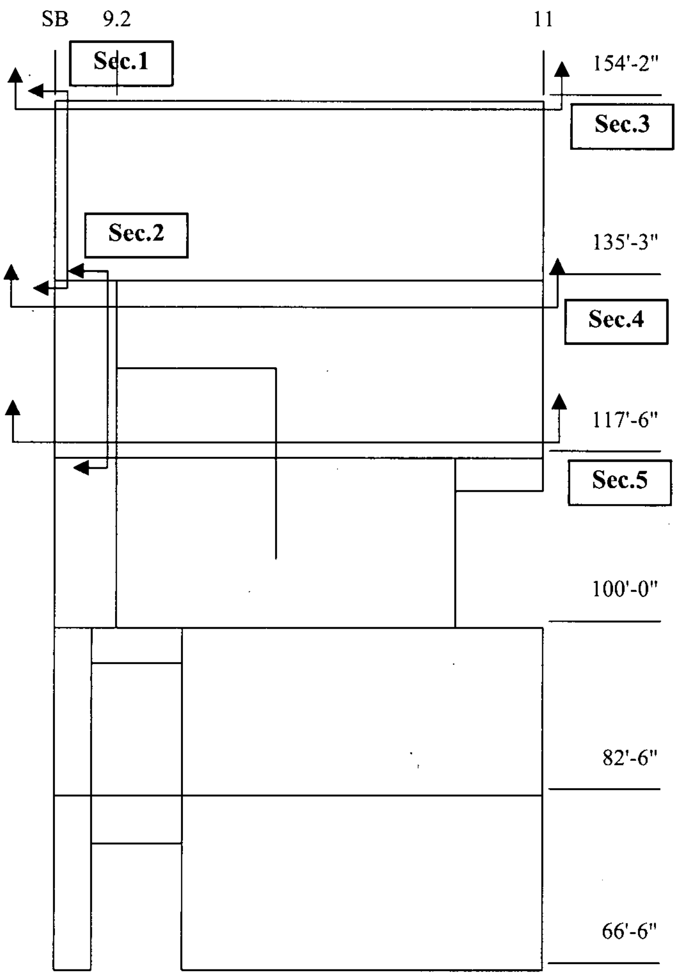


Figure 3H.5-2 (sheet 3)

[*Wall on Column Line L*]*

Table to be deleted

Table 3H.5-7

***[INTERIOR WALL ON COLUMN LINE L
DETAILS OF WALL REINFORCEMENT]****

Wall Segment	***Type***	***Reinforcement (in²/ft²)***	
		Required	***Provided***
Elevation 117'-6" to 135'-3"	*Horizontal*	*3.45*	*4.39*
	Vertical	*5.00*	*5.37*
Shear Reinforcement:			
Elevation 117'-6" to 135'-3"	*T headed bars*	*2.07*	*2.64*

Table to be inserted

Table 3H.5-7

***[INTERIOR WALL ON COLUMN LINE L
DETAILS OF WALL REINFORCEMENT]****

(SEE FIGURE 3H.5-2(SHEET 3) FOR LOCATIONS OF WALL SECTIONS.)

Wall Segment	***Location***	***Wall Section***	***Reinforcement on Each Face (in^2/ft)***
			Provided
Elevation 154'-2" to 135'-3"	*Horizontal*	*1*	*1.79*
	Vertical	*3*	*3.12*
Elevation 135'-3" to 117'-6"	*Horizontal*	*2*	*4.39*
	Vertical	*4*	*5.66*
Shear Reinforcement:			
Elevation 135'-3" to 117'-6"	*Standard hook or T headed bar*	*5*	*2.00*

Figure to be deleted

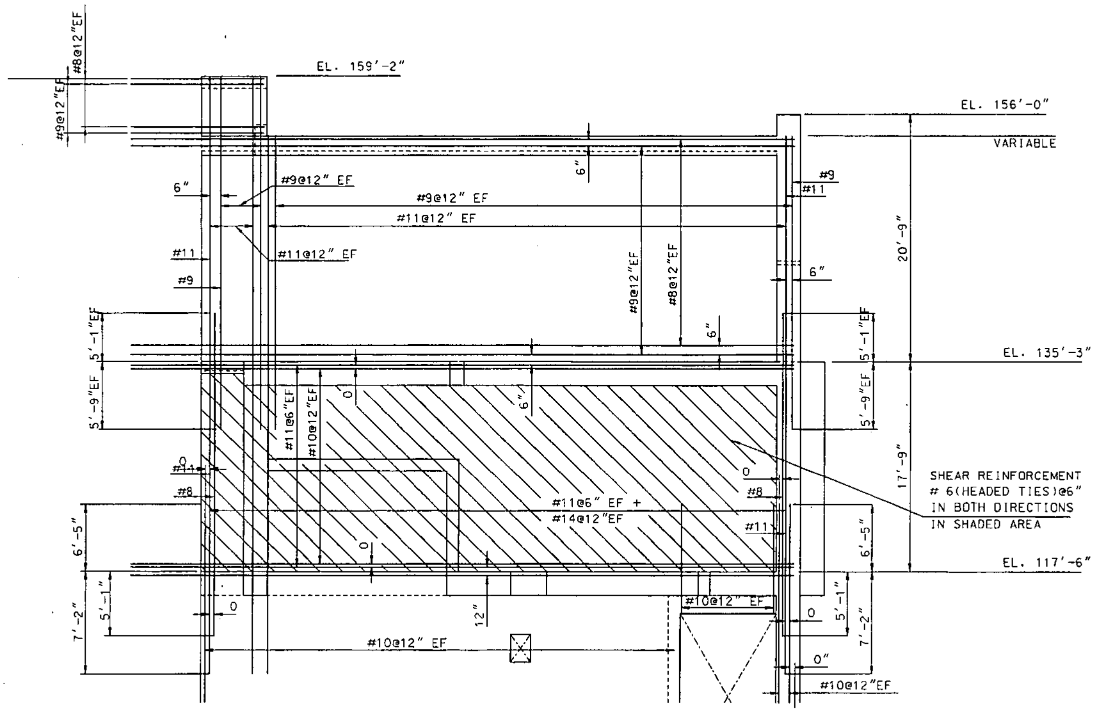


Figure 3H.5-12

*[Typical Reinforcement in Wall L]**

Figure to be inserted

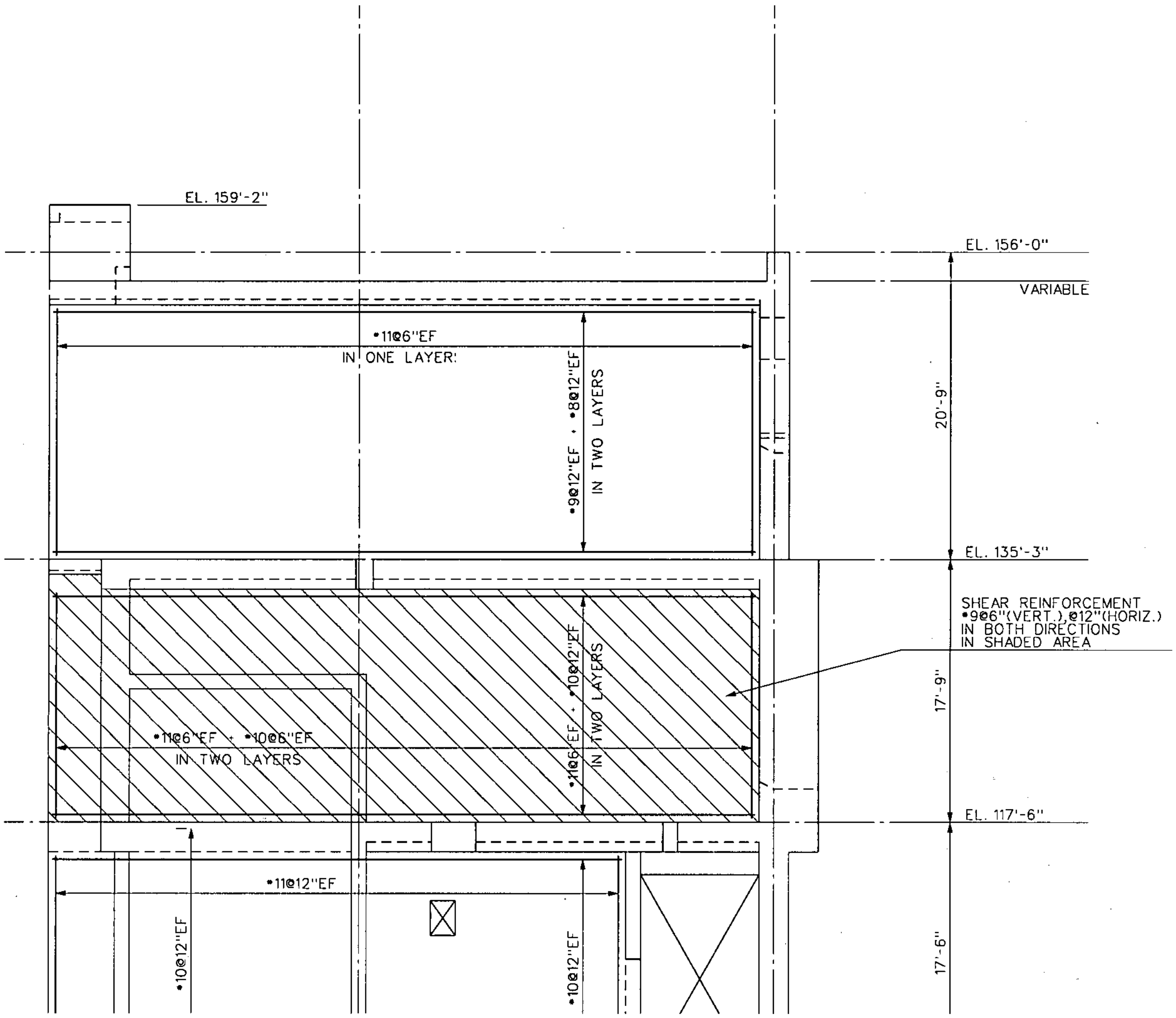


Figure 3H.5-12

*[Typical Reinforcement in Wall L]**

Figure to be deleted

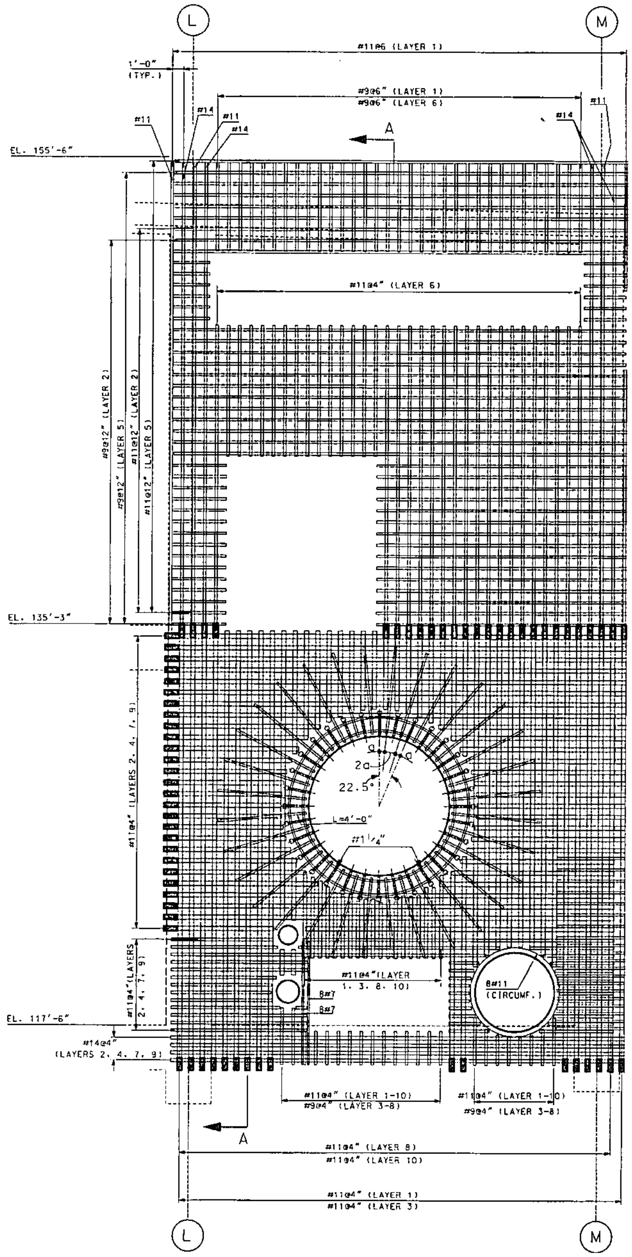


Figure 3H.5-5 (Sheet 1 of 3)

[Concrete Reinforcement in Wall 11]*

Figure to be inserted

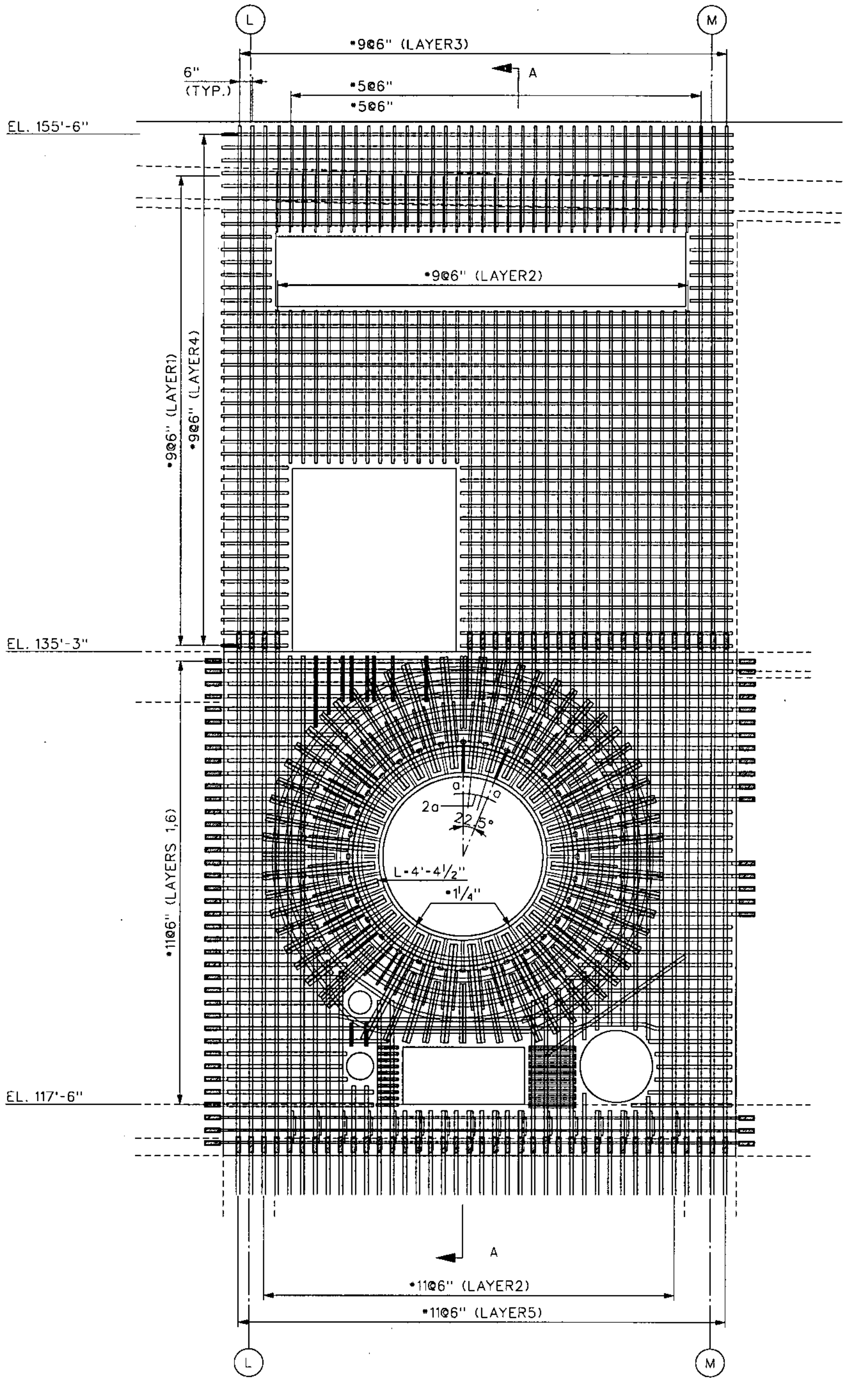


Figure 3H.5-5 (Sheet 1 of 3)

[Concrete Reinforcement in Wall 11]*

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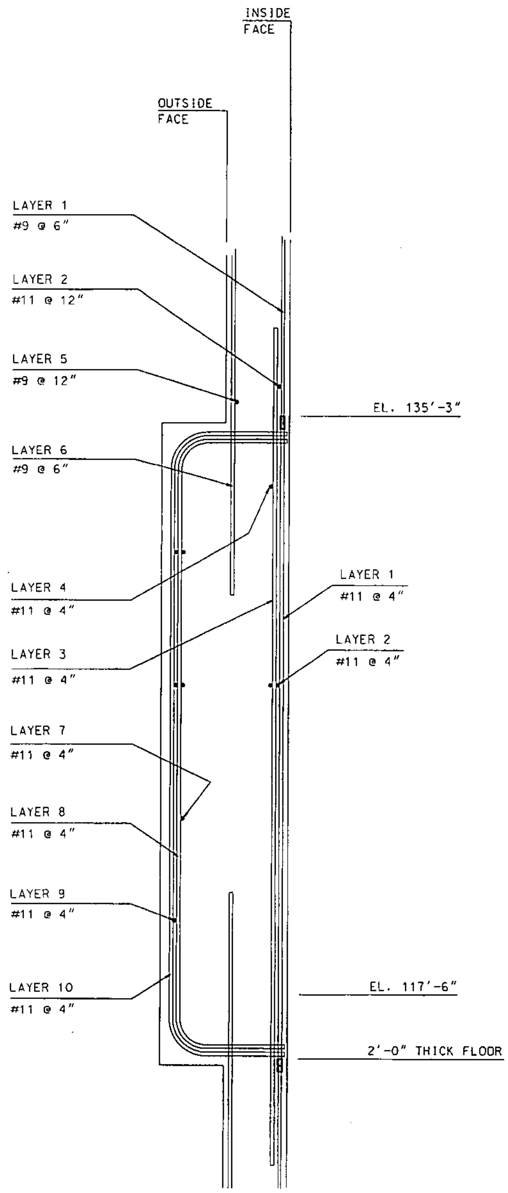


Figure 3H.5-5 (Sheet 2 of 3)

[***Concrete Reinforcement Layers in Wall 11 (Looking East)***]*

Figure to be inserted

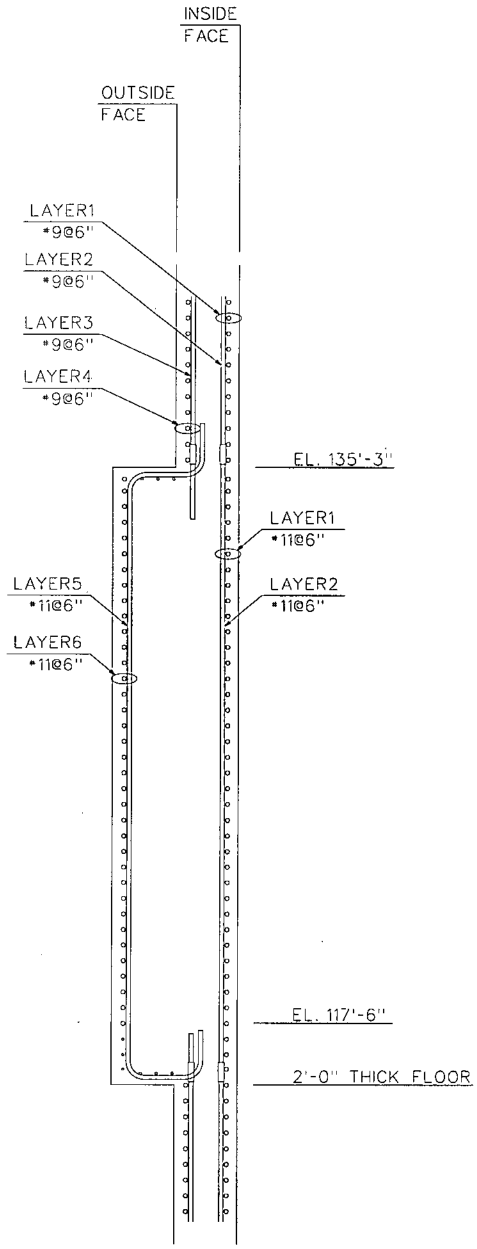


Figure 3H.5-5 (Sheet 2 of 3)

[*Concrete Reinforcement Layers in Wall 11 (Looking East)*]*

Figure to be deleted

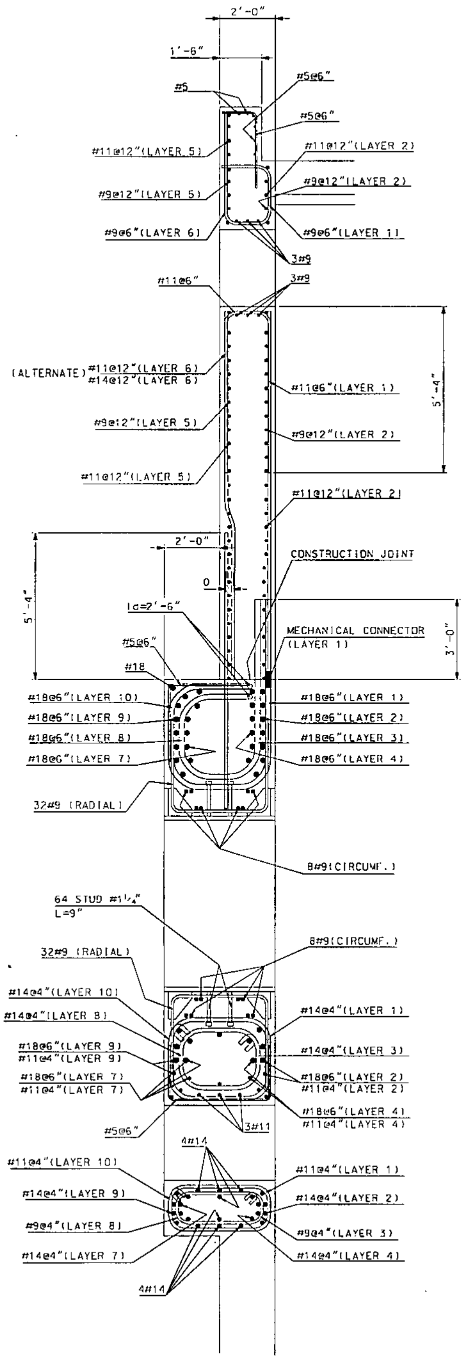


Figure 3H.5-5 (Sheet 3 of 3)

[Wall 11 at Main Steamline Anchor Section A-A]*

Figure to be inserted

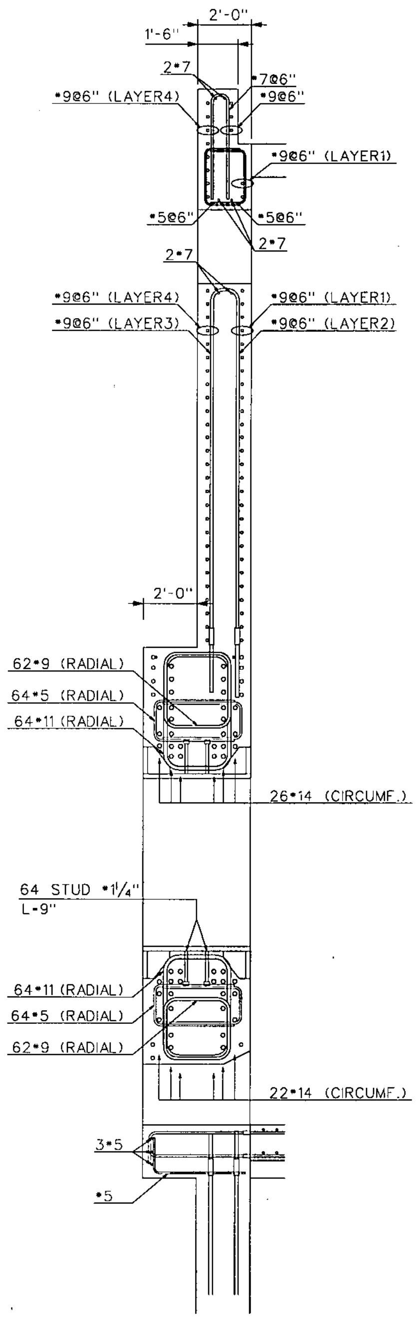


Figure 3H.5-5 (Sheet 3 of 3)

[Wall 11 at Main Steamline Anchor Section A-A]*

Table to be deleted

Table 3H.5-11

[DESIGN SUMMARY OF FLOOR AT ELEVATION 135'-3" AREA 1 (BETWEEN COLUMN LINES M AND P)]*

Governing Load Combination (Steel Beam)	
Load Combination	*Normal Condition*
Bending Moment	*= (-) 64.4 kips-ft*
Corresponding Stress	*= 16.6 ksi*
Allowable Stress	*= 23.76 ksi*
Shear Force	*= 25.4 kips*
Corresponding Stress	*= 9.8 ksi*
Allowable Stress	*= 14.4 ksi*
Governing Load Combination (Concrete Slab)	
Parallel to the Beams	
Load Combination	*3 – Extreme Environmental Condition Downward Seismic*
Bending Moment	*= (+) 6.86 kips-ft/ft*
In-plane Shear	*= 17.8 kips (per foot width of the slab)*
Reinforcement (Each Face)	
Required	*< 1.49 in^2/ft*
Provided	*= 1.56 in^2/ft*
Perpendicular to the Beams	
Combination Number	*Normal Condition*
Bending Moment	*= (-) 8.28 kips-ft (per foot width of the slab)*
Reinforcement (Each Face)	
Required	*= 0.47 in^2/ft*
Provided	*= 0.60 in^2/ft*

Table to be inserted

Table 3H.5-11

*[DESIGN SUMMARY OF FLOOR AT ELEVATION 135'-3"
AREA 1 (BETWEEN COLUMN LINES M AND P)]**

Governing Load Combination (Steel Beam)	
Load Combination *Bending Moment:* *Allowable Stress*	*Normal Condition* *= 23.76 ksi > Actual stress*
Shear Force: *Allowable Stress*	 *= 14.4 ksi > Actual stress*
Governing Load Combination (Concrete Slab)	
Parallel to the Beams *Load Combination* *Reinforcement (Each Face)* *Provided*	 *3 – Extreme Environmental Condition* *Downward Seismic* *= 0.44 in^2/ft > Required*
Perpendicular to the Beams *Load Combination* *Reinforcement (Each Face)* *Provided*	 *Normal Condition* *= 0.60 in^2/ft > Required*

Figure to be deleted

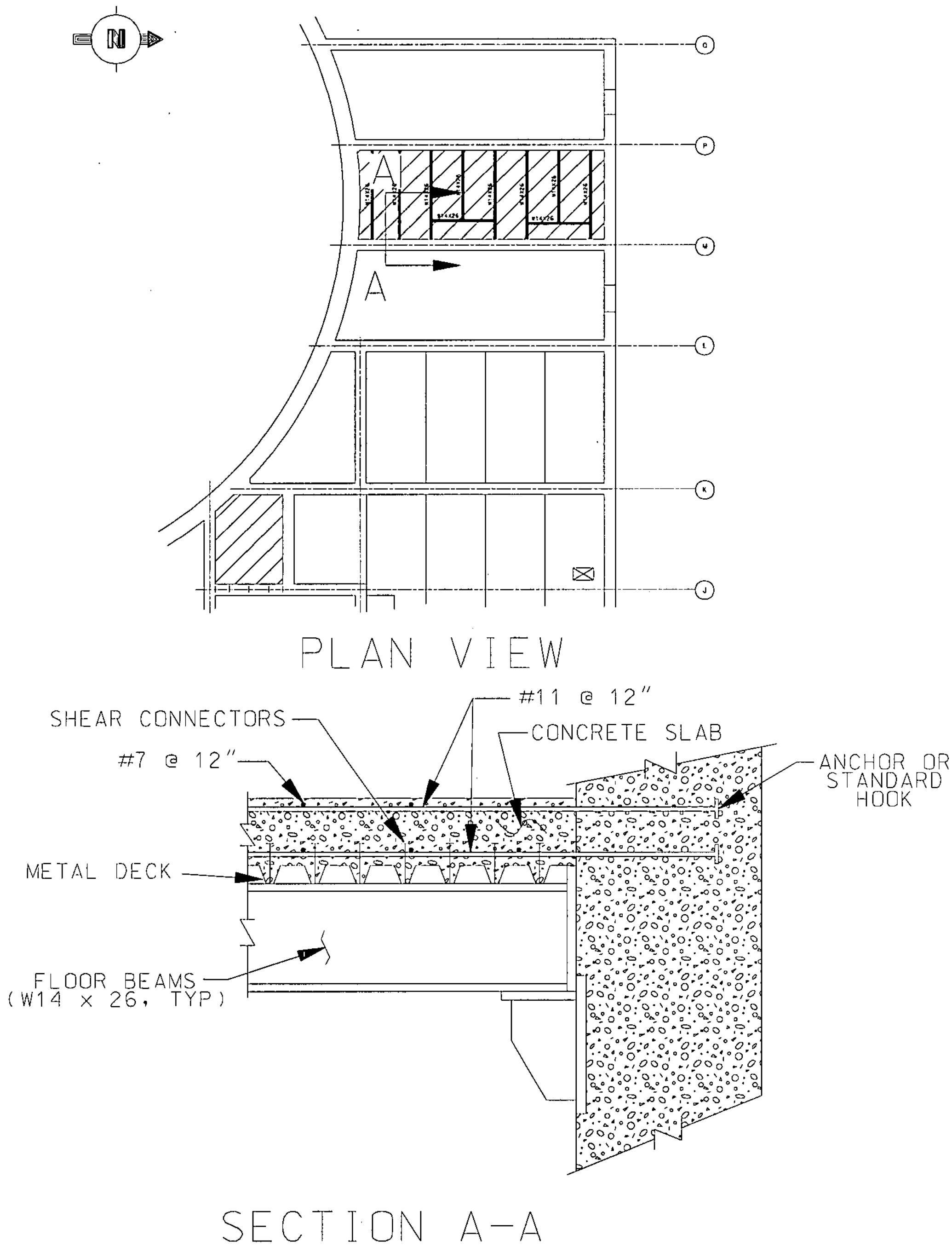
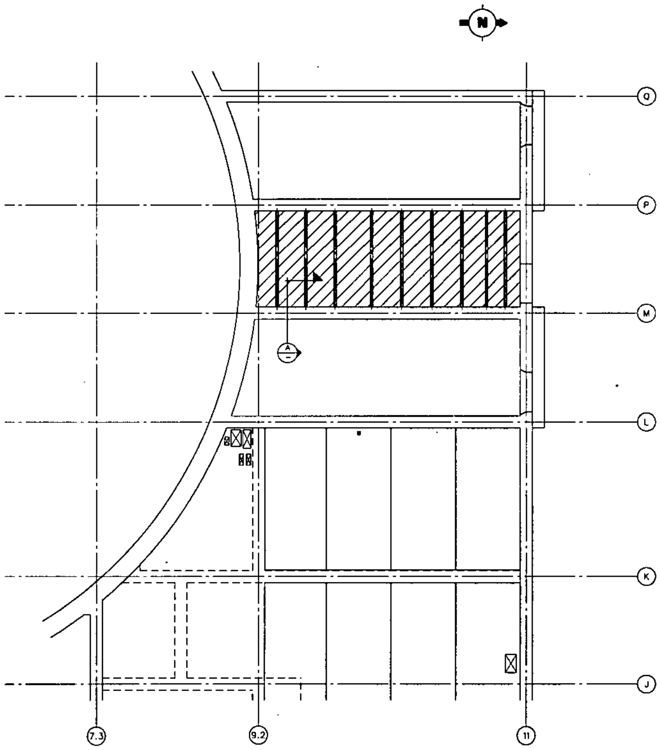


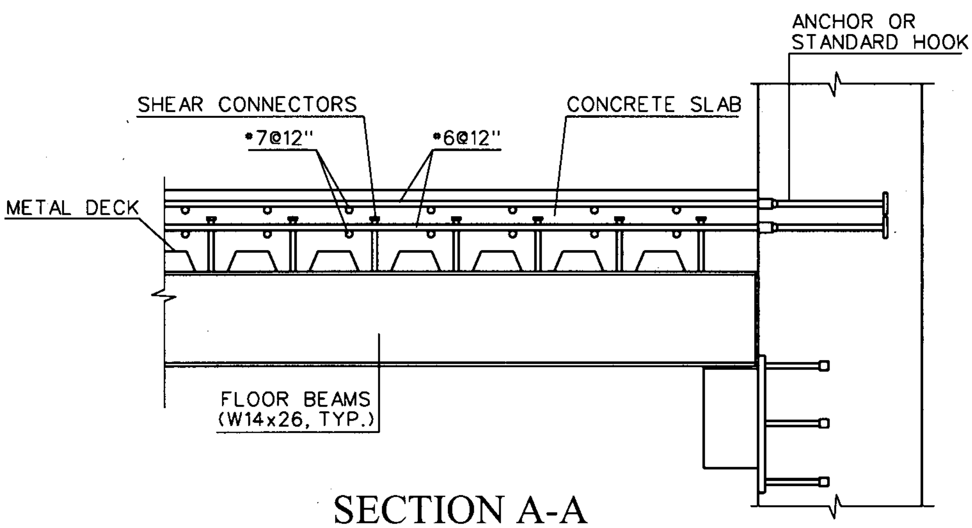
Figure 3H.5-6

*[Auxiliary Building Typical Composite Floor]**

Figure to be inserted



PLAN VIEW



SECTION A-A

Figure 3H.5-6

*[Auxiliary Building
Typical Composite Floor]**

Table to be deleted

Table 3H.5-12

***[DESIGN SUMMARY OF FLOOR AT ELEVATION 135'-3"
AREA 1 (TAGGING ROOM CEILING)]****

Design of Precast Concrete Panels	
Governing Load Combination	*Construction*
Design Bending Moment (Midspan)	*= 14.53 ft-kip/ft*
Bottom Reinforcement (E/W Direction)	
Required	*= 0.51 in²/ft*
Provided	*= 0.79 in²/ft*
Top Reinforcement (E/W Direction)	
Required	*= (Minimum required by Code)*
Provided	*= 0.20 in²/ft*
Top and Bottom Reinforcement (N/S Direction)	
Required	*= (Minimum required by Code)*
Provided	*= 0.20 in²/ft*
Design of 24-inch-Thick Slab	
Governing Load Combination	*Extreme Environmental Condition (SSE)*
Design Bending Moment (N/S Direction) Midspan	*= 5.46 kips ft/ft*
Design In-plane Shear	*= 25.4 kips/ft*
Design In-plane Tension	*= 14.7 kips/ft*
Bottom Reinforcement (E/W Direction)	
Required	*< 0.64 in²/ft*
Provided	*= 0.79 in²/ft*
Design Bending Moment (N/S Direction) at Support	*= 5.46 kips-ft/ft*
Design In-plane Shear	*= 25.4 kips/ft*
Design In-plane Tension	*= 14.7 kips/ft*
Top Reinforcement (E/W Direction)	
Required	*< 0.78 in²/ft*
Provided	*= 0.79 in²/ft*
Design Bending Moment (N/S Direction)	*= 4.3 kips ft/ft*
Design In-plane Shear	*= 25.4 kips/ft*
Design In-plane Tension	*= 13.96 kips/ft*
Top and Bottom Reinforcement (N/S Direction)	
Required	*< 0.64 in²/ft*
Provided	*= 0.79 in²/ft*

Table to be inserted

Table 3H.5-12

[DESIGN SUMMARY OF FLOOR AT ELEVATION 135'-3"
AREA 1 (TAGGING ROOM CEILING)]*

Design of Precast Concrete Panels	
Governing Load Combination	*Construction*
Bottom Reinforcement (E/W Direction)	
Provided	*= 0.79 in^2/ft> Required*
Top Reinforcement (E/W Direction)	
Required	*= (Minimum required by Code)*
Provided	*= 0.20 in^2/ft*
Top and Bottom Reinforcement (N/S Direction)	
Required	*= (Minimum required by Code)*
Provided	*= 0.20 in^2/ft*
Design of 24-inch-Thick Slab	
Governing Load Combination	*Extreme Environmental Condition (SSE)*
Bottom Reinforcement (E/W Direction)	
Provided	*= 0.79 in^2/ft > Required*
Top Reinforcement (E/W Direction)	
Provided	*= 0.79 in^2/ft > Required*
Top and Bottom Reinforcement (N/S Direction)	
Provided	*= 0.79 in^2/ft > Required*

Figure to be deleted

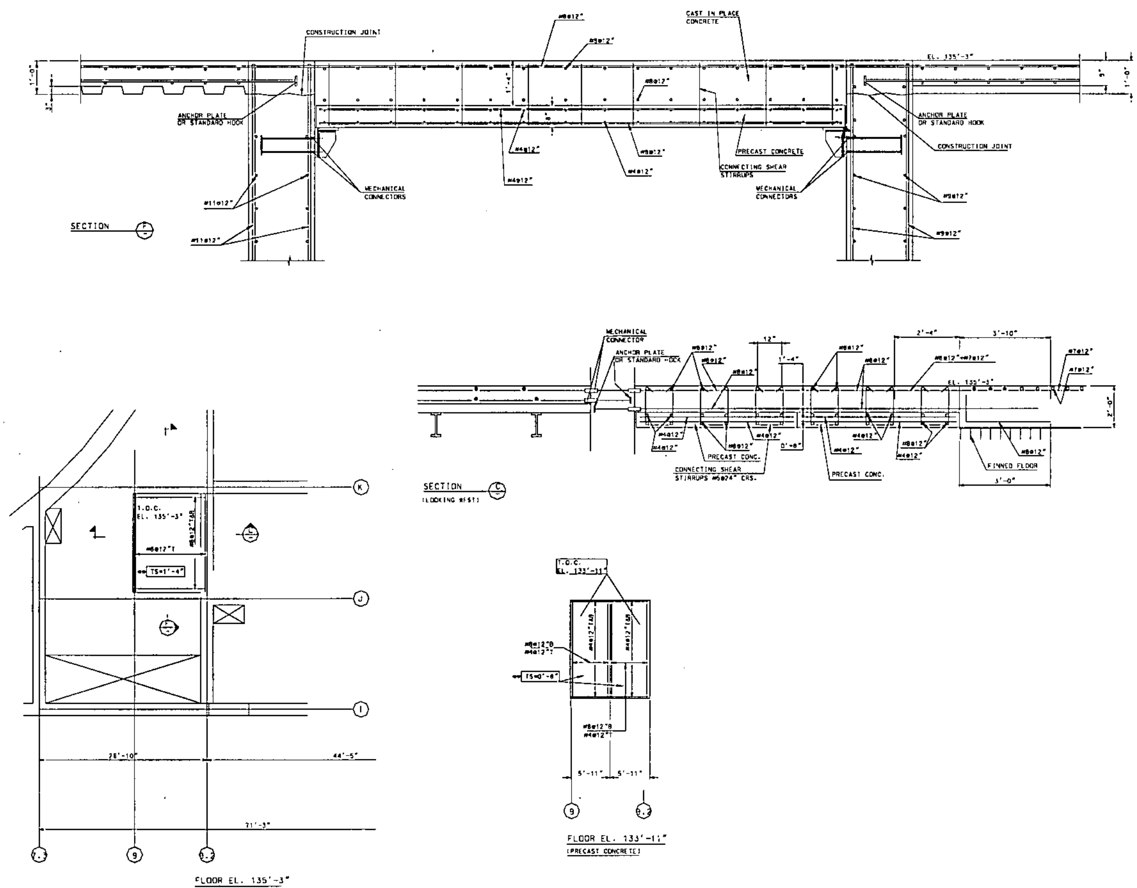


Figure 3H.5-8

[Auxiliary Building Tagging Room Ceiling]*

Figure to be Inserted

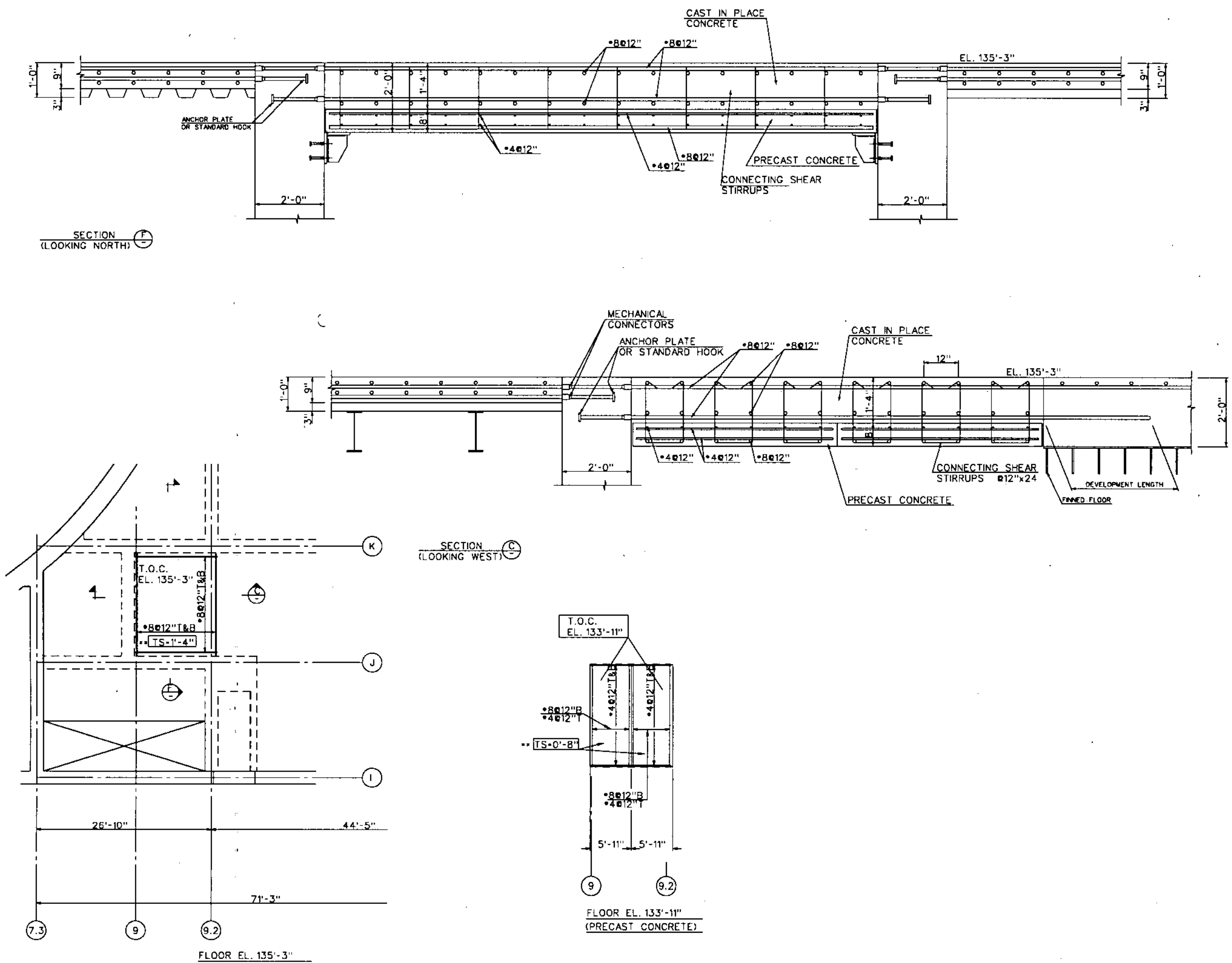


Figure 3H.5-8

*[Auxiliary Building Tagging Room Ceiling]**

Table to be deleted

Table 3H.5-13 ***[DESIGN SUMMARY OF FLOOR AT ELEVATION 135'-3" AREA 1 (MAIN CONTROL ROOM CEILING)]****
The design of the bottom plate with fins is governed by the construction load.
For the composite floor, the design forces used for the evaluation of a typical 9-inch-wide strip of the slab are as follows: *Maximum bending moment = +39.9 (-47.5) kips-ft* *Maximum shear force = 22.3 kips*
The design evaluation results are summarized below: * *The actual area of the tension steel is 9.0 in^2, which provides a design strength of 518.5 kips-ft bending moment capacity.* * *The design shear strength is 23.22 kips.* * *The shear studs are spaced 9 inches c/c, in both directions. The calculated required spacing is 15.7 inches.*

Table to be inserted

Table 3H.5-13 *[DESIGN SUMMARY OF FLOOR AT ELEVATION 135'-3"* *AREA 1 (MAIN CONTROL ROOM CEILING)]*
The design of the bottom plate with fins is governed by the construction load.
The design evaluation results are summarized below: • *The actual area of the tension steel is 9.0 in^2, which provides design strength of 518.5 kips-ft bending moment capacity. This is larger than the required capacity.* • *The design shear strength is 23.22 kips. This is larger than the required capacity.* • *The shear studs are spaced 9 inches c/c, in both directions. The calculated required spacing is 9.06 inches.*

Figure to be deleted

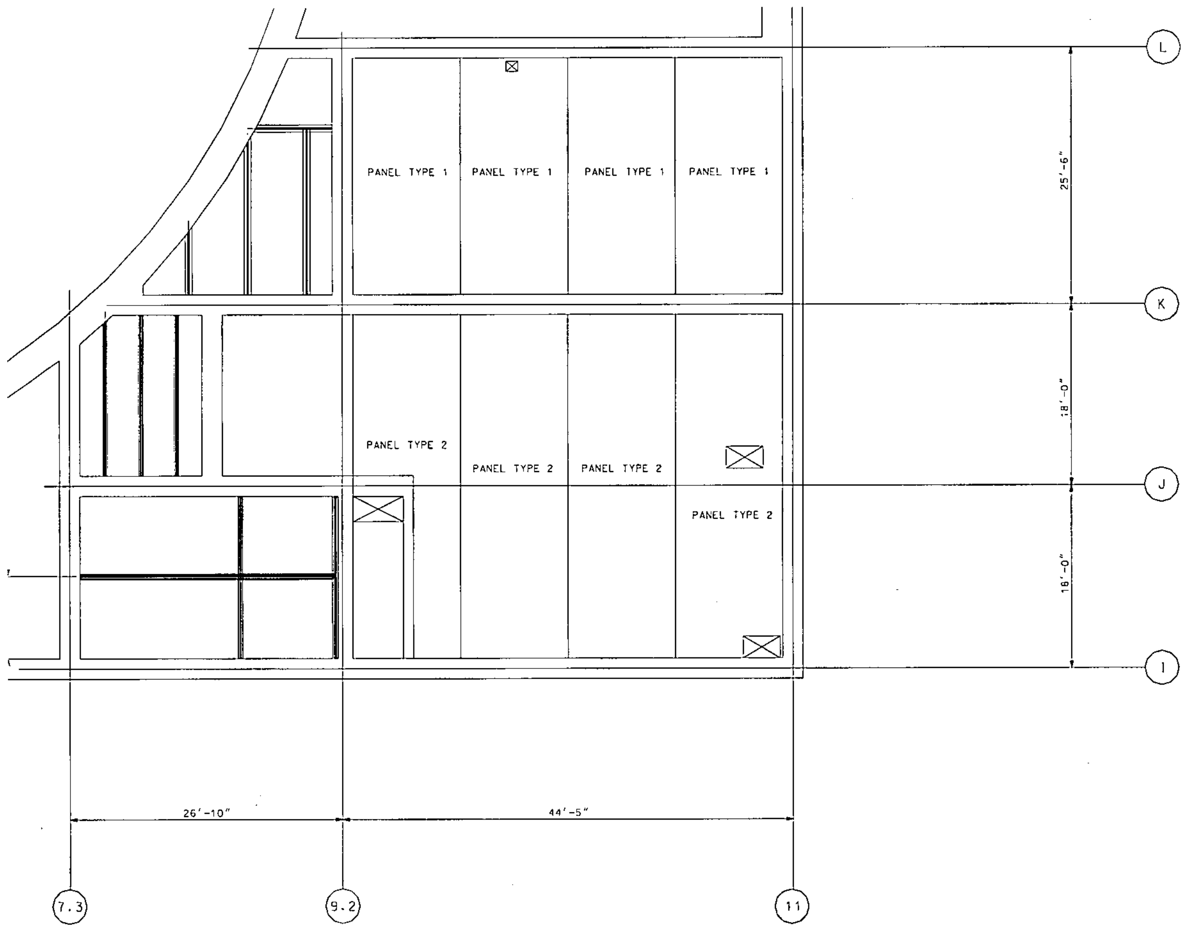


Figure 3H.5-9 (Sheet 1 of 3)
[*Auxiliary Building Finned Floor*]*

Figure to be inserted

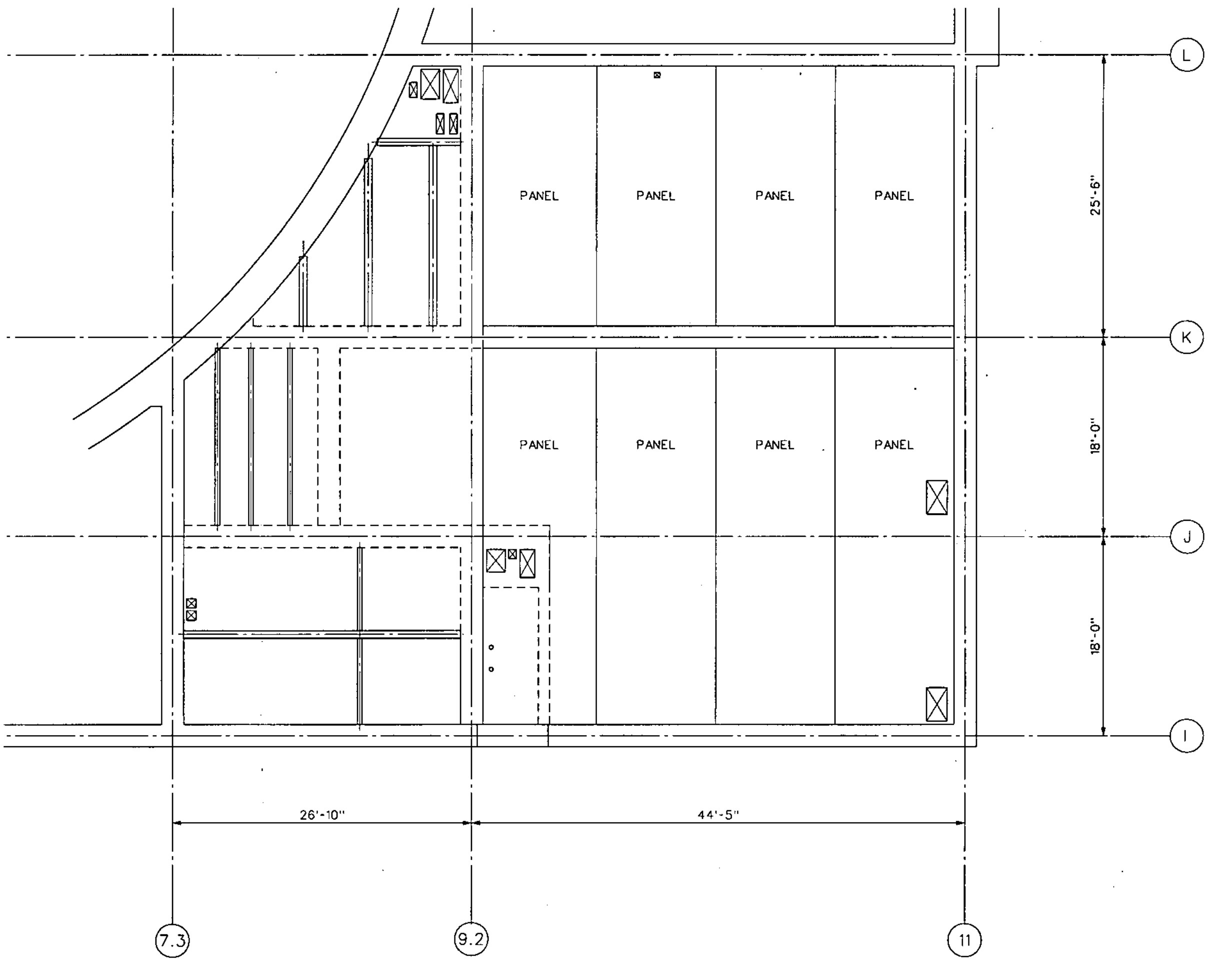


Figure 3H.5-9 (Sheet 1 of 3)

[***Auxiliary Building Finned Floor***]*

Table to be deleted

Table 3H.5-8 (Sheet 1 of 5)

[DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA ELEMENT NO. 1218]*

Load/Comb.	S_{xx} *kip/ft*	S_{yy} *kip/ft*	S_{xy} *kip/ft*	M_{xx} *k-ft/ft*	M_{yy} *k-ft/ft*	N_x *kip/ft*	N_y *kip/ft*	*Comments*
Dead (D)	*0.17*	*-11.19*	*1.52*	*-0.33*	*-3.28*			
Live (L)								
Hydro (F)	*5.02*	*5.16*	*2.23*	*-19.94*	*-148.92*	*-1.47*	*-31.76*	
In-pl Seis. (E_s)	*37.55*	*25.06*	*24.37*	*7.51*	*55.30*			
Out-pl Seis. (E_s)	*10.02*	*40.75*	*65.73*	*38.28*	*285.23*	*4.09*	*46.27*	
Thermal (T_a)	*-479.15*	*-146.29*	*57.70*	*-418.7*	*346.38*	*-3.21*	*11.32*	
LC (1)	*7.26*	*-8.43*	*5.25*	*-28.39*	*-213.08*	*-2.06*	*-44.46*	*1.4D+1.4F*
LC (2)								
LC (3a)	*52.76*	*59.78*	*151.54*	*25.51*	*534.72*	*2.63*	*25.83*	$1.0D+1.0F+1.0T_a+1.0E_s$
LC (3b)	*-521.54*	*-218.12*	*-86.34*	*-484.80*	*-492.73*	*-8.77*	*-78.03*	$1.0D+1.0F+1.0T_a-1.0E_s$
LC (4)	*-473.97*	*-152.31*	*61.45*	*-439.02*	*194.18*	*-4.68*	*-20.44*	$1.0D+1.0F+1.0T_a$
LC (5)								
LC (6a)	*52.76*	*59.78*	*93.84*	*25.51*	*188.34*	*2.63*	*14.51*	$1.0D+1.0F+1.0E_s$
LC (6b)	*-42.39*	*-71.83*	*-86.34*	*-66.06*	*-492.73*	*-5.56*	*-78.03*	$1.0D+1.0F-1.0E_s$
LC (7)								
LC (8)								
LC (9a)	*52.75*		*93.69*	*25.54*	*188.66*	*2.63*	*14.51*	$0.9D+1.0F+1.0E_s$
LC (9b)	*-42.41*	*-70.71*	*-86.49*	*-66.03*	*-492.41*	*-5.56*	*-78.03*	$0.9D+1.0F-1.0E_s$

~~***Notes:***~~
~~*x- direction is horizontal; y- direction is vertical.*~~
~~*See Figure 3H.5-10 for element location.*~~

~~*Plate thickness required for load combinations excluding thermal: 0.28 inches*~~
~~*Plate thickness provided: 0.50 inches*~~

~~*Maximum principal stress for load combination 3 including thermal: 34.43 ksi*~~
~~*Yield stress at temperature of 212°F: 43.96 ksi*~~

~~*Maximum stress intensity range for load combination 3 including thermal: N/A*~~
~~*Allowable stress intensity range for load combination 3 including thermal: 87.92 ksi*~~

Table to be inserted

TABLE 3H.5-8   ***[DESIGN SUMMARY OF SPENT FUEL POOL WALL: ELEMENT NO. 20477 (SHEET 1 OF 2)]****
Notes: *See Figure 3H.5-10 for element location.*   *Plate thickness provided is 0.50 inches, which is much greater than the plate thickness required.*

Table to be deleted

Table 3H.5-8 (Sheet 2 of 5)

[DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA ELEMENT NO. 1236]*

Load/Comb.	S_{xx} *kip/ft*	S_{yy} *kip/ft*	S_{xy} *kip/ft*	M_{xx} *k-ft/ft*	M_{yy} *k-ft/ft*	N_x *kip/ft*	N_y *kip/ft*	*Comments*
Dead (D)	2.97	-38.34	-7.30	-4.97	-13.71			
Live (L)								
Hydro (F)	4.91	0.74	-3.11	-18.04	-23.45	0.46	1.43	
In-pl Seis. (E_s)	152.33	103.11	111.13	11.46	227.73			
Out-pl Seis. (E_s)	8.00	78.00	43.13	30.59	47.23	7.07	15.88	
Thermal (T_a)	-83.04	-281.55	27.47	-708.87	-266.01	-125.35	-259.89	
LC (1)	11.04	-52.63	-14.57	-32.21	-52.03	0.65	2.00	1.4D+1.4F
LC (2)								
LC (3a)	168.22	143.52	171.33	19.04	237.79	7.54	17.30	$1.0D+1.0F+1.0T_a+1.0E_s$
LC (3b)	-235.49	-500.26	-164.67	-773.93	-578.13	-131.96	-274.34	$1.0D+1.0F+1.0T_a-1.0E_s$
LC (4)	-75.16	-319.15	17.06	-731.88	-303.17	-124.89	-258.46	$1.0D+1.0F+1.0T_a$
LC (5)								
LC (6a)	168.22	143.52	143.86	19.04	237.79	7.54	17.30	$1.0D+1.0F+1.0E_s$
LC (6b)	-152.45	-218.71	-164.67	-65.06	-312.12	-6.61	-14.45	$1.0D+1.0F-1.0E_s$
LC (7)								
LC (8)								
LC (9a)	167.92	147.35	144.59	19.54	239.16	7.54	17.30	$0.9D+1.0F+1.0E_s$
LC (9b)	-152.75	-214.88	-163.94	-64.56	-310.75	-6.61	-14.45	$0.9D+1.0F-1.0E_s$

~~***Notes:***~~

~~*x- direction is horizontal; y- direction is vertical.*~~

~~*Plate thickness required for load combinations excluding thermal:* 0.38 inches~~
~~*Plate thickness provided:* 0.50 inches~~

~~*Maximum principal stress for load combination 3 including thermal:* 40.91 ksi~~
~~*Yield stress at temperature of 212°F:* 43.96 ksi~~

~~*Maximum stress intensity range for load combination 3 including thermal:* N/A~~
~~*Allowable stress intensity range for load combination 3 including thermal:* 87.92 ksi~~

Table to be inserted

TABLE 3H.5-8 *[DESIGN SUMMARY OF SPENT FUEL POOL WALL: ELEMENT NO. 10529 (SHEET 2 OF 2)]**
Notes: *See Figure 3H.5-10 for element location.* *Plate thickness provided is 0.50 inches, which is much greater than the plate thickness required.*

Table to be deleted

Table 3H.5-8 (Sheet 3 of 5)

[DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA ELEMENT NO. 1243]*

Load/Comb.	S_{xx} *kip/ft*	S_{yy} *kip/ft*	S_{xy} *kip/ft*	M_{xx} *k-ft/ft*	M_{yy} *k-ft/ft*	N_x *kip/ft*	N_y *kip/ft*	*Comments*
Dead (D)	*0.30*	*-21.65*	*-1.14*	*6.03*	*1.26*			
Live (L)								
Hydro (F)	*11.74*	*0.13*	*2.02*	*-108.00*	*-14.29*	*20.48*	*5.19*	
In-pl Seis. (E_s)	*55.75*	*51.72*	*55.12*	*83.13*	*248.46*			
Out-pl Seis. (E_s)	*43.50*	*24.67*	*41.18*	*265.98*	*46.24*	*36.98*	*27.45*	
Thermal (T_a)	*-101.02*	*-359.38*	*-154.76*	*686.63*	*616.66*	*-47.53*	*15.37*	
LC (1)	*16.86*	*-30.12*	*1.24*	*-142.76*	*-18.24*	*28.67*	*7.26*	*1.4D+1.4F*
LC (2)								
LC (3a)	*111.29*	*54.88*	*97.19*	*933.78*	*898.33*	*57.46*	*48.01*	$1.0D+1.0F+1.0T_a+1.0E_s$
LC (3b)	*-188.22*	*-457.29*	*-250.18*	*-451.08*	*-307.73*	*-64.04*	*-22.26*	$1.0D+1.0F+1.0T_a-1.0E_s$
LC (4)	*-88.98*	*-380.89*	*-153.87*	*584.66*	*603.63*	*-27.06*	*20.56*	$1.0D+1.0F+1.0T_a$
LC (5)								
LC (6a)	*111.29*	*54.88*	*97.19*	*247.15*	*281.67*	*57.46*	*32.63*	$1.0D+1.0F+1.0E_s$
LC (6b)	*-87.20*	*-97.91*	*-95.42*	*-451.08*	*-307.73*	*-16.51*	*-22.26*	$1.0D+1.0F-1.0E_s$
LC (7)								
LC (8)								
LC (9a)	*111.26*	*57.05*	*97.306*	*246.54*	*281.55*	*57.46*	*32.63*	$0.9D+1.0F+1.0E_s$
LC (9b)	*-87.23*	*-95.74*	*-95.30*	*-451.68*	*-307.86*	*-16.51*	*-22.26*	$0.9D+1.0F-1.0E_s$

~~**Notes:**~~

~~*x- direction is horizontal; y- direction is vertical.*~~

~~*Plate thickness required for load combinations excluding thermal:* 0.27 inches~~
~~*Plate thickness provided:* 0.50 inches~~

~~*Maximum principal stress for load combination 3 including thermal:* 56.60 ksi~~
~~*Yield stress at temperature of 212°F:* 43.96 ksi~~

~~*Maximum stress intensity range for load combination 3 including thermal:* 56.60 ksi~~
~~*Allowable stress intensity range for load combination 3 including thermal:* 87.92 ksi~~

Table to be deleted

Table 3H.5-8 (Sheet 4 of 5)

[DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA ELEMENT NO. 1248]*

Load/Comb.	***S_{xx} kip/ft***	***S_{yy} kip/ft***	***S_{xy} kip/ft***	***M_{xx} k-ft/ft***	***M_{yy} k-ft/ft***	***N_x kip/ft***	***N_y kip/ft***	***Comments***
Dead (D)	*0.30*	*-21.65*	*-1.14*	*6.03*	*1.26*			
Live (L)								
Hydro (F)	*7.69*	*0.24*	*3.90*	*55.37*	*28.63*	*1.05*	*0.91*	
In-pl Seis. (E_s)	*55.75*	*51.72*	*55.12*	*83.13*	*248.46*			
Out-pl Seis. (E_s)	*35.86*	*23.37*	*52.82*	*115.25*	*90.68*	*3.00*	*4.89*	
Thermal (T_a)	*20.82*	*-92.55*	*37.81*	*337.08*	*357.75*	*-15.18*	*15.18*	
LC (1)	*11.19*	*-29.97*	*3.87*	*85.96*	*41.85*	*1.47*	*1.27*	*1.4D+1.4F*
LC (2)								
LC (3a)	*120.42*	*53.69*	*148.52*	*596.86*	*726.78*	*4.05*	*20.97*	*$1.0D+1.0F+1.0T_a+1.0E_s$*
LC (3b)	*-83.62*	*-189.05*	*-105.18*	*-136.99*	*-309.24*	*-17.13*	*-3.98*	*$1.0D+1.0F+1.0T_a-1.0E_s$*
LC (4)	*28.81*	*-113.96*	*40.58*	*398.48*	*387.64*	*-14.13*	*16.08*	*$1.0D+1.0F+1.0T_a$*
LC (5)								
LC (6a)	*99.60*	*53.69*	*110.71*	*259.78*	*369.03*	*4.05*	*5.79*	*$1.0D+1.0F+1.0E_s$*
LC (6b)	*-83.62*	*-96.50*	*-105.18*	*-136.99*	*-309.24*	*-1.95*	*-3.98*	*$1.0D+1.0F-1.0E_s$*
LC (7)								
LC (8)								
LC (9a)	*99.569*	*55.85*	*110.82*	*259.18*	*368.9*	*4.05*	*5.79*	*$0.9D+1.0F+1.0E_s$*
LC (9b)	*-83.65*	*-94.34*	*-105.06*	*-137.59*	*-309.37*	*-1.95*	*-3.98*	*$0.9D+1.0F-1.0E_s$*

~~***Notes:***~~

~~*x- direction is horizontal; y- direction is vertical.*~~

~~*Plate thickness required for load combinations excluding thermal:* *0.30 inches*~~
~~*Plate thickness provided:* *0.50 inches*~~

~~*Maximum principal stress for load combination 3 including thermal:* *49.25 ksi*~~
~~*Yield stress at temperature of 212°F:* *43.96 ksi*~~

~~*Maximum stress intensity range for load combination 3 including thermal:* *49.25 ksi*~~
~~*Allowable stress intensity range for load combination 3 including thermal:* *87.92 ksi*~~

Table to be deleted

Table 3H.5-8 (Sheet 5 of 5)

[*DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA ELEMENT NO. 1287*]*

Load/Comb.	S_{xx} *kip/ft*	S_{yy} *kip/ft*	S_{xy} *kip/ft*	M_{xx} *k-ft/ft*	M_{yy} *k-ft/ft*	N_x *kip/ft*	N_y *kip/ft*	*Comments*
Dead (D)	1.62	3.79	-3.56	0.20	-4.07			
Live (L)								
Hydro (F)	10.63	7.22	7.96	54.47	-62.63	-20.95	-55.72	
In-pl Seis. (E_s)	33.36	167.82	76.36	85.46	539.41			
Out-pl Seis. (E_s)	48.18	148.07	60.36	144.73	413.94	67.11	183.91	
Thermal (T_a)	127.96	337.53	140.02	368.33	301.06	-29.43	-135.14	
LC (1)	17.14	15.41	6.17	76.54	-93.39	-29.32	-78.00	1.4D+1.4F
LC (2)								
LC (3a)	221.75	664.43	281.15	653	1187	46.16	128.20	$1.0D+1.0F+1.0T_a+1.0E_s$
LC (3b)	-69.30	-304.89	-132.32	-175.5	-1020.0	-117.49	-239.63	$1.0D+1.0F+1.0T_a-1.0E_s$
LC (4)	140.21	348.54	144.43	423.00	234.35	-50.38	-190.86	$1.0D+1.0F+1.0T_a$
LC (5)								
LC (6a)	93.79	326.90	141.13	284.86	886.64	46.16	128.20	$1.0D+1.0F+1.0E_s$
LC (6b)	-69.30	-304.89	-132.32	-175.52	-1020.0	-88.05	-239.63	$1.0D+1.0F-1.0E_s$
LC (7)								
LC (8)								
LC (9a)	93.625	326.52	141.48	284.84	887.04	46.16	128.20	$0.9D+1.0F+1.0E_s$
LC (9b)	-69.46	-305.27	-131.96	-175.54	-1019.6	-88.05	-239.63	$0.9D+1.0F-1.0E_s$

~~***Notes:***~~
~~*x- direction is horizontal; y- direction is vertical.*~~

~~*Plate thickness required for load combinations excluding thermal:* 0.84 inches~~
~~*Plate thickness provided:* 0.875 inches~~

~~*Maximum principal stress for load combination 3 including thermal:* 77.87 ksi~~
~~*Yield stress at temperature of 212°F:* 43.96 ksi~~

~~*Maximum stress intensity range for load combination 3 including thermal:* 77.87 ksi~~
~~*Allowable stress intensity range for load combination 3 including thermal:* 87.92 ksi~~

Figure to be deleted

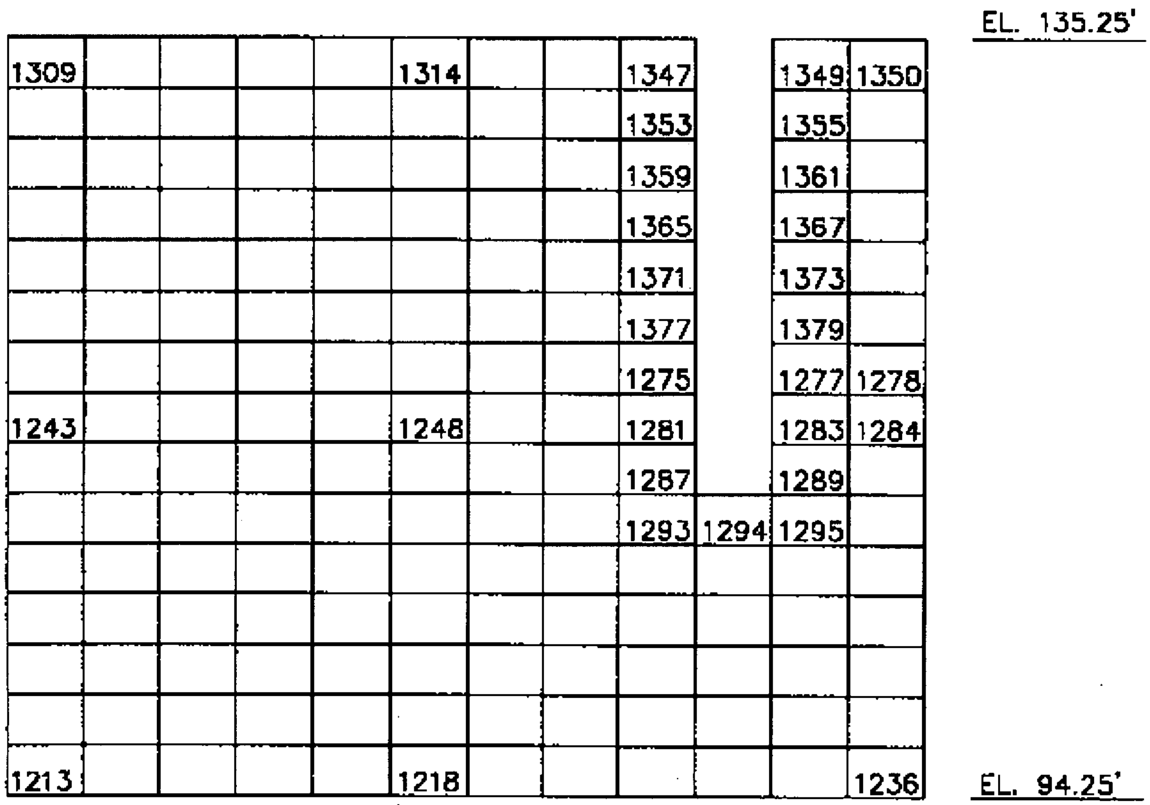


Figure 3H.5-10

[*Spent Fuel Pool Wall Divider Wall Element Locations*]*

Figure to be inserted

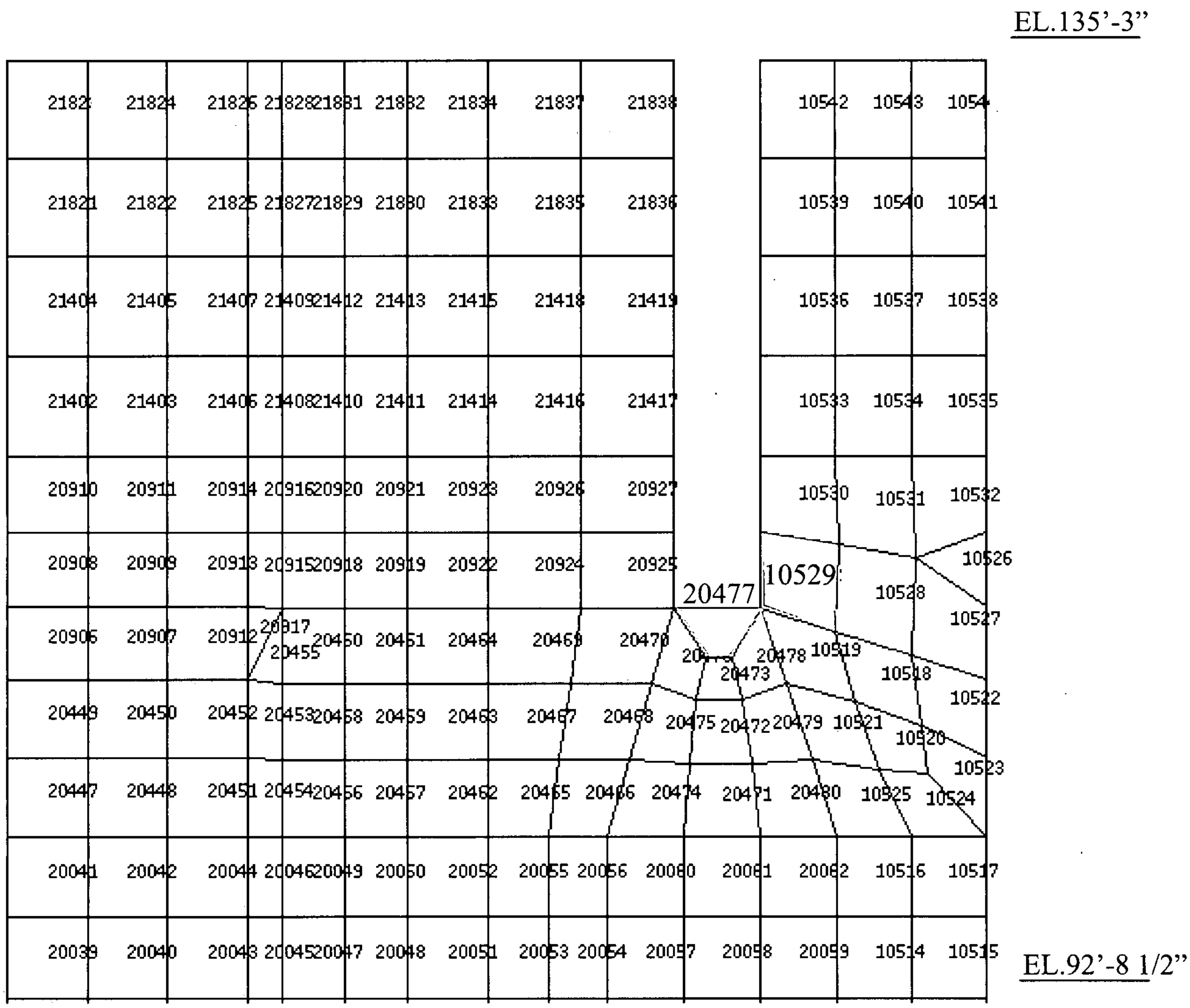


Figure 3H.5-10

[*Spent Fuel Pool Wall Divider Wall Element Locations*]*

5.2 "Mark Up for DCD Rev 16"

Changes to be made in DCD Rev 16 are described on the following pages.

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-4 (Sheet 1 of 3)

*[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL]**

Element number 101870

Plate thickness provided *= 0.50 inches*
(Note: This is a lot more than the plate thickness required ~~for load combinations excluding thermal~~)

Thermal Load Combinations:
Yield stress at design temperature *= 55.0 ksi*
Allowable stress intensity range for load combinations ~~6~~5 and ~~7~~6 (including thermal) = 110.0 ksi
(Note: The maximum principal stress for load combinations ~~6~~5 and ~~7~~6, and the maximum stress intensity range for these load combinations is much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-4 (Sheet 2 of 3)

*[DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL]**

Element number 101788

Plate thickness provided = *0.50 inches*
(Note: This is a lot more than the plate thickness required~~for load combinations excluding thermal~~)

Thermal Load Combinations:
Yield stress at design temperature = *55.0 ksi*
Allowable stress intensity range for load combinations ~~6~~5 and ~~7~~6 (including thermal) = 110.0 ksi
(Note: The maximum principal stress for load combinations ~~6~~5 and ~~7~~6, and the maximum stress intensity range for these load combinations is much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-4 (Sheet 3 of 3)

DESIGN SUMMARY OF WEST WALL OF REFUELING CANAL

Element number 101794

Plate thickness provided = 0.50 inches
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = 55.0 ksi
Allowable stress intensity range for load combinations ~~6~~5 and ~~7~~6 (including thermal) = 110.0 ksi
(Note: The maximum principal stress for load combinations ~~6~~5 and ~~7~~6, and the maximum stress intensity range for these load combinations is much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-5 (Sheet 1 of 3)

*[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT]**

Element number 104228

Plate thickness provided = 0.50 inches
(Note: This is a lot more than the plate thickness required ~~for load combinations excluding thermal~~)

Thermal Load Combinations:
Yield stress at design temperature = 36.0 ksi
Allowable stress intensity range for load combinations ~~6~~5 and ~~-6~~ ~~7~~ (including thermal) = 72.0 ksi
(Note: The maximum principal stress and the maximum stress intensity range for these load combinations are much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-5 (Sheet 2 of 3)

*[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT]**

Element number 101943

Plate thickness provided = 0.50 inches
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = 36.0 ksi
Allowable stress intensity range for load combinations ~~6~~5 and ~~7~~6 (including thermal) = 72.0 ksi
(Note: The maximum principal stress and the maximum stress intensity range for these load combinations is much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-5 (Sheet 3 of 3)

*[DESIGN SUMMARY OF SOUTH WALL OF STEAM GENERATOR COMPARTMENT]**

Element number 101933

Plate thickness provided = 0.50 inches
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = 36.0 ksi
Allowable stress intensity range for load combinations ~~6~~5 and ~~7~~6 (including thermal) = 72.0 ksi
(Note: The maximum principal stress and the maximum stress intensity range for these load combinations is much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-6 (Sheet 1 of 3)
*[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST]**

Element number 1400216

Plate thickness provided = 0.50 inches
(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:
Yield stress at design temperature = 36.0 ksi
Allowable stress intensity range for load combinations 65 and 67 (including thermal) = 72.0 ksi
(Note: The maximum principal stress and the maximum stress intensity range for these load combinations is much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-6 (Sheet 2 of 3)
[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST]

Element number 1400056

Plate thickness provided = *0.50 inches*

(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:

Yield stress at design temperature = *36.0 ksi*

Allowable stress intensity range for load combinations 65 and 76 (including thermal) = 72.0 ksi

(Note: The maximum principal stress and the maximum stress intensity range for these load combinations is much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-6 (Sheet 3 of 3)

*[DESIGN SUMMARY OF NORTH-EAST WALL OF IRWST]**

Element number 140001

Plate thickness provided = 0.50 inches

(Note: This is a lot more than the plate thickness required for load combinations excluding thermal)

Thermal Load Combinations:

Yield stress at design temperature = 36.0 ksi

Allowable stress intensity range for load combinations ~~6~~5 and ~~7~~6 (including thermal) = 72.0 ksi

(Note: The maximum principal stress and the maximum stress intensity range for these load combinations is much lower than the allowable.)

Revise DCD Rev. 16 Table as follows:

Table 3.8.3-7

DESIGN SUMMARY OF STEEL WALL OF IRWST

Mechanical Loads Only
AISC Interaction Ratio

Section Location and Element Number	T Section	L Section	Load Combination
TYPICAL COLUMN AT MIDDLE OF WALL			
Top (139701)	< 1.0	< 1.0	$D + F + L_o + ADS$
	< 1.0	< 1.0	$D + F + L_o + ADS + E_s$
Mid-height (139699)	< 1.0	< 1.0	$D + F + L_o + ADS$
	< 1.0	< 1.0	$D + F + L_o + ADS + E_s$
Bottom (139690)	< 1.0	< 1.0	$D + F + L_o + ADS$
	< 1.0	< 1.0	$D + F + L_o + ADS + E_s$
ENVELOPE OF ALL LOCATIONS AND LOAD COMBINATIONS			
	<1.0	<1.0	

Mechanical Plus Thermal Loads
Ratio of Stress to AISC or ASME (2 * Sy = 80 ksi)

Section Location and Element Number	Flange of T Section	Flange of L Section	Plate	Load Combination
TYPICAL COLUMN AT MIDDLE OF WALL				
Top (139701)	<1.0AISC	<1.0AISC	–	$D+F+L_o+ADS+E_s+T$
Mid-height (139699)	<1.0AISC	<1.0AISC	–	$D+F+L_o+ADS+E_s+T$
Bottom (139690)	<1.0AISC	<1.0AISC	<1.0	$D+F+L_o+ADS+E_s+T$
ENVELOPE OF ALL LOCATIONS AND LOAD COMBINATIONS				
–	<1.0 ASME	<1.0 ASME	<1.0	

Note:
Results of the evaluation of mechanical and thermal loads are shown against the AISC allowables when the stresses are less than yield. Portions of the steel wall at the end of the wall exceed yield due to the restraint provided by the adjacent concrete. These areas are evaluated against the ASME allowables as described in subsection 3.8.3.5.3.4.

Revise DCD Rev. 16 Table as follows:

Table 3H.5-3

[EXTERIOR WALL ON COLUMN LINE 1
DETAILS OF WALL REINFORCEMENT (in^2/ft)]*

(See Figure 3H.5-2 for Locations of Wall Sections.)

Wall Segment	***Location***	***Provided***		
		Vertical	***Horizontal***	***Shear***
Elevation 180'-0" to 135'-3" *WALL SECTION 1,6*				*None*
	Outside Face	*3.91*	*3.12*	
	Inside Face	*3.12*	*3.12*	
Elevation 135'-3" to 100'-0" *WALL SECTION 2,3,7*				*None*
	Outside Face	*3.12*	*3.12*	
	Inside Face	*3.12*	*3.12*	
Elevation 100'-0" to 82'-6" *WALL SECTION 4,8*				*0.44*
	Outside Face	*3.12*	*1.56*	
	Inside Face	*3.12*	*1.27*	
Elevation 82'-6" to 66'-6" *WALL SECTION 5,9*				*1.00*
	Outside Face	*4.39*	*1.27*	
	Inside Face	*3.12*	*1.27*	

Revise DCD Rev. 16 Figure as follows:

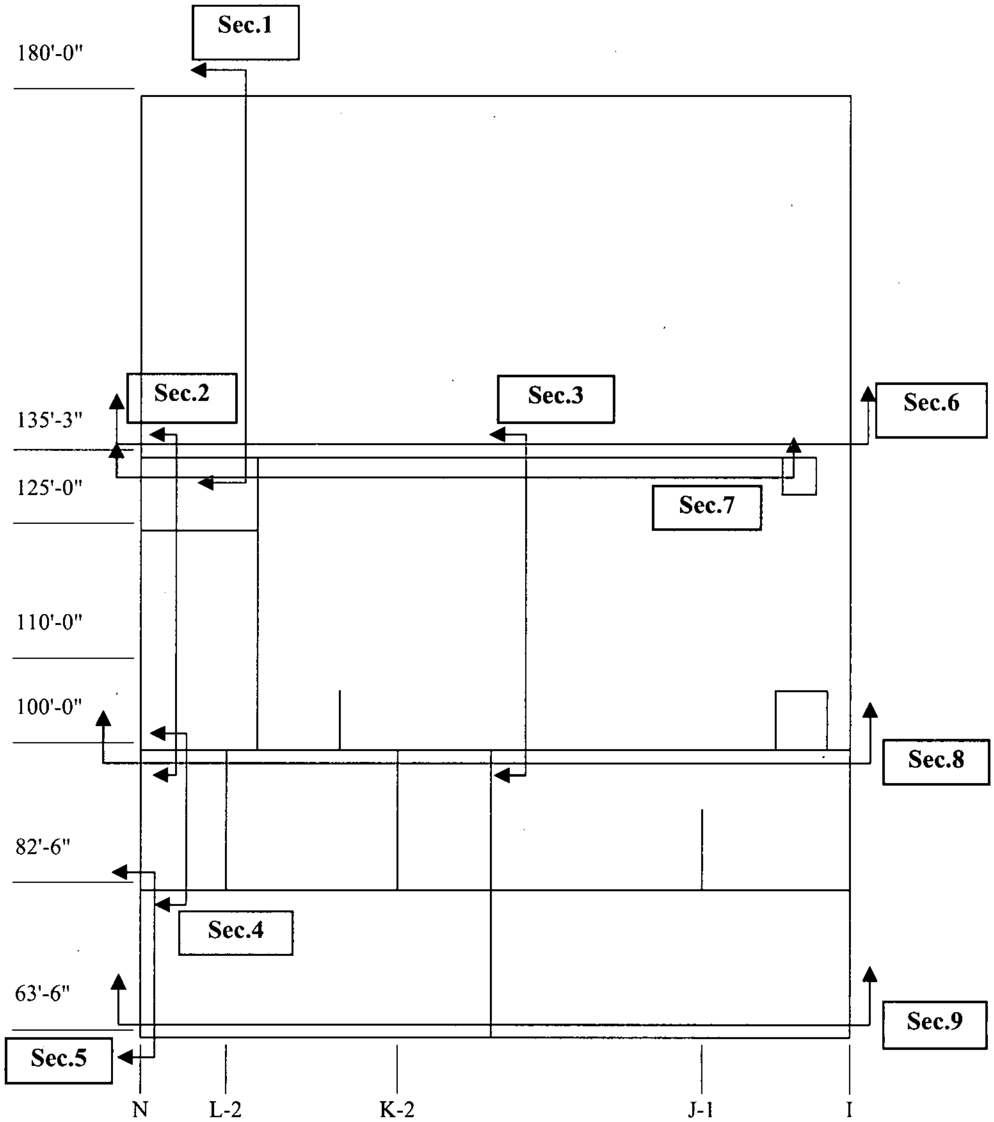


Figure 3H.5-2 (Sheet 1 of 3)

[***Wall on Column Line 1***]*

Revise DCD Rev. 16 Figure as follows:

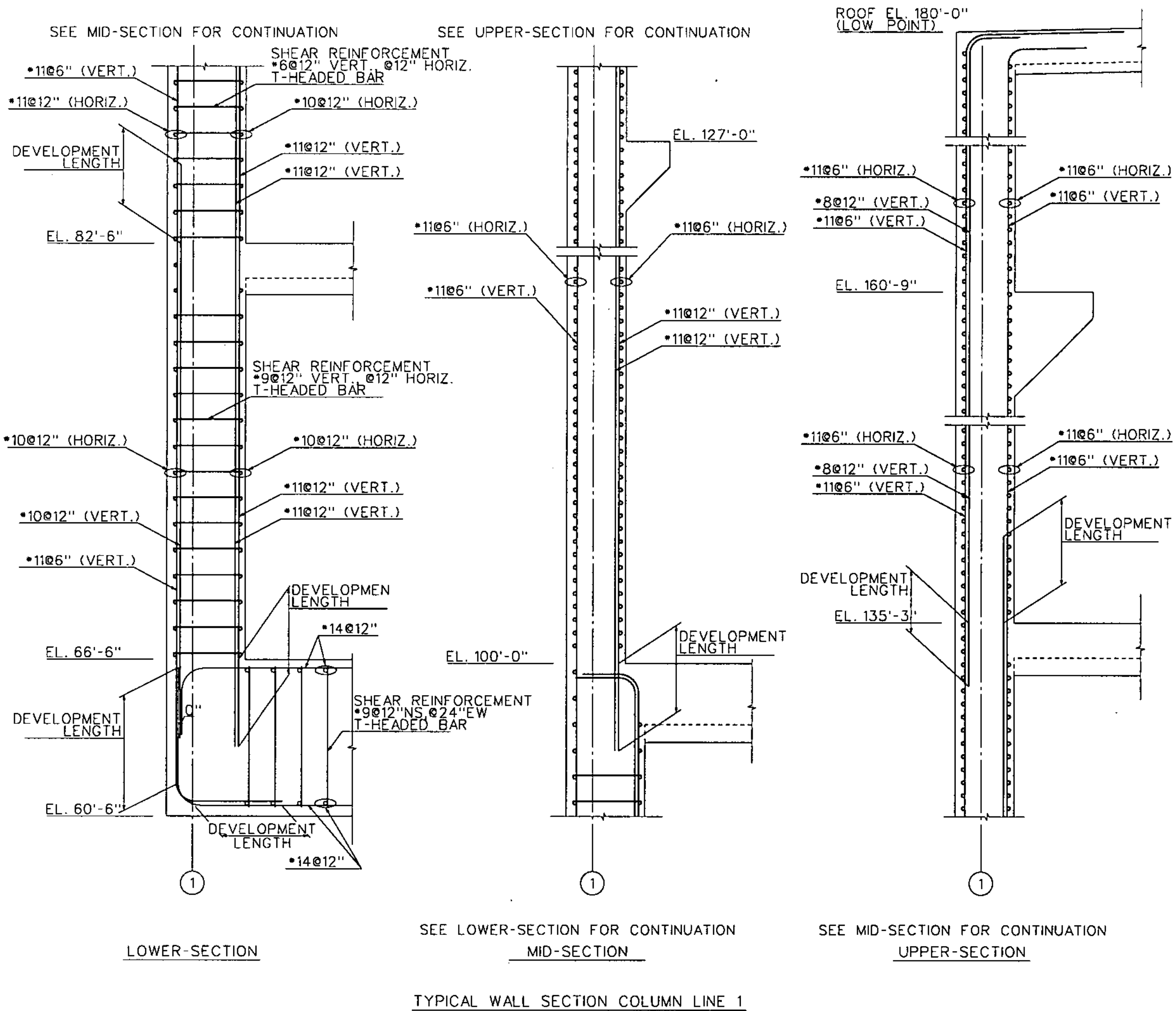


Figure 3H.5-3

*[Typical Reinforcement in Wall on Column Line 1]**

Revise DCD Rev. 16 Table as follows:

Table 3H.5-5

[INTERIOR WALL ON COLUMN LINE 7.3
DETAILS OF WALL REINFORCEMENT]*

(SEE FIGURE 3H.5-2 FOR LOCATIONS OF WALL SECTIONS.)

Wall Segment	***Location***	***Wall Section***	***Reinforcement on Each Face (in^2/ft)***
			Provided
From Roof to Elevation 155'-6"	*Horizontal*	*1*	*4.12*
	Vertical	*7*	*3.72*
Elevation 155'-6" to 135'-3"	*Horizontal*	*2*	*3.12*
	Vertical	*8*	*3.72*
Elevation 135'-3" to 117'-6"	*Horizontal*	*3*	*2.54*
	Vertical	*9*	*3.12*
Elevation 117'-6" to 100'-0"	*Horizontal*	*4*	*2.54*
	Vertical	*10*	*3.12*
Elevation 100'-0" to 82'-6"	*Horizontal*	*5*	*2.54*
	Vertical	*11*	*3.12*
Elevation 82'-6" to 66'-6"	*Horizontal*	*6*	*1.27*
	Vertical	*12*	*1.56*
Shear Reinforcement:			
From Roof to Elevation 155'-6"	*Standard hook or T headed bar*	*7*	*0.44*

Revise DCD Rev. 16 Figure as follows:

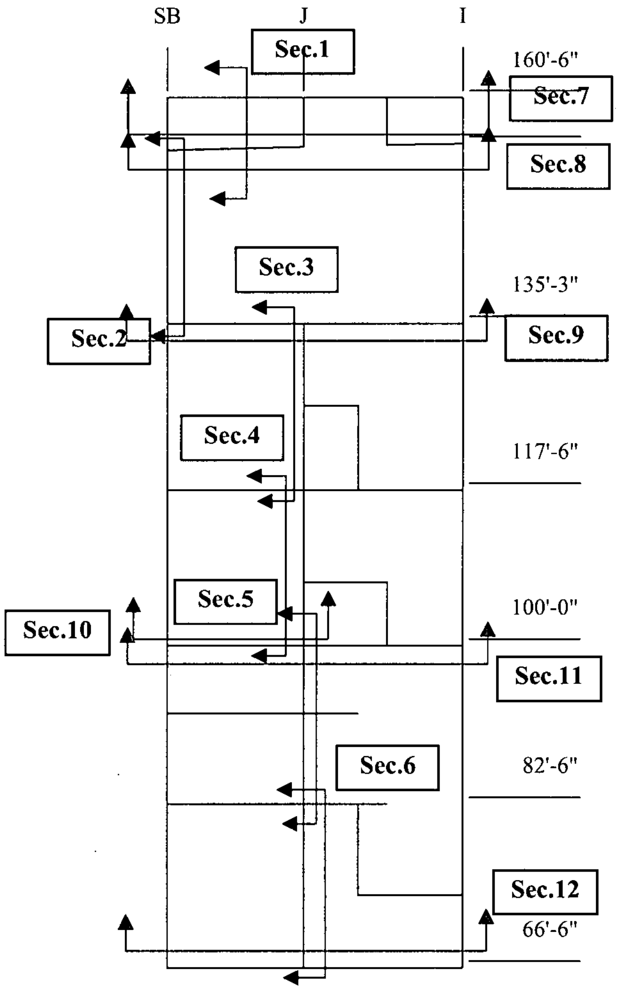
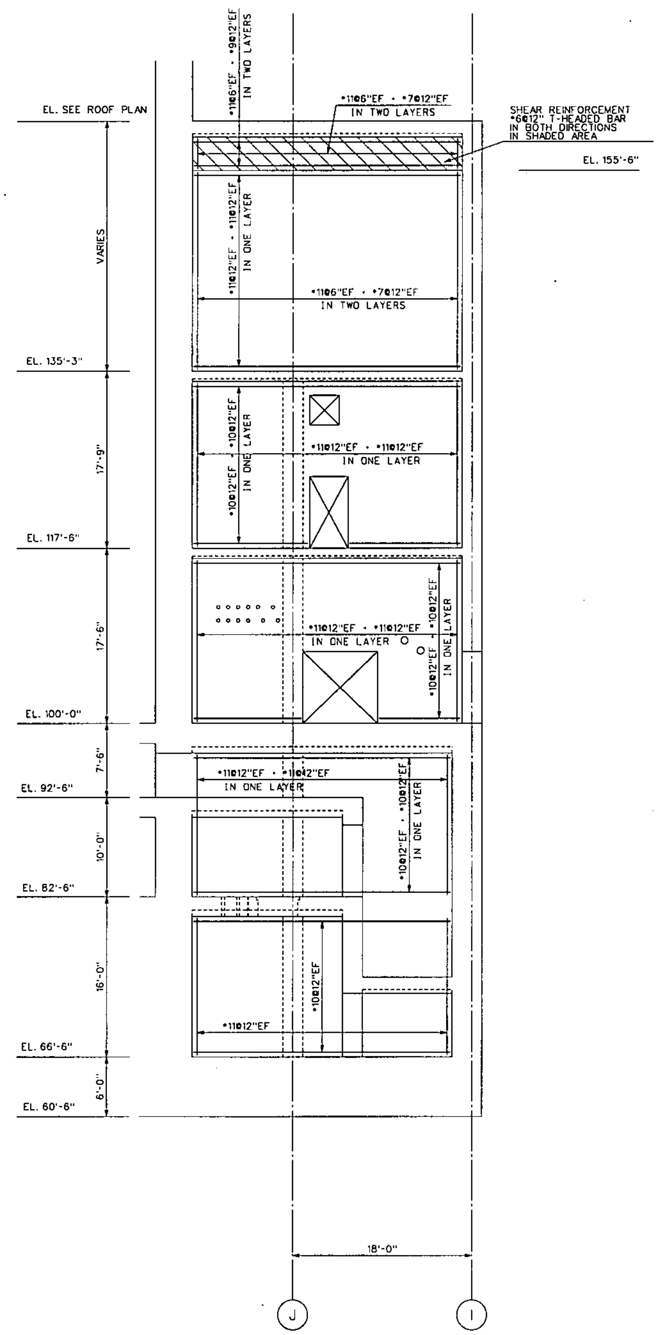


Figure 3H.5-2 (Sheet 2 of 3)

[Wall on Column Line 7.3]*

Revise DCD Rev. 16 Figure as follows:



WALL 7.3 (LOOKING NORTH)

Figure 3H.5-4

*[Typical Reinforcement in Wall 7.3]**

Revise DCD Rev. 16 Table as follows:

Table 3H.5-7

[INTERIOR WALL ON COLUMN LINE L
DETAILS OF WALL REINFORCEMENT]*

(SEE FIGURE 3H.5-2, SHEET 3, FOR LOCATIONS OF WALL SECTIONS.)

Wall Segment	***Location***	***Wall Section***	***Reinforcement (in²/ft²)***
			Provided
Elevation 154'-2" to 135'-3"	*Horizontal*	*1*	*2.27*
	Vertical	*3*	*3.12*
Elevation 135'-3" to 117'-6"	*Horizontal*	*2*	*4.39*
	Vertical	*4*	*5.66*
Shear Reinforcement:			
Elevation 154'-2" to 135'-3"	*Standard hook or T headed bar*	*5*	*0.11*
Elevation 135'-3" to 117'-6"	*Standard hook or T headed bar*	*6*	*2.00*

Revise DCD Rev. 16 Figure as follows:

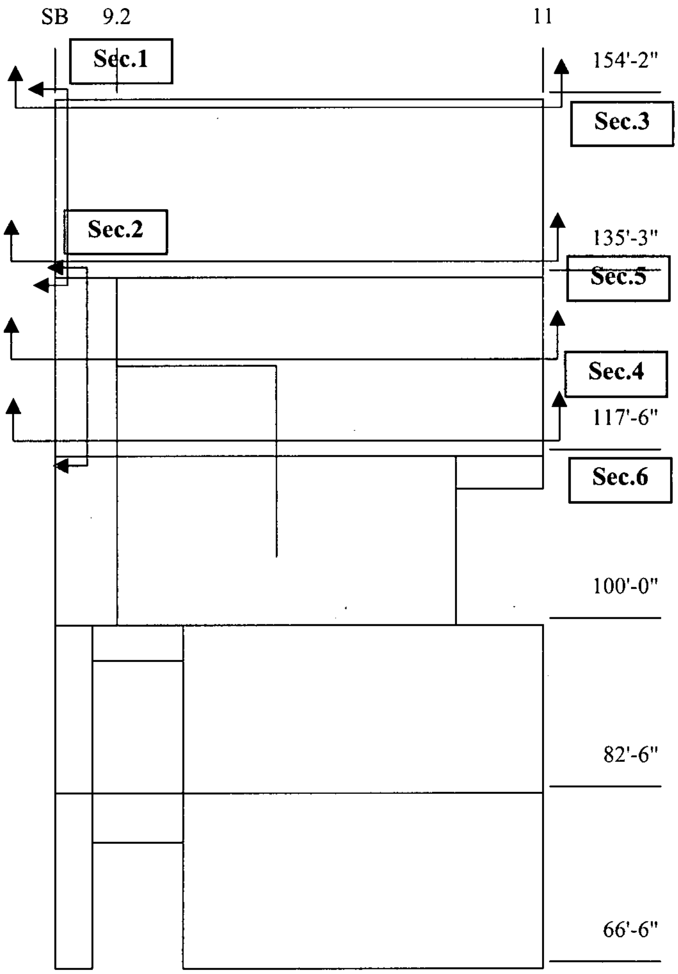


Figure 3H.5-2 (Sheet 3 of 3)

[Wall on Column Line L]*

Revise DCD Rev. 16 Figure as follows:

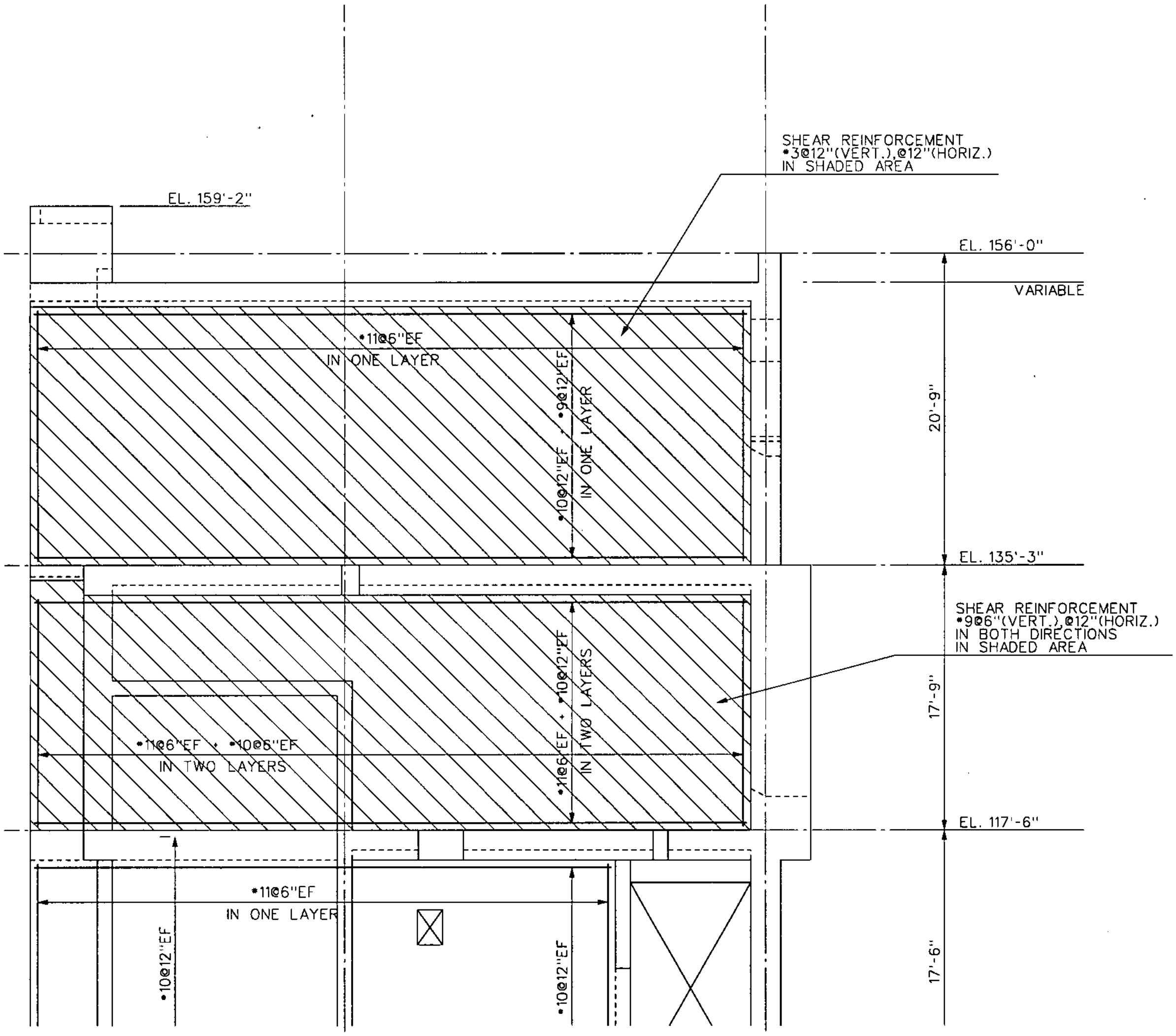


Figure 3H.5-12

[*Typical Reinforcement in Wall L*]*

Revise DCD Rev. 16 Figure as follows:

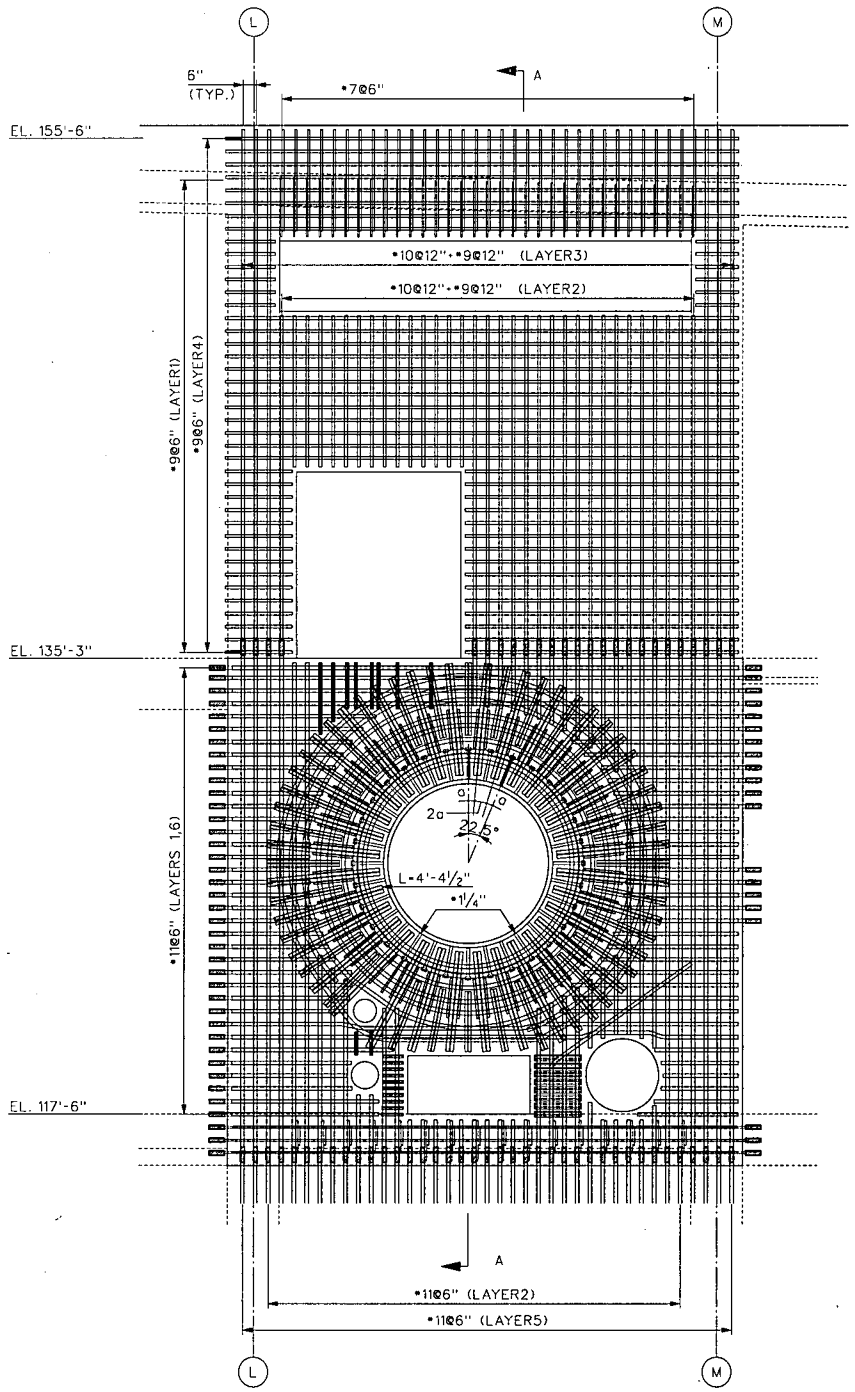


Figure 3H.5-5 (Sheet 1 of 3)

[Concrete Reinforcement in Wall 11]*

Revise DCD Rev. 16 Figure as follows:

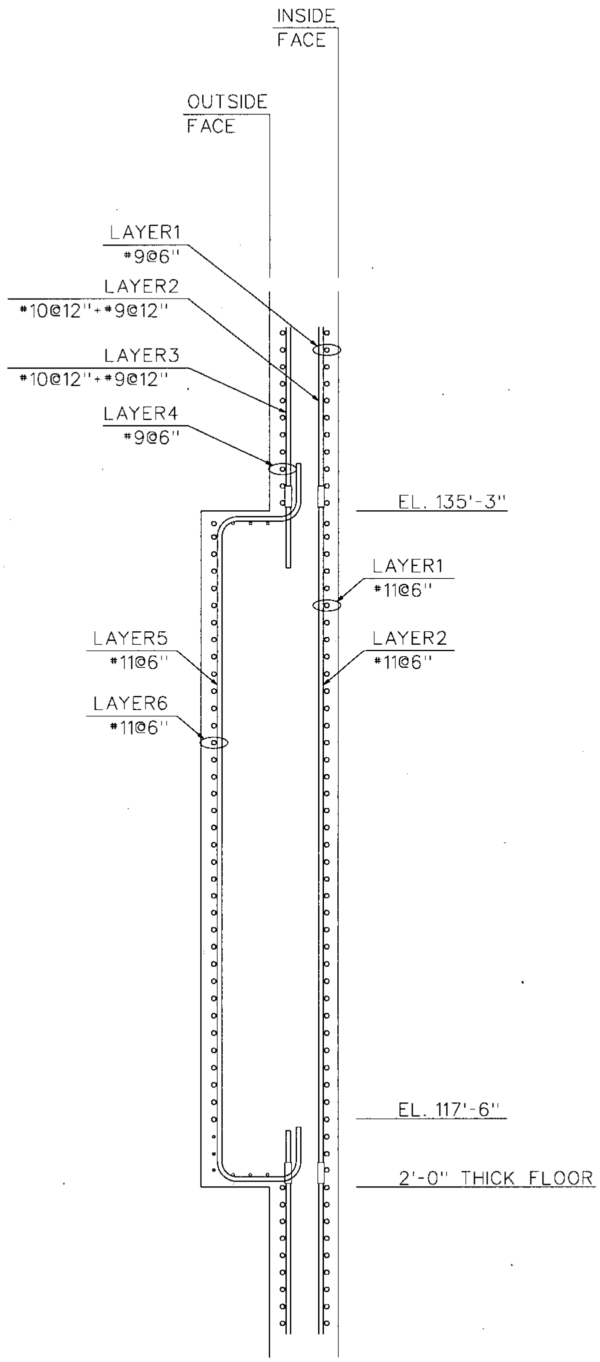


Figure 3H.5-5 (Sheet 2 of 3)

[Concrete Reinforcement Layers in Wall 11 (Looking East)]*

Revise DCD Rev. 16 Figure as follows:

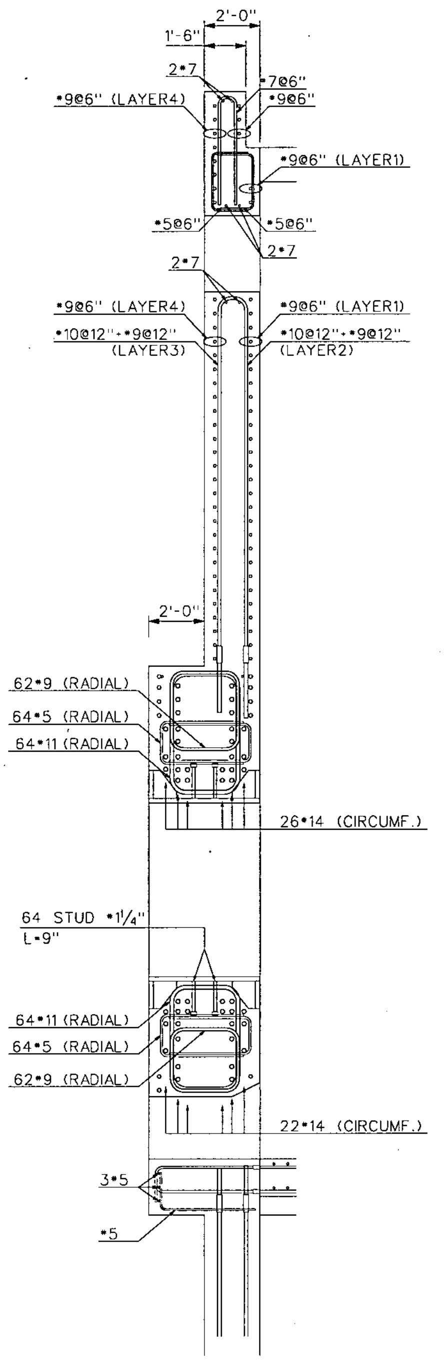


Figure 3H.5-5 (Sheet 3 of 3)

[*Wall 11 at Main Steamline Anchor Section A-A*]*

Revise DCD Rev. 16 Table as follows:

Table 3H.5-10

[DESIGN SUMMARY OF ROOF AT ELEVATION 180'-0", AREA 6]*

(Near Shield Building Interface)

Governing Load Combination (Roof Girder)	
Combination Number	*3 – Extreme Environmental Condition Downward Seismic Acceleration*
Bending Moment:	
Allowable Stress	*= 38.0 ksi > Actual Stress*
Shear Force:	
Allowable Stress	*= 20.1 ksi > Actual Stress*
Governing Load Combination (Concrete Slab)	
Parallel to the Girders	
Combination Numbers	*3 – Extreme Environmental Condition*
Reinforcement (Each Face)	
Provided	*= 2.54 in^2/ft > Required*
Perpendicular to the Girders	
Combination Numbers	*3 – Extreme Environmental Condition*
Reinforcement (Each Face)	
Provided	*= 3.12 in^2/ft > Required*

Revise DCD Rev. 16 Figure as follows:

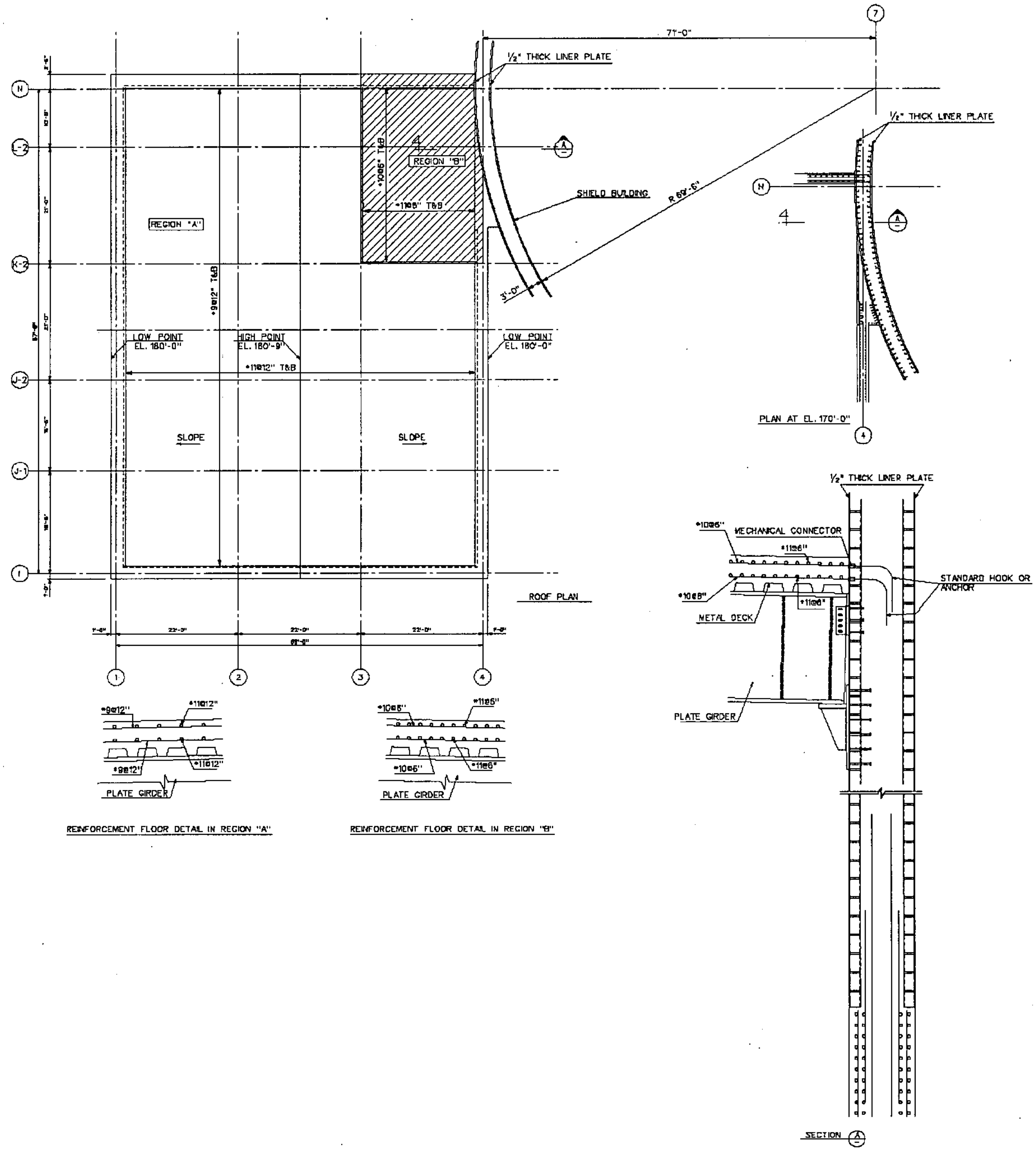


Figure 3H.5-7

[Typical Reinforcement and Connection to Shield Building]*

Revise DCD Rev. 16 Table as follows:

Table 3H.5-11

[DESIGN SUMMARY OF FLOOR AT ELEVATION 135'-3"
AREA 1 (BETWEEN COLUMN LINES M AND P)]*

Governing Load Combination (Steel Beam)	
Load Combination *Bending Moment* *Allowable Stress*	*3 – Extreme Environmental Condition* *Downward Seismic* *= 33.26 ksi > Actual stress*
Shear Force *Allowable Stress*	 *= 20.1 ksi > Actual stress*
Governing Load Combination (Concrete Slab)	
Parallel to the Beams *Load Combination* *Reinforcement (Each Face)* *Provided*	 *3 – Extreme Environmental Condition* *Downward Seismic* *= 0.44 in²/ft > Required*
Perpendicular to the Beams *Load Combination* *Reinforcement (Each Face)* *Provided*	 *Normal Condition* *= 0.60 in²/ft > Required*

Revise DCD Rev. 16 Table as follows:

Table 3H.5-12

[DESIGN SUMMARY OF FLOOR AT ELEVATION 135'-3" (OPERATOR WORK AREA (PREVIOUSLY KNOWN AS 'TAGGING ROOM') ~~TAGGING ROOM~~ CEILING)]*

Design of Precast Concrete Panels	
Governing Load Combination	*Construction*
Bottom Reinforcement (E/W Direction)	
Provided	$= 0.79\ in^2/ft$
Top Reinforcement (E/W Direction)	
Required	*= (Minimum required by Code)*
Provided	$= 0.20\ in^2/ft$
Top and Bottom Reinforcement (N/S Direction)	
Required	*= (Minimum required by Code)*
Provided	$= 0.20\ in^2/ft$
Design of 24-inch-Thick Slab	
Governing Load Combination	*Extreme Environmental Condition (SSE)*
Bottom Reinforcement (E/W Direction)	
Provided	$= 1.00\ in^2/ft >$ *Required*
Top Reinforcement (E/W Direction)	
Provided	$= 1.00\ in^2/ft >$ *Required*
Top and Bottom Reinforcement (N/S Direction)	
Provided	$= 0.79\ in^2/ft >$ *Required*

Figure to be deleted in DCD Rev. 16

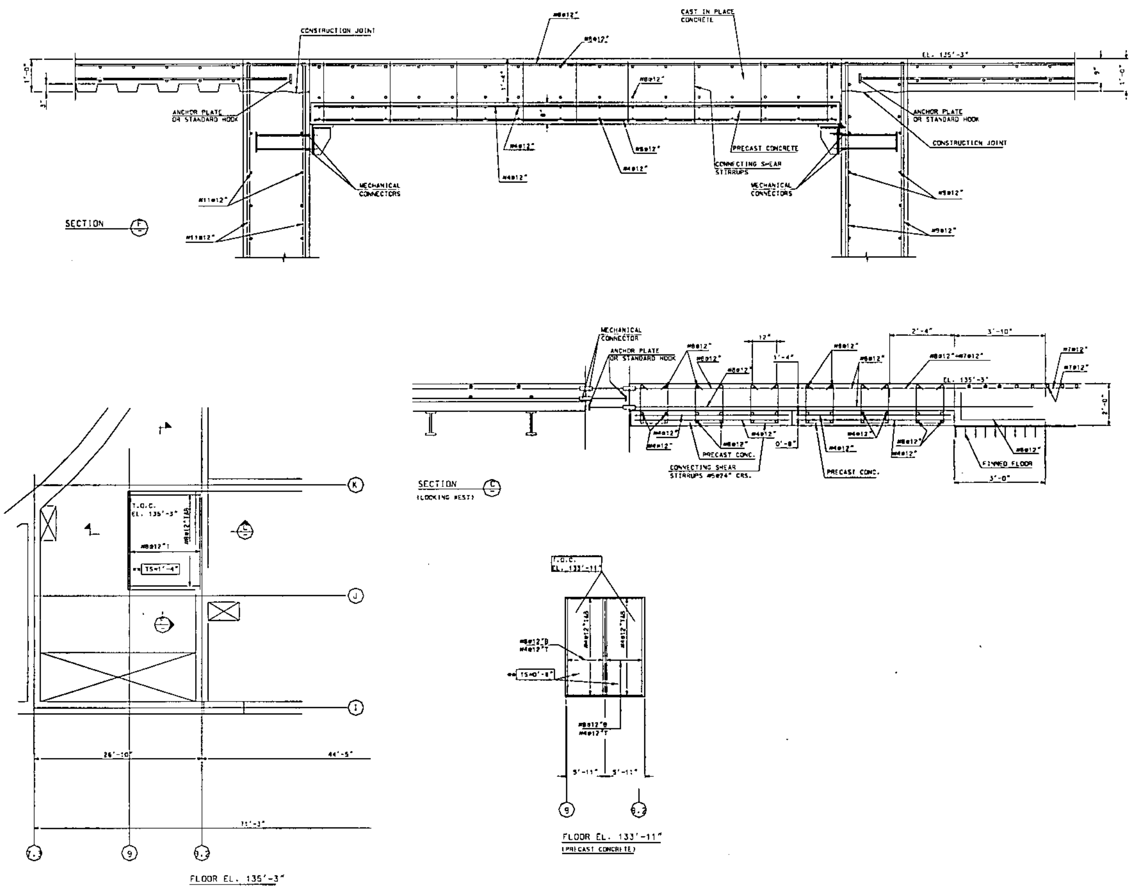


Figure 3H.5-8

[*Auxiliary Building: Operator Work Area (previously known as 'Tagging Room') Ceiling*]*

Revise DCD Rev. 16 Figure as follows:

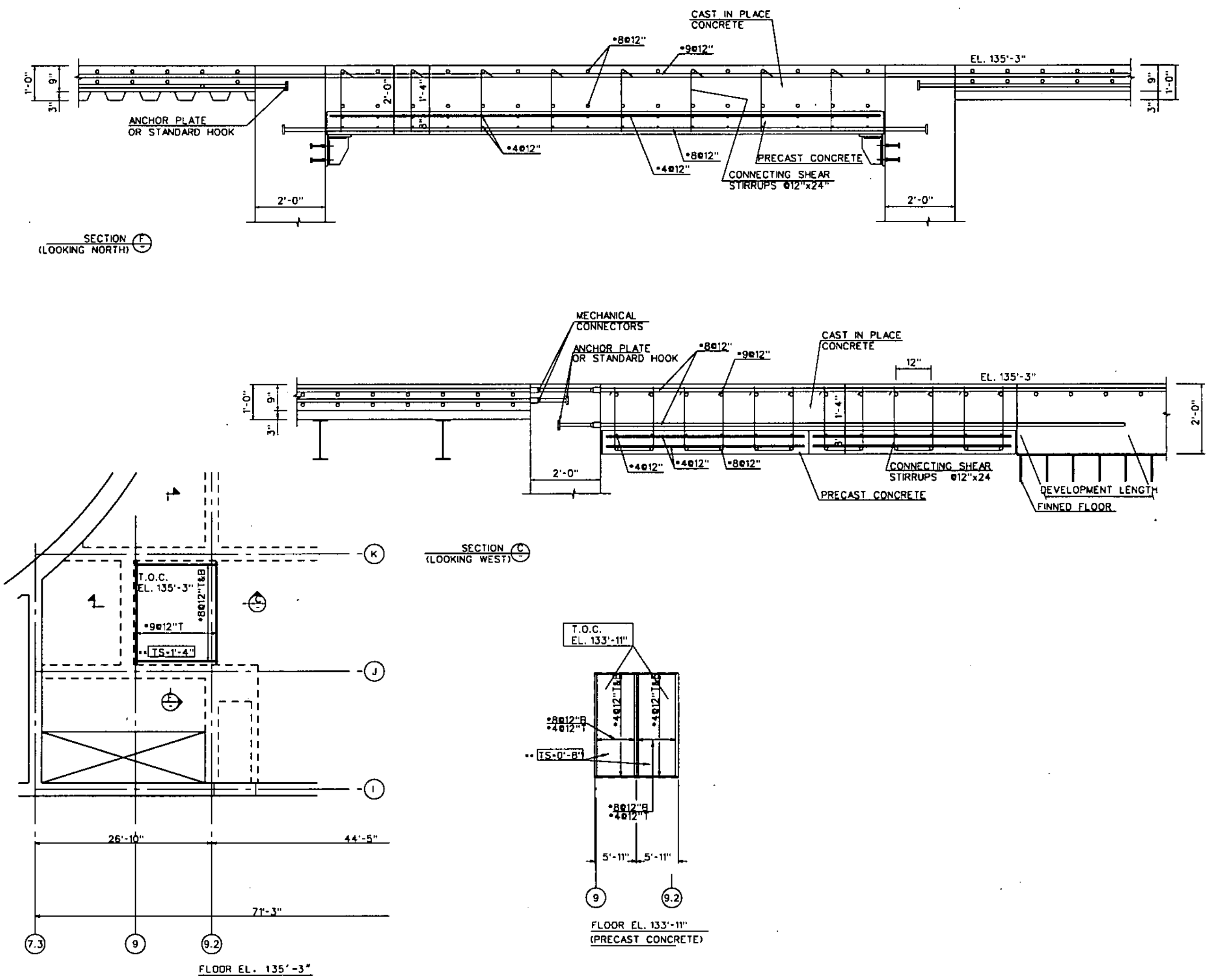


Figure 3H.5-8

[*Auxiliary Building ~~Tagging Room~~Operator Work Area (previously known as 'Tagging Room') Ceiling*]*

Table deleted in DCD Rev. 16

Table 3H.5-8 (Sheet 2 of 5)

[DESIGN SUMMARY OF SPENT FUEL POOL WALL DESIGN LOADS, LOAD COMBINATIONS, AND COMPARISONS TO ACCEPTANCE CRITERIA ELEMENT NO. 1236]*

Load/Comb.	S_{xx} kip/ft	S_{yy} kip/ft	S_{xy} kip/ft	M_{xx} k-ft/ft	M_{yy} k-ft/ft	N_x kip/ft	N_y kip/ft	Comments
Dead (D)	2.97	-38.34	-7.30	-4.97	-13.71			
Live (L)								
Hydro (F)	4.91	0.74	-3.11	-18.04	-23.45	0.46	1.43	
In-pl Seis. (E_s)	152.33	103.11	111.13	11.46	227.73			
Out-pl Seis. (E_s)	8.00	78.00	43.13	30.59	47.23	7.07	15.88	
Thermal (T_a)	-83.04	-281.55	27.47	-708.87	-266.01	-125.35	-259.89	
LC (1)	11.04	-52.63	-14.57	-32.21	-52.03	0.65	2.00	1.4D+1.4F
LC (2)								
LC (3a)	168.22	143.52	171.33	19.04	237.79	7.54	17.30	$1.0D+1.0F+1.0T_a+1.0E_s$
LC (3b)	-235.49	-500.26	-164.67	-773.93	-578.13	-131.96	-274.34	$1.0D+1.0F+1.0T_a-1.0E_s$
LC (4)	-75.16	-319.15	17.06	-731.88	-303.17	-124.89	-258.46	$1.0D+1.0F+1.0T_a$
LC (5)								
LC (6a)	168.22	143.52	143.86	19.04	237.79	7.54	17.30	$1.0D+1.0F+1.0E_s$
LC (6b)	-152.45	-218.71	-164.67	-65.06	-312.12	-6.61	-14.45	$1.0D+1.0F-1.0E_s$
LC (7)								
LC (8)								
LC (9a)	167.92	147.35	144.59	19.54	239.16	7.54	17.30	$0.9D+1.0F+1.0E_s$
LC (9b)	-152.75	-214.88	-163.94	-64.56	-310.75	-6.61	-14.45	$0.9D+1.0F-1.0E_s$

Notes:

x- direction is horizontal; y- direction is vertical.

Plate thickness required for load combinations excluding thermal: 0.38 inches
Plate thickness provided: 0.50 inches

Maximum principal stress for load combination 3 including thermal: 40.91 ksi
Yield stress at temperature of 212°F: 43.96 ksi

Maximum stress intensity range for load combination 3 including thermal: N/A
Allowable stress intensity range for load combination 3 including thermal: 87.92 ksi

Revise DCD Rev. 16 Table as follows:

Table 3H.5-8 (Sheet 1 of 3)
*[DESIGN SUMMARY OF SPENT FUEL POOL WALL: ELEMENT NO. 20477]**
Notes: *See Figure 3H.5-10 for element location* *Plate thickness provided is 0.50 inches, which is much greater than the plate thickness required.*

Revise DCD Rev. 16 Table as follows:

Table 3H.5-8 (Sheet 2 of 3) *[DESIGN SUMMARY OF SPENT FUEL POOL WALL: ELEMENT NO. 10529]**
Notes: *See Figure 3H.5-10 for element location.* *Plate thickness provided is 0.50 inches, which is much greater than the plate thickness required.*

Revise DCD Rev. 16 Table as follows:

Table 3H.5-8 (Sheet 3 of 3) ***[DESIGN SUMMARY OF SPENT FUEL POOL WALL: ELEMENT NO. 10544]****
Notes: *See Figure 3H.5-10 for element location.* *Plate thickness provided is 0.50 inches, which is much greater than the plate thickness required.*

Revise DCD Rev. 16 Figure as follows:

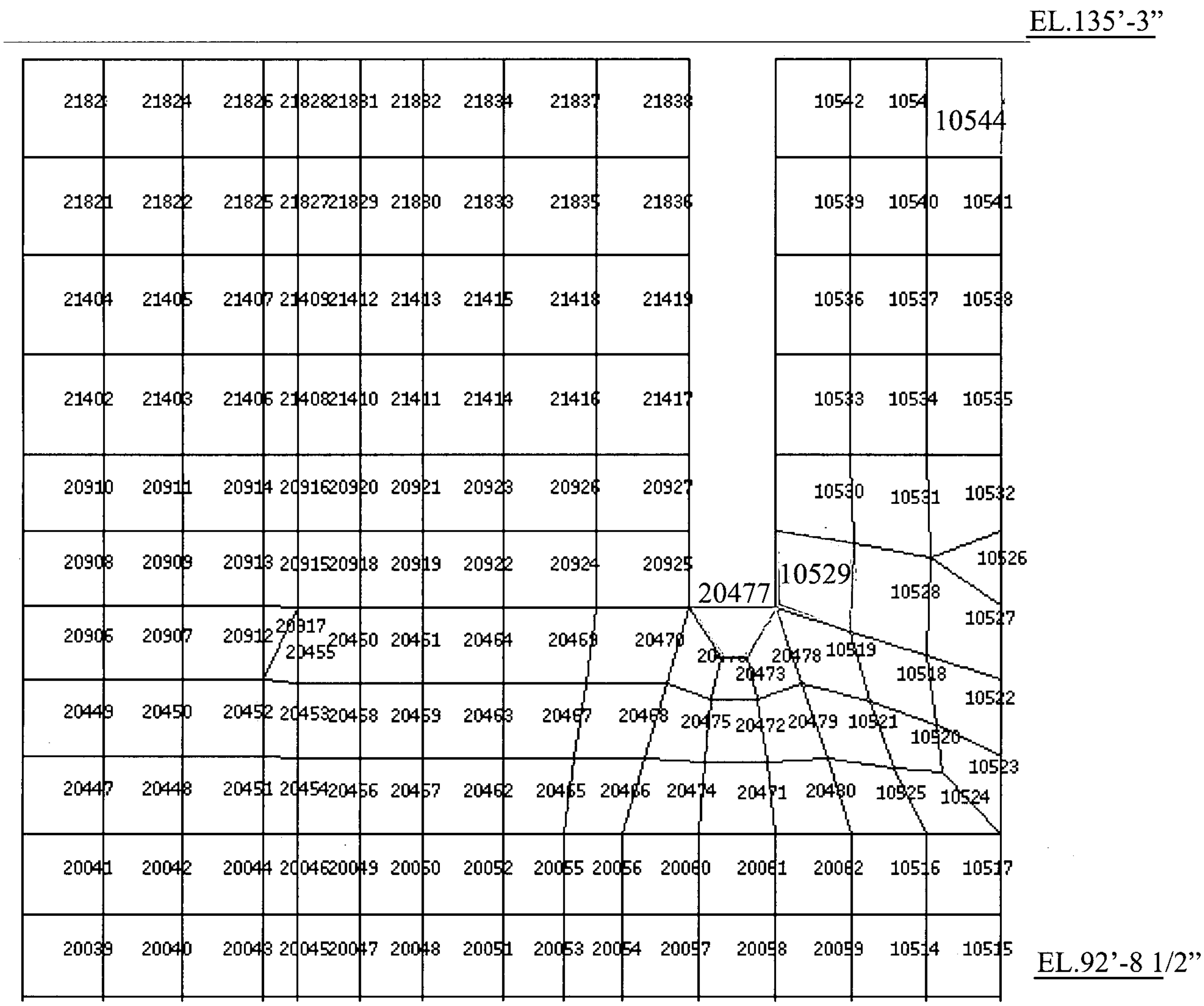


Figure 3H.5-10

*[Spent Fuel Pool Wall Divider Wall Element Locations]**