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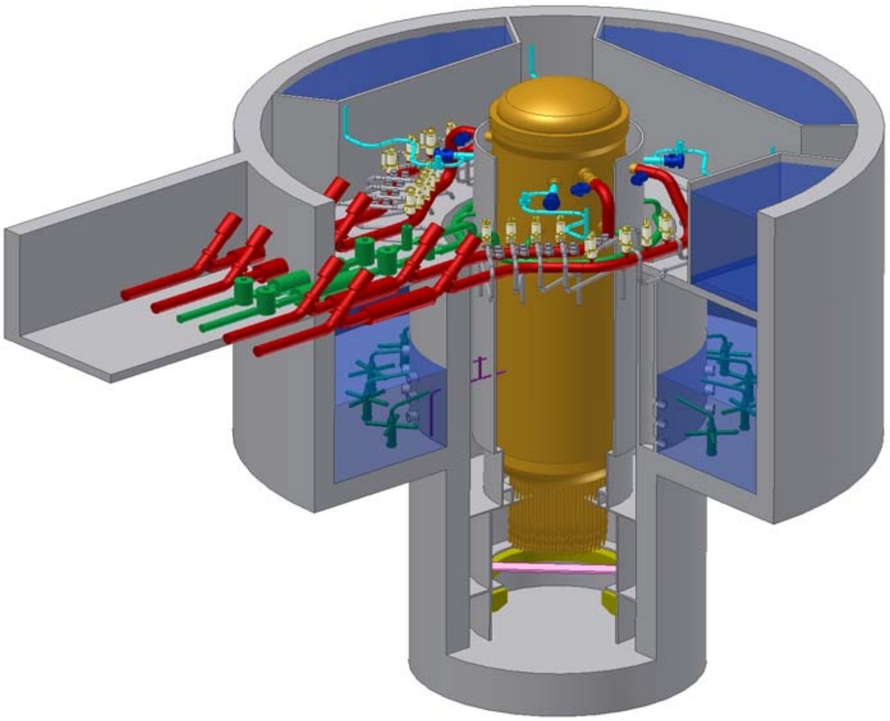

ESBWR Design Control Document

Tier 2

Chapter 3

Design of Structures, Components, Equipment, and Systems

Appendices 3G - 3L

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Global Abbreviations And Acronyms List

Term	**Definition**
10 CFR	Title 10, Code of Federal Regulations
A/D	Analog-to-Digital
AASHTO	American Association of Highway and Transportation Officials
AB	Auxiliary Boiler
ABS	Auxiliary Boiler System
ABWR	Advanced Boiling Water Reactor
ac / AC	Alternating Current
AC	Air Conditioning
ACF	Automatic Control Function
ACI	American Concrete Institute
ACS	Atmospheric Control System
AD	Administration Building
ADS	Automatic Depressurization System
AEC	Atomic Energy Commission
AFIP	Automated Fixed In-Core Probe
AGMA	American Gear Manufacturer's Association
AHS	Auxiliary Heat Sink
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AL	Analytical Limit
ALARA	As Low As Reasonably Achievable
ALWR	Advanced Light Water Reactor
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOO	Anticipated Operational Occurrence
AOV	Air Operated Valve
API	American Petroleum Institute
APLHGR	Average Planar Linear Head Generation Rate
APRM	Average Power Range Monitor
APR	Automatic Power Regulator
APRS	Automatic Power Regulator System
ARI	Alternate Rod Insertion
ARMS	Area Radiation Monitoring System
ASA	American Standards Association
ASD	Adjustable Speed Drive
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
AST	Alternate Source Term

Global Abbreviations And Acronyms List

Term	Definition
ASTM	American Society of Testing Methods
AT	Unit Auxiliary Transformer
ATLM	Automated Thermal Limit Monitor
ATWS	Anticipated Transients Without Scram
AV	Allowable Value
AWS	American Welding Society
AWWA	American Water Works Association
B&PV	Boiler and Pressure Vessel
BAF	Bottom of Active Fuel
BHP	Brake Horse Power
BOP	Balance of Plant
BPU	Bypass Unit
BPWS	Banked Position Withdrawal Sequence
BRE	Battery Room Exhaust
BRL	Background Radiation Level
BTP	NRC Branch Technical Position
BTU	British Thermal Unit
BWR	Boiling Water Reactor
BWROG	Boiling Water Reactor Owners Group
CAV	Cumulative absolute velocity
C&FS	Condensate and Feedwater System
C&I	Control and Instrumentation
C/C	Cooling and Cleanup
CB	Control Building
CBHVAC	Control Building HVAC
CCI	Core-Concrete Interaction
CDF	Core Damage Frequency
CFR	Code of Federal Regulations
CIRC	Circulating Water System
CIS	Containment Inerting System
CIV	Combined Intermediate Valve
CLAVS	Clean Area Ventilation Subsystem of Reactor Building HVAC
CM	Cold Machine Shop
CMS	Containment Monitoring System
CMU	Control Room Multiplexing Unit
COL	Combined Operating License
COLR	Core Operating Limits Report
CONAVS	Controlled Area Ventilation Subsystem of Reactor Building HVAC
CPR	Critical Power Ratio

Global Abbreviations And Acronyms List

Term	Definition
CPS	Condensate Purification System
CPU	Central Processing Unit
CR	Control Rod
CRD	Control Rod Drive
CRDA	Control Rod Drop Accident
CRDH	Control Rod Drive Housing
CRDHS	Control Rod Drive Hydraulic System
CRGT	Control Rod Guide Tube
CRHA	Control Room Habitability Area
CRT	Cathode Ray Tube
CS&TS	Condensate Storage and Transfer System
CSDM	Cold Shutdown Margin
CS / CST	Condensate Storage Tank
CT	Main Cooling Tower
CTVCF	Constant Voltage Constant Frequency
CUF	Cumulative usage factor
CWS	Chilled Water System
D-RAP	Design Reliability Assurance Program
DAC	Design Acceptance Criteria
DAW	Dry Active Waste
DBA	Design Basis Accident
dc / DC	Direct Current
DCS	Drywell Cooling System
DCIS	Distributed Control and Information System
DEPSS	Drywell Equipment and Pipe Support Structure
DF	Decontamination Factor
D/F	Diaphragm Floor
DG	Diesel-Generator
DHR	Decay Heat Removal
DM&C	Digital Measurement and Control
DOF	Degree of freedom
DOI	Dedicated Operators Interface
DOT	Department of Transportation
dPT	Differential Pressure Transmitter
DPS	Diverse Protection System
DPV	Depressurization Valve
DR&T	Design Review and Testing
DS	Independent Spent Fuel Storage Installation
DTM	Digital Trip Module

Global Abbreviations And Acronyms List

Term	Definition
DW	Drywell
EB	Electrical Building
EBAS	Emergency Breathing Air System
EBHV	Electrical Building HVAC
ECCS	Emergency Core Cooling System
E-DCIS	Essential DCIS (Distributed Control and Information System)
EDO	Environmental Qualification Document
EFDS	Equipment and Floor Drainage System
EFPY	Effective full power years
EHC	Electrohydraulic Control (Pressure Regulator)
ENS	Emergency Notification System
EOC	Emergency Operations Center
EOC	End of Cycle
EOF	Emergency Operations Facility
EOP	Emergency Operating Procedures
EPDS	Electric Power Distribution System
EPG	Emergency Procedure Guidelines
EPRI	Electric Power Research Institute
EQ	Environmental Qualification
ERICP	Emergency Rod Insertion Control Panel
ERIP	Emergency Rod Insertion Panel
ESF	Engineered Safety Feature
ETS	Emergency Trip System
FAC	Flow-Accelerated Corrosion
FAPCS	Fuel and Auxiliary Pools Cooling System
FATT	Fracture Appearance Transition Temperature
FB	Fuel Building
FBHV	Fuel Building HVAC
FCI	Fuel-Coolant Interaction
FCM	File Control Module
FCS	Flammability Control System
FCU	Fan Cooling Unit
FDDI	Fiber Distributed Data Interface
FFT	Fast Fourier Transform
FFWTR	Final Feedwater Temperature Reduction
FHA	Fire Hazards Analysis
FIV	Flow-Induced Vibration
FMCRD	Fine Motion Control Rod Drive
FMEA	Failure Modes and Effects Analysis

Global Abbreviations And Acronyms List

Term	Definition
FPS	Fire Protection System
FO	Diesel Fuel Oil Storage Tank
FOAKE	First-of-a-Kind Engineering
FPE	Fire Pump Enclosure
FTDC	Fault-Tolerant Digital Controller
FTS	Fuel Transfer System
FW	Feedwater
FWCS	Feedwater Control System
FWS	Fire Water Storage Tank
GCS	Generator Cooling System
GDC	General Design Criteria
GDCS	Gravity-Driven Cooling System
GE	General Electric Company
GE-NE	GE Nuclear Energy
GEN	Main Generator System
GETAB	General Electric Thermal Analysis Basis
GL	Generic Letter
GM	Geiger-Mueller Counter
GM-B	Beta-Sensitive GM Detector
GSIC	Gamma-Sensitive Ion Chamber
GSOS	Generator Sealing Oil System
GWSR	Ganged Withdrawal Sequence Restriction
HAZ	Heat-Affected Zone
HCU	Hydraulic Control Unit
HCW	High Conductivity Waste
HDVS	Heater Drain and Vent System
HEI	Heat Exchange Institute
HELB	High Energy Line Break
HEP	Human error probability
HEPA	High Efficiency Particulate Air/Absolute
HFE	Human Factors Engineering
HFF	Hollow Fiber Filter
HGCS	Hydrogen Gas Cooling System
HIC	High Integrity Container
HID	High Intensity Discharge
HIS	Hydraulic Institute Standards
HM	Hot Machine Shop & Storage
HP	High Pressure
HPNSS	High Pressure Nitrogen Supply System

Global Abbreviations And Acronyms List

Term	Definition
HPT	High-pressure turbine
HRA	Human Reliability Assessment
HSI	Human-System Interface
HSSS	Hardware/Software System Specification
HVAC	Heating, Ventilation and Air Conditioning
HVS	High Velocity Separator
HWCS	Hydrogen Water Chemistry System
HWS	Hot Water System
HX	Heat Exchanger
I&C	Instrumentation and Control
I/O	Input/Output
IAS	Instrument Air System
IASCC	Irradiation Assisted Stress Corrosion Cracking
IBC	International Building Code
IC	Isolation Condenser
ICD	Interface Control Diagram
ICS	Isolation Condenser System
IE	Inspection and Enforcement
IEB	Inspection and Enforcement Bulletin
IED	Instrument and Electrical Diagram
IEEE	Institute of Electrical and Electronic Engineers
IGSCC	Intergranular Stress Corrosion Cracking
IIS	Iron Injection System
ILRT	Integrated Leak Rate Test
IOP	Integrated Operating Procedure
IMC	Induction Motor Controller
IMCC	Induction Motor Controller Cabinet
IRM	Intermediate Range Monitor
ISA	Instrument Society of America
ISI	In-Service Inspection
ISLOCA	Intersystem Loss of Coolant Accident
ISLT	In-Service Leak Test
ISM	Independent Support Motion
ISMA	Independent Support Motion Response Spectrum Analysis
ISO	International Standards Organization
ITA	Inspections, Tests or Analyses
ITAAC	Inspections, Tests, Analyses and Acceptance Criteria
ITA	Initial Test Program
LAPP	Loss of Alternate Preferred Power

Global Abbreviations And Acronyms List

Term	Definition
LCO	Limiting Conditions for Operation
LCW	Low Conductivity Waste
LD	Logic Diagram
LDA	Lay down Area
LD&IS	Leak Detection and Isolation System
LERF	Large early release frequency
LFCV	Low Flow Control Valve
LHGR	Linear Heat Generation Rate
LLRT	Local Leak Rate Test
LMU	Local Multiplexer Unit
LO	Dirty/Clean Lube Oil Storage Tank
LOCA	Loss-of-Coolant-Accident
LOFW	Loss-of-feedwater
LOOP	Loss of Offsite Power
LOPP	Loss of Preferred Power
LP	Low Pressure
LPCI	Low Pressure Coolant Injection
LPCRD	Locking Piston Control Rod Drive
LPMS	Loose Parts Monitoring System
LPRM	Local Power Range Monitor
LPSP	Low Power Setpoint
LWMS	Liquid Waste Management System
MAAP	Modular Accident Analysis Program
MAPLHGR	Maximum Average Planar Linear Head Generation Rate
MAPRAT	Maximum Average Planar Ratio
MBB	Motor Built-In Brake
MCC	Motor Control Center
MCES	Main Condenser Evacuation System
MCPR	Minimum Critical Power Ratio
MCR	Main Control Room
MCRP	Main Control Room Panel
MELB	Moderate Energy Line Break
MLHGR	Maximum Linear Heat Generation Rate
MMI	Man-Machine Interface
MMIS	Man-Machine Interface Systems
MOV	Motor-Operated Valve
MPC	Maximum Permissible Concentration
MPL	Master Parts List
MS	Main Steam

Global Abbreviations And Acronyms List

Term	Definition
MSIV	Main Steam Isolation Valve
MSL	Main Steamline
MSLB	Main Steamline Break
MSLBA	Main Steamline Break Accident
MSR	Moisture Separator Reheater
MSV	Mean Square Voltage
MT	Main Transformer
MTTR	Mean Time To Repair
MWS	Makeup Water System
NBR	Nuclear Boiler Rated
NBS	Nuclear Boiler System
NCIG	Nuclear Construction Issues Group
NDE	Nondestructive Examination
NE-DCIS	Non-Essential Distributed Control and Information System
NDRC	National Defense Research Committee
NDT	Nil Ductility Temperature
NFPA	National Fire Protection Association
NIST	National Institute of Standard Technology
NMS	Neutron Monitoring System
NOV	Nitrogen Operated Valve
NPHS	Normal Power Heat Sink
NPSH	Net Positive Suction Head
NRC	Nuclear Regulatory Commission
NRHX	Non-Regenerative Heat Exchanger
NS	Non-seismic
NSSS	Nuclear Steam Supply System
NT	Nitrogen Storage Tank
NTSP	Nominal Trip Setpoint
O&M	Operation and Maintenance
O-RAP	Operational Reliability Assurance Program
OBCV	Overboard Control Valve
OBE	Operating Basis Earthquake
OGS	Offgas System
OHLHS	Overhead Heavy Load Handling System
OIS	Oxygen Injection System
OLMCPR	Operating Limit Minimum Critical Power Ratio
OLU	Output Logic Unit
OOS	Out-of-service
ORNL	Oak Ridge National Laboratory

Global Abbreviations And Acronyms List

Term	**Definition**
OSC	Operational Support Center
OSHA	Occupational Safety and Health Administration
OSI	Open Systems Interconnect
P&ID	Piping and Instrumentation Diagram
PA/PL	Page/Party-Line
PABX	Private Automatic Branch (Telephone) Exchange
PAM	Post Accident Monitoring
PAR	Passive Autocatalytic Recombiner
PAS	Plant Automation System
PASS	Post Accident Sampling Subsystem of Containment Monitoring System
PCC	Passive Containment Cooling
PCCS	Passive Containment Cooling System
PCT	Peak cladding temperature
PCV	Primary Containment Vessel
PFD	Process Flow Diagram
PGA	Peak Ground Acceleration
PGCS	Power Generation and Control Subsystem of Plant Automation System
PH	Pump House
PL	Parking Lot
PM	Preventive Maintenance
PMCS	Performance Monitoring and Control Subsystem of NE-DCIS
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PPQS	Product Performance Qualification Specification
PQCL	Product Quality Check List
PRA	Probabilistic Risk Assessment
PRMS	Process Radiation Monitoring System
PRNM	Power Range Neutron Monitoring
PS	Plant Stack
PSD	Power Spectra Density
PSS	Process Sampling System
PSWS	Plant Service Water System
PT	Pressure Transmitter
PWR	Pressurized Water Reactor
QA	Quality Assurance
RACS	Rod Action Control Subsystem
RAM	Reliability, Availability and Maintainability
RAPI	Rod Action and Position Information
RAT	Reserve Auxiliary Transformer

Global Abbreviations And Acronyms List

Term	**Definition**
RB	Reactor Building
RBC	Rod Brake Controller
RBCC	Rod Brake Controller Cabinet
RBCWS	Reactor Building Chilled Water Subsystem
RBHV	Reactor Building HVAC
RBS	Rod Block Setpoint
RBV	Reactor Building Vibration
RC&IS	Rod Control and Information System
RCC	Remote Communication Cabinet
RCCV	Reinforced Concrete Containment Vessel
RCCWS	Reactor Component Cooling Water System
RCPB	Reactor Coolant Pressure Boundary
RCS	Reactor Coolant System
RDA	Rod Drop Accident
RDC	Resolver-to-Digital Converter
REPAVS	Refueling and Pool Area Ventilation Subsystem of Fuel Building HVAC
RFP	Reactor Feed Pump
RG	Regulatory Guide
RHR	Residual Heat Removal (function)
RHX	Regenerative Heat Exchanger
RMS	Root Mean Square
RMS	Radiation Monitoring Subsystem
RMU	Remote Multiplexer Unit
RO	Reverse Osmosis
ROM	Read-only Memory
RPS	Reactor Protection System
RPV	Reactor Pressure Vessel
RRPS	Reference Rod Pull Sequence
RSM	Rod Server Module
RSPC	Rod Server Processing Channel
RSS	Remote Shutdown System
RSSM	Reed Switch Sensor Module
RSW	Reactor Shield Wall
RTIF	Reactor Trip and Isolation Function(s)
RT_{NDT}	Reference Temperature of Nil-Ductility Transition
RTP	Reactor Thermal Power
RW	Radwaste Building
RWCU/SDC	Reactor Water Cleanup/Shutdown Cooling
RWE	Rod Withdrawal Error

Global Abbreviations And Acronyms List

Term	Definition
RWM	Rod Worth Minimizer
SA	Severe Accident
SAR	Safety Analysis Report
SB	Service Building
S/C	Digital Gamma-Sensitive GM Detector
S/D	Scintillation Detector
S/DRSRO	Single/Dual Rod Sequence Restriction Override
S/N	Signal-to-Noise
S/P	Suppression Pool
SAS	Service Air System
SB&PC	Steam Bypass and Pressure Control System
SBO	Station Blackout
SBWR	Simplified Boiling Water Reactor
SCEW	System Component Evaluation Work
SCRRI	Selected Control Rod Run-in
SDC	Shutdown Cooling
SDM	Shutdown Margin
SDS	System Design Specification
SEOA	Sealed Emergency Operating Area
SER	Safety Evaluation Report
SF	Service Water Building
SFP	Spent fuel pool
SIL	Service Information Letter
SIT	Structural Integrity Test
SIU	Signal Interface Unit
SJAE	Steam Jet Air Ejector
SLC	Standby Liquid Control
SLCS	Standby Liquid Control System
SLMCPR	Safety Limit Minimum Critical Power Ratio
SMU	SSLC Multiplexing Unit
SOV	Solenoid Operated Valve
SP	Setpoint
SPC	Suppression Pool Cooling
SPDS	Safety Parameter Display System
SPTMS	Suppression Pool Temperature Monitoring Subsystem of Containment Monitoring System
SR	Surveillance Requirement
SRM	Source Range Monitor
SRNM	Startup Range Neutron Monitor
SRO	Senior Reactor Operator

Global Abbreviations And Acronyms List

Term	Definition
SRP	Standard Review Plan
SRS	Software Requirements Specification
SRSRO	Single Rod Sequence Restriction Override
SRSS	Square Root of the Sum of the Squares
SRV	Safety Relief Valve
SRVDL	Safety relief valve discharge line
SSAR	Standard Safety Analysis Report
SSC(s)	Structure, System and Component(s)
SSE	Safe Shutdown Earthquake
SSLC	Safety System Logic and Control
SSPC	Steel Structures Painting Council
ST	Spare Transformer
STP	Sewage Treatment Plant
STRAP	Scram Time Recording and Analysis Panel
STRP	Scram Time Recording Panel
SV	Safety Valve
SWH	Static water head
SWMS	Solid Waste Management System
SY	Switch Yard
TAF	Top of Active Fuel
TASS	Turbine Auxiliary Steam System
TB	Turbine Building
TBCE	Turbine Building Compartment Exhaust
TBE	Turbine Building Exhaust
TBLOE	Turbine Building Lube Oil Area Exhaust
TBS	Turbine Bypass System
TBHV	Turbine Building HVAC
TBV	Turbine Bypass Valve
TC	Training Center
TCCWS	Turbine Component Cooling Water System
TCS	Turbine Control System
TCV	Turbine Control Valve
TDH	Total Developed Head
TEMA	Tubular Exchanger Manufacturers' Association
TFSP	Turbine first stage pressure
TG	Turbine Generator
TGSS	Turbine Gland Seal System
THA	Time-history accelerograph
TLOS	Turbine Lubricating Oil System

Global Abbreviations And Acronyms List

Term	**Definition**
TLU	Trip Logic Unit
TMI	Three Mile Island
TMSS	Turbine Main Steam System
TRM	Technical Requirements Manual
TS	Technical Specification(s)
TSC	Technical Support Center
TSI	Turbine Supervisory Instrument
TSV	Turbine Stop Valve
UBC	Uniform Building Code
UHS	Ultimate Heat Sink
UL	Underwriter's Laboratories Inc.
UPS	Uninterruptible Power Supply
URS	Ultimate Rupture Strength
USE	Upper Shelf Energy
USM	Uniform Support Motion
USMA	Uniform support motion response spectrum analysis
USNRC	United States Nuclear Regulatory Commission
USS	United States Standard
UV	Ultraviolet
V&V	Verification and Validation
Vac / VAC	Volts Alternating Current
Vdc / VDC	Volts Direct Current
VDU	Video Display Unit
VW	Vent Wall
VWO	Valves Wide Open
WD	Wash Down Bays
WH	Warehouse
WS	Water Storage
WT	Water Treatment
WW	Wetwell
XMFR	Transformer
ZPA	Zero Period Acceleration

3G. DESIGN DETAILS AND EVALUATION RESULTS OF SEISMIC CATEGORY I STRUCTURES

This appendix presents the structural design and analysis for the Reactor Building, Control Building and Fuel Building of the ESBWR standard plant. It addresses all applicable items included in Appendix C to USNRC Standard Review Plan, NUREG-0800, Section 3.8.4.

3G.1 REACTOR BUILDING

The Reactor Building (RB) encloses the concrete containment and its internal systems, structures, and components. In addition, the RB contains the Isolation Condenser/Passive Containment Cooling (IC/PCC) pools and the services pools for storage of Dryer/Separator on the top of the concrete containment.

3G.1.1 Objective and Scope

The objective of this subsection is to document the structural design details, inputs and analytical results from the analysis of the ESBWR main building structures encased in the Reactor Building. The scope includes the design and analysis of the structure for normal, severe environmental, extreme environmental, and abnormal loads.

3G.1.2 Conclusions

The following are the major summary conclusions on the design and analysis of the Reactor Building, the concrete containment and the containment internal structures.

- Based on the results of finite element analyses performed in accordance with the design conditions identified in Subsections 3G.1.3 and 3G.1.5, stresses and/or strains in concrete, reinforcement, liner and containment internal structures are less than the allowable stresses and/or strains per the applicable regulations, codes or standards listed in Section 3.8.
- The factors of safety against floatation, sliding, and overturning of the structure under various loading combinations are higher than the required minimum.
- The thickness of the roof slabs and exterior walls are more than the minimum required to preclude penetration, perforation or spalling resulting from impact of design basis tornado missiles.

3G.1.3 Structural Description

3G.1.3.1 Description of the Reactor Building

3G.1.3.1.1 Reactor Building Structure

The RB structure and the containment structure share the same wall structure which encloses the Gravity-Driven Cooling System (GDCS) pools and the Suppression pool. The RB structure consists of the following areas that are not part of the containment structure.

- RB super structure at and above the refueling floor, up to the support for the bridge crane, including the roof, is made of reinforced concrete floors and walls (floor slabs can also be composite structure). Roof trusses and their supporting columns are made of structural steel.

- Passive Containment Cooling System (PCCS) and Isolation Condenser (IC) heat exchanger pools, the separator/dryer storage pool, the reactor cavity and the buffer pool.
- Rooms at several elevation levels outside the containment but attaching to the containment structure.
- The main steam tunnel that consists of reinforced concrete walls and floor.

The key dimensions of the RB are summarized in Table 3.8-8. Figures 3G.1-1 through 3G.1-7 show the configurations of the RB.

The Fuel Building (FB) is integrated with the RB in the ESBWR standard plant. The RB and FB share a common wall between them and a large common basemat. The summary of the FB design is described in Section 3G.3.

3G.1.3.1.2 Containment and Containment Structure

The containment is a reinforced concrete containment vessel (RCCV), which encloses the reactor pressure vessel (RPV) and its related systems and components. The containment is divided into a drywell region and a wetwell region with an interconnecting vent system.

The key dimensions of the RCCV are summarized in Table 3.8-1. Figure 3.8-1 shows the configuration of the RCCV.

The containment structure boundary consists of the containment top slab with removable drywell head, the containment cylindrical wall that is also the outer wall of the suppression pool, the suppression pool floor slab, the RPV pedestal that encloses the volume under the RPV, and the basemat. The concrete containment is lined with a steel liner for leak-tightness. The containment cylindrical outer wall extends below the suppression pool floor slab to the basemat. This extension is not part of the containment pressure boundary, however, it supports the upper containment cylinder. The reinforced concrete basemat foundation supports the entire containment system, which includes the RPV pedestal, and extends to support the reactor building surrounding the containment. The outline drawings are shown in Figures 3G.1-1 through 3G.1-7.

3G.1.3.1.3 Reactor Building Structure/Containment Structure Connections

The RCCV and the RB structure are integrated by the IC/PCCS pool girders at the top of the containment and by floor slabs at elevations that are defined as part of the RB structure and the basemat. The IC/PCCS pool girders are deep reinforced concrete girders, and they are integrated with the containment top slab and with RB walls.

3G.1.3.1.4 Containment Internal Structures

The containment internal structures consist of the diaphragm floor slab, vent wall, Gravity-Driven Cooling System (GDCS) pool walls, reactor shield wall, and the RPV support bracket. These structures are shown in the general arrangement drawings in this appendix.

The diaphragm floor slab acts as a barrier between the drywell and the wetwell. The diaphragm floor slab is supported on the reinforced concrete containment wall at its outer periphery and on the vent wall at its inner periphery. The diaphragm floor slab is a concrete-filled steel structure. The space between the floor slab top and bottom plates is filled with concrete. The slab is supported by a system of radial beams spaced evenly all around and spanning between the vent wall structure and the reinforced concrete containment wall.

The vent wall structure is also a concrete–filled steel design consisting of two concentric carbon steel cylinders connected together by vertical web plates evenly spaced all around. The vent wall structure is anchored at the bottom into the RPV pedestal and is restrained at the top by the diaphragm floor slab. The cylindrical annulus carries 12 vent pipes and 12 safety relief valve downcomer pipes with sleeves, from the drywell into the suppression pool. The space in the cylindrical annulus is filled with concrete.

There are three GDCS pools supported on top of the diaphragm floor slab. The pools on one side are contained by the reinforced concrete containment wall and on the other side by structural steel walls.

The reactor shield wall is a thick steel cylindrical structure that surrounds the RPV. It is supported by the RPV support brackets and the reactor pedestal. The function of the reactor shield wall is to attenuate radiation emanating from the RPV. In addition, the reactor shield wall provides structural support for the RPV stabilizer, the RPV insulation and miscellaneous equipment, piping and commodities. Openings are provided in the reactor shield wall to permit the routing of necessary piping to the RPV and to permit inservice inspection of the RPV and piping.

3G.1.4 Analytical Models

3G.1.4.1 Structural Models

The RB and the RCCV including its internal structures are analyzed as one integrated structure utilizing the finite element computer program NASTRAN. The finite element model consists of quadrilateral, triangular, and beam elements. The quadrilateral and triangular elements are used to represent the slabs and walls. Beam elements are used to represent columns and beams. The model is shown in Figures 3G.1-8 to 3G.1-18.

As shown in Figure 3G.1-8, the Fuel Building (FB) is also included in the model, because the FB is integrated with the RB. The model includes the whole (360°) portion of the RB including the RCCV and FB taking the application of nonaxisymmetrical loads and the asymmetric layout of the FB structure into consideration.

Liner plates of various thicknesses as shown in Figure 3G.1-48 are included in the model at locations of the pressure boundary of the containment. The liner plate nodal points are connected to the containment nodal points by rigid beams. The liner plate elements are shown in Figure 3G.1-18. Pressure loads in the containment are applied on the liner plate.

The vent wall and the diaphragm floor are concrete-filled structures consisting of steel plates and concrete. The infill concrete is neglected in analysis model conservatively. Steel plates including connecting rib plates and girders are modeled by shell elements. The GDCS pool, the reactor shield wall and the RPV support brackets are also included in the analysis model. These structures are modeled by shell elements, except the GDCS pool beams which are modeled by beam elements. The analysis model of these structures is shown in Figure 3G.1-17. For the GDCS pool, the detail stress evaluation is performed using a local model.

The following major penetrations in the concrete containment are included in the model in order to take local reduction of the wall stiffness into consideration. The penetrations in the model are shown in Figures 3G.1-10 and 3G.1-11.

- upper drywell equipment and personnel hatches
- lower drywell equipment and personnel hatches
- wetwell access hatch
- main steam and feedwater pipe penetrations.

Small penetrations in the containment are not modeled because their effects on the wall stiffness are negligible.

The nodal points are defined by a right hand Cartesian coordinate system X, Y, Z. This system, called the global coordinate system, has its origin located at the center of the containment at the bottom of the RPV, i.e., EL 0. The positive X axis is parallel with the IC/PCCS pool girder in the 180° direction of the containment; the Y axis is perpendicular to the IC/PCCS pool girder in the 90° direction of the containment; the Z axis is vertical upward. This coordinate system is shown in Figure 3G.1-8.

3G.1.4.2 Foundation Models

The foundation soil is represented by soil springs. The spring constants for rocking and translations are determined based on the following soil parameters which correspond to the Soft Site conditions described in Appendix 3A.

- Shear wave velocity: 300 m/s
- Unit weight: 0.0196 MN/m^3 (2.00 t/m^3)
- Shear modulus: 180 MN/m^2 (1.835×10^4 t/m^2)
- Poisson's Ratio: 0.478

Soil springs are attached to the bottom of the foundation mat, and the constraints by side soil are not included in the model. The values of the soil springs used in the analysis are shown in Table 3G.1-1. The springs have perfectly elastic stiffness.

These spring values are multiplied by the foundation mat nodal point tributary areas to compute the spring constants assigned to the base slab nodal points.

3G.1.5 Structural Analysis and Design

3G.1.5.1 Site Design Parameters

The key site design parameters are located in Table 3G.1-2.

3G.1.5.2 Design Loads, Load Combinations, and Material Properties

3G.1.5.2.1 Design Loads

3G.1.5.2.1.1 Dead Load (D) and Live Load (L and Lo)

The weights of structures are evaluated using the following unit weights.

- reinforced concrete: 23.5 kN/m^3
- plain concrete: 22.5 kN/m^3
- steel: 77.0 kN/m^3

Weights of major equipment, miscellaneous structures, piping, and commodities are summarized in Tables 3G.1-3 through 3G.1-5.

Live loads on the RB floor slabs are described in Subsection 3.8.4.3.1.1.

For the computation of global seismic loads, the value of floor live load is limited to the expected live load, L_o, during normal plant operation. The values of L_o are 25% of the above full floor live loads, L, when used in combination with seismic and dead loads as described in Subsection 3.8.4.3.1.1.

3G.1.5.2.1.2 Snow Load

The snow load is applied to the roof slabs and is taken as shown in Table 3G.1-2. Snow load is reduced to 75% when snow load is combined with seismic loads.

3G.1.5.2.1.3 Lateral Soil Pressure at Rest

The lateral soil pressure at rest is applied to external walls below grade and is based on soil properties given in Table 3G.1-2. Pressures to be applied to the walls are provided in Figure 3G.1-19.

3G.1.5.2.1.4 Wind Load (W)

The wind load is applied to the roof slabs and external walls above grade and is based on basic wind speed given in Table 3G.1-2.

3G.1.5.2.1.5 Tornado Load (W_t)

The tornado load is applied to the roof slabs and external walls above grade and its characteristics are given in Table 3G.1-2. The tornado load, W_t, is further defined by the following combinations:

$W_t = W_w$

$W_t = W_p$

$W_t = W_m$

$W_t = W_w + 0.5W_p$

$W_t = W_w + W_m$

$W_t = W_w + 0.5W_p + W_m$

where,

W_t = Total Tornado Load

W_w = Tornado Wind Load

W_p = Tornado Differential Pressure Load

W_m = Tornado Missile Load

3G.1.5.2.1.6 Thermal Loads

Thermal loads are evaluated for the normal operating conditions and abnormal (LOCA) conditions. Figure 3G.1-20 shows the section location for temperature distributions for various structural elements, and Table 3G.1-6 shows the magnitude of equivalent linear temperature distribution.

The evaluation method of temperature effect on the concrete design is based on ACI 349-01 Commentary Figure RA.1.

The two cases, winter and summer, are considered in the analysis.

Stress-free temperature is 15.5°C.

3G.1.5.2.1.7 Pressure Loads

Table 3G.1-7 shows the pressure loads applied to the RCCV during normal operation, structural integrity test, and the LOCA. Pressure loads in the IC/PCCS pools are provided in Table 3G.1-8.

3G.1.5.2.1.8 Condensation Oscillation (CO) and Chugging (CHUG) Loads

The condensation oscillation (CO) and chugging (CHUG) pressure loads along with Dynamic Load Factors (DLF) are provided in Figures 3G.1-21 and 3G.1-22.

3G.1.5.2.1.9 SRV Loads

The SRV loads along with DLF are provided in Figure 3G.1-23.

3G.1.5.2.1.10 Steam Tunnel Subcompartment Pressure

The design pressure in the RB main steam tunnel due to main steam line break is 76.0 kPag. Thermal loads need not be included due to short duration of the tunnel pressurization.

3G.1.5.2.1.11 Subcompartment Pressure in Other Compartments

For ESBWR, the Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) system is considered high energy during normal operation. The maximum design pressure inside the affected subcompartments from the high energy line break (HELB) of the system is 34.5 kPag. Thermal loads need not be included due to short duration of subcompartment pressurization.

3G.1.5.2.1.12 Annulus Pressurization (AP) Loads

The annulus pressurization (AP) loads due to FW and RWCU breaks are considered. AP loads contain pressure load and associated jet forces and pipe whip restraint loads.

3G.1.5.2.1.13 Design Seismic Loads

The design seismic loads are obtained by soil – structure interaction analyses, which are described in Appendix 3A. The seismic loads used for design are as follows:

- Figure 3G.1-24: design seismic shears and moments for RB and FB walls
- Figure 3G.1-25: design seismic shears and moments for RCCV
- Figure 3G.1-26: design seismic shears and moments for RPV Pedestal and Vent Wall
- Table 3G.1-9: maximum vertical acceleration

The seismic loads are composed of one vertical and two perpendicular horizontal components. The effects of the three components are combined based on the 100/40/40 method as described in Subsection 3.8.1.3.6.

Seismic lateral soil pressure for wall design is provided in Figure 3G.1-27 using the elastic procedure described in ASCE 4-98 Section 3.5.3.2.

Seismic member forces for each section are obtained directly from the NASTRAN analysis using these seismic input loads.

3G.1.5.2.2 Load Combinations and Acceptance Criteria

Load combinations and acceptance criteria for the various elements of the RB complex are discussed on the following subsections.

3G.1.5.2.2.1 Reinforced Concrete Containment Vessel (RCCV)

Table 3.8-2 gives a detailed list of various Service and Factored load combinations with acceptance criteria per ASME Section III Division 2. Based on previous experience, critical load combinations are selected for the RCCV design. They are mainly combinations including LOCA loads and seismic loads as shown in Table 3G.1-10. The acceptance criteria for the selected combinations are also included in Table 3G.1-10.

3G.1.5.2.2.2 Steel Containment Components

Table 3.8-4 gives a detailed list of various load combinations with acceptance criteria per ASME Section III Division 1, Subsection NE. For the drywell head, the loads of W, W’, Ro, Ra, Y, SRV and LOCA are not direct loads and their indirect effects through the supporting RCCV top slab are negligibly small.

3G.1.5.2.2.3 Containment Internal Structures

Table 3.8-7 gives a detailed list of various load combinations with acceptance criteria per ANSI/AISC N690.

3G.1.5.2.2.4 Reactor Building (RB) Concrete Structures Including Pool Girders

Table 3.8-15 gives load combinations for the safety-related reinforced concrete structure. Based on previous experience, critical load combinations are selected for the RB design. They are mainly combinations including LOCA loads and seismic loads as shown in Table 3G.1-11. The acceptance criteria for the selected combinations are also included in Table 3G.1-11.

3G.1.5.2.3 Material Properties

3G.1.5.2.3.1 Concrete

Properties of concrete used for the design analyses are shown in Table 3G.1-12.

Concrete has a tendency to change properties when subjected to elevated temperatures. For the ESBWR design, reduction of concrete strength due to high temperature is determined based upon the average value of the following upper bound and lower bound equations excerpted from Reference 3G.1-1.

- Lower bound reduction factor
  - $\phi = 1.0 - 0.0030\ (T-21.1)$ 21.1°C (70°F) ≤ T ≤ 121.1°C (250°F)
  - $\phi = 0.70 - 0.00083\ (T-121.1)$ 121.1°C (250°F) ≤ T
- Upper bound reduction factor
  - $\phi = 1.0$ T ≤ 260.0°C (500°F)
  - $\phi = 1.0 - 0.00081\ (T-260.0)$ 260.0°C (500°F) ≤ T

Young's modulus for concrete is also determined based upon the average value of the following upper bound and lower bound equations excerpted from Reference 3G.1-1.

- Lower bound reduction factor
  - $\phi = 1.0 - 0.0069\ (T-21.1)$ 21.1°C (70°F) ≤ T ≤ 93.3°C (200°F)
  - $\phi = 0.50 - 0.0009\ (T-93.3)$ 93.3°C (200°F) ≤ T
- Upper bound reduction factor
  - $\phi = 1.0 - 0.00056\ (T-21.1)$ 21.1°C (70°F) ≤ T ≤ 204.4°C (400°F)
  - $\phi = 0.90 - 0.0015\ (T-204.4)$ 204.4°C (400°F) ≤ T

The design temperature of the drywell is 171°C (340°F) as shown in Table 1.3-3, and it satisfies the concrete temperature limit, 350°F, for accident or short term period specified in ASME Section III, Subsection CC-3440.

3G.1.5.2.3.2 Reinforcing Steel

Reinforcing steel is deformed billet steel conforming to ASTM A-615 grade 60. Minimum yield strength, Fy, is 413.6 MPa.

Reinforcing steel also has tendency to decrease in strength at elevated temperatures. The reduction of reinforcing steel strength is based upon the following equation excerpted from Reference 3G.1-1.

- Reduction Factor

– ϕ = 1.0 - 0.000873 (T-21.1) 21.1°C (70°F) ≤ T ≤ 204.4°C (400°F)

3G.1.5.2.3.3 Structural Steel

Properties of structural steel used for the design analyses are included in Table 3G.1-12.

3G.1.5.3 Stability Requirements

The RB foundations shall have the following safety factors against overturning and sliding. Because the impact on the stability by seismic load is larger than wind and tornado, the load combinations for W and Wt, which are shown in Table 3.8-14, are excluded.

Load Combination	Overturning	Sliding	Floatation
D + H + E’	1.1	1.1	
D + F’			1.1

Where

D = Dead Load, F’ = Buoyant forces of design basis flood

H = Lateral soil pressure, E’ = Safe Shutdown Earthquake

3G.1.5.4 Structural Design Evaluation

The evaluation of the containment structure, the containment internal structures, and the RB structures is based on the results from the load combinations indicated in Subsection 3G.1.5.2.2.

Figure 3G.1-28 shows the location of the sections that are selected for evaluation of reinforced concrete structures. They are selected, in principle, from the center and both ends of walls and slabs, where it is reasonably expected that the critical stresses appear based on engineering experience and judgment. The computer program SSDP-2D is used for the evaluation of stresses in rebar and concrete. The input to SSDP-2D consists of rebar ratios, material properties, and element geometry at the section under consideration together with the forces and moments from the NASTRAN analysis, which are shown in Tables 3G.1-13 through 3G.1-21. Element forces and moments listed in the tables are defined with relation to the element coordinate system shown in Figure 3G.1-29. Figures 3G.1-30 through 3G.1-38 indicate deformations of structures obtained by NASTRAN analyses for the loads corresponding to Table 3G.1-13 through 3G.1-21.

Figure 3G.1-39 shows a flow chart for the structural analysis and design. Figures 3G.1-40 through 3G.1-47 present the design drawings used for the evaluation of the containment and the Reactor Building structural design. Figures 3G.1-48 through 3G.1-50 show the design details of containment liner plate. Figures 3G.1-51 through 3G.1-54 show the design details of containment major penetrations. Figures 3G.1-55 through 3G.1-59 show the details of containment internal structures.

3G.1.5.4.1 Containment Structure

Tables 3G.1-22 through 3G.1-26 show the resultant combined forces and moments in accordance with the selected load combinations listed in Table 3G.1-10. Table 3G.1-27 lists the sectional thicknesses and rebar ratios used in the evaluation. At each section, in general, three elements are analyzed at azimuth 0°, 90° and 135°.

Tables 3G.1-28 through 3G.1-32 show the rebar and concrete stresses at these sections for the representative elements. Tables 3G.1-33 and 3G.1-34 summarize evaluation results for transverse shear and tangential shear in accordance with ASME Section III, Division 2, Article CC-3520.

Table 3G.1-35 shows the maximum strains of containment liner plate. Table 3G.1-36 shows the stress summary of drywell head.

3G.1.5.4.1.1 Containment Wall Including RPV Pedestal

Sections 1 through 9 shown in Figure 3G.1-28 are considered critical sections for the containment wall including the RPV pedestal. Maximum stress in the meridional rebar is found to be 292.5 MPa at Section 4 near the bottom of the RCCV Wetwell due to load combination CV-11a, as shown in Table 3G.1-31. The maximum stress in the circumferential rebar is found to be 363.0 MPa, which occurs also at Section 4, the bottom of the RCCV Wetwell due to load combination CV-11a, as shown in Table 3G.1-31. The maximum concrete stress is found to be 22.1 MPa, which occurs at Section 6 due to load combination CV-11a.

The maximum transverse shear stress is found to be 3.88 MPa at Section 1 for the load combination CV-11b. The amounts of shear ties provided satisfy the required values at all sections, as indicated in Table 3G.1-33.

As for tangential shear, the maximum stress of 4.18 MPa is found at Section 4, the bottom of the Wetwell, due to the combination CV-11b. The value is less than the allowable tangential shear stress provided by orthogonal reinforcement, which is described in Table 3.8-3. The amounts of reinforcement provided satisfy the required values at all sections, as indicated in Table 3G.1-34.

Table 3G.1-35 shows liner plate strains. The liner maximum strain is found to be 0.0040 at Section 6, which is within allowable limits given in Table CC-3720-1, ASME Code Section III, Division 2.

3G.1.5.4.1.2 Containment Top Slab and Suppression Pool Slab

Sections 12 through 17 are examined for the Containment Top Slab and Suppression Pool Slab. The locations of these sections are shown in Figure 3G.1-28. The maximum rebar stresses are found to be 256.0 MPa at Section 16 due to the load combination CV-11b in the Top Slab, and 264.0 MPa at Section 13 due to the combination CV-7a in the Suppression Pool Slab. The maximum concrete stresses are 10.6 MPa and 20.4 MPa in the Top Slab and the Suppression Pool Slab, respectively.

The maximum transverse shear stresses are found to be 0.93 MPa at Section 17 for the load combination CV-7b in the Top Slab, and 4.22 MPa at Section 12 for the combination CV-11a in the Suppression Pool Slab. The amounts of shear ties provided satisfy the required values at all sections, as indicated in Table 3G.1-33.

Maximum Liner strain is found to be 0.0025 at Section 12 as shown in Table 3G.1-35 and is within ASME Code allowable.

3G.1.5.4.1.3 Containment Foundation Mat

Sections 10 and 11 are evaluated for the part of the concrete containment in the foundation mat. The sections are shown in Figure 3G.1-28. The maximum rebar stress is calculated as 271.3 MPa at Section 11 just inside the RPV Pedestal and is shown in Table 3G.1-32. The maximum transverse shear stress of 1.58 MPa is found also at the Section 11 for the load combination CV-11a.

The liner plate maximum strain is found to be 0.0006 at Section 11 as shown in Table 3G.1-35.

3G.1.5.4.1.4 Drywell Head

Figure 3G.1-51 shows the design details. The highest stresses are summarized in Table 3G.1-36. The stresses except PL+Pb+Q at service Level A and B are well within the allowable stress limits. PL+Pb+Q at service Level A and B exceeds allowable, however, it meets all requirements for simplified elastic-plastic analysis stipulated in NE-3228.3 of ASME B & PV Code, Sec.III.

Simplified Elastic-Plastic Analysis

The range of primary plus secondary stress intensity S_n is 794 MPa and the allowable of $3S_{m1}$ is 456 MPa from Table 3G.1-36. S_n exceeds $3S_{m1}$, so simplified elastic-plastic analysis is required. The results of comparison against each requirement of NE-3228.3 are as follows.

(1) NE-3228.3 (a)

The range of primary plus secondary membrane plus bending stress intensity, excluding thermal bending stress is 390 MPa from the result of FEM analysis.

(2) NE-3228.3 (b)

The values of S_a used for entering the design fatigue curve is multiplied by the factor K_e. The values of m and n are decided as 3 and 0.2 respectively from Table NE-3228.3(b)-1 of ASME B & PV Code, Sec. III. Because S_{m1} is 156 MPa from Table 5-2, $3 \cdot m \cdot S_{m1}$ is calculated as 1368 MPa. S_n = 794 MPa is between $3 \cdot S_{m1}$ = 456 MPa and $3 \cdot m \cdot S_{m1}$ = 1368 MPa, so K_e is calculated by the following Formula:

$$K_e = 1.0 + \left[(1-n)/n \cdot (m-1)\right] \cdot \left[(S_n/3 \cdot S_{m1}) - 1\right] = 2.49$$

(3) NE-3228.3 (c)

Fatigue evaluation is conducted as follows:

$S_a = K_e \cdot S_n$ = 1978 MPa (287 ksi)

E_1 = 30000 ksi

E_2 = 28100 ksi

Where

E_1: Modulus of elasticity given on the design fatigue curve from Figure I-9.1 of Appendix I of Sec. III.

E_2: Modulus of elasticity at 340°F (170°C) from Table TM-1 of Sec. II, Part D

$S_a' = S_a \cdot (E_1/E_2)$ = 2117 MPa (307 ksi)

S_a for 10 cycles is 3999 MPa (580 ksi) from Table I-9.1 (UTS ≤ 80 ksi) and N for S_a' = 307 ksi is obtained as 38 from Table I-9.1, General Note (b). So the requirement of NE-3228.3 (c) is satisfied.

(4) NE-3228.3 (d)

Because an accident temperature T_a is not a cyclic load, the thermal ratcheting can be neglected.

(5) NE-3228.3 (e)

From Table NE-3228.3(b)-1, the maximum temperature T_{max} is 700°F (370°C) for carbon steel. T_a is 171°C, so it satisfies this requirement.

(6) NE-3228.3 (f)

Specified minimum yield strength S_y and specified minimum tensile strength S_u of SA-516 Gr. 70 are 38 ksi and 70 ksi respectively. The ratio of S_y to S_u is calculated as 0.543. This value is below 0.80. So it satisfies this requirement.

3G.1.5.4.2 Containment Internal Structures

Tables 3G.1-37 through 3G.1-44 show the summary of stress analysis results for containment internal structures.

The type of analyses for various loads considered for the containment internal structures, such as diaphragm floor, vent wall, RPV support bracket (RPVSB), reactor shield wall and GDCS pool are:

(1) Dead load

(2) Static analysis is performed for the dead load to all containment internal structures. Hydrostatic loads of pool water are also applied statically to vent wall and GDCS pool.

(3) Pressure load

(4) Static analysis is performed for the pressure load (Po and Pa) applied to diaphragm floor and vent wall.

(5) Thermal load

(6) Static analysis is performed for the thermal load (To and Ta) to all internal structures. All steel temperature is the same as atmospheric temperature. The temperature of the intermediate node of VW rib plate is the average value of outer and inner plate ones.

(7) Seismic load

(8) Static analysis is performed for the seismic load on diaphragm floor, vent wall, RPV support bracket and reactor shield wall in the integral NASTRAN model, while response spectra analysis is performed for GDCS pool local model.

(9) In this response spectra analysis, it is assumed that all pool water mass is distributed uniformly on the GDCD pool wall and RCCV wall. This is considered as a conservative assumption, therefore sloshing is not considered in GDCS pool local model. For integral NASTRAN model, however, sloshing load is considered as the static pressure load on DF upper surface and static reaction load from GDCS pool wall. The results from integral

NASTRAN model due to these loads are used for the structural integrity evaluation of the structures other than GDCS pool, while the results from GDCS pool local model are used for evaluation of GDCS pool itself.

(10) Hydrodynamic load

(11) Static analysis is performed for the hydrodynamic load (CO, CH and SRV) on vent wall taking DLF = 2 into account.

(12) Pipe Break loads consist of Annulus Pressurization (AP) load, jet impingement and pipe-whip restraint loads

(13) These loads acting on the RSW are first analyzed for dynamic response using the NASTRAN beam model. The resulting maximum values of bending moment and shear force are then applied to the integral NASTRAN static analysis model.

3G.1.5.4.2.1 Diaphragm Floor

Design of Structural Components

The design of the diaphragm floor is based on the elastic analysis results obtained from model described in Section 3G.1.4. Figure 3G.1-55 shows design details. Table 3G.1-37 summarizes the highest stresses in various structural elements of the D/F slab. All stresses are within allowable stress limits.

Design of Anchorage

Figure 3G.1-56 shows diaphragm floor anchorage into the RCCV wall. Rebars have been used for anchoring the steel plates. Threaded couplers have been used so that the anchor bars can be connected after installation of the reinforcing steel of the RCCV wall. The anchorage is designed so as to avoid interference with the RCCV reinforcing steel. Anchorage requirements for various loading combinations and the capacity of anchorage provided is shown in Table 3G.1-38.

3G.1.5.4.2.2 Vent Wall Structure

Design of Structural Components

Figure 3G.1-57 shows the design details. Highest stresses in inner cylinder, outer cylinder and the web plates are summarized in Table 3G.1-39. The stresses are shown to be within allowable stress limits.

Design of Anchorage

Figure 3G.1-57 shows vent wall anchorage into the RCCV wall. Rebars have been used for anchoring the steel plates. Threaded couplers have been used so that the anchor bars can be connected after installation of the reinforcing steel of the RCCV wall. The anchorage is designed so as to avoid interference with the RCCV reinforcing steel. Anchorage requirements for various loading combinations and the capacity of anchorage provided is shown in Table 3G.1-42.

3G.1.5.4.2.3 Reactor Shield Wall (RSW)

The reactor shield wall is designed to resist the loads and loading combinations discussed in Subsections 3G.1.5.2. Annulus pressurization (AP) loads are also considered.

Figure 3G.1-58 shows the design details. The highest stresses are summarized in Table 3G.1-40. The stresses are well within the allowable stress limits.

3G.1.5.4.2.4 RPV Support Bracket

Design of Structural Components

Figure 3G.1-57 shows the design details. The calculated stresses in various elements of the support bracket are shown in Table 3G.1-41 and are within allowable stress limits.

Design of Anchorage

Figure 3G.1-57 shows RPV support bracket anchorage into the RCCV wall. Rebars have been used for anchoring the steel plates. Threaded couplers have been used so that the anchor bars can be connected after installation of the reinforcing steel of the RCCV wall. The anchorage is designed so as to avoid interference with the RCCV reinforcing steel. Anchorage requirements for various loading combinations and the capacity of anchorage provided is shown in Table 3G.1-42.

3G.1.5.4.2.5 Gravity Driven Cooling System (GDCS) Pool

Design of Structural Components

Figure 3G.1-59 shows the design details. Highest stresses are summarized in Table 3G.1-43. The stresses are within allowable stress limits.

Design of Anchorage

Threaded mechanical coupler with anchor bars have been used as shown in Figure 3G.1-59. Table 3G.1-44 shows the anchorage requirements and capacity of anchorage provided.

3G.1.5.4.3 Reactor Building

Tables 3G.1-45 through 3G.1-49 show the resultant combined forces and moments in accordance with the selected load combinations listed in Table 3G.1-11. Table 3G.1-50 lists the sectional thicknesses and rebar ratios used in the evaluation. At each section, in general, three elements are analyzed at azimuth 0°, 90° and 135° (or 45°).

Tables 3G.1-51 through 3G.1-55 show the rebar and concrete stresses at these sections for the representative elements. Table 3G.1-56 summarizes evaluation results for transverse shear in accordance with ACI 349, Chapter 11.

Sections 18 through 31 shown in Figure 3G.1-28 are analyzed for the RB outside the containment. Sections 18 to 23 are selected for the RB shear walls, Section 24 for the basemat outside the containment, Sections 25 to 27 for the RB slabs, Sections 28 to 30 for the IC/PCCS pool girders and Section 31 for the Main Steam tunnel wall and slab.

3G.1.5.4.3.1 RB Shear Walls

The maximum rebar stress of 364.6 MPa is found in the horizontal rebar at Section 23 due to the load combination RB-9b as shown in Table 3G.1-55. The maximum vertical rebar stress is found to be 351.8 MPa also at Section 23 due to the load combination RB-9a as shown in Table 3G.1-54. The maximum transverse shear force is found to be 4.70 MN/m against the shear strength of 5.07 MN/m at Section 20, the top of the cylindrical wall below the RCCV wall.

3G.1.5.4.3.2 RB Foundation Mat Outside Containment

Section 24 is selected for the foundation mat outside the containment at the junction with the cylindrical wall below the RCCV wall. The maximum rebar stress of 196.6 MPa is found in the top rebar as shown in Table 3G.1-54. The maximum bottom rebar stress is found to be 139.6 MPa also as shown in Table 3G.1-54. The maximum transverse shear force is found to be 12.03 MN/m against the shear strength of 14.79 MN/m.

3G.1.5.4.3.3 RB Floor Slabs

Sections 25 to 27 are selected for the floor slabs at elevations EL 4650, EL 17500 and EL 27000 (see Figure 3G.1- 28) at their junction with the RCCV. Floor slabs are composite structures, which are reinforced by rebars at their top surfaces and by steel plates at the bottom surfaces, as described in Subsection 3.8.4.1.1. However, the slabs surrounding the Main Steam (MS) tunnel are constructed of conventional reinforced concrete. Among the elements at Sections 26 and 27, Element #96113 and 98424 are included in the MS tunnel slabs.

The maximum rebar stress of 338.1 MPa is found at Section 26 as shown in Table 3G.1-53, whereas the maximum stress of steel plate is found to be 136.8 MPa at Section 26 as shown in Table 3G.1-55. The maximum transverse shear force is found to be 6.24 MN/m against the shear strength of 7.53 MN/m.

3G.1.5.4.3.4 Pool Girders

The maximum rebar stress of 263.9 MPa is found in the vertical rebar at Section 28 as shown in Table 3G.1-55, whereas the maximum horizontal rebar stress is found to be 249.2 MPa also at Section 28 as shown in Table 3G.1-53. The maximum transverse shear force is found to be 3.36 MN/m against the shear strength of 6.47 MN/m.

3G.1.5.4.3.5 Main Steam Tunnel Floors and Walls

Section 31 is selected for the MS tunnel wall (Element #150122) and slabs (Elements #96611 and #98614). The MS tunnel is composed of the reinforced concrete structures as described in Subsection 3G.1.5.4.3.3.

The maximum rebar stress is found to be 230.6 MPa in Table 3G.1-54, and the maximum transverse shear force is found to be 1.91 MN/m against the shear strength of 4.95 MN/m.

3G.1.5.5 Foundation Stability

The Reactor Building, the concrete containment and the Fuel Building share a common foundation. The stabilities of the foundation against overturning, sliding and floatation are evaluated. The energy approach is used in calculating the factor of safety against overturning.

The factors of safety against overturning, sliding and floatation are given in Table 3G.1-57. All of these meet the acceptance criteria.

Maximum soil bearing stress is found to be 699 kPa due to dead plus live loads. Maximum bearing stresses for load combinations involving SSE are shown in Table 3G.1-58 for various site conditions.

3G.1.5.6 Tornado Missile Evaluation

The minimum thickness required to prevent penetration and concrete spalling is evaluated. The methods and procedures are shown in Section 3.5.3.1.1. The minimum thickness required is less than the minimum 1000 and 700 mm thickness provided for the RB external walls and roof, respectively.

3G.1.6 References

3G.1-1 Burns & Roe, "State-of-the-Art Report on High Temperature Concrete Design," prepared for US. Department of Energy, Document No. DOE/CH/94000-1, November 1985.

Table 3G.1-1

Soil Spring Constants for the RB Analysis Model

Direction of Spring		Loads	Stiffness ($MN/m/m^2$)
Horizontal	X-direction	All	9.107
	Y-direction	All	9.654
Vertical		Horizontal Seismic Loads	38.35
		Other Loads	13.66

Table 3G.1-2

Site Design Parameters

Parameter	Value(s)
Soil:	
Minimum shear wave velocity, m/s (ft/s)	300 (984)
Poisson's Ratio	0.35 to 0.478
Unit Weight, kN/m^3 (t/m^3)	19.6 to 24.5 (2.0 to 2.5)
Maximum Ground Water Level, m (ft)	0.61 (2.0) below grade
Maximum Flood Level, m (ft)	0.30 (1.0) below grade
Maximum Snow Load, kPa (lbf/ft^2)	2.394 (50)
Design Temperatures	
Summer, °C (°F)	46.1 (115)
Winter, °C (°F)	-40.0 (-40)
Seismology: For seismic design parameters, refer to Subsection 3.7.1.	
Extreme Wind	
Basic wind speed (50 year recurrence interval), m/s (mi/hr)	62.6 (140)
Importance Factors (Safety-related structures)*	1.15
Exposure Category	Exposure D
Tornado	
Maximum Tornado wind speed, m/s (mi/hr)	147.5 (330)
Maximum Rotational Speed, m/s (mi/hr)	116.2 (260)
Maximum Translational Speed, m/s (mi/hr)	31.3 (70)
Radius, m (ft)	45.7 (150)
Maximum Pressure Drop, kPa (psi)	16.6 (2.4)
Maximum Rate of Pressure Drop, kPa/s (psi/s)	11.7 (1.7)
Missile Spectrum	See Section 3.5.1.4.
Maximum Rainfall	
Design rainfall, cm/hr (in/hr)	49.3 (19.4)
Note *: Per ASCE 7-02.	

Table 3G.1-3

Equipment and Hydrostatic Loads inside RCCV

Description	Weight
Reactor Pressure Vessel (normal operating condition)	21600 kN
Drywell Top Head (including refueling facilities bulkhead plate)	1100 kN
Top Slab	
a. Liner below slab	2.5 kN/m^2
b. Miscellaneous attachments below slab	2.4 kN/m^2
Upper Drywell	
a. Wall Liner	2.7 kN/m^2
b. Personal Airlock (EL17500)	200 kN
c. Equipment Hatch (EL17500)	110 kN
d. Miscellaneous attachments to wall	2.4 kN/m^2
GDCS Pool	
a. Water (H=6.8 m)	67 kN/m^2
Wetwell	
a. Water (H=5.5 m) HWL	54 kN/m^2
b. Wall Liner	1.6 kN/m^2
c. Floor Liner	2.4 kN/m^2
d. Access Hatch (EL13570)	90 kN
e. Quenchers (12 units)	510 kN
f. Miscellaneous attachments to wall	2.4 kN/m^2
Lower Drywell	
a. Wall Liner	3.1 kN/m^2
b. Floor Liner	0.6 kN/m^2
c. Sacrificial (basaltic) concrete (H=1.6 m)	36 kN/m^2
d. Personal Airlock (EL-6400)	200 kN
e. Equipment Hatch (EL-6400)	110 kN
f. Miscellaneous attachments to wall	2.4 kN/m^2
RCCV Internal Structures except Diaphragm Floor	
a. Equipment and piping on the slab	2.4 kN/m^2
Diaphragm Floor (excluding GDCS pool areas)	
a. Equipment and piping on the slab	9.8 kN/m^2

Table 3G.1-4

Equipment and Hydrostatic Loads in RB Pools

Description	Weight	Remarks
Reactor Cavity Pool		
a. Water (H=6.7m)	66 kN/m^2	
b. Wall Liner	1.0 kN/m^2	
c. Floor Liner	1.6 kN/m^2	
Dryer / Separator Pool		
a. Water (H=6.7m)	66 kN/m^2	
b. Wall Liner	1.0 kN/m^2	
c. Floor Liner	1.6 kN/m^2	
d. Steam Dryer, Steam Separator	66 kN/m^2	During refueling
Fuel Buffer Pool		
a. Water (H=6.7m)	66 kN/m^2	
b. Wall Liner	1.0 kN/m^2	
c. Floor Liner	1.6 kN/m^2	
d. Fuel Storage Racks	153 kN/m^2	During refueling
IC / PCCS Pool		
a. Water (H=4.8m)	47 kN/m^2	
b. Wall Liner	1.0 kN/m^2	
c. Floor Liner	1.6 kN/m^2	
d. IC heat exchanger	333 kN/unit	
e. PCCS heat exchanger	233 kN/unit	
Fuel Transfer Tube Pool		
a. Water (H=11.64m)	114 kN/m^2	
b. Wall Liner	1.0 kN/m^2	
c. Floor Liner	1.6 kN/m^2	
IC / PCCS Expansion Pools		
a. Water (H=4.8m)	47 kN/m^2	
b. Wall Liner	1.0 kN/m^2	
c. Floor Liner	1.6 kN/m^2	
Dryer/Separator Storage Pool Gate	300 kN	
Reactor Well Gate	50 kN	
Fuel Transfer Channel Pool Gate	50 kN	

Table 3G.1-5

Miscellaneous Structures, Piping, and Commodity Loads on RB Floor

Elevation (mm)	Weights	Remarks
52,400	2.4 kN/m^2 (50psf)	
34,000	2.4 kN/m^2 (50psf)	
27,000	2.4 kN/m^2 (50psf)	
17,500	2.4 kN/m^2 (50psf) 20.0 kN/m^2 (415psf)	 Main Steam Tunnel
13,570	2.4 kN/m^2 (50psf)	
9,060	2.4 kN/m^2 (50psf)	
4,650	2.4 kN/m^2 (50psf)	
-1,000	2.4 kN/m^2 (50psf)	
-6,400	2.4 kN/m^2 (50psf)	
-11,500	2.4 kN/m^2 (50psf)	

Table 3G.1-6

Equivalent Linear Temperature Distributions at Various Sections

Section*1	Side*2		Equivalent Linear Temperature*3 (°C)					
			Normal Operation Winter		DBA (6 min) Winter		DBA (72 hr) Winter	
	1	2	Td	Tg	Td	Tg	Td	Tg
C1	DW	RM	33.5	38.1	34.7	45.2	58.2	127.3
C2	WW	RM	26.5	26.7	27.4	32.0	47.0	101.0
C3	SP	RM	28.2	29.5	28.8	32.7	45.2	90.8
C4	SP	RM	28.2	29.5	28.7	32.4	45.2	90.8
C5	DW	IP	49.4	12.8	50.6	17.6	83.4	36.0
C6	DW	XP	49.4	12.8	50.6	17.7	83.4	36.0
C7	DW	RM	33.5	39.3	34.5	45.5	53.9	121.2
M1	DW	GR	27.5	23.9	27.5	23.9	27.5	23.9
M2	RM	GR	12.9	-5.2	12.9	-5.2	12.9	-5.2
P1	IP	DP	43.0	0.0	43.3	1.5	64.0	65.1
P2	IP	XP	43.0	0.0	44.2	0.3	109.8	0.0
W1	RM	RM	10.0	0.0	10.0	0.0	10.0	0.0
W2	RM	GR	13.0	-4.9	13.0	-4.9	13.0	-4.9
W3	RM	AT	-17.7	42.3	-17.7	42.3	-17.7	42.3
S1	RM	RM	10.0	0.0	10.0	0.0	10.0	0.0
S2	RM	AT	-20.0	36.0	-20.0	36.0	-20.0	36.0

Note *1: See Figure 3G.1-20 for the location of sections.

Note *2: DW: Drywell, WW: Wetwell Air Space, SP: Suppression Pool, IP: IC/PCCS Pool, XP: Expansion Pool, RM: RB Room outside Containment, GR: Ground, AT: Air

Note *3: Td: Average Temperature
Tg: Surface Temperature Difference (positive when temperature at Side 1 is higher)

Table 3G.1-7

Pressure Loads Inside RCCV

Event	Drywell pressure in kPag (psig)	Wetwell pressure in kPag (psig)	Note
Normal operation	5.2 (0.75)	5.2 (0.75)	
SIT 1	356.8 (51.8)	356.8 (51.8)	Maximum pressure
SIT 2	310 (45)	32.5 (4.75)	Maximum differential pressure
LOCA (6 minutes)	257 (37.3)	241 (35.0)	
LOCA (72 hours)	310 (45.0)	310 (45.0)	

Table 3G.1-8

Pressure Loads Inside IC/PCCS Pools

Event	IC/PCCS pool pressure in kPag (psig)
Normal operation	34.5 (5)
LOCA	48.3 (7)

Table 3G.1-9

Maximum Vertical Acceleration

RB/FB Walls

Elev. (m)	Node No.	Max. Vertical Acceleration (g)
52.40	110	0.76
34.00	109	0.65
27.00	108	0.61
22.50	107	0.50
17.50	106	0.51
13.57	105	0.50
9.06	104	0.47
4.65	103	0.44
-1.00	102	0.43
-6.40	101	0.41
-11.50	2	0.38
-15.50	1	0.34
RCCV Wall		
34.00	209	0.84
27.00	208	0.84
17.50	206	0.71
13.57	205	0.66
9.06	204	0.57
4.65	203	0.52
-1.00	202	0.44
-6.40	201	0.38
RPV Pedestal/Vent Wall		
17.50	701	0.59
14.50	702	0.57
11.50	703	0.53
8.50	704	0.49
7.4625	705	0.50
4.65	303	0.47
2.42	377	0.44
-1.00	302	0.46
-2.75	376	0.43
-6.40	301	0.43

RB/FB Slabs

Elev. (m)	Node No.	Max. Vertical Acceleration (g)
52.40	9101	1.20
	9102	1.83
	9103	1.63
	9104	1.72
	9105	1.69
	9106	1.88
27.00	9081	0.94
22.50	9071	1.57
	9072	1.26
	9073	1.39
	9074	0.97
	9075	0.76
17.50	9061	1.08
	9062	0.92
	9063	0.59
	9064	1.17
13.57	9051	0.55
9.06	9041	0.52
4.65	9031	0.87
	9032	0.54
	9033	0.52
-1.00	9021	0.73
	9022	1.05
	9023	0.67
	9024	0.53
-6.40	9011	0.57
	9012	0.66

Note : See Figure 3A.7-4 for the node numbers.

Table 3G.1-10

Selected Load Combinations for the RCCV

Category	Load Combination											Acceptance Criteria*[1]
	No.*[2]	D	L	P_t	P_a	T_a	E'	R_a	SRV	CO	CHUG	
SIT (maximum pressure)	CV-1	1.0	1.0	1.0								S
LOCA (1.5Pa) 6 minutes	CV-7a	1.0	1.0		1.5	1.0		1.0	1.0	1.5		U
LOCA (1.5Pa) 72 hours	CV-7b	1.0	1.0		1.5	1.0		1.0	1.0		1.5	U
LOCA + SSE 6 minutes	CV-11a	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0		U
LOCA + SSE 72 hours	CV-11b	1.0	1.0		1.0	1.0	1.0	1.0	1.0		1.0	U

Note:

*1: S = Allowable Stress as in ASME Section III, Div. 2, Subsection CC-3430 for Service Load Combination.
U = Allowable Stress as in ASME Section III, Div. 2, Subsection CC-3420 for Factored Load Combination.

*2: Based on Table 3.8-2

Table 3G.1-11

Selected Load Combinations for the RB

Category	Load Combination								Acceptance Criteria*[1]
	No. *[2]	D	L	P_a*[3]	T_o	T_a*[3]	E'	W	
Severe Environmental	RB-4	1.05	1.3		1.3			1.3	U
LOCA (1.5P_a) 6 minutes	RB-8a	1.0	1.0	1.5		1.0			U
LOCA (1.5P_a) 72 hours	RB-8b	1.0	1.0	1.5		1.0			U
LOCA + SSE 6 minutes	RB-9a	1.0	1.0	1.0		1.0	1.0		U
LOCA + SSE 72 hours	RB-9b	1.0	1.0	1.0		1.0	1.0		U

Note:

*1: U = Required section strength based on the strength design method per ACI 349.

*2: Based on Table 3.8-15

*3: P_a and T_a are accident pressure load within the containment and thermal load generated by LOCA, respectively.
P_a and T_a are indirect loads, but their effects are considered in the RB design.

Table 3G.1-12

Material Constants for Design Calculations

			Reinforced Concrete		**Steel**		
		Temperature (°C)	Basemat f'c=4000psi 27.6MPa	Others f'c=5000psi 34.5MPa	Carbon Steel Liner	Stainless Steel Liner	Structural Steel
Young's Modulus (MPa)	**Temperature Loads**	<21	2.49×10^{4}	2.78×10^{4}	2.00×10^{5}		
		93	1.81×10^{4}	2.03×10^{4}			
		204	1.62×10^{4}	1.81×10^{4}			
	Other Loads		2.49×10^{4}	2.78×10^{4}	2.00×10^{1}		2.00×10^{5}
Poisson's Ratio			0.17		0.3		
Thermal Expansion (m/m°C)			9.90×10^{-6}		1.17×10^{-5}	1.52×10^{-5}	1.17×10^{-5}
Weight Density (MN/m^3)			0.0235		0.0770		

Table 3G.1-13

Results of NASTRAN Analysis, Dead Load

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
1 RPV	5006	1.152	-4.311	0.163	-0.352	-2.073	0.012	-0.019	-0.856
Pedestal	5013	0.739	-5.029	0.259	-0.297	-1.732	0.000	-0.017	-0.667
Bottom	5024	0.352	-5.153	0.013	-0.271	-1.568	0.005	0.010	-0.596
2 RPV	6006	-0.082	-4.184	0.271	0.023	0.060	0.032	0.035	-0.027
Pedestal	6013	-0.115	-4.357	0.392	-0.038	-0.008	0.009	-0.016	0.031
Mid-Height	6024	0.025	-3.246	-0.362	-0.001	-0.089	0.011	0.021	0.089
3 RPV	6606	-0.123	-3.190	0.620	0.358	2.389	0.117	0.051	-0.888
Pedestal	6613	-0.157	-3.287	0.100	0.298	2.327	-0.143	-0.014	-0.864
Top	6624	-0.029	-3.152	0.154	0.333	2.335	0.147	0.012	-0.853
4 RCCV	1806	-0.360	-4.620	0.097	-0.050	-0.369	0.006	-0.003	-0.055
Wetwell	1813	-0.553	-4.690	0.161	-0.050	-0.247	0.006	-0.001	0.004
Bottom	1824	-0.408	-5.291	-0.106	-0.058	-0.375	0.000	-0.003	-0.049
5 RCCV	2606	-0.052	-4.139	0.137	0.009	-0.025	0.005	0.000	-0.092
Wetwell	2613	-0.214	-4.257	0.187	-0.034	-0.066	0.003	0.000	-0.060
Mid-Height	2624	-0.233	-4.868	-0.071	0.026	0.000	0.000	-0.003	-0.132
6 RCCV	3406	-0.056	-3.591	0.240	0.055	0.307	-0.009	0.041	-0.123
Wetwell	3413	-0.059	-3.975	0.179	-0.021	-0.025	-0.061	0.015	-0.026
Top	3424	-0.233	-4.262	-0.021	0.067	0.327	-0.022	0.050	-0.090
7 RCCV	3606	0.076	-3.285	0.151	-0.011	0.008	-0.015	0.035	0.076
Drywell	3613	0.093	-3.570	0.223	0.020	0.178	-0.040	-0.014	0.203
Bottom	3624	-0.180	-4.276	0.038	0.070	0.360	-0.020	0.037	0.150
8 RCCV	4006	0.506	-3.094	0.044	-0.119	-0.360	-0.031	0.000	0.160
Drywell	4013	0.432	-3.724	0.331	-0.047	-0.366	0.005	-0.006	0.105
Mid-Height	4976	0.029	-3.502	0.188	-0.003	-0.169	-0.004	-0.006	0.116
9 RCCV	4406	0.048	-3.381	-0.797	-0.206	-1.125	-0.016	0.002	0.242
Drywell	4413	-0.490	-3.850	0.188	-0.164	-0.828	0.000	-0.013	0.165
Top	4424	0.148	-2.696	0.151	-0.056	-0.509	0.006	0.002	0.117
10 Basemat	80003	-1.314	-1.549	0.093	4.630	4.830	-0.010	0.280	-0.216
@ Center	80007	-1.330	-1.562	0.086	4.649	4.834	-0.006	-0.032	-0.347
	80012	-1.326	-1.589	0.086	4.649	4.837	-0.008	-0.328	-0.048
11 Basemat	80206	-1.270	-1.479	0.127	1.102	1.524	1.179	1.351	-1.229
Inside	80213	-1.322	-1.581	0.144	2.324	0.060	-0.100	-0.055	-1.868
RPV Pedestal	80224	-1.385	-1.751	0.082	0.200	2.392	-0.172	-1.766	-0.148
12 S/P Slab	83306	0.148	0.584	-0.237	1.653	1.214	-0.035	1.077	-0.024
@ RPV	83313	0.357	0.453	-0.122	1.686	1.225	0.019	1.091	0.029
	83324	0.303	0.621	0.025	1.695	1.227	-0.030	1.097	-0.026
13 S/P Slab	83406	0.205	0.507	-0.186	-0.975	0.477	-0.011	0.415	0.000
@ Center	83413	0.465	0.321	-0.039	-0.966	0.464	-0.004	0.424	0.002
	83424	0.372	0.521	0.005	-0.985	0.463	-0.003	0.431	-0.001
14 S/P Slab	83506	0.228	0.432	-0.170	-1.220	-0.013	-0.010	-0.069	0.002
@ RCCV	83513	0.504	0.275	-0.005	-1.247	-0.033	-0.004	-0.058	0.004
	83524	0.383	0.496	0.007	-1.293	-0.041	-0.001	-0.051	-0.002
15 Top slab	98120	0.971	0.265	0.361	-0.447	-0.258	-0.329	0.045	0.276
@ Drywell Head	98135	2.709	0.254	-0.282	-0.611	0.277	0.078	-0.096	0.348
Opening	98104	0.122	0.721	-0.140	-0.207	-1.216	0.261	-0.003	0.283
16 Top slab	98149	1.409	-0.206	0.425	-0.616	-0.435	0.029	-0.047	-0.229
@ Center	98170	1.201	0.025	-0.054	-0.758	-1.020	0.003	-0.013	-0.023
	98109	0.301	0.591	-0.046	-0.754	-0.807	0.153	0.076	0.046
17 Top slab	98174	0.636	-0.114	0.055	-0.338	-0.628	-0.284	-0.182	0.105
@ RCCV	98197	0.153	0.132	-0.225	-0.393	1.027	0.079	0.052	0.685
	98103	0.079	0.532	0.041	1.964	0.374	0.208	0.985	0.109

Table 3G.1-13
Results of NASTRAN Analysis, Dead Load (Continued)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
18 Wall	6	0.318	-7.057	0.469	-0.279	-1.953	0.015	-0.041	-0.571
Below RCCV	13	0.474	-5.576	0.416	-0.572	-3.046	0.011	-0.015	-0.883
Bottom	24	0.497	-6.141	-0.200	-0.613	-3.202	0.007	-0.002	-0.897
19 Wall Below	806	0.072	-5.889	0.072	0.032	0.032	-0.028	0.009	-0.115
Below RCCV	813	-0.050	-5.434	0.324	-0.029	-0.030	-0.032	0.005	-0.244
Mid-Height	824	0.081	-6.028	-0.204	-0.056	-0.035	-0.010	0.003	-0.309
20 Wall	1606	-0.539	-5.095	0.007	0.130	0.675	0.003	-0.007	-0.242
Below RCCV	1613	-0.742	-5.136	0.208	0.140	0.860	0.006	-0.002	-0.320
Top	1624	-0.607	-5.737	-0.151	0.144	0.840	-0.001	-0.006	-0.299
21 Exterior Wall	20011	-0.689	-3.815	-0.467	0.006	0.210	0.009	0.055	0.107
@ EL-11.50	20023	-0.017	-1.287	-0.541	0.072	-0.324	0.005	-0.109	-0.198
~-10.50m	30010	-0.184	-2.157	0.044	-0.375	-2.012	0.018	0.006	0.463
	30020	-0.054	-1.126	-0.240	0.213	-0.634	-0.066	0.144	0.217
	40001	-0.049	-1.167	0.197	0.217	-0.647	0.065	-0.146	0.212
	40011	-0.225	-2.632	-0.013	-0.435	-2.249	-0.013	-0.003	0.502
22 Exterior Wall	22011	0.234	-2.897	0.603	-0.016	0.035	0.004	-0.017	0.032
@ EL4.65	22023	0.057	-1.428	-0.518	-0.143	-0.016	-0.022	0.105	0.014
~6.60m	32010	0.019	-1.750	0.039	0.001	0.044	0.003	0.000	-0.014
	32020	-0.047	-2.007	-0.093	-0.063	-0.001	-0.010	-0.058	-0.008
	42001	-0.062	-2.089	-0.072	-0.080	-0.003	0.000	0.042	-0.004
	42011	-0.330	-2.307	-0.121	0.000	0.023	-0.001	0.002	0.002
23 Exterior Wall	24211	-0.108	-1.460	0.038	-0.054	-0.369	0.007	-0.003	-0.086
@ EL22.50	24224	-0.025	-0.839	0.213	0.003	-0.067	-0.034	-0.055	-0.058
~24.60m	34210	0.018	-0.723	0.118	0.001	-0.023	-0.001	0.003	0.009
	34220	0.055	-0.953	-0.148	0.048	-0.024	-0.010	0.040	0.003
	44201	0.013	-1.089	-0.322	0.044	-0.012	0.017	-0.045	0.000
24 Basemat	90140	0.040	-0.822	-0.247	-1.717	-1.183	2.874	-1.685	1.913
@ Wall	90182	-0.448	-0.362	-0.067	0.860	-1.481	-0.332	0.223	0.599
Below RCCV	90111	-0.399	-0.620	0.033	-1.284	1.044	-0.462	0.643	0.129
25 Slab	93140	-0.031	0.144	0.065	0.088	0.103	-0.070	0.123	-0.101
EL4.65m	93182	0.142	0.101	0.031	0.036	0.138	0.009	-0.010	-0.179
@ RCCV	93111	0.058	0.173	-0.030	0.189	0.041	0.007	-0.188	-0.004
26 Slab	96144	-0.094	0.199	0.167	0.065	0.073	-0.054	0.107	-0.084
EL17.5m	96186	0.265	-0.077	-0.013	0.008	0.044	0.002	-0.006	-0.075
@ RCCV	96113	-0.202	0.401	-0.073	-0.074	0.039	0.009	0.168	0.023
27 Slab	98472	0.190	0.037	0.046	0.141	0.199	-0.161	0.269	-0.200
EL27.0m	98514	-0.012	0.163	0.039	0.028	0.074	0.010	0.003	-0.123
@ RCCV	98424	0.158	0.648	-0.024	2.007	0.536	0.005	-1.222	-0.095
28 Pool Girder	123004	-0.610	-4.746	-1.459	0.054	-0.031	0.030	-0.003	-0.006
@ Storage Pool	123104	0.941	-1.732	-0.725	0.032	-0.001	0.028	0.027	-0.008
29 Pool Girder	123012	1.097	0.682	0.395	-0.036	-0.297	0.002	-0.017	-0.171
@ Cavity	123112	-0.103	0.394	0.479	-0.010	-0.039	0.028	0.014	-0.009
30 Pool Girder	123017	-0.492	-4.038	1.604	0.069	-0.017	-0.098	-0.009	-0.069
@ Fuel Pool	123117	0.500	-1.278	0.853	0.047	0.040	-0.019	-0.025	0.009
31 MS Tunnel	150122	-0.250	-0.101	0.876	-0.017	0.020	0.016	-0.023	-0.054
Wall and Slab	96611	-0.068	0.293	-0.045	0.000	-0.212	-0.094	-0.179	0.011
	98614	0.014	-0.086	0.035	0.009	-0.460	-0.055	-0.159	0.014

Table 3G.1-14

Results of NASTRAN Analysis, Drywell Unit Pressure (1 MPa)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 RPV	5006	-4.911	-4.633	-0.085	1.470	8.804	0.041	-0.004	4.002
Pedestal	5013	-5.056	-4.286	-0.229	1.429	8.711	-0.007	-0.004	4.046
Bottom	5024	-4.885	-3.567	0.050	1.531	8.273	-0.037	0.035	3.699
2 RPV	6006	4.568	-4.411	-0.437	-0.183	-0.665	-0.015	0.046	-0.519
Pedestal	6013	4.479	-4.272	-0.230	-0.185	-0.711	-0.012	0.017	-0.522
Mid-Height	6024	5.177	-2.835	-0.349	0.185	-0.369	-0.004	-0.053	-0.231
3 RPV	6606	2.487	-4.322	0.035	-0.249	-1.712	-0.284	0.194	1.008
Pedestal	6613	2.001	-4.803	-0.355	-0.254	-1.244	0.271	-0.177	0.794
Top	6624	2.398	-4.701	0.056	-0.264	-1.866	-0.224	0.153	1.067
4 RCCV	1806	0.467	3.073	-0.471	0.279	1.669	0.000	-0.001	0.228
Wetwell	1813	0.467	2.342	-0.083	0.277	1.716	-0.002	-0.001	0.307
Bottom	1824	0.516	3.402	0.041	0.287	1.590	-0.003	0.001	0.271
5 RCCV	2606	1.442	3.057	-0.528	0.014	0.541	0.031	0.000	0.190
Wetwell	2613	1.261	2.085	-0.071	0.041	0.400	-0.007	-0.002	0.219
Mid-Height	2624	1.452	3.374	0.010	0.105	0.292	-0.006	0.006	0.177
6 RCCV	3406	4.373	3.292	0.030	-1.025	-5.552	1.328	-1.007	1.947
Wetwell	3413	3.381	1.775	-0.486	-0.691	-4.100	-1.220	0.767	1.526
Top	3424	2.992	3.358	0.837	-0.697	-4.401	1.466	-0.902	1.545
7 RCCV	3606	4.519	7.067	0.080	0.160	1.320	1.429	-0.404	1.817
Drywell	3613	3.612	5.452	-0.440	0.405	2.421	-1.285	0.152	2.199
Bottom	3624	3.429	8.536	0.813	0.598	3.087	1.532	-0.158	2.090
8 RCCV	4006	1.512	8.081	0.081	-0.094	0.433	0.154	0.301	-1.151
Drywell	4013	2.041	5.445	0.360	-0.215	-0.236	0.068	-0.042	-0.692
Mid-Height	4976	2.687	7.934	-0.378	-0.011	0.007	0.013	0.003	-0.902
9 RCCV	4406	0.639	10.388	2.430	1.025	7.639	-0.144	-0.109	-1.919
Drywell	4413	0.677	5.201	0.493	1.036	7.332	0.145	0.092	-2.540
Top	4424	2.055	6.903	-0.370	1.014	6.316	0.048	0.004	-2.036
10 Basemat	80003	3.974	4.223	-0.013	-10.747	-10.393	-0.003	-0.425	0.323
@ Center	80007	3.993	4.234	-0.007	-10.743	-10.390	-0.001	0.064	0.526
	80012	3.985	4.246	-0.002	-10.752	-10.386	-0.001	0.520	0.070
11 Basemat	80206	4.060	4.100	0.023	-5.849	-6.023	-1.469	-1.117	0.840
Inside	80213	4.083	4.279	-0.062	-7.508	-4.325	0.068	-0.007	1.467
RPV Pedestal	80224	4.090	4.051	-0.010	-4.585	-7.254	0.121	1.545	0.049
12 S/P Slab	83306	-1.228	1.040	-0.116	-3.691	-2.125	-0.042	-1.301	0.013
@ RPV	83313	-1.422	0.908	0.003	-3.697	-2.145	0.025	-1.315	0.002
	83324	-1.131	1.079	-0.010	-3.727	-2.183	-0.002	-1.337	-0.008
13 S/P Slab	83406	-0.651	0.391	-0.058	0.519	-1.299	-0.033	-0.902	-0.001
@ Center	83413	-0.706	0.395	-0.022	0.516	-1.309	0.009	-0.900	-0.002
	83424	-0.610	0.408	0.018	0.514	-1.290	0.005	-0.916	0.001
14 S/P Slab	83506	-0.429	0.149	-0.015	2.997	-0.103	-0.010	-0.686	-0.012
@ RCCV	83513	-0.437	0.236	-0.024	2.987	-0.106	0.004	-0.689	-0.001
	83524	-0.452	0.143	0.018	3.031	-0.062	0.003	-0.704	0.001
15 Top slab	98120	-2.469	1.190	-0.018	1.790	1.051	1.170	-0.230	-1.136
@ Drywell Head	98135	-9.521	-0.243	0.273	2.553	-1.580	0.021	0.662	-1.608
Opening	98104	0.502	2.365	-0.641	1.123	7.240	-1.038	0.435	-1.748
16 Top slab	98149	-4.573	3.370	-1.802	2.560	1.444	-0.399	0.452	1.641
@ Center	98170	-3.641	2.251	-0.696	3.552	5.282	-0.099	-0.108	-0.215
	98109	0.576	1.443	-0.192	5.270	6.281	-0.557	-0.044	-0.722
17 Top slab	98174	-1.093	2.651	-0.266	0.837	2.100	1.656	1.224	-0.967
@ RCCV	98197	-0.047	2.768	-0.076	0.724	-6.567	-0.422	-0.330	-4.964
	98103	2.025	2.126	-0.437	-6.783	0.343	-1.315	-4.883	-0.879

Table 3G.1-14
Results of NASTRAN Analysis, Drywell Unit Pressure (1 MPa) (Continued)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
18 Wall	6	-0.974	2.625	-0.442	0.543	3.146	-0.009	0.023	0.979
Below RCCV	13	-0.841	2.333	-0.144	0.570	3.263	-0.005	0.006	0.979
Bottom	24	-1.138	2.559	0.061	0.594	3.346	-0.006	0.005	1.003
19 Wall Below	806	0.068	2.574	-0.358	-0.027	-0.090	0.015	-0.008	0.070
Below RCCV	813	0.053	2.050	-0.128	-0.014	-0.034	0.017	0.005	0.205
Mid-Height	824	-0.117	2.584	0.090	0.027	-0.050	0.006	-0.003	0.216
20 Wall	1606	0.740	2.463	-0.399	-0.309	-1.768	0.000	0.000	0.488
Below RCCV	1613	0.750	1.792	-0.090	-0.322	-1.816	-0.004	0.000	0.541
Top	1624	0.771	2.759	0.067	-0.318	-1.963	-0.001	0.002	0.577
21 Exterior Wall	20011	0.083	0.589	0.047	0.233	0.862	0.016	-0.018	0.268
@ EL-11.50	20023	0.008	-0.130	-0.088	-0.071	0.043	-0.002	0.000	0.030
~-10.50m	30010	0.234	-0.091	-0.029	0.301	1.468	-0.016	-0.006	-0.313
	30020	0.089	-0.385	-0.063	-0.110	0.017	0.032	0.034	0.002
	40001	0.052	-0.342	0.172	-0.109	0.087	-0.018	-0.012	-0.017
	40011	-0.160	0.053	-0.011	0.331	1.576	0.012	0.001	-0.329
22 Exterior Wall	22011	0.076	0.484	-0.065	0.011	0.030	0.007	0.004	-0.104
@ EL4.65	22023	-0.005	-0.242	-0.020	0.002	0.028	-0.006	0.018	-0.005
~6.60m	32010	0.223	0.082	0.024	0.010	0.089	0.002	0.000	0.029
	32020	0.014	-0.351	0.330	0.017	0.034	-0.004	-0.003	0.024
	42001	-0.012	-0.289	0.321	0.017	0.028	-0.006	-0.001	0.002
	42011	0.089	0.681	-0.011	0.015	0.034	0.005	-0.003	0.050
23 Exterior Wall	24211	0.833	0.393	-0.053	0.143	0.819	0.024	0.022	-0.478
@ EL22.50	24224	0.044	-1.059	-0.252	0.033	0.143	0.056	0.069	0.088
~24.60m	34210	0.902	0.116	0.068	-0.042	0.077	0.014	-0.010	0.063
	34220	0.008	-0.767	0.201	0.021	0.089	0.058	0.002	-0.024
	44201	0.064	-0.661	0.375	0.035	0.061	-0.014	0.006	-0.010
24 Basemat	90140	-0.080	0.388	0.713	2.798	2.185	-3.294	0.247	-0.521
@ Wall	90182	1.495	0.130	-0.055	-0.942	4.136	0.435	-0.079	-0.412
Below RCCV	90111	0.164	0.784	-0.082	4.086	-0.843	0.482	-0.425	-0.045
25 Slab	93140	-0.060	0.051	0.049	0.064	0.043	-0.051	0.009	-0.011
EL4.65m	93182	0.113	-0.078	0.012	-0.017	0.025	0.002	0.002	0.055
@ RCCV	93111	-0.068	0.032	0.005	0.044	-0.010	0.001	0.028	-0.001
26 Slab	96144	0.352	0.353	1.213	0.160	0.247	-0.170	0.035	-0.080
EL17.5m	96186	1.165	-0.550	0.116	0.015	0.278	-0.064	0.019	-0.087
@ RCCV	96113	-0.852	1.280	0.344	1.849	0.141	-0.364	-0.705	-0.078
27 Slab	98472	0.203	0.751	-0.714	-0.258	-0.277	0.313	-0.368	0.122
EL27.0m	98514	0.234	-0.054	-0.039	-0.067	-0.525	-0.048	0.011	0.179
@ RCCV	98424	-0.456	1.390	-0.179	-4.819	-0.756	-0.338	1.587	0.131
28 Pool Girder	123004	3.198	12.783	7.501	-0.047	0.310	-0.287	0.157	0.025
@ Storage Pool	123104	-1.441	4.080	6.225	0.040	0.124	-0.105	-0.161	0.093
29 Pool Girder	123012	-4.030	-4.444	-2.369	0.107	1.186	-0.019	0.124	0.668
@ Cavity	123112	1.638	-2.746	-2.509	0.034	0.180	-0.136	-0.033	0.025
30 Pool Girder	123017	2.600	12.320	-6.968	-0.345	-0.205	0.493	-0.014	-0.200
@ Fuel Pool	123117	-1.287	3.605	-5.253	-0.058	0.031	0.124	0.138	0.040
31 MS Tunnel	150122	0.158	-0.206	0.196	-0.024	0.025	-0.007	0.007	-0.029
Wall and Slab	96611	-0.118	0.252	-0.053	-0.090	-0.090	-0.009	0.032	0.003
	98614	0.055	0.072	0.016	-0.772	-0.463	-0.034	0.172	0.007

Table 3G.1-15

Results of NASTRAN Analysis, Wetwell Unit Pressure (1 MPa)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
1 RPV	5006	-0.799	-1.047	0.031	0.172	1.017	0.002	0.002	0.487
Pedestal	5013	-0.812	-0.913	0.112	0.166	1.001	0.001	-0.002	0.492
Bottom	5024	-0.849	-0.771	0.023	0.177	1.026	-0.006	0.003	0.507
2 RPV	6006	-0.416	-1.191	0.054	-0.016	-0.137	0.004	0.004	-0.082
Pedestal	6013	-0.472	-0.945	0.113	-0.022	-0.128	0.001	-0.013	-0.090
Mid-Height	6024	-0.552	-0.464	-0.006	-0.060	-0.125	-0.004	0.005	-0.059
3 RPV	6606	0.613	-1.807	0.124	0.768	4.820	0.066	0.168	-1.287
Pedestal	6613	0.759	-1.543	0.116	0.721	4.595	-0.081	-0.136	-1.199
Top	6624	0.699	-1.104	-0.016	0.784	4.812	0.055	0.136	-1.282
4 RCCV	1806	2.243	4.362	0.004	0.853	5.136	0.000	0.001	1.939
Wetwell	1813	2.160	4.039	-0.016	0.849	5.146	-0.006	-0.003	1.972
Bottom	1824	2.411	4.006	0.029	0.823	5.082	0.013	-0.001	1.965
5 RCCV	2606	6.324	4.407	-0.075	-0.455	-2.270	-0.020	0.011	-0.091
Wetwell	2613	5.863	3.899	-0.004	-0.474	-2.063	-0.002	-0.011	-0.060
Mid-Height	2624	6.120	3.818	-0.014	-0.443	-2.079	-0.006	0.005	-0.187
6 RCCV	3406	2.787	4.390	-0.479	0.798	4.654	-1.228	0.928	-1.768
Wetwell	3413	2.768	3.985	0.492	0.473	3.725	1.171	-0.714	-1.507
Top	3424	2.841	3.992	-0.757	0.798	4.963	-1.376	0.826	-1.854
7 RCCV	3606	2.198	0.823	-0.618	-0.212	-1.310	-1.245	0.371	-0.665
Drywell	3613	2.232	0.441	0.672	-0.555	-2.304	1.255	-0.117	-0.877
Bottom	3624	2.326	-0.322	-0.867	-0.492	-2.542	-1.437	0.133	-0.797
8 RCCV	4006	2.047	0.219	-0.203	0.136	-0.562	-0.035	-0.227	0.007
Drywell	4013	1.577	0.039	-0.034	-0.069	-0.171	-0.062	0.028	-0.367
Mid-Height	4976	1.561	-0.264	0.001	-0.038	-0.042	0.007	-0.007	-0.365
9 RCCV	4406	0.842	-0.620	-0.273	0.464	0.376	0.116	-0.001	-0.557
Drywell	4413	0.233	-0.203	-0.114	0.147	0.687	-0.026	-0.035	-0.137
Top	4424	0.475	-0.201	0.020	0.132	0.781	-0.005	-0.010	-0.206
10 Basemat	80003	0.601	0.620	0.002	-1.111	-1.070	0.004	0.027	-0.004
@ Center	80007	0.602	0.616	0.000	-1.093	-1.065	0.007	0.019	-0.009
	80012	0.601	0.610	0.001	-1.083	-1.062	0.004	0.009	0.000
11 Basemat	80206	0.623	0.624	0.023	-1.293	-1.178	0.065	0.081	-0.035
Inside	80213	0.614	0.625	0.007	-1.132	-1.213	0.080	0.076	-0.055
RPV Pedestal	80224	0.614	0.556	-0.006	-1.082	-1.114	-0.004	-0.006	-0.012
12 S/P Slab	83306	1.680	1.903	-0.069	-0.821	1.216	-0.001	4.158	-0.052
@ RPV	83313	1.855	1.882	0.068	-0.745	1.241	-0.018	4.183	0.056
	83324	1.592	1.940	-0.005	-0.772	1.258	0.002	4.180	-0.048
13 S/P Slab	83406	1.809	1.848	-0.036	-6.236	-1.496	-0.011	-0.339	0.000
@ Center	83413	1.971	1.795	0.039	-6.211	-1.486	-0.013	-0.332	0.001
	83424	1.776	1.935	-0.005	-6.224	-1.479	0.001	-0.331	0.001
14 S/P Slab	83506	1.850	1.797	-0.010	2.798	-0.380	-0.008	-3.784	-0.003
@ RCCV	83513	2.007	1.784	0.035	2.811	-0.378	-0.002	-3.782	-0.002
	83524	1.886	1.954	-0.022	2.794	-0.373	-0.001	-3.781	0.003
15 Top slab	98120	0.417	0.564	0.328	-0.007	-0.031	-0.005	-0.003	-0.016
@ Drywell Head	98135	0.803	0.171	-0.201	-0.048	-0.008	0.008	-0.002	-0.001
Opening	98104	0.177	1.082	-0.199	-0.003	-0.025	0.001	-0.001	0.005
16 Top slab	98149	0.486	0.730	-0.001	-0.039	-0.064	0.022	0.013	-0.057
@ Center	98170	0.694	0.264	0.034	-0.083	-0.130	-0.019	-0.012	-0.027
	98109	0.394	0.729	-0.006	-0.060	-0.047	-0.004	-0.021	0.002
17 Top slab	98174	0.483	0.831	0.084	-0.206	-0.360	0.120	0.075	-0.088
@ RCCV	98197	0.323	0.266	-0.021	-0.202	-0.227	-0.054	-0.033	-0.013
	98103	0.366	0.572	0.035	-0.217	-0.064	0.000	-0.022	-0.003

Table 3G.1-15
Results of NASTRAN Analysis, Wetwell Unit Pressure (1 MPa) (Continued)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
18 Wall	6	-0.264	0.194	-0.080	0.106	0.634	-0.004	0.007	0.178
Below RCCV	13	-0.246	-0.018	-0.046	0.133	0.735	0.000	0.001	0.212
Bottom	24	-0.299	-0.056	0.034	0.135	0.749	-0.002	0.001	0.214
19 Wall Below	806	0.151	0.123	0.021	0.043	0.226	0.012	0.002	-0.025
Below RCCV	813	0.188	-0.073	-0.020	0.068	0.249	0.005	0.001	0.015
Mid-Height	824	0.156	-0.096	0.038	0.051	0.258	0.001	-0.001	0.031
20 Wall	1606	1.633	0.065	0.003	-0.464	-2.668	-0.001	0.001	0.866
Below RCCV	1613	1.594	-0.194	-0.016	-0.475	-2.726	-0.006	-0.002	0.926
Top	1624	1.796	-0.226	0.023	-0.500	-2.778	0.009	-0.001	0.957
21 Exterior Wall	20011	0.133	0.533	0.026	0.085	0.324	0.007	-0.020	0.106
@ EL-11.50	20023	0.002	-0.005	-0.007	-0.030	0.040	0.000	0.012	0.023
~-10.50m	30010	0.171	0.305	0.000	0.103	0.543	-0.004	-0.002	-0.113
	30020	0.027	-0.148	-0.023	-0.047	0.042	0.013	0.003	-0.008
	40001	0.016	-0.135	0.058	-0.047	0.059	-0.010	0.002	-0.013
	40011	0.104	0.343	0.021	0.110	0.578	0.003	0.002	-0.118
22 Exterior Wall	22011	0.997	0.293	-0.099	-0.002	0.131	0.004	-0.015	0.307
@ EL4.65	22023	0.116	0.353	0.195	0.302	0.060	-0.062	-0.097	-0.011
~6.60m	32010	1.131	0.164	-0.064	-0.016	0.100	0.016	-0.001	-0.301
	32020	0.108	0.617	0.252	0.222	0.041	-0.106	0.157	0.014
	42001	0.148	0.661	-0.054	0.292	0.041	0.041	-0.108	0.021
	42011	1.037	0.239	0.146	-0.056	0.063	-0.025	0.003	-0.291
23 Exterior Wall	24211	0.419	0.475	0.007	0.031	0.211	-0.003	-0.004	-0.010
@ EL22.50	24224	0.021	0.315	-0.168	-0.042	-0.052	0.014	0.001	-0.066
~24.60m	34210	0.478	0.176	-0.004	0.014	0.165	-0.019	0.002	0.031
	34220	-0.018	0.129	0.002	-0.013	0.029	0.017	-0.029	-0.015
	44201	-0.014	0.148	0.114	-0.008	0.022	-0.012	0.030	-0.009
24 Basemat	90140	0.079	0.126	0.130	0.077	0.039	-0.452	-0.075	0.005
@ Wall	90182	0.311	0.107	0.009	-0.308	0.020	0.063	-0.003	0.270
Below RCCV	90111	0.096	0.220	-0.013	-0.057	-0.322	0.077	0.305	0.007
25 Slab	93140	0.337	0.402	0.355	0.057	0.043	-0.051	0.002	-0.002
EL4.65m	93182	0.704	0.216	-0.057	-0.007	0.087	0.005	0.002	0.068
@ RCCV	93111	0.224	0.691	-0.132	0.062	-0.014	-0.001	0.060	-0.001
26 Slab	96144	-0.054	0.908	0.409	0.036	-0.089	0.044	0.007	0.024
EL17.5m	96186	0.852	-0.302	-0.428	0.019	-0.020	0.075	-0.023	-0.105
@ RCCV	96113	-0.526	1.389	-0.701	-0.865	-0.012	0.377	0.043	0.028
27 Slab	98472	-0.169	0.033	0.273	0.094	0.112	-0.068	0.098	-0.057
EL27.0m	98514	0.094	0.102	0.004	0.026	0.171	0.004	0.000	-0.127
@ RCCV	98424	0.150	0.439	0.004	0.429	0.070	0.026	-0.193	-0.013
28 Pool Girder	123004	0.254	-0.030	-0.051	0.005	-0.060	0.007	0.025	-0.032
@ Storage Pool	123104	0.105	0.010	-0.036	0.005	0.002	-0.002	0.012	-0.005
29 Pool Girder	123012	0.292	0.029	0.039	-0.009	0.006	0.002	0.013	0.021
@ Cavity	123112	0.215	0.029	0.085	-0.011	-0.006	-0.003	0.015	-0.006
30 Pool Girder	123017	-0.071	-0.917	0.129	0.043	-0.174	-0.078	-0.022	-0.120
@ Fuel Pool	123117	0.206	-0.292	-0.024	0.002	0.005	-0.003	-0.024	-0.014
31 MS Tunnel	150122	0.047	0.010	-0.004	-0.023	0.020	0.008	-0.001	0.000
Wall and Slab	96611	-0.098	0.361	-0.055	0.017	-0.022	0.006	0.003	0.000
	98614	0.057	-0.001	0.016	-0.134	-0.055	-0.010	0.022	0.000

Table 3G.1-16

Results of NASTRAN Analysis, Temperature Load (Normal Operation: Winter)

Location	Element ID	Nx(MN/m)	Ny(MN/m)	Nxy (MN/m)	Mx (MNm/m)	My(MNm/m)	Mxy(MNm/m)	Qx (MN/m)	Qy (MN/m)
1 RPV	5006	-4.824	-0.465	-0.214	-5.642	-4.446	-0.033	0.062	1.557
Pedestal	5013	-4.495	-0.249	-0.163	-5.751	-4.784	-0.004	0.030	1.450
Bottom	5024	-4.603	-0.081	-0.019	-5.814	-4.514	-0.025	-0.019	1.428
2 RPV	6006	-1.897	-0.133	0.043	-5.774	-5.565	0.151	0.044	-0.691
Pedestal	6013	-1.963	-0.214	-0.250	-5.876	-5.494	-0.030	-0.016	-0.801
Mid-Height	6024	-2.065	-0.151	0.004	-6.554	-4.209	-0.240	0.011	-0.694
3 RPV	6606	-2.691	-0.086	0.128	-5.695	-3.487	0.023	-0.192	-1.695
Pedestal	6613	-2.310	-0.102	-0.247	-5.619	-3.447	0.025	0.210	-1.762
Top	6624	-2.362	-0.303	0.053	-5.603	-3.222	0.027	-0.357	-1.734
4 RCCV	1806	-2.563	-1.526	-0.505	-3.715	-5.464	0.050	0.048	-0.398
Wetwell	1813	-3.004	-3.488	-0.335	-3.549	-5.455	-0.016	-0.006	-0.390
Bottom	1824	-2.581	-4.244	0.028	-3.620	-5.153	0.015	-0.056	-0.275
5 RCCV	2606	-2.955	-1.840	-0.507	-3.057	-2.370	-0.005	0.048	-0.129
Wetwell	2613	-4.074	-4.373	-0.070	-2.625	-1.960	0.002	-0.054	0.080
Mid-Height	2624	-3.188	-4.876	-0.052	-3.030	-2.118	-0.017	0.054	0.214
6 RCCV	3406	0.382	-2.431	-0.111	-3.082	-3.463	-0.092	0.172	0.532
Wetwell	3413	-1.604	-5.332	0.135	-2.805	-3.149	0.010	-0.014	0.529
Top	3424	0.907	-6.367	0.149	-2.773	-2.141	-0.017	-0.048	0.171
7 RCCV	3606	-2.497	-2.662	-0.413	-4.073	-3.963	0.046	0.167	0.167
Drywell	3613	-1.903	-6.161	0.665	-2.949	-2.526	-0.097	-0.043	0.275
Bottom	3624	-12.907	-7.430	0.040	0.091	0.481	0.011	-0.022	1.578
8 RCCV	4006	0.313	-2.683	0.093	-4.069	-4.432	0.067	-0.027	0.133
Drywell	4013	0.832	-7.035	0.527	-3.169	-3.074	0.018	-0.108	0.187
Mid-Height	4976	-8.880	-6.829	0.607	-0.328	-1.435	-0.003	0.003	-0.469
9 RCCV	4406	1.744	-2.456	-0.925	-3.912	-5.591	0.278	0.007	0.353
Drywell	4413	0.546	-7.448	-0.281	-3.488	-4.568	0.281	-0.048	0.715
Top	4424	-9.747	-5.630	0.792	0.400	2.176	-0.012	-0.012	-2.081
10 Basemat	80003	-4.346	-4.862	0.010	-4.059	-4.050	-0.018	0.025	-0.012
@ Center	80007	-4.363	-4.828	0.040	-4.040	-4.047	-0.016	0.016	-0.017
	80012	-4.366	-4.767	0.027	-4.032	-4.048	-0.016	0.005	-0.003
11 Basemat	80206	-4.334	-5.160	0.103	-4.405	-4.434	0.054	0.023	-0.084
Inside	80213	-4.492	-4.818	0.094	-4.252	-4.521	-0.088	-0.037	-0.110
RPV Pedestal	80224	-4.397	-4.671	0.051	-4.294	-4.192	-0.016	-0.060	0.011
12 S/P Slab	83306	-4.837	-1.899	-0.110	-2.916	-2.725	-0.008	0.141	-0.002
@ RPV	83313	-5.355	-1.357	0.193	-2.863	-2.724	-0.020	0.199	0.009
	83324	-5.143	-1.343	0.220	-2.826	-2.670	-0.007	0.216	0.007
13 S/P Slab	83406	-3.519	-2.900	-0.209	-3.073	-2.828	-0.013	0.071	0.002
@ Center	83413	-4.453	-2.246	0.288	-3.200	-2.880	-0.007	0.137	0.000
	83424	-3.977	-2.228	0.023	-3.178	-2.834	0.001	0.136	-0.001
14 S/P Slab	83506	-2.891	-3.113	-0.123	-3.239	-2.978	-0.023	0.022	0.003
@ RCCV	83513	-4.017	-2.908	0.302	-3.630	-3.043	-0.004	0.140	0.003
	83524	-3.373	-2.594	-0.018	-3.551	-3.013	0.013	0.106	-0.004
15 Top slab	98120	-8.852	-6.611	-4.769	0.970	0.989	0.841	0.011	0.184
@ Drywell	98135	-14.175	-4.059	2.686	2.010	0.110	-0.430	0.087	-0.026
Head Opening	98104	-3.705	-8.366	2.799	0.113	1.464	-0.357	0.027	-0.112
16 Top slab	98149	-8.419	-6.116	-1.244	1.346	1.748	0.241	0.182	0.293
@ Center	98170	-9.287	-5.378	0.041	1.797	3.119	0.000	0.112	0.365
	98109	-7.378	-6.392	1.097	1.035	1.619	0.159	0.284	-0.128
17 Top slab	98174	-7.209	-7.073	1.684	2.362	2.616	0.242	-0.386	0.208
@ RCCV	98197	-10.683	-5.431	-0.510	1.513	2.339	0.337	0.150	-0.713
	98103	-8.340	-7.216	0.229	4.178	3.159	0.208	1.069	-0.002

Table 3G.1-16
Results of NASTRAN Analysis, Temperature Load (Normal Operation: Winter), (Continued)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
18 Wall	6	1.023	-0.886	-0.654	0.212	1.426	-0.036	0.036	0.224
Below RCCV	13	0.507	-2.542	-0.586	0.379	2.154	0.000	0.013	0.472
Bottom	24	0.532	-2.869	0.118	0.411	2.277	-0.006	0.001	0.518
19 Wall Below	806	1.000	-1.482	0.007	0.116	0.725	0.064	-0.045	0.006
Below RCCV	813	0.593	-2.519	-0.497	0.074	0.726	-0.026	0.010	0.464
Mid-Height	824	0.409	-2.995	0.111	0.101	0.757	0.016	0.007	0.458
20 Wall	1606	6.731	-2.008	-0.088	-0.441	-1.840	0.064	0.047	1.352
Below RCCV	1613	6.528	-2.928	-0.407	-0.479	-2.808	-0.006	-0.011	1.675
Top	1624	6.913	-3.793	-0.068	-0.544	-2.721	-0.001	-0.051	1.709
21 Exterior Wall	20011	2.540	2.455	0.310	0.308	1.144	0.043	-0.128	0.398
@ EL-11.50	20023	-3.248	-2.017	0.860	-2.274	-2.960	0.035	-0.815	-0.643
~-10.50m	30010	0.453	2.322	-0.053	1.022	3.264	-0.016	-0.021	-0.581
	30020	-0.102	-1.058	-0.196	0.121	1.096	0.111	-0.026	-0.279
	40001	-0.159	-0.692	-0.029	0.170	1.214	-0.073	0.118	-0.312
	40011	0.823	2.622	0.053	1.046	3.500	0.007	0.012	-0.650
22 Exterior Wall	22011	1.843	2.253	-0.169	-0.064	-0.019	0.029	0.016	0.166
@ EL4.65	22023	1.142	-3.655	0.414	0.195	-0.119	-0.152	0.111	0.023
~6.60m	32010	12.203	5.953	-0.005	-2.691	-2.510	-0.004	-0.002	-0.189
	32020	0.286	4.009	2.271	-0.586	-1.816	-0.384	0.707	0.105
	42001	2.259	2.832	2.345	-0.754	-1.648	-0.038	-0.653	-0.264
	42011	10.948	4.426	0.096	-2.788	-2.373	0.071	0.067	-0.152
23 Exterior Wall	24211	2.522	2.258	-0.280	-0.128	-0.437	-0.036	-0.040	1.851
@ EL22.50	24224	0.174	4.366	-3.359	0.618	-0.270	-0.552	-0.582	-0.214
~24.60m	34210	13.072	4.591	-0.448	-2.803	-2.690	0.029	-0.011	-0.164
	34220	1.415	4.367	1.792	0.568	-1.677	-0.355	1.406	0.095
	44201	0.851	4.776	-0.637	0.172	-1.845	0.435	-1.737	0.113
24 Basemat	90140	0.776	0.878	1.441	0.099	-0.105	-0.496	-0.936	0.209
@ Wall	90182	2.003	0.465	0.485	-0.217	-3.036	0.138	-0.119	2.399
Below RCCV	90111	0.557	2.512	-0.038	-3.682	-0.570	0.051	2.681	0.125
25 Slab	93140	-0.023	1.556	2.383	-0.396	-0.318	0.219	-0.107	0.086
EL4.65m	93182	2.267	-2.651	-0.772	-0.297	-1.495	-0.065	0.061	1.107
@ RCCV	93111	-2.303	2.913	-0.078	-1.569	-0.289	-0.039	1.040	0.002
26 Slab	96144	0.027	2.598	3.033	-0.175	-0.152	0.114	-0.034	0.046
EL17.5m	96186	2.655	-1.900	-1.096	-0.113	-0.543	-0.035	0.019	0.434
@ RCCV	96113	-3.979	-2.962	-0.545	-3.812	-2.712	-0.133	0.521	-0.025
27 Slab	98472	-1.527	-0.418	4.539	-0.490	-0.061	-0.191	0.307	-0.457
EL27.0m	98514	-0.760	-2.401	-0.907	-0.504	-0.232	-0.059	0.048	-0.160
@ RCCV	98424	-10.129	-10.794	-0.971	6.001	3.682	0.035	-4.073	-0.189
28 Pool Girder	123004	-4.442	-10.462	-0.306	0.444	1.780	-0.275	-0.295	1.487
@ Storage Pool	123104	-1.614	-3.341	1.911	-0.140	-0.494	0.091	-0.445	0.305
29 Pool Girder	123012	-3.312	-0.105	0.192	0.090	0.340	0.003	-0.048	0.152
@ Cavity	123112	-3.485	-0.116	-0.081	0.051	-0.023	-0.038	-0.145	0.104
30 Pool Girder	123017	0.207	-4.788	-0.951	2.325	2.914	-0.165	0.309	0.477
@ Fuel Pool	123117	-1.651	-2.038	-0.603	2.235	1.798	-0.075	-0.157	0.287
31 MS Tunnel	150122	2.242	-0.256	-0.859	3.735	3.890	0.060	-0.257	-0.296
Wall and Slab	96611	0.077	1.898	-0.095	-3.385	-6.331	-0.225	0.617	0.053
	98614	0.356	2.473	-0.324	9.730	13.818	0.063	-1.834	-0.158

Table 3G.1-17

Results of NASTRAN Analysis, Temperature Load (LOCA After 6 minutes: Winter)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy**(MN/m)	**Mx**(MNm/m)	**My**(MNm/m)	**Mxy**(MNm/m)	**Qx**(MN/m)	**Qy**(MN/m)
1 RPV	5006	-4.914	1.511	-0.308	-6.365	-4.559	-0.052	0.107	1.915
Pedestal	5013	-4.492	1.682	-0.086	-6.538	-4.972	-0.006	0.026	1.799
Bottom	5024	-4.788	1.835	-0.003	-6.598	-4.346	-0.034	-0.030	1.882
2 RPV	6006	0.032	1.753	0.169	-6.298	-4.819	0.250	0.076	-1.338
Pedestal	6013	-0.090	1.491	-0.205	-6.540	-4.716	-0.049	-0.028	-1.484
Mid-Height	6024	-0.282	2.013	0.068	-7.565	-2.982	-0.333	0.009	-1.347
3 RPV	6606	13.800	1.993	0.458	-6.972	-5.243	0.061	-1.094	0.930
Pedestal	6613	14.040	1.756	-0.439	-6.980	-5.204	0.051	1.161	0.871
Top	6624	14.663	2.298	0.204	-6.952	-5.291	0.078	-1.430	1.061
4 RCCV	1806	1.751	-0.007	-0.297	-4.421	-7.805	0.062	0.058	-1.566
Wetwell	1813	1.093	-2.329	-0.367	-4.202	-7.396	-0.025	-0.007	-1.331
Bottom	1824	1.981	-2.824	0.082	-4.322	-7.438	0.022	-0.082	-1.354
5 RCCV	2606	1.184	-0.011	-0.269	-3.357	-1.133	0.021	0.034	0.033
Wetwell	2613	-0.038	-2.791	-0.063	-3.081	-1.119	0.008	-0.077	0.390
Mid-Height	2624	1.079	-3.158	-0.043	-3.384	-1.119	-0.022	0.071	0.377
6 RCCV	3406	11.624	0.596	0.226	-4.154	-8.398	-0.221	0.439	3.322
Wetwell	3413	7.954	-3.660	-0.047	-4.357	-9.124	-0.396	0.519	3.323
Top	3424	11.052	-4.630	0.371	-3.786	-5.604	-0.046	-0.058	2.298
7 RCCV	3606	8.432	0.427	0.558	-5.339	-8.935	0.587	0.513	-1.847
Drywell	3613	4.514	-4.417	0.816	-4.914	-6.085	-0.394	0.296	-0.734
Bottom	3624	-3.703	-6.328	0.263	-1.033	-3.093	0.041	-0.049	0.123
8 RCCV	4006	5.852	0.754	-0.011	-5.144	-5.509	0.007	-0.183	-0.528
Drywell	4013	4.218	-5.936	0.807	-4.699	-4.400	0.008	-0.150	-0.234
Mid-Height	4976	-3.420	-5.654	0.772	-0.840	-1.477	-0.001	0.007	-0.863
9 RCCV	4406	3.417	-0.742	-1.786	-4.287	-4.604	0.344	-0.208	-0.354
Drywell	4413	0.498	-6.550	-0.446	-4.823	-4.853	0.289	-0.224	0.725
Top	4424	-7.055	-4.082	0.940	-0.023	2.580	-0.017	-0.012	-1.978
10 Basemat	80003	-3.832	-4.440	0.007	-4.240	-4.238	-0.016	0.032	-0.015
@ Center	80007	-3.849	-4.408	0.035	-4.214	-4.234	-0.013	0.025	-0.019
	80012	-3.854	-4.352	0.023	-4.202	-4.237	-0.013	0.012	-0.004
11 Basemat	80206	-3.801	-4.758	0.111	-4.600	-4.678	0.083	0.016	-0.101
Inside	80213	-3.948	-4.381	0.095	-4.421	-4.762	-0.050	0.006	-0.146
RPV Pedestal	80224	-3.874	-4.291	0.046	-4.364	-4.386	-0.020	-0.043	0.010
12 S/P Slab	83306	-8.430	8.012	0.027	-4.417	-2.896	0.015	-0.248	0.001
@ RPV	83313	-8.845	8.448	-0.275	-4.426	-2.958	-0.032	-0.239	-0.022
	83324	-8.617	8.870	0.723	-4.216	-2.783	0.001	-0.123	0.042
13 S/P Slab	83406	-4.716	3.300	-0.435	-3.598	-3.189	-0.006	-0.274	0.009
@ Center	83413	-5.529	3.887	0.330	-3.708	-3.266	-0.014	-0.232	-0.007
	83424	-5.039	4.216	0.041	-3.677	-3.155	-0.002	-0.184	0.007
14 S/P Slab	83506	-2.707	1.467	-0.274	-2.852	-3.128	-0.032	-0.252	0.010
@ RCCV	83513	-3.724	1.595	0.393	-3.192	-3.182	-0.007	-0.152	0.000
	83524	-3.075	2.237	-0.023	-3.204	-3.140	0.013	-0.148	-0.004
15 Top slab	98120	-7.704	-4.732	-1.166	0.747	0.629	2.583	-0.150	0.074
@ Drywell Head	98135	-10.062	-5.610	0.556	3.094	-2.008	-1.221	0.306	-0.222
Opening	98104	-5.268	-2.661	0.786	-1.577	3.078	-1.390	0.146	-0.201
16 Top slab	98149	-6.420	-3.274	-0.448	1.814	2.130	0.346	0.136	0.106
@ Center	98170	-6.246	-3.905	-0.324	2.174	3.114	-0.038	0.113	0.455
	98109	-6.252	-2.427	0.725	1.007	2.226	0.038	0.380	-0.086
17 Top slab	98174	-5.257	-4.725	1.957	2.429	2.294	0.439	-0.175	-0.031
@ RCCV	98197	-7.993	-3.381	-0.911	1.891	2.951	0.273	0.139	-0.592
	98103	-6.656	-4.117	0.218	4.494	3.771	0.226	1.080	0.001

Table 3G.1-17
Results of NASTRAN Analysis, Temperature Load (LOCA After 6 minutes: Winter), (Continued)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
18 Wall	6	0.931	-1.125	-0.748	0.244	1.608	-0.041	0.046	0.242
Below RCCV	13	0.411	-3.022	-0.610	0.437	2.455	0.002	0.013	0.528
Bottom	24	0.330	-3.256	0.152	0.473	2.598	-0.007	0.001	0.588
19 Wall Below	806	1.402	-1.854	0.083	0.220	1.176	0.076	-0.051	-0.079
Below RCCV	813	0.936	-3.009	-0.507	0.150	1.159	-0.032	0.010	0.460
Mid-Height	824	0.749	-3.304	0.158	0.167	1.199	0.020	0.009	0.452
20 Wall	1606	10.806	-2.486	0.050	-0.665	-3.012	0.083	0.059	2.184
Below RCCV	1613	10.443	-3.560	-0.419	-0.713	-3.998	-0.010	-0.013	2.514
Top	1624	11.250	-4.196	-0.083	-0.794	-4.030	0.001	-0.077	2.602
21 Exterior Wall	20011	2.705	3.066	0.389	0.368	1.368	0.053	-0.156	0.466
@ EL-11.50	20023	-3.251	-1.996	0.825	-2.301	-2.914	0.034	-0.800	-0.621
~-10.50m	30010	0.724	2.695	-0.073	1.092	3.667	-0.017	-0.022	-0.637
	30020	-0.071	-1.233	-0.217	0.074	1.116	0.124	-0.017	-0.276
	40001	-0.153	-0.846	0.059	0.127	1.264	-0.082	0.120	-0.316
	40011	0.891	3.003	0.054	1.119	3.906	0.009	0.013	-0.707
22 Exterior Wall	22011	3.318	2.710	-0.171	-0.103	-0.066	0.048	0.030	0.058
@ EL4.65	22023	1.285	-3.170	0.477	0.534	-0.054	-0.170	0.006	0.009
~6.60m	32010	14.112	6.168	-0.023	-2.775	-2.672	0.003	-0.007	-0.020
	32020	0.400	4.604	2.519	-0.338	-1.807	-0.378	0.875	0.157
	42001	2.426	3.483	2.473	-0.440	-1.604	-0.045	-0.762	-0.249
	42011	12.516	4.854	0.184	-2.941	-2.613	0.072	0.080	0.063
23 Exterior Wall	24211	3.814	3.230	-0.215	-0.028	0.139	-0.034	-0.045	1.652
@ EL22.50	24224	0.397	5.311	-3.629	0.850	-0.366	-0.448	-0.780	-0.397
~24.60m	34210	14.993	4.941	-0.346	-2.787	-2.419	0.017	-0.013	0.093
	34220	1.556	5.056	1.786	0.885	-1.523	-0.164	1.522	-0.010
	44201	0.989	5.532	-0.249	0.541	-1.740	0.350	-1.832	0.050
24 Basemat	90140	0.810	0.937	1.518	-0.219	-0.337	-0.492	-1.096	0.272
@ Wall	90182	2.214	0.531	0.485	-0.413	-3.760	0.157	-0.103	2.795
Below RCCV	90111	0.599	2.396	-0.039	-4.358	-0.699	0.073	3.051	0.135
25 Slab	93140	0.135	2.185	3.808	-0.512	-0.404	0.288	-0.137	0.113
EL4.65m	93182	3.924	-3.797	-1.043	-0.359	-1.846	-0.083	0.076	1.380
@ RCCV	93111	-3.346	4.625	-0.234	-1.884	-0.337	-0.050	1.257	0.001
26 Slab	96144	-0.275	4.650	7.008	-0.256	-0.148	0.178	-0.080	0.026
EL17.5m	96186	6.634	-4.133	-1.423	-0.104	-0.384	-0.051	0.018	0.398
@ RCCV	96113	-8.012	3.448	-1.490	-4.673	-2.833	-0.192	1.013	-0.053
27 Slab	98472	-1.982	-0.328	5.374	-0.389	0.081	-0.331	0.462	-0.565
EL27.0m	98514	0.251	-2.349	-1.148	-0.511	0.076	-0.048	0.047	-0.499
@ RCCV	98424	-10.347	-8.098	-1.199	6.883	3.766	0.096	-4.484	-0.220
28 Pool Girder	123004	-3.222	-10.345	0.042	0.420	1.524	-0.253	-0.188	1.420
@ Storage Pool	123104	-1.162	-3.219	1.957	-0.186	-0.569	0.085	-0.399	0.291
29 Pool Girder	123012	-1.584	-0.088	-0.190	-0.062	0.579	0.047	0.057	0.427
@ Cavity	123112	-2.306	-0.056	-0.066	-0.143	-0.117	-0.095	-0.039	0.096
30 Pool Girder	123017	0.774	-6.893	-0.910	2.469	2.741	-0.228	0.208	0.414
@ Fuel Pool	123117	-0.984	-2.677	-0.716	2.293	1.832	-0.079	-0.209	0.279
31 MS Tunnel	150122	2.226	-0.111	-0.753	3.639	3.907	0.083	-0.262	-0.322
Wall and Slab	96611	-0.174	3.068	-0.248	-3.645	-6.606	-0.247	0.700	0.064
	98614	0.527	2.703	-0.288	9.377	13.644	0.044	-1.769	-0.155

Table 3G.1-18

Results of NASTRAN Analysis, Temperature Load (LOCA After 72 hours: Winter)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My**(MNm/m)	**Mxy**(MNm/m)	**Qx**(MN/m)	**Qy**(MN/m)
1 RPV	5006	-13.947	0.161	-0.486	-15.740	-11.087	-0.102	0.226	4.880
Pedestal	5013	-13.372	0.271	-0.086	-16.029	-11.713	-0.007	0.019	4.752
Bottom	5024	-13.919	0.215	0.002	-16.061	-10.406	-0.078	-0.046	4.926
2 RPV	6006	-2.483	0.613	0.460	-16.186	-15.497	0.425	0.153	-1.652
Pedestal	6013	-2.675	0.292	-0.222	-16.668	-15.409	-0.043	-0.034	-1.882
Mid-Height	6024	-2.798	0.648	0.087	-18.667	-11.882	-0.682	0.031	-1.562
3 RPV	6606	3.459	0.568	0.467	-16.412	-12.055	0.121	-0.772	-1.957
Pedestal	6613	4.014	0.624	-0.376	-16.392	-12.231	-0.024	0.838	-1.943
Top	6624	4.131	0.639	0.234	-16.379	-12.033	0.102	-1.077	-1.799
4 RCCV	1806	-2.089	-1.627	-0.394	-10.252	-14.421	0.073	0.070	-1.432
Wetwell	1813	-2.608	-4.438	-0.288	-9.980	-13.822	-0.044	-0.007	-1.104
Bottom	1824	-1.725	-4.483	0.172	-10.129	-13.767	0.031	-0.103	-1.054
5 RCCV	2606	-4.378	-2.154	-0.405	-9.998	-7.615	0.005	0.039	0.073
Wetwell	2613	-5.309	-5.586	0.063	-9.714	-7.480	-0.018	-0.096	0.442
Mid-Height	2624	-4.767	-5.072	-0.072	-10.108	-7.790	-0.038	0.082	0.381
6 RCCV	3406	5.146	-1.793	0.374	-10.845	-13.921	0.028	0.122	2.434
Wetwell	3413	3.360	-7.377	0.327	-10.754	-14.083	-0.105	0.111	2.634
Top	3424	3.550	-6.962	0.378	-10.104	-10.258	0.043	-0.160	1.032
7 RCCV	3606	0.855	-1.873	-0.034	-12.684	-14.715	0.245	0.161	-0.543
Drywell	3613	-1.019	-8.771	1.274	-12.290	-13.057	-0.280	0.001	-0.234
Bottom	3624	-10.073	-8.472	0.316	-7.314	-7.358	0.070	-0.111	1.306
8 RCCV	4006	1.877	-1.562	-0.442	-12.483	-13.207	0.139	-0.296	-0.380
Drywell	4013	1.214	-10.590	1.149	-12.238	-11.748	0.051	-0.198	-0.348
Mid-Height	4976	-8.101	-7.344	0.924	-7.622	-8.430	0.004	0.035	-0.545
9 RCCV	4406	0.823	-3.764	-3.737	-11.621	-12.462	0.691	-0.182	-0.529
Drywell	4413	-1.109	-11.745	-0.412	-12.243	-11.597	0.480	-0.143	0.316
Top	4424	-11.976	-5.333	1.168	-6.791	-4.544	-0.050	-0.027	-2.329
10 Basemat	80003	-1.458	-2.035	-0.010	-4.165	-4.332	-0.019	0.027	-0.018
@ Center	80007	-1.464	-1.996	0.023	-4.146	-4.331	-0.018	0.015	-0.025
	80012	-1.469	-1.929	0.013	-4.141	-4.341	-0.014	-0.003	-0.003
11 Basemat	80206	-1.451	-2.440	0.102	-4.566	-4.901	0.112	-0.003	-0.132
Inside	80213	-1.559	-1.931	0.037	-4.414	-4.996	-0.075	-0.008	-0.208
RPV Pedestal	80224	-1.413	-1.846	0.033	-4.392	-4.556	-0.029	-0.087	0.015
12 S/P Slab	83306	-9.972	1.598	-0.064	-9.481	-8.299	0.020	-0.052	-0.031
@ RPV	83313	-10.412	2.279	0.020	-9.487	-8.358	-0.018	-0.032	0.009
	83324	-10.086	2.442	0.535	-9.395	-8.241	-0.004	0.012	0.009
13 S/P Slab	83406	-6.718	-1.759	-0.385	-8.944	-8.523	-0.007	-0.094	0.009
@ Center	83413	-7.659	-0.903	0.493	-9.069	-8.607	-0.009	-0.043	-0.004
	83424	-6.972	-0.779	-0.021	-9.008	-8.518	0.002	-0.039	0.004
14 S/P Slab	83506	-5.228	-3.030	-0.183	-8.795	-8.644	-0.044	-0.124	0.014
@ RCCV	83513	-6.407	-2.664	0.563	-9.202	-8.697	-0.010	0.002	0.004
	83524	-5.481	-2.152	-0.087	-9.085	-8.636	0.017	-0.037	-0.005
15 Top slab	98120	-12.118	-11.183	-5.512	6.841	6.030	5.411	-0.811	-0.398
@ Drywell Head	98135	-17.422	-7.219	2.697	11.169	0.342	-2.394	0.848	-0.819
Opening	98104	-6.925	-12.999	2.994	2.265	12.026	-3.290	0.606	-0.472
16 Top slab	98149	-11.284	-4.069	-0.857	4.361	5.925	0.936	0.661	-1.018
@ Center	98170	-10.473	-4.943	0.330	4.246	5.164	-0.051	0.133	0.663
	98109	-6.965	-3.863	0.571	8.864	11.344	-0.270	0.605	-0.017
17 Top slab	98174	-8.731	-7.669	2.634	5.537	4.434	0.957	-0.904	-0.184
@ RCCV	98197	-12.156	-5.258	-1.159	4.205	6.099	0.531	0.320	-0.561
	98103	-6.757	-8.103	0.104	13.587	13.101	0.388	1.276	0.008

Table 3G.1-18
Results of NASTRAN Analysis, Temperature Load (LOCA After 72 hours: Winter),
(Continued)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
18 Wall	6	0.500	-1.654	-0.972	0.379	2.437	-0.053	0.065	0.459
Below RCCV	13	-0.085	-4.092	-0.679	0.635	3.539	0.001	0.019	0.830
Bottom	24	0.018	-3.987	0.219	0.642	3.557	-0.009	0.000	0.840
19 Wall Below	806	1.715	-2.757	0.110	0.305	1.594	0.082	-0.064	-0.104
Below RCCV	813	1.263	-4.045	-0.535	0.199	1.585	-0.036	0.005	0.613
Mid-Height	824	1.020	-4.014	0.229	0.220	1.644	0.029	0.013	0.560
20 Wall	1606	15.255	-3.697	0.077	-0.865	-3.917	0.106	0.072	2.988
Below RCCV	1613	15.098	-4.773	-0.377	-0.955	-5.278	-0.012	-0.016	3.467
Top	1624	15.945	-5.116	-0.071	-1.065	-5.223	0.003	-0.102	3.539
21 Exterior Wall	20011	3.015	4.539	0.539	0.546	2.096	0.065	-0.209	0.722
@ EL-11.50	20023	-3.247	-1.943	0.806	-2.359	-2.817	0.031	-0.795	-0.575
~-10.50m	30010	1.001	3.822	-0.190	1.305	4.878	-0.022	-0.029	-0.906
	30020	-0.043	-1.519	-0.380	0.011	1.225	0.146	-0.023	-0.288
	40001	-0.085	-1.165	0.093	0.037	1.359	-0.099	0.110	-0.329
	40011	1.348	3.854	0.063	1.290	4.897	0.012	0.016	-0.910
22 Exterior Wall	22011	4.828	4.398	-0.287	-0.154	-0.139	0.067	0.044	0.162
@ EL4.65	22023	1.518	-2.692	0.328	0.990	0.017	-0.183	-0.173	0.000
~6.60m	32010	16.476	7.814	-0.100	-2.875	-2.936	-0.003	-0.013	-0.029
	32020	0.610	4.810	2.460	0.061	-1.837	-0.391	1.189	0.188
	42001	2.708	3.726	2.529	0.074	-1.559	-0.037	-0.972	-0.233
	42011	14.259	5.931	0.283	-3.138	-2.902	0.064	0.089	0.069
23 Exterior Wall	24211	5.628	6.168	-0.121	0.036	0.461	-0.032	-0.057	1.532
@ EL22.50	24224	1.066	6.059	-3.947	1.882	0.047	-0.627	-1.457	-0.289
~24.60m	34210	21.500	5.814	-0.637	-2.922	-2.837	0.043	-0.005	-0.143
	34220	2.573	6.295	3.703	2.522	-1.254	-0.604	2.464	0.060
	44201	1.787	7.067	-0.242	2.081	-1.543	0.575	-2.867	0.058
24 Basemat	90140	0.656	1.200	1.911	-1.180	-1.211	-0.619	-1.550	0.481
@ Wall	90182	2.514	0.741	0.349	-1.063	-5.492	0.225	-0.057	3.883
Below RCCV	90111	0.765	3.129	-0.047	-5.573	-1.339	0.131	3.888	0.160
25 Slab	93140	0.490	2.920	5.382	-0.742	-0.577	0.416	-0.195	0.167
EL4.65m	93182	5.916	-4.973	-1.484	-0.488	-2.535	-0.114	0.107	1.922
@ RCCV	93111	-4.283	6.565	-0.433	-2.488	-0.436	-0.068	1.677	0.002
26 Slab	96144	0.694	5.742	8.267	-0.286	-0.226	0.196	-0.057	0.076
EL17.5m	96186	9.941	-4.575	-2.193	-0.167	-0.769	-0.060	0.027	0.707
@ RCCV	96113	-8.874	6.068	-1.617	-4.618	-2.819	-0.231	0.824	-0.088
27 Slab	98472	-4.967	-2.594	6.298	-1.805	-1.111	-0.360	0.517	-0.794
EL27.0m	98514	-3.009	-2.822	-1.263	-1.884	-1.446	-0.081	0.071	-0.380
@ RCCV	98424	-9.362	-3.812	-1.884	8.865	4.514	0.244	-4.534	-0.244
28 Pool Girder	123004	-3.773	-8.909	2.443	-3.191	-1.408	-0.451	-0.296	2.590
@ Storage Pool	123104	-0.908	-1.329	2.320	-4.096	-4.643	0.160	-1.017	0.189
29 Pool Girder	123012	-1.053	-0.015	-0.253	-3.807	-2.087	0.177	0.085	1.518
@ Cavity	123112	0.271	0.204	-0.468	-4.115	-3.707	-0.173	-0.004	-0.028
30 Pool Girder	123017	5.174	-7.676	-2.219	2.826	2.658	-0.300	0.268	0.239
@ Fuel Pool	123117	1.810	-2.768	-0.560	2.974	1.894	-0.159	-0.541	0.254
31 MS Tunnel	150122	2.279	-0.182	-0.887	3.448	3.933	0.118	-0.222	-0.262
Wall and Slab	96611	-0.295	3.728	-0.322	-3.550	-6.604	-0.232	0.690	0.063
	98614	1.306	2.277	-0.049	9.353	14.160	-0.019	-1.882	-0.168

Table 3G.1-19

Results of NASTRAN Analysis, Seismic Load (Horizontal: North to South Direction)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 RPV	5006	-3.659	-4.291	-0.463	0.933	5.377	0.046	0.061	2.277
Pedestal	5013	-0.845	1.502	-0.434	0.377	2.323	-0.013	0.130	0.940
Bottom	5024	2.083	7.762	-0.043	-0.392	-1.472	-0.004	0.013	-0.778
2 RPV	6006	0.421	-2.493	-1.016	-0.148	-0.141	0.015	0.118	0.098
Pedestal	6013	-0.364	1.437	-1.767	-0.345	-0.186	-0.111	-0.049	0.004
Mid-Height	6024	-0.380	3.898	0.316	0.367	0.224	-0.039	-0.049	-0.258
3 RPV	6606	-0.120	-1.156	-0.164	-0.406	-3.016	-0.196	0.727	0.863
Pedestal	6613	-1.375	1.345	-1.301	-0.577	-1.769	0.318	-0.089	0.297
Top	6624	0.293	3.518	-0.102	0.328	-0.109	0.011	-0.062	0.073
4 RCCV	1806	-1.663	-1.606	-3.784	0.241	1.992	-0.076	0.018	0.733
Wetwell	1813	-0.371	3.027	-4.441	0.119	0.882	-0.034	0.019	0.352
Bottom	1824	0.906	6.607	-0.267	-0.034	-0.345	-0.011	0.003	-0.240
5 RCCV	2606	-0.421	-1.104	-3.924	-0.087	-0.098	-0.120	-0.018	0.181
Wetwell	2613	-0.798	2.750	-4.413	-0.053	-0.089	-0.036	-0.024	0.163
Mid-Height	2624	-0.044	5.027	-0.262	0.099	0.205	-0.005	-0.005	-0.062
6 RCCV	3406	-0.091	-0.510	-3.585	-0.105	-0.299	-0.018	-0.047	0.142
Wetwell	3413	-0.662	2.398	-4.252	-0.039	-0.196	-0.071	0.067	0.077
Top	3424	-0.518	3.811	-0.168	0.065	0.270	0.045	-0.033	-0.081
7 RCCV	3606	-0.031	-0.141	-3.512	0.074	0.711	0.047	-0.003	0.201
Drywell	3613	-0.698	2.066	-3.945	0.081	0.502	-0.070	0.057	0.204
Bottom	3624	-0.550	3.914	-0.186	-0.048	-0.303	0.055	-0.007	-0.021
8 RCCV	4006	0.790	0.233	-3.141	-0.077	-0.071	-0.062	0.029	0.261
Drywell	4013	-0.292	2.306	-3.780	-0.012	-0.067	-0.088	0.014	0.108
Mid-Height	4976	-0.454	3.036	-0.266	-0.063	-0.168	-0.016	0.009	-0.046
9 RCCV	4406	1.184	1.012	-2.125	-0.314	-1.191	0.022	0.092	0.455
Drywell	4413	0.714	2.598	-3.377	-0.009	-0.368	-0.034	-0.042	0.072
Top	4424	-0.865	2.281	-0.226	-0.048	-0.330	-0.020	-0.004	-0.009
10 Basemat	80003	3.586	2.842	-0.331	-4.691	-4.176	0.064	0.477	0.092
@ Center	80007	3.503	2.916	-0.316	-4.254	-4.033	0.165	0.614	0.111
	80012	3.205	3.049	-0.151	-3.908	-3.829	0.022	0.680	-0.001
11 Basemat	80206	4.320	2.471	-1.054	-6.305	-4.299	0.491	0.742	0.202
Inside	80213	3.499	2.910	-1.544	-3.171	-2.170	1.378	1.189	0.724
RPV Pedestal	80224	2.510	3.600	-0.146	1.629	-1.229	0.129	1.970	0.063
12 S/P Slab	83306	-0.024	-1.056	-1.566	-2.820	-1.643	-0.313	-1.032	0.123
@ RPV	83313	-0.431	-1.505	0.783	-1.652	-1.076	-0.449	-0.591	0.167
	83324	-0.623	-0.113	0.101	-0.297	-0.317	-0.028	-0.051	0.017
13 S/P Slab	83406	0.042	-1.356	-1.365	0.433	-0.909	-0.224	-0.712	-0.011
@ Center	83413	-0.317	-1.137	0.740	0.244	-0.656	-0.297	-0.419	0.010
	83424	-0.869	-0.164	0.069	0.039	-0.327	-0.018	-0.075	0.000
14 S/P Slab	83506	0.316	-1.405	-1.038	2.407	0.020	-0.029	-0.546	-0.048
@ RCCV	83513	-0.282	-0.902	0.686	1.379	-0.078	-0.051	-0.322	-0.055
	83524	-0.923	-0.264	0.036	0.211	-0.213	0.002	-0.048	-0.004
15 Top slab	98120	0.071	0.072	0.030	-0.046	-0.076	-0.034	-0.040	-0.019
@ Drywell Head	98135	0.622	0.061	-0.118	-0.162	-0.016	0.026	0.008	0.000
Opening	98104	-0.057	-1.401	0.071	-0.034	-0.263	0.004	-0.035	0.028
16 Top slab	98149	0.296	0.658	0.077	-0.091	0.043	-0.048	-0.055	0.067
@ Center	98170	0.114	-0.309	0.242	-0.109	-0.114	-0.002	-0.025	-0.023
	98109	0.015	-1.309	-0.036	-0.221	-0.377	-0.030	-0.060	0.070
17 Top slab	98174	0.306	1.159	0.053	0.252	0.417	-0.212	-0.180	0.149
@ RCCV	98197	0.116	-0.499	0.542	0.094	-0.045	-0.123	0.028	0.104
	98103	-0.349	-1.493	0.077	-1.238	-0.628	0.001	-0.319	0.019

Table 3G.1-19
Results of NASTRAN Analysis, Seismic Load (Horizontal: North to South Direction),
(Continued)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
18 Wall	6	-4.226	-2.828	-3.149	0.950	5.629	0.027	0.006	2.014
Below RCCV	13	-0.092	2.940	-3.947	0.616	3.308	-0.083	0.135	0.998
Bottom	24	2.743	8.464	-0.014	0.216	1.126	-0.009	0.003	-0.018
19 Wall Below	806	-2.173	-2.516	-3.422	-0.138	-0.431	-0.021	0.024	0.198
Below RCCV	813	-0.413	3.201	-4.445	-0.018	-0.076	0.039	-0.051	0.288
Mid-Height	824	0.979	7.859	-0.125	0.047	0.231	0.002	-0.001	0.236
20 Wall	1606	-1.483	-1.946	-3.743	-0.333	-1.320	-0.069	-0.002	0.183
Below RCCV	1613	-0.138	3.051	-4.514	-0.243	-1.271	-0.022	0.009	0.366
Top	1624	0.985	6.565	-0.214	-0.062	-0.477	-0.009	0.004	0.204
21 Exterior Wall	20011	-0.662	-1.083	0.877	1.978	8.162	0.050	-0.088	3.032
@ EL-11.50	20023	-0.008	-1.289	-0.936	-0.832	1.337	0.170	1.299	0.909
~-10.50m	30010	1.283	2.225	-3.374	0.481	2.677	-0.053	-0.091	-0.745
	30020	0.109	2.149	-0.455	0.024	1.101	0.025	-0.285	-0.252
	40001	0.366	1.950	-0.726	-0.198	0.593	-0.080	0.012	-0.170
	40011	3.276	3.698	-0.076	0.140	1.121	0.012	0.005	-0.164
22 Exterior Wall	22011	-0.441	-7.125	2.468	0.116	0.966	0.154	-0.038	0.853
@ EL4.65	22023	0.104	-4.679	-0.933	-0.214	0.171	-0.153	0.394	0.153
~6.60m	32010	-0.867	1.234	-3.866	-0.010	-0.012	0.000	-0.002	-0.103
	32020	-0.041	3.265	-1.524	0.147	0.024	0.003	0.129	-0.002
	42001	0.127	3.461	-1.547	0.200	-0.027	-0.023	-0.077	-0.010
	42011	0.749	3.196	0.267	0.003	-0.098	0.009	0.000	0.092
23 Exterior Wall	24211	-1.174	-5.369	0.191	-0.170	-0.660	-0.042	-0.003	0.840
@ EL22.50	24224	-0.282	-7.465	0.532	0.695	1.033	-0.289	0.178	1.126
~24.60m	34210	-1.211	0.237	-3.509	-0.031	-0.189	-0.011	0.011	-0.088
	34220	-0.048	1.855	-1.261	0.007	0.010	-0.003	0.014	-0.006
	44201	-0.107	2.171	-1.075	0.032	0.040	-0.008	0.012	-0.013
24 Basemat	90140	0.034	1.460	-2.130	-6.707	-0.901	-0.370	-2.810	1.163
@ Wall	90182	3.163	0.701	-1.456	-1.619	-0.476	1.390	-1.659	0.675
Below RCCV	90111	1.027	5.920	-0.258	0.380	-1.228	0.393	-2.033	-0.131
25 Slab	93140	-1.560	0.330	-0.338	-0.361	-0.226	0.156	-0.082	0.108
EL4.65m	93182	-0.546	-0.147	-0.448	-0.089	-0.343	-0.012	0.018	0.317
@ RCCV	93111	-0.088	-0.093	0.017	0.067	-0.003	0.007	-0.042	0.002
26 Slab	96144	-0.551	0.162	0.116	-0.295	-0.230	0.156	-0.061	0.070
EL17.5m	96186	-0.608	-0.144	0.033	-0.075	-0.342	-0.012	0.027	0.274
@ RCCV	96113	0.211	-1.036	0.004	0.468	-0.036	-0.012	-0.448	-0.066
27 Slab	98472	1.119	-0.227	0.006	-0.157	-0.188	0.097	-0.125	0.084
EL27.0m	98514	-0.245	-0.158	-0.052	-0.073	-0.266	0.014	0.005	0.210
@ RCCV	98424	1.140	-1.230	0.150	-1.103	-0.494	0.076	1.187	0.079
28 Pool Girder	123004	0.507	2.822	-0.383	-0.070	-0.008	0.034	-0.041	-0.012
@ Storage Pool	123104	-0.578	1.180	-0.739	-0.090	-0.008	-0.001	-0.034	0.011
29 Pool Girder	123012	0.042	-0.086	0.277	-0.025	0.009	-0.004	0.026	0.045
@ Cavity	123112	-0.554	-0.088	0.245	-0.113	-0.026	-0.013	0.039	0.003
30 Pool Girder	123017	0.301	2.991	0.076	0.072	0.236	0.043	0.022	0.221
@ Fuel Pool	123117	-1.053	0.840	1.010	0.040	0.016	-0.022	0.023	0.011
31 MS Tunnel	150122	0.144	0.403	-0.048	-0.062	-0.103	-0.009	0.015	-0.033
Wall and Slab	96611	0.026	-0.379	0.030	-0.117	-0.342	0.005	0.077	0.012
	98614	0.080	-0.246	0.036	0.176	0.303	0.009	-0.069	-0.009

Table 3G.1-20

Results of NASTRAN Analysis, Seismic Load (Horizontal: East to West Direction)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
1 RPV	5006	3.824	6.562	-1.902	-0.846	-4.326	-0.053	0.250	-1.867
Pedestal	5013	5.429	10.427	0.215	-1.323	-6.638	-0.002	0.012	-2.984
Bottom	5024	0.453	0.627	3.241	-0.093	-0.436	0.007	-0.264	-0.196
2 RPV	6006	-0.307	2.620	-3.688	0.070	0.312	-0.267	0.010	-0.094
Pedestal	6013	-0.916	4.064	0.457	0.189	0.314	-0.026	0.009	-0.303
Mid-Height	6024	-0.203	1.547	6.461	0.032	0.048	0.415	0.220	0.041
3 RPV	6606	-1.238	0.118	-2.973	0.335	1.594	0.093	-0.028	-0.657
Pedestal	6613	-1.347	0.069	0.314	0.642	2.502	0.025	-0.155	-0.972
Top	6624	-0.190	0.065	4.374	-0.010	0.231	-0.176	0.137	-0.087
4 RCCV	1806	0.729	4.585	-4.703	-0.176	-0.955	-0.027	0.011	-0.377
Wetwell	1813	1.114	5.859	0.928	-0.274	-1.581	-0.011	0.006	-0.664
Bottom	1824	0.071	0.451	7.426	-0.033	-0.119	0.094	-0.059	-0.064
5 RCCV	2606	0.042	3.102	-4.217	0.030	0.120	-0.061	-0.007	-0.089
Wetwell	2613	-0.005	4.069	0.921	0.044	0.171	-0.017	-0.010	-0.249
Mid-Height	2624	0.046	0.198	6.829	0.008	0.044	0.103	0.036	-0.013
6 RCCV	3406	-0.398	1.932	-3.913	0.030	0.165	-0.110	0.074	-0.089
Wetwell	3413	-0.289	2.645	0.971	0.054	0.321	0.036	-0.062	-0.227
Top	3424	-0.187	0.123	5.910	0.017	0.013	0.010	0.005	0.006
7 RCCV	3606	-0.452	1.766	-3.473	-0.041	-0.248	-0.085	0.065	-0.016
Drywell	3613	-0.265	2.846	1.125	-0.134	-0.780	-0.006	-0.052	-0.296
Bottom	3624	-0.126	0.166	5.784	-0.041	-0.106	0.041	0.024	-0.050
8 RCCV	4006	-0.910	0.987	-3.270	0.020	0.052	-0.092	-0.017	-0.156
Drywell	4013	-1.066	1.762	0.993	0.076	0.313	0.008	-0.022	-0.324
Mid-Height	4976	0.115	0.026	5.969	0.045	0.045	0.059	0.041	-0.021
9 RCCV	4406	-1.432	0.273	-2.870	0.144	0.700	-0.008	0.016	-0.292
Drywell	4413	-1.216	0.860	0.828	0.183	1.145	0.044	0.052	-0.240
Top	4424	0.212	-0.022	6.191	0.053	0.031	0.004	0.056	0.017
10 Basemat	80003	0.003	0.113	0.970	0.137	0.241	-0.184	0.020	0.540
@ Center	80007	0.363	-0.256	0.505	0.315	0.349	-0.067	-0.002	0.512
	80012	-0.098	0.116	0.355	0.055	0.059	0.106	-0.005	0.558
11 Basemat	80206	1.123	-0.469	2.151	2.151	2.565	-1.023	-0.541	1.016
Inside	80213	1.929	-0.848	0.482	2.692	4.698	0.061	0.096	1.708
RPV Pedestal	80224	0.076	0.039	-1.798	0.300	0.206	0.366	0.075	0.061
12 S/P Slab	83306	-0.804	-0.320	1.004	1.133	0.470	-0.277	0.459	0.135
@ RPV	83313	-1.336	-0.260	0.171	1.627	0.736	0.021	0.659	-0.015
	83324	-0.175	-0.020	-1.709	0.074	0.043	0.410	0.039	-0.175
13 S/P Slab	83406	-0.707	0.030	0.424	-0.259	0.175	-0.189	0.290	0.000
@ Center	83413	-1.249	-0.033	0.148	-0.337	0.283	0.028	0.418	0.001
	83424	-0.106	-0.009	-0.929	-0.033	0.010	0.268	0.026	0.015
14 S/P Slab	83506	-0.506	-0.030	0.101	-1.095	-0.198	-0.003	0.234	-0.050
@ RCCV	83513	-1.070	-0.066	0.138	-1.520	-0.265	0.009	0.331	0.005
	83524	-0.061	-0.032	-0.577	-0.110	-0.025	-0.026	0.023	0.083
15 Top slab	98120	-1.292	-1.085	-0.943	-0.055	-0.435	-0.121	-0.057	-0.066
@ Drywell Head	98135	0.125	0.340	-0.586	-0.132	-0.167	0.070	0.008	-0.065
Opening	98104	0.417	0.603	-0.632	-0.056	-0.513	0.012	0.016	-0.418
16 Top slab	98149	-1.003	-0.296	-0.570	0.004	-0.119	-0.001	0.055	-0.012
@ Center	98170	-1.062	0.055	-0.748	-0.033	0.008	-0.035	0.007	-0.003
	98109	0.121	-0.022	-0.733	-0.018	-0.235	-0.142	0.014	-0.139
17 Top slab	98174	-1.274	-0.317	-0.731	-0.157	-0.150	0.128	0.060	-0.052
@ RCCV	98197	-1.529	-0.094	-0.596	-0.157	-0.512	-0.060	-0.039	-0.104
	98103	-0.222	0.168	-1.093	-0.035	-0.048	-0.197	0.040	-0.043

Table 3G.1-20
Results of NASTRAN Analysis, Seismic Load (Horizontal: East to West Direction),
(Continued)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
18 Wall	6	4.080	9.611	-4.318	-0.696	-3.389	-0.046	0.140	-1.392
Below RCCV	13	4.939	9.278	0.447	-0.384	-2.349	-0.019	0.036	-1.176
Bottom	24	0.630	0.657	6.609	0.010	-0.204	0.106	-0.160	-0.129
19 Wall Below	806	0.690	7.399	-5.103	-0.009	0.249	-0.132	-0.022	0.020
Below RCCV	813	1.979	8.078	0.751	0.012	0.364	-0.002	-0.016	-0.087
Mid-Height	824	0.194	0.650	7.276	0.037	0.064	0.059	0.069	0.036
20 Wall	1606	0.628	5.038	-5.272	0.082	0.563	-0.019	-0.005	-0.110
Below RCCV	1613	1.016	6.058	0.909	0.148	0.962	-0.001	0.010	-0.200
Top	1624	0.076	0.521	7.447	-0.016	-0.009	0.052	-0.049	0.027
21 Exterior Wall	20011	-0.657	-0.961	-9.354	-0.082	0.416	0.025	0.100	0.091
@ EL-11.50	20023	0.059	4.728	-0.475	0.320	0.224	-0.093	-0.079	0.031
~-10.50m	30010	3.694	3.409	0.982	-0.320	-1.172	-0.031	-0.026	0.395
	30020	0.512	2.678	1.213	-0.065	0.349	0.031	0.086	-0.091
	40001	0.005	3.037	0.977	0.369	1.132	0.016	0.362	-0.176
	40011	-0.252	-0.361	4.538	0.015	-0.047	0.085	0.124	-0.029
22 Exterior Wall	22011	0.466	3.318	-6.436	0.034	-0.023	-0.021	0.029	-0.002
@ EL4.65	22023	0.069	4.568	-3.234	0.055	-0.073	0.086	-0.202	-0.079
~6.60m	32010	0.643	3.408	0.932	-0.019	-0.097	-0.012	-0.001	0.219
	32020	0.047	2.920	2.784	0.125	-0.060	0.015	0.091	0.016
	42001	-0.017	2.714	2.956	0.166	0.064	-0.012	-0.063	-0.031
	42011	0.214	-0.581	5.945	0.045	0.003	0.018	0.040	-0.015
23 Exterior Wall	24211	-0.114	0.162	-5.394	-0.003	0.026	0.015	0.004	0.008
@ EL22.50	24224	0.259	3.913	-3.713	-0.231	-0.100	-0.022	0.227	-0.045
~24.60m	34210	-0.199	1.096	0.772	0.064	0.354	-0.010	-0.002	0.139
	34220	-0.162	0.839	2.354	0.119	0.142	0.026	0.026	-0.022
	44201	0.145	0.808	2.848	0.066	0.009	0.059	-0.076	0.024
24 Basemat	90140	0.415	4.638	2.888	0.033	3.216	-2.595	2.865	-5.032
@ Wall	90182	6.054	0.571	0.309	0.153	-0.445	-0.242	-0.046	-3.502
Below RCCV	90111	-0.250	0.765	-0.889	-0.470	0.409	1.439	-0.060	-2.916
25 Slab	93140	0.376	-0.215	-0.049	0.156	0.126	-0.093	0.047	-0.033
EL4.65m	93182	0.013	-0.083	-0.165	0.085	0.479	0.017	-0.023	-0.425
@ RCCV	93111	0.148	0.059	-0.226	0.001	-0.009	-0.026	0.012	0.006
26 Slab	96144	-0.105	-0.246	-0.165	0.139	0.119	-0.090	0.046	-0.017
EL17.5m	96186	-0.330	0.169	-0.231	0.108	0.616	0.023	-0.031	-0.490
@ RCCV	96113	0.093	-0.157	0.672	0.081	0.033	-0.003	-0.018	0.044
27 Slab	98472	0.368	-1.005	-0.324	0.038	0.037	-0.017	0.011	-0.012
EL27.0m	98514	-0.432	0.208	-0.345	0.063	0.441	-0.003	-0.008	-0.368
@ RCCV	98424	0.352	-0.350	-5.666	0.038	0.037	-0.205	0.024	0.046
28 Pool Girder	123004	-0.043	-0.854	-0.200	0.285	0.713	-0.142	0.099	0.614
@ Storage Pool	123104	0.031	-0.354	0.429	0.149	-0.068	-0.025	0.014	0.077
29 Pool Girder	123012	-0.584	-0.011	0.262	0.082	0.217	-0.021	0.002	0.186
@ Cavity	123112	-0.677	-0.004	0.368	0.091	-0.015	-0.016	-0.088	-0.009
30 Pool Girder	123017	-0.134	-0.858	0.754	0.327	0.638	0.095	-0.251	0.577
@ Fuel Pool	123117	-0.187	-0.380	-0.012	0.094	-0.070	0.027	0.019	0.053
31 MS Tunnel	150122	0.113	0.172	-0.176	0.072	-0.158	-0.012	0.018	0.202
Wall and Slab	96611	0.019	-0.093	-0.266	-0.036	-0.076	0.083	-0.011	-0.060
	98614	-0.025	-0.005	0.172	-0.022	0.063	0.203	-0.041	0.048

Table 3G.1-21

Results of NASTRAN Analysis, Seismic Load (Vertical: Upward Direction)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
1 RPV	5006	-1.459	1.504	-0.109	0.369	2.146	-0.005	0.011	0.951
Pedestal	5013	-1.245	1.957	-0.167	0.325	1.935	-0.001	0.012	0.845
Bottom	5024	-0.986	2.190	-0.014	0.309	1.777	-0.007	-0.003	0.773
2 RPV	6006	0.062	1.529	-0.161	-0.022	-0.079	-0.020	-0.017	-0.006
Pedestal	6013	0.066	1.672	-0.252	0.007	-0.047	-0.008	0.010	-0.040
Mid-Height	6024	-0.043	1.267	0.131	-0.001	0.014	-0.008	-0.011	-0.062
3 RPV	6606	0.166	1.067	-0.306	-0.247	-1.746	-0.099	-0.047	0.631
Pedestal	6613	0.176	1.114	-0.128	-0.210	-1.696	0.113	0.019	0.609
Top	6624	0.091	1.069	-0.073	-0.227	-1.697	-0.114	-0.019	0.598
4 RCCV	1806	0.276	3.169	-0.099	0.073	0.469	-0.006	0.001	0.100
Wetwell	1813	0.403	3.198	-0.126	0.071	0.390	-0.005	0.001	0.066
Bottom	1824	0.327	3.634	0.042	0.074	0.449	0.000	0.002	0.092
5 RCCV	2606	0.129	2.896	-0.130	-0.004	0.020	-0.007	0.001	0.061
Wetwell	2613	0.199	2.967	-0.138	0.020	0.040	-0.003	0.000	0.040
Mid-Height	2624	0.193	3.390	0.018	-0.013	-0.002	0.000	0.002	0.080
6 RCCV	3406	0.195	2.546	-0.179	-0.076	-0.463	0.034	-0.071	0.157
Wetwell	3413	0.063	2.823	-0.097	-0.025	-0.210	0.004	0.016	0.076
Top	3424	0.120	3.010	-0.010	-0.059	-0.305	0.045	-0.058	0.079
7 RCCV	3606	0.062	2.442	-0.034	0.009	-0.005	0.039	-0.062	-0.045
Drywell	3613	-0.070	2.782	-0.112	0.007	0.010	-0.009	0.017	-0.131
Bottom	3624	0.078	3.186	-0.058	-0.032	-0.159	0.047	-0.033	-0.095
8 RCCV	4006	-0.449	2.407	0.073	0.095	0.356	0.041	0.003	-0.161
Drywell	4013	-0.429	2.930	-0.188	0.043	0.368	0.001	0.006	-0.071
Mid-Height	4976	-0.086	2.647	-0.162	0.018	0.189	0.003	0.005	-0.084
9 RCCV	4406	-0.124	2.743	0.734	0.154	1.012	0.008	-0.003	-0.180
Drywell	4413	0.349	3.050	-0.086	0.139	0.731	-0.005	0.010	-0.144
Top	4424	-0.042	2.067	-0.135	0.054	0.448	-0.003	0.000	-0.085
10 Basemat	80003	1.176	1.338	-0.029	-3.648	-3.734	0.003	-0.174	0.134
@ Center	80007	1.185	1.348	-0.024	-3.657	-3.736	0.001	0.023	0.216
	80012	1.185	1.364	-0.024	-3.656	-3.737	0.002	0.208	0.029
11 Basemat	80206	1.149	1.282	-0.043	-1.685	-1.928	-0.649	-0.747	0.658
Inside	80213	1.179	1.367	-0.064	-2.356	-1.102	0.052	0.028	1.027
RPV Pedestal	80224	1.233	1.441	-0.024	-1.139	-2.368	0.090	0.999	0.079
12 S/P Slab	83306	-0.124	-0.267	0.146	-1.455	-0.965	0.018	-0.734	0.021
@ RPV	83313	-0.247	-0.187	0.074	-1.467	-0.967	-0.012	-0.738	-0.021
	83324	-0.232	-0.288	-0.002	-1.473	-0.971	0.018	-0.742	0.020
13 S/P Slab	83406	-0.143	-0.260	0.105	0.552	-0.468	0.003	-0.366	0.000
@ Center	83413	-0.294	-0.142	0.032	0.545	-0.458	0.002	-0.369	-0.002
	83424	-0.256	-0.261	-0.004	0.553	-0.457	0.001	-0.373	0.001
14 S/P Slab	83506	-0.144	-0.236	0.096	1.146	-0.010	0.006	-0.102	-0.002
@ RCCV	83513	-0.304	-0.128	0.012	1.156	0.003	0.003	-0.108	-0.003
	83524	-0.248	-0.264	-0.007	1.178	0.007	0.001	-0.111	0.001
15 Top slab	98120	-0.808	-0.210	-0.293	0.379	0.220	0.278	-0.038	-0.236
@ Drywell Head	98135	-2.236	-0.182	0.197	0.527	-0.240	-0.066	0.082	-0.299
Opening	98104	-0.066	-0.456	0.069	0.172	1.050	-0.219	0.002	-0.239
16 Top slab	98149	-1.174	0.156	-0.372	0.527	0.371	-0.031	0.043	0.191
@ Center	98170	-1.023	0.029	-0.024	0.653	0.874	-0.004	0.011	0.023
	98109	-0.194	-0.382	0.000	0.646	0.724	-0.119	-0.054	-0.048
17 Top slab	98174	-0.519	0.046	-0.052	0.277	0.532	0.234	0.161	-0.084
@ RCCV	98197	-0.155	-0.016	0.113	0.343	-0.833	-0.060	-0.048	-0.581
	98103	0.009	-0.287	-0.065	-1.481	-0.221	-0.171	-0.781	-0.095

Table 3G.1-21
Results of NASTRAN Analysis, Seismic Load (Vertical: Upward Direction) (Continued)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
18 Wall	6	-0.321	4.250	-0.279	0.231	1.518	-0.009	0.024	0.450
Below RCCV	13	-0.421	3.452	-0.258	0.399	2.157	-0.007	0.010	0.633
Bottom	24	-0.417	3.860	0.100	0.425	2.253	-0.005	0.002	0.637
19 Wall Below	806	-0.054	3.702	-0.048	-0.019	-0.024	0.019	-0.004	0.065
Below RCCV	813	0.021	3.433	-0.210	0.018	0.014	0.021	-0.002	0.157
Mid-Height	824	-0.053	3.860	0.103	0.036	0.019	0.007	-0.003	0.199
20 Wall	1606	0.407	3.300	-0.034	-0.123	-0.670	-0.005	0.004	0.219
Below RCCV	1613	0.540	3.308	-0.149	-0.128	-0.778	-0.005	0.002	0.270
Top	1624	0.471	3.747	0.069	-0.133	-0.780	0.001	0.004	0.262
21 Exterior Wall	20011	0.399	2.223	0.230	0.022	-0.013	-0.003	-0.031	-0.030
@ EL-11.50	20023	0.013	0.711	0.290	-0.077	0.136	0.003	0.048	0.091
~-10.50m	30010	0.086	1.161	-0.023	0.250	1.318	-0.013	-0.005	-0.300
	30020	0.037	0.598	0.129	-0.136	0.364	0.042	-0.080	-0.124
	40001	0.033	0.628	-0.099	-0.139	0.376	-0.039	0.082	-0.123
	40011	0.128	1.494	-0.001	0.288	1.476	0.009	0.002	-0.326
22 Exterior Wall	22011	-0.121	1.929	-0.415	0.007	-0.026	-0.001	0.012	-0.024
@ EL4.65	22023	-0.017	0.997	0.206	0.074	0.002	0.011	-0.052	-0.011
~6.60m	32010	0.012	1.087	-0.027	-0.001	-0.028	-0.002	0.000	0.013
	32020	0.032	1.252	0.072	0.042	0.001	0.007	0.038	0.006
	42001	0.039	1.311	0.061	0.053	0.002	-0.001	-0.027	0.002
	42011	0.214	1.479	0.058	-0.001	-0.021	0.002	-0.002	0.005
23 Exterior Wall	24211	0.087	0.973	-0.055	0.074	0.507	-0.011	0.000	0.135
@ EL22.50	24224	0.039	0.762	-0.252	-0.010	0.046	0.050	0.040	0.028
~24.60m	34210	0.013	0.514	-0.045	-0.006	-0.005	0.001	-0.003	-0.011
	34220	-0.042	0.660	0.115	-0.034	0.017	0.007	-0.029	-0.002
	44201	-0.013	0.763	0.232	-0.031	0.008	-0.010	0.033	0.001
24 Basemat	90140	-0.060	0.480	0.263	1.419	0.971	-2.078	0.964	-1.107
@ Wall	90182	0.369	0.221	0.046	-0.592	1.442	0.238	-0.137	-0.399
Below RCCV	90111	0.246	0.490	-0.027	1.301	-0.708	0.327	-0.439	-0.071
25 Slab	93140	-0.001	-0.080	-0.032	-0.041	-0.051	0.031	-0.067	0.055
EL4.65m	93182	-0.073	-0.068	-0.025	-0.020	-0.060	-0.004	0.005	0.099
@ RCCV	93111	-0.045	-0.094	0.017	-0.092	-0.023	-0.003	0.105	0.002
26 Slab	96144	0.200	-0.155	-0.096	-0.036	-0.037	0.029	-0.072	0.054
EL17.5m	96186	-0.178	0.088	0.017	0.003	0.021	-0.001	0.006	0.023
@ RCCV	96113	0.138	-0.325	0.062	0.169	-0.011	-0.009	-0.171	-0.016
27 Slab	98472	-0.147	0.039	-0.075	-0.116	-0.166	0.128	-0.206	0.148
EL27.0m	98514	0.011	-0.065	-0.042	-0.018	-0.046	-0.008	-0.004	0.058
@ RCCV	98424	-0.031	-0.369	0.013	-1.555	-0.380	-0.015	0.872	0.069
28 Pool Girder	123004	0.536	3.574	1.280	-0.034	0.052	-0.025	0.001	0.018
@ Storage Pool	123104	-0.664	1.245	0.734	-0.024	-0.002	-0.018	-0.017	0.015
29 Pool Girder	123012	-0.913	-0.581	-0.368	0.034	0.265	-0.003	0.016	0.151
@ Cavity	123112	0.119	-0.337	-0.426	0.010	0.031	-0.027	-0.013	0.012
30 Pool Girder	123017	0.443	3.312	-1.363	-0.060	0.040	0.080	0.011	0.084
@ Fuel Pool	123117	-0.434	0.996	-0.736	-0.052	-0.054	0.013	0.005	-0.002
31 MS Tunnel	150122	0.174	0.081	-0.517	0.007	-0.016	-0.011	0.016	0.034
Wall and Slab	96611	0.036	-0.192	0.026	0.028	0.132	0.058	0.115	-0.007
	98614	-0.008	0.058	-0.023	0.013	0.311	0.032	0.089	-0.010

Table 3G.1-22

Combined Forces and Moments: RCCV, Selected Load Combination CV-1

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 RPV	5006	OTHR	-1.727	-6.401	-0.058	0.275	1.551	0.035	-0.001	0.986
Pedestal		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bottom	5013	OTHR	-2.322	-6.785	0.057	0.163	1.662	-0.003	-0.007	1.141
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	5024	OTHR	-2.066	-6.398	0.055	0.394	1.508	-0.008	0.011	0.957
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
2 RPV	6006	OTHR	1.042	-6.118	0.013	-0.049	-0.183	0.017	0.069	-0.354
Pedestal		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mid-Height	6013	OTHR	0.749	-6.140	0.197	-0.208	-0.225	0.003	-0.002	-0.347
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	6024	OTHR	1.103	-4.503	-0.422	0.311	0.115	0.014	-0.013	-0.289
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3 RPV	6606	OTHR	0.537	-5.344	0.648	0.562	3.555	-0.005	0.263	-1.124
Pedestal		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Top	6613	OTHR	0.219	-5.533	0.019	0.423	3.594	-0.061	-0.118	-1.182
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	6624	OTHR	0.839	-5.202	0.214	0.574	3.301	0.099	0.093	-0.952
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
4 RCCV	1806	OTHR	0.376	-1.977	-0.056	0.321	1.958	0.019	0.008	0.712
Wetwell		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bottom	1813	OTHR	0.091	-2.467	0.175	0.326	2.120	0.000	-0.005	0.840
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1824	OTHR	0.586	-2.541	-0.008	0.318	1.823	0.007	-0.005	0.743
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 RCCV	2606	OTHR	2.671	-1.526	-0.123	-0.160	-0.650	0.001	0.006	-0.068
Wetwell		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mid-Height	2613	OTHR	2.262	-2.175	0.186	-0.201	-0.685	0.001	-0.004	-0.005
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	2624	OTHR	2.588	-2.151	-0.029	-0.101	-0.679	-0.005	0.002	-0.130
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 RCCV	3406	OTHR	2.479	-0.900	0.042	-0.024	0.015	0.020	0.015	-0.073
Wetwell		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Top	3413	OTHR	2.098	-1.977	0.166	-0.100	-0.158	-0.079	0.034	-0.017
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3424	OTHR	1.934	-1.509	0.034	0.093	0.438	0.009	0.021	-0.162
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7 RCCV	3606	OTHR	2.464	-0.495	-0.076	-0.032	0.012	0.048	0.026	0.488
Drywell		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bottom	3613	OTHR	2.145	-1.537	0.273	-0.029	0.252	-0.050	0.000	0.686
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	3624	OTHR	1.927	-1.314	0.050	0.126	0.621	0.007	0.024	0.627
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8 RCCV	4006	OTHR	1.797	-0.169	-0.028	-0.107	-0.416	0.010	0.026	-0.244
Drywell		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mid-Height	4013	OTHR	1.725	-1.830	0.414	-0.148	-0.514	0.004	-0.011	-0.266
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4976	OTHR	1.561	-0.735	0.079	-0.013	-0.177	0.006	-0.009	-0.323
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9 RCCV	4406	OTHR	0.600	0.050	-0.062	0.320	1.699	-0.026	-0.037	-0.632
Drywell		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Top	4413	OTHR	-0.150	-2.122	0.294	0.254	2.000	0.041	0.006	-0.780
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4424	OTHR	1.057	-0.281	0.049	0.350	1.987	0.022	0.001	-0.669
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

OTHR: Loads other than thermal loads
TEMP: Thermal loads

Table 3G.1-22
Combined Forces and Moments: RCCV, Selected Load Combination CV-1 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
10 Basemat @ Center	80003	OTHR	-2.942	-1.742	0.128	1.035	1.317	-0.019	0.176	-0.095
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	80007	OTHR	-2.979	-1.751	0.113	1.083	1.332	-0.007	0.021	-0.161
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	80012	OTHR	-3.025	-1.740	0.113	1.096	1.348	-0.013	-0.128	-0.014
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11 Basemat Inside RPV Pedestal	80206	OTHR	-2.658	-1.873	0.186	-0.915	-0.674	0.704	0.992	-1.016
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	80213	OTHR	-2.772	-1.755	0.088	-0.043	-1.330	-0.070	-0.054	-1.384
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	80224	OTHR	-3.233	-2.037	0.057	-1.239	-0.088	-0.116	-1.256	-0.120
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12 S/P Slab @ RPV	83306	OTHR	-0.016	1.200	-0.428	0.057	0.890	-0.052	2.089	-0.033
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	83313	OTHR	0.148	0.948	-0.076	0.127	0.914	0.019	2.107	0.049
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	83324	OTHR	0.177	1.482	0.033	0.072	0.887	-0.024	2.071	-0.049
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13 S/P Slab @ Center	83406	OTHR	0.297	0.897	-0.292	-2.978	-0.510	-0.031	-0.034	0.002
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	83413	OTHR	0.580	0.677	-0.037	-2.948	-0.511	-0.009	-0.023	0.003
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	83424	OTHR	0.397	1.156	0.029	-2.923	-0.498	0.004	-0.042	0.000
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14 S/P Slab @ RCCV	83506	OTHR	0.446	0.768	-0.202	0.896	-0.166	-0.025	-1.667	0.000
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	83513	OTHR	0.760	0.603	-0.030	0.881	-0.171	-0.006	-1.656	0.002
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	83524	OTHR	0.457	1.054	0.035	0.965	-0.129	-0.001	-1.675	0.001
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15 Top slab @ Drywell Head Opening	98120	OTHR	0.289	0.934	0.507	0.182	0.098	0.082	-0.038	-0.136
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	98135	OTHR	-0.376	0.222	-0.244	0.270	-0.292	0.091	0.140	-0.226
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	98104	OTHR	0.355	1.944	-0.425	0.191	1.348	-0.108	0.152	-0.343
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16 Top slab @ Center	98149	OTHR	-0.016	1.283	-0.200	0.274	0.041	-0.105	0.118	0.334
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	98170	OTHR	0.182	0.921	-0.259	0.464	0.782	-0.039	-0.057	-0.116
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	98109	OTHR	0.646	1.371	-0.090	1.101	1.409	-0.049	0.053	-0.212
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17 Top slab @ RCCV	98174	OTHR	0.444	1.149	0.002	-0.116	-0.028	0.344	0.276	-0.270
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	98197	OTHR	0.282	1.209	-0.228	-0.210	-1.380	-0.091	-0.076	-1.076
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	98103	OTHR	0.929	1.495	-0.078	-0.537	0.462	-0.264	-0.766	-0.207
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 3G.1-23

Combined Forces and Moments: RCCV, Selected Load Combination CV-7a

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 RPV Pedestal Bottom	5006	OTHR	-4.644	-13.519	0.055	0.866	5.159	0.055	-0.018	2.677
		TEMP	-4.914	1.511	-0.308	-6.365	-4.559	-0.052	0.107	1.915
	5013	OTHR	-5.508	-13.646	1.078	0.797	5.431	0.006	-0.034	2.978
		TEMP	-4.492	1.682	-0.086	-6.538	-4.972	-0.006	0.026	1.799
	5024	OTHR	-5.325	-11.447	0.743	0.997	4.947	-0.016	0.019	2.697
		TEMP	-4.788	1.835	-0.003	-6.598	-4.346	-0.034	-0.030	1.882
2 RPV Pedestal Mid-Height	6006	OTHR	1.057	-14.746	0.283	-0.129	-0.301	0.048	0.125	-0.487
		TEMP	0.032	1.753	0.169	-6.298	-4.819	0.250	0.076	-1.338
	6013	OTHR	0.521	-13.532	1.230	-0.331	-0.501	0.002	-0.019	-0.465
		TEMP	-0.090	1.491	-0.205	-6.540	-4.716	-0.049	-0.028	-1.484
	6024	OTHR	0.643	-7.415	-0.030	0.246	-0.397	-0.005	0.020	-0.290
		TEMP	-0.282	2.013	0.068	-7.565	-2.982	-0.333	0.009	-1.347
3 RPV Pedestal Top	6606	OTHR	1.004	-13.022	1.940	0.743	6.083	0.207	0.083	-2.376
		TEMP	13.800	1.993	0.458	-6.972	-5.243	0.061	-1.094	0.930
	6613	OTHR	0.429	-12.394	0.600	0.641	6.784	-0.027	0.366	-2.409
		TEMP	14.040	1.756	-0.439	-6.980	-5.204	0.051	1.161	0.871
	6624	OTHR	0.527	-9.224	0.930	1.564	8.165	0.063	1.046	-2.265
		TEMP	14.663	2.298	0.204	-6.952	-5.291	0.078	-1.430	1.061
4 RCCV Wetwell Bottom	1806	OTHR	2.031	-0.569	-0.124	0.954	5.932	0.015	0.013	2.319
		TEMP	1.751	-0.007	-0.297	-4.421	-7.805	0.062	0.058	-1.566
	1813	OTHR	1.512	-1.230	0.373	1.002	6.222	0.010	-0.016	2.564
		TEMP	1.093	-2.329	-0.367	-4.202	-7.396	-0.025	-0.007	-1.331
	1824	OTHR	1.342	-1.731	0.026	1.068	6.299	0.023	-0.019	2.639
		TEMP	1.981	-2.824	0.082	-4.322	-7.438	0.022	-0.082	-1.354
5 RCCV Wetwell Mid-Height	2606	OTHR	4.286	-0.391	-0.287	-0.244	-0.896	-0.015	0.010	-0.343
		TEMP	1.184	-0.011	-0.269	-3.358	-1.133	0.021	0.034	0.033
	2613	OTHR	3.744	-1.115	0.371	-0.279	-0.981	0.017	-0.006	-0.210
		TEMP	-0.038	-2.791	-0.063	-3.081	-1.119	0.008	-0.077	0.390
	2624	OTHR	4.162	-1.263	0.052	-0.203	-1.088	-0.002	0.009	-0.344
		TEMP	1.079	-3.158	-0.043	-3.384	-1.119	-0.022	0.071	0.377
6 RCCV Wetwell Top	3406	OTHR	2.930	0.064	-0.093	-0.055	-0.101	0.081	-0.071	0.095
		TEMP	11.624	0.596	0.226	-4.154	-8.398	-0.221	0.439	3.322
	3413	OTHR	2.419	-1.009	0.237	-0.097	-0.186	-0.116	0.080	0.132
		TEMP	7.954	-3.660	-0.047	-4.357	-9.124	-0.396	0.519	3.323
	3424	OTHR	2.524	-0.633	0.084	0.051	0.054	0.049	-0.025	0.061
		TEMP	11.052	-4.630	0.371	-3.786	-5.604	-0.046	-0.058	2.298
7 RCCV Drywell Bottom	3606	OTHR	2.808	0.553	-0.221	0.025	0.372	0.106	-0.029	0.585
		TEMP	8.432	0.427	0.558	-5.339	-8.935	0.587	0.513	-1.847
	3613	OTHR	2.328	-0.650	0.245	0.077	0.812	-0.089	0.026	0.859
		TEMP	4.514	-4.417	0.816	-4.914	-6.085	-0.394	0.296	-0.734
	3624	OTHR	2.331	-0.626	0.115	0.259	1.214	0.060	0.005	0.804
		TEMP	-3.703	-6.328	0.263	-1.033	-3.093	0.041	-0.049	0.123
8 RCCV Drywell Mid-Height	4006	OTHR	1.952	0.830	-0.142	-0.086	-0.272	0.018	0.039	-0.224
		TEMP	5.852	0.754	-0.011	-5.144	-5.509	0.007	-0.183	-0.528
	4013	OTHR	1.881	-0.739	0.380	-0.134	-0.437	0.006	-0.009	-0.177
		TEMP	4.218	-5.936	0.807	-4.699	-4.400	0.008	-0.150	-0.234
	4976	OTHR	1.786	-0.082	0.086	0.021	-0.162	0.014	-0.014	-0.236
		TEMP	-3.420	-5.654	0.772	-0.840	-1.477	-0.001	0.007	-0.863
9 RCCV Drywell Top	4406	OTHR	0.752	1.281	0.157	0.294	1.729	-0.015	-0.015	-0.555
		TEMP	3.417	-0.742	-1.786	-4.287	-4.604	0.344	-0.208	-0.354
	4413	OTHR	0.391	-0.865	0.386	0.227	1.835	0.053	0.017	-0.701
		TEMP	0.498	-6.550	-0.446	-4.823	-4.853	0.289	-0.224	0.725
	4424	OTHR	1.218	0.280	0.064	0.330	1.809	0.025	0.004	-0.594
		TEMP	-7.055	-4.082	0.940	-0.023	2.580	-0.017	-0.012	-1.978

Table 3G.1-23
Combined Forces and Moments: RCCV, Selected Load Combination CV-7a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
10 Basemat @ Center	80003	OTHR	-0.773	0.281	0.108	-1.804	-1.242	0.027	0.518	-0.397
		TEMP	-3.832	-4.439	0.007	-4.240	-4.238	-0.016	0.032	-0.015
	80007	OTHR	-0.806	0.221	0.061	-1.623	-1.205	0.054	0.227	-0.530
		TEMP	-3.849	-4.408	0.035	-4.214	-4.235	-0.013	0.025	-0.019
	80012	OTHR	-0.905	0.143	0.083	-1.419	-1.004	-0.052	-0.087	-0.244
		TEMP	-3.854	-4.352	0.023	-4.203	-4.237	-0.013	0.012	-0.004
11 Basemat Inside RPV Pedestal	80206	OTHR	-0.178	0.420	0.284	-6.537	-5.863	1.949	2.035	-2.023
		TEMP	-3.802	-4.758	0.110	-4.600	-4.678	0.084	0.016	-0.101
	80213	OTHR	-0.406	0.319	0.136	-4.092	-7.447	0.618	0.611	-2.696
		TEMP	-3.949	-4.381	0.094	-4.421	-4.763	-0.049	0.006	-0.146
	80224	OTHR	-1.192	-0.577	-0.012	-4.808	-3.505	-0.805	-1.804	-0.791
		TEMP	-3.875	-4.291	0.046	-4.364	-4.386	-0.020	-0.043	0.010
12 S/P Slab @ RPV	83306	OTHR	-0.141	2.867	-0.564	-1.806	1.160	-0.137	5.281	-0.079
		TEMP	-8.430	8.012	0.027	-4.417	-2.896	0.015	-0.248	0.001
	83313	OTHR	0.530	2.519	-0.868	-1.716	1.267	-0.150	5.316	0.073
		TEMP	-8.845	8.448	-0.275	-4.426	-2.958	-0.032	-0.239	-0.022
	83324	OTHR	2.400	2.791	-0.695	-1.441	1.649	-0.199	5.500	-0.096
		TEMP	-8.617	8.870	0.723	-4.216	-2.783	0.001	-0.123	0.042
13 S/P Slab @ Center	83406	OTHR	0.512	2.595	-0.494	-8.310	-2.323	-0.048	-0.584	-0.001
		TEMP	-4.716	3.300	-0.435	-3.598	-3.189	-0.006	-0.274	0.009
	83413	OTHR	1.326	2.246	-0.358	-8.313	-2.272	-0.109	-0.555	0.004
		TEMP	-5.529	3.887	0.330	-3.708	-3.266	-0.014	-0.232	-0.007
	83424	OTHR	2.466	2.307	-0.300	-8.353	-2.065	-0.091	-0.493	0.004
		TEMP	-5.039	4.216	0.041	-3.677	-3.155	-0.002	-0.184	0.007
14 S/P Slab @ RCCV	83506	OTHR	1.040	2.443	-0.329	4.067	-0.651	-0.038	-5.138	-0.006
		TEMP	-2.707	1.467	-0.274	-2.852	-3.128	-0.032	-0.252	0.010
	83513	OTHR	1.721	2.169	-0.246	3.982	-0.624	-0.044	-5.120	-0.007
		TEMP	-3.724	1.594	0.393	-3.192	-3.182	-0.007	-0.152	0.000
	83524	OTHR	2.395	2.144	-0.248	3.825	-0.543	-0.033	-5.076	-0.007
		TEMP	-3.075	2.237	-0.023	-3.204	-3.140	0.013	-0.148	-0.004
15 Top slab @ Drywell Head Opening	98120	OTHR	0.486	1.002	0.633	0.180	0.107	0.087	-0.035	-0.141
		TEMP	-7.704	-4.732	-1.166	0.747	0.629	2.583	-0.150	0.074
	98135	OTHR	-0.280	0.222	-0.209	0.278	-0.345	0.107	0.166	-0.268
		TEMP	-10.062	-5.610	0.556	3.094	-2.008	-1.221	0.306	-0.222
	98104	OTHR	0.348	1.803	-0.413	0.201	1.422	-0.112	0.163	-0.402
		TEMP	-5.268	-2.661	0.786	-1.577	3.078	-1.390	0.146	-0.201
16 Top slab @ Center	98149	OTHR	0.254	1.491	-0.297	0.327	0.180	-0.114	0.114	0.297
		TEMP	-6.420	-3.274	-0.448	1.814	2.130	0.346	0.136	0.106
	98170	OTHR	0.374	1.219	-0.207	0.546	0.948	-0.015	-0.019	-0.052
		TEMP	-6.246	-3.905	-0.324	2.174	3.114	-0.038	0.113	0.455
	98109	OTHR	0.643	1.367	-0.077	1.239	1.482	-0.069	0.054	-0.223
		TEMP	-6.252	-2.427	0.725	1.007	2.226	0.038	0.380	-0.086
17 Top slab @ RCCV	98174	OTHR	0.854	1.359	-0.046	-0.023	0.173	0.346	0.250	-0.221
		TEMP	-5.257	-4.725	1.957	2.429	2.294	0.439	-0.175	-0.031
	98197	OTHR	0.732	1.442	-0.094	-0.151	-1.669	-0.070	-0.078	-1.093
		TEMP	-7.993	-3.381	-0.911	1.891	2.951	0.273	0.139	-0.592
	98103	OTHR	0.936	1.552	-0.065	-0.896	0.331	-0.306	-0.957	-0.234
		TEMP	-6.656	-4.117	0.218	4.494	3.771	0.226	1.080	0.001

Table 3G.1-24

Combined Forces and Moments: RCCV, Selected Load Combination CV-7b

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 RPV Pedestal Bottom	5006	OTHR	-4.379	-12.330	0.043	0.860	5.118	0.053	-0.014	2.626
		TEMP	-13.947	0.161	-0.486	-15.740	-11.087	-0.102	0.226	4.880
	5013	OTHR	-5.160	-12.289	1.016	0.774	5.297	0.006	-0.029	2.880
		TEMP	-13.372	0.271	-0.086	-16.029	-11.713	-0.007	0.019	4.752
	5024	OTHR	-4.841	-10.006	0.735	0.966	4.729	-0.015	0.018	2.553
		TEMP	-13.919	0.215	0.002	-16.061	-10.406	-0.078	-0.046	4.926
2 RPV Pedestal Mid-Height	6006	OTHR	1.513	-13.440	0.200	-0.125	-0.259	0.041	0.117	-0.498
		TEMP	-2.483	0.613	0.460	-16.186	-15.497	0.425	0.153	-1.652
	6013	OTHR	0.987	-12.192	1.138	-0.318	-0.450	-0.001	-0.012	-0.480
		TEMP	-2.675	0.292	-0.222	-16.668	-15.409	-0.043	-0.034	-1.882
	6024	OTHR	1.163	-6.325	0.046	0.280	-0.321	-0.006	0.008	-0.313
		TEMP	-2.798	0.648	0.087	-18.667	-11.882	-0.682	0.031	-1.562
3 RPV Pedestal Top	6606	OTHR	1.298	-11.837	1.781	0.583	5.020	0.171	0.064	-1.986
		TEMP	3.459	0.568	0.467	-16.412	-12.055	0.121	-0.772	-1.957
	6613	OTHR	0.687	-11.202	0.597	0.490	5.759	0.013	0.383	-2.036
		TEMP	4.014	0.624	-0.376	-16.392	-12.231	-0.024	0.838	-1.943
	6624	OTHR	0.792	-8.006	0.864	1.422	7.146	0.022	1.031	-1.894
		TEMP	4.131	0.639	0.234	-16.379	-12.033	0.102	-1.077	-1.799
4 RCCV Wetwell Bottom	1806	OTHR	1.953	-0.245	-0.155	0.846	5.275	0.015	0.013	1.980
		TEMP	-2.089	-1.627	-0.394	-10.252	-14.421	0.073	0.070	-1.432
	1813	OTHR	1.415	-0.964	0.297	0.889	5.565	0.010	-0.016	2.222
		TEMP	-2.608	-4.438	-0.288	-9.980	-13.822	-0.044	-0.007	-1.104
	1824	OTHR	1.258	-1.275	0.011	0.951	5.584	0.023	-0.017	2.282
		TEMP	-1.725	-4.483	0.172	-10.129	-13.767	0.031	-0.103	-1.054
5 RCCV Wetwell Mid-Height	2606	OTHR	4.605	0.008	-0.310	-0.263	-0.990	-0.011	0.010	-0.248
		TEMP	-4.378	-2.154	-0.405	-9.998	-7.615	0.005	0.039	0.073
	2613	OTHR	4.013	-0.833	0.315	-0.304	-1.067	0.014	-0.005	-0.133
		TEMP	-5.309	-5.586	0.063	-9.714	-7.480	-0.018	-0.096	0.442
	2624	OTHR	4.409	-0.850	0.039	-0.208	-1.172	-0.001	0.009	-0.281
		TEMP	-4.767	-5.072	-0.072	-10.108	-7.790	-0.038	0.082	0.381
6 RCCV Wetwell Top	3406	OTHR	3.492	0.530	-0.117	-0.055	-0.085	0.053	-0.040	0.041
		TEMP	5.146	-1.793	0.374	-10.845	-13.921	0.028	0.122	2.434
	3413	OTHR	2.903	-0.723	0.224	-0.110	-0.145	-0.094	0.064	0.062
		TEMP	3.360	-7.377	0.327	-10.754	-14.083	-0.105	0.111	2.634
	3424	OTHR	2.884	-0.187	0.074	0.088	0.313	0.019	0.001	-0.073
		TEMP	3.550	-6.962	0.378	-10.104	-10.258	0.043	-0.160	1.032
7 RCCV Drywell Bottom	3606	OTHR	3.353	0.954	-0.249	-0.001	0.241	0.086	-0.012	0.643
		TEMP	0.855	-1.873	-0.034	-12.684	-14.715	0.245	0.161	-0.543
	3613	OTHR	2.819	-0.386	0.280	0.022	0.625	-0.058	0.024	0.912
		TEMP	-1.019	-8.771	1.274	-12.290	-13.057	-0.280	0.001	-0.234
	3624	OTHR	2.736	-0.116	0.086	0.221	1.041	0.029	0.015	0.853
		TEMP	-10.073	-8.472	0.316	-7.314	-7.358	0.070	-0.111	1.306
8 RCCV Drywell Mid-Height	4006	OTHR	2.267	1.274	-0.137	-0.084	-0.330	0.026	0.037	-0.332
		TEMP	1.877	-1.562	-0.442	-12.483	-13.207	0.139	-0.296	-0.380
	4013	OTHR	2.186	-0.572	0.418	-0.168	-0.500	0.005	-0.010	-0.300
		TEMP	1.214	-10.590	1.149	-12.238	-11.748	0.051	-0.198	-0.348
	4976	OTHR	2.118	0.395	0.064	0.006	-0.173	0.013	-0.013	-0.380
		TEMP	-8.101	-7.344	0.924	-7.622	-8.430	0.004	0.035	-0.545
9 RCCV Drywell Top	4406	OTHR	0.871	1.786	0.269	0.443	2.438	-0.018	-0.031	-0.802
		TEMP	0.823	-3.764	-3.737	-11.621	-12.462	0.691	-0.182	-0.529
	4413	OTHR	0.343	-0.786	0.398	0.336	2.583	0.059	0.019	-0.956
		TEMP	-1.109	-11.745	-0.412	-12.243	-11.597	0.480	-0.143	0.316
	4424	OTHR	1.407	0.702	0.042	0.439	2.498	0.028	0.002	-0.817
		TEMP	-11.976	-5.333	1.168	-6.791	-4.544	-0.050	-0.027	-2.329

Table 3G.1-24
Combined Forces and Moments: RCCV, Selected Load Combination CV-7b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
10 Basemat @ Center	80003	OTHR	-0.964	0.150	0.109	-2.152	-1.630	0.027	0.441	-0.333
		TEMP	-1.459	-2.034	-0.010	-4.165	-4.332	-0.019	0.027	-0.018
	80007	OTHR	-0.996	0.094	0.064	-1.971	-1.593	0.054	0.243	-0.428
		TEMP	-1.464	-1.995	0.022	-4.146	-4.332	-0.017	0.015	-0.025
	80012	OTHR	-1.094	0.024	0.085	-1.764	-1.390	-0.053	0.018	-0.231
		TEMP	-1.470	-1.929	0.013	-4.141	-4.342	-0.014	-0.003	-0.003
11 Basemat Inside RPV Pedestal	80206	OTHR	-0.385	0.271	0.271	-5.936	-5.329	1.634	1.735	-1.730
		TEMP	-1.452	-2.440	0.102	-4.566	-4.902	0.112	-0.003	-0.132
	80213	OTHR	-0.598	0.190	0.128	-3.790	-6.506	0.653	0.633	-2.255
		TEMP	-1.560	-1.931	0.037	-4.415	-4.996	-0.075	-0.008	-0.208
	80224	OTHR	-1.382	-0.647	-0.009	-3.875	-3.196	-0.766	-1.377	-0.757
		TEMP	-1.413	-1.845	0.033	-4.392	-4.556	-0.029	-0.087	0.015
12 S/P Slab @ RPV	83306	OTHR	-0.423	2.679	-0.507	-1.751	0.861	-0.136	4.470	-0.071
		TEMP	-9.972	1.598	-0.064	-9.481	-8.299	0.020	-0.052	-0.031
	83313	OTHR	0.214	2.311	-0.858	-1.645	0.976	-0.160	4.511	0.068
		TEMP	-10.412	2.279	0.020	-9.487	-8.358	-0.018	-0.032	0.009
	83324	OTHR	2.069	2.575	-0.690	-1.346	1.374	-0.194	4.707	-0.088
		TEMP	-10.086	2.442	0.535	-9.394	-8.241	-0.004	0.012	0.009
13 S/P Slab @ Center	83406	OTHR	0.234	2.390	-0.451	-7.113	-2.072	-0.046	-0.561	-0.001
		TEMP	-6.718	-1.759	-0.385	-8.944	-8.523	-0.007	-0.094	0.009
	83413	OTHR	1.030	2.018	-0.369	-7.117	-2.019	-0.112	-0.528	0.004
		TEMP	-7.659	-0.903	0.493	-9.069	-8.607	-0.009	-0.043	-0.004
	83424	OTHR	2.142	2.067	-0.296	-7.168	-1.806	-0.091	-0.458	0.004
		TEMP	-6.972	-0.779	-0.021	-9.008	-8.518	0.002	-0.039	0.004
14 S/P Slab @ RCCV	83506	OTHR	0.755	2.233	-0.297	3.728	-0.545	-0.035	-4.482	-0.006
		TEMP	-5.228	-3.030	-0.183	-8.795	-8.644	-0.044	-0.124	0.014
	83513	OTHR	1.437	1.939	-0.269	3.635	-0.526	-0.043	-4.460	-0.008
		TEMP	-6.407	-2.664	0.563	-9.202	-8.697	-0.010	0.002	0.004
	83524	OTHR	2.073	1.895	-0.242	3.442	-0.449	-0.034	-4.410	-0.007
		TEMP	-5.481	-2.152	-0.087	-9.085	-8.636	0.017	-0.037	-0.005
15 Top slab @ Drywell Head Opening	98120	OTHR	0.279	1.159	0.645	0.338	0.195	0.188	-0.057	-0.238
		TEMP	-12.118	-11.183	-5.512	6.841	6.030	5.411	-0.811	-0.398
	98135	OTHR	-1.032	0.220	-0.215	0.497	-0.469	0.105	0.217	-0.398
		TEMP	-17.422	-7.219	2.697	11.170	0.342	-2.394	0.848	-0.819
	98104	OTHR	0.413	2.149	-0.492	0.297	2.026	-0.202	0.198	-0.541
		TEMP	-6.925	-12.999	2.994	2.265	12.026	-3.290	0.606	-0.472
16 Top slab @ Center	98149	OTHR	-0.144	1.862	-0.422	0.541	0.283	-0.139	0.156	0.416
		TEMP	-11.284	-4.069	-0.857	4.361	5.925	0.936	0.661	-1.018
	98170	OTHR	0.103	1.440	-0.279	0.828	1.367	-0.031	-0.030	-0.071
		TEMP	-10.473	-4.943	0.330	4.246	5.164	-0.051	0.133	0.663
	98109	OTHR	0.742	1.574	-0.094	1.661	2.003	-0.112	0.048	-0.283
		TEMP	-6.965	-3.863	0.571	8.864	11.344	-0.270	0.605	-0.017
17 Top slab @ RCCV	98174	OTHR	0.724	1.682	-0.035	0.014	0.277	0.506	0.369	-0.313
		TEMP	-8.731	-7.669	2.634	5.537	4.434	0.957	-0.904	-0.184
	98197	OTHR	0.673	1.737	-0.135	-0.131	-2.224	-0.116	-0.109	-1.502
		TEMP	-12.156	-5.258	-1.159	4.205	6.099	0.531	0.320	-0.561
	98103	OTHR	1.158	1.791	-0.098	-1.409	0.394	-0.409	-1.333	-0.304
		TEMP	-6.757	-8.103	0.104	13.587	13.101	0.388	1.276	0.008

Table 3G.1-25

Combined Forces and Moments: RCCV, Selected Load Combination CV-11a

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 RPV Pedestal Bottom	5006	OTHR	-3.434	-11.709	0.057	0.564	3.351	0.046	-0.015	1.830
		TEMP	-4.914	1.511	-0.308	-6.365	-4.559	-0.052	0.107	1.915
		EQEW	3.824	6.562	-1.902	-0.846	-4.326	-0.053	0.250	-1.867
		EQNS	-3.659	-4.291	-0.463	0.933	5.377	0.046	0.061	2.277
		EQZ	-1.459	1.504	-0.109	0.369	2.146	-0.005	0.011	0.951
		EQT	0.352	0.155	0.243	0.016	-0.150	-0.018	0.037	-0.097
		SPKW	-0.240	0.042	0.193	-0.019	0.016	-0.041	0.021	0.066
		SPKN	-0.242	-0.059	-0.226	0.042	0.132	0.035	-0.009	0.105
	5013	OTHR	-4.216	-11.815	1.058	0.493	3.584	0.007	-0.030	2.092
		TEMP	-4.492	1.682	-0.086	-6.538	-4.972	-0.006	0.026	1.799
		EQEW	5.429	10.427	0.215	-1.323	-6.638	-0.002	0.012	-2.984
		EQNS	-0.845	1.502	-0.434	0.377	2.323	-0.013	0.130	0.940
		EQZ	-1.245	1.957	-0.167	0.325	1.935	-0.001	0.012	0.845
		EQT	0.259	0.237	0.247	-0.078	-0.282	-0.014	0.037	-0.146
		SPKW	0.259	0.275	0.011	0.155	-0.148	0.005	-0.002	-0.077
		SPKN	-0.678	-0.176	-0.094	-0.153	0.170	-0.007	0.012	0.192
	5024	OTHR	-3.969	-9.719	0.725	0.668	3.119	-0.008	0.012	1.841
		TEMP	-4.788	1.835	-0.003	-6.598	-4.346	-0.034	-0.030	1.882
		EQEW	0.453	0.627	3.241	-0.093	-0.436	0.007	-0.264	-0.196
		EQNS	2.083	7.762	-0.043	-0.392	-1.472	-0.004	0.013	-0.778
		EQZ	-0.986	2.190	-0.014	0.309	1.777	-0.007	-0.003	0.773
		EQT	0.016	0.008	0.419	-0.009	-0.021	-0.013	0.008	-0.007
		SPKW	-0.626	-0.190	-0.019	-0.147	0.198	0.005	-0.002	0.192
		SPKN	0.351	0.334	-0.006	0.143	-0.266	-0.001	-0.004	-0.125
2 RPV Pedestal Mid-Height	6006	OTHR	0.612	-12.872	0.298	-0.090	-0.124	0.046	0.111	-0.386
		TEMP	0.032	1.753	0.169	-6.298	-4.819	0.250	0.076	-1.338
		EQEW	-0.307	2.620	-3.688	0.070	0.312	-0.267	0.010	-0.094
		EQNS	0.421	-2.493	-1.016	-0.148	-0.141	0.015	0.118	0.098
		EQZ	0.062	1.529	-0.161	-0.022	-0.079	-0.020	-0.017	-0.006
		EQT	-0.016	0.005	0.132	0.025	0.027	-0.038	-0.007	-0.009
		SPKW	-0.450	0.080	-0.232	-0.054	0.044	-0.055	-0.159	-0.084
		SPKN	-0.183	0.071	0.166	-0.016	-0.010	0.041	0.124	-0.042
	6013	OTHR	0.109	-11.709	1.191	-0.285	-0.311	0.002	-0.015	-0.364
		TEMP	-0.090	1.491	-0.205	-6.540	-4.716	-0.049	-0.028	-1.484
		EQEW	-0.916	4.064	0.457	0.189	0.314	-0.026	0.009	-0.303
		EQNS	-0.364	1.437	-1.767	-0.345	-0.186	-0.111	-0.049	0.004
		EQZ	0.066	1.672	-0.252	0.007	-0.047	-0.008	0.010	-0.040
		EQT	-0.032	-0.006	0.321	0.014	0.040	-0.039	0.001	-0.016
		SPKW	0.044	0.014	0.072	0.513	0.287	0.014	0.041	-0.206
		SPKN	-0.608	0.082	-0.139	-0.423	-0.127	-0.019	-0.025	-0.009
	6024	OTHR	0.156	-6.104	0.084	0.247	-0.254	-0.004	0.021	-0.253
		TEMP	-0.282	2.013	0.068	-7.565	-2.982	-0.333	0.009	-1.347
		EQEW	-0.203	1.547	6.461	0.032	0.048	0.415	0.220	0.041
		EQNS	-0.380	3.898	0.316	0.367	0.224	-0.039	-0.049	-0.258
		EQZ	-0.043	1.267	0.131	-0.001	0.014	-0.008	-0.011	-0.062
		EQT	-0.022	0.111	0.592	-0.008	0.000	0.002	0.011	0.001
		SPKW	-0.606	0.083	0.037	-0.450	-0.108	-0.003	0.024	-0.028
		SPKN	-0.161	-0.122	-0.033	0.542	0.381	0.002	-0.026	-0.221

OTHR: Loads other than thermal and seismic loads
TEMP: Thermal loads
EQEW: Horizontal seismic loads in the E-W direction
EQNS: Horizontal seismic loads in the N-S direction
EQZ: Vertical seismic loads
EQT: Torsional seismic loads
SPKW: Dynamic soil pressure during a horizontal earthquake in the E-W direction
SPKN: Dynamic soil pressure during a horizontal earthquake in the N-S direction

Table 3G.1-25
Combined Forces and Moments: RCCV, Selected Load Combination CV-11a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
3 RPV Pedestal Top	6606	OTHR	0.672	-11.114	1.790	0.534	4.773	0.233	-0.007	-2.046
		TEMP	13.800	1.993	0.458	-6.972	-5.243	0.061	-1.094	0.930
		EQEW	-1.238	0.118	-2.973	0.335	1.594	0.093	-0.028	-0.657
		EQNS	-0.120	-1.156	-0.164	-0.406	-3.016	-0.196	0.727	0.863
		EQZ	0.166	1.067	-0.306	-0.247	-1.746	-0.099	-0.047	0.631
		EQT	-0.059	-0.050	0.201	-0.007	0.087	-0.021	-0.045	-0.029
		SPKW	-0.704	0.033	-0.392	-0.092	0.025	0.224	-0.499	-0.135
		SPKN	-0.339	0.062	0.323	0.044	0.014	-0.210	0.435	-0.110
	6613	OTHR	0.131	-10.445	0.659	0.447	5.457	-0.046	0.447	-2.069
		TEMP	14.040	1.756	-0.439	-6.980	-5.204	0.051	1.161	0.871
		EQEW	-1.347	0.069	0.314	0.642	2.502	0.025	-0.155	-0.972
		EQNS	-1.375	1.345	-1.301	-0.577	-1.769	0.318	-0.089	0.297
		EQZ	0.176	1.114	-0.128	-0.210	-1.696	0.113	0.019	0.609
		EQT	-0.001	-0.104	0.278	0.051	0.156	-0.040	-0.042	-0.050
		SPKW	0.387	-0.006	-0.005	0.292	0.015	-0.028	0.061	0.003
		SPKN	-1.150	0.087	0.014	-0.244	0.011	0.045	-0.060	-0.228
	6624	OTHR	0.178	-7.358	0.861	1.366	6.913	0.077	0.971	-1.959
		TEMP	14.663	2.298	0.204	-6.952	-5.291	0.078	-1.430	1.061
		EQEW	-0.190	0.065	4.374	-0.010	0.231	-0.176	0.137	-0.087
		EQNS	0.293	3.518	-0.102	0.328	-0.109	0.011	-0.062	0.073
		EQZ	0.091	1.069	-0.073	-0.227	-1.697	-0.114	-0.019	0.598
		EQT	-0.030	-0.003	0.423	-0.013	0.017	-0.034	-0.008	-0.011
		SPKW	-1.363	0.123	0.037	-0.280	-0.015	-0.035	0.045	-0.233
		SPKN	0.393	-0.065	0.000	0.276	-0.009	0.013	-0.033	0.028
4 RCCV Wetwell Bottom	1806	OTHR	1.479	-1.729	-0.057	0.672	4.234	0.015	0.013	1.690
		TEMP	1.751	-0.007	-0.297	-4.421	-7.805	0.062	0.058	-1.566
		EQEW	0.729	4.585	-4.703	-0.176	-0.955	-0.027	0.011	-0.377
		EQNS	-1.663	-1.606	-3.784	0.241	1.992	-0.076	0.018	0.733
		EQZ	0.276	3.169	-0.099	0.073	0.469	-0.006	0.001	0.100
		EQT	0.108	0.050	0.777	-0.002	-0.048	-0.016	0.000	-0.025
		SPKW	-0.433	0.096	0.283	-0.005	0.013	0.055	0.007	0.053
		SPKN	-0.162	0.088	0.000	-0.036	-0.034	-0.020	0.002	0.001
	1813	OTHR	0.962	-2.233	0.343	0.718	4.514	0.012	-0.015	1.913
		TEMP	1.093	-2.329	-0.367	-4.202	-7.396	-0.025	-0.007	-1.331
		EQEW	1.114	5.859	0.928	-0.274	-1.581	-0.011	0.006	-0.664
		EQNS	-0.371	3.027	-4.441	0.119	0.882	-0.034	0.019	0.352
		EQZ	0.403	3.198	-0.126	0.071	0.390	-0.005	0.001	0.066
		EQT	0.096	-0.035	0.890	-0.008	-0.050	-0.028	0.001	-0.036
		SPKW	0.032	-0.028	-0.069	0.037	-0.031	-0.001	0.003	0.029
		SPKN	-0.468	0.064	0.168	-0.033	0.031	0.000	-0.006	0.050
	1824	OTHR	0.748	-2.802	0.003	0.784	4.585	0.021	-0.018	1.986
		TEMP	1.981	-2.824	0.082	-4.322	-7.438	0.022	-0.082	-1.354
		EQEW	0.071	0.451	7.426	-0.033	-0.119	0.094	-0.059	-0.064
		EQNS	0.906	6.607	-0.267	-0.034	-0.345	-0.011	0.003	-0.240
		EQZ	0.327	3.634	0.042	0.074	0.449	0.000	0.002	0.092
		EQT	0.002	-0.002	1.125	-0.003	-0.005	-0.013	-0.004	-0.003
		SPKW	-0.581	0.147	-0.037	-0.044	0.047	-0.002	0.005	0.063
		SPKN	-0.022	-0.020	0.071	0.051	-0.010	0.003	-0.013	0.041

Table 3G.1-25
Combined Forces and Moments: RCCV, Selected Load Combination CV-11a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
5 RCCV Wetwell Mid-Height	2606	OTHR	3.049	-1.507	-0.188	-0.173	-0.626	-0.014	0.008	-0.298
		TEMP	1.184	-0.011	-0.269	-3.358	-1.133	0.021	0.034	0.033
		EQEW	0.042	3.102	-4.217	0.030	0.120	-0.061	-0.007	-0.089
		EQNS	-0.421	-1.104	-3.924	-0.087	-0.098	-0.120	-0.018	0.181
		EQZ	0.129	2.896	-0.130	-0.004	0.020	-0.007	0.001	0.061
		EQT	0.002	0.036	0.741	0.003	0.003	-0.019	0.005	-0.004
		SPKW	-0.080	0.068	0.138	-0.013	-0.040	0.018	0.004	0.001
		SPKN	-0.084	0.034	-0.014	-0.017	0.001	-0.018	-0.003	-0.002
	2613	OTHR	2.592	-2.032	0.349	-0.214	-0.720	0.017	-0.002	-0.189
		TEMP	-0.038	-2.791	-0.063	-3.081	-1.119	0.008	-0.077	0.390
		EQEW	-0.005	4.069	0.921	0.044	0.171	-0.017	-0.010	-0.249
		EQNS	-0.798	2.750	-4.413	-0.053	-0.089	-0.036	-0.024	0.163
		EQZ	0.199	2.967	-0.138	0.020	0.040	-0.003	0.000	0.040
		EQT	0.102	-0.088	0.859	0.011	0.023	-0.025	-0.002	-0.011
		SPKW	0.224	0.087	-0.048	0.025	-0.043	-0.002	0.000	0.018
		SPKN	-0.291	-0.003	0.164	-0.035	-0.019	0.005	0.002	-0.008
	2624	OTHR	2.916	-2.327	0.043	-0.141	-0.803	0.000	0.006	-0.300
		TEMP	1.079	-3.158	-0.043	-3.384	-1.119	-0.022	0.071	0.377
		EQEW	0.046	0.198	6.829	0.008	0.044	0.103	0.036	-0.013
		EQNS	-0.044	5.027	-0.262	0.099	0.205	-0.005	-0.005	-0.062
		EQZ	0.193	3.390	0.018	-0.013	-0.002	0.000	0.002	0.080
		EQT	-0.002	-0.017	0.934	-0.001	0.006	-0.019	0.003	0.000
		SPKW	-0.284	0.016	-0.021	-0.043	-0.029	-0.005	0.004	-0.020
		SPKN	0.208	0.115	0.031	0.023	-0.048	0.002	-0.003	0.032
6 RCCV Wetwell Top	3406	OTHR	1.993	-1.049	-0.017	-0.022	0.029	0.055	-0.044	0.044
		TEMP	11.624	0.596	0.226	-4.154	-8.398	-0.221	0.439	3.322
		EQEW	-0.398	1.932	-3.913	0.030	0.165	-0.110	0.074	-0.089
		EQNS	-0.091	-0.510	-3.585	-0.105	-0.299	-0.018	-0.047	0.142
		EQZ	0.195	2.546	-0.179	-0.076	-0.463	0.034	-0.071	0.157
		EQT	0.052	-0.005	0.713	-0.006	-0.021	-0.024	-0.003	0.008
		SPKW	-0.019	0.052	0.051	-0.006	-0.011	0.016	-0.012	-0.006
		SPKN	-0.031	0.005	0.025	-0.001	0.012	-0.012	0.007	-0.006
	3413	OTHR	1.615	-1.886	0.226	-0.072	-0.133	-0.102	0.066	0.099
		TEMP	7.954	-3.660	-0.047	-4.357	-9.124	-0.396	0.519	3.323
		EQEW	-0.289	2.645	0.971	0.054	0.321	0.036	-0.062	-0.227
		EQNS	-0.662	2.398	-4.252	-0.039	-0.196	-0.071	0.067	0.077
		EQZ	0.063	2.823	-0.097	-0.025	-0.210	0.004	0.016	0.076
		EQT	0.091	-0.104	0.873	0.007	0.025	-0.013	-0.010	-0.005
		SPKW	0.132	0.130	-0.025	0.009	-0.056	-0.004	0.004	0.033
		SPKN	-0.166	-0.041	0.094	-0.011	0.022	0.001	-0.002	-0.021
	3424	OTHR	1.691	-1.711	0.068	0.051	0.080	0.024	-0.001	0.046
		TEMP	11.052	-4.630	0.371	-3.786	-5.604	-0.046	-0.058	2.298
		EQEW	-0.187	0.123	5.910	0.017	0.013	0.010	0.005	0.006
		EQNS	-0.518	3.812	-0.168	0.065	0.270	0.045	-0.033	-0.081
		EQZ	0.120	3.010	-0.010	-0.059	-0.305	0.045	-0.058	0.079
		EQT	-0.032	-0.004	0.782	-0.001	-0.004	-0.024	-0.007	0.004
		SPKW	-0.147	-0.044	-0.004	-0.005	0.046	-0.004	0.002	-0.031
		SPKN	0.183	0.153	0.008	-0.008	-0.136	0.003	-0.004	0.053

Table 3G.1-25
Combined Forces and Moments: RCCV, Selected Load Combination CV-11a (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
7 RCCV Drywell Bottom	3606	OTHR	1.944	-0.613	-0.132	0.018	0.291	0.071	-0.015	0.420
		TEMP	8.432	0.427	0.558	-5.339	-8.935	0.587	0.513	-1.847
		EQEW	-0.452	1.766	-3.473	-0.041	-0.248	-0.085	0.065	-0.016
		EQNS	-0.031	-0.141	-3.512	0.074	0.711	0.047	-0.003	0.201
		EQZ	0.062	2.442	-0.034	0.009	-0.005	0.039	-0.062	-0.045
		EQT	0.059	-0.015	0.652	-0.012	-0.046	-0.022	-0.003	-0.015
		SPKW	-0.017	0.050	0.033	-0.003	0.004	-0.002	-0.012	0.002
		SPKN	-0.026	0.005	0.016	0.000	0.012	0.001	0.008	0.005
	3613	OTHR	1.588	-1.539	0.225	0.070	0.671	-0.073	0.020	0.656
		TEMP	4.514	-4.417	0.816	-4.914	-6.085	-0.394	0.296	-0.734
		EQEW	-0.265	2.846	1.125	-0.134	-0.780	-0.006	-0.052	-0.296
		EQNS	-0.698	2.066	-3.945	0.081	0.502	-0.070	0.057	0.204
		EQZ	-0.070	2.782	-0.112	0.007	0.010	-0.009	0.017	-0.131
		EQT	0.095	-0.082	0.789	-0.001	-0.019	-0.016	-0.009	-0.006
		SPKW	0.103	0.099	-0.019	0.022	0.033	-0.002	0.003	0.004
		SPKN	-0.143	-0.041	0.051	-0.011	0.011	-0.001	-0.002	0.013
	3624	OTHR	1.544	-1.784	0.111	0.219	1.021	0.035	0.015	0.608
		TEMP	-3.703	-6.328	0.263	-1.033	-3.093	0.041	-0.049	0.123
		EQEW	-0.126	0.166	5.784	-0.041	-0.106	0.041	0.024	-0.050
		EQNS	-0.550	3.914	-0.186	-0.048	-0.303	0.055	-0.007	-0.021
		EQZ	0.078	3.186	-0.058	-0.032	-0.159	0.047	-0.033	-0.095
		EQT	-0.021	-0.004	0.787	-0.007	-0.013	-0.022	-0.005	-0.006
		SPKW	-0.123	-0.026	-0.002	-0.011	-0.001	0.000	0.002	0.005
		SPKN	0.142	0.069	0.005	0.022	0.048	-0.001	-0.004	0.008
8 RCCV Drywell Mid-Height	4006	OTHR	1.498	-0.379	-0.106	-0.095	-0.285	0.001	0.028	-0.088
		TEMP	5.852	0.754	-0.011	-5.144	-5.509	0.007	-0.183	-0.528
		EQEW	-0.910	0.987	-3.270	0.020	0.052	-0.092	-0.017	-0.156
		EQNS	0.790	0.233	-3.141	-0.077	-0.071	-0.062	0.029	0.261
		EQZ	-0.449	2.407	0.073	0.095	0.356	0.041	0.003	-0.161
		EQT	0.019	-0.053	0.620	-0.001	-0.016	-0.024	0.000	-0.007
		SPKW	-0.013	0.044	0.005	-0.003	0.001	0.010	-0.001	-0.001
		SPKN	-0.014	0.006	0.039	0.001	-0.004	-0.006	0.001	0.002
	4013	OTHR	1.408	-1.628	0.351	-0.102	-0.401	0.005	-0.007	-0.069
		TEMP	4.218	-5.936	0.807	-4.699	-4.400	0.008	-0.150	-0.234
		EQEW	-1.066	1.762	0.993	0.076	0.313	0.008	-0.022	-0.324
		EQNS	-0.292	2.306	-3.780	-0.012	-0.067	-0.088	0.014	0.108
		EQZ	-0.429	2.930	-0.188	0.043	0.368	0.001	0.006	-0.071
		EQT	0.077	-0.117	0.773	-0.003	-0.022	-0.006	-0.001	0.008
		SPKW	0.058	0.139	-0.017	0.011	0.005	-0.002	0.000	0.014
		SPKN	-0.064	-0.052	0.039	-0.010	-0.009	-0.001	0.000	-0.003
	4976	OTHR	1.221	-1.164	0.141	0.020	-0.163	0.010	-0.012	-0.098
		TEMP	-3.420	-5.654	0.772	-0.840	-1.477	-0.001	0.007	-0.863
		EQEW	0.115	0.026	5.969	0.045	0.045	0.059	0.041	-0.021
		EQNS	-0.454	3.036	-0.266	-0.063	-0.168	-0.016	0.009	-0.046
		EQZ	-0.086	2.647	-0.162	0.018	0.189	0.003	0.005	-0.084
		EQT	0.030	-0.017	0.833	0.005	0.002	-0.016	0.006	-0.001
		SPKW	-0.050	-0.035	0.003	-0.004	0.006	-0.002	0.000	-0.009
		SPKN	0.067	0.077	-0.003	0.007	-0.007	0.002	-0.001	0.019

Table 3G.1-25
Combined Forces and Moments: RCCV, Selected Load Combination CV-11a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
9 RCCV Drywell Top	4406	OTHR	0.540	-0.162	-0.152	0.116	0.741	-0.014	-0.006	-0.267
		TEMP	3.417	-0.742	-1.786	-4.287	-4.604	0.344	-0.208	-0.354
		EQEW	-1.432	0.273	-2.870	0.144	0.700	-0.008	0.016	-0.292
		EQNS	1.184	1.012	-2.125	-0.314	-1.191	0.022	0.092	0.455
		EQZ	-0.124	2.743	0.734	0.154	1.012	0.008	-0.003	-0.180
		EQT	-0.058	-0.128	0.705	0.017	0.085	-0.019	-0.034	-0.040
		SPKW	-0.005	0.045	0.000	-0.001	0.004	0.006	0.009	-0.001
		SPKN	-0.010	0.008	0.051	-0.001	-0.009	-0.004	-0.005	0.000
	4413	OTHR	0.153	-1.736	0.327	0.090	0.901	0.036	0.008	-0.394
		TEMP	0.498	-6.550	-0.446	-4.823	-4.853	0.289	-0.224	0.725
		EQEW	-1.216	0.860	0.828	0.183	1.145	0.044	0.052	-0.240
		EQNS	0.714	2.598	-3.377	-0.009	-0.368	-0.034	-0.042	0.072
		EQZ	0.349	3.050	-0.086	0.139	0.731	-0.005	0.010	-0.144
		EQT	-0.003	-0.148	0.957	0.006	0.052	-0.010	-0.002	-0.030
		SPKW	0.085	0.166	-0.005	-0.005	-0.062	0.001	0.000	0.027
		SPKN	-0.051	-0.051	0.033	-0.001	0.016	0.000	0.000	-0.013
	4424	OTHR	0.873	-0.661	0.113	0.193	0.973	0.019	0.004	-0.334
		TEMP	-7.055	-4.082	0.940	-0.023	2.580	-0.017	-0.012	-1.978
		EQEW	0.212	-0.022	6.191	0.053	0.031	0.004	0.056	0.017
		EQNS	-0.865	2.281	-0.226	-0.048	-0.330	-0.020	-0.004	-0.009
		EQZ	-0.042	2.067	-0.135	0.054	0.448	-0.003	0.000	-0.085
		EQT	0.048	-0.016	1.133	0.008	0.006	-0.013	-0.009	0.001
		SPKW	-0.016	-0.034	0.004	0.006	0.045	0.000	-0.001	-0.016
		SPKN	0.027	0.069	-0.003	-0.011	-0.079	0.000	0.001	0.029
10 Basemat @ Center	80003	OTHR	-1.728	-0.684	0.111	0.116	0.581	0.026	0.539	-0.413
		TEMP	-3.832	-4.439	0.007	-4.240	-4.238	-0.016	0.032	-0.015
		EQEW	0.003	0.113	0.970	0.137	0.241	-0.184	0.020	0.540
		EQNS	3.586	2.842	-0.331	-4.691	-4.176	0.064	0.477	0.092
		EQZ	1.176	1.338	-0.029	-3.648	-3.734	0.003	-0.174	0.134
		EQT	0.037	-0.014	0.415	0.005	0.011	-0.032	0.006	0.031
		SPKW	0.503	-1.631	-0.002	0.153	0.078	-0.003	-0.012	-0.008
		SPKN	-1.793	0.512	0.019	0.092	0.131	-0.015	0.022	0.007
	80007	OTHR	-1.764	-0.742	0.064	0.293	0.617	0.053	0.222	-0.556
		TEMP	-3.849	-4.408	0.035	-4.214	-4.235	-0.013	0.025	-0.019
		EQEW	0.363	-0.256	0.505	0.315	0.349	-0.067	-0.002	0.512
		EQNS	3.503	2.916	-0.316	-4.254	-4.033	0.165	0.614	0.111
		EQZ	1.185	1.348	-0.024	-3.657	-3.736	0.001	0.023	0.216
		EQT	0.062	-0.063	0.349	0.016	0.016	-0.025	0.009	0.028
		SPKW	0.508	-1.633	-0.003	0.149	0.079	-0.003	-0.002	-0.006
		SPKN	-1.791	0.519	0.021	0.100	0.135	-0.012	0.011	0.004
	80012	OTHR	-1.861	-0.816	0.084	0.499	0.818	-0.054	-0.114	-0.248
		TEMP	-3.854	-4.352	0.023	-4.203	-4.237	-0.013	0.012	-0.004
		EQEW	-0.098	0.116	0.355	0.055	0.059	0.106	-0.005	0.558
		EQNS	3.205	3.049	-0.151	-3.908	-3.829	0.022	0.680	-0.001
		EQZ	1.185	1.364	-0.024	-3.656	-3.737	0.002	0.208	0.029
		EQT	0.024	-0.016	0.318	0.003	0.001	-0.016	0.003	0.030
		SPKW	0.516	-1.630	0.001	0.143	0.078	-0.003	0.001	-0.002
		SPKN	-1.793	0.522	0.020	0.111	0.146	-0.016	0.007	0.001

Table 3G.1-25
Combined Forces and Moments: RCCV, Selected Load Combination CV-11a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
11 Basemat Inside RPV Pedestal	80206	OTHR	-1.163	-0.535	0.267	-4.846	-4.206	1.996	2.025	-1.976
		TEMP	-3.802	-4.758	0.110	-4.600	-4.678	0.084	0.016	-0.101
		EQEW	1.123	-0.469	2.151	2.151	2.565	-1.023	-0.541	1.016
		EQNS	4.320	2.471	-1.054	-6.305	-4.299	0.491	0.742	0.202
		EQZ	1.149	1.282	-0.043	-1.685	-1.928	-0.649	-0.747	0.658
		EQT	0.104	-0.077	0.574	-0.151	0.217	-0.100	0.111	0.160
		SPKW	0.385	-1.507	-0.021	0.051	0.222	-0.006	0.084	0.094
		SPKN	-1.718	0.364	0.005	0.174	-0.067	0.002	-0.077	-0.102
	80213	OTHR	-1.383	-0.655	0.141	-2.327	-5.824	0.613	0.613	-2.662
		TEMP	-3.949	-4.381	0.094	-4.421	-4.763	-0.049	0.006	-0.146
		EQEW	1.929	-0.848	0.482	2.692	4.698	0.061	0.096	1.708
		EQNS	3.499	2.910	-1.544	-3.171	-2.170	1.378	1.189	0.724
		EQZ	1.179	1.367	-0.064	-2.356	-1.102	0.052	0.028	1.027
		EQT	0.217	-0.076	0.421	0.124	0.163	0.087	0.136	0.041
		SPKW	0.312	-1.636	-0.043	-0.034	0.008	0.016	-0.002	0.005
		SPKN	-1.592	0.519	0.012	0.279	0.202	-0.018	-0.006	-0.006
	80224	OTHR	-2.170	-1.459	-0.007	-3.168	-1.785	-0.801	-1.803	-0.775
		TEMP	-3.875	-4.291	0.046	-4.364	-4.386	-0.020	-0.043	0.010
		EQEW	0.076	0.039	-1.798	0.300	0.206	0.366	0.075	0.061
		EQNS	2.510	3.600	-0.146	1.629	-1.229	0.129	1.970	0.063
		EQZ	1.233	1.441	-0.024	-1.139	-2.368	0.090	0.999	0.079
		EQT	0.029	-0.016	-0.094	0.040	-0.001	-0.126	0.011	-0.150
		SPKW	0.558	-1.432	0.002	0.166	0.244	0.006	-0.016	0.014
		SPKN	-1.804	0.342	0.016	0.082	0.010	-0.007	0.010	0.000
12 S/P Slab @ RPV	83306	OTHR	-0.440	2.216	-0.498	-0.948	1.120	-0.128	4.205	-0.066
		TEMP	-8.430	8.012	0.027	-4.417	-2.896	0.015	-0.248	0.001
		EQEW	-0.804	-0.320	1.004	1.133	0.470	-0.277	0.459	0.135
		EQNS	-0.024	-1.056	-1.566	-2.820	-1.643	-0.313	-1.032	0.123
		EQZ	-0.124	-0.267	0.146	-1.455	-0.965	0.018	-0.734	0.021
		EQT	-0.015	0.015	-0.033	0.056	0.025	-0.023	0.017	0.014
		SPKW	-0.450	-0.624	1.118	-0.045	-0.038	0.007	-0.032	0.005
		SPKN	-0.194	-0.406	-0.948	-0.019	-0.016	0.004	-0.008	-0.004
	83313	OTHR	0.211	1.881	-0.873	-0.861	1.231	-0.158	4.241	0.058
		TEMP	-8.845	8.448	-0.275	-4.426	-2.958	-0.032	-0.239	-0.022
		EQEW	-1.336	-0.260	0.171	1.627	0.736	0.021	0.659	-0.015
		EQNS	-0.431	-1.505	0.783	-1.652	-1.076	-0.449	-0.591	0.167
		EQZ	-0.247	-0.187	0.074	-1.467	-0.967	-0.012	-0.738	-0.021
		EQT	-0.008	0.052	-0.097	0.100	0.051	0.005	0.037	0.005
		SPKW	-0.598	0.253	-0.089	-0.057	-0.032	0.000	-0.057	0.001
		SPKN	-0.208	-0.985	0.124	-0.025	-0.021	-0.001	-0.004	-0.003
	83324	OTHR	2.069	2.110	-0.691	-0.560	1.627	-0.196	4.437	-0.079
		TEMP	-8.617	8.870	0.723	-4.216	-2.783	0.001	-0.123	0.042
		EQEW	-0.175	-0.020	-1.709	0.074	0.043	0.410	0.039	-0.175
		EQNS	-0.623	-0.113	0.101	-0.297	-0.317	-0.028	-0.051	0.017
		EQZ	-0.232	-0.288	-0.002	-1.473	-0.971	0.018	-0.742	0.020
		EQT	-0.007	-0.012	-0.225	0.007	0.004	0.029	0.002	-0.011
		SPKW	-0.201	-1.214	-0.128	-0.044	-0.044	0.000	-0.012	0.004
		SPKN	-0.482	0.259	0.061	-0.046	-0.017	0.000	-0.051	-0.002

Table 3G.1-25
Combined Forces and Moments: RCCV, Selected Load Combination CV-11a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
13 S/P Slab @ Center	83406	OTHR	0.099	2.051	-0.451	-6.449	-1.643	-0.039	-0.342	-0.001
		TEMP	-4.716	3.300	-0.435	-3.598	-3.189	-0.006	-0.274	0.009
		EQEW	-0.707	0.030	0.424	-0.259	0.175	-0.189	0.290	0.000
		EQNS	0.042	-1.356	-1.365	0.433	-0.909	-0.224	-0.712	-0.011
		EQZ	-0.143	-0.260	0.105	0.552	-0.468	0.003	-0.366	0.000
		EQT	-0.012	0.060	0.007	0.004	0.009	-0.018	0.012	0.001
		SPKW	-0.388	-0.588	0.846	0.055	-0.010	-0.007	-0.024	0.012
		SPKN	-0.186	-0.377	-0.648	0.009	-0.009	0.009	-0.006	-0.005
	83413	OTHR	0.882	1.695	-0.369	-6.457	-1.591	-0.110	-0.313	0.004
		TEMP	-5.529	3.887	0.330	-3.708	-3.266	-0.014	-0.232	-0.007
		EQEW	-1.249	-0.033	0.148	-0.337	0.283	0.028	0.418	0.001
		EQNS	-0.317	-1.137	0.740	0.244	-0.656	-0.297	-0.419	0.010
		EQZ	-0.294	-0.142	0.032	0.545	-0.458	0.002	-0.369	-0.002
		EQT	-0.017	0.072	-0.049	-0.008	0.023	0.003	0.024	-0.001
		SPKW	-0.916	0.099	-0.048	0.119	0.017	0.001	-0.042	0.000
		SPKN	-0.003	-0.766	0.028	-0.010	-0.017	-0.004	-0.004	0.001
	83424	OTHR	2.021	1.723	-0.299	-6.502	-1.385	-0.092	-0.242	0.004
		TEMP	-5.039	4.216	0.041	-3.677	-3.155	-0.002	-0.184	0.007
		EQEW	-0.106	-0.009	-0.929	-0.033	0.010	0.268	0.026	0.015
		EQNS	-0.869	-0.164	0.069	0.039	-0.327	-0.018	-0.075	0.000
		EQZ	-0.256	-0.261	-0.004	0.553	-0.457	0.001	-0.373	0.001
		EQT	0.003	-0.010	-0.130	-0.001	0.002	0.019	0.002	0.000
		SPKW	0.053	-0.975	-0.101	-0.006	-0.031	0.001	-0.009	-0.001
		SPKN	-0.791	0.077	0.054	0.112	0.025	-0.001	-0.037	0.001
14 S/P Slab @ RCCV	83506	OTHR	0.578	1.946	-0.305	2.778	-0.491	-0.033	-3.874	-0.003
		TEMP	-2.707	1.467	-0.274	-2.852	-3.128	-0.032	-0.252	0.010
		EQEW	-0.506	-0.030	0.101	-1.095	-0.198	-0.003	0.234	-0.050
		EQNS	0.316	-1.405	-1.038	2.407	0.020	-0.029	-0.546	-0.048
		EQZ	-0.144	-0.236	0.096	1.146	-0.010	0.006	-0.102	-0.002
		EQT	-0.030	0.096	0.021	-0.029	-0.007	-0.006	0.009	-0.002
		SPKW	-0.377	-0.563	0.689	0.113	0.027	-0.034	-0.017	0.011
		SPKN	-0.113	-0.291	-0.437	0.018	0.000	0.015	-0.002	-0.002
	83513	OTHR	1.233	1.643	-0.263	2.688	-0.470	-0.044	-3.853	-0.007
		TEMP	-3.724	1.594	0.393	-3.192	-3.182	-0.007	-0.152	0.000
		EQEW	-1.070	-0.066	0.138	-1.520	-0.265	0.009	0.331	0.005
		EQNS	-0.282	-0.902	0.686	1.379	-0.078	-0.051	-0.322	-0.055
		EQZ	-0.304	-0.128	0.012	1.156	0.003	0.003	-0.108	-0.003
		EQT	-0.012	0.090	-0.031	-0.076	-0.008	0.006	0.019	-0.001
		SPKW	-1.040	-0.083	-0.027	0.241	0.072	0.001	-0.034	0.000
		SPKN	0.093	-0.574	-0.045	-0.011	-0.008	-0.005	0.000	-0.001
	83524	OTHR	1.905	1.595	-0.243	2.502	-0.400	-0.034	-3.803	-0.008
		TEMP	-3.075	2.237	-0.023	-3.204	-3.140	0.013	-0.148	-0.004
		EQEW	-0.061	-0.032	-0.577	-0.110	-0.025	-0.026	0.023	0.083
		EQNS	-0.923	-0.264	0.036	0.211	-0.213	0.002	-0.048	-0.004
		EQZ	-0.248	-0.264	-0.007	1.178	0.007	0.001	-0.111	0.001
		EQT	0.008	-0.008	-0.086	-0.008	-0.001	0.001	0.002	0.005
		SPKW	0.171	-0.733	-0.086	0.000	-0.013	0.003	-0.003	0.000
		SPKN	-0.939	-0.110	0.071	0.229	0.073	-0.003	-0.033	0.001

Table 3G.1-25
Combined Forces and Moments: RCCV, Selected Load Combination CV-11a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
15 Top slab @ Drywell Head Opening	98120	OTHR	0.698	0.780	0.572	-0.038	-0.023	-0.058	-0.008	0.000
		TEMP	-7.704	-4.732	-1.166	0.747	0.629	2.583	-0.150	0.074
		EQEW	-1.292	-1.085	-0.943	-0.055	-0.435	-0.121	-0.057	-0.066
		EQNS	0.071	0.072	0.030	-0.046	-0.076	-0.034	-0.040	-0.019
		EQZ	-0.808	-0.210	-0.293	0.379	0.220	0.278	-0.038	-0.236
		EQT	-0.009	-0.026	-0.014	0.008	0.022	0.005	-0.006	-0.004
		SPKW	0.031	-0.011	0.008	-0.005	0.003	-0.001	0.002	0.002
		SPKN	-0.031	-0.002	-0.012	0.002	-0.003	-0.001	-0.001	0.001
	98135	OTHR	0.746	0.227	-0.218	-0.032	-0.140	0.101	0.079	-0.062
		TEMP	-10.062	-5.610	0.556	3.094	-2.008	-1.221	0.306	-0.222
		EQEW	0.125	0.340	-0.586	-0.132	-0.167	0.070	0.008	-0.065
		EQNS	0.622	0.061	-0.118	-0.162	-0.016	0.026	0.008	0.000
		EQZ	-2.236	-0.182	0.197	0.527	-0.240	-0.066	0.082	-0.299
		EQT	0.038	0.018	-0.022	-0.001	0.001	-0.007	-0.009	0.003
		SPKW	0.089	0.008	-0.008	-0.008	0.002	0.000	-0.001	0.002
		SPKN	-0.097	-0.013	0.017	0.004	-0.002	0.001	0.001	-0.001
	98104	OTHR	0.263	1.419	-0.308	0.061	0.523	0.016	0.108	-0.177
		TEMP	-5.268	-2.661	0.786	-1.577	3.078	-1.390	0.146	-0.201
		EQEW	0.417	0.603	-0.632	-0.056	-0.513	0.012	0.016	-0.418
		EQNS	-0.057	-1.401	0.071	-0.034	-0.263	0.004	-0.035	0.028
		EQZ	-0.066	-0.456	0.069	0.172	1.050	-0.219	0.002	-0.239
		EQT	0.020	0.039	-0.032	-0.008	-0.029	0.009	-0.002	-0.017
		SPKW	-0.001	-0.056	0.002	-0.003	0.007	0.000	-0.002	0.000
		SPKN	-0.005	0.036	0.006	0.001	-0.016	0.001	0.002	0.000
16 Top slab @ Center	98149	OTHR	0.689	0.927	-0.056	0.002	-0.029	-0.068	0.058	0.124
		TEMP	-6.420	-3.274	-0.448	1.814	2.130	0.346	0.136	0.106
		EQEW	-1.003	-0.296	-0.570	0.004	-0.119	-0.001	0.055	-0.012
		EQNS	0.296	0.658	0.077	-0.091	0.043	-0.048	-0.055	0.067
		EQZ	-1.174	0.156	-0.372	0.527	0.371	-0.031	0.043	0.191
		EQT	0.033	-0.037	0.002	0.002	0.005	-0.008	-0.005	-0.013
		SPKW	0.050	-0.025	-0.007	-0.006	0.008	-0.002	0.000	0.002
		SPKN	-0.050	-0.002	0.004	0.004	-0.004	0.000	-0.001	-0.001
	98170	OTHR	0.680	0.815	-0.130	0.102	0.274	-0.006	-0.016	-0.045
		TEMP	-6.246	-3.905	-0.324	2.174	3.114	-0.038	0.113	0.455
		EQEW	-1.062	0.055	-0.748	-0.033	0.008	-0.035	0.007	-0.003
		EQNS	0.114	-0.309	0.242	-0.109	-0.114	-0.002	-0.025	-0.023
		EQZ	-1.023	0.029	-0.024	0.653	0.874	-0.004	0.011	0.023
		EQT	0.033	0.043	-0.026	-0.001	-0.003	-0.009	0.003	0.001
		SPKW	0.050	-0.009	0.001	-0.003	0.011	0.001	0.000	0.002
		SPKN	-0.051	-0.003	0.008	0.003	-0.011	0.001	0.000	-0.002
	98109	OTHR	0.517	1.104	-0.050	0.570	0.705	0.003	0.062	-0.133
		TEMP	-6.252	-2.427	0.725	1.007	2.226	0.038	0.380	-0.086
		EQEW	0.121	-0.022	-0.733	-0.018	-0.235	-0.142	0.014	-0.139
		EQNS	0.015	-1.309	-0.036	-0.221	-0.377	-0.030	-0.060	0.070
		EQZ	-0.194	-0.382	0.000	0.646	0.724	-0.119	-0.054	-0.048
		EQT	0.012	0.024	-0.078	-0.008	-0.020	-0.001	-0.001	-0.014
		SPKW	0.017	-0.016	-0.002	-0.008	0.009	0.000	0.000	-0.001
		SPKN	-0.028	0.011	0.007	0.006	-0.017	-0.001	0.000	0.002

Table 3G.1-25
Combined Forces and Moments: RCCV, Selected Load Combination CV-11a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
17 Top slab @ RCCV	98174	OTHR	0.832	0.866	-0.015	-0.126	-0.089	0.127	0.098	-0.110
		TEMP	-5.257	-4.725	1.957	2.429	2.294	0.439	-0.175	-0.031
		EQEW	-1.274	-0.317	-0.731	-0.157	-0.150	0.128	0.060	-0.052
		EQNS	0.306	1.159	0.053	0.252	0.417	-0.212	-0.180	0.149
		EQZ	-0.519	0.046	-0.052	0.277	0.532	0.234	0.161	-0.084
		EQT	0.054	-0.063	0.001	-0.026	-0.069	0.005	0.013	-0.026
		SPKW	0.045	-0.016	-0.016	-0.005	0.020	-0.002	-0.001	0.004
		SPKN	-0.044	-0.015	0.009	0.005	-0.011	-0.001	-0.001	-0.003
	98197	OTHR	0.584	0.986	-0.105	-0.226	-0.765	-0.017	-0.035	-0.491
		TEMP	-7.993	-3.381	-0.911	1.891	2.951	0.273	0.139	-0.592
		EQEW	-1.529	-0.094	-0.596	-0.157	-0.512	-0.060	-0.039	-0.104
		EQNS	0.116	-0.499	0.542	0.094	-0.045	-0.123	0.028	0.104
		EQZ	-0.155	-0.016	0.113	0.343	-0.833	-0.060	-0.048	-0.581
		EQT	0.030	0.070	-0.039	-0.013	-0.013	0.004	-0.003	-0.005
		SPKW	0.062	-0.027	0.006	0.006	0.007	0.002	0.001	0.001
		SPKN	-0.047	0.006	0.007	0.003	-0.007	0.001	0.000	0.001
	98103	OTHR	0.633	1.208	-0.016	0.041	0.325	-0.137	-0.315	-0.120
		TEMP	-6.656	-4.117	0.218	4.494	3.771	0.226	1.080	0.001
		EQEW	-0.222	0.168	-1.093	-0.035	-0.048	-0.197	0.040	-0.043
		EQNS	-0.349	-1.493	0.077	-1.238	-0.628	0.001	-0.319	0.019
		EQZ	0.009	-0.287	-0.065	-1.481	-0.221	-0.171	-0.781	-0.095
		EQT	-0.020	0.037	-0.202	0.003	0.003	-0.009	0.009	0.006
		SPKW	0.019	-0.001	0.002	-0.002	0.013	0.000	0.004	-0.001
		SPKN	-0.032	0.001	0.000	-0.016	-0.027	0.000	-0.009	0.001

Table 3G.1-26

Combined Forces and Moments: RCCV, Selected Load Combination CV-11b

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 RPV Pedestal Bottom	5006	OTHR	-3.257	-10.916	0.049	0.561	3.323	0.045	-0.012	1.795
		TEMP	-13.947	0.161	-0.486	-15.740	-11.087	-0.102	0.226	4.880
		EQEW	3.824	6.562	-1.902	-0.846	-4.326	-0.053	0.250	-1.867
		EQNS	-3.659	-4.291	-0.463	0.933	5.377	0.046	0.061	2.277
		EQZ	-1.459	1.504	-0.109	0.369	2.146	-0.005	0.011	0.951
		EQT	0.352	0.155	0.243	0.016	-0.150	-0.018	0.037	-0.097
		SPKW	-0.240	0.042	0.193	-0.019	0.016	-0.041	0.021	0.066
		SPKN	-0.242	-0.059	-0.226	0.042	0.132	0.035	-0.009	0.105
	5013	OTHR	-3.985	-10.910	1.017	0.478	3.494	0.007	-0.027	2.027
		TEMP	-13.372	0.271	-0.086	-16.029	-11.713	-0.007	0.019	4.752
		EQEW	5.429	10.427	0.215	-1.323	-6.638	-0.002	0.012	-2.984
		EQNS	-0.845	1.502	-0.434	0.377	2.323	-0.013	0.130	0.940
		EQZ	-1.245	1.957	-0.167	0.325	1.935	-0.001	0.012	0.845
		EQT	0.259	0.237	0.247	-0.078	-0.282	-0.014	0.037	-0.146
		SPKW	0.259	0.275	0.011	0.155	-0.148	0.005	-0.002	-0.077
		SPKN	-0.678	-0.176	-0.094	-0.153	0.170	-0.007	0.012	0.192
	5024	OTHR	-3.647	-8.758	0.720	0.647	2.974	-0.007	0.011	1.745
		TEMP	-13.919	0.215	0.002	-16.061	-10.406	-0.078	-0.046	4.926
		EQEW	0.453	0.627	3.241	-0.093	-0.436	0.007	-0.264	-0.196
		EQNS	2.083	7.762	-0.043	-0.392	-1.472	-0.004	0.013	-0.778
		EQZ	-0.986	2.190	-0.014	0.309	1.777	-0.007	-0.003	0.773
		EQT	0.016	0.008	0.419	-0.009	-0.021	-0.013	0.008	-0.007
		SPKW	-0.626	-0.190	-0.019	-0.147	0.198	0.005	-0.002	0.192
		SPKN	0.351	0.334	-0.006	0.143	-0.266	-0.001	-0.004	-0.125
2 RPV Pedestal Mid-Height	6006	OTHR	0.916	-12.002	0.243	-0.087	-0.095	0.041	0.105	-0.392
		TEMP	-2.483	0.613	0.460	-16.186	-15.497	0.425	0.153	-1.652
		EQEW	-0.307	2.620	-3.688	0.070	0.312	-0.267	0.010	-0.094
		EQNS	0.421	-2.493	-1.016	-0.148	-0.141	0.015	0.118	0.098
		EQZ	0.062	1.529	-0.161	-0.022	-0.079	-0.020	-0.017	-0.006
		EQT	-0.016	0.005	0.132	0.025	0.027	-0.038	-0.007	-0.009
		SPKW	-0.450	0.080	-0.232	-0.054	0.044	-0.055	-0.159	-0.084
		SPKN	-0.183	0.071	0.166	-0.016	-0.010	0.041	0.124	-0.042
	6013	OTHR	0.420	-10.816	1.129	-0.277	-0.278	0.000	-0.011	-0.374
		TEMP	-2.675	0.292	-0.222	-16.668	-15.409	-0.043	-0.034	-1.882
		EQEW	-0.916	4.064	0.457	0.189	0.314	-0.026	0.009	-0.303
		EQNS	-0.364	1.437	-1.767	-0.345	-0.186	-0.111	-0.049	0.004
		EQZ	0.066	1.672	-0.252	0.007	-0.047	-0.008	0.010	-0.040
		EQT	-0.032	-0.006	0.321	0.014	0.040	-0.039	0.001	-0.016
		SPKW	0.044	0.014	0.072	0.513	0.287	0.014	0.041	-0.206
		SPKN	-0.608	0.082	-0.139	-0.423	-0.127	-0.019	-0.025	-0.009
	6024	OTHR	0.502	-5.378	0.135	0.270	-0.203	-0.006	0.013	-0.269
		TEMP	-2.798	0.648	0.087	-18.667	-11.882	-0.682	0.031	-1.562
		EQEW	-0.203	1.547	6.461	0.032	0.048	0.415	0.220	0.041
		EQNS	-0.380	3.898	0.316	0.367	0.224	-0.039	-0.049	-0.258
		EQZ	-0.043	1.267	0.131	-0.001	0.014	-0.008	-0.011	-0.062
		EQT	-0.022	0.111	0.592	-0.008	0.000	0.002	0.011	0.001
		SPKW	-0.606	0.083	0.037	-0.450	-0.108	-0.003	0.024	-0.028
		SPKN	-0.161	-0.122	-0.033	0.542	0.381	0.002	-0.026	-0.221

Table 3G.1-26
Combined Forces and Moments: RCCV, Selected Load Combination CV-11b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
3 RPV Pedestal Top	6606	OTHR	0.868	-10.324	1.683	0.427	4.064	0.209	-0.019	-1.787
		TEMP	3.459	0.568	0.467	-16.412	-12.055	0.121	-0.772	-1.957
		EQEW	-1.238	0.118	-2.973	0.335	1.594	0.093	-0.028	-0.657
		EQNS	-0.120	-1.156	-0.164	-0.406	-3.016	-0.196	0.727	0.863
		EQZ	0.166	1.067	-0.306	-0.247	-1.746	-0.099	-0.047	0.631
		EQT	-0.059	-0.050	0.201	-0.007	0.087	-0.021	-0.045	-0.029
		SPKW	-0.704	0.033	-0.392	-0.092	0.025	0.224	-0.499	-0.135
		SPKN	-0.339	0.062	0.323	0.044	0.014	-0.210	0.435	-0.110
	6613	OTHR	0.304	-9.650	0.657	0.346	4.774	-0.019	0.458	-1.820
		TEMP	4.014	0.624	-0.376	-16.392	-12.231	-0.024	0.838	-1.943
		EQEW	-1.347	0.069	0.314	0.642	2.502	0.025	-0.155	-0.972
		EQNS	-1.375	1.345	-1.301	-0.577	-1.769	0.318	-0.089	0.297
		EQZ	0.176	1.114	-0.128	-0.210	-1.696	0.113	0.019	0.609
		EQT	-0.001	-0.104	0.278	0.051	0.156	-0.040	-0.042	-0.050
		SPKW	0.387	-0.006	-0.005	0.292	0.015	-0.028	0.061	0.003
		SPKN	-1.150	0.087	0.014	-0.244	0.011	0.045	-0.060	-0.228
	6624	OTHR	0.355	-6.546	0.817	1.271	6.234	0.050	0.962	-1.712
		TEMP	4.131	0.639	0.234	-16.379	-12.033	0.102	-1.077	-1.799
		EQEW	-0.190	0.065	4.374	-0.010	0.231	-0.176	0.137	-0.087
		EQNS	0.293	3.518	-0.102	0.328	-0.109	0.011	-0.062	0.073
		EQZ	0.091	1.069	-0.073	-0.227	-1.697	-0.114	-0.019	0.598
		EQT	-0.030	-0.003	0.423	-0.013	0.017	-0.034	-0.008	-0.011
		SPKW	-1.363	0.123	0.037	-0.280	-0.015	-0.035	0.045	-0.233
		SPKN	0.393	-0.065	0.000	0.276	-0.009	0.013	-0.033	0.028
4 RCCV Wetwell Bottom	1806	OTHR	1.426	-1.513	-0.077	0.601	3.795	0.015	0.012	1.464
		TEMP	-2.089	-1.627	-0.394	-10.252	-14.421	0.073	0.070	-1.432
		EQEW	0.729	4.585	-4.703	-0.176	-0.955	-0.027	0.011	-0.377
		EQNS	-1.663	-1.606	-3.784	0.241	1.992	-0.076	0.018	0.733
		EQZ	0.276	3.169	-0.099	0.073	0.469	-0.006	0.001	0.100
		EQT	0.108	0.050	0.777	-0.002	-0.048	-0.016	0.000	-0.025
		SPKW	-0.433	0.096	0.283	-0.005	0.013	0.055	0.007	0.053
		SPKN	-0.162	0.088	0.000	-0.036	-0.034	-0.020	0.002	0.001
	1813	OTHR	0.897	-2.056	0.292	0.643	4.075	0.012	-0.015	1.685
		TEMP	-2.608	-4.438	-0.288	-9.980	-13.822	-0.044	-0.007	-1.104
		EQEW	1.114	5.859	0.928	-0.274	-1.581	-0.011	0.006	-0.664
		EQNS	-0.371	3.027	-4.441	0.119	0.882	-0.034	0.019	0.352
		EQZ	0.403	3.198	-0.126	0.071	0.390	-0.005	0.001	0.066
		EQT	0.096	-0.035	0.890	-0.008	-0.050	-0.028	0.001	-0.036
		SPKW	0.032	-0.028	-0.069	0.037	-0.031	-0.001	0.003	0.029
		SPKN	-0.468	0.064	0.168	-0.033	0.031	0.000	-0.006	0.050
	1824	OTHR	0.692	-2.498	-0.008	0.706	4.109	0.021	-0.017	1.748
		TEMP	-1.725	-4.483	0.172	-10.129	-13.767	0.031	-0.103	-1.054
		EQEW	0.071	0.451	7.426	-0.033	-0.119	0.094	-0.059	-0.064
		EQNS	0.906	6.607	-0.267	-0.034	-0.345	-0.011	0.003	-0.240
		EQZ	0.327	3.634	0.042	0.074	0.449	0.000	0.002	0.092
		EQT	0.002	-0.002	1.125	-0.003	-0.005	-0.013	-0.004	-0.003
		SPKW	-0.581	0.147	-0.037	-0.044	0.047	-0.002	0.005	0.063
		SPKN	-0.022	-0.020	0.071	0.051	-0.010	0.003	-0.013	0.041

Table 3G.1-26
Combined Forces and Moments: RCCV, Selected Load Combination CV-11b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
5 RCCV Wetwell Mid-Height	2606	OTHR	3.262	-1.242	-0.204	-0.185	-0.688	-0.011	0.008	-0.235
		TEMP	-4.378	-2.154	-0.405	-9.998	-7.615	0.005	0.039	0.073
		EQEW	0.042	3.102	-4.217	0.030	0.120	-0.061	-0.007	-0.089
		EQNS	-0.421	-1.104	-3.924	-0.087	-0.098	-0.120	-0.018	0.181
		EQZ	0.129	2.896	-0.130	-0.004	0.020	-0.007	0.001	0.061
		EQT	0.002	0.036	0.741	0.003	0.003	-0.019	0.005	-0.004
		SPKW	-0.080	0.068	0.138	-0.013	-0.040	0.018	0.004	0.001
		SPKN	-0.084	0.034	-0.014	-0.017	0.001	-0.018	-0.003	-0.002
	2613	OTHR	2.771	-1.844	0.312	-0.230	-0.777	0.014	-0.002	-0.137
		TEMP	-5.309	-5.586	0.063	-9.714	-7.480	-0.018	-0.096	0.442
		EQEW	-0.005	4.069	0.921	0.044	0.171	-0.017	-0.010	-0.249
		EQNS	-0.798	2.750	-4.413	-0.053	-0.089	-0.036	-0.024	0.163
		EQZ	0.199	2.967	-0.138	0.020	0.040	-0.003	0.000	0.040
		EQT	0.102	-0.088	0.859	0.011	0.023	-0.025	-0.002	-0.011
		SPKW	0.224	0.087	-0.048	0.025	-0.043	-0.002	0.000	0.018
		SPKN	-0.291	-0.003	0.164	-0.035	-0.019	0.005	0.002	-0.008
	2624	OTHR	3.081	-2.051	0.035	-0.145	-0.859	0.001	0.006	-0.258
		TEMP	-4.767	-5.072	-0.072	-10.108	-7.790	-0.038	0.082	0.381
		EQEW	0.046	0.198	6.829	0.008	0.044	0.103	0.036	-0.013
		EQNS	-0.044	5.027	-0.262	0.099	0.205	-0.005	-0.005	-0.062
		EQZ	0.193	3.390	0.018	-0.013	-0.002	0.000	0.002	0.080
		EQT	-0.002	-0.017	0.934	-0.001	0.006	-0.019	0.003	0.000
		SPKW	-0.284	0.016	-0.021	-0.043	-0.029	-0.005	0.004	-0.020
		SPKN	0.208	0.115	0.031	0.023	-0.048	0.002	-0.003	0.032
6 RCCV Wetwell Top	3406	OTHR	2.368	-0.738	-0.033	-0.022	0.040	0.036	-0.024	0.008
		TEMP	5.146	-1.793	0.374	-10.845	-13.921	0.028	0.122	2.434
		EQEW	-0.398	1.932	-3.913	0.030	0.165	-0.110	0.074	-0.089
		EQNS	-0.091	-0.510	-3.585	-0.105	-0.299	-0.018	-0.047	0.142
		EQZ	0.195	2.546	-0.179	-0.076	-0.463	0.034	-0.071	0.157
		EQT	0.052	-0.005	0.713	-0.006	-0.021	-0.024	-0.003	0.008
		SPKW	-0.019	0.052	0.051	-0.006	-0.011	0.016	-0.012	-0.006
		SPKN	-0.031	0.005	0.025	-0.001	0.012	-0.012	0.007	-0.006
	3413	OTHR	1.937	-1.695	0.218	-0.081	-0.106	-0.087	0.055	0.053
		TEMP	3.360	-7.377	0.327	-10.754	-14.083	-0.105	0.111	2.634
		EQEW	-0.289	2.645	0.971	0.054	0.321	0.036	-0.062	-0.227
		EQNS	-0.662	2.398	-4.252	-0.039	-0.196	-0.071	0.067	0.077
		EQZ	0.063	2.823	-0.097	-0.025	-0.210	0.004	0.016	0.076
		EQT	0.091	-0.104	0.873	0.007	0.025	-0.013	-0.010	-0.005
		SPKW	0.132	0.130	-0.025	0.009	-0.056	-0.004	0.004	0.033
		SPKN	-0.166	-0.041	0.094	-0.011	0.022	0.001	-0.002	-0.021
	3424	OTHR	1.931	-1.413	0.062	0.076	0.252	0.004	0.016	-0.044
		TEMP	3.550	-6.962	0.378	-10.104	-10.258	0.043	-0.160	1.032
		EQEW	-0.187	0.123	5.910	0.017	0.013	0.010	0.005	0.006
		EQNS	-0.518	3.812	-0.168	0.065	0.270	0.045	-0.033	-0.081
		EQZ	0.120	3.010	-0.010	-0.059	-0.305	0.045	-0.058	0.079
		EQT	-0.032	-0.004	0.782	-0.001	-0.004	-0.024	-0.007	0.004
		SPKW	-0.147	-0.044	-0.004	-0.005	0.046	-0.004	0.002	-0.031
		SPKN	0.183	0.153	0.008	-0.008	-0.136	0.003	-0.004	0.053

Table 3G.1-26
Combined Forces and Moments: RCCV, Selected Load Combination CV-11b (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
7 RCCV	3606	OTHR	2.307	-0.345	-0.150	0.001	0.204	0.058	-0.004	0.458
Drywell		TEMP	0.855	-1.873	-0.034	-12.684	-14.715	0.245	0.161	-0.543
Bottom		EQEW	-0.452	1.766	-3.473	-0.041	-0.248	-0.085	0.065	-0.016
		EQNS	-0.031	-0.141	-3.512	0.074	0.711	0.047	-0.003	0.201
		EQZ	0.062	2.442	-0.034	0.009	-0.005	0.039	-0.062	-0.045
		EQT	0.059	-0.015	0.652	-0.012	-0.046	-0.022	-0.003	-0.015
		SPKW	-0.017	0.050	0.033	-0.003	0.004	-0.002	-0.012	0.002
		SPKN	-0.026	0.005	0.016	0.000	0.012	0.001	0.008	0.005
	3613	OTHR	1.914	-1.363	0.249	0.034	0.546	-0.052	0.018	0.692
		TEMP	-1.019	-8.771	1.274	-12.290	-13.057	-0.280	0.001	-0.234
		EQEW	-0.265	2.846	1.125	-0.134	-0.780	-0.006	-0.052	-0.296
		EQNS	-0.698	2.066	-3.945	0.081	0.502	-0.070	0.057	0.204
		EQZ	-0.070	2.782	-0.112	0.007	0.010	-0.009	0.017	-0.131
		EQT	0.095	-0.082	0.789	-0.001	-0.019	-0.016	-0.009	-0.006
		SPKW	0.103	0.099	-0.019	0.022	0.033	-0.002	0.003	0.004
		SPKN	-0.143	-0.041	0.051	-0.011	0.011	-0.001	-0.002	0.013
	3624	OTHR	1.814	-1.444	0.092	0.193	0.906	0.014	0.022	0.641
		TEMP	-10.073	-8.472	0.316	-7.314	-7.358	0.070	-0.111	1.306
		EQEW	-0.126	0.166	5.784	-0.041	-0.106	0.041	0.024	-0.050
		EQNS	-0.550	3.914	-0.186	-0.048	-0.303	0.055	-0.007	-0.021
		EQZ	0.078	3.186	-0.058	-0.032	-0.159	0.047	-0.033	-0.095
		EQT	-0.021	-0.004	0.787	-0.007	-0.013	-0.022	-0.005	-0.006
		SPKW	-0.123	-0.026	-0.002	-0.011	-0.001	0.000	0.002	0.005
		SPKN	0.142	0.069	0.005	0.022	0.048	-0.001	-0.004	0.008
8 RCCV	4006	OTHR	1.708	-0.083	-0.103	-0.094	-0.323	0.007	0.026	-0.160
Drywell		TEMP	1.877	-1.562	-0.442	-12.483	-13.207	0.139	-0.296	-0.380
Mid-Height		EQEW	-0.910	0.987	-3.270	0.020	0.052	-0.092	-0.017	-0.156
		EQNS	0.790	0.233	-3.141	-0.077	-0.071	-0.062	0.029	0.261
		EQZ	-0.449	2.407	0.073	0.095	0.356	0.041	0.003	-0.161
		EQT	0.019	-0.053	0.620	-0.001	-0.016	-0.024	0.000	-0.007
		SPKW	-0.013	0.044	0.005	-0.003	0.001	0.010	-0.001	-0.001
		SPKN	-0.014	0.006	0.039	0.001	-0.004	-0.006	0.001	0.002
	4013	OTHR	1.611	-1.516	0.377	-0.124	-0.443	0.004	-0.008	-0.151
		TEMP	1.214	-10.590	1.149	-12.238	-11.748	0.051	-0.198	-0.348
		EQEW	-1.066	1.762	0.993	0.076	0.313	0.008	-0.022	-0.324
		EQNS	-0.292	2.306	-3.780	-0.012	-0.067	-0.088	0.014	0.108
		EQZ	-0.429	2.930	-0.188	0.043	0.368	0.001	0.006	-0.071
		EQT	0.077	-0.117	0.773	-0.003	-0.022	-0.006	-0.001	0.008
		SPKW	0.058	0.139	-0.017	0.011	0.005	-0.002	0.000	0.014
		SPKN	-0.064	-0.052	0.039	-0.010	-0.009	-0.001	0.000	-0.003
	4976	OTHR	1.442	-0.846	0.125	0.010	-0.170	0.010	-0.011	-0.194
		TEMP	-8.101	-7.344	0.924	-7.622	-8.430	0.004	0.035	-0.545
		EQEW	0.115	0.026	5.969	0.045	0.045	0.059	0.041	-0.021
		EQNS	-0.454	3.036	-0.266	-0.063	-0.168	-0.016	0.009	-0.046
		EQZ	-0.086	2.647	-0.162	0.018	0.189	0.003	0.005	-0.084
		EQT	0.030	-0.017	0.833	0.005	0.002	-0.016	0.006	-0.001
		SPKW	-0.050	-0.035	0.003	-0.004	0.006	-0.002	0.000	-0.009
		SPKN	0.067	0.077	-0.003	0.007	-0.007	0.002	-0.001	0.019

Table 3G.1-26
Combined Forces and Moments: RCCV, Selected Load Combination CV-11b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
9 RCCV	4406	OTHR	0.619	0.175	-0.078	0.216	1.213	-0.016	-0.016	-0.432
Drywell		TEMP	0.823	-3.764	-3.737	-11.621	-12.462	0.691	-0.182	-0.529
Top		EQEW	-1.432	0.273	-2.870	0.144	0.700	-0.008	0.016	-0.292
		EQNS	1.184	1.012	-2.125	-0.314	-1.191	0.022	0.092	0.455
		EQZ	-0.124	2.743	0.734	0.154	1.012	0.008	-0.003	-0.180
		EQT	-0.058	-0.128	0.705	0.017	0.085	-0.019	-0.034	-0.040
		SPKW	-0.005	0.045	0.000	-0.001	0.004	0.006	0.009	-0.001
		SPKN	-0.010	0.008	0.051	-0.001	-0.009	-0.004	-0.005	0.000
	4413	OTHR	0.121	-1.684	0.335	0.163	1.400	0.040	0.009	-0.564
		TEMP	-1.109	-11.745	-0.412	-12.243	-11.597	0.480	-0.143	0.316
		EQEW	-1.216	0.860	0.828	0.183	1.145	0.044	0.052	-0.240
		EQNS	0.714	2.598	-3.377	-0.009	-0.368	-0.034	-0.042	0.072
		EQZ	0.349	3.050	-0.086	0.139	0.731	-0.005	0.010	-0.144
		EQT	-0.003	-0.148	0.957	0.006	0.052	-0.010	-0.002	-0.030
		SPKW	0.085	0.166	-0.005	-0.005	-0.062	0.001	0.000	0.027
		SPKN	-0.051	-0.051	0.033	-0.001	0.016	0.000	0.000	-0.013
	4424	OTHR	0.999	-0.380	0.099	0.265	1.433	0.021	0.003	-0.483
		TEMP	-11.976	-5.333	1.168	-6.791	-4.544	-0.050	-0.027	-2.329
		EQEW	0.212	-0.022	6.191	0.053	0.031	0.004	0.056	0.017
		EQNS	-0.865	2.281	-0.226	-0.048	-0.330	-0.020	-0.004	-0.009
		EQZ	-0.042	2.067	-0.135	0.054	0.448	-0.003	0.000	-0.085
		EQT	0.048	-0.016	1.133	0.008	0.006	-0.013	-0.009	0.001
		SPKW	-0.016	-0.034	0.004	0.006	0.045	0.000	-0.001	-0.016
		SPKN	0.027	0.069	-0.003	-0.011	-0.079	0.000	0.001	0.029
10 Basemat	80003	OTHR	-1.855	-0.771	0.112	-0.116	0.322	0.026	0.488	-0.370
@ Center		TEMP	-1.459	-2.034	-0.010	-4.165	-4.332	-0.019	0.027	-0.018
		EQEW	0.003	0.113	0.970	0.137	0.241	-0.184	0.020	0.540
		EQNS	3.586	2.842	-0.331	-4.691	-4.176	0.064	0.477	0.092
		EQZ	1.176	1.338	-0.029	-3.648	-3.734	0.003	-0.174	0.134
		EQT	0.037	-0.014	0.415	0.005	0.011	-0.032	0.006	0.031
		SPKW	0.503	-1.631	-0.002	0.153	0.078	-0.003	-0.012	-0.008
		SPKN	-1.793	0.512	0.019	0.092	0.131	-0.015	0.022	0.007
	80007	OTHR	-1.890	-0.826	0.066	0.061	0.359	0.053	0.234	-0.488
		TEMP	-1.464	-1.995	0.022	-4.146	-4.332	-0.017	0.015	-0.025
		EQEW	0.363	-0.256	0.505	0.315	0.349	-0.067	-0.002	0.512
		EQNS	3.503	2.916	-0.316	-4.254	-4.033	0.165	0.614	0.111
		EQZ	1.185	1.348	-0.024	-3.657	-3.736	0.001	0.023	0.216
		EQT	0.062	-0.063	0.349	0.016	0.016	-0.025	0.009	0.028
		SPKW	0.508	-1.633	-0.003	0.149	0.079	-0.003	-0.002	-0.006
		SPKN	-1.791	0.519	0.021	0.100	0.135	-0.012	0.011	0.004
	80012	OTHR	-1.987	-0.895	0.086	0.269	0.561	-0.054	-0.045	-0.239
		TEMP	-1.470	-1.929	0.013	-4.141	-4.342	-0.014	-0.003	-0.003
		EQEW	-0.098	0.116	0.355	0.055	0.059	0.106	-0.005	0.558
		EQNS	3.205	3.049	-0.151	-3.908	-3.829	0.022	0.680	-0.001
		EQZ	1.185	1.364	-0.024	-3.656	-3.737	0.002	0.208	0.029
		EQT	0.024	-0.016	0.318	0.003	0.001	-0.016	0.003	0.030
		SPKW	0.516	-1.630	0.001	0.143	0.078	-0.003	0.001	-0.002
		SPKN	-1.793	0.522	0.020	0.111	0.146	-0.016	0.007	0.001

Table 3G.1-26
Combined Forces and Moments: RCCV, Selected Load Combination CV-11b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
11 Basemat Inside RPV Pedestal	80206	OTHR	-1.301	-0.634	0.258	-4.446	-3.850	1.787	1.824	-1.781
		TEMP	-1.452	-2.440	0.102	-4.566	-4.902	0.112	-0.003	-0.132
		EQEW	1.123	-0.469	2.151	2.151	2.565	-1.023	-0.541	1.016
		EQNS	4.320	2.471	-1.054	-6.305	-4.299	0.491	0.742	0.202
		EQZ	1.149	1.282	-0.043	-1.685	-1.928	-0.649	-0.747	0.658
		EQT	0.104	-0.077	0.574	-0.151	0.217	-0.100	0.111	0.160
		SPKW	0.385	-1.507	-0.021	0.051	0.222	-0.006	0.084	0.094
		SPKN	-1.718	0.364	0.005	0.174	-0.067	0.002	-0.077	-0.102
	80213	OTHR	-1.511	-0.742	0.135	-2.126	-5.197	0.636	0.628	-2.368
		TEMP	-1.560	-1.931	0.037	-4.415	-4.996	-0.075	-0.008	-0.208
		EQEW	1.929	-0.848	0.482	2.692	4.698	0.061	0.096	1.708
		EQNS	3.499	2.910	-1.544	-3.171	-2.170	1.378	1.189	0.724
		EQZ	1.179	1.367	-0.064	-2.356	-1.102	0.052	0.028	1.027
		EQT	0.217	-0.076	0.421	0.124	0.163	0.087	0.136	0.041
		SPKW	0.312	-1.636	-0.043	-0.034	0.008	0.016	-0.002	0.005
		SPKN	-1.592	0.519	0.012	0.279	0.202	-0.018	-0.006	-0.006
	80224	OTHR	-2.296	-1.506	-0.004	-2.546	-1.579	-0.774	-1.518	-0.753
		TEMP	-1.413	-1.845	0.033	-4.392	-4.556	-0.029	-0.087	0.015
		EQEW	0.076	0.039	-1.798	0.300	0.206	0.366	0.075	0.061
		EQNS	2.510	3.600	-0.146	1.629	-1.229	0.129	1.970	0.063
		EQZ	1.233	1.441	-0.024	-1.139	-2.368	0.090	0.999	0.079
		EQT	0.029	-0.016	-0.094	0.040	-0.001	-0.126	0.011	-0.150
		SPKW	0.558	-1.432	0.002	0.166	0.244	0.006	-0.016	0.014
		SPKN	-1.804	0.342	0.016	0.082	0.010	-0.007	0.010	0.000
12 S/P Slab @ RPV	83306	OTHR	-0.628	2.091	-0.460	-0.911	0.921	-0.127	3.664	-0.060
		TEMP	-9.972	1.598	-0.064	-9.481	-8.299	0.020	-0.052	-0.031
		EQEW	-0.804	-0.320	1.004	1.133	0.470	-0.277	0.459	0.135
		EQNS	-0.024	-1.056	-1.566	-2.820	-1.643	-0.313	-1.032	0.123
		EQZ	-0.124	-0.267	0.146	-1.455	-0.965	0.018	-0.734	0.021
		EQT	-0.015	0.015	-0.033	0.056	0.025	-0.023	0.017	0.014
		SPKW	-0.450	-0.624	1.118	-0.045	-0.038	0.007	-0.032	0.005
		SPKN	-0.194	-0.406	-0.948	-0.019	-0.016	0.004	-0.008	-0.004
	83313	OTHR	0.001	1.742	-0.867	-0.814	1.037	-0.164	3.705	0.055
		TEMP	-10.412	2.279	0.020	-9.487	-8.358	-0.018	-0.032	0.009
		EQEW	-1.336	-0.260	0.171	1.627	0.736	0.021	0.659	-0.015
		EQNS	-0.431	-1.505	0.783	-1.652	-1.076	-0.449	-0.591	0.167
		EQZ	-0.247	-0.187	0.074	-1.467	-0.967	-0.012	-0.738	-0.021
		EQT	-0.008	0.052	-0.097	0.100	0.051	0.005	0.037	0.005
		SPKW	-0.598	0.253	-0.089	-0.057	-0.032	0.000	-0.057	0.001
		SPKN	-0.208	-0.985	0.124	-0.025	-0.021	-0.001	-0.004	-0.003
	83324	OTHR	1.847	1.966	-0.687	-0.497	1.443	-0.193	3.909	-0.074
		TEMP	-10.086	2.442	0.535	-9.394	-8.241	-0.004	0.012	0.009
		EQEW	-0.175	-0.020	-1.709	0.074	0.043	0.410	0.039	-0.175
		EQNS	-0.623	-0.113	0.101	-0.297	-0.317	-0.028	-0.051	0.017
		EQZ	-0.232	-0.288	-0.002	-1.473	-0.971	0.018	-0.742	0.020
		EQT	-0.007	-0.012	-0.225	0.007	0.004	0.029	0.002	-0.011
		SPKW	-0.201	-1.214	-0.128	-0.044	-0.044	0.000	-0.012	0.004
		SPKN	-0.482	0.259	0.061	-0.046	-0.017	0.000	-0.051	-0.002

Table 3G.1-26
Combined Forces and Moments: RCCV, Selected Load Combination CV-11b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
13 S/P Slab @ Center	83406	OTHR	-0.086	1.914	-0.422	-5.651	-1.475	-0.038	-0.326	0.000
		TEMP	-6.718	-1.759	-0.385	-8.944	-8.523	-0.007	-0.094	0.009
		EQEW	-0.707	0.030	0.424	-0.259	0.175	-0.189	0.290	0.000
		EQNS	0.042	-1.356	-1.365	0.433	-0.909	-0.224	-0.712	-0.011
		EQZ	-0.143	-0.260	0.105	0.552	-0.468	0.003	-0.366	0.000
		EQT	-0.012	0.060	0.007	0.004	0.009	-0.018	0.012	0.001
		SPKW	-0.388	-0.588	0.846	0.055	-0.010	-0.007	-0.024	0.012
		SPKN	-0.186	-0.377	-0.648	0.009	-0.009	0.009	-0.006	-0.005
	83413	OTHR	0.684	1.543	-0.376	-5.659	-1.422	-0.112	-0.295	0.004
		TEMP	-7.659	-0.903	0.493	-9.069	-8.607	-0.009	-0.043	-0.004
		EQEW	-1.249	-0.033	0.148	-0.337	0.283	0.028	0.418	0.001
		EQNS	-0.317	-1.137	0.740	0.244	-0.656	-0.297	-0.419	0.010
		EQZ	-0.294	-0.142	0.032	0.545	-0.458	0.002	-0.369	-0.002
		EQT	-0.017	0.072	-0.049	-0.008	0.023	0.003	0.024	-0.001
		SPKW	-0.916	0.099	-0.048	0.119	0.017	0.001	-0.042	0.000
		SPKN	-0.003	-0.766	0.028	-0.010	-0.017	-0.004	-0.004	0.001
	83424	OTHR	1.805	1.563	-0.297	-5.712	-1.212	-0.093	-0.220	0.004
		TEMP	-6.972	-0.779	-0.021	-9.008	-8.518	0.002	-0.039	0.004
		EQEW	-0.106	-0.009	-0.929	-0.033	0.010	0.268	0.026	0.015
		EQNS	-0.869	-0.164	0.069	0.039	-0.327	-0.018	-0.075	0.000
		EQZ	-0.256	-0.261	-0.004	0.553	-0.457	0.001	-0.373	0.001
		EQT	0.003	-0.010	-0.130	-0.001	0.002	0.019	0.002	0.000
		SPKW	0.053	-0.975	-0.101	-0.006	-0.031	0.001	-0.009	-0.001
		SPKN	-0.791	0.077	0.054	0.112	0.025	-0.001	-0.037	0.001
14 S/P Slab @ RCCV	83506	OTHR	0.388	1.806	-0.283	2.552	-0.420	-0.031	-3.437	-0.003
		TEMP	-5.228	-3.030	-0.183	-8.795	-8.644	-0.044	-0.124	0.014
		EQEW	-0.506	-0.030	0.101	-1.095	-0.198	-0.003	0.234	-0.050
		EQNS	0.316	-1.405	-1.038	2.407	0.020	-0.029	-0.546	-0.048
		EQZ	-0.144	-0.236	0.096	1.146	-0.010	0.006	-0.102	-0.002
		EQT	-0.030	0.096	0.021	-0.029	-0.007	-0.006	0.009	-0.002
		SPKW	-0.377	-0.563	0.689	0.113	0.027	-0.034	-0.017	0.011
		SPKN	-0.113	-0.291	-0.437	0.018	0.000	0.015	-0.002	-0.002
	83513	OTHR	1.044	1.490	-0.279	2.456	-0.404	-0.044	-3.413	-0.007
		TEMP	-6.407	-2.664	0.563	-9.202	-8.697	-0.010	0.002	0.004
		EQEW	-1.070	-0.066	0.138	-1.520	-0.265	0.009	0.331	0.005
		EQNS	-0.282	-0.902	0.686	1.379	-0.078	-0.051	-0.322	-0.055
		EQZ	-0.304	-0.128	0.012	1.156	0.003	0.003	-0.108	-0.003
		EQT	-0.012	0.090	-0.031	-0.076	-0.008	0.006	0.019	-0.001
		SPKW	-1.040	-0.083	-0.027	0.241	0.072	0.001	-0.034	0.000
		SPKN	0.093	-0.574	-0.045	-0.011	-0.008	-0.005	0.000	-0.001
	83524	OTHR	1.691	1.429	-0.239	2.247	-0.338	-0.034	-3.359	-0.008
		TEMP	-5.481	-2.152	-0.087	-9.085	-8.636	0.017	-0.037	-0.005
		EQEW	-0.061	-0.032	-0.577	-0.110	-0.025	-0.026	0.023	0.083
		EQNS	-0.923	-0.264	0.036	0.211	-0.213	0.002	-0.048	-0.004
		EQZ	-0.248	-0.264	-0.007	1.178	0.007	0.001	-0.111	0.001
		EQT	0.008	-0.008	-0.086	-0.008	-0.001	0.001	0.002	0.005
		SPKW	0.171	-0.733	-0.086	0.000	-0.013	0.003	-0.003	0.000
		SPKN	-0.939	-0.110	0.071	0.229	0.073	-0.003	-0.033	0.001

Table 3G.1-26
Combined Forces and Moments: RCCV, Selected Load Combination CV-11b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
15 Top slab @ Drywell Head Opening	98120	OTHR	0.559	0.884	0.580	0.067	0.036	0.010	-0.022	-0.065
		TEMP	-12.118	-11.183	-5.512	6.841	6.030	5.411	-0.811	-0.398
		EQEW	-1.292	-1.085	-0.943	-0.055	-0.435	-0.121	-0.057	-0.066
		EQNS	0.071	0.072	0.030	-0.046	-0.076	-0.034	-0.040	-0.019
		EQZ	-0.808	-0.210	-0.293	0.379	0.220	0.278	-0.038	-0.236
		EQT	-0.009	-0.026	-0.014	0.008	0.022	0.005	-0.006	-0.004
		SPKW	0.031	-0.011	0.008	-0.005	0.003	-0.001	0.002	0.002
		SPKN	-0.031	-0.002	-0.012	0.002	-0.003	-0.001	-0.001	0.001
	98135	OTHR	0.244	0.225	-0.222	0.113	-0.223	0.099	0.113	-0.149
		TEMP	-17.422	-7.219	2.697	11.170	0.342	-2.394	0.848	-0.819
		EQEW	0.125	0.340	-0.586	-0.132	-0.167	0.070	0.008	-0.065
		EQNS	0.622	0.061	-0.118	-0.162	-0.016	0.026	0.008	0.000
		EQZ	-2.236	-0.182	0.197	0.527	-0.240	-0.066	0.082	-0.299
		EQT	0.038	0.018	-0.022	-0.001	0.001	-0.007	-0.009	0.003
		SPKW	0.089	0.008	-0.008	-0.008	0.002	0.000	-0.001	0.002
		SPKN	-0.097	-0.013	0.017	0.004	-0.002	0.001	0.001	-0.001
	98104	OTHR	0.306	1.649	-0.360	0.125	0.926	-0.044	0.131	-0.270
		TEMP	-6.925	-12.999	2.994	2.265	12.026	-3.290	0.606	-0.472
		EQEW	0.417	0.603	-0.632	-0.056	-0.513	0.012	0.016	-0.418
		EQNS	-0.057	-1.401	0.071	-0.034	-0.263	0.004	-0.035	0.028
		EQZ	-0.066	-0.456	0.069	0.172	1.050	-0.219	0.002	-0.239
		EQT	0.020	0.039	-0.032	-0.008	-0.029	0.009	-0.002	-0.017
		SPKW	-0.001	-0.056	0.002	-0.003	0.007	0.000	-0.002	0.000
		SPKN	-0.005	0.036	0.006	0.001	-0.016	0.001	0.002	0.000
16 Top slab @ Center	98149	OTHR	0.424	1.174	-0.139	0.145	0.040	-0.085	0.086	0.203
		TEMP	-11.284	-4.069	-0.857	4.361	5.925	0.936	0.661	-1.018
		EQEW	-1.003	-0.296	-0.570	0.004	-0.119	-0.001	0.055	-0.012
		EQNS	0.296	0.658	0.077	-0.091	0.043	-0.048	-0.055	0.067
		EQZ	-1.174	0.156	-0.372	0.527	0.371	-0.031	0.043	0.191
		EQT	0.033	-0.037	0.002	0.002	0.005	-0.008	-0.005	-0.013
		SPKW	0.050	-0.025	-0.007	-0.006	0.008	-0.002	0.000	0.002
		SPKN	-0.050	-0.002	0.004	0.004	-0.004	0.000	-0.001	-0.001
	98170	OTHR	0.499	0.963	-0.178	0.290	0.553	-0.017	-0.024	-0.058
		TEMP	-10.473	-4.943	0.330	4.246	5.164	-0.051	0.133	0.663
		EQEW	-1.062	0.055	-0.748	-0.033	0.008	-0.035	0.007	-0.003
		EQNS	0.114	-0.309	0.242	-0.109	-0.114	-0.002	-0.025	-0.023
		EQZ	-1.023	0.029	-0.024	0.653	0.874	-0.004	0.011	0.023
		EQT	0.033	0.043	-0.026	-0.001	-0.003	-0.009	0.003	0.001
		SPKW	0.050	-0.009	0.001	-0.003	0.011	0.001	0.000	0.002
		SPKN	-0.051	-0.003	0.008	0.003	-0.011	0.001	0.000	-0.002
	98109	OTHR	0.583	1.242	-0.061	0.851	1.052	-0.026	0.058	-0.173
		TEMP	-6.965	-3.863	0.571	8.864	11.344	-0.270	0.605	-0.017
		EQEW	0.121	-0.022	-0.733	-0.018	-0.235	-0.142	0.014	-0.139
		EQNS	0.015	-1.309	-0.036	-0.221	-0.377	-0.030	-0.060	0.070
		EQZ	-0.194	-0.382	0.000	0.646	0.724	-0.119	-0.054	-0.048
		EQT	0.012	0.024	-0.078	-0.008	-0.020	-0.001	-0.001	-0.014
		SPKW	0.017	-0.016	-0.002	-0.008	0.009	0.000	0.000	-0.001
		SPKN	-0.028	0.011	0.007	0.006	-0.017	-0.001	0.000	0.002

Table 3G.1-26
Combined Forces and Moments: RCCV, Selected Load Combination CV-11b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
17 Top slab @ RCCV	98174	OTHR	0.746	1.081	-0.007	-0.101	-0.020	0.234	0.177	-0.171
		TEMP	-8.731	-7.669	2.634	5.537	4.434	0.957	-0.904	-0.184
		EQEW	-1.274	-0.317	-0.731	-0.157	-0.150	0.128	0.060	-0.052
		EQNS	0.306	1.159	0.053	0.252	0.417	-0.212	-0.180	0.149
		EQZ	-0.519	0.046	-0.052	0.277	0.532	0.234	0.161	-0.084
		EQT	0.054	-0.063	0.001	-0.026	-0.069	0.005	0.013	-0.026
		SPKW	0.045	-0.016	-0.016	-0.005	0.020	-0.002	-0.001	0.004
		SPKN	-0.044	-0.015	0.009	0.005	-0.011	-0.001	-0.001	-0.003
	98197	OTHR	0.545	1.183	-0.132	-0.213	-1.135	-0.048	-0.055	-0.763
		TEMP	-12.156	-5.258	-1.159	4.205	6.099	0.531	0.320	-0.561
		EQEW	-1.529	-0.094	-0.596	-0.157	-0.512	-0.060	-0.039	-0.104
		EQNS	0.116	-0.499	0.542	0.094	-0.045	-0.123	0.028	0.104
		EQZ	-0.155	-0.016	0.113	0.343	-0.833	-0.060	-0.048	-0.581
		EQT	0.030	0.070	-0.039	-0.013	-0.013	0.004	-0.003	-0.005
		SPKW	0.062	-0.027	0.006	0.006	0.007	0.002	0.001	0.001
		SPKN	-0.047	0.006	0.007	0.003	-0.007	0.001	0.000	0.001
	98103	OTHR	0.781	1.367	-0.038	-0.301	0.367	-0.205	-0.566	-0.167
		TEMP	-6.757	-8.103	0.104	13.587	13.101	0.388	1.276	0.008
		EQEW	-0.222	0.168	-1.093	-0.035	-0.048	-0.197	0.040	-0.043
		EQNS	-0.349	-1.493	0.077	-1.238	-0.628	0.001	-0.319	0.019
		EQZ	0.009	-0.287	-0.065	-1.481	-0.221	-0.171	-0.781	-0.095
		EQT	-0.020	0.037	-0.202	0.003	0.003	-0.009	0.009	0.006
		SPKW	0.019	-0.001	0.002	-0.002	0.013	0.000	0.004	-0.001
		SPKN	-0.032	0.001	0.000	-0.016	-0.027	0.000	-0.009	0.001

Table 3G.1-27

Sectional Thicknesses and Rebar Ratios of RCCV Used in the Evaluation

Location	Element ID	Thickness (m)	Primary Reinforcement					Shear Tie	
			Position	Direction 1[*1]		Direction2[*1]			
				Arrangement[*2]	Ratio (%)	Arrangement[*2]	Ratio (%)	Arrangement	Ratio (%)
1 RPV Pedestal Bottom	5006 5013 5024	2.4	Inside	2-#18@300	0.717	2-#18@1.8º	1.007	#9@1.8ºx300	1.007
			Outside	3-#18@300	1.075	3-#18@1.8º	1.510		
2 RPV Pedestal Mid-Height	6006 6013 6024	2.4	Inside	2-#18@300	0.717	2-#18@1.8º	1.007	#9@3.6ºx600	0.252
			Outside	3-#18@300	1.075	3-#18@1.8º	1.510		
3 RPV Pedestal Top	6606 6613 6624	2.4	Inside	2-#18@300	0.717	2-#18@1.8º	1.007	#9@1.8ºx300	1.007
			Outside	3-#18@300	1.075	3-#18@1.8º	1.510		
4 RCCV Wetwell Bottom	1806 1813 1824	2.0	Inside	2-#18@300	0.860	3-#18@0.9º	1.297	#9@1.2ºx300	0.540
			Outside	3-#18@300	1.290	3-#18@0.9º +1-#18@1.8º	1.513		
5 RCCV Wetwell Mid-Height	2606 2613 2624	2.0	Inside	2-#18@300	0.860	2-#18@0.9º	0.865	#9@1.2ºx600	0.270
			Outside	3-#18@300	1.290	3-#18@0.9º	1.297		
6 RCCV Wetwell Top	3406 3413 3424	2.0	Inside	2-#18@300 +1-#18@600	1.075	2-#18@0.9º	0.865	#9@0.9ºx300	0.721
			Outside	3-#18@300 +1-#18@300	1.720	3-#18@0.9º +1-#18@0.9º	1.729		
7 RCCV Drywell Bottom	3606 3613 3624	2.0	Inside	2-#18@300	0.860	2-#18@0.9º	0.865	#9@1.2ºx300	0.540
			Outside	3-#18@300 +1-#18@300	1.720	3-#18@0.9º +1-#18@0.9º	1.729		
8 RCCV Drywell Mid-Height	4006 4013 4976	2.0	Inside	2-#18@300	0.860	2-#18@0.9º	0.865	#9@1.2ºx600	0.270
			Outside	3-#18@300	1.290	3-#18@0.9º	1.297		
9 RCCV Drywell Top	4406 4413	2.0	Inside	2-#18@300	0.860	2-#18@0.9º	0.865	#9@1.2ºx300	0.540
			Outside	3-#18@300	1.290	3-#18@0.9º	1.297		
	4424	2.0	Inside	2-#18@300	0.860	2-#18@0.9º (+1-#18@1.8º)	1.081	#9@1.2ºx300	0.540
			Outside	3-#18@300	1.290	3-#18@0.9º	1.297		

Note *1: RCCV, Pedestal Direction1 : Hoop, Direction2 : Vertical, S/P Slab Direction1 : Radial, Direction2 : Circumferential, Top slab Direction1 : N-S, Direction2 : E-W, Basemat @center Direction1 : N-S, Direction2 : E-W, Basemat Inside RPV Pedestal Direction1 : Top :Radial, Bottom : N-S, Direction2 Top : Circumferential, Bottom : E-W

Note *2: Rebar in parentheses indicates additional bars locally required.

Table 3G.1-27
Sectional Thicknesses and Rebar Ratios of RCCV Used in the Evaluation (Continued)

Location	Element ID	Thickness (m)	Primary Reinforcement					Shear Tie	
			Position	Direction 1*		Direction2*			
				Arrangement	Ratio (%)	Arrangement	Ratio (%)	Arrangement	Ratio (%)
10 Basemat @ Center	80003 80007 80012	4.0	Top	3-#9@120	0.403	3-#9@120	0.403	#9@600x600	0.179
			Bottom	5-#11@200	0.629	5-#11@200	0.629		
11 Basemat Inside RPV Pedestal	80206 80213 80224	4.0	Top	6-#9@1.8°	0.497	2-#9@200 +4-#9@400	0.323	#9@3.6°x400	0.414
			Bottom	5-#11@200	0.629	5-#11@200	0.629		
12 S/P Slab @ RPV	83306 83313 83324	2.0	Top	2-#18@1.8º	0.913	2-#18@300	0.860	#9@1.2ºx300	1.141
			Bottom	2-#18@1.8º	0.913	2-#18@300	0.860		
13 S/P Slab @ Center	83406 83413 83424	2.0	Top	2-#18@0.9º	1.264	2-#18@300	0.860	#9@1.8ºx600	0.263
			Bottom	2-#18@0.9º	1.264	2-#18@300	0.860		
14 S/P Slab @ RCCV	83506 83513 83524	2.0	Top	2-#18@0.9º	0.966	2-#18@300	0.860	#9@0.72ºx300	1.007
			Bottom	2-#18@0.9º	0.966	2-#18@300	0.860		
15 Top slab @ Drywell Head Opening	98120 98135 98104	2.4	Top	3-#14@300	0.605	3-#14@300	0.605	#9@600x300	0.358
			Bottom	3-#14@300	0.605	3-#14@300	0.605		
16 Top slab @ Center	98149 98170	2.4	Top	3-#14@300	0.605	3-#14@300	0.605	#9@600x600	0.179
			Bottom	3-#14@300	0.605	3-#14@300	0.605		
	98109	2.4	Top	3-#14@300	0.605	3-#14@300 +1-#14@300	0.806	#9@600x600	0.179
			Bottom	3-#14@300	0.605	3-#14@300	0.605		
17 Top slab @ RCCV	98174	2.4	Top	3-#14@300	0.605	3-#14@300	0.605	#9@600x600	0.179
			Bottom	3-#14@300	0.605	3-#14@300	0.605		
	98197	2.4	Top	3-#14@300	0.605	3-#14@300	0.605	#9@300x300	0.717
			Bottom	3-#14@300	0.605	3-#14@300	0.605		
	98103	2.4	Top	3-#14@300	0.605	3-#14@300 +1-#14@300	0.806	#9@300x300	0.717
			Bottom	3-#14@300	0.605	3-#14@300	0.605		

Note *: RCCV, Pedestal Direction1 : Hoop, Direction2 : Vertical, S/P Slab Direction1 : Radial, Direction2 : Circumferential,
Top slab Direction1 : N-S, Direction2 : E-W, Basemat @center Direction1 : N-S, Direction2 : E-W,
Basemat Inside RPV Pedestal Direction1 : Top :Radial, Bottom : N-S, Direction2 Top : Circumferential, Bottom : E-W

Table 3G.1-28

Rebar and Concrete Stresses of RCCV: Selected Load Combination CV-1

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
				Calculated				Allowable
		Calculated	Allowable	Direction1*		Direction2*		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
1 RPV	5006	-3.5	-15.5	-1.9	-2.4	-9.2	-20.7	310.2
Pedestal	5013	-3.7	-15.5	-3.9	-3.2	-9.3	-21.9	310.2
Bottom	5024	-3.5	-15.5	-2.3	-3.8	-9.3	-20.4	310.2
2 RPV	6006	-2.4	-15.5	29.4	20.6	-16.7	-14.6	310.2
Pedestal	6013	-2.4	-15.5	15.1	19.1	-16.9	-14.4	310.2
Mid-Height	6024	-1.7	-15.5	45.4	14.1	-10.6	-11.1	310.2
3 RPV	6606	-5.3	-15.5	39.0	6.4	10.7	-25.9	310.2
Pedestal	6613	-5.2	-15.5	20.1	3.5	4.8	-27.1	310.2
Top	6624	-5.0	-15.5	45.2	7.7	5.0	-25.1	310.2
4 RCCV	1806	-4.4	-15.5	24.7	4.3	20.1	-16.2	310.2
Wetwell	1813	-4.7	-15.5	16.9	2.5	18.3	-18.0	310.2
Bottom	1824	-4.0	-15.5	31.3	6.1	9.4	-17.3	310.2
5 RCCV	2606	-1.4	-15.5	73.1	55.0	-13.4	2.9	310.2
Wetwell	2613	-1.7	-15.5	59.0	48.8	-16.2	1.7	310.2
Mid-Height	2624	-1.8	-15.5	73.3	51.3	-11.2	-3.2	310.2
6 RCCV	3406	-0.4	-15.5	60.1	34.3	-1.3	-3.3	310.2
Wetwell	3413	-1.1	-15.5	47.8	31.3	-18.0	2.2	310.2
Top	3424	-1.1	-15.5	50.9	24.2	-1.5	-7.0	310.2
7 RCCV	3606	-0.5	-15.5	75.4	34.1	-7.1	1.9	310.2
Drywell	3613	-1.0	-15.5	67.0	30.3	-3.6	-4.1	310.2
Bottom	3624	-1.2	-15.5	66.2	22.8	1.6	-8.0	310.2
8 RCCV	4006	-0.5	-15.5	49.0	37.0	-10.0	9.1	310.2
Drywell	4013	-1.5	-15.5	47.1	38.4	-7.6	-0.1	310.2
Mid-Height	4976	-0.5	-15.5	46.8	29.6	-4.3	0.2	310.2
9 RCCV	4406	-4.6	-15.5	34.4	7.0	68.3	-2.9	310.2
Drywell	4413	-4.8	-15.5	11.0	2.1	29.9	-14.9	310.2
Top	4424	-4.9	-15.5	49.0	12.1	55.2	-9.1	310.2
10 Basemat	80003	-1.0	-12.4	-3.2	-6.5	0.3	-4.6	310.2
@ Center	80007	-1.0	-12.4	-3.2	-6.6	0.3	-4.6	310.2
	80012	-1.1	-12.4	-3.2	-6.7	0.3	-4.6	310.2
11 Basemat	80206	-1.1	-12.4	-7.0	-2.7	-2.8	-1.6	310.2
Inside	80213	-0.9	-12.4	-5.0	-4.8	-4.5	0.1	310.2
RPV Pedestal	80224	-1.2	-12.4	-7.8	-2.9	-2.7	-3.0	310.2
12 S/P Slab	83306	-1.7	-15.5	26.6	5.6	84.5	8.3	310.2
@ RPV	83313	-2.0	-15.5	13.5	2.3	67.5	3.5	310.2
	83324	-1.4	-15.5	9.8	2.3	83.0	9.7	310.2
13 S/P Slab	83406	-6.2	-15.5	-7.7	85.3	14.2	54.5	310.2
@ Center	83413	-5.8	-15.5	-5.7	86.5	7.0	40.1	310.2
	83424	-6.0	-15.5	-8.3	82.1	12.5	54.8	310.2
14 S/P Slab	83506	-0.3	-15.5	56.5	-21.3	22.6	31.9	310.2
@ RCCV	83513	-2.4	-15.5	57.0	-6.9	14.8	14.3	310.2
	83524	-0.7	-15.5	51.5	-24.7	26.5	35.8	310.2
15 Top slab	98120	-0.6	-15.5	45.0	16.8	55.6	37.5	310.2
@ Drywell Head	98135	-0.6	-15.5	3.3	2.1	0.9	25.0	310.2
Opening	98104	-1.6	-15.5	52.7	14.1	139.9	19.7	310.2
16 Top slab	98149	-0.4	-15.5	30.3	-8.8	55.2	41.2	310.2
@ Center	98170	-1.5	-15.5	40.9	5.8	73.5	10.1	310.2
	98109	-3.1	-15.5	72.9	7.7	81.9	9.1	310.2
17 Top slab	98174	-1.0	-15.5	20.3	19.3	40.8	38.2	310.2
@ RCCV	98197	-2.2	-15.5	9.7	27.4	9.5	99.2	310.2
	98103	-2.5	-15.5	38.7	53.2	55.8	42.3	310.2

Note: Negative value means compression.

Note *: RCCV, Pedestal Direction1 : Hoop, Direction2 : Vertical, S/P Slab Direction1 : Radial, Direction2 : Circumferential, Top slab Direction1 : N-S, Direction2 : E-W, Basemat @center Direction1 : N-S, Direction2 : E-W, Basemat Inside RPV Pedestal Direction1 : Top :Radial, Bottom : N-S, Direction2 Top : Circumferential, Bottom : E-W

Table 3G.1-29

Rebar and Concrete Stresses of RCCV: Selected Load Combination CV-7a

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				Direction1*		Direction2*		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
1 RPV	5006	-8.4	-28.7	-5.5	-3.5	-16.6	-48.7	367.9
Pedestal	5013	-8.2	-28.7	-8.7	-5.8	-14.8	-47.0	367.9
Bottom	5024	-7.3	-28.7	-7.9	-7.0	-10.7	-40.7	367.9
2 RPV	6006	-7.1	-28.7	14.4	31.6	-46.5	-33.6	367.9
Pedestal	6013	-6.7	-28.7	6.8	28.2	-43.4	-25.1	367.9
Mid-Height	6024	-3.8	-28.7	13.2	18.1	-25.0	-13.3	367.9
3 RPV	6606	-5.3	-28.7	-1.9	0.4	-33.2	-30.9	367.9
Pedestal	6613	-4.4	-28.7	-5.5	-0.6	-29.3	-30.5	367.9
Top	6624	-9.6	-28.7	2.1	-7.6	-54.7	10.8	367.9
4 RCCV	1806	-10.3	-29.0	79.9	24.5	111.2	-20.7	369.7
Wetwell	1813	-9.5	-29.0	72.5	29.6	90.8	-24.0	369.7
Bottom	1824	-9.0	-29.0	159.7	75.0	77.9	-29.3	369.7
5 RCCV	2606	-1.0	-29.1	127.1	119.4	-26.0	52.7	370.2
Wetwell	2613	-1.7	-29.1	78.6	94.4	-32.9	20.9	370.2
Mid-Height	2624	-3.1	-29.1	123.8	105.2	-16.1	7.3	370.2
6 RCCV	3406	-12.1	-29.1	66.6	65.1	-47.7	54.6	370.2
Wetwell	3413	-6.0	-29.1	21.8	52.0	-20.6	40.6	370.2
Top	3424	-10.2	-29.1	213.2	136.0	-82.9	67.3	370.2
7 RCCV	3606	-9.0	-28.7	96.5	118.1	72.6	46.0	367.8
Drywell	3613	-2.9	-28.7	83.8	107.4	-35.5	50.1	367.8
Bottom	3624	-2.5	-27.7	84.2	6.6	-14.1	-13.9	360.2
8 RCCV	4006	-2.2	-28.7	29.3	117.7	3.6	62.0	367.8
Drywell	4013	-1.7	-28.7	41.4	111.8	-13.1	41.2	367.8
Mid-Height	4976	-1.1	-27.7	46.7	26.3	4.3	17.4	360.2
9 RCCV	4406	-2.7	-28.7	32.3	98.2	61.7	29.0	367.8
Drywell	4413	-2.8	-28.7	1.1	45.5	-1.3	-10.4	367.8
Top	4424	-5.9	-27.7	41.3	7.6	87.0	-5.3	360.2
10 Basemat	80003	-3.1	-23.2	-17.7	13.6	-15.1	22.8	370.2
@ Center	80007	-3.0	-23.2	-17.3	11.0	-15.2	21.0	370.2
	80012	-3.0	-23.2	-17.3	8.0	-14.8	16.9	370.2
11 Basemat	80206	-8.9	-23.2	-28.8	96.8	-13.5	81.3	370.2
Inside	80213	-7.1	-23.2	-22.2	47.9	-20.3	107.9	370.2
RPV Pedestal	80224	-6.1	-23.2	-21.7	47.4	-20.2	36.2	370.2
12 S/P Slab	83306	-2.7	-29.0	-63.2	72.5	137.7	50.7	369.8
@ RPV	83313	-2.3	-29.0	-52.3	105.4	147.9	47.2	369.8
	83324	-0.4	-29.0	-70.4	114.2	151.0	26.8	369.8
13 S/P Slab	83406	-19.9	-29.0	-30.7	236.5	35.7	210.1	369.8
@ Center	83413	-19.0	-29.0	-26.2	240.2	16.3	162.4	369.8
	83424	-18.6	-29.0	-19.2	264.0	20.7	159.9	369.8
14 S/P Slab	83506	-0.8	-29.0	165.8	-96.1	39.1	120.3	369.8
@ RCCV	83513	-7.8	-29.0	158.3	-20.6	-18.1	-2.1	369.8
	83524	-8.5	-29.0	178.0	-28.1	22.9	41.5	369.8
15 Top slab	98120	-1.6	-27.9	1.1	-12.3	60.6	35.7	361.7
@ Drywell Head	98135	-2.6	-27.9	1.9	-15.1	-6.2	7.8	361.7
Opening	98104	-1.8	-27.9	-28.3	62.6	162.7	-1.1	361.7
16 Top slab	98149	-2.1	-28.0	0.5	-10.0	103.8	16.2	362.7
@ Center	98170	-4.5	-28.0	22.8	-6.6	97.0	0.2	362.7
	98109	-4.4	-28.0	89.0	5.3	113.3	11.3	362.7
17 Top slab	98174	-2.8	-28.0	18.0	-3.4	64.9	4.3	362.7
@ RCCV	98197	-1.6	-28.0	24.6	22.0	10.7	80.6	362.7
	98103	-0.5	-28.0	-4.3	15.9	59.1	24.3	362.7

Note: Negative value means compression.

Note *: RCCV, Pedestal Direction1 : Hoop, Direction2 : Vertical, S/P Slab Direction1 : Radial, Direction2 : Circumferential, Top slab Direction1 : N-S, Direction2 : E-W, Basemat @center Direction1 : N-S, Direction2 : E-W, Basemat Inside RPV Pedestal Direction1 : Top :Radial, Bottom : N-S, Direction2 Top : Circumferential, Bottom : E-W

Table 3G.1-30
Rebar and Concrete Stresses of RCCV: Selected Load Combination CV-7b

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
				Calculated				Allowable
		Calculated	Allowable	Direction1*		Direction2*		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
1 RPV	5006	-7.2	-27.9	-28.9	-22.6	-11.4	-38.5	361.6
Pedestal	5013	-7.0	-27.9	-35.6	-28.3	-12.3	-36.5	361.6
Bottom	5024	-6.0	-27.9	-36.7	-31.3	-7.8	-29.5	361.6
2 RPV	6006	-7.1	-27.9	60.8	71.9	-43.4	-24.0	361.6
Pedestal	6013	-7.3	-27.9	44.4	74.4	-47.6	-15.6	361.6
Mid-Height	6024	-4.5	-27.9	69.0	65.9	-28.8	-5.0	361.6
3 RPV	6606	-6.5	-27.9	174.6	129.3	1.1	-39.2	361.6
Pedestal	6613	-6.4	-27.9	119.4	112.7	-14.3	-39.0	361.6
Top	6624	-3.8	-27.9	251.8	148.9	60.4	-84.5	361.6
4 RCCV	1806	-7.3	-28.3	73.3	29.1	82.3	-14.8	364.4
Wetwell	1813	-7.2	-28.3	23.9	27.6	63.8	-19.6	364.4
Bottom	1824	-6.3	-28.3	35.9	18.6	55.5	-22.9	364.4
5 RCCV	2606	-1.1	-28.2	91.2	111.0	-46.5	74.6	363.8
Wetwell	2613	-8.2	-28.2	47.7	101.1	-30.1	38.6	363.8
Mid-Height	2624	-4.8	-28.2	86.1	96.6	-21.1	29.2	363.8
6 RCCV	3406	-5.6	-28.2	37.7	59.1	-24.3	45.0	363.8
Wetwell	3413	-7.9	-28.2	36.7	60.6	-31.5	29.2	363.8
Top	3424	-1.3	-28.2	44.6	42.1	-29.4	16.4	363.8
7 RCCV	3606	-6.1	-27.7	17.6	132.5	-5.5	66.4	360.2
Drywell	3613	-5.7	-27.7	-0.1	96.5	-13.6	17.6	360.2
Bottom	3624	-1.9	-26.7	78.2	26.3	24.3	-5.3	352.9
8 RCCV	4006	-6.4	-27.7	19.4	165.8	2.7	88.5	360.2
Drywell	4013	-4.6	-27.7	20.7	152.6	-5.6	58.9	360.2
Mid-Height	4976	-1.2	-26.7	50.8	63.4	0.5	33.5	352.9
9 RCCV	4406	-5.5	-27.7	1.2	173.2	87.4	87.8	360.2
Drywell	4413	-5.6	-27.7	-7.4	62.5	4.1	-10.2	360.2
Top	4424	-2.7	-26.7	62.5	5.6	64.7	5.7	352.9
10 Basemat	80003	-2.6	-23.2	-13.6	20.6	-10.7	33.9	370.2
@ Center	80007	-2.4	-23.2	-13.0	17.8	-11.3	31.5	370.2
	80012	-2.5	-23.2	-12.5	14.7	-10.7	28.3	370.2
11 Basemat	80206	-7.7	-23.2	-20.5	82.7	-8.6	96.8	370.2
Inside	80213	-6.1	-23.2	-16.4	46.2	-15.3	99.5	370.2
RPV Pedestal	80224	-5.1	-23.2	-16.2	41.5	-13.8	46.2	370.2
12 S/P Slab	83306	-3.9	-28.3	-74.5	79.6	126.5	66.3	364.4
@ RPV	83313	-2.7	-28.3	-83.5	104.9	127.7	69.9	364.4
	83324	-7.1	-28.3	1.0	98.5	140.9	46.0	364.4
13 S/P Slab	83406	-18.4	-28.3	-29.0	211.2	20.7	162.7	364.4
@ Center	83413	-18.4	-28.3	-29.5	212.9	21.2	174.1	364.4
	83424	-18.1	-28.3	-22.9	239.8	24.0	165.6	364.4
14 S/P Slab	83506	-0.7	-28.3	105.2	-70.0	29.3	126.4	364.4
@ RCCV	83513	-0.6	-28.3	119.2	-68.8	-1.6	118.0	364.4
	83524	-0.4	-28.3	131.0	-45.2	12.1	111.3	364.4
15 Top slab	98120	-7.8	-26.2	26.7	-17.3	41.3	-6.2	349.2
@ Drywell Head	98135	-7.2	-26.2	12.6	-35.0	-7.6	3.0	349.2
Opening	98104	-10.0	-26.2	-2.3	-4.9	170.2	-10.9	349.2
16 Top slab	98149	-4.6	-26.6	-8.4	-20.1	250.5	30.6	352.0
@ Center	98170	-7.9	-26.6	44.5	-12.6	127.5	-3.1	352.0
	98109	-7.9	-27.2	116.4	0.7	146.4	6.2	356.6
17 Top slab	98174	-5.8	-26.6	43.8	-9.0	108.6	9.7	352.0
@ RCCV	98197	-2.5	-26.6	41.7	13.9	14.5	90.6	352.0
	98103	-2.2	-27.2	16.6	0.4	78.7	5.0	356.6

Note: Negative value means compression.
Note *: RCCV, Pedestal Direction1 : Hoop, Direction2 : Vertical, S/P Slab Direction1 : Radial, Direction2 : Circumferential, Top slab Direction1 : N-S, Direction2 : E-W, Basemat @center Direction1 : N-S, Direction2 : E-W, Basemat Inside RPV Pedestal Direction1 : Top :Radial, Bottom : N-S, Direction2 Top : Circumferential, Bottom : E-W

Table 3G.1-31
Rebar and Concrete Stresses of RCCV: Selected Load Combination CV-11a

Location	Element ID	Concrete Stress (MPa) Calculated	Concrete Stress (MPa) Allowable	Primary Reinforcement Stress (MPa) Calculated Direction1* In/Top	Calculated Direction1* Out/Bottom	Calculated Direction2* In/Top	Calculated Direction2* Out/Bottom	Allowable
1 RPV	5006	-15.7	-28.7	64.7	104.8	-46.3	-82.1	367.9
Pedestal	5013	-16.5	-28.7	44.3	117.1	-44.3	105.4	367.9
Bottom	5024	-9.3	-28.7	38.1	37.0	52.4	-54.2	367.9
2 RPV	6006	-8.7	-28.7	39.7	44.2	-53.0	-38.9	367.9
Pedestal	6013	-7.7	-28.7	20.3	31.1	-52.7	-34.9	367.9
Mid-Height	6024	-8.3	-28.7	158.6	117.4	94.6	101.3	367.9
3 RPV	6606	-10.3	-28.7	-9.6	40.6	-57.3	-35.3	367.9
Pedestal	6613	-8.1	-28.7	-17.4	-8.9	-46.0	-37.9	367.9
Top	6624	-14.2	-28.7	16.2	59.0	-69.7	128.1	367.9
4 RCCV	1806	-12.9	-29.0	251.1	148.4	291.1	128.8	369.7
Wetwell	1813	-12.2	-29.0	200.6	127.9	269.3	102.4	369.7
Bottom	1824	-11.9	-29.0	363.0	212.6	292.5	109.0	369.7
5 RCCV	2606	-7.3	-29.1	282.6	208.2	206.2	227.3	370.2
Wetwell	2613	-7.0	-29.1	217.5	171.0	136.7	187.9	370.2
Mid-Height	2624	-8.8	-29.1	295.3	203.3	199.1	232.0	370.2
6 RCCV	3406	-10.8	-29.1	201.9	135.2	125.8	166.4	370.2
Wetwell	3413	-10.0	-29.1	144.9	113.7	114.3	136.8	370.2
Top	3424	-22.1	-29.1	303.0	189.2	-212.3	236.1	370.2
7 RCCV	3606	-8.8	-28.7	272.8	179.3	93.4	177.6	367.8
Drywell	3613	-8.0	-28.7	202.0	166.7	161.8	152.2	367.8
Bottom	3624	-8.0	-27.7	222.0	62.6	130.6	77.2	360.2
8 RCCV	4006	-5.8	-28.7	183.8	212.9	144.8	176.4	367.8
Drywell	4013	-7.0	-28.7	153.2	171.2	95.9	113.6	367.8
Mid-Height	4976	-8.3	-27.7	233.8	139.5	209.6	183.9	360.2
9 RCCV	4406	-7.7	-28.7	139.8	195.3	165.2	194.0	367.8
Drywell	4413	-7.2	-28.7	108.2	168.0	145.7	142.8	367.8
Top	4424	-8.6	-27.7	250.1	134.4	238.1	133.3	360.2
10 Basemat	80003	-6.4	-23.2	-24.3	96.3	-22.7	133.3	370.2
@ Center	80007	-6.2	-23.2	-24.5	86.6	-21.0	132.8	370.2
	80012	-5.5	-23.2	-23.5	70.4	-20.1	119.0	370.2
11 Basemat	80206	-14.1	-23.2	-35.5	250.7	-21.0	250.6	370.2
Inside	80213	-11.0	-23.2	-35.0	135.7	-29.7	244.9	370.2
RPV Pedestal	80224	-6.3	-23.2	-32.4	59.9	-25.1	113.9	370.2
12 S/P Slab	83306	-13.2	-29.0	61.6	183.9	227.0	157.2	369.8
@ RPV	83313	-15.7	-29.0	70.6	168.4	228.7	102.7	369.8
	83324	-11.7	-29.0	-64.3	164.2	192.6	75.3	369.8
13 S/P Slab	83406	-20.4	-29.0	-41.1	209.4	49.2	193.5	369.8
@ Center	83413	-17.3	-29.0	-34.6	217.8	34.6	151.1	369.8
	83424	-16.3	-29.0	-25.1	241.8	29.1	149.8	369.8
14 S/P Slab	83506	-13.9	-29.0	250.3	-59.4	55.8	131.8	369.8
@ RCCV	83513	-11.8	-29.0	198.3	-36.4	-24.0	-9.0	369.8
	83524	-14.8	-29.0	155.6	-58.4	-31.8	73.1	369.8
15 Top slab	98120	-10.6	-27.9	127.9	-36.6	158.5	82.6	361.7
@ Drywell Head	98135	-3.5	-27.9	95.3	-26.8	30.3	46.8	361.7
Opening	98104	-5.6	-27.9	-43.1	70.6	191.2	102.3	361.7
16 Top slab	98149	-3.0	-28.0	17.9	-13.8	111.8	23.7	362.7
@ Center	98170	-5.1	-28.0	36.8	-11.0	103.8	6.9	362.7
	98109	-4.4	-28.0	110.7	11.5	148.3	59.1	362.7
17 Top slab	98174	-3.7	-28.0	91.7	36.0	119.1	41.2	362.7
@ RCCV	98197	-2.9	-28.0	63.7	47.1	80.2	89.9	362.7
	98103	-8.1	-28.0	153.1	36.2	137.5	48.4	362.7

Note: Negative value means compression.
Note *: RCCV, Pedestal Direction1 : Hoop, Direction2 : Vertical, S/P Slab Direction1 : Radial, Direction2 : Circumferential,
Top slab Direction1 : N-S, Direction2 : E-W, Basemat @center Direction1 : N-S, Direction2 : E-W,
Basemat Inside RPV Pedestal Direction1 : Top :Radial, Bottom : N-S, Direction2 Top : Circumferential, Bottom : E-W

Table 3G.1-32
Rebar and Concrete Stresses of RCCV: Selected Load Combination CV-11b

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				Direction1*		Direction2*		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
1 RPV	5006	-14.4	-27.9	-40.5	-35.5	-42.0	-72.7	361.6
Pedestal	5013	-15.2	-27.9	-44.9	-41.6	-39.1	108.6	361.6
Bottom	5024	-8.2	-27.9	-39.0	-34.1	-31.8	-44.4	361.6
2 RPV	6006	-9.1	-27.9	89.9	85.1	-52.4	-31.1	361.6
Pedestal	6013	-8.6	-27.9	67.7	74.3	-56.4	-27.0	361.6
Mid-Height	6024	-9.3	-27.9	193.2	167.5	80.8	145.3	361.6
3 RPV	6606	-8.7	-27.9	225.5	178.1	68.1	-56.0	361.6
Pedestal	6613	-8.9	-27.9	152.8	152.7	-30.0	-49.8	361.6
Top	6624	-7.8	-27.9	294.8	187.0	204.7	-84.9	361.6
4 RCCV	1806	-10.3	-28.3	223.6	149.4	261.1	159.6	364.4
Wetwell	1813	-10.6	-28.3	157.9	132.9	238.6	125.7	364.4
Bottom	1824	-9.3	-28.3	272.3	174.3	251.0	118.8	364.4
5 RCCV	2606	-8.9	-28.2	235.5	191.7	194.5	254.3	363.8
Wetwell	2613	-7.2	-28.2	184.8	173.0	110.6	209.2	363.8
Mid-Height	2624	-9.0	-28.2	256.6	197.4	162.4	251.6	363.8
6 RCCV	3406	-7.3	-28.2	166.0	120.9	117.7	152.9	363.8
Wetwell	3413	-6.7	-28.2	139.9	115.9	79.3	123.0	363.8
Top	3424	-7.6	-28.2	179.1	124.0	163.5	144.0	363.8
7 RCCV	3606	-7.2	-27.7	133.6	187.6	111.6	172.8	360.2
Drywell	3613	-7.8	-27.7	41.4	165.6	39.0	112.9	360.2
Bottom	3624	-7.4	-26.7	261.7	108.0	201.7	114.5	352.9
8 RCCV	4006	-7.3	-27.7	99.9	252.3	112.3	209.3	360.2
Drywell	4013	-7.5	-27.7	98.7	215.7	75.6	132.4	360.2
Mid-Height	4976	-8.4	-26.7	232.4	171.6	201.6	196.4	352.9
9 RCCV	4406	-10.6	-27.7	127.2	293.8	171.0	244.3	360.2
Drywell	4413	-10.9	-27.7	-35.8	195.1	123.9	150.4	360.2
Top	4424	-8.8	-26.7	264.0	136.8	198.2	180.0	352.9
10 Basemat	80003	-6.5	-23.2	-23.1	127.2	-19.1	150.0	370.2
@ Center	80007	-6.2	-23.2	-21.0	112.4	-17.0	146.9	370.2
	80012	-5.1	-23.2	-19.5	83.7	-15.5	127.7	370.2
11 Basemat	80206	-13.2	-23.2	-30.2	260.6	-17.4	271.3	370.2
Inside	80213	-10.4	-23.2	-29.7	182.7	50.9	252.4	370.2
RPV Pedestal	80224	-6.0	-23.2	-26.8	75.6	-20.6	118.8	370.2
12 S/P Slab	83306	-14.9	-28.3	-51.0	187.9	218.3	167.2	364.4
@ RPV	83313	-17.1	-28.3	-67.4	162.1	220.0	123.8	364.4
	83324	-14.8	-28.3	-80.0	162.5	187.8	90.6	364.4
13 S/P Slab	83406	-16.8	-28.3	-37.2	192.3	26.8	155.0	364.4
@ Center	83413	-16.9	-28.3	-38.0	200.3	35.3	155.8	364.4
	83424	-16.4	-28.3	-29.1	230.4	31.2	154.1	364.4
14 S/P Slab	83506	-11.5	-28.3	190.5	66.0	57.1	147.2	364.4
@ RCCV	83513	-13.2	-28.3	160.5	-67.0	-34.1	111.7	364.4
	83524	-11.5	-28.3	120.6	-73.6	-30.9	98.9	364.4
15 Top slab	98120	-10.0	-26.2	90.8	-20.3	114.2	-9.0	349.2
@ Drywell Head	98135	-7.7	-26.2	63.5	-38.9	-8.0	3.7	349.2
Opening	98104	-10.3	-26.2	50.1	5.7	187.5	-23.3	349.2
16 Top slab	98149	-5.4	-26.6	-10.7	-23.2	256.0	32.6	352.0
@ Center	98170	-8.0	-26.6	74.8	-17.2	127.9	-9.6	352.0
	98109	-7.5	-27.2	139.1	-9.8	176.2	24.2	356.6
17 Top slab	98174	-6.5	-26.6	134.2	-16.2	160.2	24.5	352.0
@ RCCV	98197	-3.5	-26.6	81.6	34.8	87.9	90.4	352.0
	98103	-9.7	-27.2	153.1	-12.0	145.4	28.7	356.6

Note: Negative value means compression.
Note *: RCCV, Pedestal Direction1 : Hoop, Direction2 : Vertical, S/P Slab Direction1 : Radial, Direction2 : Circumferential, Top slab Direction1 : N-S, Direction2 : E-W, Basemat @center Direction1 : N-S, Direction2 : E-W, Basemat Inside RPV Pedestal Direction1 : Top :Radial, Bottom : N-S, Direction2 Top : Circumferential, Bottom : E-W

Table 3G.1-33

Transverse Shear of RCCV

Location	Element ID	Load ID	Shear Force Q (MN/m)	d (m)	Shear Stress (MPa)			Shear Tie Ratio (%)	
					vu	vc	vs	required	provided
1 RPV	5006	CV-11b	6.84	2.08	3.88	2.92	0.96	0.238	1.010
Pedestal	5013	CV-11a	4.96	1.94	3.01	1.66	1.36	0.332	1.010
Bottom	5024	CV-11a	5.65	1.94	3.44	1.90	1.53	0.374	1.010
2 RPV	6006	CV-7b	2.04	1.94	1.24	2.67	0.00	0.000	0.252
Pedestal	6013	CV-7b	3.10	1.94	1.88	2.61	0.00	0.000	0.252
Mid-Height	6024	CV-11b	2.98	1.94	1.81	1.69	0.13	0.031	0.252
3 RPV	6606	CV-7b	2.20	2.08	1.25	2.57	0.00	0.000	1.010
Pedestal	6613	CV-7b	2.27	2.07	1.29	2.49	0.00	0.000	1.010
Top	6624	CV-7b	2.21	2.07	1.26	2.22	0.00	0.000	1.010
4 RCCV	1806	CV-11a	1.70	1.57	1.27	0.63	0.65	0.157	0.540
Wetwell	1813	CV-11a	1.86	1.57	1.39	0.39	1.00	0.244	0.540
Bottom	1824	CV-11a	1.50	1.57	1.12	0.27	0.86	0.209	0.540
5 RCCV	2606	CV-7a	0.35	1.54	0.27	1.06	0.00	0.000	0.270
Wetwell	2613	CV-7a	0.24	1.54	0.18	1.87	0.00	0.000	0.270
Mid-Height	2624	CV-7b	0.24	1.54	0.18	1.04	0.00	0.000	0.270
6 RCCV	3406	CV-7b	0.58	1.59	0.43	0.91	0.00	0.000	0.721
Wetwell	3413	CV-1	0.04	1.66	0.02	0.02	0.00	0.000	0.721
Top	3424	CV-7a	0.02	1.67	0.02	0.02	0.00	0.000	0.721
7 RCCV	3606	CV-11b	0.63	1.66	0.45	0.00	0.45	0.111	0.540
Drywell	3613	CV-7a	0.63	1.59	0.46	0.96	0.00	0.000	0.540
Bottom	3624	CV-1	0.63	1.68	0.38	1.30	0.00	0.000	0.540
8 RCCV	4006	CV-11a	0.62	1.59	0.46	0.06	0.40	0.098	0.270
Drywell	4013	CV-7b	0.36	1.54	0.27	1.03	0.00	0.000	0.270
Mid-Height	4976	CV-7b	0.52	1.54	0.40	1.70	0.00	0.000	0.270
9 RCCV	4406	CV-11a	2.67	1.68	1.87	0.85	1.03	0.251	0.540
Drywell	4413	CV-1	0.78	1.68	0.47	1.11	0.00	0.000	0.540
Top	4424	CV-11b	0.95	1.54	0.73	0.65	0.08	0.020	0.540
10 Basemat	80003	CV-7b	0.57	3.50	0.19	0.97	0.00	0.000	0.179
@ Center	80007	CV-7a	0.59	3.48	0.20	1.07	0.00	0.000	0.179
	80012	CV-7a	0.26	3.47	0.09	0.96	0.00	0.000	0.179
11 Basemat	80206	CV-11b	4.29	3.49	1.45	0.84	0.61	0.148	0.414
Inside	80213	CV-11a	4.66	3.47	1.58	1.00	0.58	0.140	0.414
RPV Pedestal	80224	CV-7a	1.99	3.50	0.67	1.08	0.00	0.000	0.414
12 S/P Slab	83306	CV-11a	5.46	1.53	4.22	2.02	2.19	0.534	1.140
@ RPV	83313	CV-11a	5.24	1.53	4.04	1.93	2.11	0.515	1.140
	83324	CV-11a	5.14	1.53	3.96	0.89	3.07	0.747	1.140
13 S/P Slab	83406	CV-1	0.03	1.76	0.02	0.02	0.00	0.000	0.263
@ Center	83413	CV-1	0.02	1.75	0.01	0.01	0.00	0.000	0.263
	83424	CV-1	0.04	1.76	0.02	0.02	0.00	0.000	0.263
14 S/P Slab	83506	CV-7a	5.08	1.53	3.92	0.89	3.02	0.736	1.010
@ RCCV	83513	CV-7a	5.12	1.53	3.95	0.81	3.14	0.764	1.010
	83524	CV-7a	5.07	1.53	3.91	0.70	3.21	0.781	1.010
15 Top slab	98120	CV-1	0.14	1.95	0.07	0.07	0.00	0.000	0.358
@ Drywell Head	98135	CV-1	0.27	1.98	0.13	0.13	0.00	0.000	0.358
Opening	98104	CV-7b	0.11	1.94	0.07	0.07	0.00	0.000	0.358
16 Top slab	98149	CV-7a	0.34	1.94	0.20	0.20	0.00	0.000	0.179
@ Center	98170	CV-1	0.13	1.94	0.07	0.07	0.00	0.000	0.179
	98109	CV-1	0.22	2.00	0.11	0.11	0.00	0.000	0.179
17 Top slab	98174	CV-7b	1.12	1.94	0.68	0.85	0.00	0.000	0.179
@ RCCV	98197	CV-7b	1.58	2.00	0.93	0.88	0.05	0.014	0.717
	98103	CV-1	0.79	1.93	0.41	0.81	0.00	0.000	0.717

Table 3G.1-34

Tangential Shear of RCCV

Location	Element ID	Load ID	Section Forces			Thickness	Rebar Area (cm^2/m)		rAs/pAs	v_{so} (MPa)		v_u (MPa)	
			Nx / Ny (MN/m)	Nxl / Nyl (MN/m)	V (MN/m)	T (m)	Required rAs	Provided pAs		Calculated	Allowable	Calculated	Allowable $0.4f_c'-v_{so}$
1 RPV Pedestal Bottom	5006	CV-11a	-1.145	-8.848	1.642	2.40	213.5	431.3	0.495	0.68	4.37	0.68	12.83
		CV-11a	-5.817	-14.908	1.730	2.40	249.8	604.8	0.413	0.72	4.37	0.72	12.80
	5013	CV-11a	-1.724	-9.028	0.261	2.40	198.6	431.3	0.461	0.11	4.37	0.11	13.41
		CV-11a	-6.251	-17.407	0.743	2.40	303.7	604.8	0.502	0.31	4.37	0.31	13.21
	5024	CV-11a	-1.480	-3.734	4.326	2.40	115.1	431.3	0.267	1.80	4.37	1.80	11.71
		CV-11a	-5.953	-12.404	-1.003	2.40	176.4	604.8	0.292	0.42	4.37	0.42	13.10
2 RPV Pedestal Mid-Height	6006	CV-11b	0.847	-0.356	4.338	2.40	143.8	431.3	0.333	1.81	4.30	1.81	11.30
		CV-11a	-5.539	-11.449	3.561	2.40	175.3	604.8	0.290	1.48	4.37	1.48	12.03
	6013	CV-11b	0.563	-0.794	3.188	2.40	106.4	431.3	0.247	1.33	4.30	1.33	11.78
		CV-11a	-5.603	-11.372	1.672	2.40	160.2	604.8	0.265	0.70	4.37	0.70	12.82
	6024	CV-11b	0.886	-1.448	7.797	2.40	243.8	431.3	0.565	3.25	4.30	3.25	9.86
		CV-11a	-4.167	-5.627	-6.738	2.40	125.3	604.8	0.207	2.81	4.37	2.81	10.71
3 RPV Pedestal Top	6606	CV-11b	0.392	0.797	4.143	2.40	127.5	431.3	0.296	1.73	4.30	1.73	11.38
		CV-11a	-4.702	-7.410	4.129	2.40	102.7	604.8	0.170	1.72	4.37	1.72	11.80
	6613	CV-11b	0.095	-2.769	-0.763	2.40	82.1	431.3	0.190	0.32	4.30	0.32	12.79
		CV-11a	-4.874	-7.353	2.387	2.40	77.7	604.8	0.128	0.99	4.37	0.99	12.52
	6624	CV-11b	0.690	-1.913	5.508	2.40	180.3	431.3	0.418	2.30	4.30	2.30	10.81
		CV-11a	-4.607	-6.690	2.969	2.40	73.7	604.8	0.122	1.24	4.37	1.24	12.28
4 RCCV Wetwell Bottom	1806	CV-11b	0.226	0.505	6.903	2.00	196.1	430.0	0.456	3.45	4.33	3.45	9.84
		CV-11b	-2.346	6.278	-6.380	2.00	181.2	562.0	0.322	3.19	4.33	3.19	10.10
	1813	CV-11b	0.018	1.689	5.664	2.00	162.7	430.0	0.378	2.83	4.33	2.83	10.46
		CV-11b	-2.717	8.910	-2.046	2.00	176.3	562.0	0.314	1.02	4.33	1.02	12.27
	1824	CV-11b	0.411	-0.798	-8.356	2.00	241.6	430.0	0.562	4.18	4.33	4.18	9.11
		CV-11b	-2.924	4.615	-8.326	2.00	181.0	562.0	0.322	4.16	4.33	4.16	9.13

Note : Top and bottom lines for each element indicate evaluation results for hoop and vertical rebars, respectively.

Nomenclature:

Nx, Ny: axial forces in the hoop and vertical directions due to pressure and dead loads, respectively

Nxl, Nyl: axial forces in the hoop and vertical directions due to lateral loads, respectively

V: tangential shear due to lateral loads

v_{so}: tangential shear stress borne by orthogonal rebars (Refer to Table 3.8-3.)

Table 3G.1-34
Tangential Shear of RCCV (Continued)

Location	Element ID	Load ID	Section Forces			Thickness	Rebar Area (cm^2/m)		rAs/pAs	v_{so} (MPa)		v_u (MPa)	
			Nx / Ny (MN/m)	Nxl / Nyl (MN/m)	V (MN/m)	T (m)	Required rAs	Provided pAs		Calculated	Allowable	Calculated	Allowable $0.4f_c'-v_{so}$
5 RCCV	2606	CV-11b	2.353	1.026	6.310	2.00	240.4	430.0	0.559	3.16	4.33	3.16	10.10
Wetwell		CV-11b	-1.890	4.790	-6.180	2.00	162.9	433.0	0.376	3.09	4.33	3.09	10.16
Mid-Height	2613	CV-11b	2.044	1.466	5.660	2.00	216.9	430.0	0.504	2.83	4.33	2.83	10.42
		CV-11b	-2.398	5.779	-4.696	2.00	138.8	433.0	0.320	2.35	4.33	2.35	10.91
	2624	CV-11b	2.271	0.684	7.582	2.00	271.7	430.0	0.632	3.79	4.33	3.79	9.46
		CV-11b	-2.528	3.917	7.582	2.00	165.1	433.0	0.381	3.79	4.33	3.79	9.46
6 RCCV	3406	CV-11b	2.226	0.816	5.686	2.00	219.1	560.0	0.391	2.84	4.33	2.84	10.41
Wetwell		CV-11b	-1.370	3.321	-5.629	2.00	142.0	519.0	0.274	2.81	4.33	2.81	10.44
Top	3413	CV-11b	1.883	0.351	5.309	2.00	198.0	560.0	0.354	2.65	4.33	2.65	10.60
		CV-11b	-2.111	4.955	-4.569	2.00	127.2	519.0	0.245	2.28	4.33	2.28	10.97
	3424	CV-11b	1.665	0.060	6.741	2.00	231.0	560.0	0.413	3.37	4.33	3.37	9.88
		CV-11b	-1.958	3.279	6.741	2.00	152.2	519.0	0.293	3.37	4.33	3.37	9.88
7 RCCV	3606	CV-11b	2.198	-0.230	-5.400	2.00	211.1	516.0	0.409	2.70	4.29	2.70	10.32
Drywell		CV-11b	-0.951	3.195	-5.163	2.00	142.2	519.0	0.274	2.58	4.29	2.58	10.44
Bottom	3613	CV-11b	1.927	0.501	5.021	2.00	193.6	516.0	0.375	2.51	4.29	2.51	10.51
		CV-11b	-1.655	4.550	-4.310	2.00	128.0	519.0	0.247	2.15	4.29	2.15	10.86
	3624	CV-11b	1.701	-0.134	6.469	2.00	231.5	516.0	0.449	3.23	4.21	3.23	9.31
		CV-11b	-1.590	3.012	6.469	2.00	157.1	519.0	0.303	3.23	4.21	3.23	9.31
8 RCCV	4006	CV-11b	1.601	0.607	-5.101	2.00	187.1	430.0	0.435	2.55	4.29	2.55	10.47
Drywell		CV-11b	-0.585	2.603	-4.989	2.00	140.0	433.0	0.323	2.49	4.29	2.49	10.52
Mid-Height	4013	CV-11b	1.535	0.036	4.848	2.00	177.2	430.0	0.412	2.42	4.29	2.42	10.59
		CV-11b	-1.731	4.253	-4.236	2.00	118.6	433.0	0.274	2.12	4.29	2.12	10.90
	4976	CV-11b	1.391	-0.297	6.789	2.00	232.0	430.0	0.539	3.39	4.21	3.39	9.15
		CV-11b	-1.073	2.620	6.789	2.00	175.8	433.0	0.406	3.39	4.21	3.39	9.15
9 RCCV	4406	CV-11b	0.496	0.825	-4.612	2.00	143.8	430.0	0.334	2.31	4.29	2.31	10.71
Drywell		CV-11b	-0.318	2.297	-4.612	2.00	134.2	433.0	0.310	2.31	4.29	2.31	10.71
Top	4413	CV-11b	0.126	-0.659	4.494	2.00	129.6	430.0	0.301	2.25	4.29	2.25	10.77
		CV-11b	-1.815	4.056	-4.011	2.00	108.0	433.0	0.249	2.01	4.29	2.01	11.01
	4424	CV-11b	0.845	-0.223	7.140	2.00	226.3	430.0	0.526	3.57	4.21	3.57	8.98
		CV-11b	-0.683	2.364	7.140	2.00	193.7	476.0	0.407	3.57	4.21	3.57	8.98

Table 3G.1-35

Containment Liner Plate Strains (Max)

Category	Calculated Strain					Allowable Tension Allowable Compression
	Cylinder	Pedestal	DW Bottom	WW Bottom	Top Slab	
Test	0.0003 -0.0010	0.0004 -0.0006	0.0000 -0.0001	0.0002 -0.0002	0.0002 0.0000	0.002 -0.002
Normal Operation	0.0004 -0.0008	0.0004 -0.0010	0.0001 -0.0003	0.0004 -0.0005	0.0001 -0.0005	0.002 -0.002
Severe Environment	0.0004 -0.0008	0.0004 -0.0010	0.0001 -0.0003	0.0004 -0.0005	0.0001 -0.0005	0.003 -0.005
Extreme Environment	0.0005 -0.0008	0.0004 -0.0010	0.0001 -0.0003	0.0004 -0.0005	0.0002 -0.0005	0.003 -0.005
Abnormal ; LOCA	0.0005 -0.0032	0.0005 -0.0028	0.0001 -0.0004	0.0004 -0.0019	0.0002 -0.0017	0.003 -0.005
Abnormal/Extreme Environment	0.0012 -0.0040	0.0007 -0.0030	0.0002 -0.0006	0.0009 -0.0025	0.0004 -0.0018	0.003 -0.005

Table 3G.1-35
Containment Liner Plate Strains (Max) (Continued)

Category	Calculated Strain		Allowable Tension
	DF Thick PLate	Pedestal Thick Plate	Allowable Compression
Test	0.0004 -0.0002	0.0001 -0.0001	0.002 -0.002
Normal Operation	0.0001 -0.0005	0.0001 -0.0006	0.002 -0.002
Severe Environment	0.0001 -0.0005	0.0001 -0.0006	0.003 -0.005
Extreme Environment	0.0002 -0.0005	0.0001 -0.0006	0.003 -0.005
Abnormal ; LOCA	0.0004 -0.0017	0.0003 -0.0020	0.003 -0.005
Abnormal/Extreme Environment	0.0005 -0.0017	0.0004 -0.0021	0.003 -0.005

Table 3G.1-36

Drywell Head Elements Stress Summary

Service Level	PL		PL+Pb		PL+Pb+Q	
	Calculated Stress (MPa)	Allowable Stress (MPa)	Calculated Stress (MPa)	Allowable Stress (MPa)	Calculated Stress (MPa)	Allowable Stress (MPa)
Test Condition	77	262	77	262	-	-
Design Condition	66	227	66	227	-	-
A, B	66	227	66	227	794 *1	456
C	73	342	73	342	-	-
D	73	430	73	430	-	-

*1 Acceptable by meeting all requirements for simplified elastic-plastic analysis stipulated in NE-3228.3 of ASME B&PV Code, Sec.III.

Table 3G.1-37

Diaphragm Floor (D/F) Slab Elements Stress Summary

Structural Elements	Member Size	Governing Load Combination	Stress or Stress Ratio	Allowable Stress	Acceptance Criteria *2
Top Plate	25mm	Abnormal Abnormal/Extreme	σmin = -377MPa τmax = 200MPa	σ = 391MPa τ = 243MPa	1.5S 1.4S
Bottom Plate	25mm	Abnormal Abnormal/Extreme	σmin = -399MPa τmax = 202MPa	σ = 408MPa τ = 253MPa	1.5S 1.4S
Radial Web Plate (Upper Web)	25mm	Abnormal Normal	σmin = -336MPa τmax = 150MPa	σ = 391MPa τ = 174MPa	1.5S 1.0S
Radial Web Plate (Lower Web) *1	25mm	Normal Normal	σmin = -201MPa τmax = 141MPa	σ = 261MPa τ = 181MPa	1.0S 1.0S
Tangential Web Plate*1	25mm	Severe Normal	σmin = -83MPa τmax = 61MPa	σ = 261MPa τ = 174MPa	1.0S 1.0S
Bottom Flange*1	38mm	Normal Normal	σmin = -160MPa τmax = 80MPa	σ = 269MPa τ = 181MPa	1.0S 1.0S

*1 Thermal stress associated with extreme and abnormal load conditions meets deformation limits of AISC N690 Section Q1.5.7.2. The total stress excluding thermal stress satisfies the allowable stress limit in Table Q1.5.7.1 of AISC N690.

*2 S = Allowable stress limit specified in part 1 of AISC N690.

Table 3G.1-38

Diaphragm Floor (D/F) Slab Anchorage Structural Capacity

Anchor Locations	**Governing Load Combination**	**Design Load** (kN)	**No. of Anchor Bars Provided**	**Total Capacity** (kN)	**Acceptance Criteria *1**
Top Plate	Normal (SIT)	639/deg	1-#18 @ 0.9 deg	782/deg	0.66Fy
Bottom Plate	Normal	153/deg	1-#18 @ 0.9 deg	591/deg	0.5Fy
Girder Radial Web Plate	Abnormal/Extreme	4300	5-#18	4804	0.9Fy
Girder Bottom Flange	Abnormal/Extreme	3320	5-#18	4804	0.9Fy

*1 F_y = Specified minimum yield stress.

Table 3G.1-39

Vent Wall Structural Elements Stress Summary

Structural Elements	Member Size	Governing Load Combination	Calculated Stress	Allowable Stress	Acceptance Criteria *1
Inner Cylinder	25mm	Abnormal/Extreme Abnormal/Extreme	σmin= -266MPa τmax= 133MPa	σ = 417MPa τ = 243MPa	1.6S 1.4S
Outer Cylinder	25mm	Abnormal Abnormal/Extreme	σmin = -262MPa τmax = 152MPa	σ = 408MPa τ = 253MPa	1.5S 1.4S
Radial Web Plate	25mm	Abnormal/Extreme Abnormal/Extreme	σmin = -299MPa τmax = 174MPa	σ = 417MPa τ = 243MPa	1.6S 1.4S

*1 S = Allowable stress limit specified in part 1 of AISC N690.

Table 3G.1-40

Reactor Shield Wall (RSW) Structural Element Stress Summary

Structural Element	Member Size	Governing Load Combination	Calculated Stress	Allowable	Acceptance Criteria *1
RSW Cylindrical Shell	260mm 260mm	Abnormal/Extreme Abnormal/Extreme	σmin = -223MPa τmax = 111MPa	σ = 417MPa τ = 243MPa	1.6S 1.4S

*1 S = Allowable stress limit specified in part 1 of AISC N690.

Table 3G.1-41

RPV Support Bracket Structural Elements Stress Summary

Structural Elements	Member Size	Governing Load Combination	Stress or Stress Ratio	Allowable Stress	Acceptance Criteria *1 *2
Horizontal Plate	100mm	Abnormal/Extreme Abnormal/Extreme	σmax = 306MPa τmax = 157MPa	σ = 371MPa τ = 243MPa	0.7Fu 1.4S
Vertical Plate	150mm	Abnormal/Extreme Abnormal/Extreme	σmin = -169MPa τmax = 91MPa	σ = 225MPa τ = 131MPa	1.6S 1.4S

*1 Fu = Specified minimum tensile stress.

*2 S = Allowable stress limit specified in Part 1 of AISC N690.

Table 3G.1-42

Vent Wall and RPV Support Bracket Anchorage Structural Capacity

Anchor Locations	Governing Load Combination	Design Load (kN)	No. of Anchor Bars Provided	Total Capacity (kN)	Acceptance Criteria*1
Vent Wall	Abnormal/Extreme	1663/deg	4-#18 @ 1.8deg	2112/deg	0.9Fy
RPV Support Bracket	Abnormal/Extreme	45400	60-#18	57600	0.9Fy

*1 Fy = Specified minimum yield stress.

Table 3G.1-43

Gravity Driven Cooling System (GDCS) Pool Structural Elements Stress Summary

Structural Elements	Member Size	Governing Load Combination	Stress or Stress Ratio	Allowable Stress	Acceptance Criteria *2
Wall Plate	16mm	Abnormal Abnormal/Extreme	σmin= -387MPa τmax= 234MPa	σ = 391MPa τ = 243MPa	1.5S 1.4S
Vertical Column	550x550x25	Severe Abnormal/Extreme	Ratio =0.63 τ = 108MPa	Ratio=1.0 τ = 243MPa	S 1.4S
Vertical Column	750x750x32	Severe Abnormal/Extreme	Ratio =0.91 τ = 169MPa	Ratio=1.0 τ = 243MPa	S 1.4S
Horizontal Member *1	450x450x25	Severe Severe	Ratio =0.61 τ = 55MPa	Ratio=1.0 τ = 174MPa	S S
Bracing Member	200x200x25	Abnormal/Extreme Severe	Ratio =0.78 τ = 18MPa	Ratio=1.0 τ = 174MPa	1.6S S

*1 Thermal stress associated with extreme and abnormal load conditions meets deformation limits of AISC N690 Section Q1.5.7.2. The total stress excluding thermal stress satisfies the allowable stress limit in Table Q1.5.7.1 of AISC N690.

*2 S = Allowable stress limit specified in Part 1 of AISC N690.

Table 3G.1-44

Gravity Driven Cooling System (GDCS) Pool Anchorage Structural Capacity

Anchor Locations	Governing Load Combination	Design Load / Anchor Bar (kN)	Capacity / Anchor Bar (kN)	Acceptance Criteria *1
Bracing Members @ RCCV Wall	Abnormal/Extreme	613	960	0.9Fy
Horizontal Members @ RCCV Wall	Abnormal/Extreme	842	960	0.9Fy

*1 F_y = Specified minimum yield stress.

Table 3G.1-45

Combined Forces and Moments: RB, Selected Load Combination RB-4

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
21 Exterior Wall @ EL-11.50 ~-10.50m	20011	OTHR	-2.338	-3.837	-0.785	0.037	0.427	0.008	0.048	0.132
		TEMP	3.302	3.192	0.403	0.400	1.487	0.056	-0.166	0.518
	20023	OTHR	-1.564	-1.510	-0.465	0.040	-0.314	0.034	-0.016	-0.171
		TEMP	-4.222	-2.622	1.119	-2.956	-3.848	0.045	-1.060	-0.836
	30010	OTHR	-1.806	-2.425	-0.279	-0.384	-2.033	0.019	0.005	1.240
		TEMP	0.589	3.018	-0.068	1.328	4.243	-0.021	-0.028	-0.755
	30020	OTHR	-1.294	-1.461	-0.193	-0.689	-0.845	0.022	-0.264	0.365
		TEMP	-0.133	-1.376	-0.255	0.157	1.425	0.145	-0.034	-0.363
	40001	OTHR	-1.002	-1.708	0.283	-0.418	-1.300	-0.265	0.134	0.768
		TEMP	-0.207	-0.899	-0.037	0.221	1.578	-0.095	0.154	-0.406
	40011	OTHR	-1.716	-3.458	-0.041	-0.463	-2.658	-0.005	0.007	2.194
		TEMP	1.070	3.409	0.069	1.360	4.550	0.010	0.015	-0.846
22 Exterior Wall @ EL4.65 ~6.60m	22011	OTHR	-0.233	-2.976	0.712	-0.007	0.045	0.009	-0.025	0.091
		TEMP	2.396	2.929	-0.220	-0.084	-0.025	0.038	0.021	0.216
	22023	OTHR	-0.112	-1.607	0.011	0.032	0.019	-0.097	0.112	0.031
		TEMP	1.485	-4.752	0.539	0.254	-0.154	-0.198	0.145	0.030
	32010	OTHR	-0.377	-1.978	-0.016	-0.025	-0.087	0.002	0.001	0.000
		TEMP	15.865	7.739	-0.006	-3.498	-3.263	-0.005	-0.002	-0.245
	32020	OTHR	-0.046	-1.838	-0.024	-0.099	-0.078	-0.021	-0.039	0.020
		TEMP	0.372	5.212	2.952	-0.762	-2.361	-0.499	0.919	0.136
	42001	OTHR	-0.039	-1.933	-0.039	-0.085	-0.114	0.057	0.031	0.054
		TEMP	2.936	3.681	3.048	-0.980	-2.143	-0.049	-0.848	-0.343
	42011	OTHR	-0.599	-2.773	-0.060	-0.036	-0.200	0.005	0.006	0.047
		TEMP	14.232	5.754	0.125	-3.625	-3.085	0.092	0.088	-0.197
23 Exterior Wall @ EL22.50 ~24.60m	24211	OTHR	-0.140	-1.638	0.078	-0.064	-0.440	0.008	-0.002	-0.111
		TEMP	3.279	2.935	-0.364	-0.167	-0.569	-0.047	-0.053	2.406
	24224	OTHR	-0.018	-0.985	0.293	0.037	-0.062	-0.038	-0.079	-0.046
		TEMP	0.227	5.676	-4.367	0.804	-0.351	-0.718	-0.757	-0.278
	34210	OTHR	-0.009	-0.821	0.044	-0.002	-0.042	-0.002	0.004	0.010
		TEMP	16.993	5.968	-0.582	-3.644	-3.497	0.038	-0.015	-0.213
	34220	OTHR	0.049	-0.957	-0.178	0.039	-0.030	-0.009	0.046	0.004
		TEMP	1.840	5.678	2.329	0.739	-2.179	-0.461	1.828	0.124
	44201	OTHR	0.024	-1.101	-0.332	0.048	-0.013	0.021	-0.040	0.000
		TEMP	1.107	6.208	-0.828	0.224	-2.398	0.566	-2.258	0.147

OTHR: Loads other than thermal loads

TEMP: Thermal loads

Table 3G.1-46

Combined Forces and Moments: RB, Selected Load Combination RB-8a

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
18 Wall Below RCCV Bottom	6	OTHR	-2.585	-8.230	-0.231	0.308	1.462	-0.008	0.004	0.600
		TEMP	0.931	-1.122	-0.745	0.243	1.608	-0.041	0.046	0.242
	13	OTHR	-2.289	-6.898	-0.039	-0.072	-0.145	0.012	-0.007	0.069
		TEMP	0.411	-3.019	-0.612	0.436	2.455	0.002	0.013	0.527
	24	OTHR	-1.736	-7.576	-0.429	-0.268	-1.541	-0.003	0.009	-0.555
		TEMP	0.330	-3.256	0.153	0.473	2.598	-0.007	0.001	0.588
19 Wall Below Below RCCV Mid-Height	806	OTHR	-1.207	-7.144	-0.082	0.019	0.221	0.003	-0.020	-0.042
		TEMP	1.402	-1.850	0.087	0.220	1.175	0.076	-0.051	-0.079
	813	OTHR	-1.724	-6.996	0.034	0.017	0.296	-0.019	0.008	0.083
		TEMP	0.936	-3.006	-0.511	0.150	1.159	-0.032	0.010	0.459
	824	OTHR	-2.088	-7.810	-0.399	0.140	0.594	-0.010	-0.002	0.183
		TEMP	0.749	-3.304	0.159	0.167	1.199	0.020	0.009	0.452
20 Wall Below RCCV Top	1606	OTHR	1.452	-6.655	-0.099	-0.862	-4.761	0.024	0.007	1.350
		TEMP	10.805	-2.483	0.058	-0.665	-3.014	0.082	0.059	2.184
	1613	OTHR	0.961	-7.055	0.202	-0.842	-4.690	-0.003	-0.020	1.372
		TEMP	10.442	-3.559	-0.426	-0.713	-4.000	-0.009	-0.013	2.514
	1624	OTHR	0.692	-7.593	-0.248	-0.741	-4.413	0.010	-0.022	1.292
		TEMP	11.250	-4.196	-0.083	-0.794	-4.030	0.001	-0.077	2.602
21 Exterior Wall @ EL-11.50 ~-10.50m	20011	OTHR	-1.852	-3.292	-0.679	0.133	0.750	0.016	0.035	0.239
		TEMP	2.705	3.066	0.389	0.368	1.368	0.053	-0.156	0.466
	20023	OTHR	-1.202	-1.461	-0.490	0.015	-0.286	0.025	-0.041	-0.158
		TEMP	-3.251	-1.996	0.825	-2.301	-2.914	0.034	-0.800	-0.621
	30010	OTHR	-1.290	-2.229	-0.190	-0.221	-1.225	0.011	0.003	0.890
		TEMP	0.724	2.695	-0.073	1.092	3.667	-0.017	-0.022	-0.637
	30020	OTHR	-0.964	-1.562	-0.227	-0.546	-0.762	0.020	-0.158	0.324
		TEMP	-0.071	-1.233	-0.217	0.074	1.116	0.124	-0.017	-0.276
	40001	OTHR	-0.757	-1.739	0.347	-0.336	-1.078	-0.201	0.070	0.623
		TEMP	-0.153	-0.846	0.059	0.127	1.264	-0.082	0.120	-0.316
	40011	OTHR	-1.409	-3.060	-0.029	-0.277	-1.686	-0.001	0.006	1.620
		TEMP	0.891	3.003	0.054	1.119	3.906	0.009	0.013	-0.707
22 Exterior Wall @ EL4.65 ~6.60m	22011	OTHR	0.250	-2.538	0.588	-0.006	0.094	0.011	-0.026	0.142
		TEMP	3.318	2.710	-0.171	-0.103	-0.066	0.048	0.030	0.058
	22023	OTHR	-0.052	-1.467	-0.024	0.112	0.043	-0.101	0.075	0.019
		TEMP	1.285	-3.170	0.477	0.534	-0.054	-0.170	0.006	0.009
	32010	OTHR	0.216	-1.777	0.022	-0.020	0.013	0.008	0.000	-0.096
		TEMP	14.112	6.168	-0.023	-2.775	-2.672	0.003	-0.007	-0.020
	32020	OTHR	0.005	-1.760	0.189	0.001	-0.031	-0.056	0.011	0.027
		TEMP	0.400	4.604	2.519	-0.338	-1.807	-0.378	0.875	0.157
	42001	OTHR	0.000	-1.814	0.070	0.027	-0.063	0.059	-0.010	0.049
		TEMP	2.426	3.483	2.473	-0.440	-1.604	-0.045	-0.762	-0.249
	42011	OTHR	-0.123	-2.264	-0.022	-0.042	-0.111	-0.004	0.005	-0.055
		TEMP	12.516	4.854	0.184	-2.941	-2.613	0.072	0.080	0.063
23 Exterior Wall @ EL22.50 ~24.60m	24211	OTHR	0.345	-1.191	0.048	0.005	-0.034	0.017	0.005	-0.300
		TEMP	3.814	3.230	-0.215	-0.028	0.139	-0.034	-0.045	1.652
	24224	OTHR	-0.003	-1.187	0.105	0.018	-0.029	-0.010	-0.041	-0.042
		TEMP	0.397	5.311	-3.629	0.850	-0.366	-0.448	-0.780	-0.397
	34210	OTHR	0.575	-0.662	0.116	0.010	0.168	-0.003	0.000	0.060
		TEMP	14.993	4.941	-0.346	-2.787	-2.420	0.017	-0.013	0.093
	34220	OTHR	0.056	-1.178	-0.065	0.057	0.022	0.009	0.031	-0.009
		TEMP	1.556	5.056	1.786	0.885	-1.523	-0.164	1.522	-0.010
	44201	OTHR	0.037	-1.274	-0.135	0.059	0.021	0.011	-0.034	-0.006
		TEMP	0.989	5.532	-0.249	0.541	-1.740	0.350	-1.832	0.050

Table 3G.1-46
Combined Forces and Moments: RB, Selected Load Combination RB-8a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
24 Basemat @ Wall Below RCCV	90140	OTHR	-2.616	-2.477	0.157	-2.121	-1.168	1.196	-2.800	2.490
		TEMP	0.810	0.936	1.517	-0.214	-0.335	-0.493	-1.094	0.272
	90182	OTHR	-1.641	-2.233	-0.257	-0.707	-1.154	0.256	0.088	1.580
		TEMP	2.212	0.531	0.485	-0.412	-3.757	0.157	-0.104	2.793
	90111	OTHR	-3.798	-1.449	-0.006	-1.461	-0.524	-0.304	0.951	0.299
		TEMP	0.599	2.397	-0.039	-4.358	-0.699	0.073	3.051	0.135
25 Slab EL4.65m @ RCCV	93140	OTHR	-0.231	0.483	0.777	0.128	0.135	-0.144	0.126	-0.105
		TEMP	0.137	2.182	3.808	-0.512	-0.403	0.288	-0.137	0.113
	93182	OTHR	0.762	-0.320	-0.001	-0.026	0.079	0.014	0.000	0.099
		TEMP	3.923	-3.798	-1.042	-0.359	-1.845	-0.083	0.076	1.379
	93111	OTHR	-0.013	0.686	-0.124	0.059	-0.031	-0.003	0.073	-0.005
		TEMP	-3.346	4.625	-0.234	-1.884	-0.337	-0.050	1.257	0.001
26 Slab EL17.5m @ RCCV	96144	OTHR	0.048	0.666	0.817	0.074	0.085	-0.081	0.123	-0.107
		TEMP	-0.269	4.658	7.008	-0.257	-0.148	0.178	-0.080	0.026
	96186	OTHR	1.039	-0.414	-0.013	-0.037	-0.115	-0.005	0.005	0.051
		TEMP	6.641	-4.128	-1.421	-0.104	-0.385	-0.051	0.018	0.399
	96113	OTHR	-0.606	1.711	-0.140	-0.201	-0.033	-0.011	0.320	0.041
		TEMP	-8.012	3.448	-1.490	-4.673	-2.833	-0.192	1.013	-0.053
27 Slab EL27.0m @ RCCV	98472	OTHR	0.604	0.608	-0.234	-0.009	0.013	-0.027	0.138	-0.179
		TEMP	-1.976	-0.331	5.371	-0.390	0.080	-0.331	0.460	-0.565
	98514	OTHR	0.364	0.433	0.121	-0.043	-0.327	0.001	0.003	-0.013
		TEMP	0.290	-2.436	-1.243	-0.535	-0.083	-0.010	0.037	-0.712
	98424	OTHR	0.269	1.265	-0.162	-0.102	0.003	-0.203	-0.318	-0.070
		TEMP	-9.771	-8.139	-2.242	6.366	3.591	0.270	-4.372	-0.664
28 Pool Girder @ Storage Pool	123004	OTHR	0.747	0.952	1.149	0.049	0.211	-0.055	0.055	0.155
		TEMP	-3.222	-10.346	0.042	0.420	1.524	-0.253	-0.188	1.420
	123104	OTHR	0.317	0.223	1.284	-0.012	-0.031	0.000	0.037	0.040
		TEMP	-1.162	-3.220	1.957	-0.186	-0.569	0.085	-0.399	0.291
29 Pool Girder @ Cavity	123012	OTHR	-0.120	-0.859	-0.592	0.019	0.254	-0.012	0.041	0.200
		TEMP	-1.585	-0.088	-0.191	-0.062	0.579	0.047	0.057	0.427
	123112	OTHR	0.525	-0.503	-0.569	0.003	-0.024	-0.027	0.002	0.006
		TEMP	-2.307	-0.056	-0.067	-0.143	-0.117	-0.095	-0.040	0.096
30 Pool Girder @ Fuel Pool	123017	OTHR	0.850	2.144	-1.045	-0.048	-0.102	0.077	0.004	-0.142
		TEMP	0.774	-6.892	-0.909	2.470	2.743	-0.228	0.208	0.415
	123117	OTHR	-0.277	0.601	-0.781	0.030	0.043	0.019	0.027	0.025
		TEMP	-0.985	-2.677	-0.715	2.293	1.832	-0.079	-0.209	0.279
31 MS Tunnel Wall and Slab	150122	OTHR	-0.184	-0.341	0.968	-0.013	0.073	0.021	-0.024	-0.052
		TEMP	2.226	-0.111	-0.753	3.639	3.907	0.083	-0.262	-0.322
	96611	OTHR	-0.094	0.552	-0.069	0.070	-0.127	-0.087	-0.200	0.008
		TEMP	-0.174	3.068	-0.248	-3.645	-6.606	-0.247	0.700	0.064
	98614	OTHR	0.017	-0.019	0.044	-0.334	-0.746	-0.071	-0.081	0.015
		TEMP	0.527	2.703	-0.288	9.377	13.644	0.044	-1.769	-0.155

Table 3G.1-47

Combined Forces and Moments: RB, Selected Load Combination RB-8b

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
18 Wall Below RCCV Bottom	6	OTHR	-2.461	-7.298	-0.309	0.287	1.350	-0.009	0.009	0.559
		TEMP	0.500	-1.652	-0.970	0.379	2.436	-0.053	0.065	0.459
	13	OTHR	-2.184	-5.983	-0.135	-0.074	-0.177	0.010	-0.005	0.048
		TEMP	-0.084	-4.089	-0.681	0.635	3.538	0.001	0.019	0.830
	24	OTHR	-1.602	-6.493	-0.421	-0.258	-1.530	-0.003	0.009	-0.570
		TEMP	0.018	-3.987	0.219	0.642	3.557	-0.009	0.000	0.840
19 Wall Below Below RCCV Mid-Height	806	OTHR	-1.141	-6.158	-0.157	0.016	0.200	0.000	-0.021	-0.045
		TEMP	1.716	-2.753	0.114	0.305	1.594	0.082	-0.064	-0.104
	813	OTHR	-1.662	-6.039	-0.073	0.010	0.275	-0.017	0.009	0.073
		TEMP	1.264	-4.042	-0.538	0.199	1.585	-0.036	0.005	0.613
	824	OTHR	-2.009	-6.663	-0.392	0.142	0.569	-0.009	-0.002	0.184
		TEMP	1.020	-4.014	0.230	0.220	1.644	0.029	0.013	0.560
20 Wall Below RCCV Top	1606	OTHR	1.409	-5.592	-0.135	-0.759	-4.186	0.024	0.007	1.196
		TEMP	15.254	-3.694	0.085	-0.865	-3.919	0.106	0.072	2.988
	1613	OTHR	0.896	-6.060	0.111	-0.739	-4.074	-0.003	-0.020	1.197
		TEMP	15.098	-4.772	-0.383	-0.955	-5.279	-0.012	-0.016	3.467
	1624	OTHR	0.642	-6.393	-0.253	-0.638	-3.821	0.010	-0.021	1.121
		TEMP	15.945	-5.116	-0.070	-1.065	-5.223	0.003	-0.102	3.540
21 Exterior Wall @ EL-11.50 ~-10.50m	20011	OTHR	-1.832	-3.190	-0.673	0.161	0.852	0.018	0.031	0.271
		TEMP	3.015	4.539	0.539	0.546	2.096	0.065	-0.209	0.722
	20023	OTHR	-1.201	-1.471	-0.498	0.006	-0.278	0.025	-0.039	-0.154
		TEMP	-3.247	-1.943	0.806	-2.359	-2.817	0.031	-0.795	-0.575
	30010	OTHR	-1.254	-2.205	-0.193	-0.186	-1.052	0.010	0.002	0.854
		TEMP	1.001	3.822	-0.190	1.305	4.878	-0.022	-0.029	-0.906
	30020	OTHR	-0.954	-1.608	-0.235	-0.560	-0.756	0.024	-0.155	0.323
		TEMP	-0.043	-1.519	-0.380	0.011	1.225	0.146	-0.023	-0.288
	40001	OTHR	-0.751	-1.780	0.367	-0.349	-1.065	-0.204	0.069	0.620
		TEMP	-0.085	-1.165	0.093	0.037	1.359	-0.099	0.110	-0.329
	40011	OTHR	-1.411	-3.021	-0.028	-0.240	-1.501	0.001	0.006	1.582
		TEMP	1.348	3.854	0.063	1.290	4.897	0.012	0.016	-0.910
22 Exterior Wall @ EL4.65 ~6.60m	22011	OTHR	0.359	-2.469	0.573	-0.005	0.110	0.012	-0.027	0.166
		TEMP	4.828	4.398	-0.287	-0.154	-0.139	0.067	0.044	0.162
	22023	OTHR	-0.041	-1.450	-0.006	0.144	0.051	-0.108	0.066	0.017
		TEMP	1.518	-2.692	0.328	0.990	0.017	-0.183	-0.173	0.000
	32010	OTHR	0.351	-1.753	0.018	-0.021	0.031	0.010	0.000	-0.125
		TEMP	16.476	7.814	-0.100	-2.875	-2.936	-0.003	-0.013	-0.029
	32020	OTHR	0.018	-1.724	0.242	0.025	-0.024	-0.067	0.027	0.031
		TEMP	0.610	4.810	2.460	0.061	-1.837	-0.391	1.189	0.188
	42001	OTHR	0.015	-1.768	0.090	0.058	-0.056	0.063	-0.021	0.052
		TEMP	2.708	3.726	2.529	0.074	-1.559	-0.037	-0.972	-0.233
	42011	OTHR	-0.008	-2.186	-0.007	-0.047	-0.102	-0.006	0.005	-0.081
		TEMP	14.259	5.931	0.283	-3.138	-2.902	0.064	0.089	0.069
23 Exterior Wall @ EL22.50 ~24.60m	24211	OTHR	0.455	-1.111	0.044	0.020	0.053	0.019	0.007	-0.339
		TEMP	5.628	6.168	-0.121	0.036	0.461	-0.032	-0.057	1.532
	24224	OTHR	0.002	-1.238	0.067	0.016	-0.023	-0.005	-0.036	-0.042
		TEMP	1.066	6.059	-3.947	1.882	0.047	-0.627	-1.457	-0.289
	34210	OTHR	0.696	-0.635	0.121	0.008	0.191	-0.004	0.000	0.069
		TEMP	21.500	5.814	-0.637	-2.922	-2.837	0.043	-0.005	-0.143
	34220	OTHR	0.055	-1.225	-0.049	0.058	0.032	0.016	0.028	-0.013
		TEMP	2.573	6.295	3.703	2.522	-1.254	-0.604	2.464	0.060
	44201	OTHR	0.040	-1.311	-0.094	0.061	0.028	0.008	-0.030	-0.008
		TEMP	1.787	7.067	-0.242	2.081	-1.543	0.575	-2.867	0.058

Table 3G.1-47
Combined Forces and Moments: RB, Selected Load Combination RB-8b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
24 Basemat @ Wall Below	90140	OTHR	-2.862	-2.514	0.127	-1.580	-0.714	0.924	-2.518	2.183
		TEMP	0.656	1.198	1.910	-1.176	-1.209	-0.620	-1.549	0.481
	90182	OTHR	-1.848	-2.294	-0.217	-0.546	-0.719	0.279	0.024	1.236
		TEMP	2.512	0.741	0.349	-1.062	-5.489	0.225	-0.058	3.881
	90111	OTHR	-3.843	-1.594	-0.010	-1.109	-0.398	-0.265	0.594	0.273
		TEMP	0.765	3.129	-0.048	-5.573	-1.340	0.131	3.888	0.160
25 Slab EL4.65m @ RCCV	93140	OTHR	-0.207	0.438	0.722	0.132	0.137	-0.138	0.128	-0.108
		TEMP	0.492	2.917	5.382	-0.741	-0.577	0.416	-0.195	0.167
	93182	OTHR	0.701	-0.285	0.024	-0.018	0.086	0.012	-0.001	0.070
		TEMP	5.915	-4.974	-1.483	-0.488	-2.534	-0.114	0.106	1.921
	93111	OTHR	0.005	0.607	-0.115	0.066	-0.023	-0.003	0.050	-0.005
		TEMP	-4.283	6.565	-0.433	-2.488	-0.436	-0.068	1.677	0.002
26 Slab EL17.5m @ RCCV	96144	OTHR	0.061	0.786	0.953	0.111	0.113	-0.099	0.131	-0.114
		TEMP	0.700	5.749	8.267	-0.286	-0.227	0.196	-0.057	0.076
	96186	OTHR	1.209	-0.500	-0.061	-0.018	-0.027	0.001	0.001	-0.022
		TEMP	9.948	-4.570	-2.192	-0.167	-0.770	-0.060	0.028	0.708
	96113	OTHR	-0.749	1.860	-0.206	-0.017	0.009	0.004	0.169	0.028
		TEMP	-8.874	6.067	-1.617	-4.618	-2.819	-0.231	0.824	-0.088
27 Slab EL27.0m @ RCCV	98472	OTHR	0.521	0.650	-0.233	0.003	0.035	-0.025	0.143	-0.194
		TEMP	-4.962	-2.596	6.296	-1.806	-1.112	-0.359	0.516	-0.793
	98514	OTHR	0.352	0.462	0.104	-0.033	-0.298	-0.002	0.004	-0.067
		TEMP	-2.970	-2.936	-1.382	-1.925	-1.714	-0.029	0.056	-0.715
	98424	OTHR	0.276	1.415	-0.202	-0.298	0.006	-0.240	-0.290	-0.056
		TEMP	-8.160	-4.306	-3.504	8.110	4.330	0.601	-4.475	-0.830
28 Pool Girder @ Storage Pool	123004	OTHR	1.040	1.803	1.811	0.049	0.223	-0.077	0.075	0.152
		TEMP	-3.773	-8.910	2.443	-3.192	-1.409	-0.451	-0.296	2.590
	123104	OTHR	0.279	0.492	1.880	-0.004	-0.023	-0.009	0.028	0.046
		TEMP	-0.908	-1.329	2.320	-4.096	-4.643	0.160	-1.017	0.189
29 Pool Girder @ Cavity	123012	OTHR	-0.447	-1.207	-0.748	0.027	0.351	-0.013	0.053	0.257
		TEMP	-1.054	-0.015	-0.253	-3.807	-2.087	0.177	0.085	1.518
	123112	OTHR	0.736	-0.715	-0.728	0.005	-0.010	-0.038	0.002	0.008
		TEMP	0.270	0.204	-0.469	-4.115	-3.707	-0.173	-0.004	-0.028
30 Pool Girder @ Fuel Pool	123017	OTHR	0.953	2.523	-1.579	-0.066	-0.144	0.104	-0.005	-0.179
		TEMP	5.174	-7.676	-2.218	2.827	2.660	-0.299	0.268	0.240
	123117	OTHR	-0.253	0.690	-1.315	0.030	0.047	0.030	0.031	0.026
		TEMP	1.809	-2.768	-0.560	2.974	1.894	-0.159	-0.541	0.254
31 MS Tunnel Wall and Slab	150122	OTHR	-0.165	-0.317	0.982	-0.023	0.068	0.020	-0.022	-0.058
		TEMP	2.279	-0.182	-0.887	3.448	3.933	0.118	-0.222	-0.262
	96611	OTHR	-0.127	0.596	-0.083	0.040	-0.167	-0.089	-0.189	0.009
		TEMP	-0.295	3.728	-0.322	-3.550	-6.604	-0.232	0.690	0.063
	98614	OTHR	0.041	-0.029	0.050	-0.413	-0.769	-0.076	-0.068	0.016
		TEMP	1.306	2.277	-0.049	9.353	14.160	-0.019	-1.882	-0.168

Table 3G.1-48

Combined Forces and Moments: RB, Selected Load Combination RB-9a

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
18 Wall Below RCCV Bottom	6	OTHR	-2.277	-8.129	-0.186	0.176	0.701	-0.006	0.002	0.363
		TEMP	0.931	-1.122	-0.745	0.243	1.608	-0.041	0.046	0.242
		EQEW	4.080	9.611	-4.318	-0.696	-3.389	-0.046	0.140	-1.392
		EQNS	-4.226	-2.828	-3.149	0.950	5.629	0.027	0.006	2.014
		EQZ	-0.321	4.250	-0.279	0.231	1.518	-0.009	0.024	0.450
		EQT	0.666	0.149	0.610	-0.044	-0.288	-0.014	0.027	-0.152
		SPKW	-0.491	0.161	-0.422	-0.051	-0.221	-0.034	0.064	-0.040
		SPKN	-0.386	-0.001	0.016	0.009	0.091	0.009	-0.016	0.064
	13	OTHR	-2.021	-6.714	-0.066	-0.201	-0.894	0.011	-0.007	-0.162
		TEMP	0.411	-3.019	-0.612	0.436	2.455	0.002	0.013	0.527
		EQEW	4.939	9.278	0.447	-0.384	-2.349	-0.019	0.036	-1.176
		EQNS	-0.092	2.940	-3.947	0.616	3.308	-0.083	0.135	0.998
		EQZ	-0.421	3.452	-0.258	0.399	2.157	-0.007	0.010	0.633
		EQT	0.548	0.139	0.740	-0.080	-0.369	-0.006	0.013	-0.168
		SPKW	0.171	0.101	0.078	-0.066	-0.733	-0.008	0.009	-0.359
		SPKN	-0.924	0.001	-0.248	0.008	0.263	0.004	-0.003	0.188
	24	OTHR	-1.387	-7.320	-0.442	-0.394	-2.280	-0.002	0.008	-0.786
		TEMP	0.330	-3.256	0.153	0.473	2.598	-0.007	0.001	0.588
		EQEW	0.630	0.657	6.609	0.010	-0.204	0.106	-0.160	-0.129
		EQNS	2.743	8.464	-0.014	0.216	1.126	-0.009	0.003	-0.018
		EQZ	-0.417	3.860	0.100	0.425	2.253	-0.005	0.002	0.637
		EQT	0.075	0.011	1.005	0.002	-0.029	-0.003	0.005	-0.017
		SPKW	-0.938	0.026	0.082	0.024	0.350	0.003	-0.006	0.230
		SPKN	0.179	0.094	-0.078	-0.086	-0.857	-0.006	0.008	-0.423
19 Wall Below Below RCCV Mid-Height	806	OTHR	-1.203	-6.985	-0.069	0.014	0.182	-0.004	-0.019	-0.052
		TEMP	1.402	-1.850	0.087	0.220	1.175	0.076	-0.051	-0.079
		EQEW	0.690	7.399	-5.103	-0.009	0.249	-0.132	-0.022	0.020
		EQNS	-2.173	-2.516	-3.422	-0.138	-0.431	-0.021	0.024	0.198
		EQZ	-0.054	3.702	-0.048	-0.019	-0.024	0.019	-0.004	0.065
		EQT	0.313	0.075	0.573	0.023	0.068	-0.031	-0.006	-0.004
		SPKW	-1.132	0.198	-0.192	-0.014	0.070	-0.024	-0.049	-0.015
		SPKN	-0.360	0.086	0.077	-0.040	-0.026	0.000	0.000	0.010
	813	OTHR	-1.727	-6.723	-0.008	0.002	0.242	-0.021	0.008	0.037
		TEMP	0.936	-3.006	-0.511	0.150	1.159	-0.032	0.010	0.459
		EQEW	1.979	8.078	0.751	0.012	0.364	-0.002	-0.016	-0.087
		EQNS	-0.413	3.201	-4.445	-0.018	-0.076	0.039	-0.051	0.288
		EQZ	0.021	3.433	-0.210	0.018	0.014	0.021	-0.002	0.157
		EQT	0.211	0.052	0.809	-0.001	0.055	-0.050	0.006	-0.020
		SPKW	-0.838	-0.098	0.007	0.119	0.414	0.024	-0.016	0.042
		SPKN	-0.761	0.184	-0.138	-0.077	-0.142	-0.003	0.013	-0.003
	824	OTHR	-2.043	-7.509	-0.418	0.127	0.538	-0.010	-0.001	0.139
		TEMP	0.749	-3.304	0.159	0.167	1.199	0.020	0.009	0.452
		EQEW	0.194	0.650	7.276	0.037	0.064	0.059	0.069	0.036
		EQNS	0.979	7.859	-0.125	0.047	0.231	0.002	-0.001	0.236
		EQZ	-0.053	3.860	0.103	0.036	0.019	0.007	-0.003	0.199
		EQT	0.021	0.007	1.071	0.007	0.007	-0.019	0.010	0.004
		SPKW	-0.931	0.329	0.017	-0.093	-0.178	-0.001	-0.001	-0.007
		SPKN	-0.869	-0.134	0.000	0.164	0.434	0.008	-0.002	0.065

OTHR: Loads other than thermal and seismic loads
TEMP: Thermal loads
EQEW: Horizontal seismic loads in the E-W direction
EQNS: Horizontal seismic loads in the N-S direction
EQZ: Vertical seismic loads
EQT: Torsional seismic loads
SPKW: Dynamic soil pressure during a horizontal earthquake in the E-W direction
SPKN: Dynamic soil pressure during a horizontal earthquake in the N-S direction

Table 3G.1-48
Combined Forces and Moments: RB, Selected Load Combination RB-9a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
20 Wall Below RCCV Top	1606	OTHR	0.988	-6.414	-0.050	-0.652	-3.566	0.024	0.007	1.000
		TEMP	10.805	-2.483	0.058	-0.665	-3.014	0.082	0.059	2.184
		EQEW	0.628	5.038	-5.272	0.082	0.563	-0.019	-0.005	-0.110
		EQNS	-1.483	-1.946	-3.743	-0.333	-1.320	-0.069	-0.002	0.183
		EQZ	0.407	3.300	-0.034	-0.123	-0.670	-0.005	0.004	0.219
		EQT	0.125	0.054	0.710	0.010	0.019	-0.017	-0.002	0.013
		SPKW	-0.530	0.104	0.453	-0.034	-0.146	0.069	0.006	0.014
		SPKN	-0.181	0.094	-0.130	-0.042	-0.060	-0.016	0.001	-0.009
	1613	OTHR	0.487	-6.687	0.163	-0.628	-3.449	-0.001	-0.019	0.987
		TEMP	10.442	-3.559	-0.426	-0.713	-4.000	-0.009	-0.013	2.514
		EQEW	1.016	6.058	0.909	0.148	0.962	-0.001	0.010	-0.200
		EQNS	-0.138	3.051	-4.514	-0.243	-1.271	-0.022	0.009	0.366
		EQZ	0.540	3.308	-0.149	-0.128	-0.778	-0.005	0.002	0.270
		EQT	0.086	-0.041	0.872	0.017	0.106	-0.027	-0.001	-0.022
		SPKW	-0.031	0.069	-0.065	-0.049	-0.514	0.002	0.003	0.244
		SPKN	-0.507	0.074	0.116	-0.030	0.051	-0.007	-0.005	-0.089
	1624	OTHR	0.189	-7.266	-0.268	-0.522	-3.152	0.008	-0.022	0.897
		TEMP	11.250	-4.196	-0.083	-0.794	-4.030	0.001	-0.077	2.602
		EQEW	0.076	0.521	7.447	-0.016	-0.009	0.052	-0.049	0.027
		EQNS	0.985	6.565	-0.214	-0.062	-0.477	-0.009	0.004	0.204
		EQZ	0.471	3.747	0.069	-0.133	-0.780	0.001	0.004	0.262
		EQT	0.003	0.006	1.120	-0.002	-0.001	-0.016	-0.006	0.002
		SPKW	-0.642	0.163	-0.047	-0.043	0.061	-0.002	0.004	-0.106
		SPKN	-0.081	0.048	0.057	-0.023	-0.469	0.002	-0.011	0.215

Table 3G.1-48
Combined Forces and Moments: RB, Selected Load Combination RB-9a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
21 Exterior Wall @ EL-11.50 ~-10.50m	20011	OTHR	-1.878	-3.430	-0.688	0.093	0.598	0.013	0.039	0.191
		TEMP	2.705	3.066	0.389	0.368	1.368	0.053	-0.156	0.466
		EQEW	-0.657	-0.961	-9.354	-0.082	0.416	0.025	0.100	0.091
		EQNS	-0.662	-1.083	0.877	1.978	8.162	0.050	-0.088	3.032
		EQZ	0.399	2.223	0.230	0.022	-0.013	-0.003	-0.031	-0.030
		EQT	0.045	0.000	0.742	0.044	0.150	-0.010	0.016	0.051
		SPKW	-0.940	0.122	0.125	0.019	0.107	-0.005	-0.002	0.047
		SPKN	0.198	0.046	-0.209	-0.099	-0.402	0.004	0.000	-0.193
	20023	OTHR	-1.204	-1.442	-0.478	0.028	-0.296	0.025	-0.042	-0.165
		TEMP	-3.251	-1.996	0.825	-2.301	-2.914	0.034	-0.800	-0.621
		EQEW	0.059	4.728	-0.475	0.320	0.224	-0.093	-0.079	0.031
		EQNS	-0.008	-1.289	-0.936	-0.832	1.337	0.170	1.299	0.909
		EQZ	0.013	0.711	0.290	-0.077	0.136	0.003	0.048	0.091
		EQT	-0.071	-0.099	0.316	0.150	-0.095	-0.040	-0.281	-0.111
		SPKW	-0.619	-0.161	0.146	-0.075	-0.036	0.004	0.016	0.014
		SPKN	0.085	0.082	-0.115	-0.003	-0.002	0.005	0.015	-0.017
	30010	OTHR	-1.339	-2.257	-0.187	-0.273	-1.482	0.014	0.004	0.945
		TEMP	0.724	2.695	-0.073	1.092	3.667	-0.017	-0.022	-0.637
		EQEW	3.694	3.409	0.982	-0.320	-1.172	-0.031	-0.026	0.395
		EQNS	1.283	2.225	-3.374	0.481	2.677	-0.053	-0.091	-0.745
		EQZ	0.086	1.161	-0.023	0.250	1.318	-0.013	-0.005	-0.300
		EQT	0.623	-0.159	0.842	-0.074	-0.293	-0.013	-0.017	0.102
		SPKW	-0.102	-0.362	0.000	-0.054	-0.444	-0.009	-0.009	0.538
		SPKN	-0.755	0.135	-0.073	0.018	0.168	0.006	0.006	-0.068
	30020	OTHR	-0.978	-1.495	-0.216	-0.527	-0.769	0.015	-0.163	0.324
		TEMP	-0.071	-1.233	-0.217	0.074	1.116	0.124	-0.017	-0.276
		EQEW	0.512	2.678	1.213	-0.065	0.349	0.031	0.086	-0.091
		EQNS	0.109	2.149	-0.455	0.024	1.101	0.025	-0.285	-0.252
		EQZ	0.037	0.598	0.129	-0.136	0.364	0.042	-0.080	-0.124
		EQT	0.111	-0.186	0.205	-0.040	-0.050	0.005	0.118	-0.005
		SPKW	-0.077	-0.160	-0.125	-0.069	-0.255	0.115	-0.007	0.145
		SPKN	-0.231	-0.074	0.067	-0.289	0.022	-0.037	-0.108	-0.046
	40001	OTHR	-0.765	-1.678	0.319	-0.316	-1.096	-0.198	0.071	0.627
		TEMP	-0.153	-0.846	0.059	0.127	1.264	-0.082	0.120	-0.316
		EQEW	0.005	3.037	0.977	0.369	1.132	0.016	0.362	-0.176
		EQNS	0.366	1.950	-0.726	-0.198	0.593	-0.080	0.012	-0.170
		EQZ	0.033	0.628	-0.099	-0.139	0.376	-0.039	0.082	-0.123
		EQT	-0.020	0.049	0.302	0.129	0.031	0.017	0.064	0.042
		SPKW	-0.237	-0.076	-0.075	-0.240	0.040	0.034	0.086	-0.041
		SPKN	-0.097	-0.190	0.116	-0.103	-0.367	-0.143	-0.008	0.163
	40011	OTHR	-1.403	-3.110	-0.031	-0.333	-1.960	-0.002	0.005	1.677
		TEMP	0.891	3.003	0.054	1.119	3.906	0.009	0.013	-0.707
		EQEW	-0.252	-0.361	4.538	0.015	-0.047	0.085	0.124	-0.029
		EQNS	3.276	3.698	-0.076	0.140	1.121	0.012	0.005	-0.164
		EQZ	0.128	1.494	-0.001	0.288	1.476	0.009	0.002	-0.326
		EQT	-0.021	-0.014	0.917	0.006	0.005	-0.006	-0.007	-0.010
		SPKW	-0.539	0.209	0.000	0.020	0.248	-0.002	-0.003	-0.104
		SPKN	-0.224	-0.417	-0.024	-0.053	-0.519	0.004	0.004	0.587

Table 3G.1-48
Combined Forces and Moments: RB, Selected Load Combination RB-9a (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
22 Exterior Wall @ EL4.65 ~6.60m	22011	OTHR	0.121	-2.632	0.608	-0.007	0.075	0.009	-0.025	0.118
		TEMP	3.318	2.710	-0.171	-0.103	-0.066	0.048	0.030	0.058
		EQEW	0.466	3.318	-6.436	0.034	-0.023	-0.021	0.029	-0.002
		EQNS	-0.441	-7.125	2.468	0.116	0.966	0.154	-0.038	0.853
		EQZ	-0.121	1.929	-0.415	0.007	-0.026	-0.001	0.012	-0.024
		EQT	0.025	-0.350	0.750	-0.005	-0.001	-0.020	0.001	-0.005
		SPKW	-0.649	0.235	-0.140	-0.009	-0.013	0.003	-0.002	0.000
		SPKN	0.118	0.144	0.013	0.025	0.049	-0.007	-0.003	0.073
	22023	OTHR	-0.066	-1.476	-0.046	0.076	0.032	-0.093	0.084	0.021
		TEMP	1.285	-3.170	0.477	0.534	-0.054	-0.170	0.006	0.009
		EQEW	0.069	4.568	-3.234	0.055	-0.073	0.086	-0.202	-0.079
		EQNS	0.104	-4.679	-0.933	-0.214	0.171	-0.153	0.394	0.153
		EQZ	-0.017	0.997	0.206	0.074	0.002	0.011	-0.052	-0.011
		EQT	-0.067	0.247	0.587	0.014	-0.006	-0.010	-0.027	-0.017
		SPKW	-0.336	-0.137	0.601	0.024	0.011	-0.023	0.019	-0.004
		SPKN	0.015	0.083	0.162	0.081	0.009	-0.006	-0.026	0.005
	32010	OTHR	0.050	-1.814	0.027	-0.020	-0.010	0.006	0.000	-0.063
		TEMP	14.112	6.168	-0.023	-2.775	-2.672	0.003	-0.007	-0.020
		EQEW	0.643	3.408	0.932	-0.019	-0.097	-0.012	-0.001	0.219
		EQNS	-0.867	1.234	-3.866	-0.010	-0.012	0.000	-0.002	-0.103
		EQZ	0.012	1.087	-0.027	-0.001	-0.028	-0.002	0.000	0.013
		EQT	0.223	-0.010	0.982	-0.001	0.007	-0.018	0.002	0.009
		SPKW	-0.043	-0.151	0.004	-0.022	-0.175	-0.001	0.000	0.010
		SPKN	-0.319	0.066	0.060	-0.009	-0.002	0.000	0.001	0.003
	32020	OTHR	-0.009	-1.788	0.119	-0.028	-0.040	-0.043	-0.008	0.023
		TEMP	0.400	4.604	2.519	-0.338	-1.807	-0.378	0.875	0.157
		EQEW	0.047	2.920	2.784	0.125	-0.060	0.015	0.091	0.016
		EQNS	-0.041	3.265	-1.524	0.147	0.024	0.003	0.129	-0.002
		EQZ	0.032	1.252	0.072	0.042	0.001	0.007	0.038	0.006
		EQT	0.005	-0.203	0.864	-0.003	-0.004	-0.011	-0.004	0.011
		SPKW	-0.005	-0.031	-0.126	0.016	-0.068	-0.102	-0.059	0.022
		SPKN	-0.200	-0.101	0.256	-0.171	-0.038	0.044	-0.041	0.004
	42001	OTHR	-0.016	-1.855	0.037	-0.011	-0.071	0.055	0.003	0.046
		TEMP	2.426	3.483	2.473	-0.440	-1.604	-0.045	-0.762	-0.249
		EQEW	-0.017	2.714	2.956	0.166	0.064	-0.012	-0.063	-0.031
		EQNS	0.127	3.461	-1.547	0.200	-0.027	-0.023	-0.077	-0.010
		EQZ	0.039	1.311	0.061	0.053	0.002	-0.001	-0.027	0.002
		EQT	-0.019	-0.222	0.860	-0.003	0.013	-0.013	0.003	-0.013
		SPKW	-0.121	-0.041	-0.237	-0.084	-0.024	-0.041	0.004	0.003
		SPKN	-0.037	-0.085	0.119	-0.029	-0.061	0.133	0.133	0.022
	42011	OTHR	-0.260	-2.382	-0.038	-0.037	-0.124	-0.002	0.005	-0.026
		TEMP	12.516	4.854	0.184	-2.941	-2.613	0.072	0.080	0.063
		EQEW	0.214	-0.581	5.945	0.045	0.003	0.018	0.040	-0.015
		EQNS	0.749	3.196	0.267	0.003	-0.098	0.009	0.000	0.092
		EQZ	0.214	1.479	0.058	-0.001	-0.021	0.002	-0.002	0.005
		EQT	0.051	-0.064	1.181	0.005	0.001	-0.011	0.005	-0.002
		SPKW	-0.203	0.107	0.030	-0.015	0.003	-0.001	-0.002	-0.002
		SPKN	-0.091	-0.212	0.024	-0.022	-0.149	0.014	0.024	0.006

Table 3G.1-48
Combined Forces and Moments: RB, Selected Load Combination RB-9a (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
23 Exterior Wall @ EL22.50 ~24.60m	24211	OTHR	0.185	-1.298	0.054	-0.017	-0.161	0.014	0.003	-0.236
		TEMP	3.814	3.230	-0.215	-0.028	0.139	-0.034	-0.045	1.652
		EQEW	-0.114	0.162	-5.394	-0.003	0.026	0.015	0.004	0.008
		EQNS	-1.174	-5.369	0.191	-0.170	-0.660	-0.042	-0.003	0.840
		EQZ	0.087	0.973	-0.055	0.074	0.507	-0.011	0.000	0.135
		EQT	0.000	-0.040	0.890	-0.001	-0.004	-0.032	-0.005	0.020
		SPKW	-0.053	-0.031	-0.004	0.002	0.009	-0.001	0.000	0.000
		SPKN	-0.026	0.065	-0.028	-0.003	-0.003	0.000	-0.001	0.015
	24224	OTHR	-0.011	-1.086	0.160	0.018	-0.043	-0.019	-0.050	-0.047
		TEMP	0.397	5.311	-3.629	0.850	-0.366	-0.448	-0.780	-0.397
		EQEW	0.259	3.913	-3.713	-0.231	-0.100	-0.022	0.227	-0.045
		EQNS	-0.282	-7.465	0.532	0.695	1.033	-0.289	0.178	1.126
		EQZ	0.039	0.762	-0.252	-0.010	0.046	0.050	0.040	0.028
		EQT	-0.026	0.368	0.803	-0.082	-0.201	0.028	-0.100	-0.263
		SPKW	-0.001	0.002	0.020	0.006	-0.005	0.002	-0.012	-0.007
		SPKN	-0.006	-0.120	0.071	0.031	0.062	-0.006	0.036	0.080
	34210	OTHR	0.385	-0.705	0.108	0.007	0.100	-0.003	0.002	0.041
		TEMP	14.993	4.941	-0.346	-2.787	-2.420	0.017	-0.013	0.093
		EQEW	-0.199	1.096	0.772	0.064	0.354	-0.010	-0.002	0.139
		EQNS	-1.211	0.237	-3.509	-0.031	-0.189	-0.011	0.011	-0.088
		EQZ	0.013	0.514	-0.045	-0.006	-0.005	0.001	-0.003	-0.011
		EQT	0.183	-0.017	1.010	0.002	0.017	-0.008	0.000	0.008
		SPKW	0.016	-0.040	0.002	-0.002	-0.023	0.001	0.000	-0.010
		SPKN	-0.098	0.000	-0.003	-0.001	0.001	-0.001	0.000	0.000
	34220	OTHR	0.056	-1.100	-0.095	0.054	0.006	0.003	0.034	-0.005
		TEMP	1.556	5.056	1.786	0.885	-1.523	-0.164	1.522	-0.010
		EQEW	-0.162	0.839	2.354	0.119	0.142	0.026	0.026	-0.022
		EQNS	-0.048	1.855	-1.261	0.007	0.010	-0.003	0.014	-0.006
		EQZ	-0.042	0.660	0.115	-0.034	0.017	0.007	-0.029	-0.002
		EQT	0.022	-0.043	0.825	0.027	0.009	-0.016	0.006	0.019
		SPKW	0.004	0.012	-0.005	0.004	-0.002	-0.002	0.003	0.001
		SPKN	-0.001	0.024	-0.002	0.001	0.000	0.001	0.000	-0.001
	44201	OTHR	0.030	-1.212	-0.195	0.053	0.009	0.013	-0.038	-0.004
		TEMP	0.989	5.532	-0.249	0.541	-1.740	0.350	-1.832	0.050
		EQEW	0.145	0.808	2.848	0.066	0.009	0.059	-0.076	0.024
		EQNS	-0.107	2.171	-1.075	0.032	0.040	-0.008	0.012	-0.013
		EQZ	-0.013	0.763	0.232	-0.031	0.008	-0.010	0.033	0.001
		EQT	0.031	-0.063	0.814	0.013	-0.003	-0.009	-0.025	-0.019
		SPKW	0.002	0.012	0.001	0.004	0.001	-0.002	-0.002	-0.001
		SPKN	0.003	0.022	0.007	0.000	-0.002	0.000	-0.001	0.000

Table 3G.1-48
Combined Forces and Moments: RB, Selected Load Combination RB-9a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
24 Basemat @ Wall Below	90140	OTHR	-2.775	-2.595	-0.016	-2.285	-1.271	1.697	-2.645	2.382
		TEMP	0.810	0.936	1.517	-0.214	-0.335	-0.493	-1.094	0.272
		EQEW	0.415	4.638	2.888	0.033	3.216	-2.595	2.865	-5.032
		EQNS	0.034	1.460	-2.130	-6.707	-0.901	-0.370	-2.810	1.163
		EQZ	-0.060	0.480	0.263	1.419	0.971	-2.078	0.964	-1.107
		EQT	0.965	-0.447	0.984	0.658	0.012	-0.229	0.294	0.106
		SPKW	-0.052	-1.084	-0.003	-0.119	0.019	-0.123	-0.029	-0.213
		SPKN	-1.849	0.114	-0.120	-0.044	-0.045	0.049	-0.037	0.017
	90182	OTHR	-2.103	-2.317	-0.223	-0.372	-1.614	0.181	0.061	1.376
		TEMP	2.212	0.531	0.485	-0.412	-3.757	0.157	-0.104	2.793
		EQEW	6.054	0.571	0.309	0.153	-0.445	-0.242	-0.046	-3.502
		EQNS	3.163	0.701	-1.456	-1.619	-0.476	1.390	-1.659	0.675
		EQZ	0.369	0.221	0.046	-0.592	1.442	0.238	-0.137	-0.399
		EQT	1.000	0.064	0.515	0.020	0.260	-0.335	0.346	-0.258
		SPKW	0.120	-1.176	-0.143	-0.170	-0.632	-0.021	0.026	-0.440
		SPKN	-1.507	0.096	0.137	-0.018	-0.210	0.106	-0.110	0.162
	90111	OTHR	-3.876	-1.729	0.008	-1.955	-0.228	-0.380	0.736	0.289
		TEMP	0.599	2.397	-0.039	-4.358	-0.699	0.073	3.051	0.135
		EQEW	-0.250	0.765	-0.889	-0.470	0.409	1.439	-0.060	-2.916
		EQNS	1.027	5.920	-0.258	0.380	-1.228	0.393	-2.033	-0.131
		EQZ	0.246	0.490	-0.027	1.301	-0.708	0.327	-0.439	-0.071
		EQT	-0.052	0.035	-0.613	-0.075	0.084	0.414	0.010	-0.492
		SPKW	0.162	-1.308	0.049	-0.226	-0.098	0.013	0.201	-0.026
		SPKN	-1.233	0.065	-0.048	-0.638	-0.141	0.024	-0.484	0.020
25 Slab EL4.65m @ RCCV	93140	OTHR	-0.268	0.369	0.667	0.109	0.120	-0.121	0.125	-0.104
		TEMP	0.137	2.182	3.808	-0.512	-0.403	0.288	-0.137	0.113
		EQEW	0.376	-0.215	-0.049	0.156	0.126	-0.093	0.047	-0.033
		EQNS	-1.560	0.330	-0.338	-0.361	-0.226	0.156	-0.082	0.108
		EQZ	-0.001	-0.080	-0.032	-0.041	-0.051	0.031	-0.067	0.055
		EQT	0.164	-0.083	0.044	0.017	0.011	-0.010	0.005	-0.005
		SPKW	0.047	-0.822	0.094	-0.028	-0.028	0.019	-0.015	0.002
		SPKN	-0.302	0.113	-0.040	-0.001	-0.004	0.002	0.000	0.002
	93182	OTHR	0.570	-0.324	0.024	-0.016	0.064	0.012	-0.001	0.056
		TEMP	3.923	-3.798	-1.042	-0.359	-1.845	-0.083	0.076	1.379
		EQEW	0.013	-0.083	-0.165	0.085	0.479	0.017	-0.023	-0.425
		EQNS	-0.546	-0.147	-0.448	-0.089	-0.343	-0.012	0.018	0.317
		EQZ	-0.073	-0.068	-0.025	-0.020	-0.060	-0.004	0.005	0.099
		EQT	0.070	0.029	-0.054	0.008	0.039	0.000	-0.002	-0.035
		SPKW	-0.143	-0.871	-0.027	-0.030	-0.155	-0.009	0.008	0.161
		SPKN	-0.252	-0.027	0.059	0.003	0.012	0.001	-0.001	-0.011
	93111	OTHR	-0.033	0.501	-0.094	0.045	-0.021	-0.003	0.041	-0.004
		TEMP	-3.346	4.625	-0.234	-1.884	-0.337	-0.050	1.257	0.001
		EQEW	0.148	0.059	-0.226	0.001	-0.009	-0.026	0.012	0.006
		EQNS	-0.088	-0.093	0.017	0.067	-0.003	0.007	-0.042	0.002
		EQZ	-0.045	-0.094	0.017	-0.092	-0.023	-0.003	0.105	0.002
		EQT	0.004	0.003	0.000	-0.002	-0.002	-0.002	0.003	0.000
		SPKW	0.021	-0.214	0.023	0.018	0.003	0.001	-0.014	0.000
		SPKN	-0.906	-0.142	0.121	-0.154	-0.028	-0.007	0.135	-0.001

Table 3G.1-48
Combined Forces and Moments: RB, Selected Load Combination RB-9a (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
26 Slab EL17.5m @ RCCV	96144	OTHR	0.003	0.515	0.612	0.063	0.076	-0.071	0.120	-0.102
		TEMP	-0.269	4.658	7.008	-0.257	-0.148	0.178	-0.080	0.026
		EQEW	-0.105	-0.246	-0.165	0.139	0.119	-0.090	0.046	-0.017
		EQNS	-0.551	0.162	0.116	-0.295	-0.230	0.156	-0.061	0.070
		EQZ	0.200	-0.155	-0.096	-0.036	-0.037	0.029	-0.072	0.054
		EQT	0.135	-0.045	0.000	0.011	0.010	-0.006	0.003	-0.001
		SPKW	0.019	-0.035	0.000	-0.004	-0.004	0.002	-0.002	0.000
		SPKN	-0.063	0.031	-0.002	0.002	-0.001	0.000	0.001	0.000
	96186	OTHR	0.783	-0.306	0.015	-0.030	-0.101	-0.004	0.003	0.038
		TEMP	6.641	-4.128	-1.421	-0.104	-0.385	-0.051	0.018	0.399
		EQEW	-0.330	0.169	-0.231	0.108	0.616	0.023	-0.031	-0.490
		EQNS	-0.608	-0.144	0.033	-0.075	-0.342	-0.012	0.027	0.274
		EQZ	-0.178	0.088	0.017	0.003	0.021	-0.001	0.006	0.023
		EQT	0.064	0.032	-0.075	0.005	0.025	-0.001	-0.002	-0.022
		SPKW	0.040	0.012	-0.002	-0.011	-0.049	-0.002	0.002	0.040
		SPKN	-0.077	-0.028	0.030	0.001	0.004	0.001	0.000	-0.003
	96113	OTHR	-0.447	1.321	-0.113	-0.251	-0.029	-0.007	0.340	0.042
		TEMP	-8.012	3.448	-1.490	-4.673	-2.833	-0.192	1.013	-0.053
		EQEW	0.093	-0.157	0.672	0.081	0.033	-0.003	-0.018	0.044
		EQNS	0.211	-1.036	0.004	0.468	-0.036	-0.012	-0.448	-0.066
		EQZ	0.138	-0.325	0.062	0.169	-0.011	-0.009	-0.171	-0.016
		EQT	0.010	-0.006	0.231	0.008	0.008	0.007	0.003	0.011
		SPKW	-0.039	-0.093	-0.004	0.033	0.008	0.001	-0.022	-0.002
		SPKN	0.042	0.100	0.008	-0.114	-0.024	-0.004	0.084	0.007
27 Slab EL27.0m @ RCCV	98472	OTHR	0.517	0.428	-0.152	0.029	0.059	-0.064	0.170	-0.177
		TEMP	-1.976	-0.331	5.371	-0.390	0.080	-0.331	0.460	-0.565
		EQEW	0.368	-1.005	-0.324	0.038	0.037	-0.017	0.011	-0.012
		EQNS	1.119	-0.227	0.006	-0.157	-0.188	0.097	-0.125	0.084
		EQZ	-0.147	0.039	-0.075	-0.116	-0.166	0.128	-0.206	0.148
		EQT	-0.089	0.058	0.007	0.014	0.016	-0.011	0.014	-0.007
		SPKW	0.037	-0.008	-0.012	-0.004	-0.007	0.003	-0.006	0.003
		SPKN	-0.066	0.024	0.010	0.000	-0.001	0.000	0.000	0.001
	98514	OTHR	0.261	0.335	0.118	-0.024	-0.215	0.007	0.002	-0.043
		TEMP	0.290	-2.436	-1.243	-0.535	-0.083	-0.010	0.037	-0.712
		EQEW	-0.436	0.202	-0.314	0.063	0.442	-0.005	-0.007	-0.334
		EQNS	-0.235	-0.151	-0.159	-0.073	-0.260	0.002	0.008	0.265
		EQZ	0.011	-0.071	-0.044	-0.025	-0.082	-0.018	-0.002	0.114
		EQT	0.074	0.006	-0.051	0.005	0.022	-0.002	-0.001	-0.021
		SPKW	0.030	-0.008	-0.004	-0.007	-0.034	-0.001	0.000	0.028
		SPKN	-0.025	-0.007	0.021	0.000	-0.001	0.001	0.000	0.000
	98424	OTHR	0.240	1.022	-0.125	0.488	0.128	-0.136	-0.561	-0.113
		TEMP	-9.771	-8.139	-2.242	6.366	3.591	0.270	-4.372	-0.664
		EQEW	0.659	-0.569	-5.339	0.057	0.036	-0.148	0.029	-0.002
		EQNS	0.941	-1.089	0.420	-1.018	-0.413	0.137	1.105	0.161
		EQZ	-0.029	-0.290	0.019	-1.420	-0.331	-0.030	0.841	0.152
		EQT	0.057	-0.034	-0.745	0.023	0.019	0.018	-0.014	0.006
		SPKW	0.005	-0.004	-0.003	0.032	0.015	-0.002	-0.023	-0.005
		SPKN	-0.007	0.009	0.005	-0.070	-0.034	0.000	0.049	0.007

Table 3G.1-48
Combined Forces and Moments: RB, Selected Load Combination RB-9a (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
28 Pool Girder @ Storage Pool	123004	OTHR	0.279	-0.884	0.232	0.051	0.136	-0.028	0.035	0.105
		TEMP	-3.222	-10.346	0.042	0.420	1.524	-0.253	-0.188	1.420
		EQEW	-0.043	-0.854	-0.200	0.285	0.713	-0.142	0.099	0.614
		EQNS	0.507	2.822	-0.383	-0.070	-0.008	0.034	-0.041	-0.012
		EQZ	0.536	3.574	1.280	-0.034	0.052	-0.025	0.001	0.018
		EQT	-0.016	-0.254	-0.044	0.023	0.060	-0.020	-0.001	0.045
		SPKW	0.012	-0.013	-0.018	0.001	0.007	-0.002	0.000	0.004
		SPKN	-0.021	0.073	-0.005	-0.003	-0.006	0.001	-0.001	-0.003
	123104	OTHR	0.492	-0.409	0.554	0.001	-0.021	0.009	0.033	0.025
		TEMP	-1.162	-3.220	1.957	-0.186	-0.569	0.085	-0.399	0.291
		EQEW	0.031	-0.354	0.429	0.149	-0.068	-0.025	0.014	0.077
		EQNS	-0.578	1.180	-0.739	-0.090	-0.008	-0.001	-0.034	0.011
		EQZ	-0.664	1.245	0.734	-0.024	-0.002	-0.018	-0.017	0.015
		EQT	0.011	-0.111	0.039	0.026	0.005	-0.005	-0.002	0.008
		SPKW	-0.001	-0.004	-0.016	0.001	0.001	-0.001	-0.001	0.001
		SPKN	-0.025	0.025	-0.018	-0.002	0.000	0.001	0.000	-0.001
29 Pool Girder @ Cavity	123012	OTHR	0.306	-0.346	-0.278	-0.001	0.069	-0.007	0.021	0.076
		TEMP	-1.585	-0.088	-0.191	-0.062	0.579	0.047	0.057	0.427
		EQEW	-0.584	-0.011	0.262	0.082	0.217	-0.021	0.002	0.186
		EQNS	0.042	-0.086	0.277	-0.025	0.009	-0.004	0.026	0.045
		EQZ	-0.913	-0.581	-0.368	0.034	0.265	-0.003	0.016	0.151
		EQT	0.026	0.003	-0.007	0.001	-0.005	-0.002	0.002	-0.003
		SPKW	0.031	0.001	-0.003	0.000	0.001	0.000	-0.001	0.000
		SPKN	-0.032	0.000	0.003	0.000	-0.001	0.000	0.000	0.000
	123112	OTHR	0.282	-0.207	-0.237	-0.002	-0.029	-0.008	0.006	0.001
		TEMP	-2.307	-0.056	-0.067	-0.143	-0.117	-0.095	-0.040	0.096
		EQEW	-0.677	-0.004	0.368	0.091	-0.015	-0.016	-0.088	-0.009
		EQNS	-0.554	-0.088	0.245	-0.113	-0.026	-0.013	0.039	0.003
		EQZ	0.119	-0.337	-0.426	0.010	0.031	-0.027	-0.013	0.012
		EQT	0.051	0.002	-0.021	-0.001	-0.003	-0.005	0.003	0.001
		SPKW	-0.001	-0.001	0.000	0.000	0.000	0.001	-0.001	0.000
		SPKN	-0.013	0.001	-0.002	0.000	0.000	0.000	0.000	0.000
30 Pool Girder @ Fuel Pool	123017	OTHR	0.457	0.324	-0.164	-0.010	-0.064	0.022	0.002	-0.109
		TEMP	0.774	-6.892	-0.909	2.470	2.743	-0.228	0.208	0.415
		EQEW	-0.134	-0.858	0.754	0.327	0.638	0.095	-0.251	0.577
		EQNS	0.301	2.991	0.076	0.072	0.236	0.043	0.022	0.221
		EQZ	0.443	3.312	-1.363	-0.060	0.040	0.080	0.011	0.084
		EQT	-0.005	-0.005	-0.041	-0.014	-0.083	-0.023	-0.001	-0.054
		SPKW	0.015	-0.001	0.018	0.002	0.009	0.003	0.000	0.007
		SPKN	-0.014	0.057	-0.009	-0.003	-0.005	-0.003	0.003	-0.005
	123117	OTHR	-0.068	0.055	-0.182	0.035	0.041	0.006	0.011	0.020
		TEMP	-0.985	-2.677	-0.715	2.293	1.832	-0.079	-0.209	0.279
		EQEW	-0.187	-0.380	-0.012	0.094	-0.070	0.027	0.019	0.053
		EQNS	-1.053	0.840	1.010	0.040	0.016	-0.022	0.023	0.011
		EQZ	-0.434	0.996	-0.736	-0.052	-0.054	0.013	0.005	-0.002
		EQT	0.066	0.034	-0.012	-0.017	-0.005	-0.009	-0.008	-0.007
		SPKW	-0.005	0.000	0.014	0.001	0.000	0.000	0.001	0.001
		SPKN	-0.006	0.018	0.008	-0.004	-0.001	-0.001	0.000	0.000

Table 3G.1-48
Combined Forces and Moments: RB, Selected Load Combination RB-9a (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
31 MS Tunnel Wall and Slab	150122	OTHR	-0.210	-0.287	0.943	-0.010	0.061	0.020	-0.024	-0.051
		TEMP	2.226	-0.111	-0.753	3.639	3.907	0.083	-0.262	-0.322
		EQEW	0.113	0.172	-0.176	0.072	-0.158	-0.012	0.018	0.202
		EQNS	0.144	0.403	-0.048	-0.062	-0.103	-0.009	0.015	-0.033
		EQZ	0.174	0.081	-0.517	0.007	-0.016	-0.011	0.016	0.034
		EQT	0.009	0.016	-0.055	0.012	-0.027	-0.012	0.003	0.047
		SPKW	0.006	-0.006	0.001	0.002	0.001	-0.001	0.000	0.000
		SPKN	-0.010	-0.013	0.000	0.002	0.003	0.000	0.000	0.001
	96611	OTHR	-0.075	0.466	-0.058	0.063	-0.133	-0.088	-0.199	0.008
		TEMP	-0.174	3.068	-0.248	-3.645	-6.606	-0.247	0.700	0.064
		EQEW	0.019	-0.093	-0.266	-0.036	-0.076	0.083	-0.011	-0.060
		EQNS	0.026	-0.379	0.030	-0.117	-0.342	0.005	0.077	0.012
		EQZ	0.036	-0.192	0.026	0.028	0.132	0.058	0.115	-0.007
		EQT	0.006	-0.014	-0.072	-0.008	-0.014	0.036	-0.004	-0.011
		SPKW	-0.017	0.004	-0.006	0.000	0.002	0.000	0.000	0.000
		SPKN	0.024	-0.015	0.009	0.010	0.014	0.001	-0.004	0.000
	98614	OTHR	0.007	-0.034	0.040	-0.220	-0.668	-0.066	-0.107	0.015
		TEMP	0.527	2.703	-0.288	9.377	13.644	0.044	-1.769	-0.155
		EQEW	-0.025	-0.005	0.172	-0.022	0.063	0.203	-0.041	0.048
		EQNS	0.080	-0.246	0.036	0.176	0.303	0.009	-0.069	-0.009
		EQZ	-0.008	0.058	-0.023	0.013	0.311	0.032	0.089	-0.010
		EQT	-0.012	0.006	0.057	-0.005	0.004	0.061	-0.006	0.002
		SPKW	0.000	-0.006	0.001	-0.014	-0.009	-0.001	0.003	0.000
		SPKN	-0.006	0.013	-0.002	0.015	0.000	0.002	-0.002	0.000

Table 3G.1-49

Combined Forces and Moments: RB, Selected Load Combination RB-9b

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
18 Wall Below RCCV Bottom	6	OTHR	-2.195	-7.507	-0.237	0.162	0.627	-0.007	0.005	0.335
		TEMP	0.500	-1.652	-0.970	0.379	2.436	-0.053	0.065	0.459
		EQEW	4.080	9.611	-4.318	-0.696	-3.389	-0.046	0.140	-1.392
		EQNS	-4.226	-2.828	-3.149	0.950	5.629	0.027	0.006	2.014
		EQZ	-0.321	4.250	-0.279	0.231	1.518	-0.009	0.024	0.450
		EQT	0.666	0.149	0.610	-0.044	-0.288	-0.014	0.027	-0.152
		SPKW	-0.491	0.161	-0.422	-0.051	-0.221	-0.034	0.064	-0.040
		SPKN	-0.386	-0.001	0.016	0.009	0.091	0.009	-0.016	0.064
	13	OTHR	-1.951	-6.103	-0.130	-0.202	-0.915	0.010	-0.005	-0.176
		TEMP	-0.084	-4.089	-0.681	0.635	3.538	0.001	0.019	0.830
		EQEW	4.939	9.278	0.447	-0.384	-2.349	-0.019	0.036	-1.176
		EQNS	-0.092	2.940	-3.947	0.616	3.308	-0.083	0.135	0.998
		EQZ	-0.421	3.452	-0.258	0.399	2.157	-0.007	0.010	0.633
		EQT	0.548	0.139	0.740	-0.080	-0.369	-0.006	0.013	-0.168
		SPKW	0.171	0.101	0.078	-0.066	-0.733	-0.008	0.009	-0.359
		SPKN	-0.924	0.001	-0.248	0.008	0.263	0.004	-0.003	0.188
	24	OTHR	-1.297	-6.598	-0.436	-0.387	-2.272	-0.002	0.008	-0.796
		TEMP	0.018	-3.987	0.219	0.642	3.557	-0.009	0.000	0.840
		EQEW	0.630	0.657	6.609	0.010	-0.204	0.106	-0.160	-0.129
		EQNS	2.743	8.464	-0.014	0.216	1.126	-0.009	0.003	-0.018
		EQZ	-0.417	3.860	0.100	0.425	2.253	-0.005	0.002	0.637
		EQT	0.075	0.011	1.005	0.002	-0.029	-0.003	0.005	-0.017
		SPKW	-0.938	0.026	0.082	0.024	0.350	0.003	-0.006	0.230
		SPKN	0.179	0.094	-0.078	-0.086	-0.857	-0.006	0.008	-0.423
19 Wall Below Below RCCV Mid-Height	806	OTHR	-1.160	-6.328	-0.119	0.012	0.167	-0.006	-0.020	-0.054
		TEMP	1.716	-2.753	0.114	0.305	1.594	0.082	-0.064	-0.104
		EQEW	0.690	7.399	-5.103	-0.009	0.249	-0.132	-0.022	0.020
		EQNS	-2.173	-2.516	-3.422	-0.138	-0.431	-0.021	0.024	0.198
		EQZ	-0.054	3.702	-0.048	-0.019	-0.024	0.019	-0.004	0.065
		EQT	0.313	0.075	0.573	0.023	0.068	-0.031	-0.006	-0.004
		SPKW	-1.132	0.198	-0.192	-0.014	0.070	-0.024	-0.049	-0.015
		SPKN	-0.360	0.086	0.077	-0.040	-0.026	0.000	0.000	0.010
	813	OTHR	-1.685	-6.085	-0.079	-0.002	0.228	-0.020	0.008	0.030
		TEMP	1.264	-4.042	-0.538	0.199	1.585	-0.036	0.005	0.613
		EQEW	1.979	8.078	0.751	0.012	0.364	-0.002	-0.016	-0.087
		EQNS	-0.413	3.201	-4.445	-0.018	-0.076	0.039	-0.051	0.288
		EQZ	0.021	3.433	-0.210	0.018	0.014	0.021	-0.002	0.157
		EQT	0.211	0.052	0.809	-0.001	0.055	-0.050	0.006	-0.020
		SPKW	-0.838	-0.098	0.007	0.119	0.414	0.024	-0.016	0.042
		SPKN	-0.761	0.184	-0.138	-0.077	-0.142	-0.003	0.013	-0.003
	824	OTHR	-1.991	-6.744	-0.414	0.128	0.522	-0.009	-0.001	0.140
		TEMP	1.020	-4.014	0.230	0.220	1.644	0.029	0.013	0.560
		EQEW	0.194	0.650	7.276	0.037	0.064	0.059	0.069	0.036
		EQNS	0.979	7.859	-0.125	0.047	0.231	0.002	-0.001	0.236
		EQZ	-0.053	3.860	0.103	0.036	0.019	0.007	-0.003	0.199
		EQT	0.021	0.007	1.071	0.007	0.007	-0.019	0.010	0.004
		SPKW	-0.931	0.329	0.017	-0.093	-0.178	-0.001	-0.001	-0.007
		SPKN	-0.869	-0.134	0.000	0.164	0.434	0.008	-0.002	0.065

Table 3G.1-49
Combined Forces and Moments: RB, Selected Load Combination RB-9b (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
20 Wall Below RCCV Top	1606	OTHR	0.959	-5.706	-0.074	-0.584	-3.182	0.025	0.007	0.897
		TEMP	15.254	-3.694	0.085	-0.865	-3.919	0.106	0.072	2.988
		EQEW	0.628	5.038	-5.272	0.082	0.563	-0.019	-0.005	-0.110
		EQNS	-1.483	-1.946	-3.743	-0.333	-1.320	-0.069	-0.002	0.183
		EQZ	0.407	3.300	-0.034	-0.123	-0.670	-0.005	0.004	0.219
		EQT	0.125	0.054	0.710	0.010	0.019	-0.017	-0.002	0.013
		SPKW	-0.530	0.104	0.453	-0.034	-0.146	0.069	0.006	0.014
		SPKN	-0.181	0.094	-0.130	-0.042	-0.060	-0.016	0.001	-0.009
	1613	OTHR	0.443	-6.024	0.102	-0.559	-3.038	-0.002	-0.019	0.870
		TEMP	15.098	-4.772	-0.383	-0.955	-5.279	-0.012	-0.016	3.467
		EQEW	1.016	6.058	0.909	0.148	0.962	-0.001	0.010	-0.200
		EQNS	-0.138	3.051	-4.514	-0.243	-1.271	-0.022	0.009	0.366
		EQZ	0.540	3.308	-0.149	-0.128	-0.778	-0.005	0.002	0.270
		EQT	0.086	-0.041	0.872	0.017	0.106	-0.027	-0.001	-0.022
		SPKW	-0.031	0.069	-0.065	-0.049	-0.514	0.002	0.003	0.244
		SPKN	-0.507	0.074	0.116	-0.030	0.051	-0.007	-0.005	-0.089
	1624	OTHR	0.155	-6.466	-0.272	-0.453	-2.757	0.008	-0.021	0.783
		TEMP	15.945	-5.116	-0.070	-1.065	-5.223	0.003	-0.102	3.540
		EQEW	0.076	0.521	7.447	-0.016	-0.009	0.052	-0.049	0.027
		EQNS	0.985	6.565	-0.214	-0.062	-0.477	-0.009	0.004	0.204
		EQZ	0.471	3.747	0.069	-0.133	-0.780	0.001	0.004	0.262
		EQT	0.003	0.006	1.120	-0.002	-0.001	-0.016	-0.006	0.002
		SPKW	-0.642	0.163	-0.047	-0.043	0.061	-0.002	0.004	-0.106
		SPKN	-0.081	0.048	0.057	-0.023	-0.469	0.002	-0.011	0.215

Table 3G.1-49
Combined Forces and Moments: RB, Selected Load Combination RB-9b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
21 Exterior Wall @ EL-11.50 ~-10.50m	20011	OTHR	-1.865	-3.362	-0.684	0.111	0.666	0.014	0.037	0.212
		TEMP	3.015	4.539	0.539	0.546	2.096	0.065	-0.209	0.722
		EQEW	-0.657	-0.961	-9.354	-0.082	0.416	0.025	0.100	0.091
		EQNS	-0.662	-1.083	0.877	1.978	8.162	0.050	-0.088	3.032
		EQZ	0.399	2.223	0.230	0.022	-0.013	-0.003	-0.031	-0.030
		EQT	0.045	0.000	0.742	0.044	0.150	-0.010	0.016	0.051
		SPKW	-0.940	0.122	0.125	0.019	0.107	-0.005	-0.002	0.047
		SPKN	0.198	0.046	-0.209	-0.099	-0.402	0.004	0.000	-0.193
	20023	OTHR	-1.203	-1.450	-0.484	0.022	-0.291	0.025	-0.041	-0.162
		TEMP	-3.247	-1.943	0.806	-2.359	-2.817	0.031	-0.795	-0.575
		EQEW	0.059	4.728	-0.475	0.320	0.224	-0.093	-0.079	0.031
		EQNS	-0.008	-1.289	-0.936	-0.832	1.337	0.170	1.299	0.909
		EQZ	0.013	0.711	0.290	-0.077	0.136	0.003	0.048	0.091
		EQT	-0.071	-0.099	0.316	0.150	-0.095	-0.040	-0.281	-0.111
		SPKW	-0.619	-0.161	0.146	-0.075	-0.036	0.004	0.016	0.014
		SPKN	0.085	0.082	-0.115	-0.003	-0.002	0.005	0.015	-0.017
	30010	OTHR	-1.315	-2.241	-0.188	-0.249	-1.366	0.013	0.004	0.921
		TEMP	1.001	3.822	-0.190	1.305	4.878	-0.022	-0.029	-0.906
		EQEW	3.694	3.409	0.982	-0.320	-1.172	-0.031	-0.026	0.395
		EQNS	1.283	2.225	-3.374	0.481	2.677	-0.053	-0.091	-0.745
		EQZ	0.086	1.161	-0.023	0.250	1.318	-0.013	-0.005	-0.300
		EQT	0.623	-0.159	0.842	-0.074	-0.293	-0.013	-0.017	0.102
		SPKW	-0.102	-0.362	0.000	-0.054	-0.444	-0.009	-0.009	0.538
		SPKN	-0.755	0.135	-0.073	0.018	0.168	0.006	0.006	-0.068
	30020	OTHR	-0.972	-1.526	-0.221	-0.536	-0.766	0.017	-0.161	0.324
		TEMP	-0.043	-1.519	-0.380	0.011	1.225	0.146	-0.023	-0.288
		EQEW	0.512	2.678	1.213	-0.065	0.349	0.031	0.086	-0.091
		EQNS	0.109	2.149	-0.455	0.024	1.101	0.025	-0.285	-0.252
		EQZ	0.037	0.598	0.129	-0.136	0.364	0.042	-0.080	-0.124
		EQT	0.111	-0.186	0.205	-0.040	-0.050	0.005	0.118	-0.005
		SPKW	-0.077	-0.160	-0.125	-0.069	-0.255	0.115	-0.007	0.145
		SPKN	-0.231	-0.074	0.067	-0.289	0.022	-0.037	-0.108	-0.046
	40001	OTHR	-0.762	-1.706	0.332	-0.325	-1.087	-0.199	0.071	0.625
		TEMP	-0.085	-1.165	0.093	0.037	1.359	-0.099	0.110	-0.329
		EQEW	0.005	3.037	0.977	0.369	1.132	0.016	0.362	-0.176
		EQNS	0.366	1.950	-0.726	-0.198	0.593	-0.080	0.012	-0.170
		EQZ	0.033	0.628	-0.099	-0.139	0.376	-0.039	0.082	-0.123
		EQT	-0.020	0.049	0.302	0.129	0.031	0.017	0.064	0.042
		SPKW	-0.237	-0.076	-0.075	-0.240	0.040	0.034	0.086	-0.041
		SPKN	-0.097	-0.190	0.116	-0.103	-0.367	-0.143	-0.008	0.163
	40011	OTHR	-1.405	-3.084	-0.030	-0.308	-1.836	-0.002	0.005	1.651
		TEMP	1.348	3.854	0.063	1.290	4.897	0.012	0.016	-0.910
		EQEW	-0.252	-0.361	4.538	0.015	-0.047	0.085	0.124	-0.029
		EQNS	3.276	3.698	-0.076	0.140	1.121	0.012	0.005	-0.164
		EQZ	0.128	1.494	-0.001	0.288	1.476	0.009	0.002	-0.326
		EQT	-0.021	-0.014	0.917	0.006	0.005	-0.006	-0.007	-0.010
		SPKW	-0.539	0.209	0.000	0.020	0.248	-0.002	-0.003	-0.104
		SPKN	-0.224	-0.417	-0.024	-0.053	-0.519	0.004	0.004	0.587

Table 3G.1-49
Combined Forces and Moments: RB, Selected Load Combination RB-9b (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
22 Exterior Wall @ EL4.65 ~6.60m	22011	OTHR	0.193	-2.586	0.597	-0.006	0.085	0.010	-0.026	0.134
		TEMP	4.828	4.398	-0.287	-0.154	-0.139	0.067	0.044	0.162
		EQEW	0.466	3.318	-6.436	0.034	-0.023	-0.021	0.029	-0.002
		EQNS	-0.441	-7.125	2.468	0.116	0.966	0.154	-0.038	0.853
		EQZ	-0.121	1.929	-0.415	0.007	-0.026	-0.001	0.012	-0.024
		EQT	0.025	-0.350	0.750	-0.005	-0.001	-0.020	0.001	-0.005
		SPKW	-0.649	0.235	-0.140	-0.009	-0.013	0.003	-0.002	0.000
		SPKN	0.118	0.144	0.013	0.025	0.049	-0.007	-0.003	0.073
	22023	OTHR	-0.058	-1.465	-0.033	0.097	0.038	-0.098	0.078	0.020
		TEMP	1.518	-2.692	0.328	0.990	0.017	-0.183	-0.173	0.000
		EQEW	0.069	4.568	-3.234	0.055	-0.073	0.086	-0.202	-0.079
		EQNS	0.104	-4.679	-0.933	-0.214	0.171	-0.153	0.394	0.153
		EQZ	-0.017	0.997	0.206	0.074	0.002	0.011	-0.052	-0.011
		EQT	-0.067	0.247	0.587	0.014	-0.006	-0.010	-0.027	-0.017
		SPKW	-0.336	-0.137	0.601	0.024	0.011	-0.023	0.019	-0.004
		SPKN	0.015	0.083	0.162	0.081	0.009	-0.006	-0.026	0.005
	32010	OTHR	0.140	-1.798	0.024	-0.020	0.002	0.008	0.000	-0.082
		TEMP	16.476	7.814	-0.100	-2.875	-2.936	-0.003	-0.013	-0.029
		EQEW	0.643	3.408	0.932	-0.019	-0.097	-0.012	-0.001	0.219
		EQNS	-0.867	1.234	-3.866	-0.010	-0.012	0.000	-0.002	-0.103
		EQZ	0.012	1.087	-0.027	-0.001	-0.028	-0.002	0.000	0.013
		EQT	0.223	-0.010	0.982	-0.001	0.007	-0.018	0.002	0.009
		SPKW	-0.043	-0.151	0.004	-0.022	-0.175	-0.001	0.000	0.010
		SPKN	-0.319	0.066	0.060	-0.009	-0.002	0.000	0.001	0.003
	32020	OTHR	-0.001	-1.764	0.154	-0.012	-0.035	-0.050	0.003	0.025
		TEMP	0.610	4.810	2.460	0.061	-1.837	-0.391	1.189	0.188
		EQEW	0.047	2.920	2.784	0.125	-0.060	0.015	0.091	0.016
		EQNS	-0.041	3.265	-1.524	0.147	0.024	0.003	0.129	-0.002
		EQZ	0.032	1.252	0.072	0.042	0.001	0.007	0.038	0.006
		EQT	0.005	-0.203	0.864	-0.003	-0.004	-0.011	-0.004	0.011
		SPKW	-0.005	-0.031	-0.126	0.016	-0.068	-0.102	-0.059	0.022
		SPKN	-0.200	-0.101	0.256	-0.171	-0.038	0.044	-0.041	0.004
	42001	OTHR	-0.006	-1.825	0.051	0.010	-0.067	0.057	-0.004	0.048
		TEMP	2.708	3.726	2.529	0.074	-1.559	-0.037	-0.972	-0.233
		EQEW	-0.017	2.714	2.956	0.166	0.064	-0.012	-0.063	-0.031
		EQNS	0.127	3.461	-1.547	0.200	-0.027	-0.023	-0.077	-0.010
		EQZ	0.039	1.311	0.061	0.053	0.002	-0.001	-0.027	0.002
		EQT	-0.019	-0.222	0.860	-0.003	0.013	-0.013	0.003	-0.013
		SPKW	-0.121	-0.041	-0.237	-0.084	-0.024	-0.041	0.004	0.003
		SPKN	-0.037	-0.085	0.119	-0.029	-0.061	0.133	0.133	0.022
	42011	OTHR	-0.184	-2.329	-0.029	-0.041	-0.118	-0.003	0.005	-0.044
		TEMP	14.259	5.931	0.283	-3.138	-2.902	0.064	0.089	0.069
		EQEW	0.214	-0.581	5.945	0.045	0.003	0.018	0.040	-0.015
		EQNS	0.749	3.196	0.267	0.003	-0.098	0.009	0.000	0.092
		EQZ	0.214	1.479	0.058	-0.001	-0.021	0.002	-0.002	0.005
		EQT	0.051	-0.064	1.181	0.005	0.001	-0.011	0.005	-0.002
		SPKW	-0.203	0.107	0.030	-0.015	0.003	-0.001	-0.002	-0.002
		SPKN	-0.091	-0.212	0.024	-0.022	-0.149	0.014	0.024	0.006

Table 3G.1-49
Combined Forces and Moments: RB, Selected Load Combination RB-9b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
23 Exterior Wall @ EL22.50 ~24.60m	24211	OTHR	0.259	-1.245	0.051	-0.007	-0.103	0.015	0.004	-0.262
		TEMP	5.628	6.168	-0.121	0.036	0.461	-0.032	-0.057	1.532
		EQEW	-0.114	0.162	-5.394	-0.003	0.026	0.015	0.004	0.008
		EQNS	-1.174	-5.369	0.191	-0.170	-0.660	-0.042	-0.003	0.840
		EQZ	0.087	0.973	-0.055	0.074	0.507	-0.011	0.000	0.135
		EQT	0.000	-0.040	0.890	-0.001	-0.004	-0.032	-0.005	0.020
		SPKW	-0.053	-0.031	-0.004	0.002	0.009	-0.001	0.000	0.000
		SPKN	-0.026	0.065	-0.028	-0.003	-0.003	0.000	-0.001	0.015
	24224	OTHR	-0.007	-1.121	0.135	0.016	-0.039	-0.015	-0.046	-0.047
		TEMP	1.066	6.059	-3.947	1.882	0.047	-0.627	-1.457	-0.289
		EQEW	0.259	3.913	-3.713	-0.231	-0.100	-0.022	0.227	-0.045
		EQNS	-0.282	-7.465	0.532	0.695	1.033	-0.289	0.178	1.126
		EQZ	0.039	0.762	-0.252	-0.010	0.046	0.050	0.040	0.028
		EQT	-0.026	0.368	0.803	-0.082	-0.201	0.028	-0.100	-0.263
		SPKW	-0.001	0.002	0.020	0.006	-0.005	0.002	-0.012	-0.007
		SPKN	-0.006	-0.120	0.071	0.031	0.062	-0.006	0.036	0.080
	34210	OTHR	0.465	-0.687	0.111	0.005	0.115	-0.003	0.001	0.047
		TEMP	21.500	5.814	-0.637	-2.922	-2.837	0.043	-0.005	-0.143
		EQEW	-0.199	1.096	0.772	0.064	0.354	-0.010	-0.002	0.139
		EQNS	-1.211	0.237	-3.509	-0.031	-0.189	-0.011	0.011	-0.088
		EQZ	0.013	0.514	-0.045	-0.006	-0.005	0.001	-0.003	-0.011
		EQT	0.183	-0.017	1.010	0.002	0.017	-0.008	0.000	0.008
		SPKW	0.016	-0.040	0.002	-0.002	-0.023	0.001	0.000	-0.010
		SPKN	-0.098	0.000	-0.003	-0.001	0.001	-0.001	0.000	0.000
	34220	OTHR	0.055	-1.132	-0.085	0.054	0.013	0.007	0.032	-0.008
		TEMP	2.573	6.295	3.703	2.522	-1.254	-0.604	2.464	0.060
		EQEW	-0.162	0.839	2.354	0.119	0.142	0.026	0.026	-0.022
		EQNS	-0.048	1.855	-1.261	0.007	0.010	-0.003	0.014	-0.006
		EQZ	-0.042	0.660	0.115	-0.034	0.017	0.007	-0.029	-0.002
		EQT	0.022	-0.043	0.825	0.027	0.009	-0.016	0.006	0.019
		SPKW	0.004	0.012	-0.005	0.004	-0.002	-0.002	0.003	0.001
		SPKN	-0.001	0.024	-0.002	0.001	0.000	0.001	0.000	-0.001
	44201	OTHR	0.032	-1.237	-0.167	0.055	0.014	0.011	-0.035	-0.005
		TEMP	1.787	7.067	-0.242	2.081	-1.543	0.575	-2.867	0.058
		EQEW	0.145	0.808	2.848	0.066	0.009	0.059	-0.076	0.024
		EQNS	-0.107	2.171	-1.075	0.032	0.040	-0.008	0.012	-0.013
		EQZ	-0.013	0.763	0.232	-0.031	0.008	-0.010	0.033	0.001
		EQT	0.031	-0.063	0.814	0.013	-0.003	-0.009	-0.025	-0.019
		SPKW	0.002	0.012	0.001	0.004	0.001	-0.002	-0.002	-0.001
		SPKN	0.003	0.022	0.007	0.000	-0.002	0.000	-0.001	0.000

Table 3G.1-49
Combined Forces and Moments: RB, Selected Load Combination RB-9b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
24 Basemat @ Wall Below	90140	OTHR	-2.939	-2.620	-0.036	-1.925	-0.968	1.516	-2.457	2.177
		TEMP	0.656	1.198	1.910	-1.176	-1.209	-0.620	-1.549	0.481
		EQEW	0.415	4.638	2.888	0.033	3.216	-2.595	2.865	-5.032
		EQNS	0.034	1.460	-2.130	-6.707	-0.901	-0.370	-2.810	1.163
		EQZ	-0.060	0.480	0.263	1.419	0.971	-2.078	0.964	-1.107
		EQT	0.965	-0.447	0.984	0.658	0.012	-0.229	0.294	0.106
		SPKW	-0.052	-1.084	-0.003	-0.119	0.019	-0.123	-0.029	-0.213
		SPKN	-1.849	0.114	-0.120	-0.044	-0.045	0.049	-0.037	0.017
	90182	OTHR	-2.241	-2.358	-0.196	-0.265	-1.324	0.195	0.018	1.146
		TEMP	2.512	0.741	0.349	-1.062	-5.489	0.225	-0.058	3.881
		EQEW	6.054	0.571	0.309	0.153	-0.445	-0.242	-0.046	-3.502
		EQNS	3.163	0.701	-1.456	-1.619	-0.476	1.390	-1.659	0.675
		EQZ	0.369	0.221	0.046	-0.592	1.442	0.238	-0.137	-0.399
		EQT	1.000	0.064	0.515	0.020	0.260	-0.335	0.346	-0.258
		SPKW	0.120	-1.176	-0.143	-0.170	-0.632	-0.021	0.026	-0.440
		SPKN	-1.507	0.096	0.137	-0.018	-0.210	0.106	-0.110	0.162
	90111	OTHR	-3.906	-1.826	0.005	-1.720	-0.144	-0.354	0.499	0.271
		TEMP	0.765	3.129	-0.048	-5.573	-1.340	0.131	3.888	0.160
		EQEW	-0.250	0.765	-0.889	-0.470	0.409	1.439	-0.060	-2.916
		EQNS	1.027	5.920	-0.258	0.380	-1.228	0.393	-2.033	-0.131
		EQZ	0.246	0.490	-0.027	1.301	-0.708	0.327	-0.439	-0.071
		EQT	-0.052	0.035	-0.613	-0.075	0.084	0.414	0.010	-0.492
		SPKW	0.162	-1.308	0.049	-0.226	-0.098	0.013	0.201	-0.026
		SPKN	-1.233	0.065	-0.048	-0.638	-0.141	0.024	-0.484	0.020
25 Slab EL4.65m @ RCCV	93140	OTHR	-0.251	0.339	0.631	0.112	0.122	-0.118	0.127	-0.106
		TEMP	0.492	2.917	5.382	-0.741	-0.577	0.416	-0.195	0.167
		EQEW	0.376	-0.215	-0.049	0.156	0.126	-0.093	0.047	-0.033
		EQNS	-1.560	0.330	-0.338	-0.361	-0.226	0.156	-0.082	0.108
		EQZ	-0.001	-0.080	-0.032	-0.041	-0.051	0.031	-0.067	0.055
		EQT	0.164	-0.083	0.044	0.017	0.011	-0.010	0.005	-0.005
		SPKW	0.047	-0.822	0.094	-0.028	-0.028	0.019	-0.015	0.002
		SPKN	-0.302	0.113	-0.040	-0.001	-0.004	0.002	0.000	0.002
	93182	OTHR	0.530	-0.301	0.040	-0.011	0.069	0.011	-0.002	0.036
		TEMP	5.915	-4.974	-1.483	-0.488	-2.534	-0.114	0.106	1.921
		EQEW	0.013	-0.083	-0.165	0.085	0.479	0.017	-0.023	-0.425
		EQNS	-0.546	-0.147	-0.448	-0.089	-0.343	-0.012	0.018	0.317
		EQZ	-0.073	-0.068	-0.025	-0.020	-0.060	-0.004	0.005	0.099
		EQT	0.070	0.029	-0.054	0.008	0.039	0.000	-0.002	-0.035
		SPKW	-0.143	-0.871	-0.027	-0.030	-0.155	-0.009	0.008	0.161
		SPKN	-0.252	-0.027	0.059	0.003	0.012	0.001	-0.001	-0.011
	93111	OTHR	-0.021	0.449	-0.089	0.049	-0.016	-0.003	0.026	-0.004
		TEMP	-4.283	6.565	-0.433	-2.488	-0.436	-0.068	1.677	0.002
		EQEW	0.148	0.059	-0.226	0.001	-0.009	-0.026	0.012	0.006
		EQNS	-0.088	-0.093	0.017	0.067	-0.003	0.007	-0.042	0.002
		EQZ	-0.045	-0.094	0.017	-0.092	-0.023	-0.003	0.105	0.002
		EQT	0.004	0.003	0.000	-0.002	-0.002	-0.002	0.003	0.000
		SPKW	0.021	-0.214	0.023	0.018	0.003	0.001	-0.014	0.000
		SPKN	-0.906	-0.142	0.121	-0.154	-0.028	-0.007	0.135	-0.001

Table 3G.1-49
Combined Forces and Moments: RB, Selected Load Combination RB-9b (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
26 Slab EL17.5m @ RCCV	96144	OTHR	0.012	0.595	0.703	0.087	0.094	-0.082	0.126	-0.107
		TEMP	0.700	5.749	8.267	-0.286	-0.227	0.196	-0.057	0.076
		EQEW	-0.105	-0.246	-0.165	0.139	0.119	-0.090	0.046	-0.017
		EQNS	-0.551	0.162	0.116	-0.295	-0.230	0.156	-0.061	0.070
		EQZ	0.200	-0.155	-0.096	-0.036	-0.037	0.029	-0.072	0.054
		EQT	0.135	-0.045	0.000	0.011	0.010	-0.006	0.003	-0.001
		SPKW	0.019	-0.035	0.000	-0.004	-0.004	0.002	-0.002	0.000
		SPKN	-0.063	0.031	-0.002	0.002	-0.001	0.000	0.001	0.000
	96186	OTHR	0.896	-0.363	-0.017	-0.018	-0.042	0.000	0.001	-0.011
		TEMP	9.948	-4.570	-2.192	-0.167	-0.770	-0.060	0.028	0.708
		EQEW	-0.330	0.169	-0.231	0.108	0.616	0.023	-0.031	-0.490
		EQNS	-0.608	-0.144	0.033	-0.075	-0.342	-0.012	0.027	0.274
		EQZ	-0.178	0.088	0.017	0.003	0.021	-0.001	0.006	0.023
		EQT	0.064	0.032	-0.075	0.005	0.025	-0.001	-0.002	-0.022
		SPKW	0.040	0.012	-0.002	-0.011	-0.049	-0.002	0.002	0.040
		SPKN	-0.077	-0.028	0.030	0.001	0.004	0.001	0.000	-0.003
	96113	OTHR	-0.542	1.420	-0.157	-0.128	-0.001	0.003	0.240	0.033
		TEMP	-8.874	6.067	-1.617	-4.618	-2.819	-0.231	0.824	-0.088
		EQEW	0.093	-0.157	0.672	0.081	0.033	-0.003	-0.018	0.044
		EQNS	0.211	-1.036	0.004	0.468	-0.036	-0.012	-0.448	-0.066
		EQZ	0.138	-0.325	0.062	0.169	-0.011	-0.009	-0.171	-0.016
		EQT	0.010	-0.006	0.231	0.008	0.008	0.007	0.003	0.011
		SPKW	-0.039	-0.093	-0.004	0.033	0.008	0.001	-0.022	-0.002
		SPKN	0.042	0.100	0.008	-0.114	-0.024	-0.004	0.084	0.007
27 Slab EL27.0m @ RCCV	98472	OTHR	0.461	0.456	-0.152	0.038	0.073	-0.063	0.174	-0.187
		TEMP	-4.962	-2.596	6.296	-1.806	-1.112	-0.359	0.516	-0.793
		EQEW	0.368	-1.005	-0.324	0.038	0.037	-0.017	0.011	-0.012
		EQNS	1.119	-0.227	0.006	-0.157	-0.188	0.097	-0.125	0.084
		EQZ	-0.147	0.039	-0.075	-0.116	-0.166	0.128	-0.206	0.148
		EQT	-0.089	0.058	0.007	0.014	0.016	-0.011	0.014	-0.007
		SPKW	0.037	-0.008	-0.012	-0.004	-0.007	0.003	-0.006	0.003
		SPKN	-0.066	0.024	0.010	0.000	-0.001	0.000	0.000	0.001
	98514	OTHR	0.253	0.354	0.106	-0.017	-0.196	0.006	0.003	-0.079
		TEMP	-2.970	-2.936	-1.382	-1.925	-1.714	-0.029	0.056	-0.715
		EQEW	-0.436	0.202	-0.314	0.063	0.442	-0.005	-0.007	-0.334
		EQNS	-0.235	-0.151	-0.159	-0.073	-0.260	0.002	0.008	0.265
		EQZ	0.011	-0.071	-0.044	-0.025	-0.082	-0.018	-0.002	0.114
		EQT	0.074	0.006	-0.051	0.005	0.022	-0.002	-0.001	-0.021
		SPKW	0.030	-0.008	-0.004	-0.007	-0.034	-0.001	0.000	0.028
		SPKN	-0.025	-0.007	0.021	0.000	-0.001	0.001	0.000	0.000
	98424	OTHR	0.245	1.121	-0.152	0.357	0.130	-0.160	-0.543	-0.103
		TEMP	-8.160	-4.306	-3.504	8.110	4.330	0.601	-4.475	-0.830
		EQEW	0.659	-0.569	-5.339	0.057	0.036	-0.148	0.029	-0.002
		EQNS	0.941	-1.089	0.420	-1.018	-0.413	0.137	1.105	0.161
		EQZ	-0.029	-0.290	0.019	-1.420	-0.331	-0.030	0.841	0.152
		EQT	0.057	-0.034	-0.745	0.023	0.019	0.018	-0.014	0.006
		SPKW	0.005	-0.004	-0.003	0.032	0.015	-0.002	-0.023	-0.005
		SPKN	-0.007	0.009	0.005	-0.070	-0.034	0.000	0.049	0.007

Table 3G.1-49
Combined Forces and Moments: RB, Selected Load Combination RB-9b (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
28 Pool Girder @ Storage Pool	123004	OTHR	0.475	-0.317	0.673	0.051	0.144	-0.042	0.048	0.102
		TEMP	-3.773	-8.910	2.443	-3.192	-1.409	-0.451	-0.296	2.590
		EQEW	-0.043	-0.854	-0.200	0.285	0.713	-0.142	0.099	0.614
		EQNS	0.507	2.822	-0.383	-0.070	-0.008	0.034	-0.041	-0.012
		EQZ	0.536	3.574	1.280	-0.034	0.052	-0.025	0.001	0.018
		EQT	-0.016	-0.254	-0.044	0.023	0.060	-0.020	-0.001	0.045
		SPKW	0.012	-0.013	-0.018	0.001	0.007	-0.002	0.000	0.004
		SPKN	-0.021	0.073	-0.005	-0.003	-0.006	0.001	-0.001	-0.003
	123104	OTHR	0.467	-0.230	0.951	0.006	-0.015	0.003	0.026	0.029
		TEMP	-0.908	-1.329	2.320	-4.096	-4.643	0.160	-1.017	0.189
		EQEW	0.031	-0.354	0.429	0.149	-0.068	-0.025	0.014	0.077
		EQNS	-0.578	1.180	-0.739	-0.090	-0.008	-0.001	-0.034	0.011
		EQZ	-0.664	1.245	0.734	-0.024	-0.002	-0.018	-0.017	0.015
		EQT	0.011	-0.111	0.039	0.026	0.005	-0.005	-0.002	0.008
		SPKW	-0.001	-0.004	-0.016	0.001	0.001	-0.001	-0.001	0.001
		SPKN	-0.025	0.025	-0.018	-0.002	0.000	0.001	0.000	-0.001
29 Pool Girder @ Cavity	123012	OTHR	0.089	-0.578	-0.382	0.005	0.134	-0.008	0.029	0.114
		TEMP	-1.054	-0.015	-0.253	-3.807	-2.087	0.177	0.085	1.518
		EQEW	-0.584	-0.011	0.262	0.082	0.217	-0.021	0.002	0.186
		EQNS	0.042	-0.086	0.277	-0.025	0.009	-0.004	0.026	0.045
		EQZ	-0.913	-0.581	-0.368	0.034	0.265	-0.003	0.016	0.151
		EQT	0.026	0.003	-0.007	0.001	-0.005	-0.002	0.002	-0.003
		SPKW	0.031	0.001	-0.003	0.000	0.001	0.000	-0.001	0.000
		SPKN	-0.032	0.000	0.003	0.000	-0.001	0.000	0.000	0.000
	123112	OTHR	0.422	-0.348	-0.343	0.000	-0.020	-0.016	0.006	0.002
		TEMP	0.270	0.204	-0.469	-4.115	-3.707	-0.173	-0.004	-0.028
		EQEW	-0.677	-0.004	0.368	0.091	-0.015	-0.016	-0.088	-0.009
		EQNS	-0.554	-0.088	0.245	-0.113	-0.026	-0.013	0.039	0.003
		EQZ	0.119	-0.337	-0.426	0.010	0.031	-0.027	-0.013	0.012
		EQT	0.051	0.002	-0.021	-0.001	-0.003	-0.005	0.003	0.001
		SPKW	-0.001	-0.001	0.000	0.000	0.000	0.001	-0.001	0.000
		SPKN	-0.013	0.001	-0.002	0.000	0.000	0.000	0.000	0.000
30 Pool Girder @ Fuel Pool	123017	OTHR	0.526	0.576	-0.520	-0.022	-0.093	0.040	-0.004	-0.134
		TEMP	5.174	-7.676	-2.218	2.827	2.660	-0.299	0.268	0.240
		EQEW	-0.134	-0.858	0.754	0.327	0.638	0.095	-0.251	0.577
		EQNS	0.301	2.991	0.076	0.072	0.236	0.043	0.022	0.221
		EQZ	0.443	3.312	-1.363	-0.060	0.040	0.080	0.011	0.084
		EQT	-0.005	-0.005	-0.041	-0.014	-0.083	-0.023	-0.001	-0.054
		SPKW	0.015	-0.001	0.018	0.002	0.009	0.003	0.000	0.007
		SPKN	-0.014	0.057	-0.009	-0.003	-0.005	-0.003	0.003	-0.005
	123117	OTHR	-0.052	0.114	-0.538	0.035	0.044	0.013	0.015	0.021
		TEMP	1.809	-2.768	-0.560	2.974	1.894	-0.159	-0.541	0.254
		EQEW	-0.187	-0.380	-0.012	0.094	-0.070	0.027	0.019	0.053
		EQNS	-1.053	0.840	1.010	0.040	0.016	-0.022	0.023	0.011
		EQZ	-0.434	0.996	-0.736	-0.052	-0.054	0.013	0.005	-0.002
		EQT	0.066	0.034	-0.012	-0.017	-0.005	-0.009	-0.008	-0.007
		SPKW	-0.005	0.000	0.014	0.001	0.000	0.000	0.001	0.001
		SPKN	-0.006	0.018	0.008	-0.004	-0.001	-0.001	0.000	0.000

Table 3G.1-49
Combined Forces and Moments: RB, Selected Load Combination RB-9b (Continued)

Location	Element ID		**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
31 MS Tunnel Wall and Slab	150122	OTHR	-0.198	-0.271	0.952	-0.017	0.058	0.019	-0.023	-0.054
		TEMP	2.279	-0.182	-0.887	3.448	3.933	0.118	-0.222	-0.262
		EQEW	0.113	0.172	-0.176	0.072	-0.158	-0.012	0.018	0.202
		EQNS	0.144	0.403	-0.048	-0.062	-0.103	-0.009	0.015	-0.033
		EQZ	0.174	0.081	-0.517	0.007	-0.016	-0.011	0.016	0.034
		EQT	0.009	0.016	-0.055	0.012	-0.027	-0.012	0.003	0.047
		SPKW	0.006	-0.006	0.001	0.002	0.001	-0.001	0.000	0.000
		SPKN	-0.010	-0.013	0.000	0.002	0.003	0.000	0.000	0.001
	96611	OTHR	-0.096	0.496	-0.067	0.043	-0.160	-0.090	-0.191	0.009
		TEMP	-0.295	3.728	-0.322	-3.550	-6.604	-0.232	0.690	0.063
		EQEW	0.019	-0.093	-0.266	-0.036	-0.076	0.083	-0.011	-0.060
		EQNS	0.026	-0.379	0.030	-0.117	-0.342	0.005	0.077	0.012
		EQZ	0.036	-0.192	0.026	0.028	0.132	0.058	0.115	-0.007
		EQT	0.006	-0.014	-0.072	-0.008	-0.014	0.036	-0.004	-0.011
		SPKW	-0.017	0.004	-0.006	0.000	0.002	0.000	0.000	0.000
		SPKN	0.024	-0.015	0.009	0.010	0.014	0.001	-0.004	0.000
	98614	OTHR	0.023	-0.040	0.044	-0.272	-0.683	-0.069	-0.099	0.015
		TEMP	1.306	2.277	-0.049	9.353	14.160	-0.019	-1.882	-0.168
		EQEW	-0.025	-0.005	0.172	-0.022	0.063	0.203	-0.041	0.048
		EQNS	0.080	-0.246	0.036	0.176	0.303	0.009	-0.069	-0.009
		EQZ	-0.008	0.058	-0.023	0.013	0.311	0.032	0.089	-0.010
		EQT	-0.012	0.006	0.057	-0.005	0.004	0.061	-0.006	0.002
		SPKW	0.000	-0.006	0.001	-0.014	-0.009	-0.001	0.003	0.000
		SPKN	-0.006	0.013	-0.002	0.015	0.000	0.002	-0.002	0.000

Table 3G.1-50

Sectional Thicknesses and Rebar Ratios of RB Used in the Evaluation

Location	Element ID	Thickness (m)	Position	Primary Reinforcement Direction 1[*1] Arrangement[*2]	Direction 1 Ratio (%)	Direction2[*1] Arrangement[*2]	Direction2 Ratio (%)	Shear Tie Arrangement	Shear Tie Ratio (%)
18 Wall Below RCCV Bottom	6 13 24	2.0	Inside	2-#18@300	0.860	3-#18@0.9º	1.297	#9@0.9ºx300	0.721
			Outside	3-#18@300	1.290	3-#18@0.9º +1-#18@0.9º	1.729		
19 Wall Below Below RCCV Mid-Height	806 813 824	2.0	Inside	2-#18@300	0.860	3-#18@0.9º	1.297	#9@1.2ºx600	0.270
			Outside	3-#18@300	1.290	3-#18@0.9º	1.297		
20 Wall Below RCCV Top	1606 1613 1624	2.0	Inside	2-#18@300	0.860	3-#18@0.9º	1.297	#9@1.2ºx300	0.540
			Outside	3-#18@300	1.290	3-#18@0.9º +1-#18@1.8º	1.513		
21 Exterior Wall @ EL-11.50 ~-10.50m	20011 20023	2.0	Inside	4-#11@200 +1-#11@400	1.132	5-#11@200	1.258	#7@400x200	0.484
			Outside	4-#11@200 +1-#11@400	1.132	5-#11@200	1.258		
	30010 30020	2.0	Inside	3-#11@200 +1-#11@400	0.881	4-#11@200	1.006	#6@400x400	0.177
			Outside	3-#11@200 +1-#11@400	0.881	4-#11@200	1.006		
	40001 40011	2.0	Inside	3-#11@200	0.755	3-#11@200	0.755	#6@400x400	0.177
			Outside	3-#11@200	0.755	3-#11@200	0.755		
22 Exterior Wall @ EL4.65 ~6.60m	22011	1.5	Inside	3-#11@200 +1-#11@400	1.174	4-#11@200 (+1-#11@200)	1.677	#7@400x200	0.484
			Outside	3-#11@200 +1-#11@400	1.174	4-#11@200 (+1-#11@200)	1.677		
	22023	1.5	Inside	3-#11@200 +1-#11@400	1.174	4-#11@200	1.342	#7@400x200	0.484
			Outside	3-#11@200 +1-#11@400	1.174	4-#11@200	1.342		
	32010	1.5	Inside	3-#11@200	1.006	3-#11@200	1.006	#6@400x400	0.177
			Outside	3-#11@200 (+2-#11@200)	1.677	3-#11@200 (+2-#11@200)	1.677		
	32020	1.5	Inside	3-#11@200	1.006	3-#11@200	1.006	#6@400x400	0.177
			Outside	3-#11@200	1.006	3-#11@200	1.006		
	42001	1.5	Inside	3-#11@200	1.006	3-#11@200	1.006	#7@400x400	0.242
			Outside	4-#11@200	1.342	4-#11@200	1.342		

Note *1: Wall Below RCCV Direction1 : Hoop, Direction2 : Vertical
Exterior Wall Direction1 : Horizontal, Direction2 : Vertical
Slab Direction1 : N-S, Direction2 : E-W
Pool Girder Direction1 : Horizontal, Direction2 : Vertical
MS Tunnel Wall Direction1 : Horizontal, Direction2 : Vertical
MS Tunnel Slab Direction1 : N-S, Direction2 : E-W

Note *2: Rebar in parentheses indicates additional bars locally required.

Table 3G.1-50
Sectional Thicknesses and Rebar Ratios of RB Used in the Evaluation (Continued)

Location	Element ID	Thickness (m)	Primary Reinforcement					Shear Tie	
			Position	Direction 1[*1]		Direction2[*1]			
				Arrangement[*2]	Ratio (%)	Arrangement[*2]	Ratio (%)	Arrangement	Ratio (%)
22 Exterior Wall @ EL4.65 ~6.60m	42011	1.5	Inside	3-#11@200	1.006	3-#11@200	1.006	#7@400x400	0.242
			Outside	4-#11@200 (+1-#11@200)	1.677	4-#11@200 (+1-#11@200)	1.677		
23 Exterior Wall @ EL22.50 ~24.60m	24211	1.5	Inside	3-#11@200 +1-#11@400	1.174	4-#11@200	1.342	#7@400x200	0.484
			Outside	3-#11@200 +1-#11@400	1.174	4-#11@200	1.342		
	24224	1.5	Inside	3-#11@200 +1-#11@400	1.174	4-#11@200	1.342	#7@200x200	0.968
			Outside	3-#11@200 +1-#11@400	1.174	4-#11@200	1.342		
	34210	1.5	Inside	3-#11@200	1.006	3-#11@200	1.006	#6@400x400	0.177
			Outside	3-#11@200 (+2-#11@200)	1.677	3-#11@200 (+2-#11@200)	1.677		
	34220	1.5	Inside	3-#11@200	1.006	3-#11@200	1.006	#6@200x200	0.710
			Outside	3-#11@200	1.006	3-#11@200	1.006		
	44201	1.5	Inside	3-#11@200	1.006	3-#11@200	1.006	#7@200x200	0.968
			Outside	4-#11@200	1.342	4-#11@200	1.342		
24 Basemat @ Wall Below RCCV	90140 90182 90111	4.0	Top	6-#9@1.8°	0.497	2-#9@200 +4-#9@400	0.323	#9@200x200	1.613
			Bottom	5-#11@200	0.629	5-#11@200	0.629		
25 Slab EL4.65m @ RCCV	93140 93182 93111	1.0	Top	2-#11@200	1.006	2-#11@200	1.006	#5@200x200	0.500
			Bottom	PLATE t=16	-	PLATE t=16	-		
26 Slab EL17.5m @ RCCV	96144 96186	1.0	Top	2-#11@200	1.006	2-#11@200	1.006	#5@200x200	0.500
			Bottom	PLATE t=16	-	PLATE t=16	-		
	96113	1.6	Top	2-#11@200	0.629	2-#11@200	0.629	#5@200x200	0.500
			Bottom	3-#11@200	0.944	3-#11@200	0.944		

Note *1: Wall Below RCCV Direction1 : Hoop, Direction2 : Vertical
Exterior Wall Direction1 : Horizontal, Direction2 : Vertical
Slab Direction1 : N-S, Direction2 : E-W
Pool Girder Direction1 : Horizontal, Direction2 : Vertical
MS Tunnel Wall Direction1 : Horizontal, Direction2 : Vertical
MS Tunnel Slab Direction1 : N-S, Direction2 : E-W

Note *2: Rebar in parentheses indicates additional bars locally required.

Table 3G.1-50
Sectional Thicknesses and Rebar Ratios of RB Used in the Evaluation (Continued)

Location	Element ID	Thickness (m)	Primary Reinforcement					Shear Tie	
			Position	Direction 1*1		Direction2*1			
				Arrangement*2	Ratio (%)	Arrangement*2	Ratio (%)	Arrangement	Ratio (%)
27 Slab EL27.0m @ RCCV	98472 98514	1.0	Top	3-#11@200	1.510	3-#11@200	1.510	#5@200x200	0.500
			Bottom	PLATE t=25	-	PLATE t=25	-		
	98424	2.4	Top	4-#11@200	0.839	4-#11@200	0.839	#5@200x200	0.500
			Bottom	3-#11@200	0.629	3-#11@200	0.629		
28 Pool Girder @ Storage Pool	123004	1.6	Inside	3-#11@200	0.944	3-#11@200 (+1#11@200)	1.258	#7@200x200	0.968
			Outside	3-#11@200	0.944	3-#11@200	0.944		
	123104	1.6	Inside	3-#11@200	0.944	3-#11@200	0.944	#7@400x200	0.484
			Outside	3-#11@200	0.944	3-#11@200	0.944		
29 Pool Girder @ Cavity	123012 123112	1.6	Inside	3-#11@200	0.944	2-#11@200	0.629	#7@400x400	0.242
			Outside	2-#11@200	0.629	2-#11@200	0.629		
30 Pool Girder @ Fuel Pool	123017	1.6	Inside	3-#11@200	0.944	3-#11@200 (+1#11@200)	1.258	#7@200x200	0.968
			Outside	3-#11@200	0.944	3-#11@200	0.944		
	123117	1.6	Inside	3-#11@200	0.944	3-#11@200	0.944	#7@400x200	0.484
			Outside	3-#11@200	0.944	3-#11@200	0.944		
31 MS Tunnel Wall and Slab	150122	1.3	Inside	2-#11@200	0.774	2-#11@200	0.774	#6@400x400	0.177
			Outside	2-#11@200 +1-#11@400	0.968	4-#11@200 +1-#11@400	0.968		
	96611	1.6	Top	2-#11@200	0.629	2-#11@200	0.629	#5@200x200	0.500
			Bottom	3-#11@200	0.944	3-#11@200	0.944		
	98614	2.4	Top	4-#11@200	0.839	4-#11@200	0.839	#5@200x200	0.500
			Bottom	3-#11@200	0.629	3-#11@200	0.629		

Note *1: Wall Below RCCV Direction1 : Hoop, Direction2 : Vertical
Exterior Wall Direction1 : Horizontal, Direction2 : Vertical
Slab Direction1 : N-S, Direction2 : E-W
Pool Girder Direction1 : Horizontal, Direction2 : Vertical
MS Tunnel Wall Direction1 : Horizontal, Direction2 : Vertical
MS Tunnel Slab Direction1 : N-S, Direction2 : E-W

Note *2: Rebar in parentheses indicates additional bars locally required.

Table 3G.1-51

Rebar and Concrete Stresses of RB: Selected Load Combination RB-4

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				Direction1*		Direction2*		
				In	Out	In	Out	
21 Exterior Wall @ EL-11.50 ~-10.50m	20011	-2.2	-29.3	1.7	0.7	7.2	-9.7	372.2
	20023	-6.3	-29.1	-30.4	-1.0	-20.4	16.5	370.5
	30010	-1.4	-29.3	0.3	-8.0	1.4	-0.8	372.2
	30020	-2.1	-29.3	-7.6	1.5	-4.3	-12.1	372.2
	40001	-1.8	-29.3	-4.3	-1.0	-5.8	-9.9	372.2
	40011	-0.9	-29.3	-0.1	-4.6	-0.6	-3.3	372.2
22 Exterior Wall @ EL4.65 ~6.60m	22011	-1.0	-29.3	31.1	32.9	8.6	1.5	372.2
	22023	-3.8	-29.3	13.1	5.7	-27.8	-23.2	372.2
	32010	-0.1	-29.3	74.2	158.7	17.2	113.2	372.2
	32020	-3.5	-29.3	5.6	47.2	-5.1	53.7	372.2
	42001	-3.4	-29.3	7.8	34.7	-10.3	29.0	372.2
	42011	-3.9	-29.3	27.8	90.1	-10.5	20.6	372.2
23 Exterior Wall @ EL22.50 ~24.60m	24211	-2.0	-29.3	16.4	26.2	-5.3	21.1	372.2
	24224	-2.7	-29.3	24.2	-0.2	6.2	16.4	372.2
	34210	-2.4	-29.3	51.8	127.5	7.9	91.2	372.2
	34220	-0.8	-29.3	35.5	7.4	-19.8	56.1	372.2
	44201	-0.6	-29.3	44.0	34.7	-4.3	69.1	372.2

Note: Negative value means compression.
Note *: Exterior Wall Direction1 : Horizontal, Direction2 : Vertical

Table 3G.1-52

Rebar and Concrete Stresses of RB: Selected Load Combination RB-8a

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
				Calculated				Allowable*2
		Calculated	Allowable	Direction1*1		Direction2*1		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
18 Wall	6	-7.5	-29.3	-1.0	-1.1	-11.9	-41.3	372.2
Below RCCV	13	-6.8	-29.3	-1.3	-1.8	-17.5	-39.0	372.2
Bottom	24	-5.6	-29.3	0.8	-0.1	-26.9	-35.6	372.2
19 Wall Below	806	-5.6	-29.3	3.4	4.7	-19.8	-34.1	372.2
Below RCCV	813	-6.1	-29.3	1.6	2.5	-22.3	-37.1	372.2
Mid-Height	824	-7.1	-29.3	0.9	0.8	-23.7	-41.8	372.2
20 Wall	1606	-15.3	-29.3	41.8	95.7	-68.4	42.9	372.2
Below RCCV	1613	-16.7	-29.3	35.6	85.7	-76.6	40.7	372.2
Top	1624	-16.6	-29.3	35.5	81.4	-80.1	30.0	372.2
21 Exterior Wall	20011	-2.1	-29.3	3.6	0.0	9.5	-8.4	372.2
@ EL-11.50	20023	-5.0	-29.1	-23.5	-0.2	-17.2	10.5	370.5
~-10.50m	30010	-1.1	-29.3	3.0	-5.0	2.4	-3.4	372.2
	30020	-1.8	-29.3	-5.7	2.6	-5.8	-10.7	372.2
	40001	-1.7	-29.3	-3.4	0.3	-6.5	-9.3	372.2
	40011	-1.3	-29.3	0.4	-3.9	4.6	-5.9	372.2
22 Exterior Wall	22011	-0.9	-29.3	49.9	51.9	12.2	2.6	372.2
@ EL4.65	22023	-3.2	-29.3	23.3	4.6	-18.9	-18.4	372.2
~6.60m	32010	-1.1	-29.3	36.4	91.9	-2.5	14.0	372.2
	32020	-3.0	-29.3	8.3	31.7	-6.8	40.5	372.2
	42001	-1.9	-29.3	10.6	18.8	-10.0	18.9	372.2
	42011	-2.4	-29.3	27.9	82.8	-8.5	15.7	372.2
23 Exterior Wall	24211	-0.1	-29.3	46.1	46.5	19.5	15.3	372.2
@ EL22.50	24224	-1.6	-29.3	16.8	-0.3	-0.3	13.7	372.2
~24.60m	34210	-0.1	-29.3	100.1	173.4	35.0	110.2	372.2
	34220	-0.8	-29.3	35.6	-7.3	-12.0	42.0	372.2
	44201	-0.2	-29.3	46.7	21.9	3.1	48.9	372.2
24 Basemat	90140	-1.8	-23.5	-12.1	1.5	-0.3	-1.0	372.2
@ Wall	90182	-1.8	-23.5	-9.5	2.7	-1.4	7.3	372.2
Below RCCV	90111	-2.3	-23.5	-14.7	3.6	0.3	3.0	372.2
25 Slab	93140	-6.7	-29.3	107.4	68.5	174.9	81.2	372.2(223.3)
EL4.65m	93182	-12.8	-29.3	74.7	53.9	-64.1	48.3	372.2(223.3)
@ RCCV	93111	-12.3	-29.3	-58.7	62.0	76.0	56.4	372.2(223.3)
26 Slab	96144	-9.3	-29.3	227.5	94.2	296.0	107.9	372.2(223.3)
EL17.5m	96186	-6.7	-29.3	134.8	67.4	-32.3	-6.3	372.2(223.3)
@ RCCV	96113	-13.5	-28.8	-79.9	28.9	69.0	104.0	368.2
27 Slab	98472	-8.5	-29.1	118.2	29.8	167.1	25.9	370.3(222.2)
EL27.0m	98514	-3.8	-29.1	7.8	36.7	-9.2	13.3	370.3(222.2)
@ RCCV	98424	-9.1	-28.1	18.1	-46.9	9.8	-30.5	363.0
28 Pool Girder	123004	-9.0	-28.4	-2.7	-5.9	-21.1	-46.3	365.0
@ Storage Pool	123104	-4.6	-28.4	45.3	69.6	17.5	51.9	365.0
29 Pool Girder	123012	-2.0	-28.4	-4.4	-5.1	10.1	-7.8	365.0
@ Cavity	123112	-1.7	-28.4	-8.0	-5.9	-2.2	0.1	365.0
30 Pool Girder	123017	-9.5	-29.0	103.4	29.6	49.8	-25.8	369.8
@ Fuel Pool	123117	-7.0	-29.0	77.6	0.9	79.3	-3.9	369.8
31 MS Tunnel	150122	-10.8	-29.3	159.7	2.4	130.7	-18.9	372.2
Wall and Slab	96611	-6.7	-29.3	-11.0	42.0	-9.6	156.9	372.2
	98614	-4.4	-29.3	54.4	-8.9	91.6	-10.3	372.2

Note: Negative value means compression.

Note *1: Wall Below RCCV Direction1 : Hoop, Direction2 : Vertical
Exterior Wall Direction1 : Horizontal, Direction2 : Vertical
Slab Direction1 : N-S, Direction2 : E-W
Pool Girder Direction1 : Horizontal, Direction2 : Vertical
MS Tunnel Wall Direction1 : Horizontal, Direction2 : Vertical
MS Tunnel Slab Direction1 : N-S, Direction2 : E-W

Note *2: Value in parentheses indicates the allowable stress of the steel plate.

Table 3G.1-53

Rebar and Concrete Stresses of RB: Selected Load Combination RB-8b

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable*2
				Direction1*1		Direction2*1		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
18 Wall	6	-8.0	-29.3	-2.1	-2.6	-7.3	-42.4	372.2
Below RCCV	13	-8.1	-29.3	-2.0	-3.0	-12.6	-44.4	372.2
Bottom	24	-6.6	-29.3	0.3	-1.1	-20.8	-39.3	372.2
19 Wall Below	806	-6.1	-29.3	3.7	4.9	-17.5	-35.8	372.2
Below RCCV	813	-6.7	-29.3	2.4	4.1	-20.5	-39.5	372.2
Mid-Height	824	-7.4	-29.3	1.7	1.7	-20.4	-42.6	372.2
20 Wall	1606	-15.9	-29.3	61.8	108.6	-70.6	47.2	372.2
Below RCCV	1613	-17.7	-29.3	48.5	97.8	-79.8	46.9	372.2
Top	1624	-17.2	-29.3	47.8	94.0	-81.0	37.7	372.2
21 Exterior Wall	20011	-2.0	-29.3	7.9	0.8	15.9	-6.2	372.2
@ EL-11.50	20023	-5.0	-29.1	-23.8	0.7	-16.9	9.6	370.5
~-10.50m	30010	-1.3	-29.3	8.4	-4.2	9.6	-3.0	372.2
	30020	-2.2	-29.3	-6.1	4.3	-6.1	-12.3	372.2
	40001	-2.0	-29.3	-3.9	2.1	-6.9	-11.2	372.2
	40011	-0.9	-29.3	0.8	-3.0	2.5	-4.3	372.2
22 Exterior Wall	22011	-0.8	-29.3	71.5	75.6	32.6	25.2	372.2
@ EL4.65	22023	-3.2	-29.3	35.4	3.9	-16.0	-16.9	372.2
~6.60m	32010	-2.6	-29.3	53.6	113.2	1.5	75.8	372.2
	32020	-3.2	-29.3	9.7	21.8	-8.2	39.8	372.2
	42001	-1.0	-29.3	21.5	4.8	-7.3	5.6	372.2
	42011	-2.7	-29.3	27.1	89.8	-7.2	21.3	372.2
23 Exterior Wall	24211	0.0	-29.3	81.9	75.8	69.2	36.3	372.2
@ EL22.50	24224	-2.3	-29.3	45.4	-2.6	21.8	10.6	372.2
~24.60m	34210	-0.1	-29.3	132.0	190.1	27.9	101.3	372.2
	34220	-2.0	-29.3	66.2	-28.8	-7.9	44.1	372.2
	44201	-0.4	-29.3	64.2	2.1	-7.8	46.8	372.2
24 Basemat	90140	-1.8	-23.5	-11.8	-0.4	-0.7	-1.3	372.2
@ Wall	90182	-1.8	-23.5	-9.6	2.8	-1.3	8.3	372.2
Below RCCV	90111	-2.4	-23.5	-15.1	4.3	0.5	3.7	372.2
25 Slab	93140	-9.6	-29.3	132.1	90.2	211.5	98.6	372.2(223.3)
EL4.65m	93182	-17.5	-29.3	87.1	67.9	-85.8	73.1	372.2(223.3)
@ RCCV	93111	-16.3	-29.3	-76.7	83.8	87.3	68.8	372.2(223.3)
26 Slab	96144	-10.0	-29.3	249.9	104.3	338.1	129.5	372.2(223.3)
EL17.5m	96186	-8.7	-29.3	181.1	91.1	-38.4	11.1	372.2(223.3)
@ RCCV	96113	-14.5	-28.8	-87.8	16.0	92.3	120.1	368.2
27 Slab	98472	-10.3	-27.6	10.4	60.6	64.4	44.9	359.4(215.6)
EL27.0m	98514	-13.7	-27.6	-20.7	70.7	-20.3	74.0	359.4(215.6)
@ RCCV	98424	-11.4	-28.1	72.8	-55.4	90.8	-8.2	363.0
28 Pool Girder	123004	-8.0	-27.4	5.7	109.1	-20.2	32.8	358.3
@ Storage Pool	123104	-13.3	-27.4	34.3	249.2	20.5	257.5	358.3
29 Pool Girder	123012	-8.2	-27.4	-12.6	96.0	-3.7	67.9	358.3
@ Cavity	123112	-8.4	-27.4	9.7	147.7	-6.0	136.8	358.3
30 Pool Girder	123017	-9.0	-29.0	169.1	55.0	101.3	-7.2	369.8
@ Fuel Pool	123117	-6.9	-29.0	124.5	18.4	106.7	2.1	369.8
31 MS Tunnel	150122	-10.3	-29.3	151.2	5.7	125.7	-19.5	372.2
Wall and Slab	96611	-6.4	-29.3	-12.8	39.3	-7.0	163.2	372.2
	98614	-4.8	-29.3	54.1	-5.6	93.7	-12.9	372.2

Note: Negative value means compression.

Note *1:
Wall Below RCCV	Direction1 : Hoop,	Direction2 : Vertical
Exterior Wall	Direction1 : Horizontal,	Direction2 : Vertical
Slab	Direction1 : N-S,	Direction2 : E-W
Pool Girder	Direction1 : Horizontal,	Direction2 : Vertical
MS Tunnel Wall	Direction1 : Horizontal,	Direction2 : Vertical
MS Tunnel Slab	Direction1 : N-S,	Direction2 : E-W

Note *2: Value in parentheses indicates the allowable stress of the steel plate.

Table 3G.1-54

Rebar and Concrete Stresses of RB: Selected Load Combination RB-9a

Location	Element ID	**Concrete Stress** (MPa)		**Primary Reinforcement Stress** (MPa)				
				Calculated				
		Calculated	Allowable	Direction1[*1]		Direction2[*1]		Allowable[*2]
				In/Top	Out/Bottom	In/Top	Out/Bottom	
18 Wall	6	-20.4	-29.3	206.2	142.3	194.2	206.3	372.2
Below RCCV	13	-17.0	-29.3	173.2	122.2	217.0	147.3	372.2
Bottom	24	-12.3	-29.3	189.5	96.3	124.7	65.3	372.2
19 Wall Below	806	-10.3	-29.3	162.5	97.1	163.7	113.7	372.2
Below RCCV	813	-10.7	-29.3	107.5	67.7	130.6	77.3	372.2
Mid-Height	824	-11.6	-29.3	166.7	81.6	138.7	-69.4	372.2
20 Wall	1606	-20.7	-29.3	185.6	214.1	-89.3	290.9	372.2
Below RCCV	1613	-22.4	-29.3	97.1	178.1	-99.0	280.9	372.2
Top	1624	-21.2	-29.3	168.7	240.1	-99.1	269.8	372.2
21 Exterior Wall	20011	-21.9	-29.3	257.5	229.6	312.0	331.6	372.2
@ EL-11.50	20023	-8.5	-29.1	-29.8	62.8	57.0	125.4	370.5
~-10.50m	30010	-10.5	-29.3	198.5	149.2	278.2	211.3	372.2
	30020	-4.4	-29.3	-30.5	47.1	76.1	49.8	372.2
	40001	-5.4	-29.3	47.2	55.3	118.8	76.4	372.2
	40011	-5.8	-29.3	240.0	160.0	231.8	166.3	372.2
22 Exterior Wall	22011	-12.5	-29.3	246.7	245.8	293.1	322.8	372.2
@ EL4.65	22023	-9.7	-29.3	135.7	81.9	154.2	168.8	372.2
~6.60m	32010	-11.3	-29.3	275.3	310.6	221.2	285.6	372.2
	32020	-7.1	-29.3	142.8	189.1	149.6	250.6	372.2
	42001	-7.7	-29.3	106.8	146.8	133.1	189.4	372.2
	42011	-12.1	-29.3	301.1	307.1	246.7	303.9	372.2
23 Exterior Wall	24211	-8.9	-29.3	242.3	245.0	279.8	246.6	372.2
@ EL22.50	24224	-8.6	-29.3	171.9	200.1	247.9	351.8	372.2
~24.60m	34210	-7.9	-29.3	294.9	316.5	244.0	244.6	372.2
	34220	-4.9	-29.3	152.5	119.2	137.3	190.2	372.2
	44201	-7.2	-29.3	187.9	124.1	153.4	177.1	372.2
24 Basemat	90140	-9.6	-23.5	124.5	129.9	173.6	112.1	372.2
@ Wall	90182	-14.1	-23.5	-116.9	139.6	196.6	108.8	372.2
Below RCCV	90111	-5.6	-23.5	-88.4	125.7	115.0	126.5	372.2
25 Slab	93140	-9.3	-29.3	242.4	92.4	173.3	74.5	372.2(223.3)
EL4.65m	93182	-18.3	-29.3	103.6	55.8	-84.5	92.7	372.2(223.3)
@ RCCV	93111	-14.6	-29.3	-71.7	68.5	68.3	51.0	372.2(223.3)
26 Slab	96144	-12.0	-29.3	280.7	101.6	312.0	120.4	372.2(223.3)
EL17.5m	96186	-10.5	-29.3	175.5	84.3	-59.5	-24.8	372.2(223.3)
@ RCCV	96113	-19.9	-28.8	-115.9	80.2	113.0	158.9	368.2
27 Slab	98472	-11.4	-29.1	159.1	41.2	223.9	38.2	370.3(222.2)
EL27.0m	98514	-7.2	-29.1	38.0	44.4	31.9	24.6	370.3(222.2)
@ RCCV	98424	-14.0	-28.1	229.7	-63.2	201.2	-33.9	363.0
28 Pool Girder	123004	-13.1	-28.4	-5.4	-8.4	-48.0	-73.4	365.0
@ Storage Pool	123104	-5.6	-28.4	73.2	76.3	38.5	74.7	365.0
29 Pool Girder	123012	-2.6	-28.4	52.6	57.2	36.8	41.6	365.0
@ Cavity	123112	-2.3	-28.4	64.7	55.7	43.6	40.9	365.0
30 Pool Girder	123017	-12.8	-29.0	181.6	53.2	232.9	-61.9	369.8
@ Fuel Pool	123117	-8.3	-29.0	118.3	22.9	109.0	-27.1	369.8
31 MS Tunnel	150122	-16.8	-29.3	230.6	3.9	215.0	-29.8	372.2
Wall and Slab	96611	-11.7	-29.3	-18.4	125.3	-19.9	199.9	372.2
	98614	-10.6	-29.3	142.2	-16.6	175.1	-18.1	372.2

Note: Negative value means compression.

Note *1:

Wall Below RCCV	Direction1 : Hoop,	Direction2 : Vertical
Exterior Wall	Direction1 : Horizontal,	Direction2 : Vertical
Slab	Direction1 : N-S,	Direction2 : E-W
Pool Girder	Direction1 : Horizontal,	Direction2 : Vertical
MS Tunnel Wall	Direction1 : Horizontal,	Direction2 : Vertical
MS Tunnel Slab	Direction1 : N-S,	Direction2 : E-W

Note *2: Value in parentheses indicates the allowable stress of the steel plate.

Table 3G.1-55

Rebar and Concrete Stresses of RB: Selected Load Combination RB-9b

Location	Element ID	**Concrete Stress** (MPa)		**Primary Reinforcement Stress** (MPa)				
				Calculated				
		Calculated	Allowable	Direction1[*1]		Direction2[*1]		Allowable[*2]
				In/Top	Out/Bottom	In/Top	Out/Bottom	
18 Wall	6	-21.3	-29.3	225.2	146.1	217.2	206.0	372.2
Below RCCV	13	-18.4	-29.3	184.7	112.1	237.0	129.0	372.2
Bottom	24	-11.2	-29.3	206.3	91.9	143.6	58.0	372.2
19 Wall Below	806	-11.1	-29.3	173.1	99.6	176.7	117.5	372.2
Below RCCV	813	-11.4	-29.3	114.9	69.7	143.5	79.1	372.2
Mid-Height	824	-12.1	-29.3	176.3	83.0	152.3	-71.4	372.2
20 Wall	1606	-22.9	-29.3	209.1	236.1	-96.8	305.9	372.2
Below RCCV	1613	-25.0	-29.3	107.5	197.3	-107.3	303.2	372.2
Top	1624	-23.6	-29.3	183.8	265.9	-106.3	294.3	372.2
21 Exterior Wall	20011	-22.7	-29.3	272.3	229.8	335.7	331.8	372.2
@ EL-11.50	20023	-8.4	-29.1	-31.8	63.6	57.7	124.2	370.5
~-10.50m	30010	-10.8	-29.3	216.5	144.7	314.6	194.5	372.2
	30020	-4.4	-29.3	-36.3	49.5	75.8	47.6	372.2
	40001	-5.5	-29.3	48.0	61.5	118.5	74.1	372.2
	40011	-5.7	-29.3	259.1	154.6	264.6	170.2	372.2
22 Exterior Wall	22011	-12.4	-29.3	272.1	273.9	311.0	344.1	372.2
@ EL4.65	22023	-9.6	-29.3	147.6	75.3	157.9	168.5	372.2
~6.60m	32010	-13.3	-29.3	308.0	339.9	253.0	315.6	372.2
	32020	-7.2	-29.3	162.1	179.9	156.7	247.1	372.2
	42001	-7.8	-29.3	131.0	131.3	138.7	182.6	372.2
	42011	-12.6	-29.3	322.3	329.4	257.5	326.1	372.2
23 Exterior Wall	24211	-8.9	-29.3	278.7	275.2	328.4	265.8	372.2
@ EL22.50	24224	-8.9	-29.3	205.2	193.0	249.6	345.9	372.2
~24.60m	34210	-11.1	-29.3	340.6	364.6	243.6	280.7	372.2
	34220	-8.6	-29.3	179.9	78.5	121.3	155.4	372.2
	44201	-7.9	-29.3	221.8	130.4	182.5	192.8	372.2
24 Basemat	90140	-9.6	-23.5	127.4	120.5	177.9	107.5	372.2
@ Wall	90182	-12.9	-23.5	-77.6	136.3	193.9	125.9	372.2
Below RCCV	90111	-6.0	-23.5	-97.1	131.7	113.6	126.0	372.2
25 Slab	93140	-12.2	-29.3	275.9	110.1	215.1	92.7	372.2(223.3)
EL4.65m	93182	-22.8	-29.3	116.7	70.4	-105.8	116.7	372.2(223.3)
@ RCCV	93111	-18.6	-29.3	-89.8	90.6	80.9	64.3	372.2(223.3)
26 Slab	96144	-12.6	-29.3	322.2	116.8	337.7	136.8	372.2(223.3)
EL17.5m	96186	-12.8	-29.3	217.7	105.3	-69.3	30.3	372.2(223.3)
@ RCCV	96113	-17.4	-28.8	-112.6	67.7	133.2	158.0	368.2
27 Slab	98472	-13.6	-27.6	50.2	91.2	114.6	71.0	359.4(215.6)
EL27.0m	98514	-16.6	-27.6	-26.4	76.2	-27.2	91.8	359.4(215.6)
@ RCCV	98424	-15.4	-28.1	296.1	-66.4	276.3	80.1	363.0
28 Pool Girder	123004	-10.5	-27.4	15.5	166.0	-59.1	156.0	358.3
@ Storage Pool	123104	-14.5	-27.4	43.5	248.7	28.4	263.9	358.3
29 Pool Girder	123012	-10.4	-27.4	-21.0	169.0	-6.5	153.0	358.3
@ Cavity	123112	-9.6	-27.4	20.9	191.0	-7.8	197.1	358.3
30 Pool Girder	123017	-12.7	-29.0	246.2	97.9	261.4	110.4	369.8
@ Fuel Pool	123117	-8.0	-29.0	149.2	38.1	134.6	-27.6	369.8
31 MS Tunnel	150122	-15.8	-29.3	216.3	8.1	201.3	-30.7	372.2
Wall and Slab	96611	-11.8	-29.3	-18.5	121.4	-17.3	223.1	372.2
	98614	-11.5	-29.3	158.7	-13.7	191.6	-21.0	372.2

Note: Negative value means compression.

Note *1:

Wall Below RCCV	Direction1 : Hoop,	Direction2 : Vertical
Exterior Wall	Direction1 : Horizontal,	Direction2 : Vertical
Slab	Direction1 : N-S,	Direction2 : E-W
Pool Girder	Direction1 : Horizontal,	Direction2 : Vertical
MS Tunnel Wall	Direction1 : Horizontal,	Direction2 : Vertical
MS Tunnel Slab	Direction1 : N-S,	Direction2 : E-W

Note *2: Value in parentheses indicates the allowable stress of the steel plate.

Table 3G.1-56

Transverse Shear of RB

Location	Element ID	Load ID	d (m)	pv (%)	Shear Force (MN/m) Vu	Vc	Vs	ϕVn	Vu/ϕVn
18 Wall	6	RB-9a	1.59	0.721	1.64	0.49	4.74	4.44	0.369
Below RCCV	13	RB-9a	1.59	0.721	1.72	1.16	4.73	5.00	0.343
Bottom	24	RB-8b	1.57	0.721	0.27	4.25	4.68	7.60	0.036
19 Wall Below	806	RB-8b	1.57	0.270	0.16	3.89	1.75	4.80	0.034
Below RCCV	813	RB-8b	1.57	0.270	0.69	4.21	1.75	5.07	0.135
Mid-Height	824	RB-8b	1.57	0.270	0.74	4.28	1.75	5.13	0.145
20 Wall	1606	RB-9b	1.57	0.540	3.97	2.38	3.50	4.99	0.796
Below RCCV	1613	RB-9b	1.57	0.540	4.57	2.58	3.50	5.17	0.884
Top	1624	RB-9b	1.57	0.540	4.70	2.47	3.50	5.07	0.926
21 Exterior Wall	20011	RB-9b	1.59	0.484	3.59	1.82	3.18	4.25	0.845
@ EL-11.50	20023	RB-9a	1.64	0.484	2.88	3.20	3.28	5.50	0.523
~-10.50m	30010	RB-9a	1.65	0.177	2.03	1.46	1.21	2.27	0.898
	30020	RB-4	1.72	0.177	0.29	3.22	1.26	3.80	0.077
	40001	RB-4	1.73	0.177	0.46	3.32	1.27	3.90	0.119
	40011	RB-9a	1.72	0.177	1.89	1.38	1.26	2.24	0.845
22 Exterior Wall	22011	RB-9a	1.19	0.484	0.64	0.00	2.38	2.02	0.316
@ EL4.65	22023	RB-4	1.21	0.484	0.17	2.14	2.42	3.88	0.043
~6.60m	32010	RB-9a	1.24	0.177	0.21	0.00	0.91	0.77	0.268
	32020	RB-9b	1.26	0.177	1.24	1.18	0.92	1.78	0.698
	42001	RB-9b	1.25	0.242	0.91	0.61	1.26	1.59	0.575
	42011	RB-9a	1.20	0.242	0.14	0.00	1.21	1.02	0.141
23 Exterior Wall	24211	RB-9b	1.15	0.484	1.20	0.81	2.31	2.65	0.452
@ EL22.50	24224	RB-9b	1.19	0.968	2.20	0.29	4.64	4.19	0.526
~24.60m	34210	RB-9a	1.24	0.177	0.29	0.00	0.91	0.77	0.370
	34220	RB-9b	1.26	0.710	2.48	0.57	3.69	3.62	0.687
	44201	RB-9b	1.26	0.968	3.02	0.76	4.89	4.80	0.630
24 Basemat	90140	RB-9b	3.49	1.610	12.03	5.22	12.18	14.79	0.813
@ Wall	90182	RB-9b	3.47	1.610	7.75	5.22	12.12	14.73	0.526
Below RCCV	90111	RB-9b	3.49	1.610	4.77	3.03	12.16	12.92	0.369
25 Slab	93140	RB-8a	1.00	0.500	0.16	2.22	2.07	3.65	0.045
EL4.65m	93182	RB-9b	1.00	0.500	2.59	1.59	2.07	3.11	0.834
@ RCCV	93111	RB-9b	1.00	0.500	1.84	1.52	2.07	3.05	0.603
26 Slab	96144	RB-8b	1.00	0.500	0.17	2.51	2.07	3.89	0.045
EL17.5m	96186	RB-8b	1.00	0.500	0.69	2.69	2.07	4.04	0.170
@ RCCV	96113	RB-8a	1.34	0.500	1.22	3.50	2.76	5.32	0.229
27 Slab	98472	RB-8a	0.62	0.500	0.95	1.50	1.27	2.36	0.405
EL27.0m	98514	RB-9a	0.62	0.500	1.23	1.29	1.27	2.18	0.566
@ RCCV	98424	RB-9b	1.95	0.500	6.24	4.82	4.04	7.53	0.829
28 Pool Girder	123004	RB-9b	1.18	0.968	3.36	3.02	4.58	6.47	0.519
@ Storage Pool	123104	RB-8b	1.21	0.484	1.02	1.43	2.43	3.28	0.310
29 Pool Girder	123012	RB-9b	1.33	0.242	1.54	1.25	1.33	2.19	0.703
@ Cavity	123112	RB-8a	1.27	0.242	0.06	2.20	1.27	2.96	0.021
30 Pool Girder	123017	RB-9b	1.24	0.968	0.54	0.61	4.84	4.64	0.117
@ Fuel Pool	123117	RB-8a	1.24	0.484	0.29	1.17	2.47	3.10	0.095
31 MS Tunnel	150122	RB-8a	1.08	0.177	0.17	0.20	0.79	0.84	0.206
Wall and Slab	96611	RB-8a	1.34	0.500	0.50	1.46	2.76	3.59	0.138
	98614	RB-9a	1.95	0.500	1.91	1.79	4.04	4.95	0.385

Table 3G.1-57

Factors of Safety for Foundation Stability

Load Combination	Overturning		Sliding		Floatation	
	Required	Actual	Required	Actual	Required	Actual
D + H + E’	1.1	344.2	1.1	1.11	--	--
D + F’	--	--	--	--	1.1	3.48

Where,
D = Dead Load
H = Lateral soil pressure
E’ = Safe Shutdown Earthquake
F’ = Buoyant forces of design basis flood

Table 3G.1-58

Maximum Soil Bearing Stress Involving SSE

	Site Condition*		
	Soft	Medium	Hard
Bearing Stress (MPa)	2.35	5.15	5.33

* See Table 3A.1-2 for site properties.

Figure 3G.1-1. RB and FB Concrete Outline Plan at EL -11500

Figure 3G.1-2. RB and FB Concrete Outline Plan at EL 4650

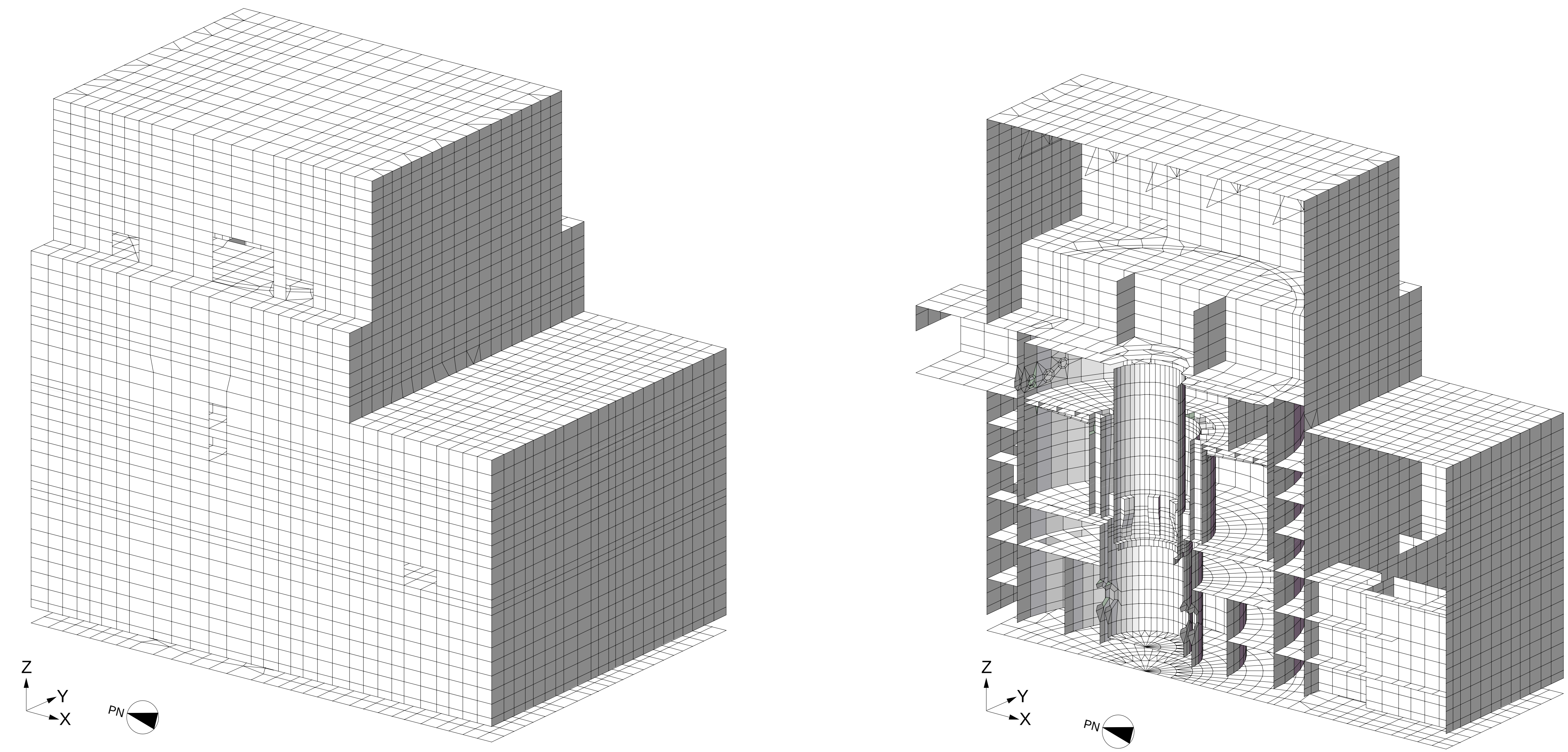
Figure 3G.1-3. RB and FB Concrete Outline Plan at EL 17500

Figure 3G.1-4. RB and FB Concrete Outline Plan at EL 27000

Figure 3G.1-5. RB Concrete Outline Plan at EL 34000

Figure 3G.1-6. RB and FB Concrete Outline N-S Section

Figure 3G.1-7. RB and FB Concrete Outline E-W Section



Whole View **Cut View**

Figure 3G.1-8. FE Model of RB/FB (Isometric View)

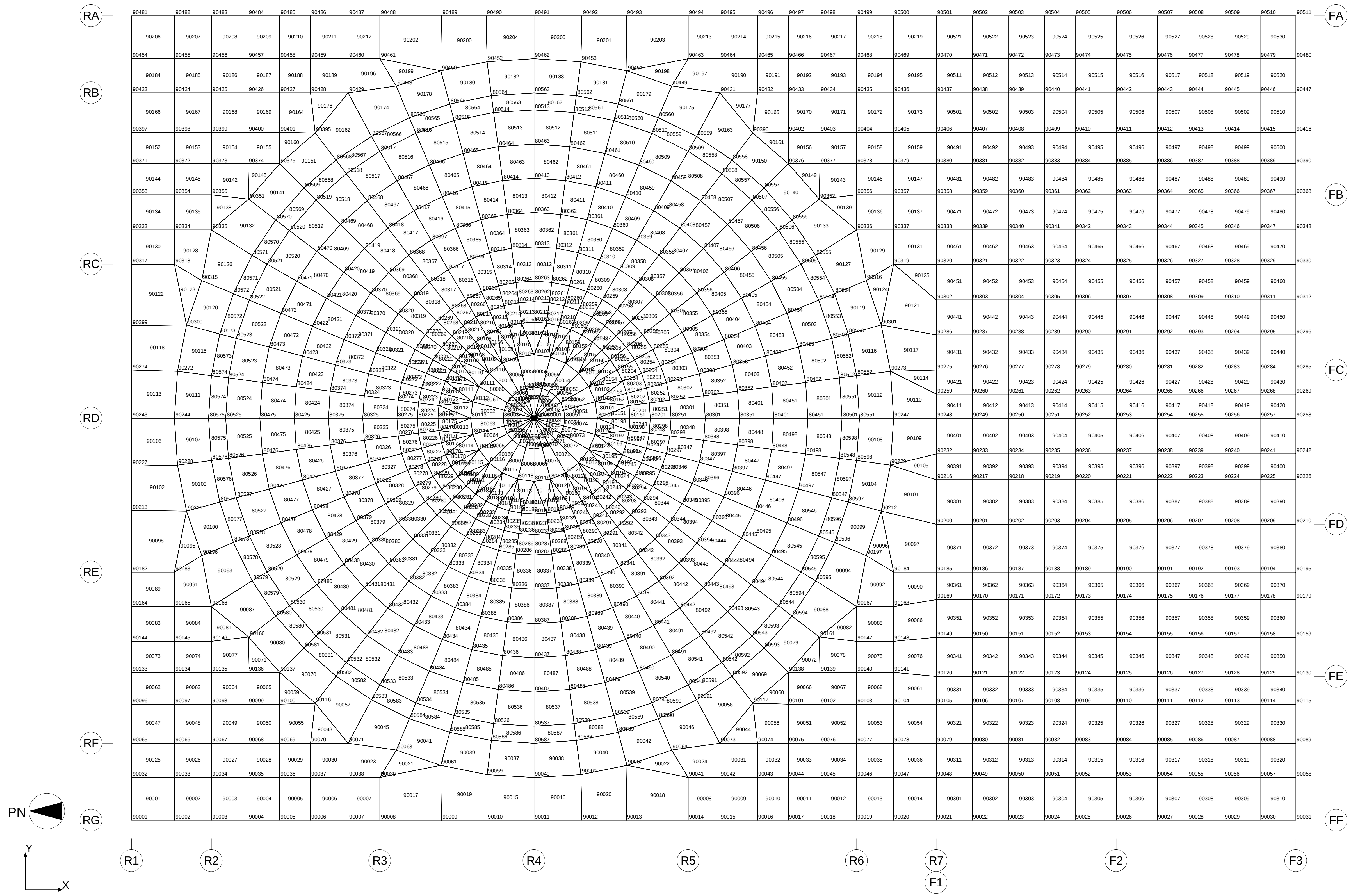


Figure 3G.1-9. FE Model of RB/FB (Foundation Mat)

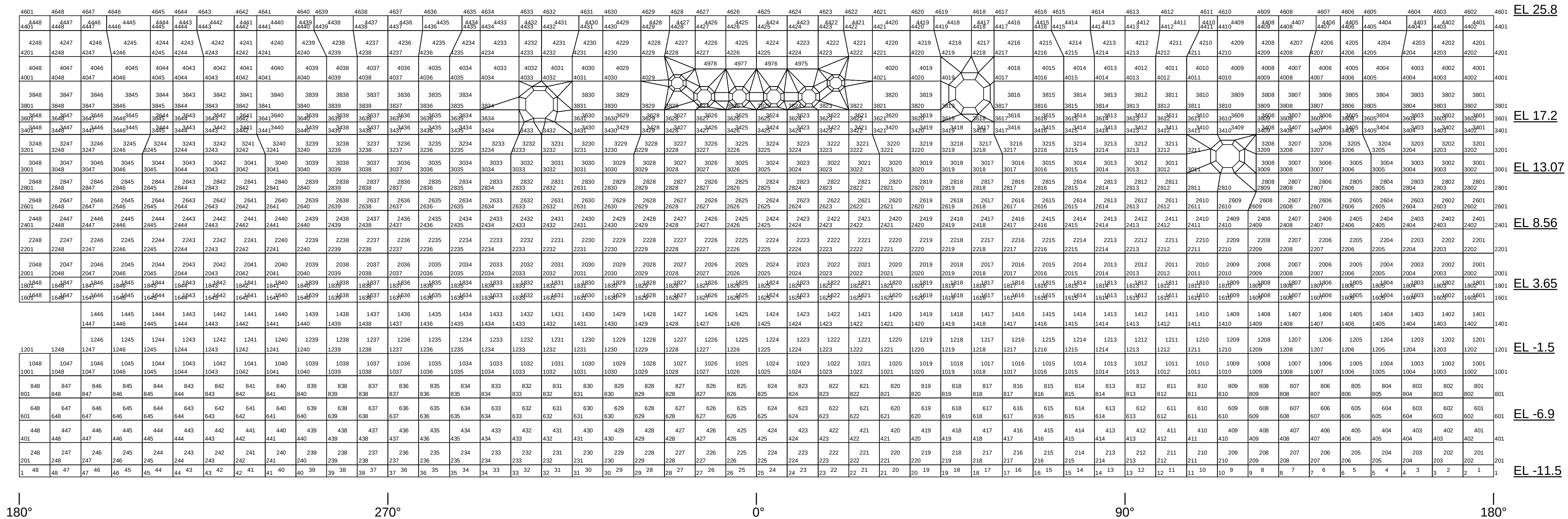


Figure 3G.1-10. FE Model of RB/FB (RCCV Wall)

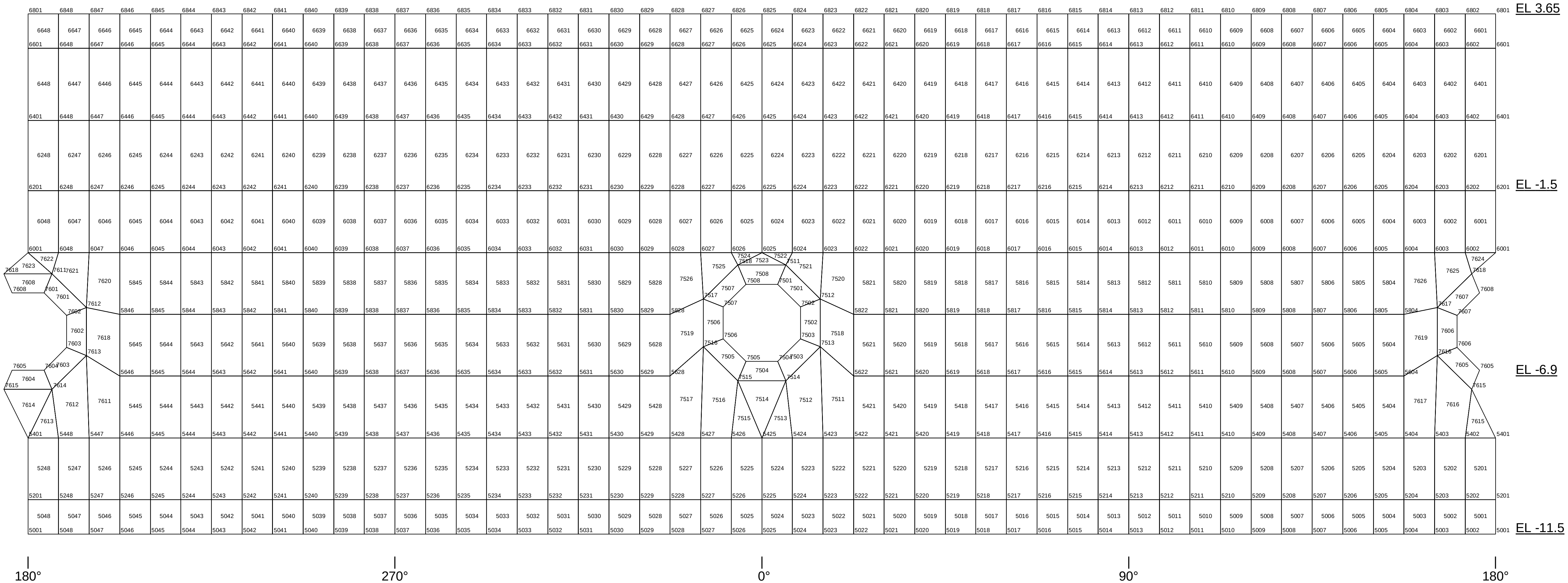


Figure 3G.1-11. FE Model of RB/FB (RPV Pedestal)

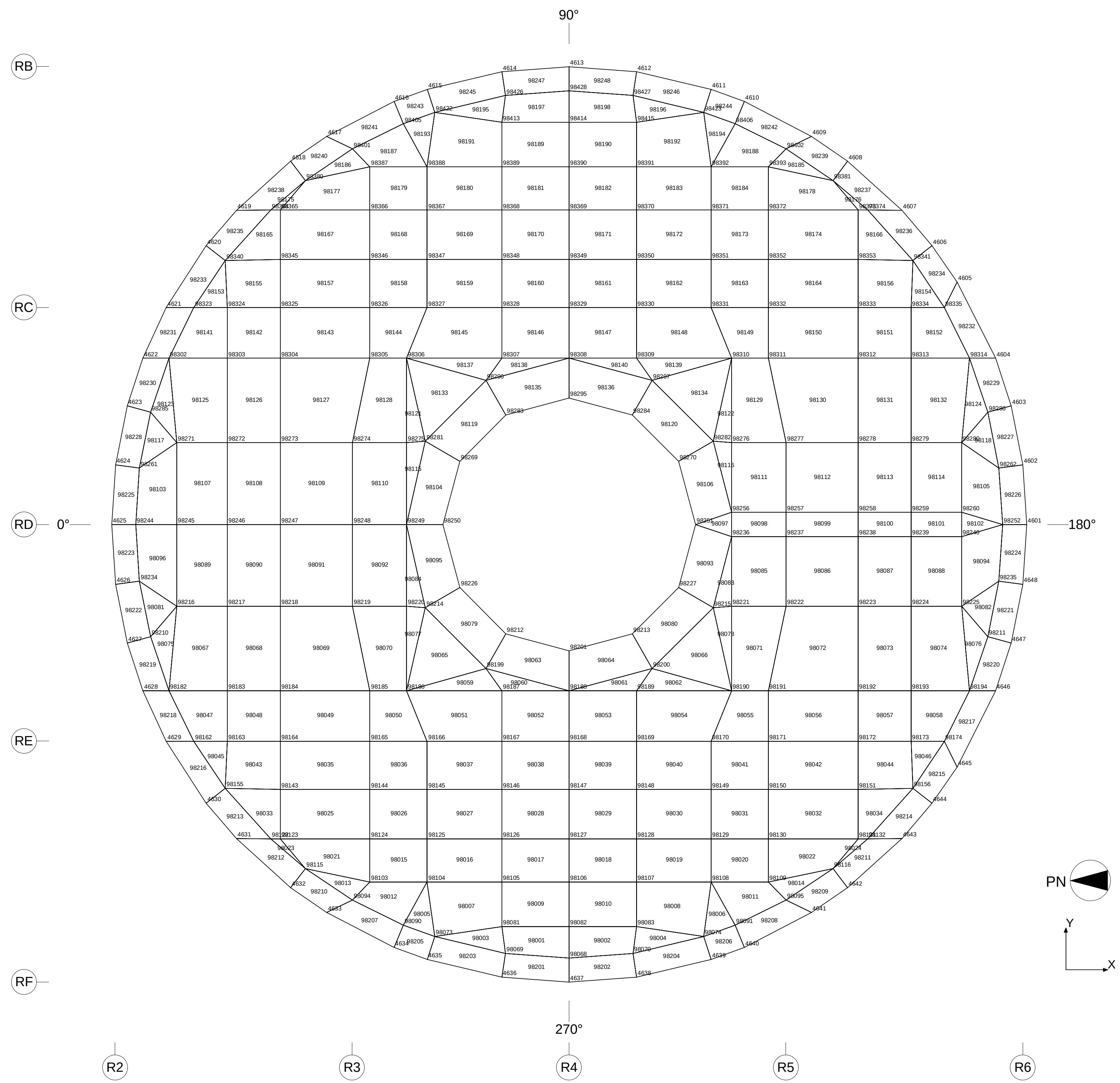


Figure 3G.1-12. FE Model of RB/FB (Top Slab)

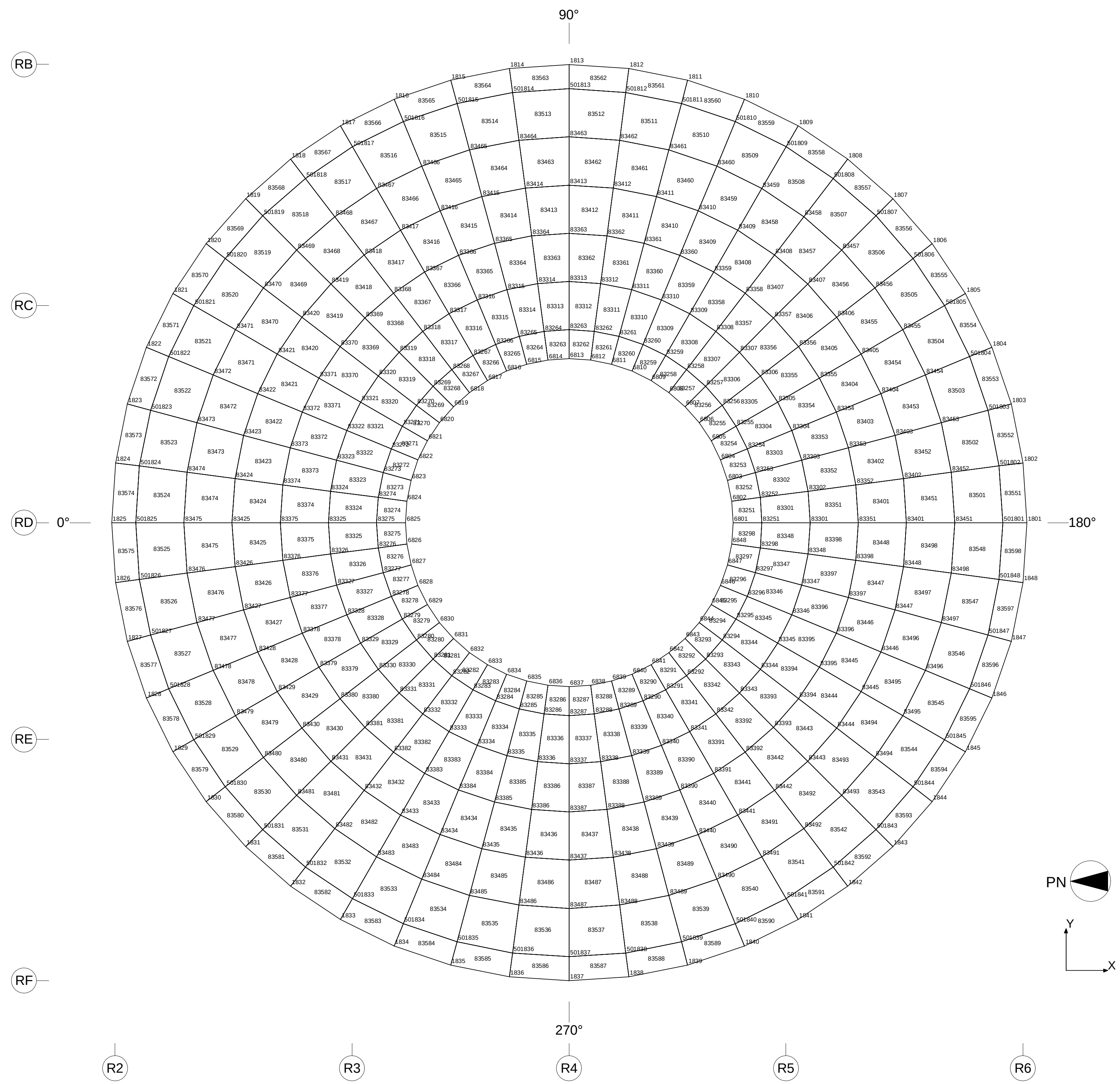


Figure 3G.1-13. FE Model of RB/FB (Suppression Pool Slab)

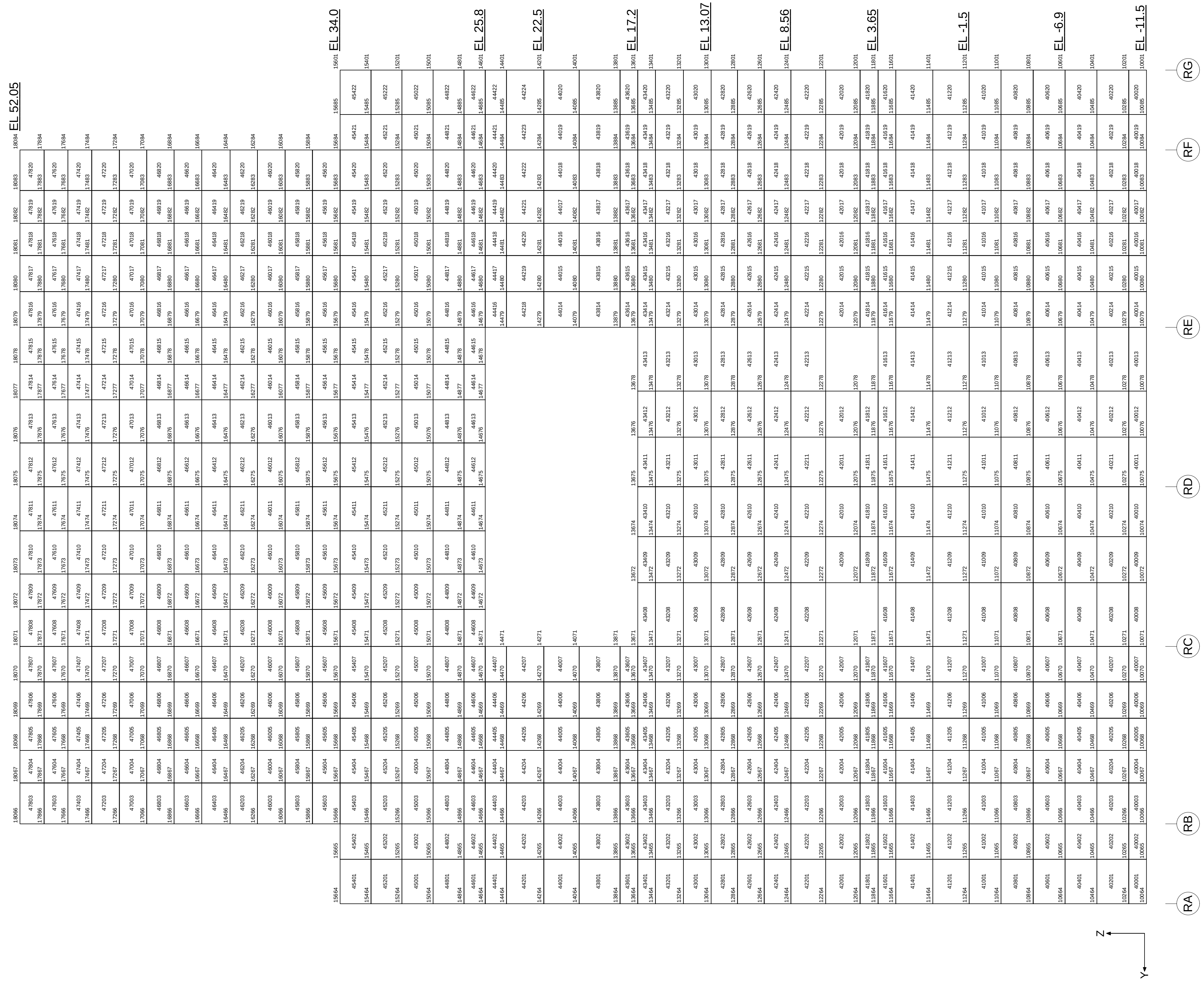


Figure 3G.1-14. FE Model of RB/FB (External Wall: North Side)

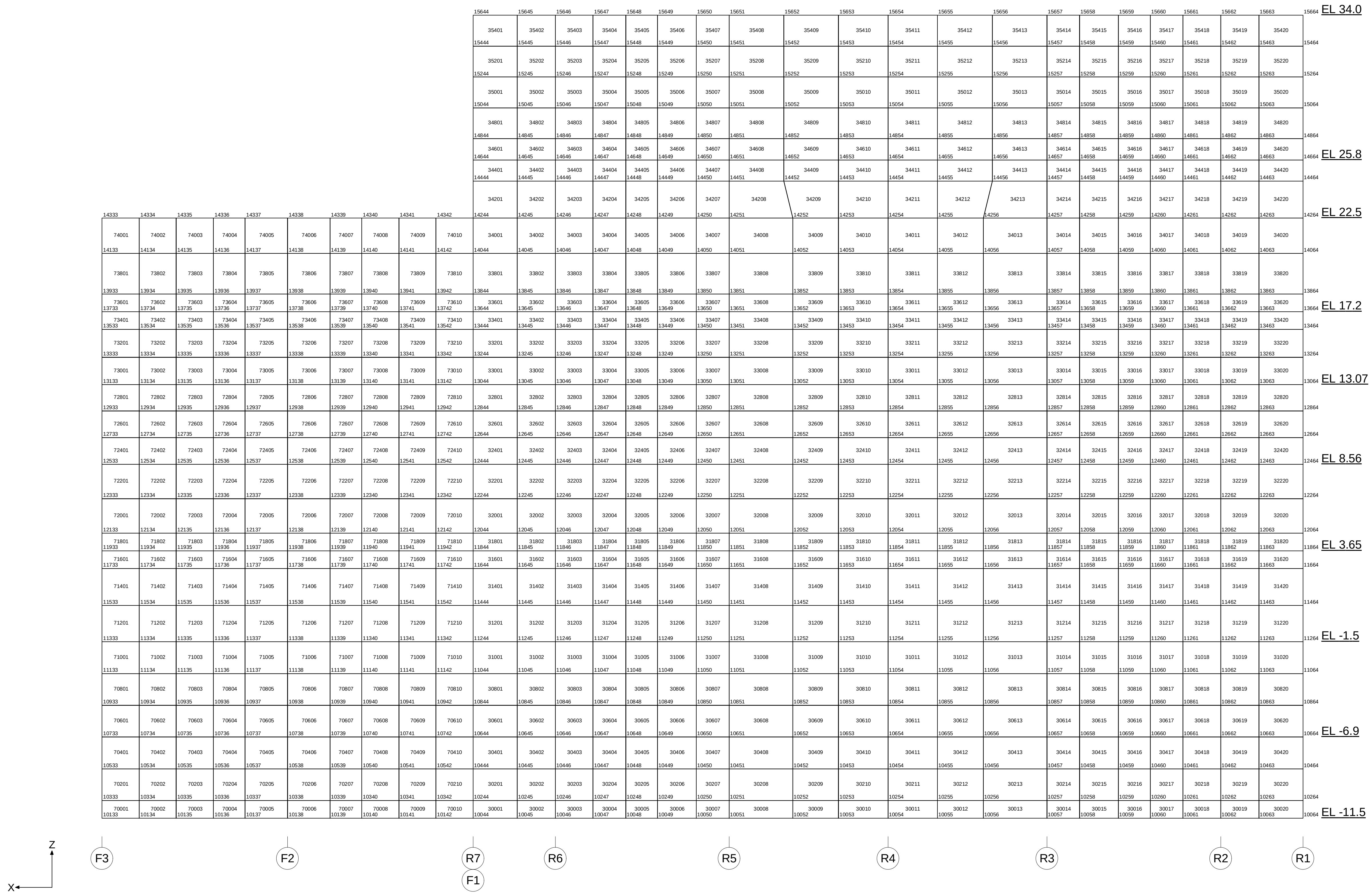


Figure 3G.1-15. FE Model of RB/FB (External Wall: East Side)

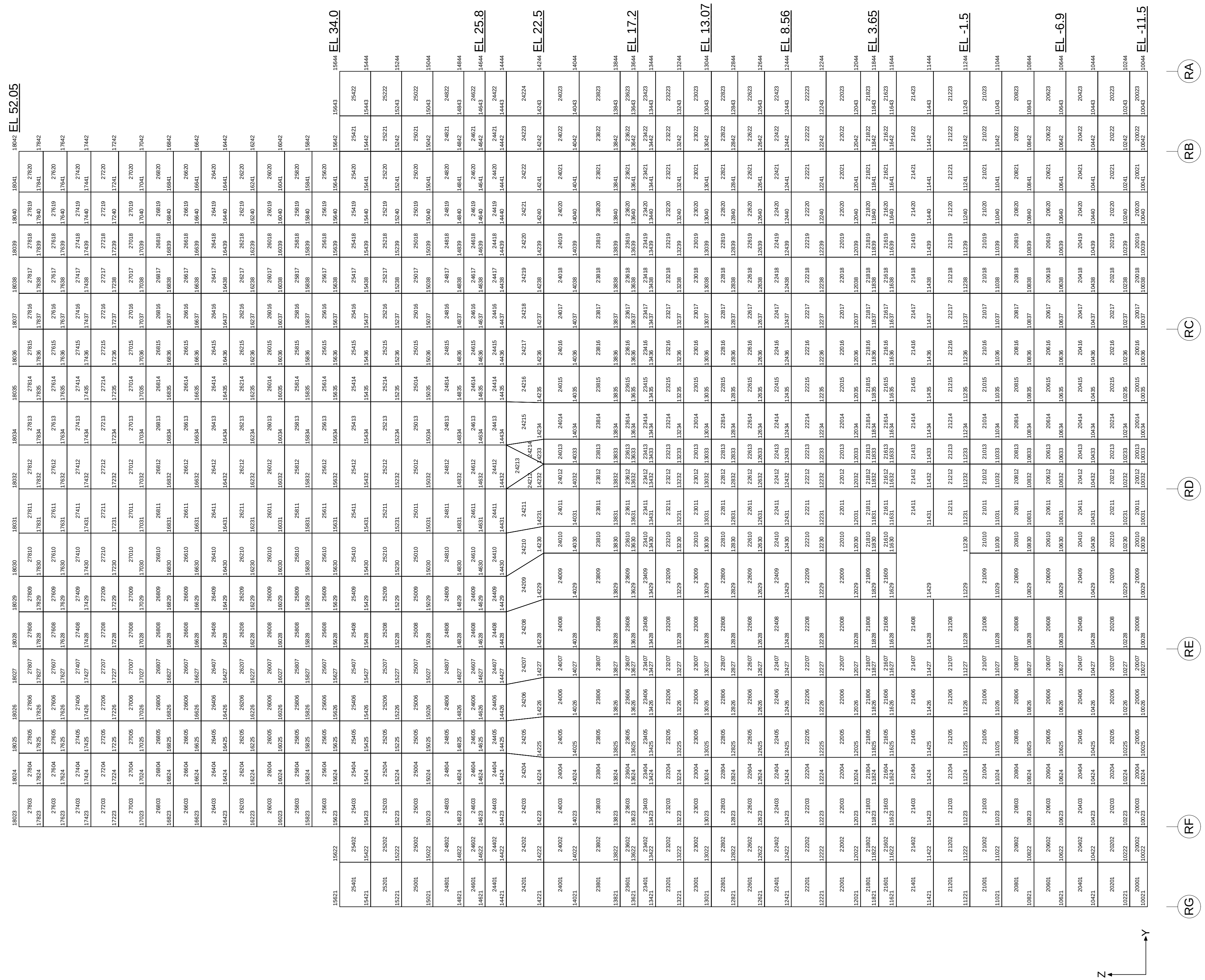
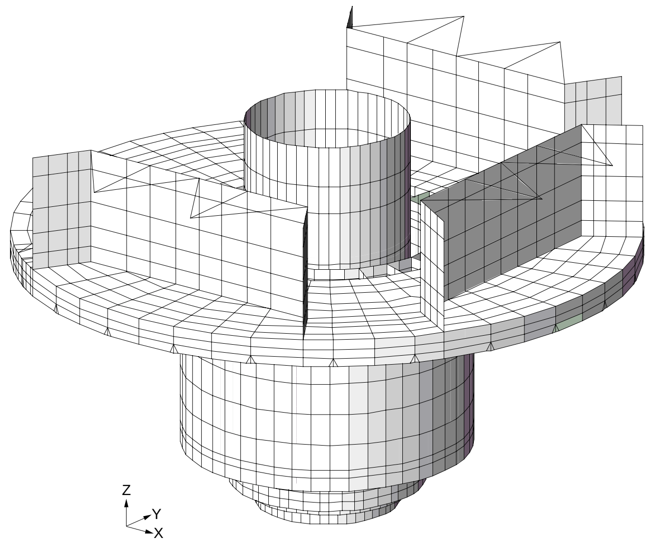
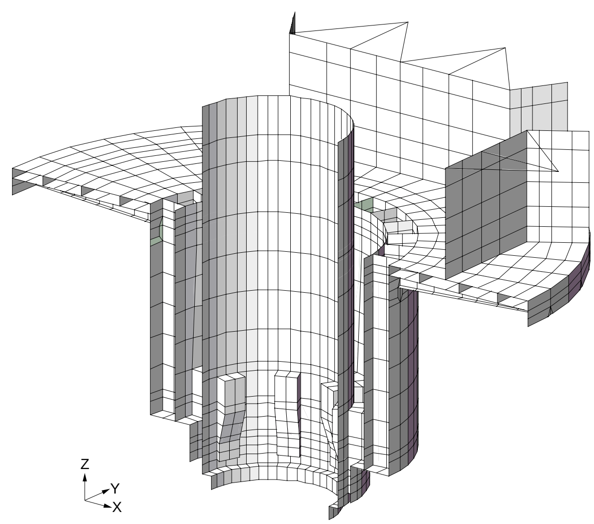


Figure 3G.1-16. FE Model of RB/FB (Internal Wall on R7/F1 Column Line)

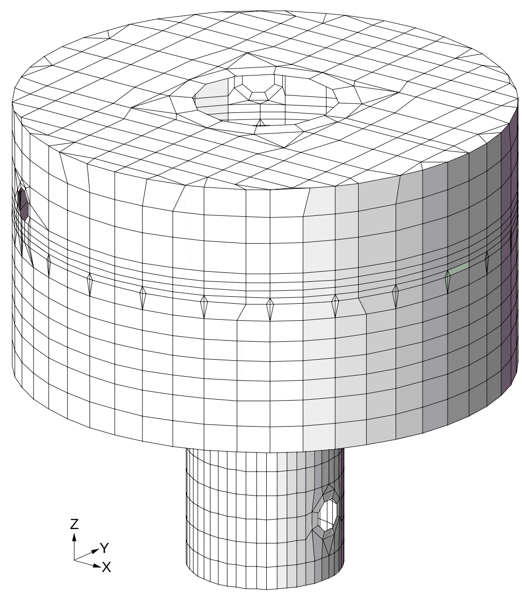


Whole View

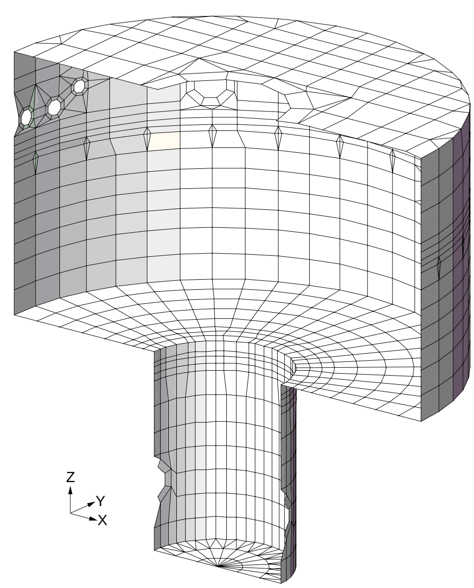


Cut View

Figure 3G.1-17. FE Model of RB/FB (RCCV Internals)



Whole View



Cut View

Figure 3G.1-18. FE Model of RB/FB (RCCV Liner)

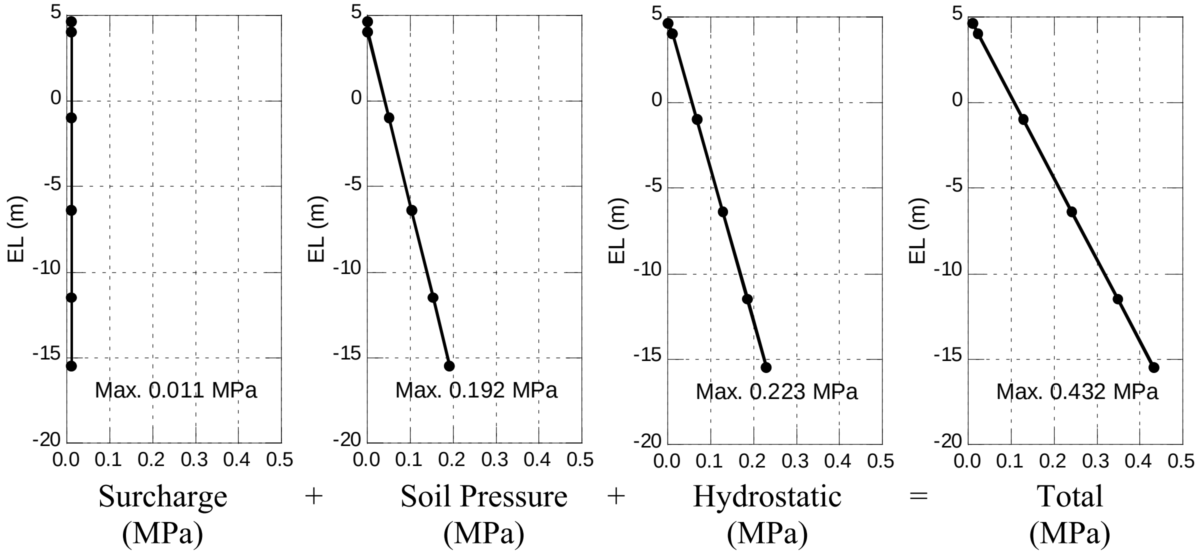


Figure 3G.1-19. Soil Pressure at Rest

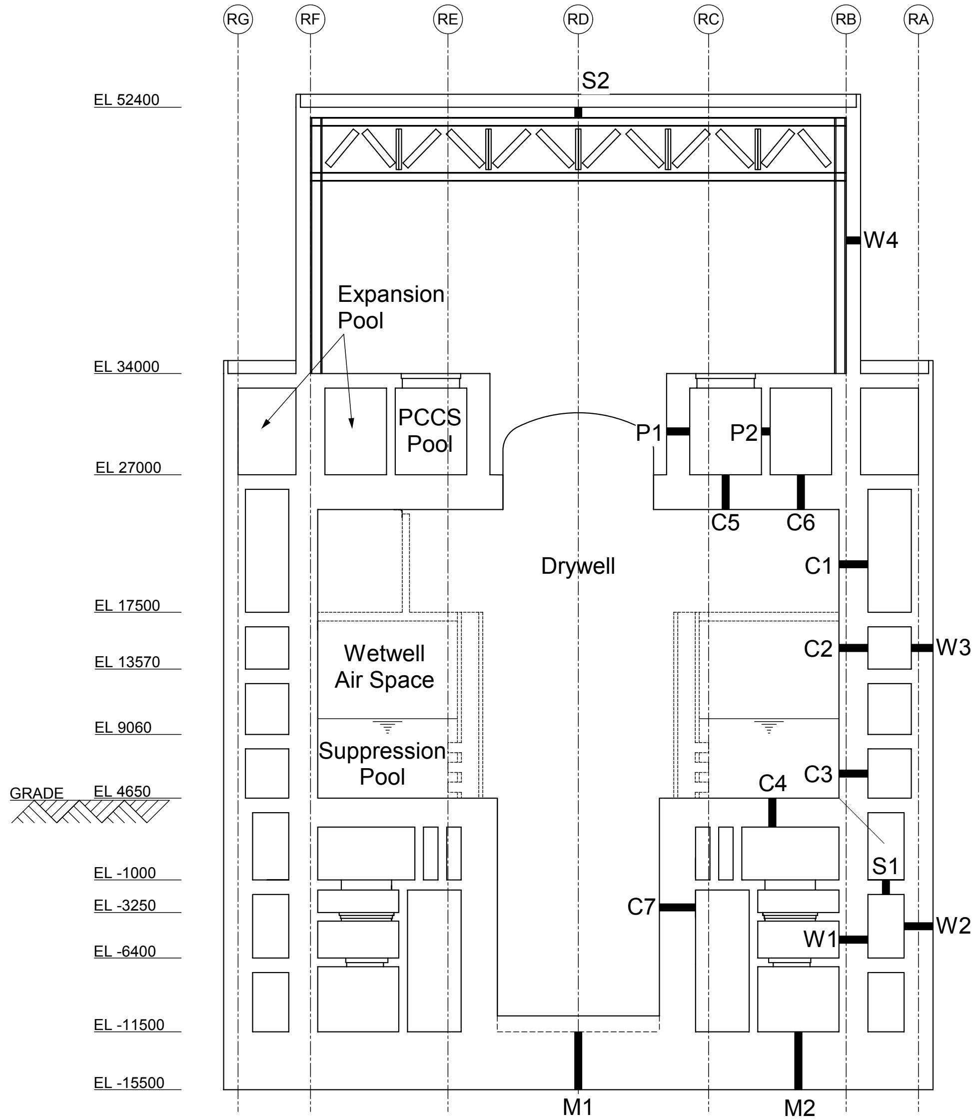
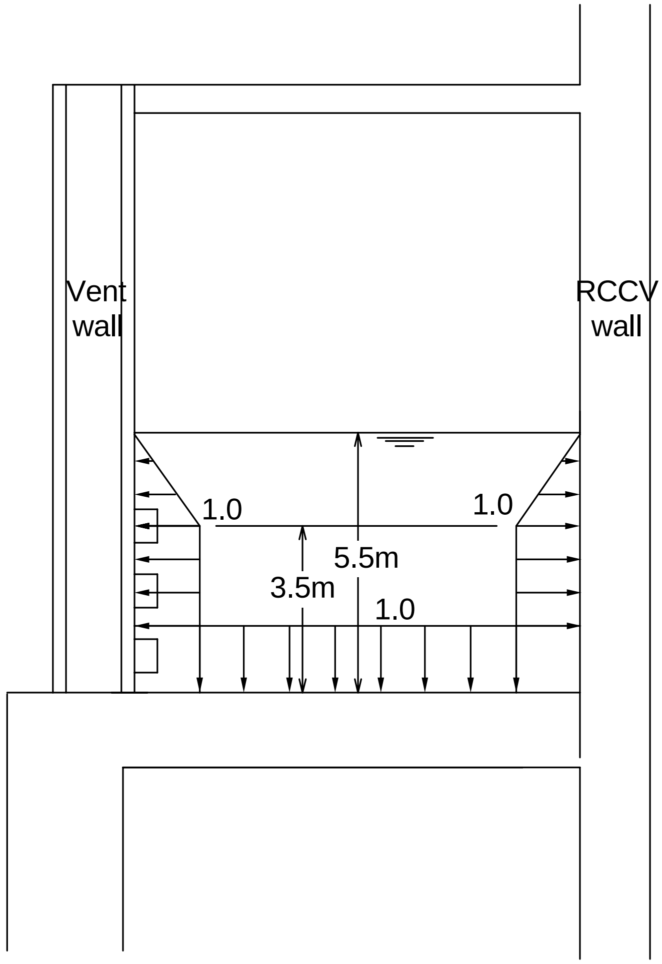
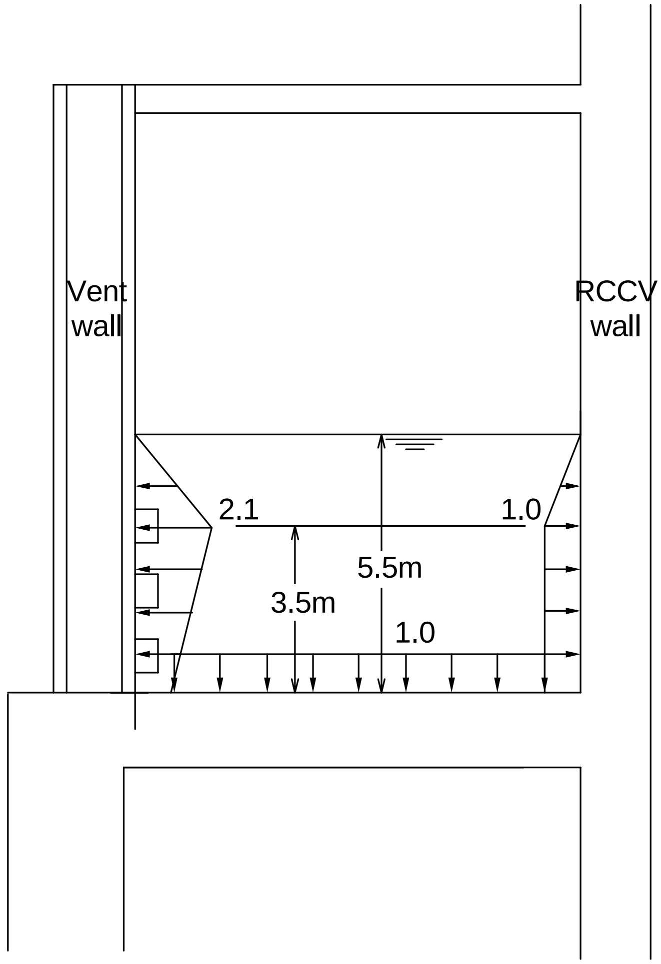


Figure 3G.1-20. Sections Where Temperature Loads Are Defined



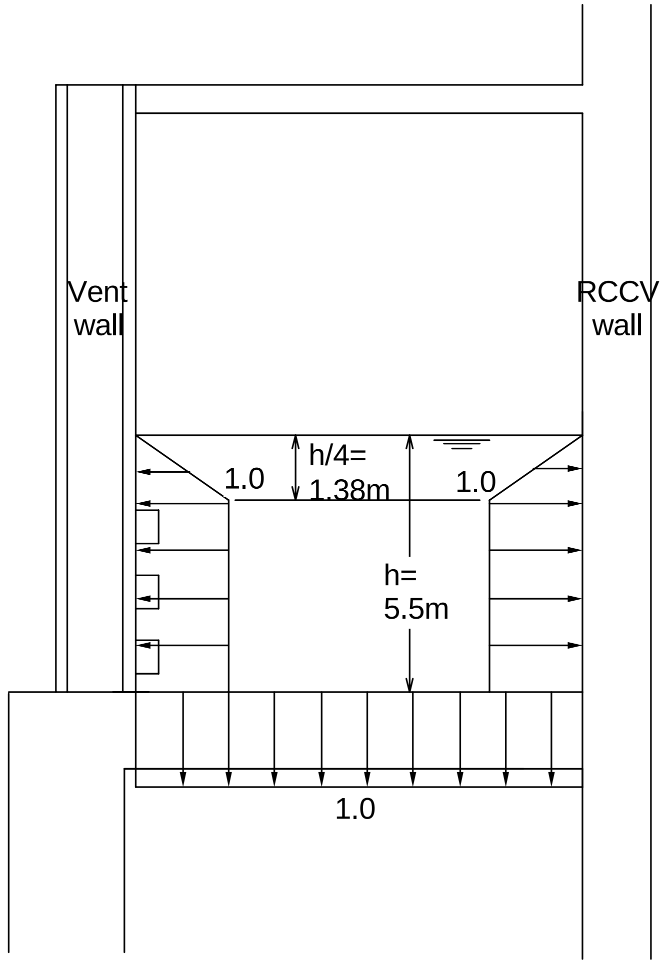
CO Peak Positive Pressure = 186 kPag
CO Peak Negative Pressure = -186 kPag
Dynamic Load Factor (DLF) = 2.0

Figure 3G.1-21. Condensation Oscillation (CO) Pressure Loads



CHUG Peak Positive Pressure = 91 kPag
CHUG Peak Negative Pressure = -66 kPag
Dynamic Load Factor (DLF) = 2.0

Figure 3G.1-22. Chugging (CHUG) Pressure Loads



SRV Peak Positive Pressure = 152 kPag
SRV Peak Negative Pressure = -63 kPag
Dynamic Load Factor (DLF) = 2.0

Figure 3G.1-23. Safety Relief Valve (SRV) Pressure Loads

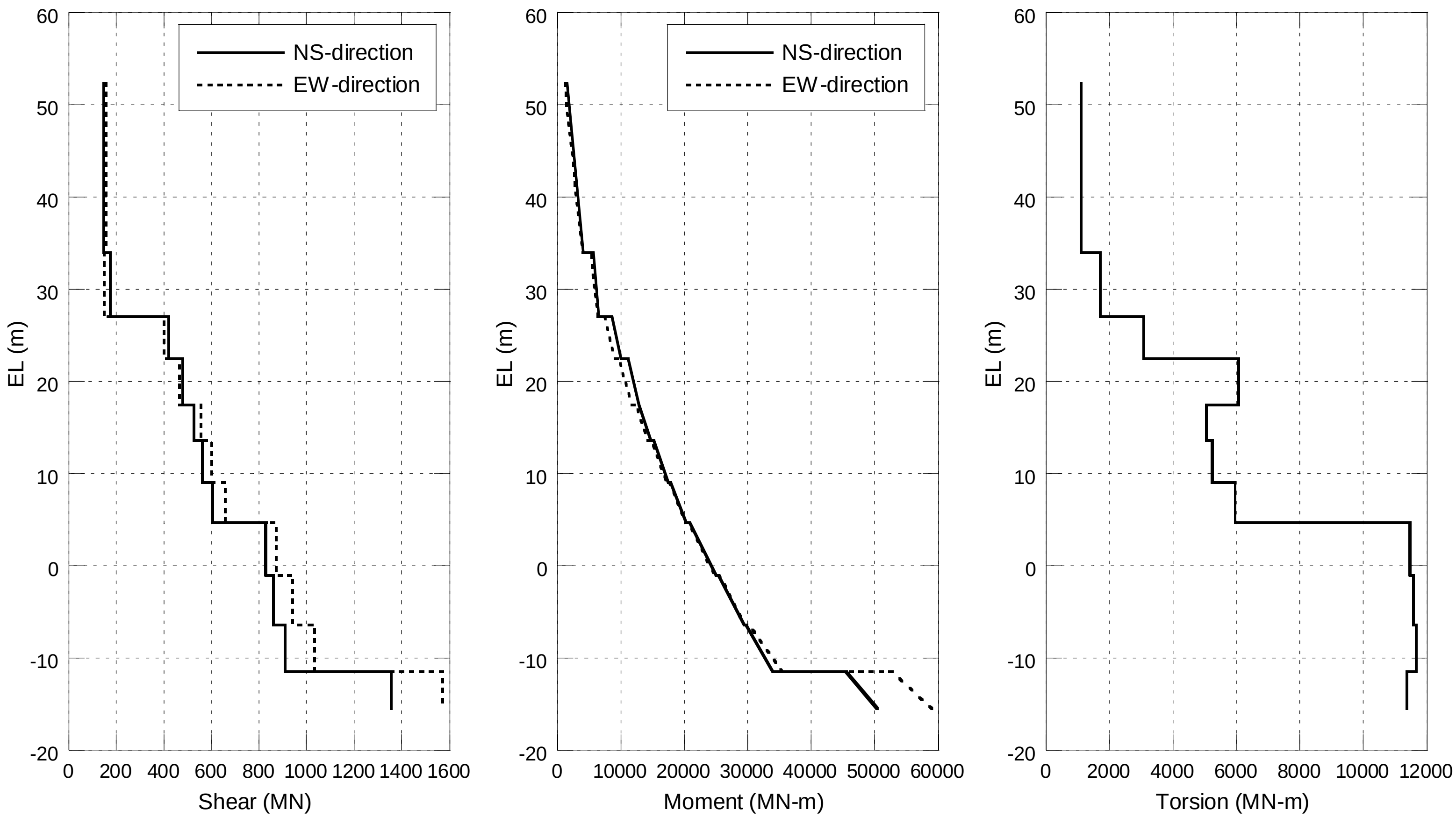


Figure 3G.1-24. Design Seismic Shears and Moments for RB and FB Walls

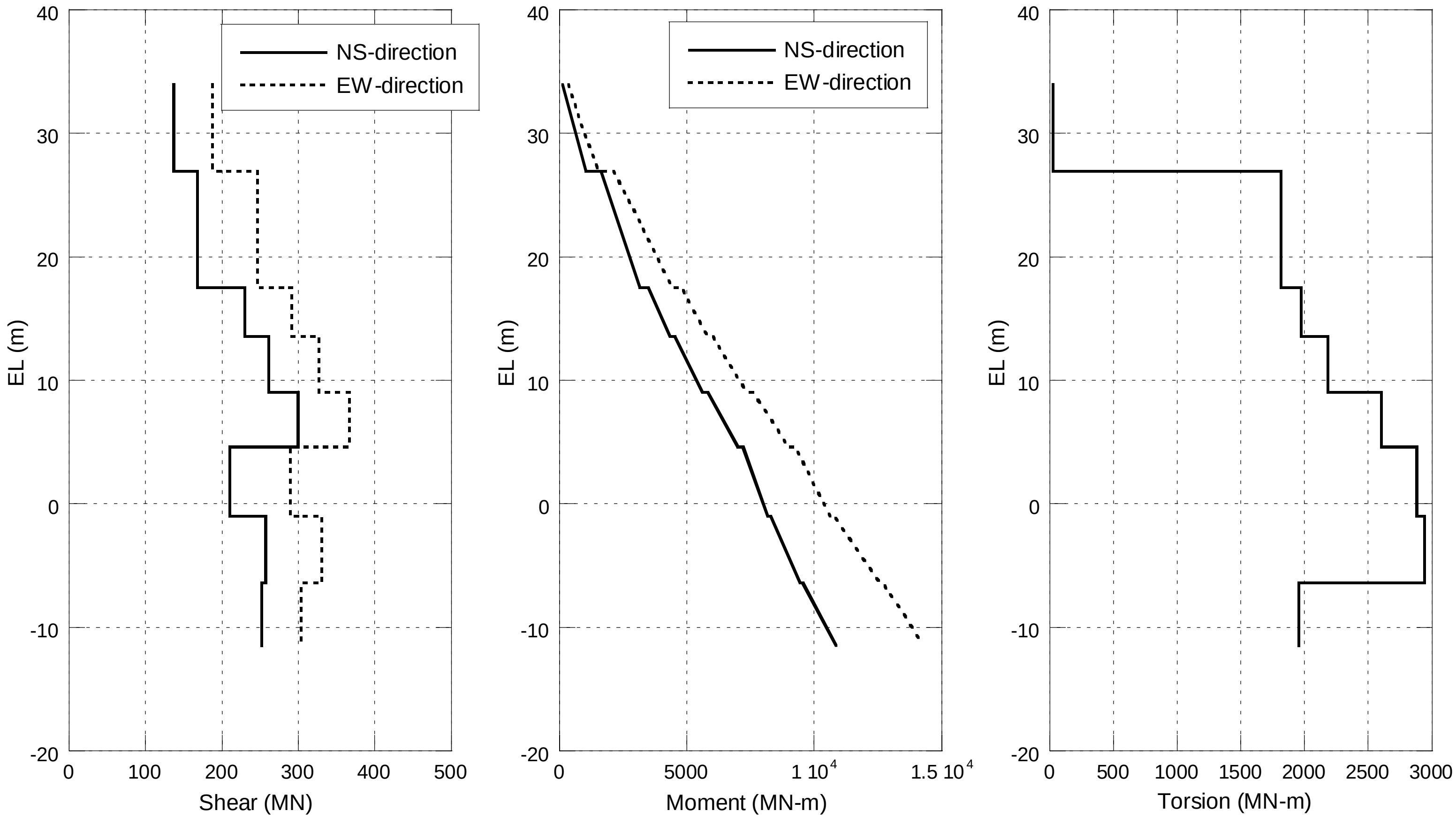


Figure 3G.1-25. Design Seismic Shears and Moments for RCCV

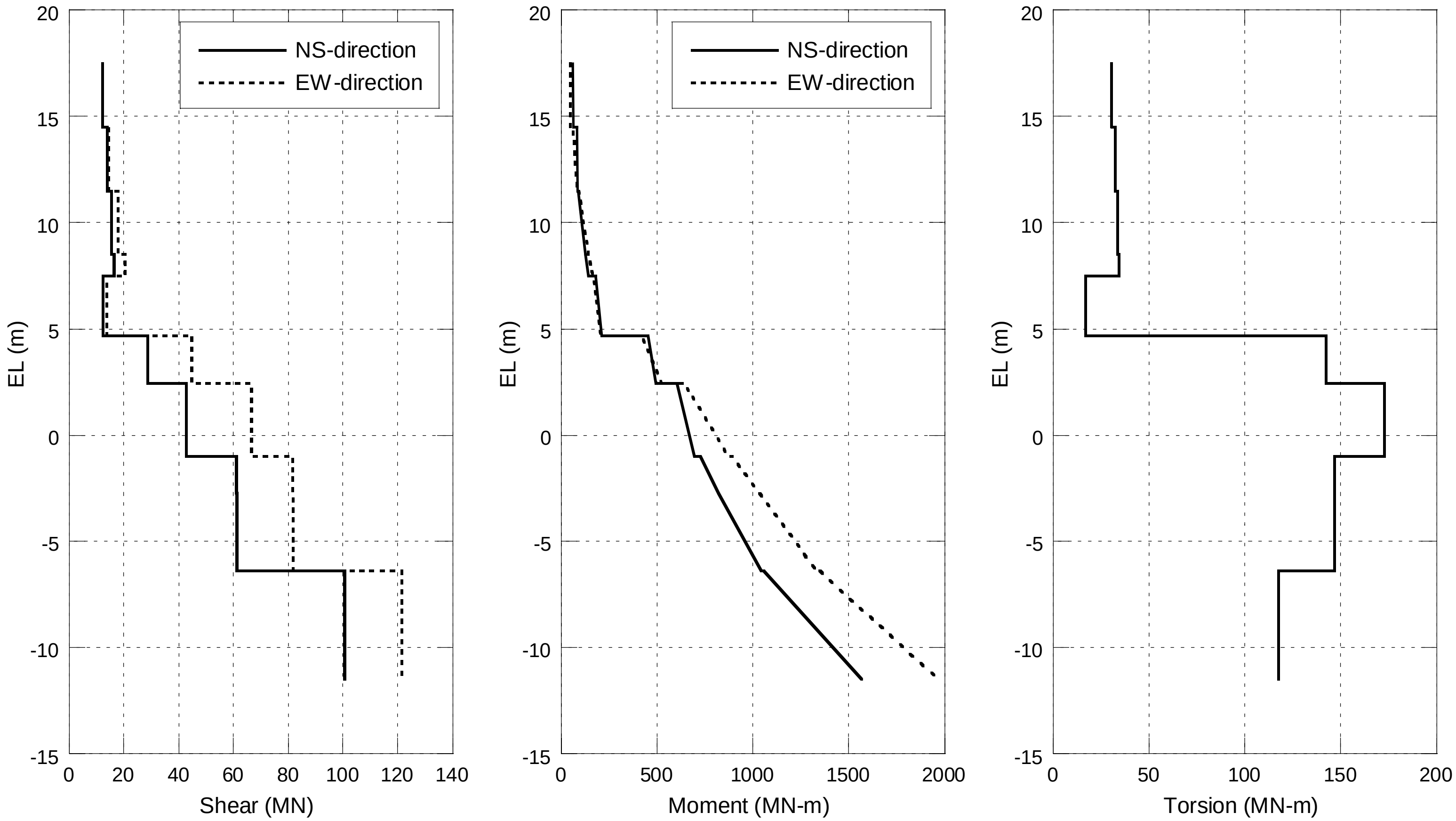


Figure 3G.1-26. Design Seismic Shears and Moments for RPV Pedestal and Vent Wall

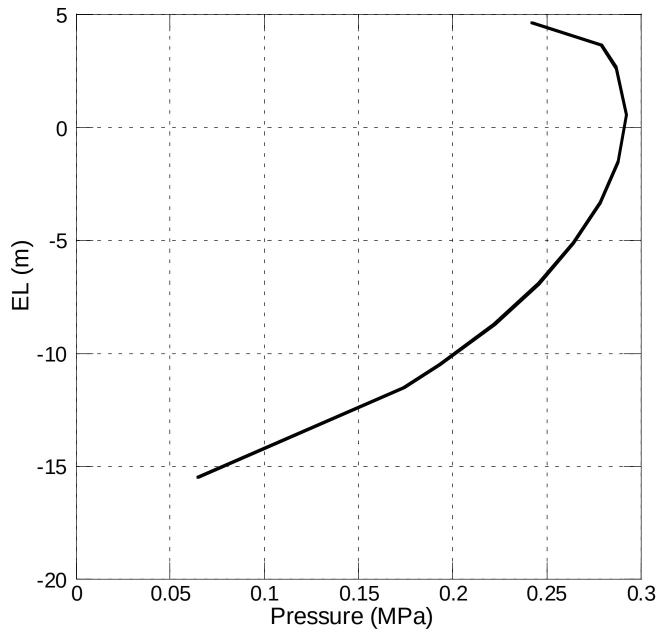


Figure 3G.1-27. Seismic Lateral Soil Pressure

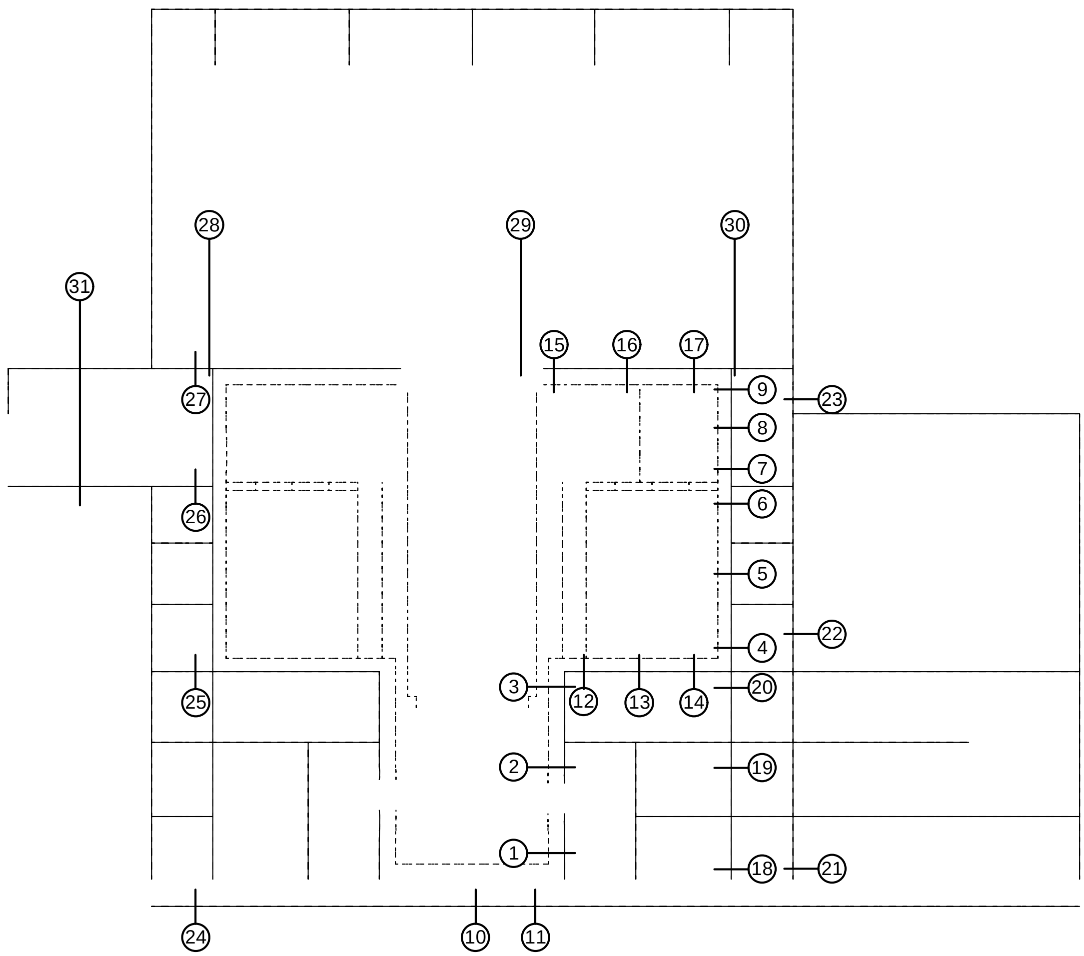
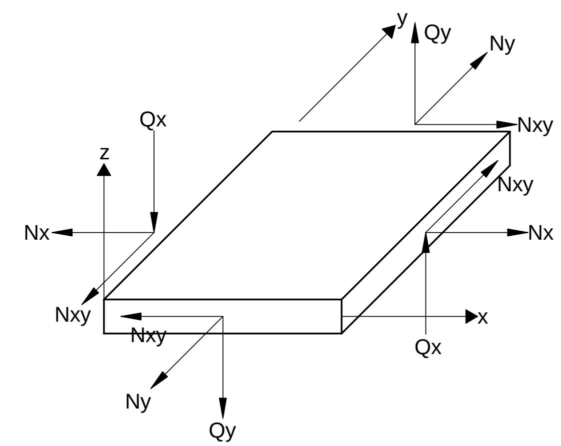
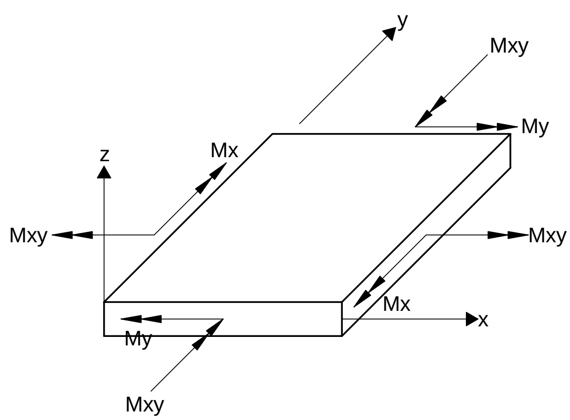


Figure 3G.1-28. Section Considered for Analysis



Membrane and Shear Forces



Moments

Definition of Element Coordinate System

Structure	x	y	z
RCCV Wall RPV Pedestal External Wall	horizontal	vertical	outward
Wall in N-S Direction	horizontal	vertical	toward West
Wall in E-W Direction	horizontal	vertical	toward South
Foundation Mat Floor Slab Top Slab	toward South	toward West	downward
Suppression Pool Slab	radial	circumferential	downward

Figure 3G.1-29. Force and Moment in Shell Element

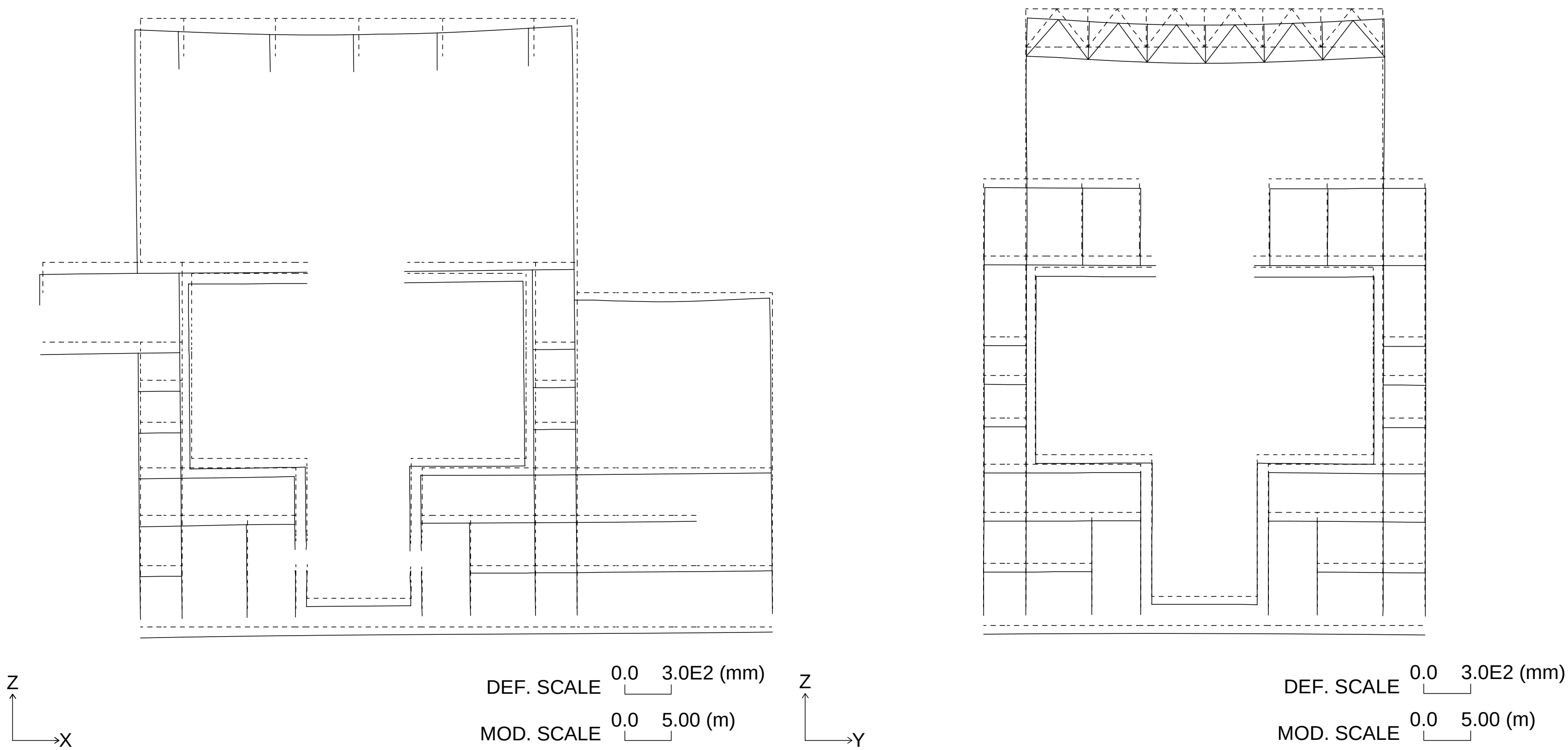


Figure 3G.1-30. Section Deformation for Dead Load

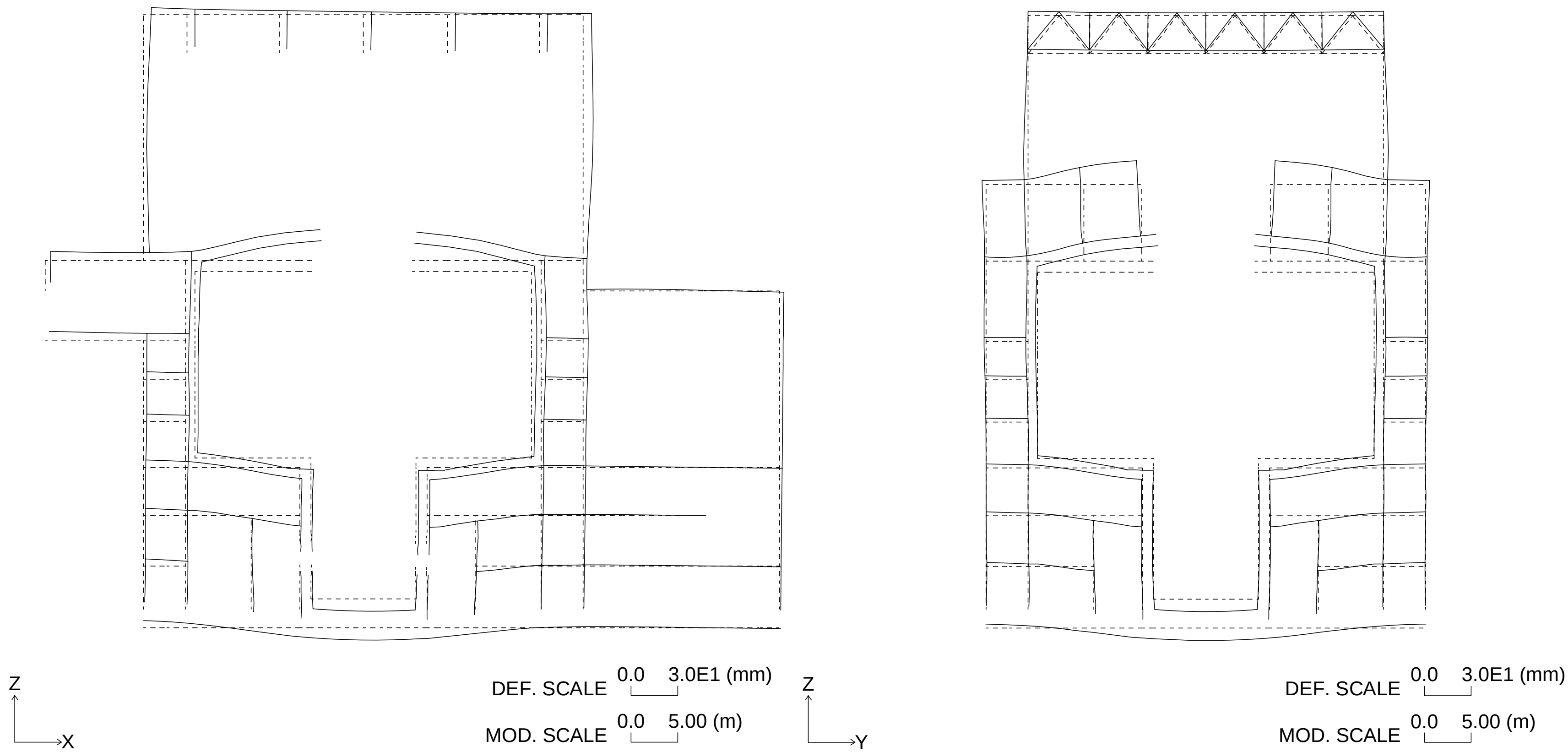


Figure 3G.1-31. Section Deformation for Drywell Unit Pressure (1 MPa)

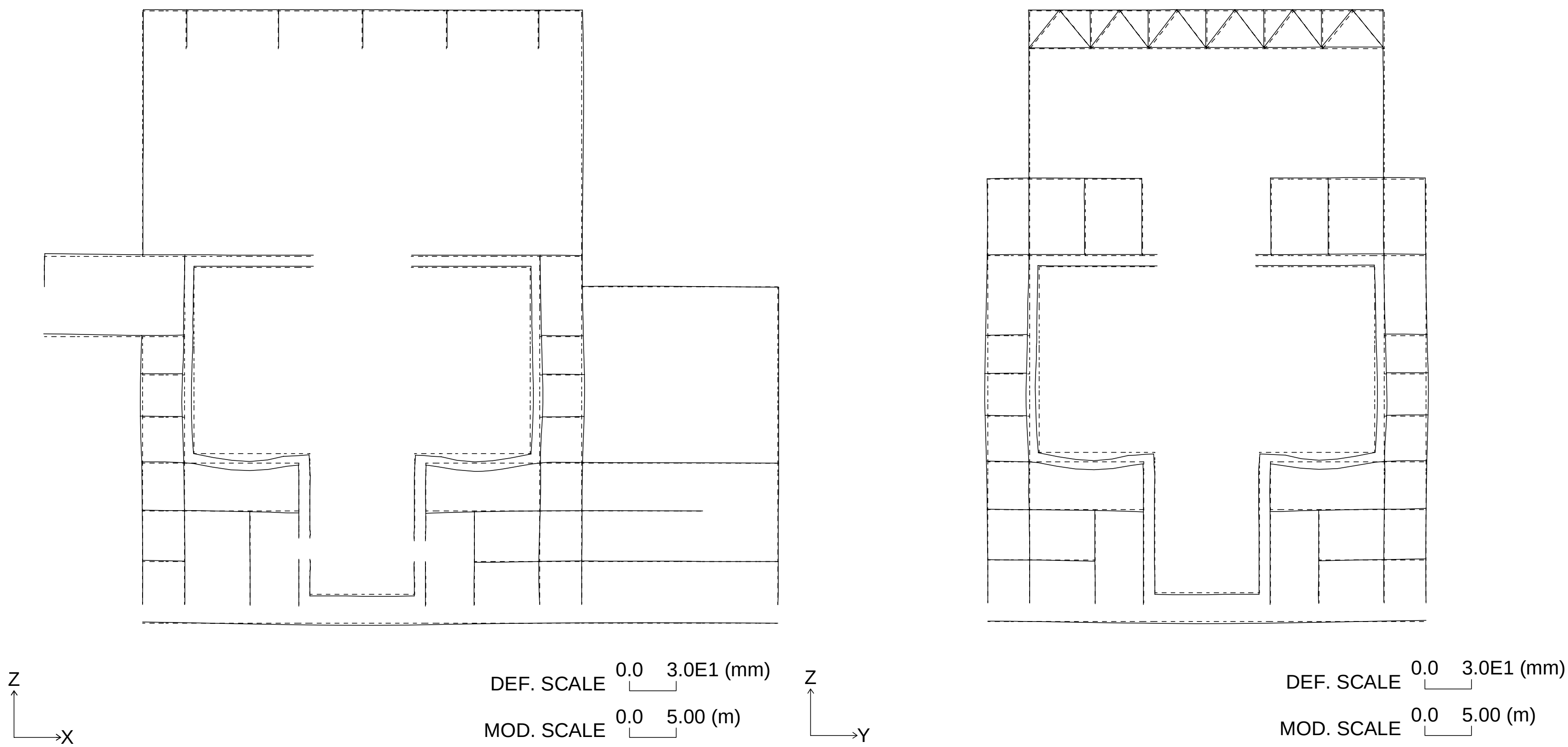


Figure 3G.1-32. Section Deformation for Wetwell Unit Pressure (1 MPa)

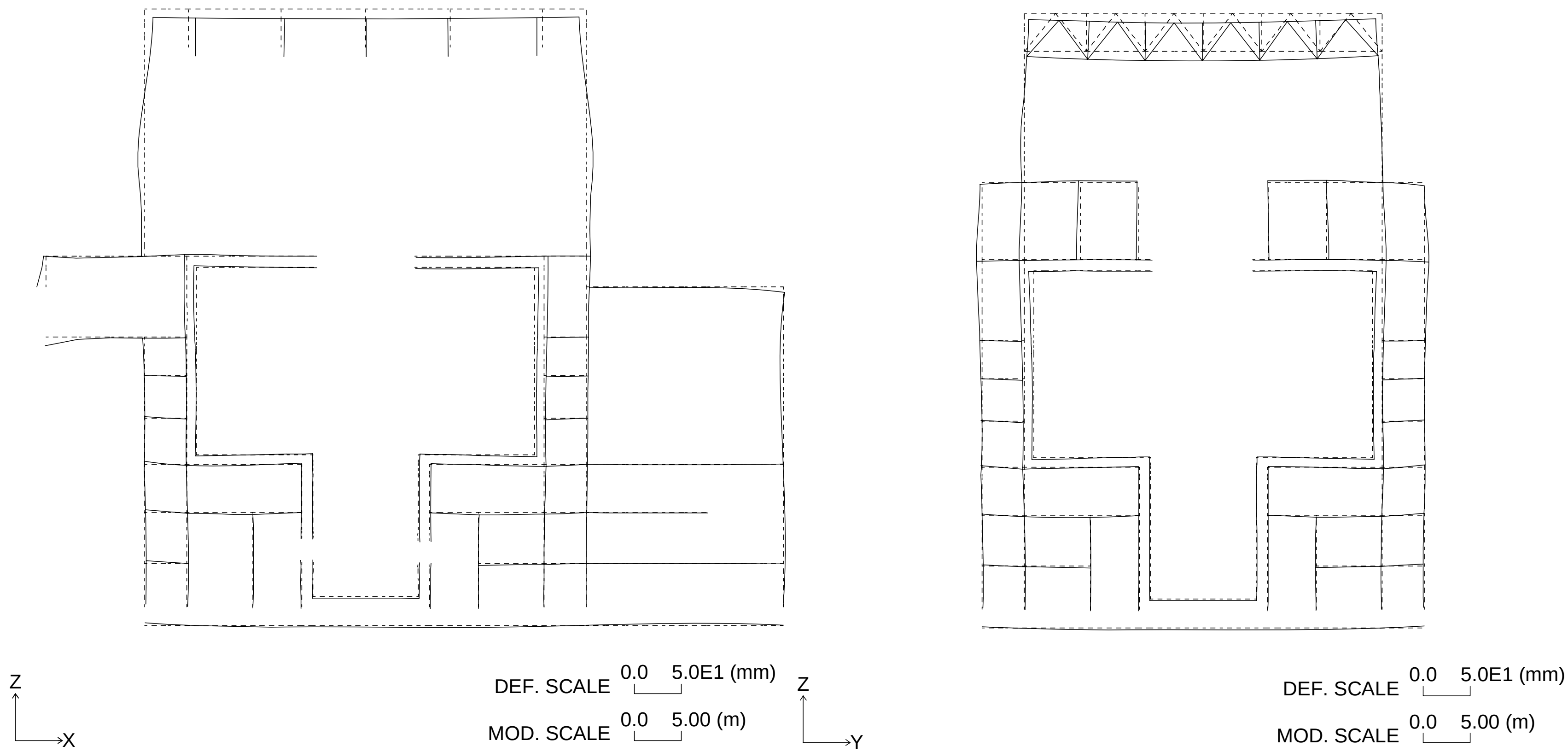


Figure 3G.1-33. Section Deformation for Temperature Load (Normal Operation: Winter)

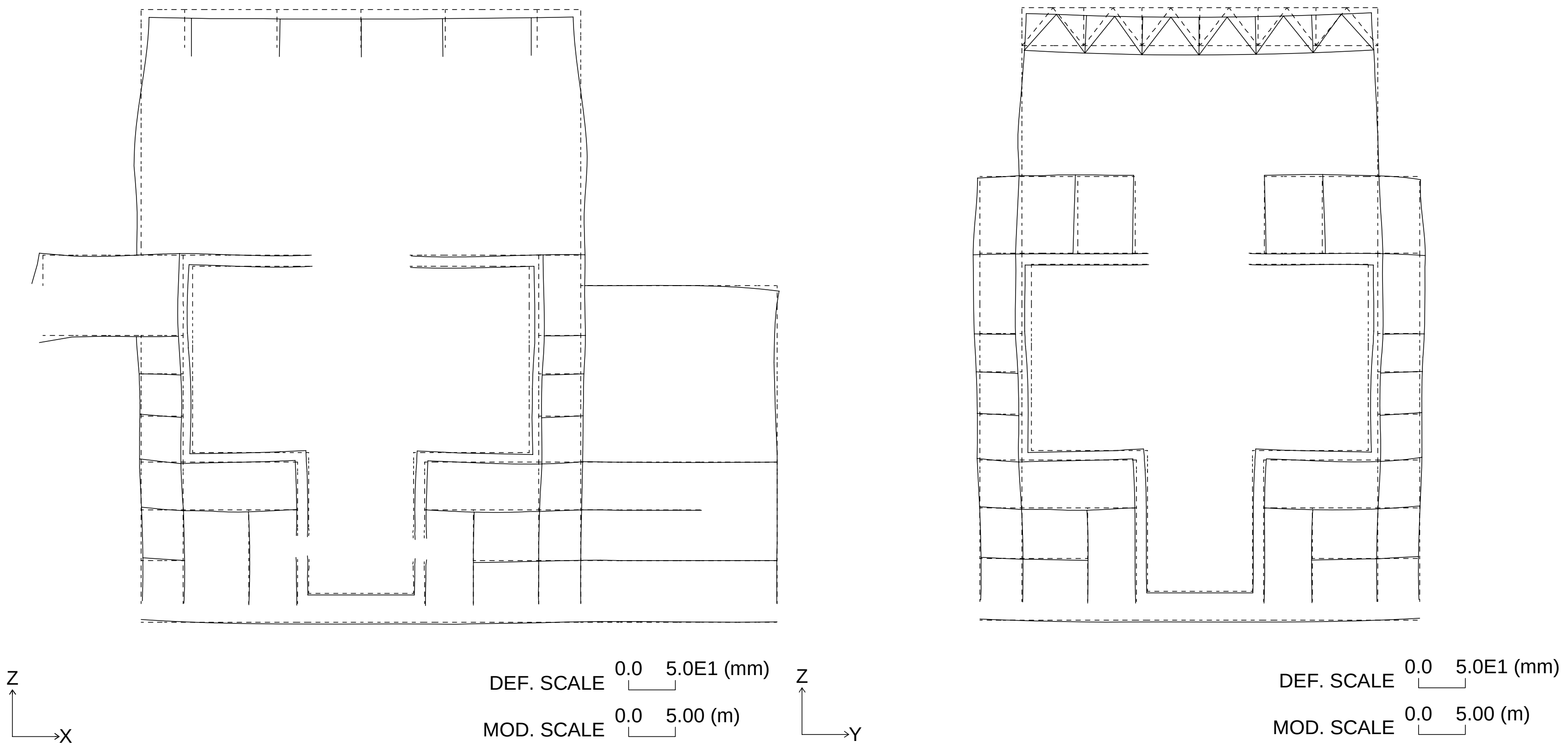


Figure 3G.1-34. Section Deformation for Temperature Load (LOCA After 6 min.: Winter)

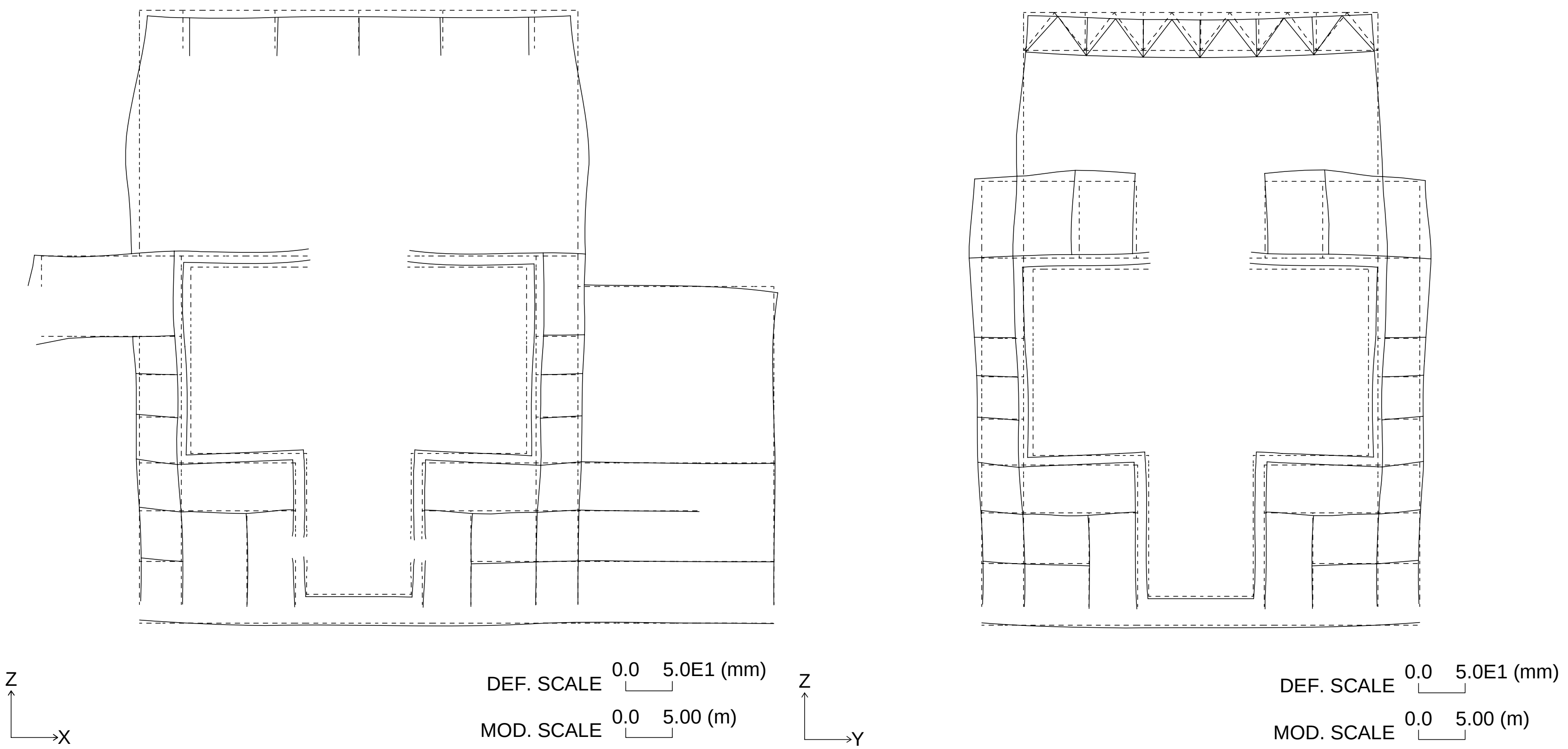


Figure 3G.1-35. Section Deformation for Temperature Load (LOCA After 72 hr.: Winter)

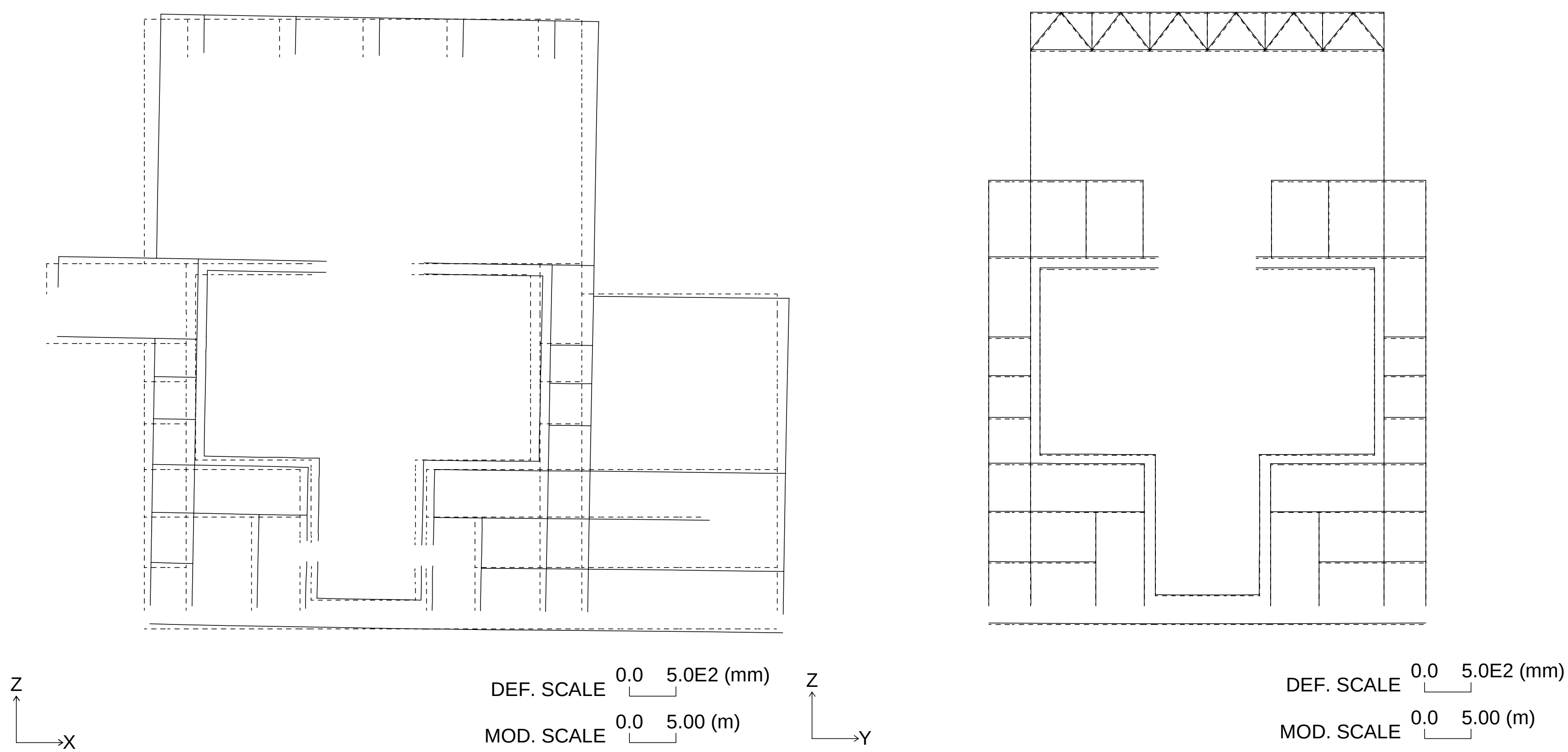


Figure 3G.1-36. Section Deformation for Seismic Load (Horizontal: North to South)

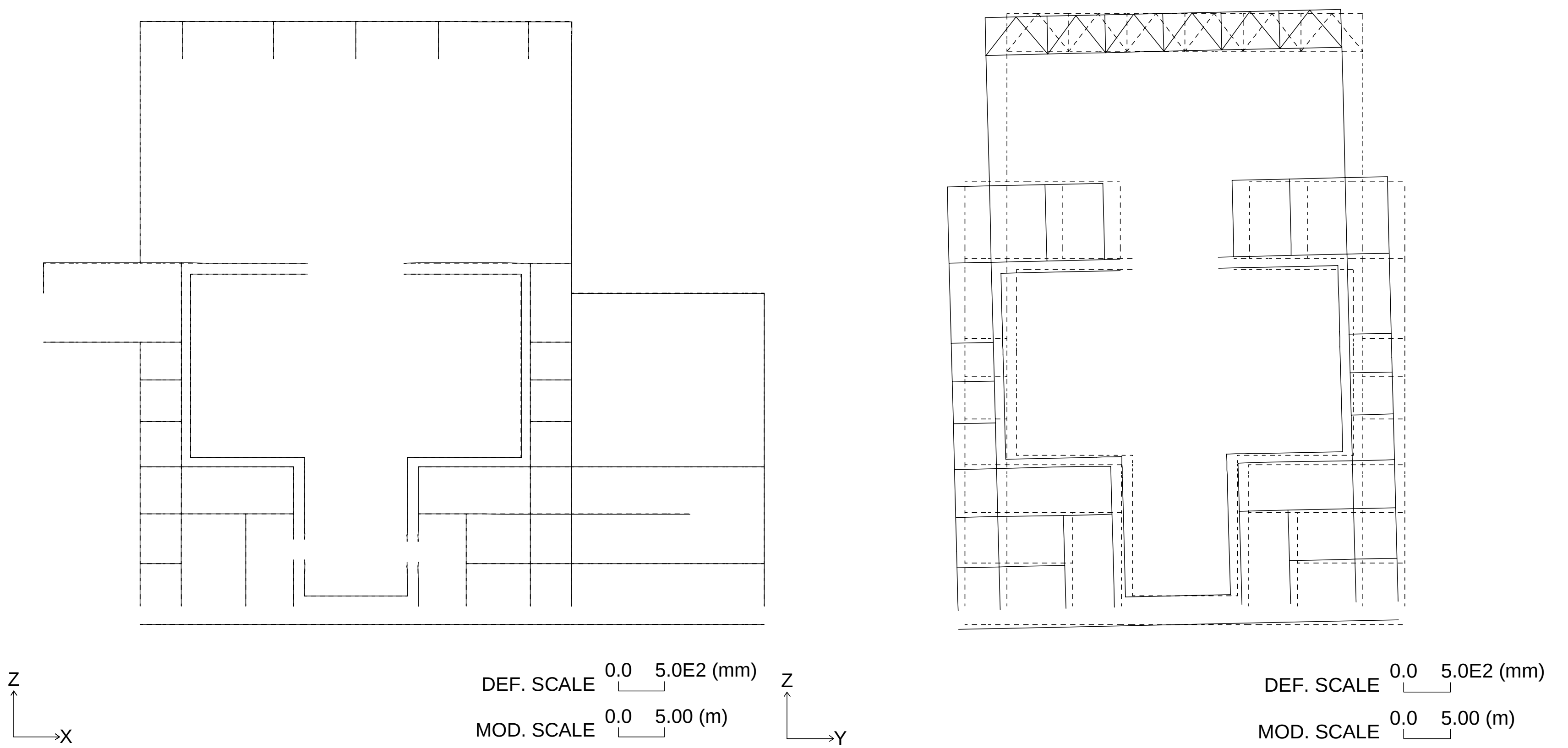
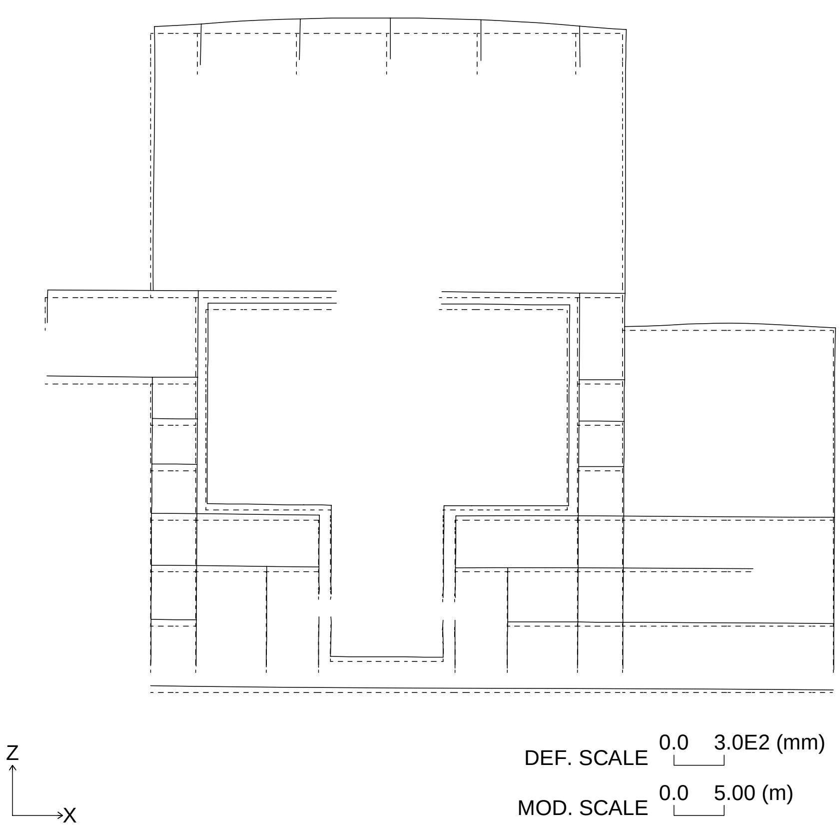


Figure 3G.1-37. Section Deformation for Seismic Load (Horizontal: East to West)



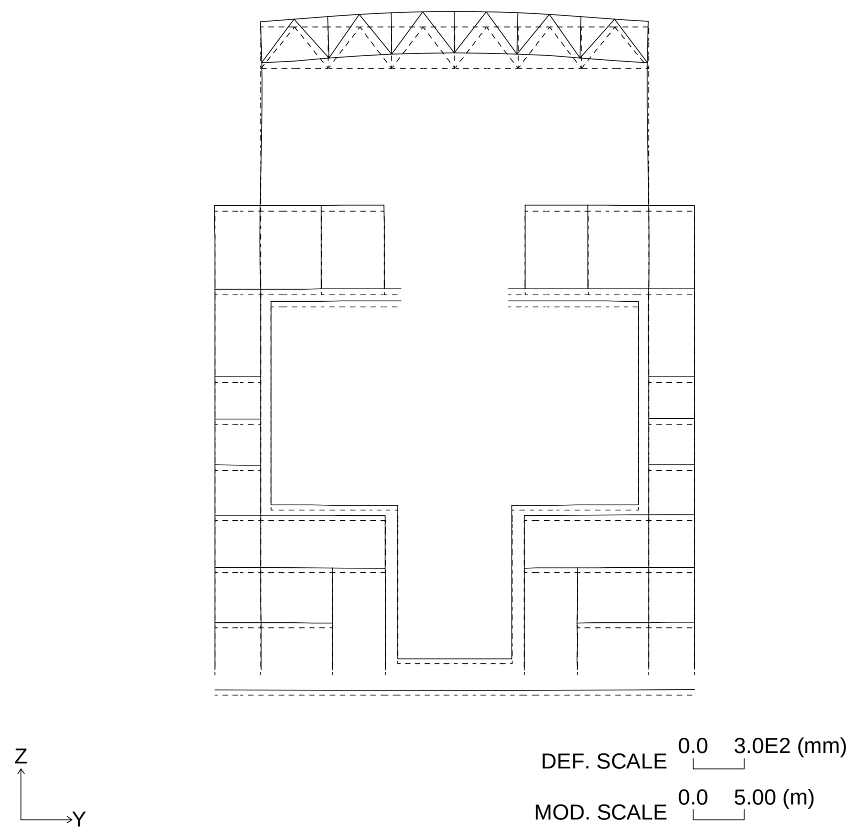
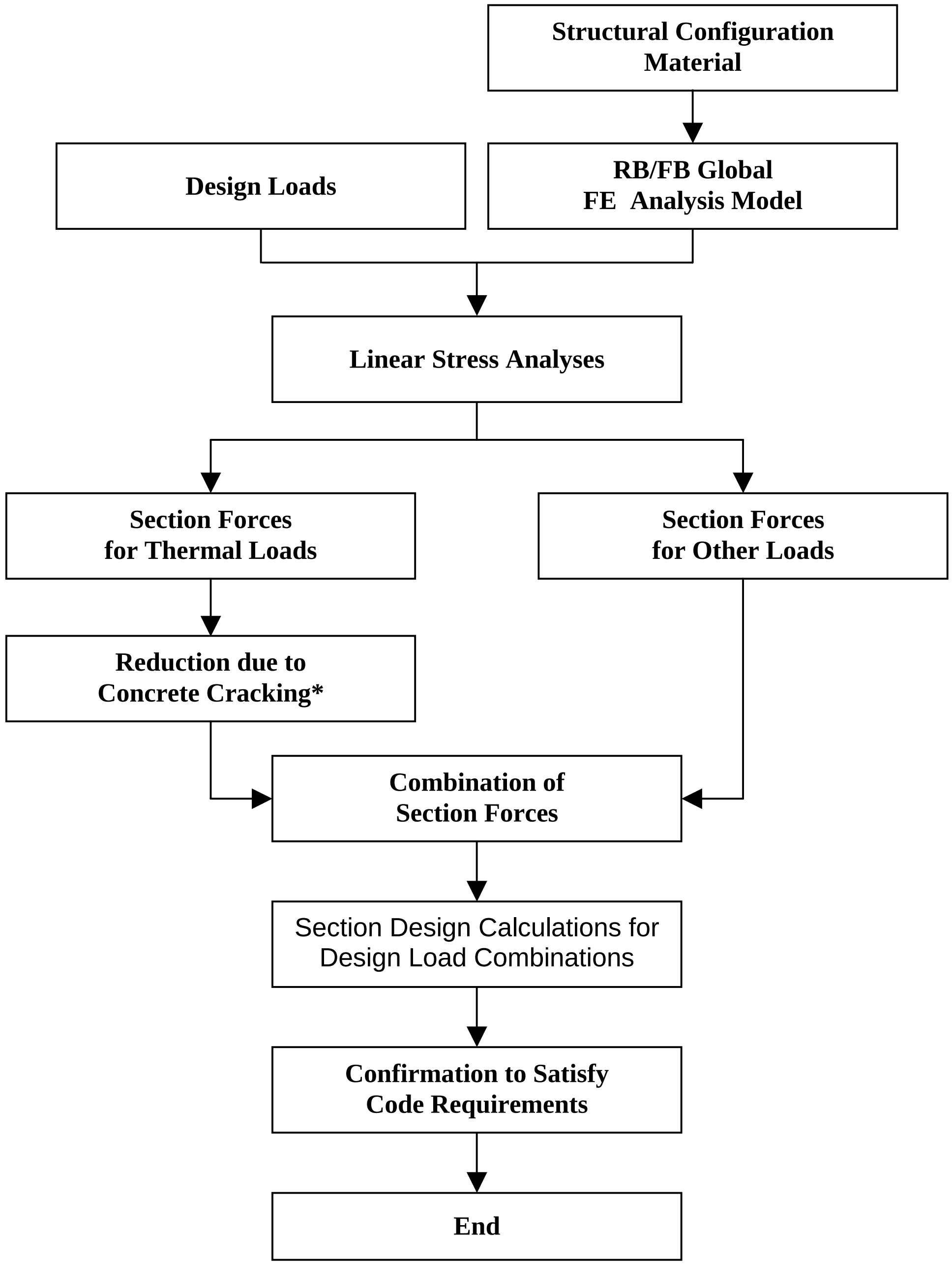


Figure 3G.1-38. Section Deformation for Seismic Load (Vertical: Upward)



*: Thermal section forces are reduced using the section design calculation program, SSDP-2D, with thermal cracking option selected.
However, for the LOCA thermal loads, “thermal ratios” obtained by 3D nonlinear analyses are multiplied to the section forces obtained by linear stress analyses.
The section forces from the non-linear analyses can also be used directly.
Thermal cracking option of SSDP-2D is not used together with 3D non-linear analyses.
(Refer to Subsections 3.8.1.4.1.2 and 3.8.1.4.1.3.)

Figure 3G.1-39. Flow Chart for Structural Analysis and Design

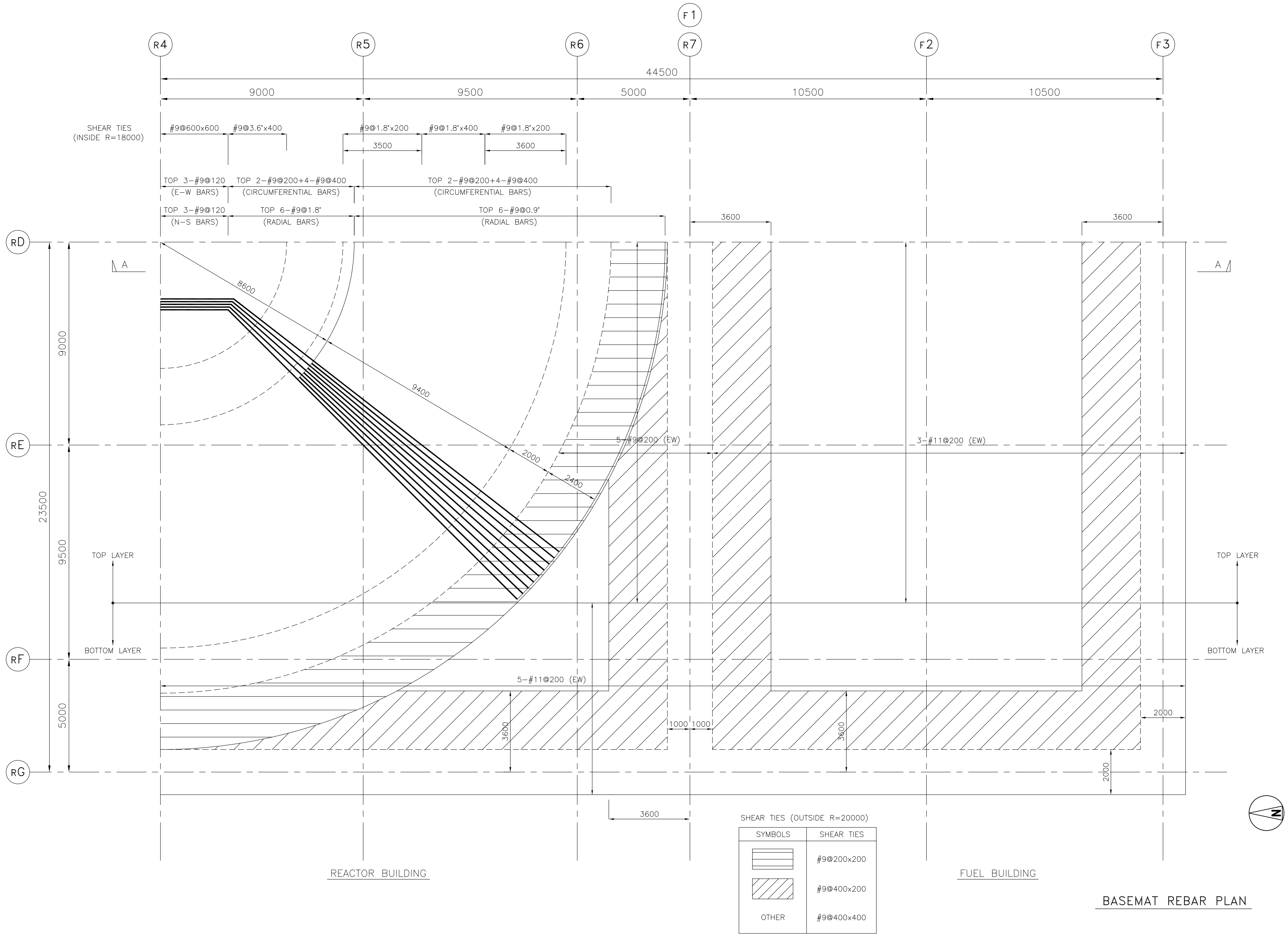


Figure 3G.1-40. Reinforcing Steel of Foundation Mat: Plan

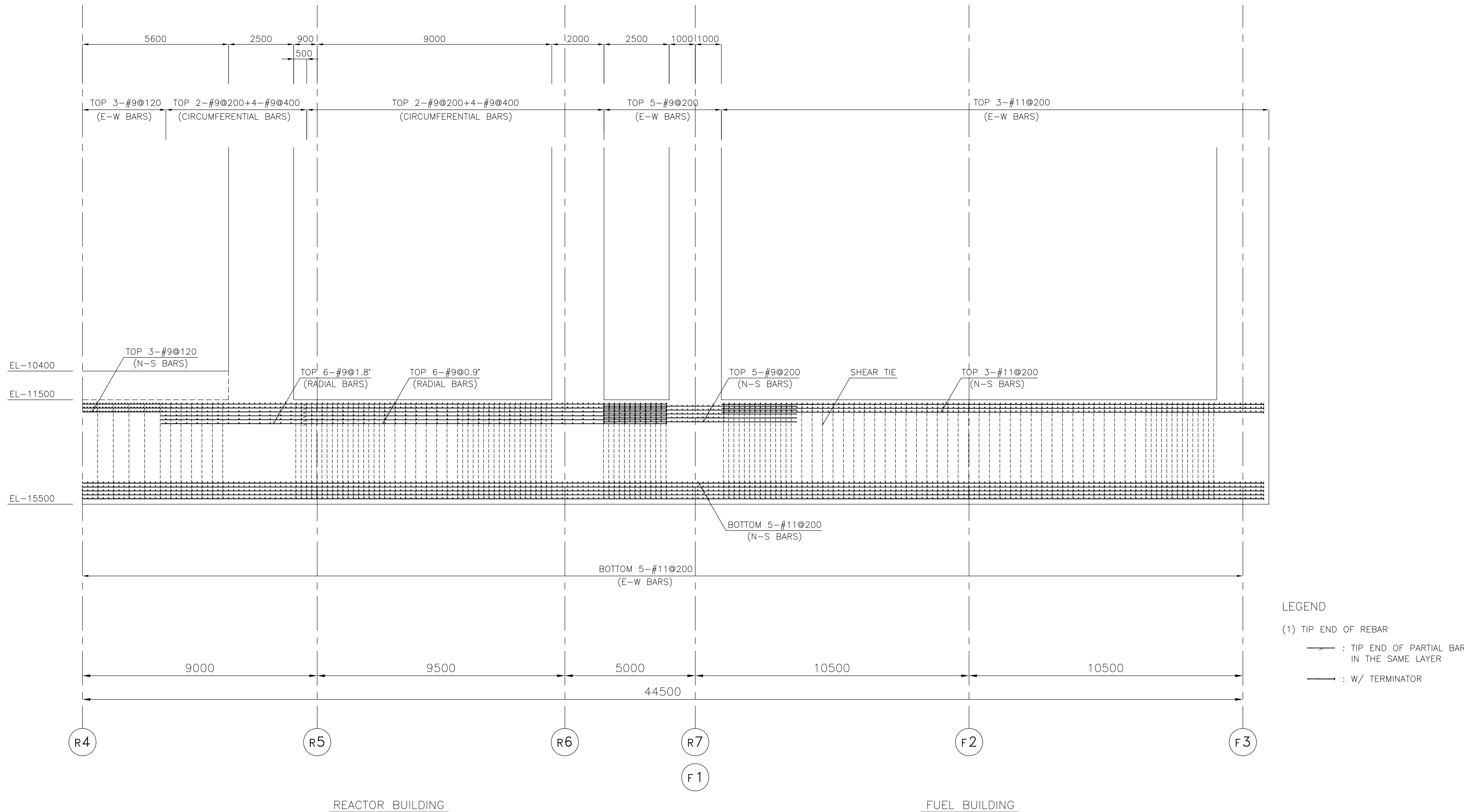


Figure 3G.1-41. Reinforcing Steel of Foundation Mat: Section A-A

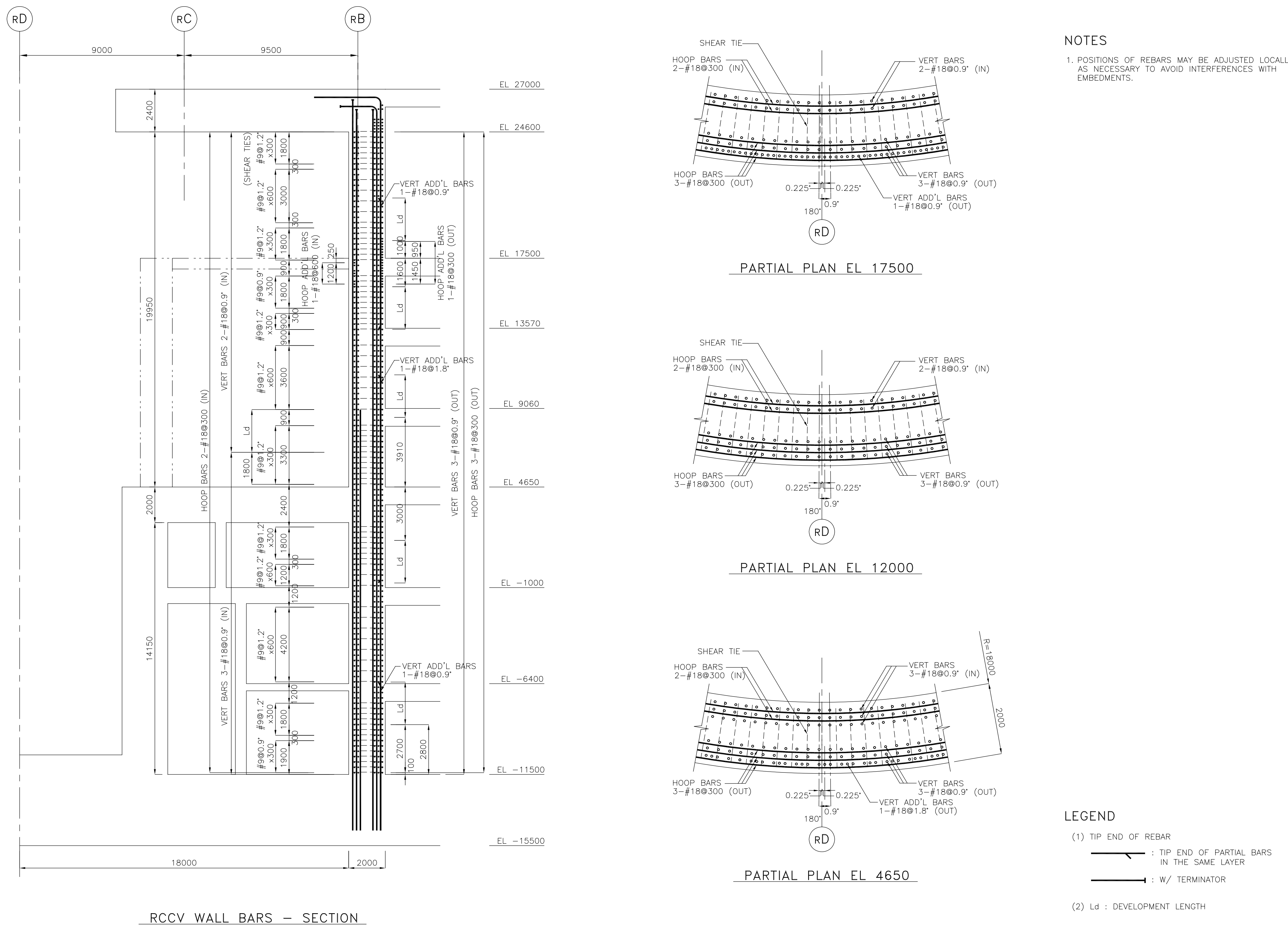


Figure 3G.1-42. Reinforcing Steel of RCCV Wall

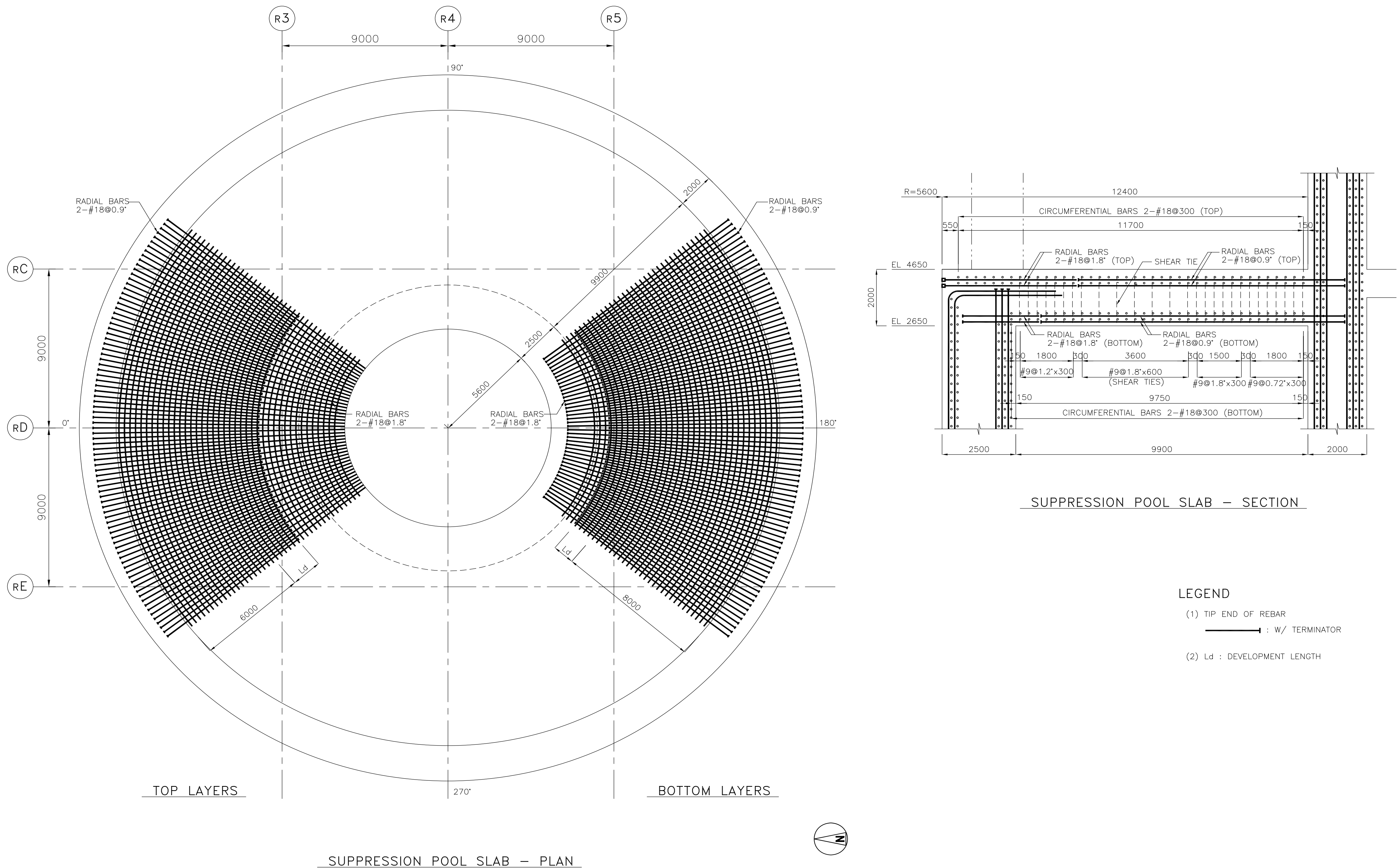
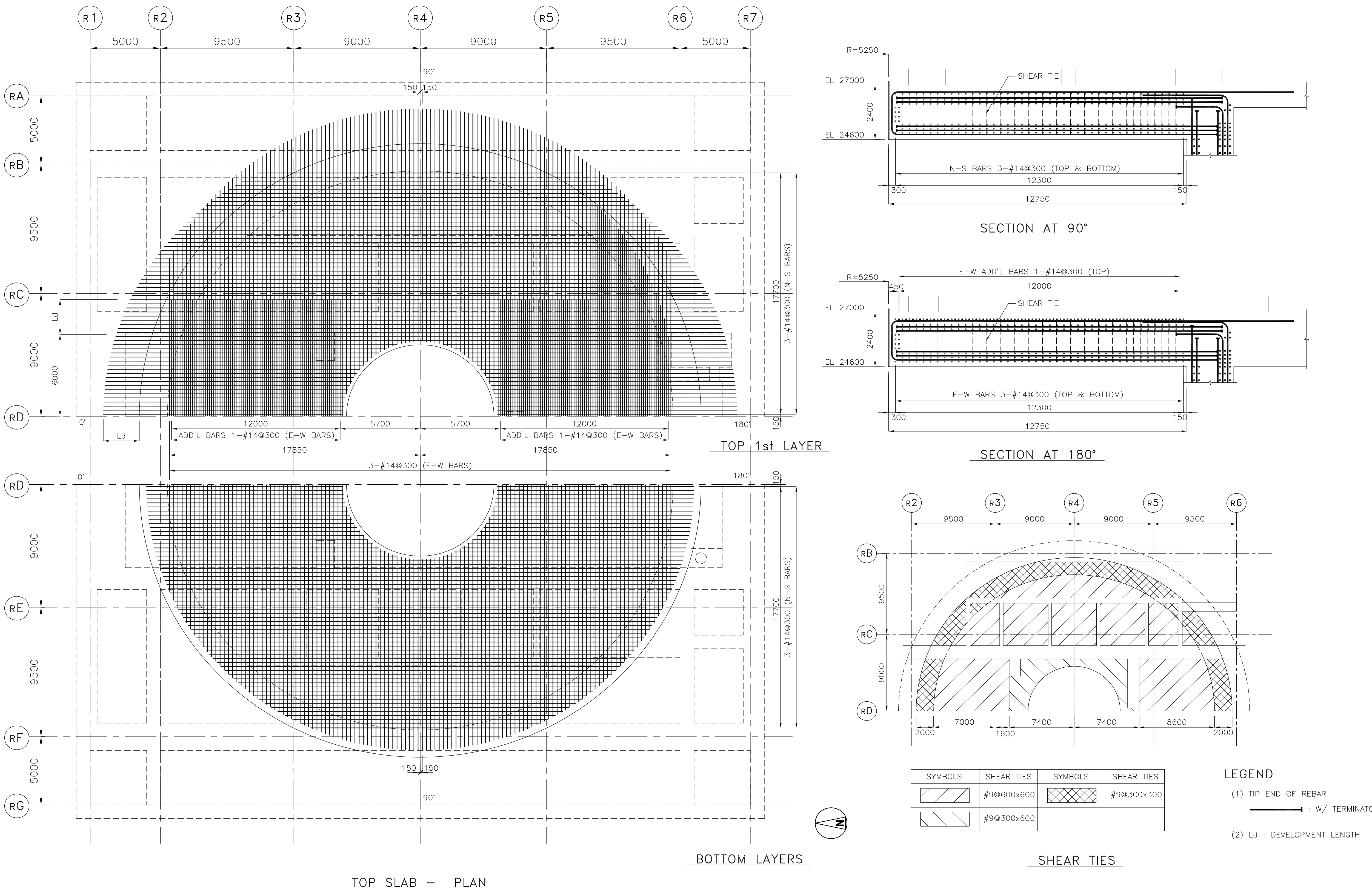


Figure 3G.1-43. Reinforcing Steel of Suppression Pool Slab



SYMBOLS	SHEAR TIES	SYMBOLS	SHEAR TIES
(hatch)	#9@600x600	(cross-hatch)	#9@300x300
(hatch)	#9@300x600		

Figure 3G.1-44. Reinforcing Steel of Top Slab

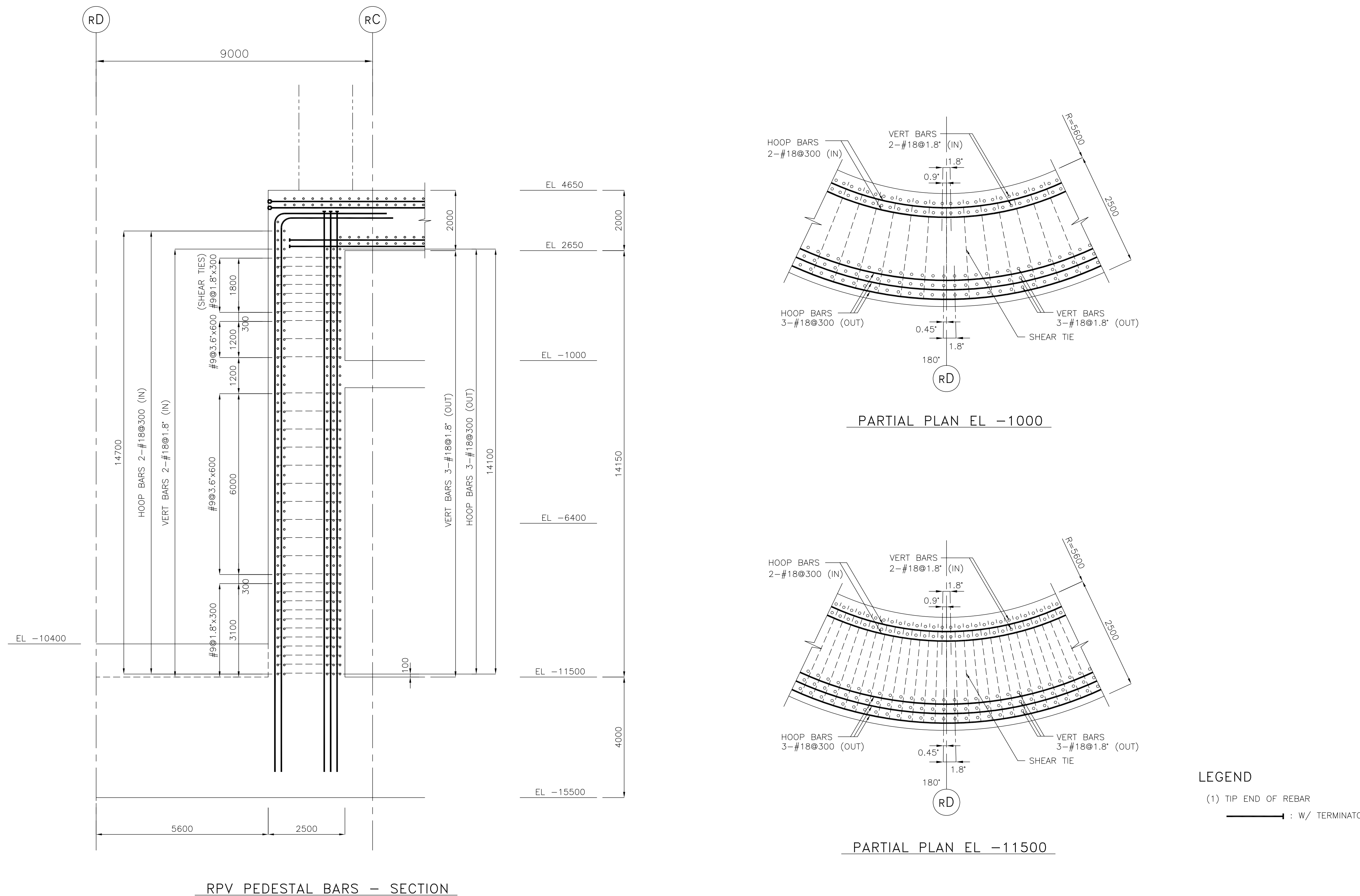


Figure 3G.1-45. Reinforcing Steel of RPV Pedestal

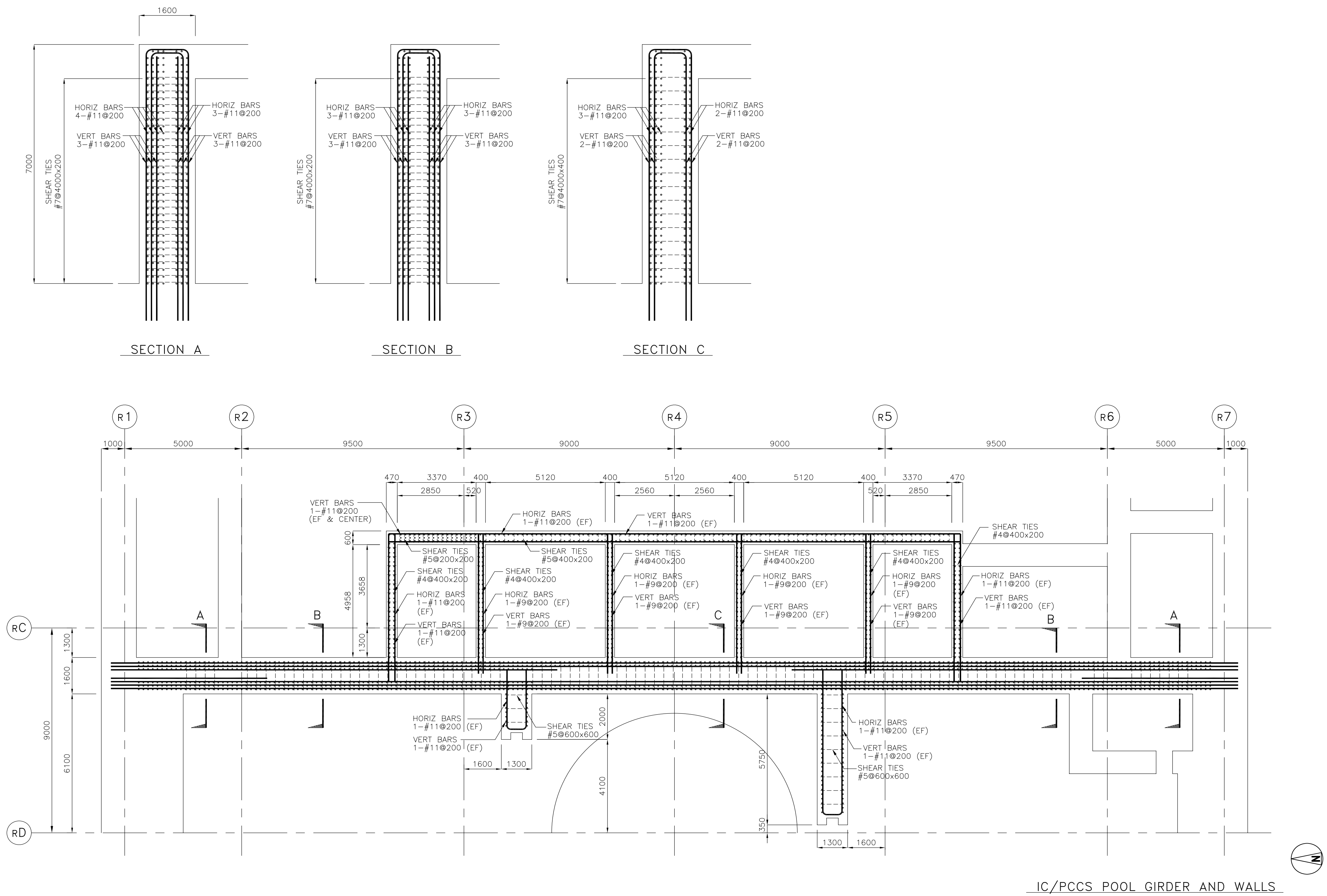
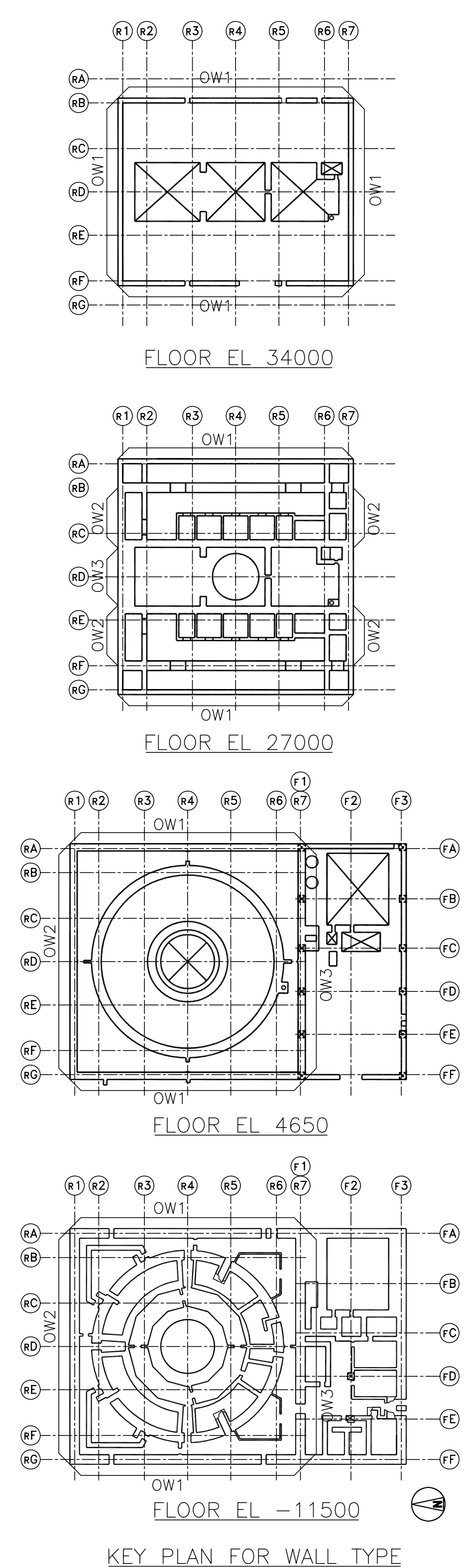


Figure 3G.1-46. Reinforcing Steel of IC/PCCS Pool Girder

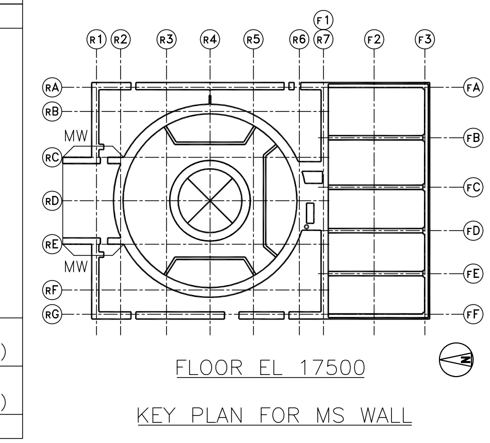
RB SEISMIC WALLS REINFORCING SCHEDULE EL-11500 ~ EL34000

EL 34000	TYPE	OW1		
	SECTION	OUTSIDE INSIDE 1000		
	VERT BAR	2-#11 @200 (EF)		
	HORIZ BAR	2-#11 @200 (EF)		
	SHEAR TIE	#5 @400x400		
EL 27000	TYPE	OW1	OW2	OW3
	SECTION	OUTSIDE INSIDE 1000	OUTSIDE INSIDE (POOL SIDE) 1500	OUTSIDE INSIDE (POOL SIDE) 3500
	VERT BAR	3-#11@200(OUT) 2-#11@200(IN)	4-#11@200(OUT) 3-#11@200(IN)	6-#11@200(OUT) 3-#11@200(IN)
	HORIZ BAR	3-#11@200(OUT) 2-#11@200(IN)	4-#11@200(OUT) 3-#11@200(IN)	6-#11@200(OUT) 3-#11@200(IN)
	SHEAR TIE	#6 @400x400	#7 @400x200	#7 @400x200
EL 17500 ~ EL 4650	TYPE	OW1	OW2	OW3
	SECTION	OUTSIDE INSIDE 1500	OUTSIDE INSIDE 1500	OUTSIDE INSIDE 1500
	VERT BAR	3-#11 @200 (EF)	4-#11@200(OUT) 3-#11@200(IN)	4-#11 @200 (EF)
	HORIZ BAR	3-#11 @200 (EF)	4-#11@200(OUT) 3-#11@200(IN)	3-#11@200+1-#11@400 (EF)
	SHEAR TIE	#6 @400x400	#7 @400x400	#7 @400x200
EL -1000 ~ EL -11500	TYPE	OW1	OW2	OW3
	SECTION	OUTSIDE INSIDE 2000	OUTSIDE INSIDE 2000	OUTSIDE INSIDE 2000
	VERT BAR	4-#11 @200 (EF)	3-#11 @200 (EF)	5-#11 @200 (EF)
	HORIZ BAR	3-#11@200+1-#11@400 (EF)	3-#11 @200 (EF)	4-#11@200+1-#11@400 (EF)
	SHEAR TIE	#6 @400x400	#6 @400x400	#7 @400x200



MS TUNNEL WALL REINFORCING SCHEDULE

EL 17500	TYPE	MW
	SECTION	OUTSIDE INSIDE 1300
	VERT BAR	2-#11 @200(IN) 2-#11@200+1-#11@400(OUT)
	HORIZ BAR	2-#11 @200(IN) 2-#11@200+1-#11@400(OUT)
	SHEAR TIE	#6 @400x400



SLAB REINFORCING SCHEDULE

EL 27000	SECTION	TOP BOTTOM 1000	(MS TUNNEL ROOF) TOP BOTTOM 2400
	TOP	3-#11 @200 (EW)	4-#11 @200 (EW)
	BOTTOM	PLATE t=25	3-#11 @200 (EW)
	SHEAR TIE	#5 @200x200	#5 @200x200
EL 17500	SECTION	TOP BOTTOM 1000	(MS TUNNEL SLAB) TOP BOTTOM 1600
	TOP	2-#11 @200 (EW)	2-#11 @200 (EW)
	BOTTOM	PLATE t=16	3-#11 @200 (EW)
	SHEAR TIE	#5 @200x200	#5 @200x200
EL 4650	SECTION	TOP BOTTOM 1000	
	TOP	2-#11 @200 (EW)	
	BOTTOM	PLATE t=16	
	SHEAR TIE	#5 @200x200	

Figure 3G.1-47. List of RB Wall and Slab Reinforcement

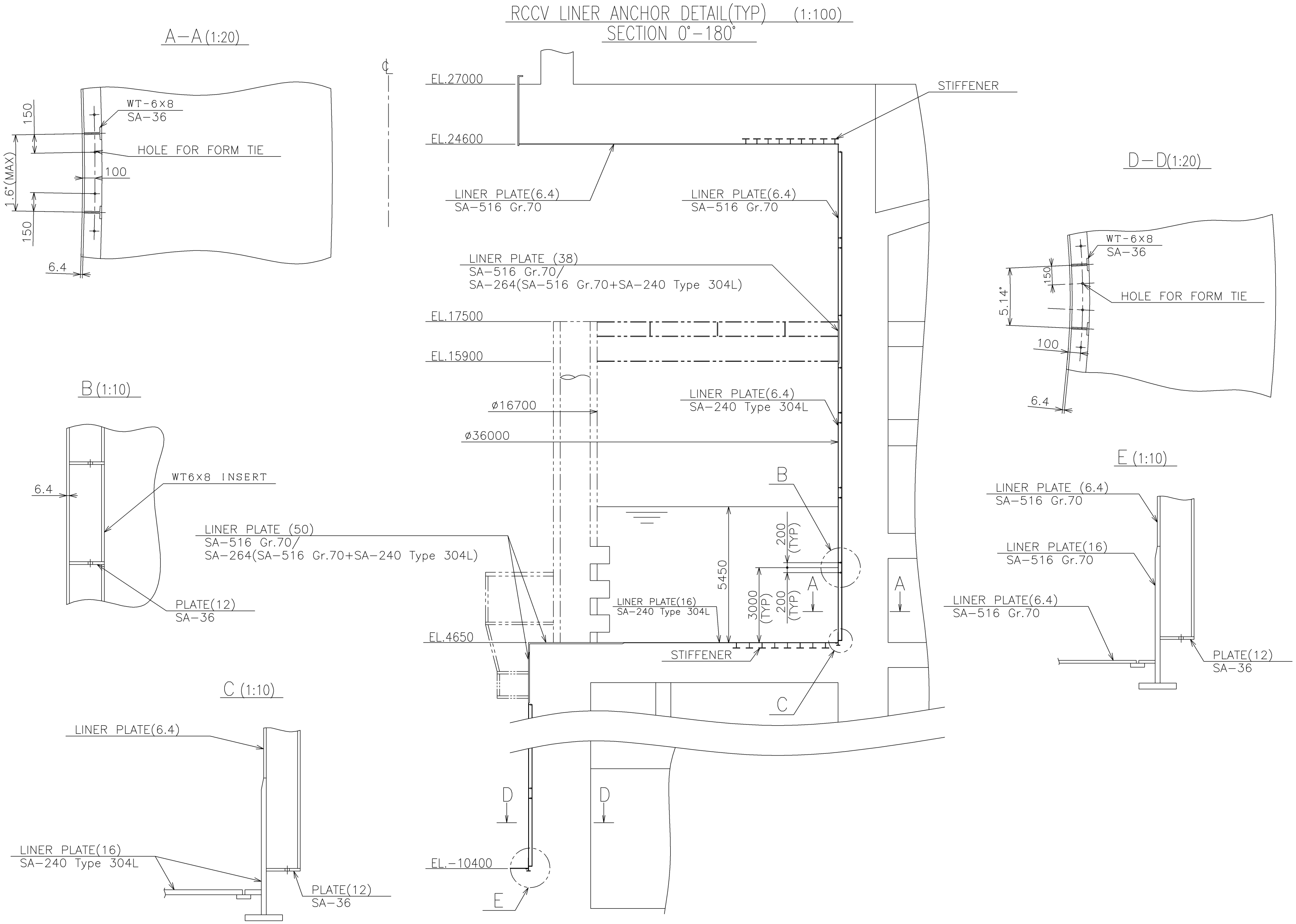


Figure 3G.1-48. Liner Anchor

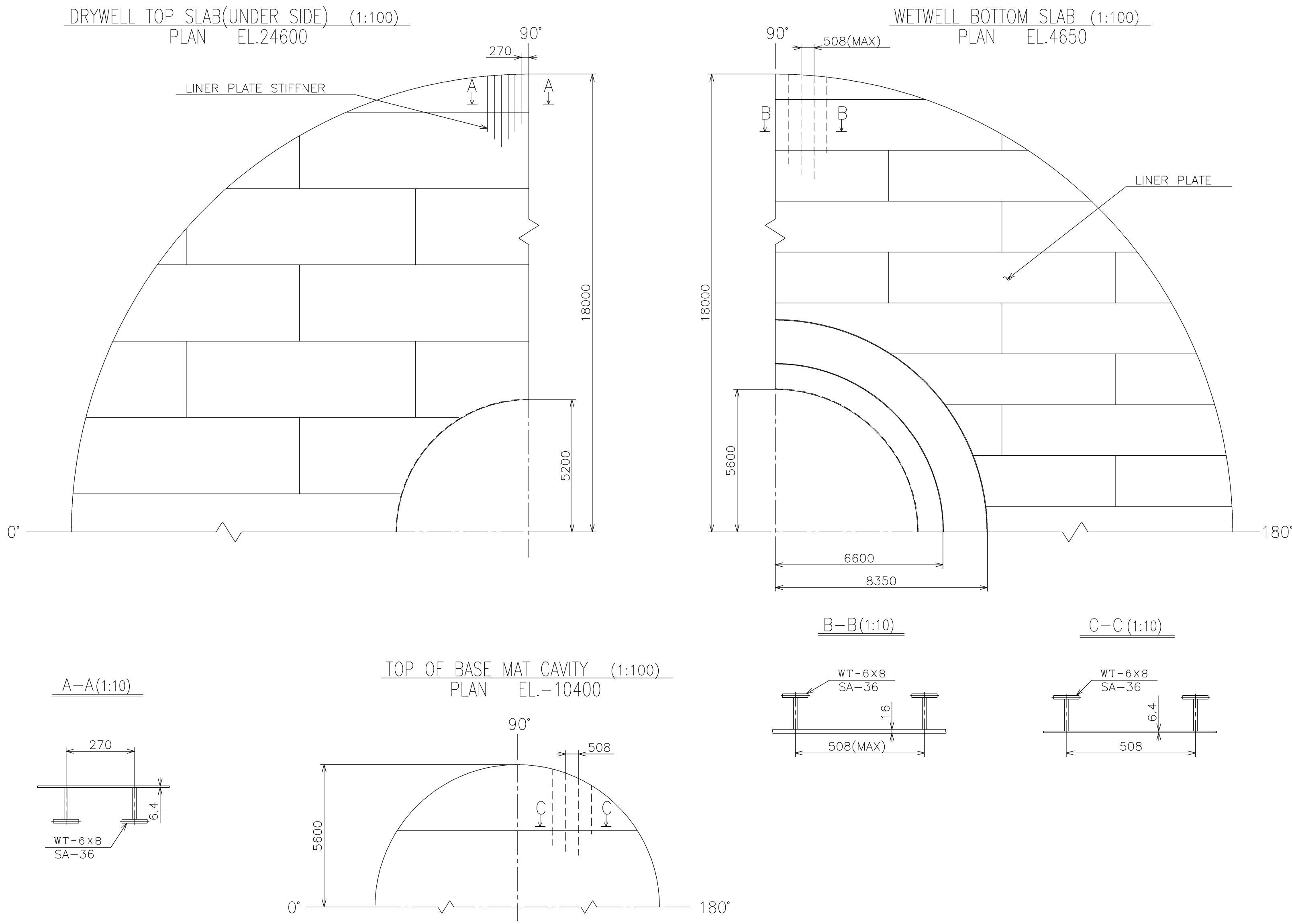


Figure 3G.1-49. Liner Plate Plans

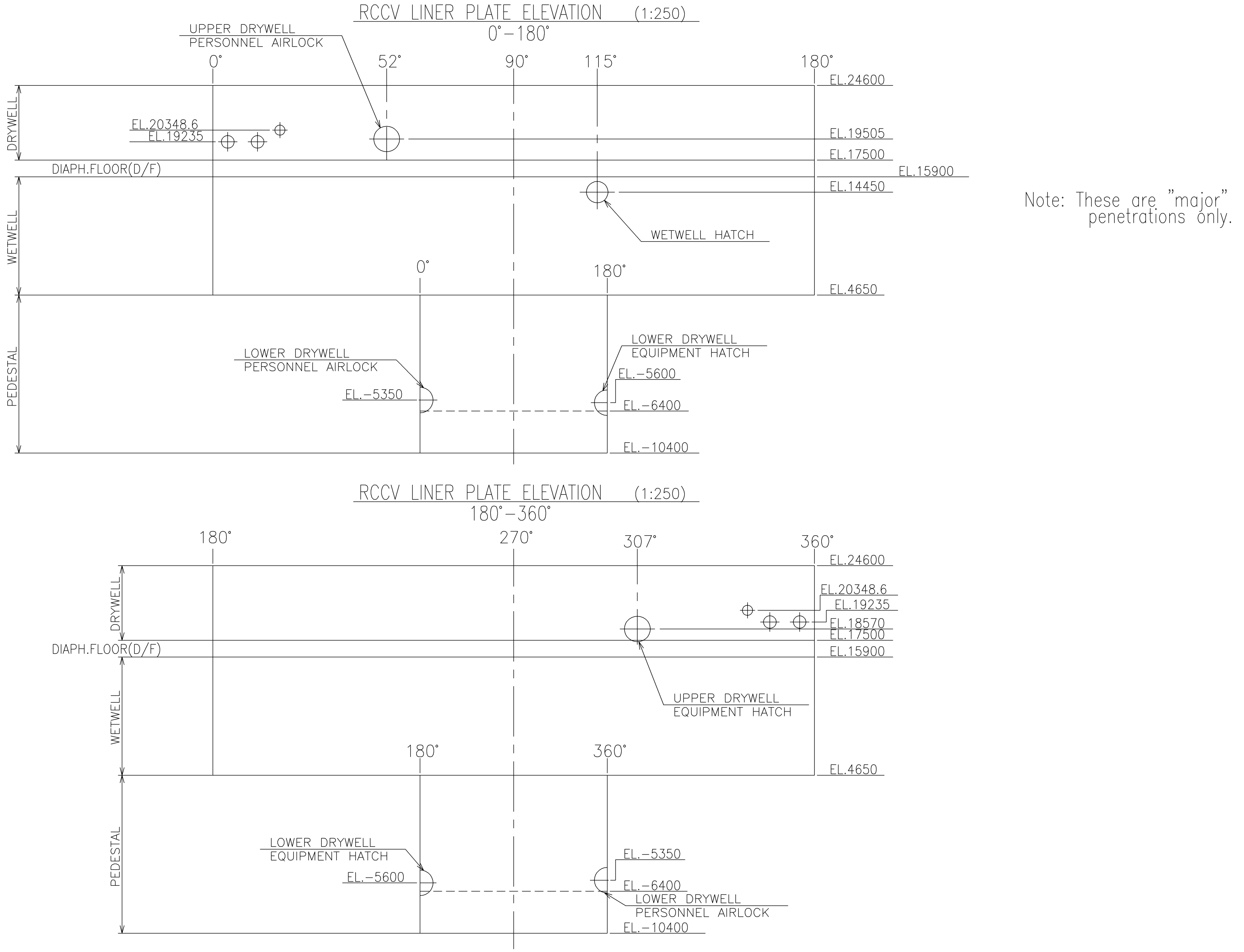


Figure 3G.1-50. Liner Plate Development Elevation

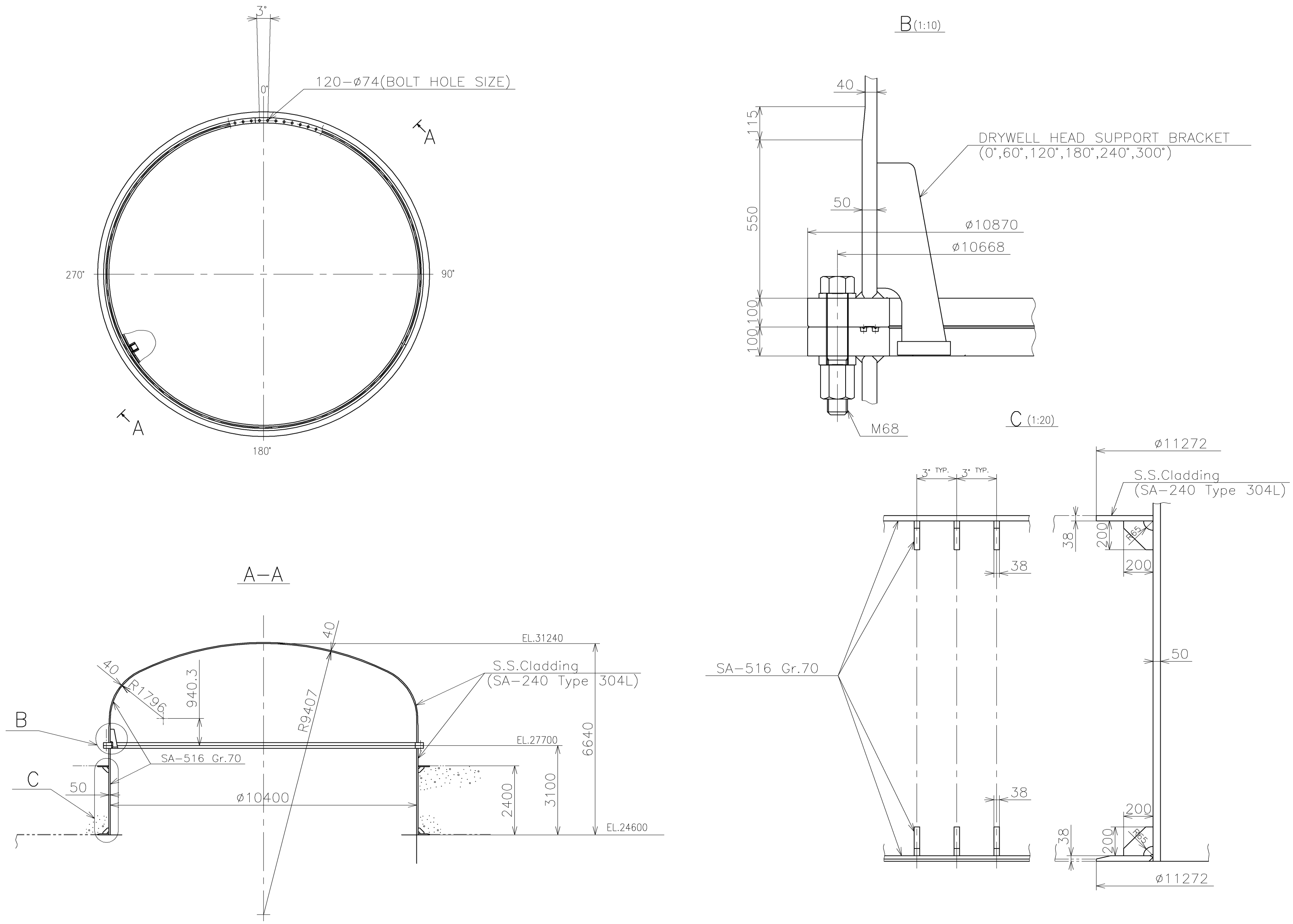


Figure 3G.1-51. Drywell Head

Figure 3G.1-52. Equipment Hatch

Figure 3G.1-53. Wetwell Hatch

Figure 3G.1-54. Personnel Airlock

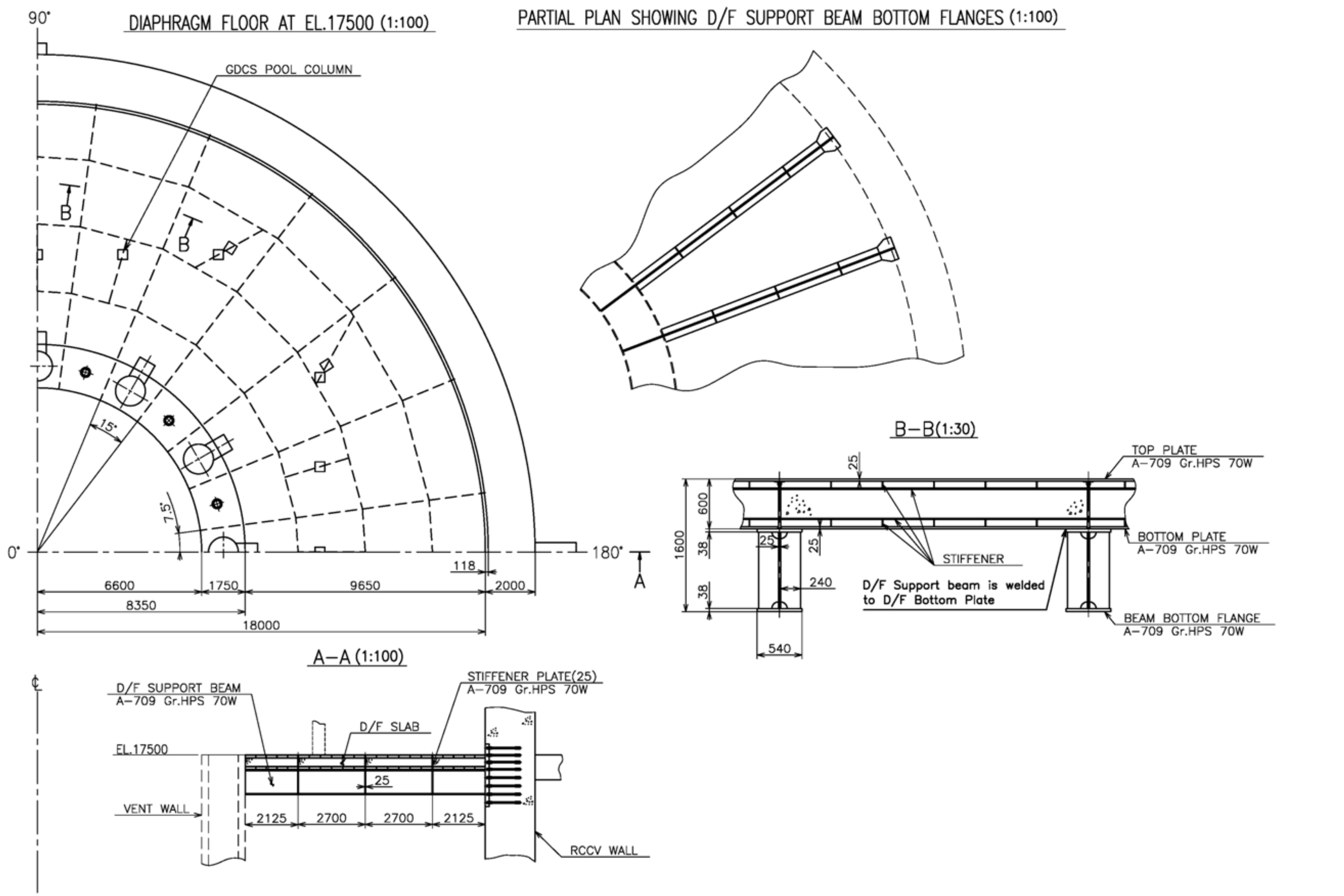


Figure 3G.1-55. Diaphragm Floor

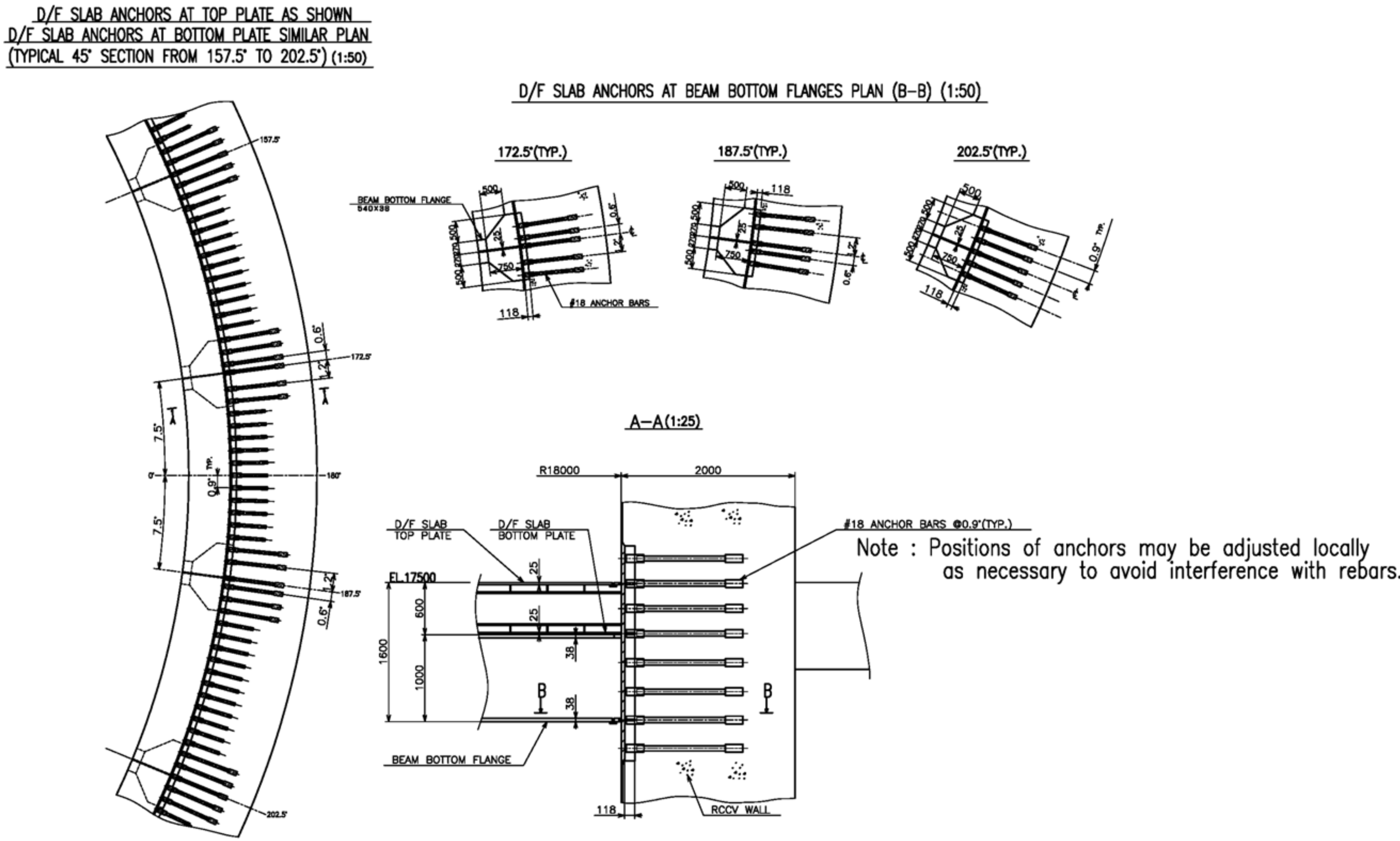


Figure 3G.1-56. Diaphragm Floor Slab Anchor

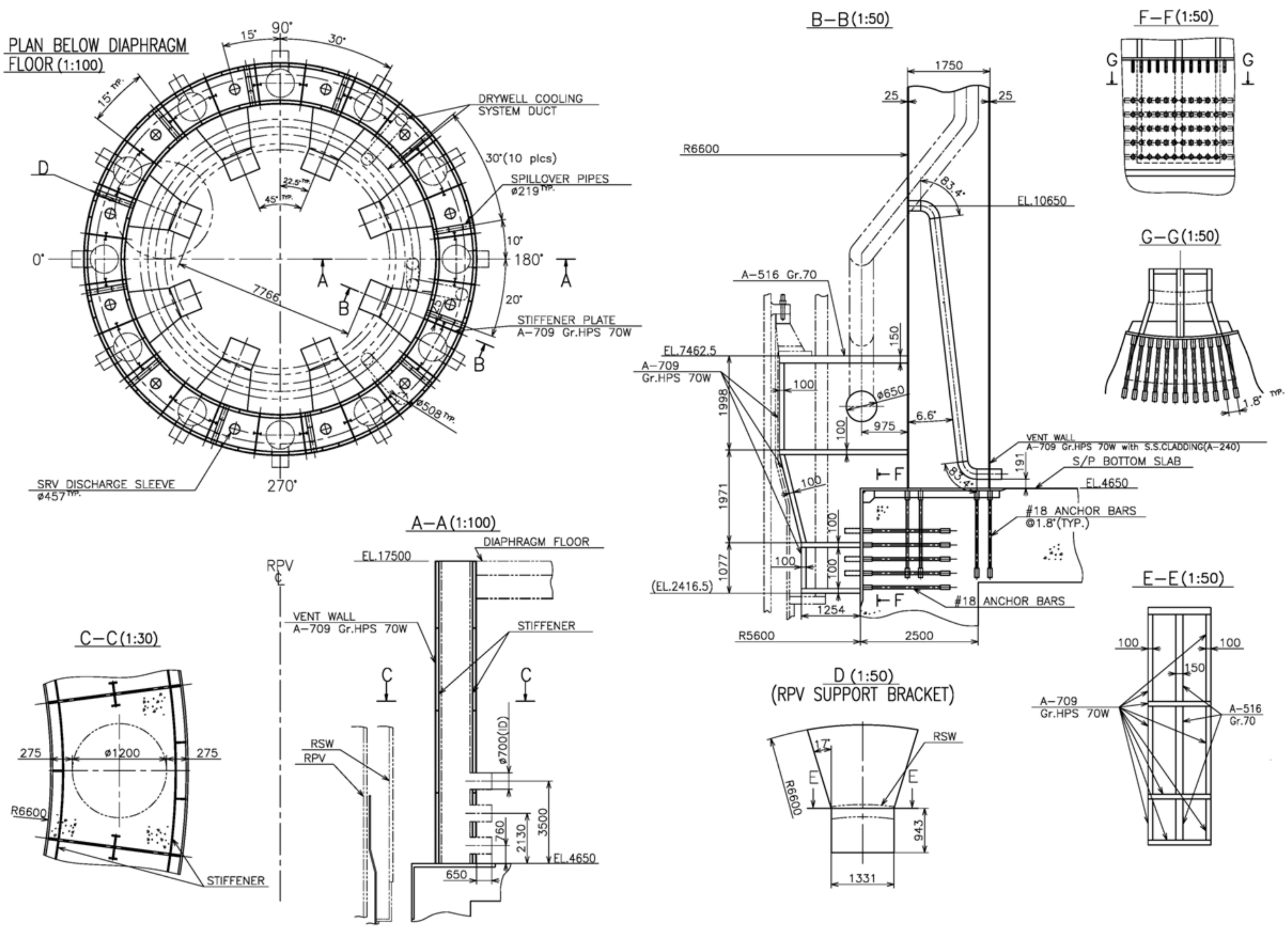


Figure 3G.1-57. RPV Support Bracket & Vent Wall

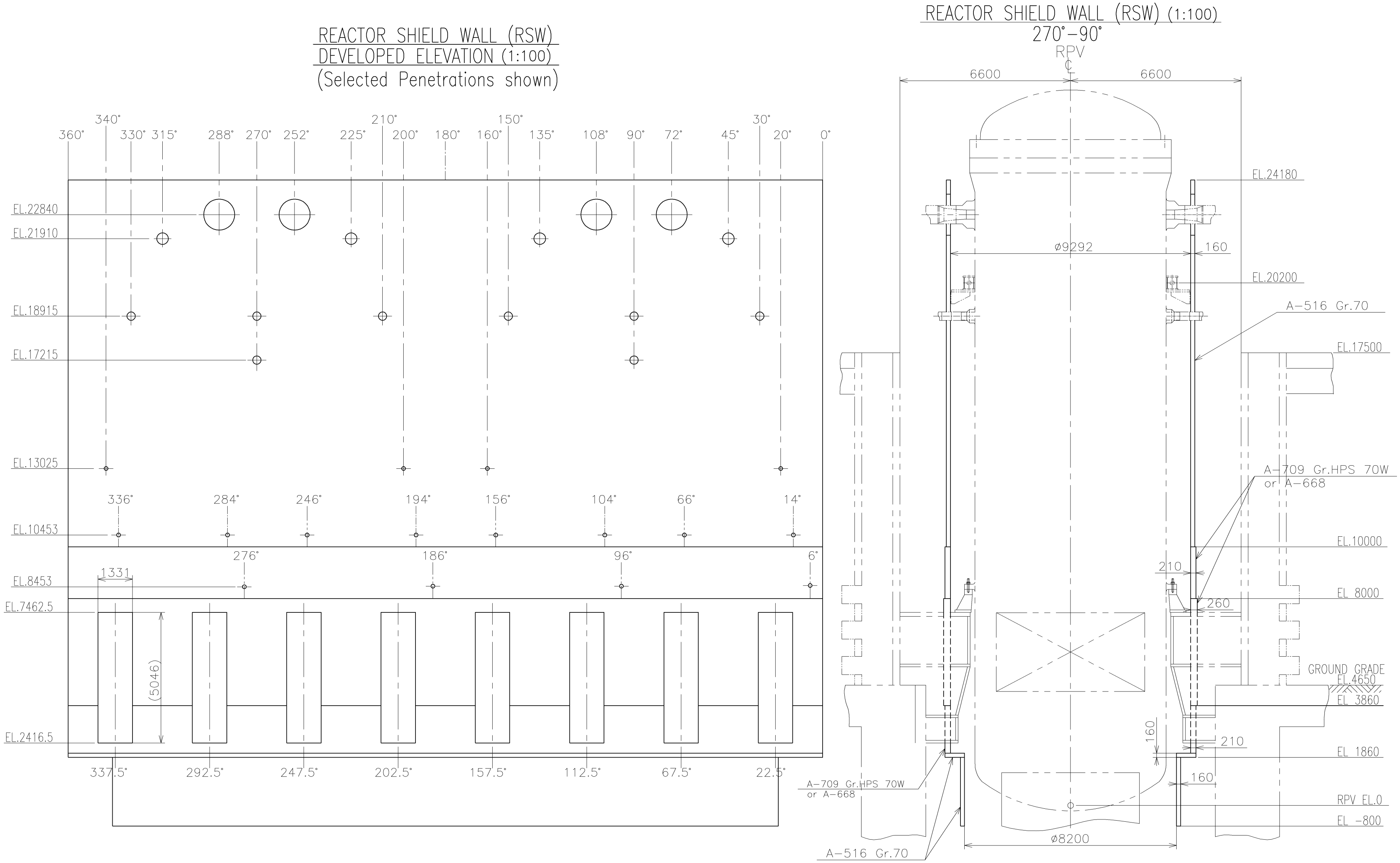
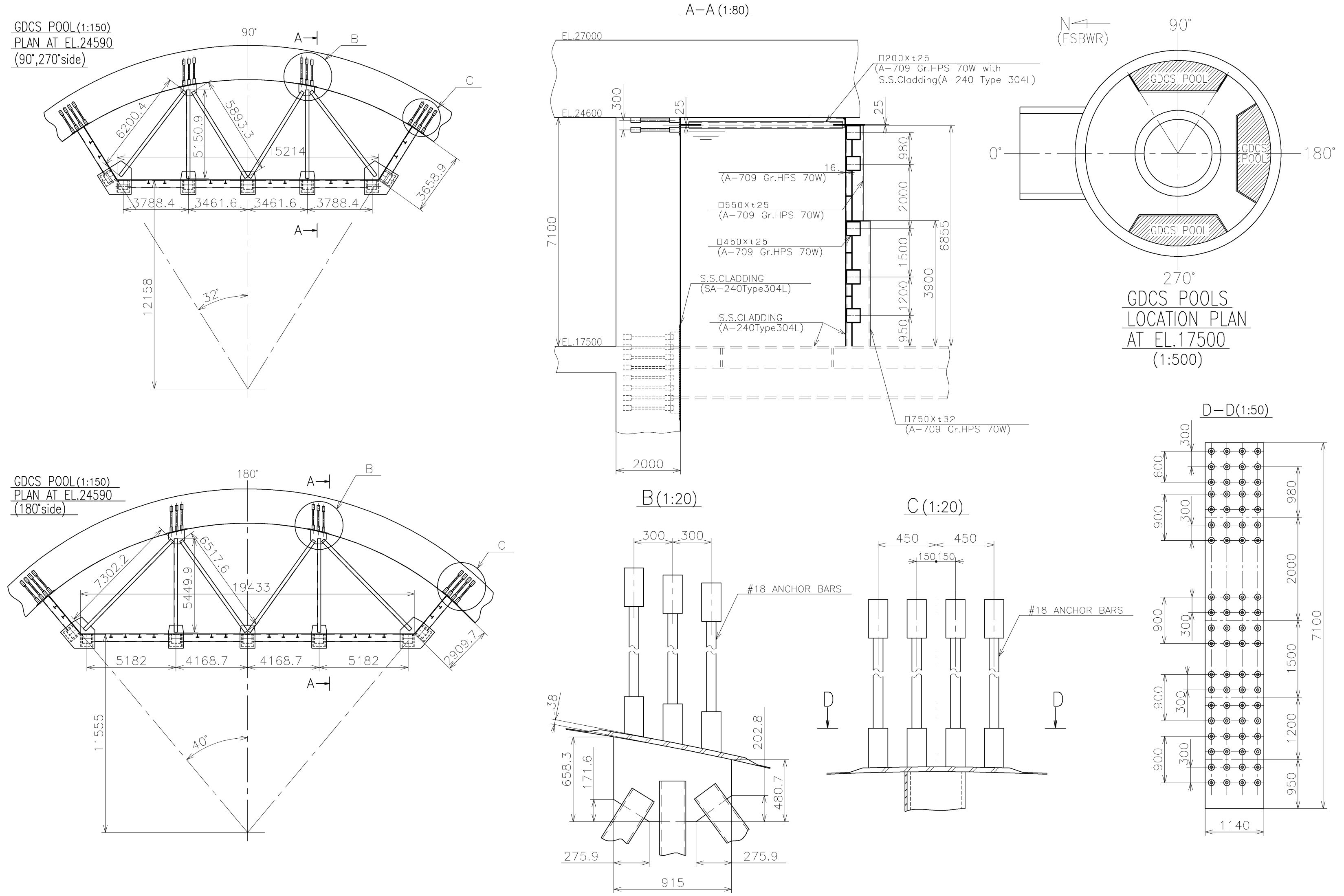


Figure 3G.1-58. Reactor Shield Wall



Note : Positions of anchors may be adjusted locally as necessary to avoid interference with rebars.

Figure 3G.1-59. GDCS Pool

3G.2 CONTROL BUILDING

3G.2.1 Objective and Scope

The objective of this subsection is to document the structural design details, inputs and analytical results from the analysis the Control Building (CB) of the standard ESBWR plant. The scope includes the design and analysis of the structure for normal, severe environmental, extreme environmental, and construction loads.

3G.2.2 Conclusions

The following are the major summary conclusions on the design and analysis of the CB.

- Based on the results of finite element analyses performed in accordance with the design conditions identified in Subsection 3G.2.3, stresses in concrete and reinforcement are less than the allowable stresses per the applicable regulations, codes or standards listed in Section 3.8.
- The factors of safety against floatation, sliding, and overturning of the structure under various loading combinations are higher than the required minimum.
- The thickness of the roof slabs and exterior walls are more than the minimum required to preclude penetration, perforation or spalling resulting from impact of design basis tornado missiles.

3G.2.3 Structural Description

The CB houses the essential electrical, control and instrumentation equipment, the control room for the Reactor and Turbine Buildings, and the CB HVAC equipment. Structure below grade in the CB is a Seismic Category I structure that houses control equipment and operation personnel. Structure above grade is a Seismic Category II structure.

The CB is a reinforced concrete box type shear wall structure consisting of walls and slabs and is supported by a foundation mat. Steel framing is composite with concrete slab and used to support the slabs for vertical loads. The CB is a shear wall structure designed to accommodate all seismic loads with its walls and the connected floors. Therefore, frame members such as beams or columns are designed to accommodate deformations of the walls in case of earthquake conditions. The CB is adjacent to but structurally independent of the Reactor Building (see Figures 1.2-2 through 1.2-5 and Figure 1.2-11).

The key dimensions of the CB are summarized in Table 3.8-8. Figures 3G.2-1 through 3G.2-3 show the outline drawings of the CB.

3G.2.4 Analytical Models

3G.2.4.1 Structural Model

The CB is analyzed utilizing the finite element computer program NASTRAN. The finite element model consists of quadrilateral and beam elements. The quadrilateral elements are used to represent the slabs and walls. Beam elements are used to represent columns and beams. The model is shown in Figures 3G.2-4 to 3G.2-9. The model includes the whole (360°) portion of the CB taking the application of nonaxisymmetrical loads into consideration.

The penthouse structure, which is located above EL 9060 mm, is Seismic Category II, and is not included in the analysis model. The weight of the penthouse is applied as distributed loads in the dead load analysis.

The nodal points are defined by a right hand Cartesian coordinate system X, Y, Z. This system, called the global coordinate system, has its origin located at the north-west corner of the CB at EL 0 mm. The positive X axis is in the south direction; the Y axis is in the east direction; the Z axis is vertical upward. This coordinate system is shown in Figure 3G.2-4.

3G.2.4.2 Foundation Models

The foundation soil is represented by soil springs. The spring constants for rocking and translations are determined based on the following soil parameters which correspond to the Soft Site conditions described in Appendix 3A:

- Shear wave velocity: 300 m/s
- Unit weight: 0.0196 MN/m^3 (2.00 t/m^3)
- Shear modulus: 180 MN/m^2 (1.835 x 10^4 t/m^2)
- Poisson's Ratio: 0.478

Soil springs are attached to the bottom of the foundation mat, and the constraints by side soil are not included in the model. The values of the soil springs used in the analysis are shown in Table 3G.2-1. The springs have perfectly elastic stiffness.

These spring values are multiplied by the foundation mat nodal point tributary areas to compute the spring constants assigned to the base slab nodal points.

3G.2.5 Structural Analysis and Design

3G.2.5.1 Site Design Parameters

The key site design parameters are described in Subsection 3G.1.5.1.

3G.2.5.2 Design Loads, Load Combinations, and Material Properties

3G.2.5.2.1 Design Loads

3G.2.5.2.1.1 Dead Load (D) and Live Load (L and Lo)

The weights of structures are evaluated using the following unit weights.

- reinforced concrete: 23.5 kN/m^3
- steel: 77.0 kN/m^3

Weights of major equipment, miscellaneous structures, piping, and commodities are summarized in Tables 3G.2-2 and 3G.2-3.

Live loads on the CB floor slabs are described in Subsection 3.8.4.3.2.

3G.2.5.2.1.2 Snow Load

The snow load is applied to the roof slab and is taken as shown in Table 3G.1-2. Snow load is reduced to 75% when snow load is combined with seismic loads.

3G.2.5.2.1.3 Lateral Soil Pressure at Rest

The lateral soil pressure at rest is applied to the external walls below grade and is based on soil properties given in Table 3G.1-2. Pressures to be applied to the walls are provided in Figure 3G.2-10.

3G.2.5.2.1.4 Wind Load (W)

Wind load is applied to the roof slab and external walls above grade and is based on basic wind speed given in Table 3G.1-2.

3G.2.5.2.1.5 Tornado Load (W_t)

The tornado load is applied to the roof slab and external walls above grade and its characteristics are given in Table 3G.1-2. The tornado load, W_t, is further defined by the combinations described in Subsection 3G.1.5.2.1.5.

3G.2.5.2.1.6 Thermal Load (T_o and T_a)

Thermal loads for the CB are evaluated for the normal operating conditions and abnormal (LOCA) conditions. Figure 3G.2-11 shows the section location for temperature distributions for various structural elements of the CB, and Table 3G.2-4 shows the magnitude of equivalent linear temperature distribution.

Stress-free temperature is 15.5°C.

3G.2.5.2.1.7 Design Seismic Loads

The design seismic loads are obtained by soil – structure interaction analyses, which are described in Appendix 3A. The seismic loads used for design are as follows:

- Figure 3G.2-12: design seismic shears and moments
- Table 3G.2-5: maximum vertical acceleration

The seismic loads are composed of two perpendicular horizontal and one vertical components. The effects of the three components are combined based on the 100/40/40 method as described in Subsection 3.8.1.3.6.

Seismic lateral soil pressure for wall design is provided in Figure 3G.2-13 using the elastic procedure described in ASCE 4-98 Section 3.5.3.2.

3G.2.5.2.2 Load Combinations and Acceptance Criteria

Table 3.8-15 gives load combinations for the safety-related reinforced concrete structure. Based on previous experience, critical load combinations are selected for the CB design. They are mainly combinations including LOCA loads and seismic loads as shown in Table 3G.2-6. The acceptance criteria for the selected combinations are also included in Table 3G.2-6.

3G.2.5.2.3 Material Properties

Properties of the materials used for the CB design analyses are the same as those for the RB, and they are described in Subsection 3G.1.5.2.3.

3G.2.5.3 Stability Requirements

The stability requirements for the CB foundation are same as those for the RB, and they are described in Subsection 3G.1.5.3.

3G.2.5.4 Structural Design Evaluation

The evaluation of the Seismic Category I structures in the CB is performed using the same procedure as the RB, which is described in Subsection 3G.1.5.4.

The locations of the sections that are selected for evaluation are indicated in Figures 3G.2-5 through 9. They are selected, in principle, from the center and both ends of wall and slab, where it is reasonably expected that the critical stresses appear based on engineering experience and judgment. Tables 3G.2-7 through 3G.2-11 show the forces and moments at the selected sections from NASTRAN analysis. Element forces and moments listed in the tables are defined with relation to the element coordinate system shown in Figure 3G.2-14. Tables 3G.2-12 through 3G.2-14 show the combined forces and moments in accordance with the selected load combinations listed in Table 3G.2-6.

Table 3G.2-15 lists the sectional thicknesses and rebar ratios used in the evaluation. The values are retrieved from the outline drawings shown in Figures 3G.2-1 through 3G.2-3.

Tables 3G.2-16 through 3G.2-21 show the rebar and concrete stresses at these sections for the representative elements. Table 3G.2-22 summarizes evaluation results for transverse shear in accordance with ACI 349, Chapter 11.

3G.2.5.4.1 Shear Walls

The maximum rebar stress of 239.3 MPa is found in the vertical rebar in the wall at EL -7400 due to the load combination CB-9 as shown in Table 3G.2-21. The maximum horizontal rebar stress is found to be 189.1 MPa also in B2F wall due to the load combination CB-9. The maximum transverse shear force is found to be 0.687 MN/m against the shear strength of 1.227 MN/m in the wall at EL -2000.

3G.2.5.4.2 Floor Slabs

The maximum rebar stress of 180.2 MPa is found in the slab at EL 4650 due to the load combination CB-9 as shown in Table 3G.2-20. The maximum transverse shear force is found to be 0.295 MN/m against the shear strength of 0.519 MN/m.

3G.2.5.4.3 Foundation Mat

The maximum rebar stress is found to be 224.5 MPa due to the load combination CB-9 as shown in Table 3G.2-20. The maximum transverse shear force is found to be 1.030 MN/m against the shear strength of 3.969 MN/m.

3G.2.5.5 Foundation Stability

The stabilities of the CB foundation against overturning, sliding and floatation are evaluated. The energy approach is used in calculating the factor of safety against overturning.

The factors of safety against overturning, sliding and floatation are given in Table 3G.2-23. All of these meet the acceptance criteria given in Table 3.8-14.

Maximum soil bearing stress is found to be 256 kPa due to dead plus live loads. Maximum bearing stresses for load combinations involving SSE are shown in Table 3G.2-24 for various site conditions.

3G.2.5.6 Tornado Missile Evaluation

Because the Category I portions of the CB are located below grade as shown in Figure 3G.2-3, only the slab at EL 4650 is required the protection to a tornado missile. The minimum thickness required to prevent penetration and concrete spalling are evaluated. The methods and procedures are shown in Section 3.5.3.1.1. The minimum slab thickness required is less than the minimum 700 mm thickness provided for the CB slab at EL 4650.

Table 3G.2-1

Soil Spring Constants for the CB Analysis Model

Direction of Spring		Loads	Stiffness (MN/m/m^2)
Horizontal	X-direction	All	19.650
	Y-direction	All	20.378
Vertical		Horizontal Seismic Loads	79.174
		Other Loads	29.177

Table 3G.2-2

Equipment Load of CB

Description	Weight	Remarks
Division DCIS Room	216 kN	per one room
MCR Display Consoles	230 kN	
Non 1E DCIS Room	490 kN	per one room
HVAC Units	1079 kN	total

Table 3G.2-3

Miscellaneous Structures, Piping, and Commodity Load of CB

Elevation (mm)	Area Load
9,060	2.4 kN/m^2 (50psf)
4,650	2.4 kN/m^2 (50psf)
-2,000	2.4 kN/m^2 (50psf)
-7,400	2.4 kN/m^2 (50psf)

Table 3G.2-4

Equivalent Liner Temperature Distributions at Various Sections

Section*1	Side*2		Equivalent Linear Temperature*3 (°C)			
			Normal Operation		DBA	
	1	2	Td	Tg	Td	Tg
W1	MCR	GR	17.7	4.4	21.3	11.5
W2	DCIS	GR	17.7	4.4	29.2	27.4
M1	DCIS	GR	18.1	5.1	31.5	32.0
S1	DCIS	MCR	21.0	0.0	40.0	12.0
S2	MCR	DCIS	21.0	0.0	40.0	-10.3

Note *1: See Figure 3G.2-11 for the location of sections.

Note *2: MCR: Main Control Room, DCIS: Distributed Control and Information System, GR: Ground

Note *3: Td: Average Temperature,
Tg: Surface Temperature Difference (positive when temperature at Side 1 is higher)

Table 3G.2-5

Maximum Vertical Acceleration

Walls			Slabs		
Elev. (m)	Node No.	Max. Vertical Acceleration (g)	Elev. (m)	Node No.	Max. Vertical Acceleration (g)
9.06	5	1.11	9.06	9101	1.01
4.65	4	0.92		9102	1.51
-2.00	3	0.62		9103	2.89
-7.40	2	0.47		9104	2.93
-10.40	1	0.47		9105	2.62

See Figure 3A.7-5 for the node numbers.

Table 3G.2-6

Selected Load Combinations for the CB

Category	Load Combination								Acceptance Criteria*1
	No. *2	D	L	T_o	T_a	E'	W	W_t	
Severe Environmental	CB-3	1.4	1.7				1.7		U
Tornado	CB-7	1.0	1.0	1.0				1.0	U
LOCA + SSE	CB-9	1.0	1.0		1.0	1.0			U

*1: U = Required section strength based on the strength design method per ACI 349

*2: Based on Table 3.8-15.

Table 3G.2-7

Results of NASTRAN Analysis: Dead Load

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL-7.4	67	0.031	-0.740	0.023	-0.881	-1.011	0.066	0.209	-0.215
	72	-0.049	0.291	-0.002	-0.401	-0.156	0.015	-0.633	-0.023
	115	-0.761	-0.256	0.261	-0.246	-0.157	-0.302	-0.058	-0.584
	120	-0.083	0.008	-0.135	-0.075	-0.128	0.616	-0.035	0.050
Slab B1F EL-2.0	567	-0.007	0.691	-0.047	-0.050	-0.018	-0.003	-0.063	0.016
	572	0.092	0.117	-0.014	-0.021	-0.011	0.002	0.076	-0.006
	615	0.161	0.132	-0.231	-0.025	-0.003	0.017	-0.031	-0.006
	620	0.034	0.037	0.045	-0.014	-0.017	-0.019	0.021	0.025
Slab 1F EL4.65	1067	0.084	0.096	0.000	0.207	0.110	-0.012	0.037	0.019
	1072	0.001	-0.019	0.002	-0.062	-0.014	0.002	0.084	-0.002
	1115	0.249	0.063	0.093	-0.018	-0.174	-0.022	-0.001	0.159
	1120	0.027	0.006	0.038	-0.025	-0.026	-0.024	0.016	0.025
Wall EL-7.4m ~EL-2.0m	6007	-0.242	-0.639	-0.235	-0.010	0.090	-0.004	-0.051	0.066
	4006	0.097	-0.812	-0.050	-0.042	-0.206	-0.001	0.001	-0.058
	4010	0.068	-0.142	-0.052	0.012	-0.071	-0.005	-0.031	-0.041
Wall EL-2.0m ~EL4.65m	6043	0.182	-1.089	-0.293	0.039	0.021	0.006	0.038	-0.010
	4036	0.061	-0.541	-0.051	0.020	0.110	0.001	-0.001	0.038
	4040	-0.010	-0.248	0.107	-0.002	0.022	0.011	0.014	0.016

Table 3G.2-8

Results of NASTRAN Analysis: Temperature Load (LOCA: Winter)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL-7.4	67	-0.659	-1.669	0.174	6.545	6.107	-0.153	0.371	-0.144
	72	-0.273	-0.342	0.023	1.970	5.689	0.040	0.144	0.088
	115	-1.282	-0.171	0.109	6.248	2.349	-0.234	0.385	0.929
	120	-1.011	-0.921	-0.608	3.338	3.354	2.200	1.174	1.295
Slab B1F EL-2.0	567	-0.739	0.490	0.042	-0.073	-0.091	0.002	0.001	0.004
	572	0.311	-0.838	-0.057	-0.006	-0.062	0.003	-0.035	0.000
	615	-0.814	0.635	-0.748	-0.081	-0.030	0.005	-0.032	-0.080
	620	-0.923	-0.938	-1.400	-0.058	-0.060	0.007	0.002	0.005
Slab 1F EL4.65	1067	-1.536	-0.270	-0.038	0.118	0.014	0.002	0.004	-0.006
	1072	-0.482	-2.085	-0.085	0.418	0.170	0.014	-0.137	0.006
	1115	-0.017	0.193	0.233	0.129	0.233	0.020	-0.006	-0.020
	1120	-2.239	-2.260	-2.503	0.265	0.265	-0.013	-0.044	-0.043
Wall EL-7.4m ~EL-2.0m	6007	0.338	1.553	-0.208	0.638	0.905	0.002	-0.036	0.159
	4006	0.710	-0.086	0.026	-0.707	-1.171	-0.001	-0.001	-0.221
	4010	1.106	0.968	-0.456	-0.526	-0.930	-0.043	-0.184	-0.372
Wall EL-2.0m ~EL4.65m	6043	3.009	-0.382	-0.764	0.387	0.511	-0.026	0.137	0.106
	4036	2.363	0.048	-0.085	-0.282	-0.293	0.002	0.031	0.030
	4040	1.333	0.159	-0.800	-0.094	-0.285	-0.026	-0.200	-0.181

Table 3G.2-9

Results of NASTRAN Analysis: Seismic Load (Horizontal: North to South Direction)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL-7.4	67	-0.116	-0.109	0.139	-0.407	-0.294	-0.209	0.656	-0.020
	72	-0.119	-2.846	0.005	-1.371	-1.194	0.051	-1.216	-0.021
	115	-0.136	-0.061	1.667	0.057	0.013	-1.892	0.842	-0.138
	120	0.085	-0.610	0.083	-0.594	-0.251	0.475	0.063	-0.698
Slab B1F EL-2.0	567	0.038	0.013	0.005	0.047	0.000	-0.009	0.015	-0.010
	572	0.087	0.101	0.000	-0.001	-0.006	0.000	-0.005	0.002
	615	0.007	0.004	-0.055	0.028	0.001	0.006	0.027	0.006
	620	0.103	0.063	-0.001	-0.011	0.015	0.000	0.014	-0.017
Slab 1F EL4.65	1067	0.039	-0.015	0.070	-0.010	-0.010	-0.006	0.015	-0.001
	1072	0.264	0.496	-0.036	-0.008	-0.016	0.001	-0.009	0.001
	1115	0.342	0.051	-0.417	-0.022	-0.001	-0.006	0.011	0.004
	1120	0.179	0.105	-0.011	-0.025	0.022	0.004	0.028	-0.029
Wall EL-7.4m ~EL-2.0m	6007	0.081	-0.174	1.857	-0.053	0.035	-0.011	-0.067	0.030
	4006	-0.737	-1.756	-0.067	0.000	-0.018	-0.001	0.004	-0.002
	4010	-0.132	-0.701	-0.691	0.030	0.006	-0.013	0.004	-0.006
Wall EL-2.0m ~EL4.65m	6043	-0.004	0.042	1.702	-0.005	-0.013	0.007	0.003	-0.004
	4036	0.066	-1.078	-0.091	-0.004	-0.007	-0.001	-0.002	-0.006
	4040	-0.017	-0.759	-0.905	-0.001	0.008	-0.012	-0.002	-0.002

Table 3G.2-10

Results of NASTRAN Analysis: Seismic Load (Horizontal: East to West Direction)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL-7.4	67	-0.129	0.236	-0.377	-0.415	-1.265	-0.065	-0.480	1.724
	72	-0.010	0.055	1.512	-0.045	-0.105	-1.531	-0.085	0.661
	115	-2.477	-0.177	-0.226	-0.196	-0.498	0.028	0.282	-0.279
	120	-0.611	0.212	0.150	-0.182	-0.471	0.001	-0.801	0.150
Slab B1F EL-2.0	567	-0.005	-0.050	0.387	-0.017	-0.050	-0.010	-0.012	0.091
	572	0.004	0.003	0.238	0.001	0.000	-0.001	-0.001	-0.001
	615	-0.205	0.179	0.378	-0.004	-0.026	-0.002	0.007	0.026
	620	0.045	0.109	0.186	0.012	-0.015	-0.001	-0.018	0.017
Slab 1F EL4.65	1067	0.005	0.023	-0.026	-0.005	-0.004	-0.005	-0.001	0.005
	1072	0.002	0.006	-0.308	0.002	0.000	-0.007	-0.001	-0.005
	1115	0.671	0.164	0.055	-0.023	-0.085	0.000	0.006	0.028
	1120	0.086	0.103	-0.117	0.017	-0.035	0.000	-0.032	0.030
Wall EL-7.4m ~EL-2.0m	6007	-0.863	-0.595	0.061	-0.013	-0.037	-0.003	0.016	-0.006
	4006	0.048	-0.094	1.505	-0.005	-0.012	0.011	0.006	-0.005
	4010	0.145	-0.649	0.666	-0.035	-0.083	0.006	-0.031	-0.035
Wall EL-2.0m ~EL4.65m	6043	-0.300	0.092	0.004	-0.069	-0.140	0.008	-0.047	-0.067
	4036	0.015	-0.040	1.400	0.000	0.000	-0.003	-0.006	0.000
	4040	0.006	-0.464	0.990	-0.006	0.009	0.018	0.012	0.009

Table 3G.2-11

Results of NASTRAN Analysis: Seismic Load (Vertical: Downward Direction)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
Basemat EL-7.4	67	-0.028	0.625	-0.019	0.851	0.873	-0.060	-0.146	0.164
	72	0.044	-0.208	-0.002	0.330	0.132	-0.006	0.512	-0.002
	115	0.642	0.224	-0.231	0.229	0.142	0.259	0.054	0.520
	120	0.065	0.000	0.112	0.064	0.114	-0.511	0.029	-0.025
Slab B1F EL-2.0	567	0.002	-0.598	0.039	0.043	0.013	0.002	0.045	-0.012
	572	-0.080	-0.105	0.011	0.018	0.007	-0.001	-0.053	0.004
	615	-0.145	-0.121	0.199	0.018	0.000	-0.012	0.023	0.009
	620	-0.032	-0.034	-0.043	0.009	0.011	0.013	-0.013	-0.016
Slab 1F EL4.65	1067	-0.092	-0.098	0.003	-0.198	-0.112	0.012	-0.035	-0.017
	1072	-0.011	-0.003	0.001	0.071	0.014	-0.001	-0.087	0.002
	1115	-0.235	-0.072	-0.092	0.018	0.174	0.022	0.001	-0.155
	1120	-0.029	-0.012	-0.028	0.026	0.026	0.023	-0.016	-0.023
Wall EL-7.4m ~EL-2.0m	6007	0.201	0.576	0.202	0.008	-0.077	0.003	0.044	-0.058
	4006	-0.070	0.712	0.021	0.033	0.168	0.000	0.000	0.049
	4010	-0.055	0.136	0.053	-0.010	0.060	0.004	0.025	0.035
Wall EL-2.0m ~EL4.65m	6043	-0.154	1.017	0.252	-0.034	-0.018	-0.005	-0.033	0.012
	4036	-0.053	0.540	0.032	-0.016	-0.087	0.000	0.001	-0.033
	4040	0.009	0.251	-0.083	0.001	-0.017	-0.007	-0.011	-0.013

Table 3G.2-12

Combined Forces and Moments: Selected Load Combination CB-3

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
on Basemat EL-7.4	67	OTHR	-2.301	-3.420	0.064	-1.171	-0.629	0.026	0.313	-0.308
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	72	OTHR	-2.543	-1.869	-0.021	1.226	0.218	-0.005	-1.028	-0.074
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	115	OTHR	-3.203	-2.274	0.134	-0.211	0.512	-0.108	-0.039	-0.855
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	120	OTHR	-2.020	-1.840	0.035	0.618	0.398	0.098	-0.299	-0.179
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
on Slab B1F EL-2.0	567	OTHR	-1.006	-0.224	-0.007	-0.081	-0.027	-0.005	-0.109	0.025
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	572	OTHR	-1.189	-0.493	0.044	-0.058	-0.021	0.003	0.139	-0.009
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	615	OTHR	-0.475	-0.501	-0.300	-0.037	-0.022	0.024	-0.042	0.010
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	620	OTHR	-0.590	-0.432	0.756	-0.030	-0.037	-0.028	0.036	0.047
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
on Slab 1F EL4.65	1067	OTHR	-0.219	0.023	0.004	0.342	0.211	-0.020	0.058	0.027
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1072	OTHR	-0.354	-0.163	0.003	-0.231	-0.041	0.001	0.194	-0.006
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1115	OTHR	-0.022	-0.042	0.113	-0.038	-0.356	-0.033	0.003	0.295
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1120	OTHR	-0.101	-0.015	0.074	-0.073	-0.049	-0.023	0.045	0.032
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
on Wall EL-7.4m ~ EL-2.0m	6007	OTHR	-0.973	-0.978	-0.238	0.069	0.143	0.047	0.085	0.335
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4006	OTHR	-0.610	-1.209	-0.093	-0.068	-0.368	-0.002	0.000	-0.707
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4010	OTHR	-0.457	-0.512	-0.100	-0.074	-0.140	0.063	0.097	-0.289
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
on Wall EL-2.0m ~ EL4.65m	6043	OTHR	-0.491	-1.355	-0.288	0.062	0.031	-0.015	0.060	0.183
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4036	OTHR	-0.540	-0.750	-0.053	0.015	0.060	-0.003	0.016	-0.359
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	4040	OTHR	-0.351	-0.686	0.277	-0.084	-0.012	0.048	0.147	-0.121
		TEMP	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

OTHR: Loads other than thermal loads
TEMP: Thermal loads

Table 3G.2-13

Combined Forces and Moments: Selected Load Combination CB-7

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
on Basemat EL-7.4	67	OTHR	-1.351	-2.125	0.043	-0.795	-0.528	0.021	0.229	-0.217
		TEMP	0.015	-0.149	0.022	1.036	0.949	-0.015	0.032	-0.011
	72	OTHR	-1.505	-1.081	-0.014	0.653	0.087	0.003	-0.712	-0.049
		TEMP	-0.003	0.213	0.028	0.262	0.985	-0.003	0.000	0.047
	115	OTHR	-2.000	-1.375	0.131	-0.157	0.282	-0.125	-0.024	-0.586
		TEMP	0.061	-0.011	0.038	1.073	0.366	-0.038	0.100	0.138
	120	OTHR	-1.200	-1.085	0.000	0.349	0.216	0.156	-0.179	-0.099
		TEMP	-0.182	-0.166	0.058	0.528	0.535	0.222	0.248	0.273
on Slab B1F EL-2.0	567	OTHR	-0.593	-0.028	-0.011	-0.054	-0.019	-0.003	-0.074	0.017
		TEMP	-0.177	0.047	0.001	-0.003	-0.004	0.000	-0.001	0.001
	572	OTHR	-0.686	-0.272	0.024	-0.036	-0.014	0.002	0.094	-0.006
		TEMP	0.061	-0.255	-0.021	0.004	0.001	0.001	-0.003	0.000
	615	OTHR	-0.257	-0.274	-0.209	-0.026	-0.014	0.017	-0.030	0.006
		TEMP	-0.289	0.062	-0.091	-0.003	0.002	0.000	-0.005	-0.010
	620	OTHR	-0.342	-0.248	0.451	-0.020	-0.024	-0.020	0.025	0.032
		TEMP	-0.233	-0.239	-0.381	-0.002	-0.002	0.003	0.001	0.002
on Slab 1F EL4.65	1067	OTHR	-0.123	0.020	0.005	0.237	0.137	-0.013	0.041	0.019
		TEMP	-0.973	-0.282	-0.007	-0.006	-0.042	0.001	0.003	-0.002
	1072	OTHR	-0.204	-0.092	0.000	-0.139	-0.027	0.002	0.123	-0.004
		TEMP	-0.249	-1.407	-0.041	0.172	0.020	0.007	-0.074	0.003
	1115	OTHR	0.017	-0.028	0.068	-0.024	-0.233	-0.022	0.001	0.199
		TEMP	0.152	0.206	0.139	-0.022	0.025	0.014	-0.008	0.008
	1120	OTHR	-0.054	-0.004	0.045	-0.047	-0.032	-0.017	0.030	0.023
		TEMP	-1.448	-1.451	-1.673	0.139	0.137	-0.012	-0.052	-0.050
on Wall EL-7.4m ~ EL-2.0m	6007	OTHR	-0.608	-0.664	-0.158	0.039	0.098	0.027	0.042	0.207
		TEMP	0.149	0.206	-0.006	0.104	0.142	0.000	-0.006	0.029
	4006	OTHR	-0.348	-0.843	-0.065	-0.047	-0.249	-0.001	0.000	-0.425
		TEMP	0.246	-0.157	0.042	-0.115	-0.173	0.000	0.000	-0.035
	4010	OTHR	-0.260	-0.323	-0.072	-0.042	-0.093	0.036	0.053	-0.176
		TEMP	0.176	0.319	0.051	-0.086	-0.133	-0.008	-0.023	-0.048
on Wall EL-2.0m ~ EL4.65m	6043	OTHR	-0.262	-0.940	-0.194	0.042	0.020	-0.008	0.041	0.104
		TEMP	0.151	-0.064	-0.184	0.105	0.120	-0.005	0.009	-0.025
	4036	OTHR	-0.306	-0.518	-0.041	0.012	0.053	-0.001	0.010	-0.206
		TEMP	0.001	-0.325	-0.014	-0.102	-0.100	0.001	0.001	0.064
	4040	OTHR	-0.208	-0.441	0.171	-0.050	-0.003	0.030	0.089	-0.069
		TEMP	0.225	0.814	0.007	-0.045	-0.111	-0.019	-0.063	-0.024

Table 3G.2-14

Combined Forces and Moments: Selected Load Combination CB-9

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
on Basemat	67	OTHR	-1.347	-2.147	0.041	-0.859	-0.553	0.029	0.217	-0.220
EL-7.4		TEMP	-0.659	-1.669	0.174	6.545	6.107	-0.153	0.371	-0.144
		EQEW	0.129	-0.236	0.377	0.415	1.265	0.065	0.480	-1.724
		EQNS	-0.116	-0.109	0.139	-0.407	-0.294	-0.209	0.656	-0.020
		EQZ	-0.028	0.625	-0.019	0.851	0.873	-0.060	-0.146	0.164
		EQT	0.001	0.001	0.069	0.000	0.000	0.006	0.000	-0.001
		SPKW	0.080	-1.028	0.047	0.445	0.691	-0.061	0.156	-0.080
		SPKN	-0.717	0.137	-0.018	-0.127	-0.089	0.010	-0.064	0.038
	72	OTHR	-1.504	-1.030	-0.013	0.652	0.108	-0.001	-0.715	-0.047
		TEMP	-0.273	-0.342	0.023	1.970	5.689	0.040	0.144	0.088
		EQEW	0.010	-0.055	-1.512	0.045	0.105	1.531	0.085	-0.661
		EQNS	-0.119	-2.846	0.005	-1.371	-1.194	0.051	-1.216	-0.021
		EQZ	0.044	-0.208	-0.002	0.330	0.132	-0.006	0.512	-0.002
		EQT	0.000	-0.009	-0.113	-0.001	0.000	0.072	0.001	-0.077
		SPKW	0.028	-0.506	-0.005	-0.068	0.105	-0.005	0.073	-0.018
		SPKN	-0.702	-0.139	-0.018	0.923	0.205	0.005	-0.116	-0.014
	115	OTHR	-2.024	-1.385	0.119	-0.171	0.271	-0.110	-0.038	-0.612
		TEMP	-1.282	-0.171	0.109	6.248	2.349	-0.234	0.385	0.929
		EQEW	2.477	0.177	0.226	0.196	0.498	-0.028	-0.282	0.279
		EQNS	-0.136	-0.061	1.667	0.057	0.013	-1.892	0.842	-0.138
		EQZ	0.642	0.224	-0.231	0.229	0.142	0.259	0.054	0.520
		EQT	0.014	0.000	0.128	0.013	0.006	-0.054	0.089	0.001
		SPKW	-0.121	-0.455	-0.054	0.126	0.449	0.062	-0.038	0.015
		SPKN	-0.647	0.001	-0.037	0.027	-0.020	0.049	0.003	0.005
	120	OTHR	-1.204	-1.078	-0.004	0.352	0.210	0.169	-0.184	-0.094
		TEMP	-1.011	-0.921	-0.608	3.338	3.354	2.200	1.174	1.295
		EQEW	0.611	-0.212	-0.150	0.182	0.471	-0.001	0.801	-0.150
		EQNS	0.085	-0.610	0.083	-0.594	-0.251	0.475	0.063	-0.698
		EQZ	0.065	0.000	0.112	0.064	0.114	-0.511	0.029	-0.025
		EQT	0.039	-0.031	-0.005	-0.012	0.016	0.007	0.066	-0.064
		SPKW	-0.029	-0.395	0.029	0.015	0.386	-0.175	-0.047	-0.074
		SPKN	-0.412	-0.025	0.001	0.411	0.030	-0.085	-0.062	-0.016

OTHR: Loads other than thermal and seismic loads
TEMP: Thermal loads
EQEW: Horizontal seismic loads in the E-W direction
EQNS: Horizontal seismic loads in the N-S direction
EQZ: Vertical seismic loads
EQT: Torsional seismic loads
SPKW: Dynamic soil pressure during a horizontal earthquake in the E-W direction
SPKN: Dynamic soil pressure during a horizontal earthquake in the N-S direction

Table 3G.2-14
Combined Forces and Moments: Selected Load Combination CB-9 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
on Slab B1F EL-2.0	567	OTHR	-0.593	-0.005	-0.013	-0.058	-0.019	-0.003	-0.076	0.018
		TEMP	-0.739	0.490	0.042	-0.073	-0.091	0.002	0.001	0.004
		EQEW	0.005	0.050	-0.387	0.017	0.050	0.010	0.012	-0.091
		EQNS	0.038	0.013	0.005	0.047	0.000	-0.009	0.015	-0.010
		EQZ	0.002	-0.598	0.039	0.043	0.013	0.002	0.045	-0.012
		EQT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		SPKW	0.117	-1.155	0.044	0.003	0.000	0.001	0.000	-0.005
		SPKN	-0.949	0.119	-0.005	0.001	0.000	0.000	0.001	0.001
	572	OTHR	-0.682	-0.268	0.023	-0.038	-0.014	0.002	0.096	-0.006
		TEMP	0.311	-0.838	-0.057	-0.006	-0.062	0.003	-0.035	0.000
		EQEW	-0.004	-0.003	-0.238	-0.001	0.000	0.001	0.001	0.001
		EQNS	0.087	0.101	0.000	-0.001	-0.006	0.000	-0.005	0.002
		EQZ	-0.080	-0.105	0.011	0.018	0.007	-0.001	-0.053	0.004
		EQT	0.000	0.000	-0.004	0.000	0.000	0.000	0.000	0.000
		SPKW	0.004	-0.465	0.005	-0.008	-0.002	0.000	0.003	0.000
		SPKN	-1.112	-0.205	0.044	0.032	0.005	0.000	-0.013	0.000
	615	OTHR	-0.249	-0.271	-0.220	-0.027	-0.013	0.017	-0.031	0.004
		TEMP	-0.814	0.635	-0.748	-0.081	-0.030	0.005	-0.032	-0.080
		EQEW	0.205	-0.179	-0.378	0.004	0.026	0.002	-0.007	-0.026
		EQNS	0.007	0.004	-0.055	0.028	0.001	0.006	0.027	0.006
		EQZ	-0.145	-0.121	0.199	0.018	0.000	-0.012	0.023	0.009
		EQT	0.000	0.000	0.001	0.001	0.000	0.000	0.001	0.000
		SPKW	-0.151	-0.912	-0.264	0.002	0.034	0.002	-0.008	-0.038
		SPKN	-0.452	-0.018	0.120	0.001	-0.002	0.000	0.002	0.004
	620	OTHR	-0.341	-0.247	0.453	-0.020	-0.025	-0.020	0.025	0.032
		TEMP	-0.923	-0.938	-1.400	-0.058	-0.060	0.007	0.002	0.005
		EQEW	-0.045	-0.109	-0.186	-0.012	0.015	0.001	0.018	-0.017
		EQNS	0.103	0.063	-0.001	-0.011	0.015	0.000	0.014	-0.017
		EQZ	-0.032	-0.034	-0.043	0.009	0.011	0.013	-0.013	-0.016
		EQT	0.001	0.000	-0.001	-0.001	0.001	0.000	0.002	-0.002
		SPKW	-0.015	-0.506	0.291	-0.004	0.007	-0.004	0.005	-0.007
		SPKN	-0.501	-0.016	0.367	0.008	-0.003	-0.004	-0.007	0.005

Table 3G.2-14
Combined Forces and Moments: Selected Load Combination CB-9 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
on Slab 1F	1067	OTHR	-0.112	0.034	0.002	0.238	0.145	-0.014	0.040	0.019
EL4.65		TEMP	-1.536	-0.270	-0.038	0.118	0.014	0.002	0.004	-0.006
		EQEW	-0.005	-0.023	0.026	0.005	0.004	0.005	0.001	-0.005
		EQNS	0.039	-0.015	0.070	-0.010	-0.010	-0.006	0.015	-0.001
		EQZ	-0.092	-0.098	0.003	-0.198	-0.112	0.012	-0.035	-0.017
		EQT	-0.001	0.002	-0.008	0.000	0.000	0.000	0.000	0.000
		SPKW	0.089	-0.671	0.041	-0.018	0.042	0.000	-0.004	0.004
		SPKN	-0.630	0.076	-0.008	0.011	0.008	-0.001	0.000	0.000
	1072	OTHR	-0.211	-0.104	0.003	-0.149	-0.027	0.000	0.131	-0.004
		TEMP	-0.482	-2.085	-0.085	0.418	0.170	0.014	-0.137	0.006
		EQEW	-0.002	-0.006	0.308	-0.002	0.000	0.007	0.001	0.005
		EQNS	0.264	0.496	-0.036	-0.008	-0.016	0.001	-0.009	0.001
		EQZ	-0.011	-0.003	0.001	0.071	0.014	-0.001	-0.087	0.002
		EQT	0.001	0.001	-0.010	0.000	0.000	0.000	0.000	0.000
		SPKW	0.026	-0.391	-0.014	0.001	0.007	-0.003	0.007	-0.002
		SPKN	-0.697	-0.103	0.026	-0.166	-0.026	-0.002	0.064	-0.002
	1115	OTHR	0.034	-0.009	0.089	-0.026	-0.242	-0.024	0.001	0.202
		TEMP	-0.017	0.193	0.233	0.129	0.233	0.020	-0.006	-0.020
		EQEW	-0.671	-0.164	-0.055	0.023	0.085	0.000	-0.006	-0.028
		EQNS	0.342	0.051	-0.417	-0.022	-0.001	-0.006	0.011	0.004
		EQZ	-0.235	-0.072	-0.092	0.018	0.174	0.022	0.001	-0.155
		EQT	0.022	0.004	-0.022	-0.001	0.000	0.001	0.001	0.000
		SPKW	-0.088	-0.632	-0.050	-0.031	-0.158	0.005	0.005	0.059
		SPKN	-0.487	-0.004	0.007	0.004	-0.002	0.000	0.002	0.002
	1120	OTHR	-0.056	-0.010	0.053	-0.048	-0.034	-0.018	0.029	0.023
		TEMP	-2.239	-2.260	-2.503	0.265	0.265	-0.013	-0.044	-0.043
		EQEW	-0.086	-0.103	0.117	-0.017	0.035	0.000	0.032	-0.030
		EQNS	0.179	0.105	-0.011	-0.025	0.022	0.004	0.028	-0.029
		EQZ	-0.029	-0.012	-0.028	0.026	0.026	0.023	-0.016	-0.023
		EQT	0.005	-0.005	-0.004	-0.002	0.002	0.000	0.003	-0.003
		SPKW	0.007	-0.303	0.124	0.014	-0.048	0.020	-0.027	0.039
		SPKN	-0.302	0.005	0.135	-0.050	0.013	0.022	0.040	-0.028

Table 3G.2-14
Combined Forces and Moments: Selected Load Combination CB-9 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
on Wall EL-7.4m ~EL-2.0m	6007	OTHR	-0.617	-0.695	-0.193	0.039	0.101	0.027	0.041	0.209
		TEMP	0.338	1.553	-0.208	0.638	0.905	0.002	-0.036	0.159
		EQEW	0.863	0.595	-0.061	0.013	0.037	0.003	-0.016	0.006
		EQNS	0.081	-0.174	1.857	-0.053	0.035	-0.011	-0.067	0.030
		EQZ	0.201	0.576	0.202	0.008	-0.077	0.003	0.044	-0.058
		EQT	0.007	0.003	0.132	-0.002	0.001	0.001	-0.004	0.001
		SPKW	-0.051	0.063	-0.023	0.033	0.032	0.021	0.050	0.102
		SPKN	-0.312	0.010	0.002	-0.002	-0.017	-0.001	0.002	-0.007
	4006	OTHR	-0.338	-0.855	-0.063	-0.048	-0.254	-0.001	0.000	-0.426
		TEMP	0.710	-0.086	0.026	-0.707	-1.171	-0.001	-0.001	-0.221
		EQEW	-0.048	0.094	-1.505	0.005	0.012	-0.011	-0.006	0.005
		EQNS	-0.737	-1.756	-0.067	0.000	-0.018	-0.001	0.004	-0.002
		EQZ	-0.070	0.712	0.021	0.033	0.168	0.000	0.000	0.049
		EQT	-0.004	-0.001	-0.128	0.000	0.001	0.001	-0.001	0.000
		SPKW	-0.286	0.124	-0.010	0.013	0.076	-0.001	0.001	0.033
		SPKN	-0.106	-0.068	-0.019	-0.022	-0.134	0.000	-0.001	-0.283
	4010	OTHR	-0.255	-0.326	-0.065	-0.042	-0.096	0.036	0.052	-0.178
		TEMP	1.106	0.968	-0.456	-0.526	-0.930	-0.043	-0.184	-0.372
		EQEW	-0.145	0.649	-0.666	0.035	0.083	-0.006	0.031	0.035
		EQNS	-0.132	-0.701	-0.691	0.030	0.006	-0.013	0.004	-0.006
		EQZ	-0.055	0.136	0.053	-0.010	0.060	0.004	0.025	0.035
		EQT	-0.013	0.007	-0.090	0.003	0.006	0.000	0.002	0.003
		SPKW	-0.186	-0.031	0.030	-0.036	0.015	-0.014	0.032	0.020
		SPKN	-0.047	-0.106	-0.068	-0.009	-0.046	0.044	0.027	-0.120

Table 3G.2-14
Combined Forces and Moments: Selected Load Combination CB-9 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
on Wall	6043	OTHR	-0.255	-1.003	-0.234	0.043	0.023	-0.008	0.042	0.106
EL-2.0m		TEMP	3.009	-0.382	-0.764	0.387	0.511	-0.026	0.137	0.106
~EL4.65m		EQEW	0.300	-0.092	-0.004	0.069	0.140	-0.008	0.047	0.067
		EQNS	-0.004	0.042	1.702	-0.005	-0.013	0.007	0.003	-0.004
		EQZ	-0.154	1.017	0.252	-0.034	-0.018	-0.005	-0.033	0.012
		EQT	-0.001	0.012	0.123	0.000	-0.001	0.002	0.000	0.000
		SPKW	-0.014	-0.086	-0.071	0.026	0.019	-0.018	0.051	0.535
		SPKN	-0.580	0.184	0.067	-0.005	0.013	0.003	-0.012	-0.001
	4036	OTHR	-0.308	-0.541	-0.039	0.012	0.056	-0.001	0.009	-0.204
		TEMP	2.363	0.048	-0.085	-0.282	-0.293	0.002	0.031	0.030
		EQEW	-0.015	0.040	-1.400	0.000	0.000	0.003	0.006	0.000
		EQNS	0.066	-1.078	-0.091	-0.004	-0.007	-0.001	-0.002	-0.006
		EQZ	-0.053	0.540	0.032	-0.016	-0.087	0.000	0.001	-0.033
		EQT	0.000	-0.001	-0.107	0.000	0.000	0.002	0.000	0.000
		SPKW	-0.515	0.172	0.009	-0.009	-0.039	-0.001	-0.003	-0.009
		SPKN	-0.177	-0.017	0.000	0.008	0.019	-0.002	0.017	-0.500
	4040	OTHR	-0.208	-0.447	0.187	-0.050	-0.003	0.030	0.089	-0.068
		TEMP	1.333	0.159	-0.800	-0.094	-0.285	-0.026	-0.200	-0.181
		EQEW	-0.006	0.464	-0.990	0.006	-0.009	-0.018	-0.012	-0.009
		EQNS	-0.017	-0.759	-0.905	-0.001	0.008	-0.012	-0.002	-0.002
		EQZ	0.009	0.251	-0.083	0.001	-0.017	-0.007	-0.011	-0.013
		EQT	-0.004	-0.006	-0.104	0.000	0.000	0.000	0.000	0.000
		SPKW	-0.367	-0.152	0.051	-0.109	-0.023	-0.019	0.047	0.024
		SPKN	-0.115	-0.252	0.015	-0.032	-0.002	0.093	0.137	-0.157

Table 3G.2-15

Sectional Thicknesses and Rebar Ratios Used in the Evaluation

Location	Element ID	Thickness (m)	Position	Primary Reinforcement: N-S Bars (Slab) Horizontal Bars (Wall)		Primary Reinforcement: E-W Bars (Slab) Vertical Bars (Wall)		Shear Tie	
				Arrangement	Ratio (%)	Arrangement	Ratio (%)	Arrangement	Ratio (%)
Basemat EL-7.4	67 72 115 120	3.0	Top	1-#11@200 + 1-#11@400	0.252	1-#11@200 + 1-#11@400	0.252	--	0.000
			Bottom	1-#11@200 + 1-#11@400	0.252	1-#11@200 + 1-#11@400	0.252		
Slab B1F EL-2.0	567 572 615 620	0.5	Top	1-#11@200	1.006	1-#11@200	1.006	--	0.000
			Bottom	1-#11@200	1.006	1-#11@200	1.006		
Slab 1F EL4.65	1067 1072 1115 1120	0.7	Top	1-#11@200	0.719	1-#11@200	0.719	--	0.000
			Bottom	1-#11@200	0.719	1-#11@200	0.719		
Wall EL-7.4m ~EL-2.0m	6007 4006 4010	0.9	Inside	2-#11@200	1.118	2-#11@200	1.118	#6@400x200	0.355
			Outside	2-#11@200	1.118	2-#11@200	1.118		
Wall EL-2.0m ~EL4.65m	6043 4036 4040	0.9	Inside	2-#11@200	1.118	2-#11@200	1.118	#6@400x200	0.355
			Outside	2-#11@200	1.118	2-#11@200	1.118		

Table 3G.2-16

Rebar and Concrete Stresses (Basemat and Slabs): Selected Load Combination CB-3

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction		Y-direction		
				Top	Bottom	Top	Bottom	
on Basemat EL-7.4	67	-1.5	-20.7	0.1	-8.8	-5.9	-9.7	372.2
	72	-1.6		-10.8	-0.9	-3.8	-3.6	
	115	-1.2		-6.0	-8.5	-6.9	-2.2	
	120	-1.1		-6.8	-2.2	-5.2	-2.6	
on Slab B1F EL-2.0	567	-3.6	-25.9	-6.8	-17.6	0.8	-2.4	
	572	-3.4		-10.1	-17.8	-2.9	-5.0	
	615	-3.0		13.0	-5.3	9.1	-6.4	
	620	-4.1		57.5	7.7	65.9	3.7	
on Slab 1F EL4.65	1067	-9.0		-10.9	114.8	-4.8	83.3	
	1072	-5.2		56.0	-13.0	0.5	-1.5	
	1115	-7.3		27.2	4.4	137.0	-20.7	
	1120	-2.5		30.8	-1.7	32.4	-0.1	

Note: Negative value means compression.

Table 3G.2-17

Rebar and Concrete Stresses (Walls): Selected Load Combination CB-3

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				Horizontal direction		Vertical direction		
				Inside	Outside	Inside	Outside	
on Wall EL-7.4m ~EL-2.0m	6007	-2.3	-25.9	-7.0	-4.4	-8.9	-2.6	372.2
	4006	-4.3		-3.3	-2.1	-16.5	9.0	
	4010	-2.6		-3.9	6.0	-5.7	9.6	
on Wall EL-2.0m ~EL4.65m	6043	-1.6		-3.5	-0.5	-9.3	-8.3	
	4036	-1.1		-2.8	-3.1	-3.2	-6.0	
	4040	-1.5		-3.9	0.5	-4.4	-4.4	

Note: Negative value means compression.

Table 3G.2-18
Rebar and Concrete Stresses (Basemat and Slabs): Selected Load Combination CB-7

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				X-direction		Y-direction		
				Top	Bottom	Top	Bottom	
on Basemat EL-7.4	67	-1.0	-23.5	-3.2	-1.8	-7.0	-3.7	372.2
	72	-1.0		-6.7	-0.5	-4.2	1.0	
	115	-1.3		-7.9	-1.1	-5.0	-0.7	
	120	-1.0		-5.8	-0.2	-4.8	-0.4	
on Slab B1F EL-2.0	567	-2.7	-29.3	-5.8	-13.4	9.9	0.5	
	572	-1.9		-4.7	-9.0	-4.7	-6.2	
	615	-2.5		12.0	-5.0	13.3	-1.7	
	620	-2.6		19.1	-0.7	23.5	-2.7	
on Slab 1F EL4.65	1067	-5.5		-17.4	30.6	-5.7	43.8	
	1072	-2.0		-3.7	-0.4	-12.5	-14.1	
	1115	-4.5		38.0	7.7	89.2	-12.2	
	1120	-4.8		-5.8	22.7	-9.5	27.7	

Note: Negative value means compression.

Table 3G.2-19
Rebar and Concrete Stresses (Walls): Selected Load Combination CB-7

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
		Calculated	Allowable	Calculated				Allowable
				Horizontal direction		Vertical direction		
				Inside	Outside	Inside	Outside	
on Wall EL-7.4m ~EL-2.0m	6007	-1.8	-29.3	-4.9	0.0	-6.0	1.9	372.2
	4006	-3.9		-0.5	2.5	-14.0	10.7	
	4010	-2.6		-1.2	16.1	-1.4	22.0	
on Wall EL-2.0m ~EL4.65m	6043	-1.9		-1.5	7.7	-8.6	-0.6	
	4036	-1.2		-2.8	0.5	-6.4	-4.6	
	4040	-0.8		1.3	12.3	5.2	7.6	

Note: Negative value means compression.

Table 3G.2-20

Rebar and Concrete Stresses (Basemat and Slabs): Selected Load Combination CB-9

Location	Element ID	Concrete Stress (MPa) Calculated	Concrete Stress (MPa) Allowable	Primary Reinforcement Stress (MPa) Calculated X-direction Top	X-direction Bottom	Y-direction Top	Y-direction Bottom	Allowable
on Basemat EL-7.4	67	-5.4	-23.1	-15.9	23.6	-34.7	36.5	368.9
	72	-5.0		41.1	56.8	52.5	224.5	
	115	-6.0		57.2	80.2	60.1	19.7	
	120	-4.1		-22.4	47.2	-20.0	45.9	
on Slab B1F EL-2.0	567	-8.4	-28.5	-23.9	-40.9	73.2	-17.9	366.1
	572	-4.7		-17.1	-17.2	-14.0	-26.3	
	615	-8.2		85.4	-27.7	71.1	19.9	
	620	-6.7		-18.3	-24.6	-16.1	-26.4	
on Slab 1F EL4.65	1067	-13.3		-38.2	125.8	-18.6	94.7	
	1072	-5.4		-16.7	-8.0	-31.9	-18.4	
	1115	-9.8		104.4	33.2	180.2	-35.5	
	1120	-8.1		-25.6	30.6	-28.9	36.2	

Note: Negative value means compression.

Table 3G.2-21

Rebar and Concrete Stresses (Walls): Selected Load Combination CB-9

Location	Element ID	Concrete Stress (MPa) Calculated	Concrete Stress (MPa) Allowable	Primary Reinforcement Stress (MPa) Calculated Horizontal direction Inside	Horizontal direction Outside	Vertical direction Inside	Vertical direction Outside	Allowable
on Wall EL-7.4m ~EL-2.0m	6007	-10.8	-29.0	23.1	189.1	50.8	205.6	369.6
	4006	-15.6		27.0	176.3	-41.6	239.3	
	4010	-10.5		19.7	118.6	27.8	149.9	
on Wall EL-2.0m ~EL4.65m	6043	-9.0	-29.3	38.4	147.2	-27.7	135.1	372.2
	4036	-3.8		48.5	108.7	52.7	121.6	
	4040	-4.8		42.7	89.6	56.2	85.9	

Note: Negative value means compression.

Table 3G.2-22

Calculation Results for Transverse Shear

Location	Element ID	Load ID	d (m)	ρ_w (%)	ρ_v (%)	Shear Forces (MN/m) Vu	Vc	Vs	ϕVn	Vu/ϕVn
Basemat EL-7.4	67	CB-3	2.830	0.267	0.000	0.439	4.893	0.000	4.159	0.105
	72	CB-3	2.740	0.276	0.000	1.030	4.669	0.000	3.969	0.260
	115	CB-3	2.780	0.272	0.000	0.856	4.687	0.000	3.984	0.215
	120	CB-3	2.751	0.275	0.000	0.349	4.578	0.000	3.891	0.090
B1F EL-2.0	567	CB-3	0.363	1.393	0.000	0.112	0.774	0.000	0.658	0.170
	572	CB-3	0.360	1.402	0.000	0.140	0.799	0.000	0.679	0.206
	615	CB-3	0.363	1.393	0.000	0.044	0.679	0.000	0.577	0.075
	620	CB-3	0.392	1.290	0.000	0.059	0.329	0.000	0.280	0.210
1F EL4.65	1067	CB-3	0.569	0.884	0.000	0.064	0.540	0.000	0.459	0.140
	1072	CB-3	0.560	0.899	0.000	0.194	0.590	0.000	0.502	0.386
	1115	CB-3	0.610	0.825	0.000	0.295	0.611	0.000	0.519	0.569
	1120	CB-3	0.576	0.873	0.000	0.055	0.566	0.000	0.481	0.115
Wall EL-7.4m ~EL-2.0m	6007	CB-3	0.673	1.497	0.355	0.390	0.438	0.989	1.213	0.321
	4006	CB-9	0.672	1.500	0.355	0.673	0.400	0.988	1.179	0.570
	4010	CB-9	0.672	1.499	0.355	0.566	0.472	0.988	1.241	0.456
Wall EL-2.0m ~EL4.65m	6043	CB-3	0.677	1.489	0.355	0.192	1.399	0.995	2.035	0.094
	4036	CB-9	0.672	1.500	0.355	0.687	0.456	0.988	1.227	0.560
	4040	CB-3	0.696	1.449	0.355	0.191	1.325	1.023	1.996	0.096

Table 3G.2-23

Factors of Safety for Foundation Stability

Load Combination	Overturning		Sliding		Floatation	
	Required	Actual	Required	Actual	Required	Actual
D + H + E’	1.1	415.6	1.1	1.54	--	--
D + F’	--	--	--	--	1.1	1.66

Where,

D = Dead Load

H = Lateral soil pressure

E’ = Safe Shutdown Earthquake

F’ = Buoyant forces of design basis flood

Table 3G.2-24

Maximum Soil Bearing Stress Involving SSE

	Site Condition*		
	Soft	Medium	Hard
Bearing Stress (MPa)	1.70	1.78	1.77

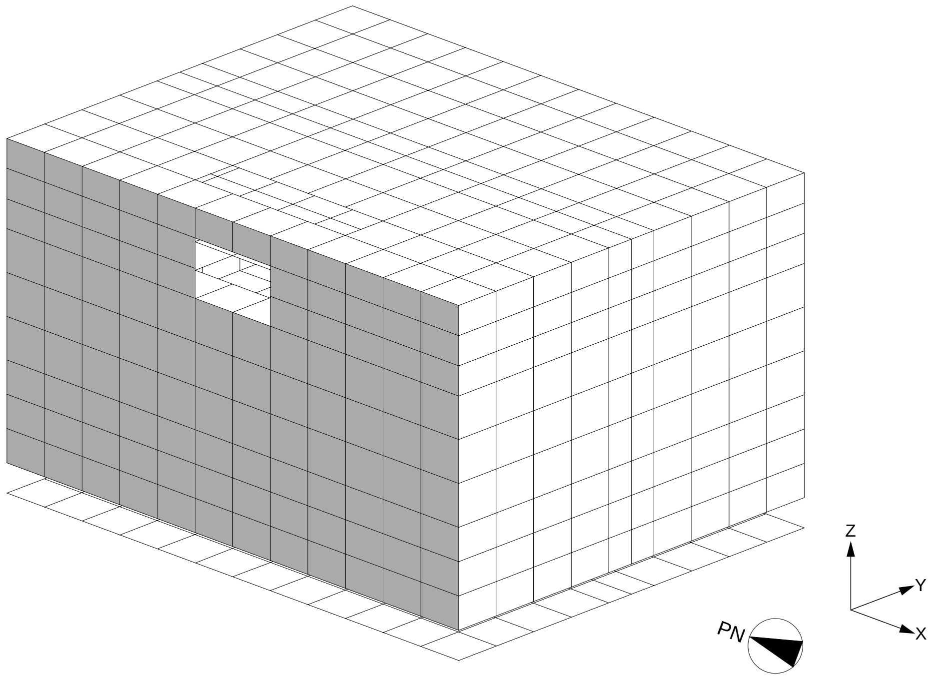
* See Table 3A.1-2 for site properties.

Figure 3G.2-1. CB Concrete Outline Plan at EL -7400 and Foundation Reinforcement

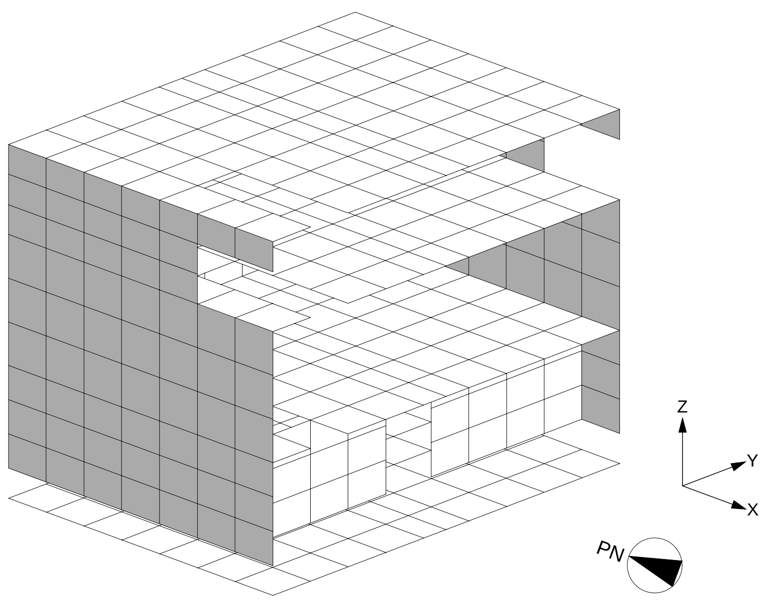
Figure 3G.2-2. CB Concrete Outline Plan at EL –2000/4850 and Section Details

Figure 3G.2-3. CB Concrete Outline Plan at EL 9060, Section and Section Detail

{{{Security-Related Information - Withheld Under 10 CFR 2.390}}}



Whole View



Cut View

Figure 3G.2-4. FE Model of CB (Isometric View)

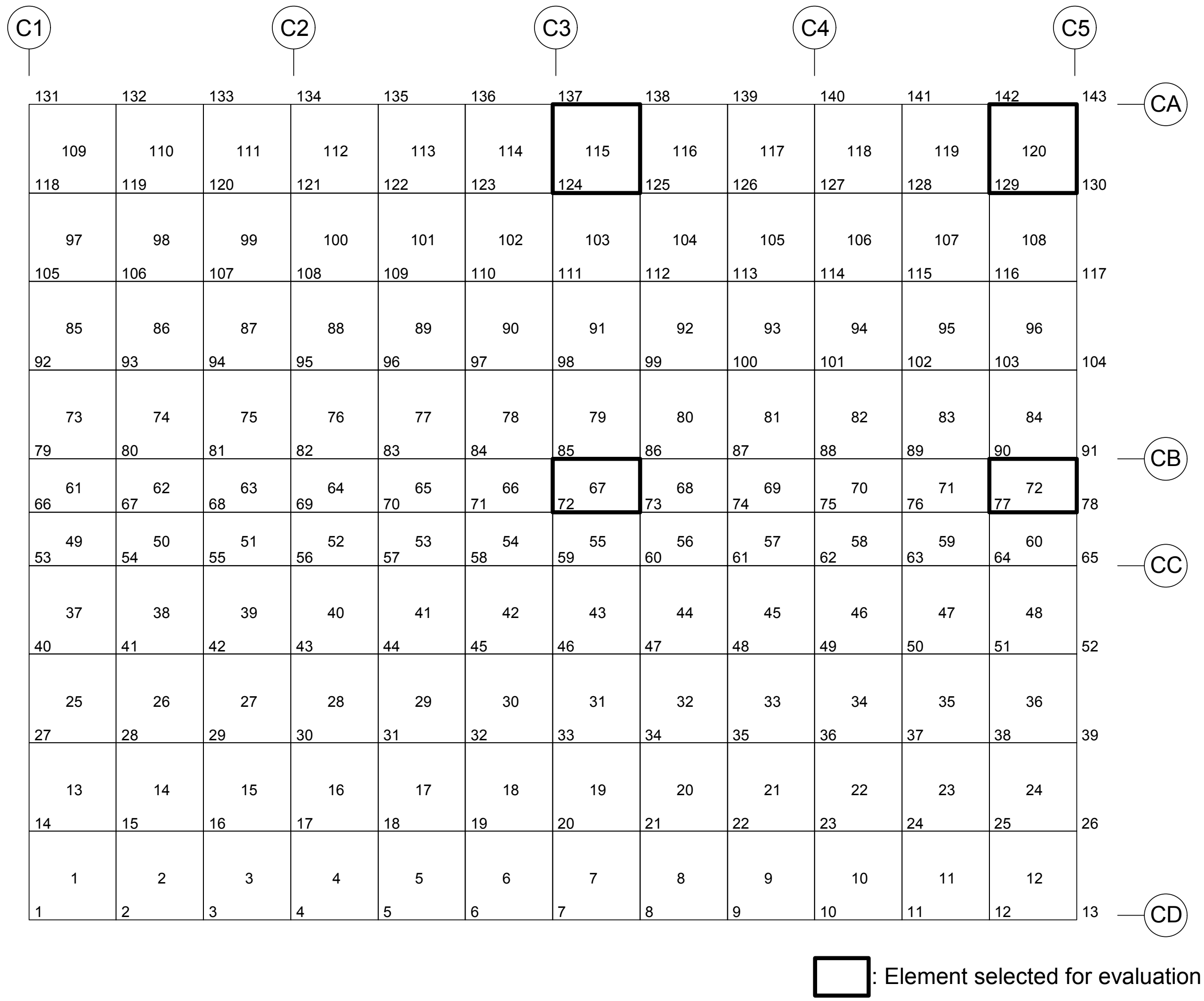


Figure 3G.2-5. FE Model of CB (Foundation Mat)

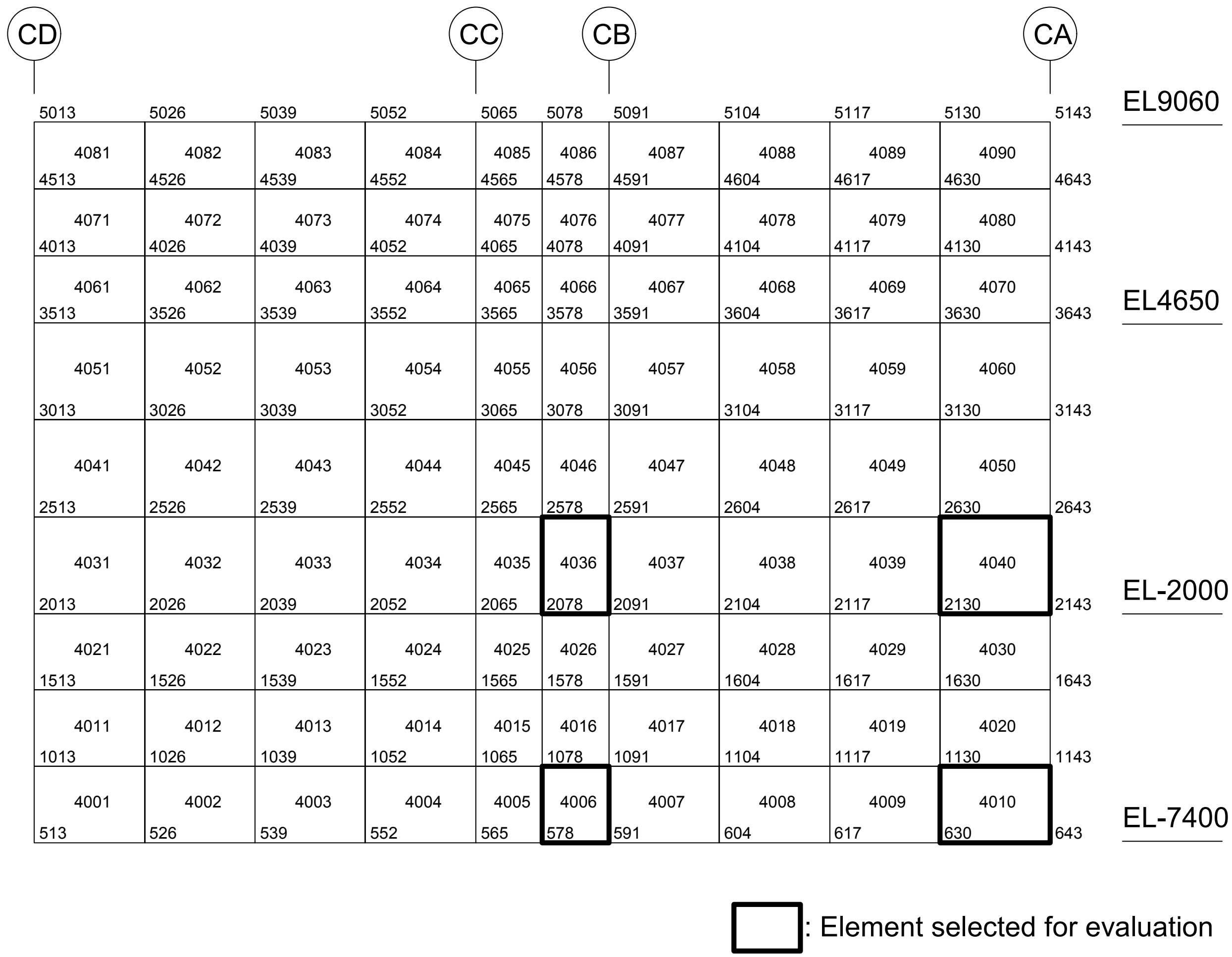


Figure 3G.2-6. FE Model of CB (External Wall: South Side)

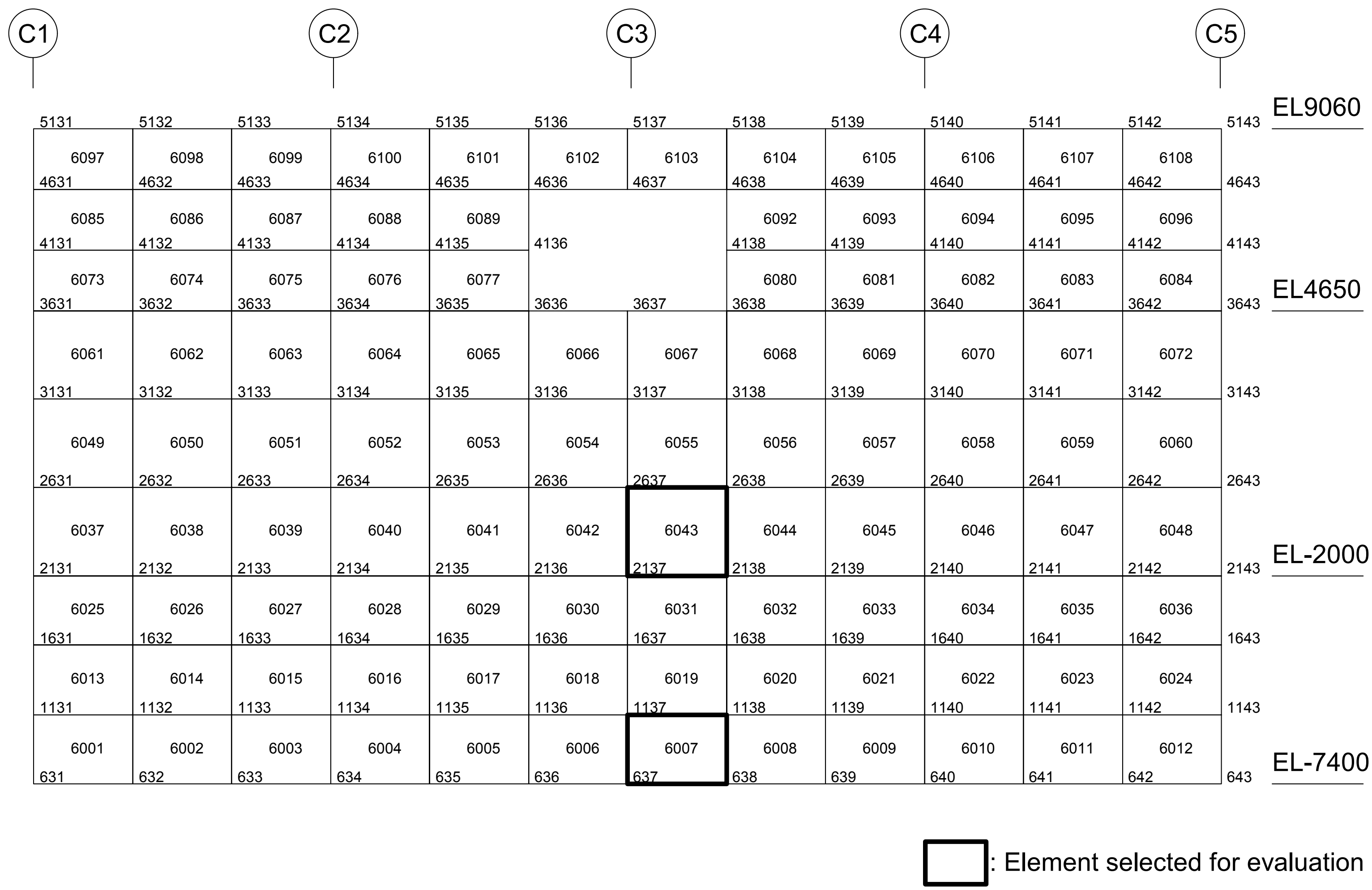


Figure 3G.2-7. FE Model of CB (External Wall: East Side)

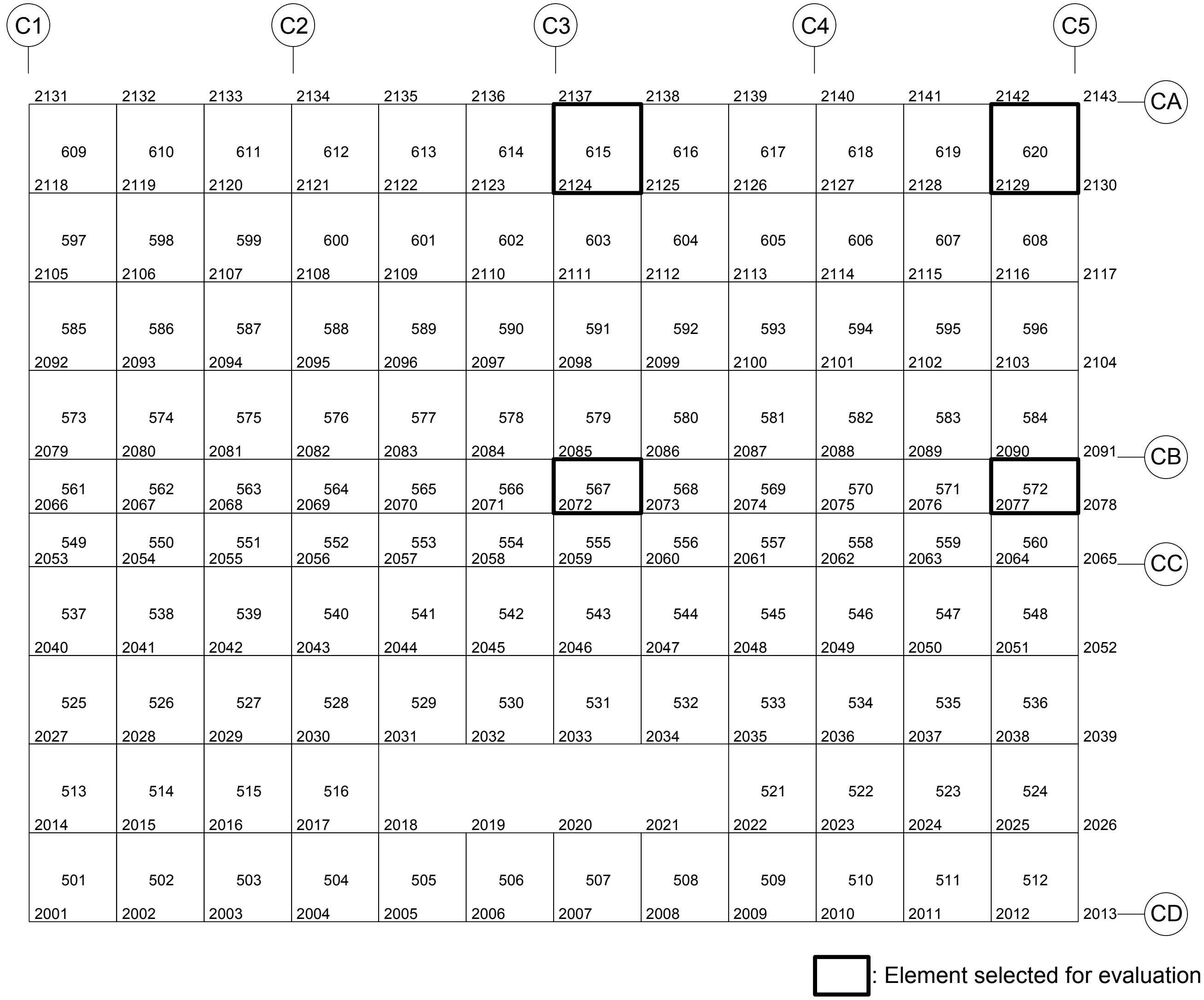


Figure 3G.2-8. FE Model of CB (Floor Slab: EL -2000)

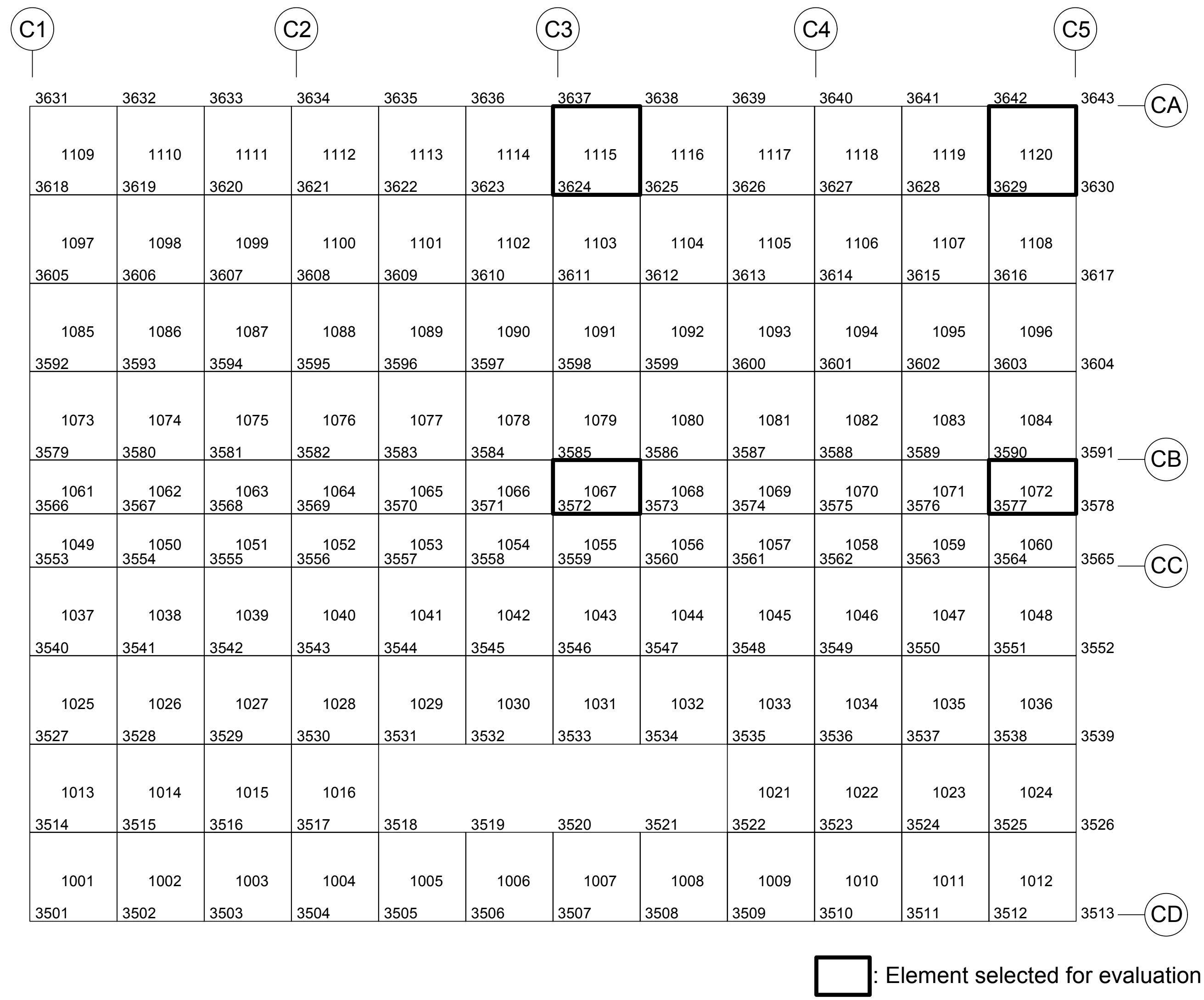


Figure 3G.2-9. FE Model of CB (Floor Slab: EL 4650)

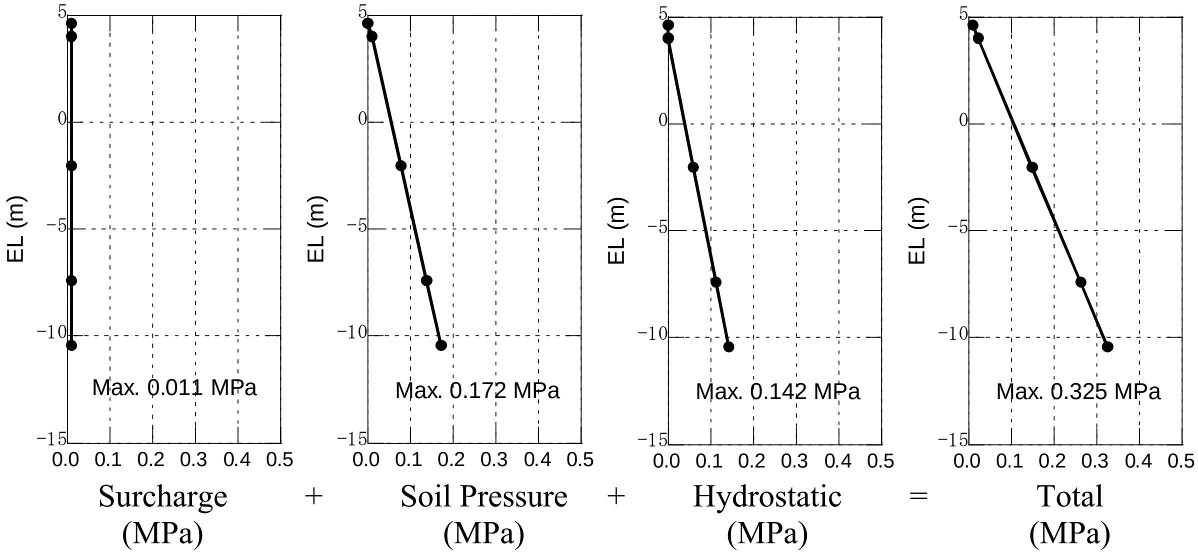


Figure 3G.2-10. Soil Pressure at Rest

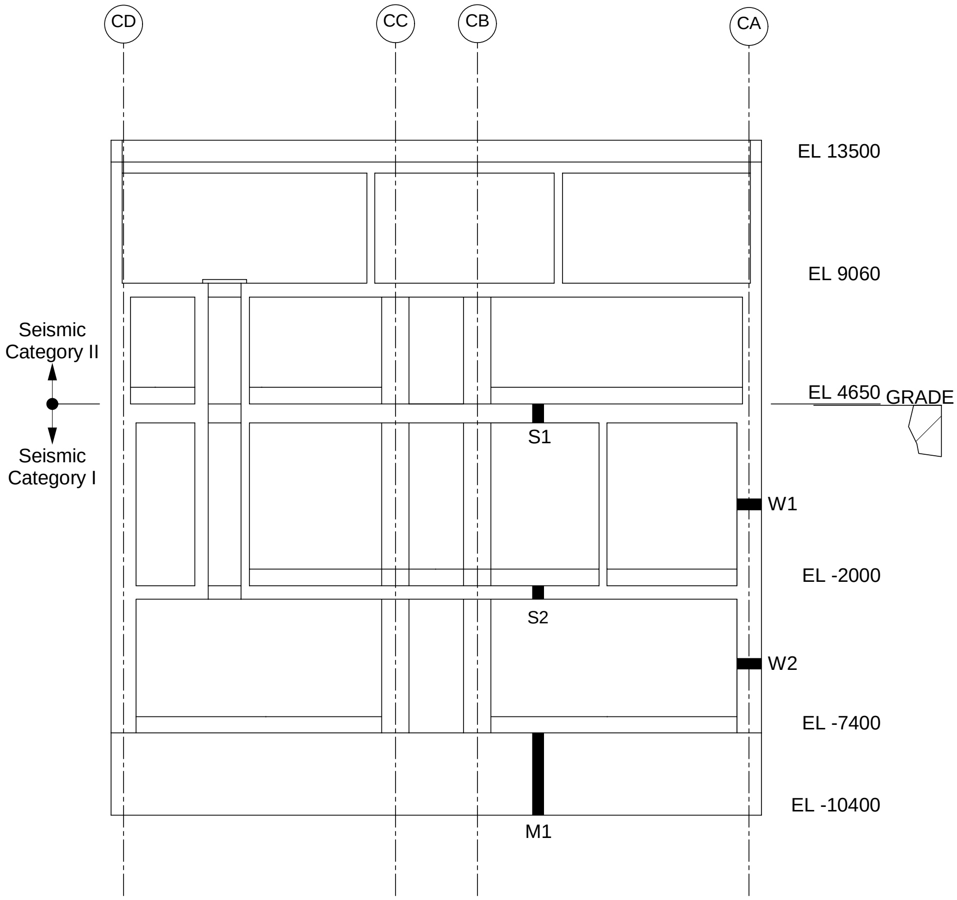


Figure 3G.2-11. Sections Where Temperature Loads Are Defined

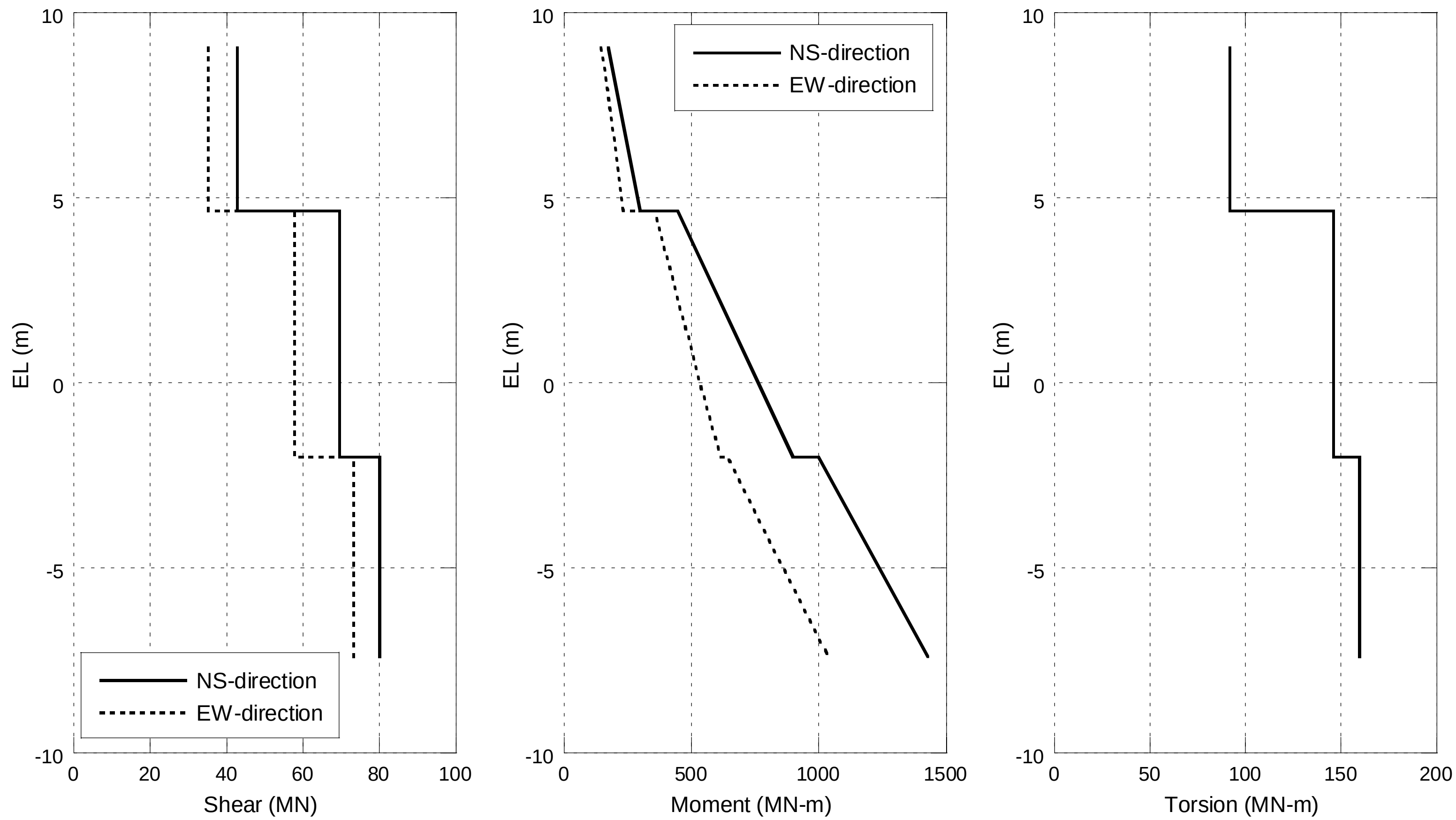


Figure 3G.2-12. Design Seismic Shears and Moments for CB

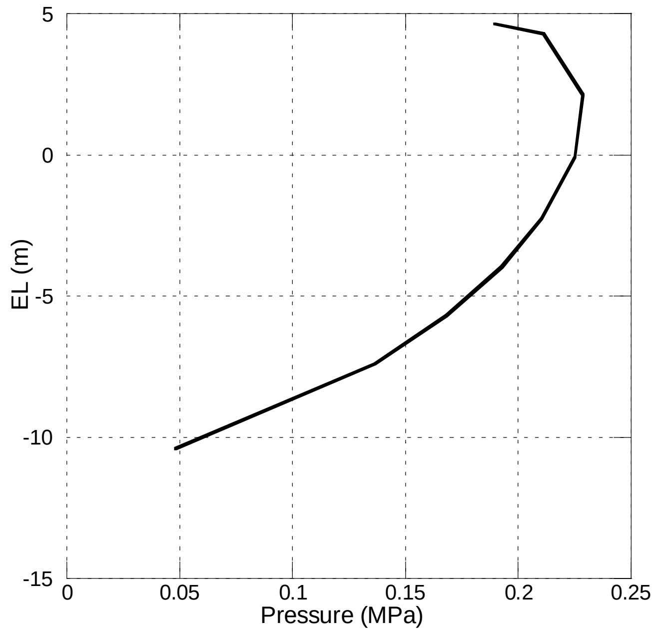
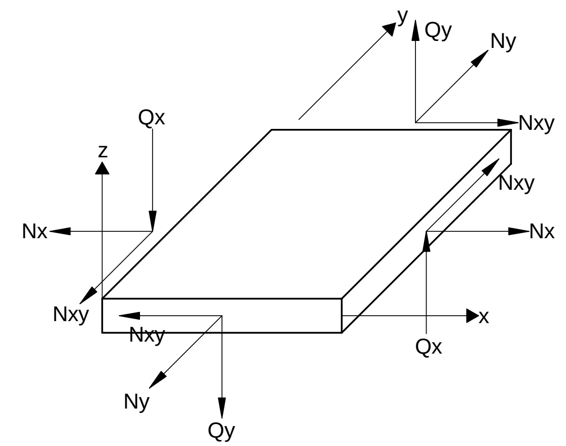
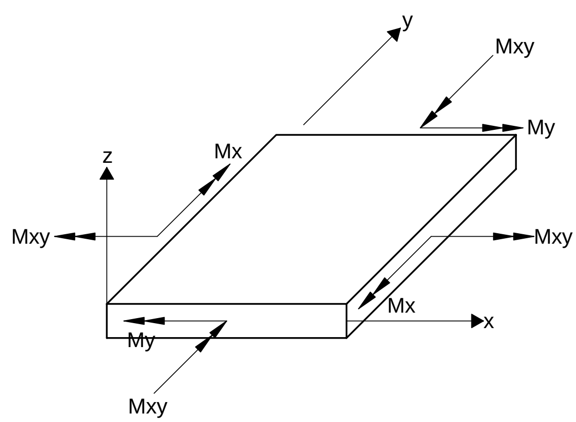


Figure 3G.2-13. Seismic Lateral Soil Pressure



Membrane and Shear Forces



Moments

Definition of Element Coordinate System

Structure	x	y	z
Wall in N-S Direction	horizontal	vertical	toward West
Wall in E-W Direction	horizontal	vertical	toward South
Foundation Mat Floor Slab	toward South	toward East	upward

Figure 3G.2-14. Force and Moment in Shell Element

3G.3 FUEL BUILDING

3G.3.1 Objective and Scope

The objective of this subsection is to document the structural design details, inputs and analytical results from the analysis the Fuel Building (FB) of the standard ESBWR plant. The scope includes the design and analysis of the structure for normal, severe environmental, extreme environmental, and construction loads.

3G.3.2 Conclusions

The following are the major summary conclusions on the design and analysis of the FB.

- Based on the results of finite element analyses performed in accordance with the design conditions identified in Subsection 3G.3.5, stresses in concrete and reinforcement are less than the allowable stresses per the applicable regulations, codes or standards listed in Section 3.8.
- The factors of safety against floatation, sliding, and overturning of the structure under various loading combinations are higher than the required minimum.
- The thickness of the roof slabs and exterior walls are more than the minimum required to preclude penetration, perforation or spalling resulting from impact of design basis tornado missiles.

3G.3.3 Structural Description

The FB is integrated with the RB, sharing a common wall between the RB and the FB and a large common foundation mat (see Section 3.8.4.1.3). The FB houses the spent fuel pool facilities and their supporting system, and HVAC equipment. The FB is a Seismic Category I structure except for the penthouse that covers HVAC equipment. The penthouse is a Seismic Category II structure.

The FB is a reinforced concrete box type shear wall structure consisting of walls and slabs and is supported by a foundation mat. Concrete framing (steel beams can be used partially) is composite with concrete slab and used to support the slabs for vertical loads. The FB is a shear wall structure designed to accommodate all seismic loads with its walls and the connected floors. Therefore, frame members such as beams or columns are designed to accommodate deformations of the walls in case of earthquake conditions.

The key dimensions of the FB are summarized in Table 3.8-8. Figures 3G.1-1 through 3G.1-4 and Figure 3G.1-6 show the outline plans of the FB.

3G.3.4 Analytical Models

Because the FB is integrated with the RB, the finite element model which integrates the RB and FB is used for the stress analysis of the FB. The analysis model is described in Subsection 3G.1.4.1.

3G.3.5 Structural Analysis and Design

3G.3.5.1 Site Design Parameters

The key site design parameters are described in Subsection 3G.1.5.1.

3G.3.5.2 Design Loads, Load Combinations, and Material Properties

3G.3.5.2.1 Design Loads

This section presents only the loads which are applied to the FB directly. Other loads which are applied to the RCCV only but have effects on FB structures because of common foundation mat, like P_a and T_a, are also considered in the FB design.

3G.3.5.2.1.1 Dead Load (D) and Live Load (L and Lo)

The weights of structures are evaluated using the following unit weights.

- reinforced concrete: 23.5 kN/m^3
- steel: 77.0 kN/m^3

Weights of major equipment, miscellaneous structures, piping, and commodities are summarized in Tables 3G.3-1 and 3G.3-2.

Live loads on the FB floor slabs are described in Subsection 3.8.4.3.3.

3G.3.5.2.1.2 Snow Load

The snow load is applied to the roof slab and is taken as shown in Table 3G.1-2. Snow load is reduced to 75% when snow load is combined with seismic loads.

3G.3.5.2.1.3 Lateral Soil Pressure at Rest

The lateral soil pressure at rest is applied to the walls below grade and is based on soil properties given in Table 3G.1-2. Pressures to be applied to the walls are provided in Figure 3G.1-19.

3G.3.5.2.1.4 Wind Load (W)

The wind load is applied to the roof slab and external walls above grade and is based on basic wind speed given in Table 3G.1-2.

3G.3.5.2.1.5 Tornado Load (W_t)

The tornado load is applied to roof slab and external walls above grade and its characteristics are given in Table 3G.1-2. The tornado load, W_t is further defined by the combinations described in Subsection 3G.1.5.2.1.5.

3G.3.5.2.1.6 Thermal Load (T_o)

Thermal loads for the FB are evaluated for the normal operating conditions. Figure 3G.3-1 shows the section location for temperature distributions for various structural elements of the FB, and Table 3G.3-3 shows the magnitude of equivalent linear temperature distribution.

Stress-free temperature is 15.5°C.

3G.3.5.2.1.7 Design Seismic Loads

The design seismic loads applied to the FB are provided in Subsection 3G.1.5.2.1.13.

Seismic lateral soil pressure for the FB is provided in Subsection 3G.1.5.2.1.13.

3G.3.5.2.2 Load Combinations and Acceptance Criteria

Table 3.8-15 gives load combinations for the safety-related reinforced concrete structure. Based on previous experience, critical load combinations are selected for the FB design. They are mainly combinations including LOCA loads and seismic loads as shown in Table 3G.3-4. The acceptance criteria for the selected combinations are also included in Table 3G.3-4.

3G.3.5.2.3 Material Properties

Properties of the materials used for the FB design analyses are same as those for the RB, and they are described in Subsection 3G.1.5.2.3.

3G.3.5.3 Stability Requirements

The stability requirements for the FB foundation are same as those for the RB, and they are described in Subsection 3G.1.5.3.

3G.3.5.4 Structural Design Evaluation

The evaluation of the seismic category I structures in the FB is performed with the same procedure as the RB, which is described in Subsection 3G.1.5.4.

Figure 3G.3-2 shows the location of the sections that are selected for evaluation. They are selected, in principle, from the center and both ends of wall and slab, where it is reasonably expected that the critical stresses appear based on engineering experience and judgment. Tables 3G.3-5 through 3G.3-9 show the forces and moments at the selected sections from NASTRAN analysis. Element forces and moments listed in the tables are defined with relation to the element coordinate system shown in Figure 3G.3-3. Tables 3G.3-10 through 3G.3-12 show the combined forces and moments in accordance with the selected load combinations listed in Table 3G.3-4.

Figures 3G.3-4 and 3G.3-5 present the design drawings used for the evaluation of the FB structural design. Table 3G.3-13 lists the sectional thicknesses and rebar ratios used in the evaluation.

Tables 3G.3-14 through 3G.3-16 show the rebar and concrete stresses at these sections for the representative elements. Table 3G.3-17 summarizes evaluation results for transverse shear in accordance with ACI 349, Chapter 11.

3G.3.5.4.1 Shear Walls and Spent Fuel Pool Walls

The maximum rebar stress of 349.2 MPa is found in the horizontal rebar at Section 3 due to the load combination FB-9 as shown in Table 3G.3-16. The maximum vertical rebar stress is found to be 316.5 MPa at Section 1 for the combination FB-9. The maximum transverse shear force is found to be 4.11 MN/m against the shear strength of 5.91 MN/m at Section 4, Spent Fuel Pool wall.

3G.3.5.4.2 Floor Slabs

The maximum rebar stress of 230.9 MPa is found due to the load combination FB-9 as shown in Table 3G.3-16. The maximum transverse shear force is found to be 0.48 MN/m against the shear strength of 4.37 MN/m.

3G.3.5.4.3 Foundation Mat

The maximum rebar stress is found to be 272.7 MPa due to the load combination FB-9 as shown in Table 3G.3-16. The maximum transverse shear force is found to be 11.20 MN/m against the shear strength of 15.72 MN/m.

3G.3.5.5 Foundation Stability

The FB shares the foundation mat with the RB. Evaluation results of the foundation stability are described in Subsection 3G.1.5.5.

3G.3.5.6 Tornado Missile Evaluation

The minimum thickness required to prevent penetration and concrete spalling are evaluated. The methods and procedures are shown in Section 3.5.3.1.1. The minimum thickness required is less than the minimum 1000 and 700 mm thickness provided for the FB external walls and slab at EL 22500, respectively.

Table 3G.3-1

Miscellaneous Structures and Commodity in Spent Fuel Pool

Description	Weight
Fuel Pool	
a. Spent Fuel Storage Racks	88.7 kN/m^2
b. Floor Liner	1.6 kN/m^2
c. Wall Liner	1.0 kN/m^2
d. Water (14.35 m)	141 kN/m^2
Pool Gate	
a. Spent Fuel Pool Gate	70 kN
b. Cask Pit Gate	70 kN
Spent Fuel Cask Pool	
a. Spent Fuel Cask	120 kN/m^2
b. Floor Liner	1.6 kN/m^2
c. Wall Liner	1.0 kN/m^2
d. Water (14.35 m)	141 kN/m^2
e. Cask Lid	100 kN
f. Cask bearing Plate	20 kN
Fuel Transfer Tube Pool	
a. Floor Liner	1.6 kN/m^2
b. Wall Liner	1.0 kN/m^2
c. Water (14.35 m)	141 kN/m^2
d. Transfer Tube Equipment	160 kN

Table 3G.3-2

Miscellaneous Structures, Piping, and Commodity Load on FB Floor

Elevation (mm)	Area Load
22,500	2.4 kN/m^2 (50psf)
4,650	2.4 kN/m^2 (50psf)
-1,000	2.4 kN/m^2 (50psf)
-6,400	2.4 kN/m^2 (50psf)
-11,500	2.4 kN/m^2 (50psf)

Table 3G.3-3

Equivalent Liner Temperature Distributions at Various Sections*

Section[*1]	**Side**[*2]		**Equivalent Linear Temperature**[*3] (°C)	
			Normal Operation (Winter)	
	1	2	Td	Tg
W1	FP	RM	27.0	26.0
W2	FP	RM	26.6	26.7
W3	FP	GR	27.8	24.5
W4	FP	GR	27.8	24.5

*1: See Figure 3G.3-1 for the location of sections.

*2: FP: Spent Fuel Pool, RM: FB Room, GR: Ground

*3: Td: Average Temperature, Tg: Surface Temperature Difference (positive when temperature at Side 1 is higher)

Table 3G.3-4

Selected Load Combinations for the FB

Category	Load Combination								Acceptance Criteria*1
	No. *2	D	L	P_a *3	T_o	T_a *3	E’	W	
Severe Environmental	FB-4	1.05	1.3		1.3			1.3	U
LOCA (1.5P_a) 72 hours	FB-8	1.0	1.0	1.5		1.0			U
LOCA + SSE 72 hours	FB-9	1.0	1.0	1.0		1.0	1.0		U

*1: U = Required section strength based on the strength design method per ACI 349

*2: Based on Table 3.8-15.

*3: P_a and T_a are accident pressure load within the containment and thermal load generated by LOCA, respectively.

P_a and T_a are indirect loads, but their effects are considered in the FB design.

Table 3G.3-5

Results of NASTRAN Analysis: Dead Load

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	-0.462	-1.630	-0.428	-0.140	-1.074	-0.031	-0.091	-0.336
	60019	0.501	-1.578	-0.113	-1.027	-1.537	-0.060	0.107	0.206
	70001	-0.014	-0.199	0.064	0.618	-0.037	0.087	-0.196	0.114
	70004	0.565	-0.969	0.033	-0.286	-0.030	0.078	0.093	-0.371
	110708	0.314	-1.593	-0.170	-0.004	0.282	0.009	-0.012	0.267
2 Exterior Wall @ EL4.65 ~6.60m	62011	0.086	-1.006	0.122	0.041	0.134	0.006	0.010	0.050
	62019	0.105	-0.555	-0.174	-0.033	0.036	-0.029	0.000	0.013
	72001	0.107	-0.133	0.144	0.110	0.022	-0.005	-0.013	-0.008
	72004	0.150	-0.398	0.255	-0.038	0.007	0.000	-0.017	0.013
3 Exterior Wall @ EL22.50 ~24.60m	64011	0.019	-0.284	-0.050	-0.109	-0.530	-0.010	-0.006	0.069
	64019	-0.122	-0.373	-0.071	-0.064	-0.370	0.057	0.063	0.054
	74001	-0.017	-0.047	0.108	0.048	-0.046	-0.045	-0.020	-0.029
	74004	-0.045	-0.210	0.119	-0.079	-0.336	-0.060	0.019	-0.069
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	0.635	-1.144	-0.408	-1.364	-0.958	-0.258	-0.001	-0.138
	70801	0.782	-0.116	0.046	1.262	0.113	-0.035	-0.608	0.015
	70804	0.636	-0.662	0.163	-0.645	-0.464	0.053	-0.118	0.075
	110748	0.322	-0.981	-0.506	-0.217	-0.097	-0.010	0.051	-0.024
5 Basemat	90306	-1.031	-0.384	0.451	0.851	-0.102	0.118	-0.478	1.078
	90310	-0.130	-0.091	-0.037	-0.144	-0.135	-0.642	0.159	-0.090
	90410	-0.418	-0.846	0.472	-0.686	0.137	1.346	1.276	-0.027
5 Basemat @ Spent Fuel Pool	90486	0.101	-0.132	0.036	2.387	1.876	0.183	-0.075	0.164
	90490	0.207	0.028	0.159	0.056	0.576	0.192	1.131	0.067
	90526	0.272	0.354	-0.025	1.100	1.562	0.010	-0.124	-0.676
6 Slab EL4.65m	93306	0.125	0.007	0.045	0.037	0.008	0.005	0.030	-0.100
	93310	0.021	0.046	0.211	0.026	0.014	0.034	-0.017	-0.001
	93410	0.282	0.347	-0.401	0.002	0.010	-0.070	0.003	-0.011

Table 3G.3-6

Results of NASTRAN Analysis: Temperature Load (Winter)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	-1.034	-0.276	-0.470	0.886	0.701	0.061	-0.213	-0.156
	60019	2.130	-1.517	0.794	-8.495	-10.347	-0.205	0.203	-1.171
	70001	0.665	1.233	-0.737	-3.570	-3.154	0.152	0.567	0.226
	70004	1.044	0.657	-0.355	-2.833	-2.909	0.079	0.100	-0.124
	110708	-2.397	-1.876	-0.602	-1.526	-1.620	0.049	-0.061	0.020
2 Exterior Wall @ EL4.65 ~6.60m	62011	5.927	1.780	0.309	-1.104	-1.219	0.001	-0.029	-0.064
	62019	6.956	0.288	-1.863	-1.152	-1.400	-0.037	0.028	-0.086
	72001	3.754	-1.871	2.422	-0.553	-0.895	0.030	-0.600	0.207
	72004	6.378	0.376	2.500	-1.249	-1.455	0.078	-0.032	0.128
3 Exterior Wall @ EL22.50 ~24.60m	64011	4.746	0.186	0.252	-0.966	-0.394	-0.010	0.000	-0.081
	64019	5.498	1.414	1.600	-1.021	-0.456	0.014	-0.015	-0.050
	74001	2.909	-0.796	-3.432	-0.753	-0.461	0.131	-0.303	0.097
	74004	4.062	0.184	-3.546	-0.936	-0.309	-0.011	0.015	0.087
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	-2.416	-2.905	-0.161	-6.457	-6.777	-0.882	-0.081	-0.506
	70801	-0.297	2.505	-0.133	-3.413	-3.179	0.038	0.115	-0.021
	70804	-1.329	0.117	0.288	-2.912	-3.121	0.212	0.007	0.047
	110748	-1.034	-1.835	-0.279	-1.382	-1.642	-0.031	0.137	-0.058
5 Basemat	90306	-0.913	-0.080	0.219	1.890	0.786	-0.008	0.045	0.256
	90310	0.105	0.315	0.323	1.205	1.335	0.598	0.186	-0.135
	90410	-0.147	-1.226	0.653	0.548	2.081	0.464	0.252	-0.198
5 Basemat @ Spent Fuel Pool	90486	-2.543	-0.964	0.092	-6.708	-6.839	0.557	0.292	0.029
	90490	-1.286	2.984	-0.063	-12.028	-8.686	-0.110	1.320	1.060
	90526	2.540	0.079	0.140	-6.918	-3.496	0.413	-0.639	0.524
6 Slab EL4.65m	93306	-0.743	-0.035	-1.631	-0.052	0.030	-0.015	0.079	-0.027
	93310	-2.216	-2.169	-3.228	-0.757	-0.782	-0.242	0.271	0.285
	93410	-0.804	-2.214	0.295	-0.053	-0.014	0.028	-0.118	-0.029

Table 3G.3-7

Results of NASTRAN Analysis: Seismic Load (Horizontal: North to South Direction)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	-5.135	-4.086	-0.865	-0.105	-1.008	-0.082	0.034	-0.339
	60019	-5.900	-6.560	-0.955	-0.197	-3.119	0.204	-0.371	-0.304
	70001	-0.169	-1.548	-1.870	0.188	-0.964	0.056	-0.590	0.222
	70004	1.716	-5.368	-4.964	-1.178	-2.731	-0.040	-0.060	0.566
	110708	1.416	-4.879	1.245	-0.119	-0.268	-0.005	-0.048	-0.182
2 Exterior Wall @ EL4.65 ~6.60m	62011	0.921	-1.364	-0.345	0.048	0.175	0.002	-0.018	0.033
	62019	0.761	-1.226	-2.242	0.019	0.134	-0.012	0.009	0.018
	72001	-0.160	-1.387	-3.624	-0.090	-0.064	0.011	-0.001	0.051
	72004	-0.274	-1.755	-4.201	-0.033	-0.035	-0.003	0.016	0.007
3 Exterior Wall @ EL22.50 ~24.60m	64011	3.743	-0.254	-0.233	-0.057	-0.192	0.013	0.007	0.030
	64019	2.758	-0.032	-0.696	-0.059	-0.139	-0.046	-0.028	0.025
	74001	0.085	-0.152	-1.111	0.036	0.049	-0.049	0.041	-0.012
	74004	-1.414	-0.263	-1.644	0.036	0.028	-0.033	0.014	0.010
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	-0.758	-4.288	-2.652	-0.157	-0.613	0.392	0.139	-0.196
	70801	0.400	-1.574	-4.088	0.042	-0.070	-0.183	-0.223	-0.086
	70804	1.104	-3.154	-4.888	-0.691	-0.169	-0.213	0.013	0.171
	110748	0.513	-1.335	0.892	0.012	0.081	-0.101	-0.050	0.016
5 Basemat	90306	-1.129	-1.348	5.098	2.431	-0.453	4.997	-4.224	3.195
	90310	0.257	-1.778	0.199	0.866	-0.448	-1.064	-0.701	2.209
	90410	-0.846	-9.305	-0.106	1.325	1.118	2.287	3.027	-0.578
5 Basemat @ Spent Fuel Pool	90486	-1.781	-3.137	-1.736	10.401	7.567	-0.576	-1.304	0.304
	90490	-1.008	-8.548	0.724	0.391	3.634	0.468	5.107	-0.686
	90526	0.318	-0.881	-5.240	3.620	-0.226	-6.336	-3.821	-3.929
6 Slab EL4.65m	93306	2.092	0.406	-0.866	0.344	-0.454	-0.007	-0.050	0.040
	93310	0.689	0.289	0.932	0.434	-0.376	0.016	-0.422	0.426
	93410	0.136	1.152	0.896	0.170	0.076	0.058	-0.048	0.010

Table 3G.3-8

Results of NASTRAN Analysis: Seismic Load (Horizontal: East to West Direction)

Location	Element ID	**Nx** (MN/m)	**Ny** (MN/m)	**Nxy** (MN/m)	**Mx** (MNm/m)	**My** (MNm/m)	**Mxy** (MNm/m)	**Qx** (MN/m)	**Qy** (MN/m)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	-0.305	-0.149	-5.998	-0.037	-0.600	-0.106	0.072	-0.114
	60019	0.781	6.824	-4.005	2.516	7.217	-0.246	0.194	1.162
	70001	0.578	1.593	-0.568	-0.290	0.836	-0.133	-0.050	-0.353
	70004	1.297	7.233	0.849	0.520	1.606	-0.082	-0.070	-0.170
	110708	0.389	4.429	-0.006	0.653	1.780	0.058	-0.045	0.720
2 Exterior Wall @ EL4.65 ~6.60m	62011	0.094	0.084	-3.589	0.029	0.050	-0.003	-0.023	0.015
	62019	-0.276	1.277	-1.922	0.018	0.013	0.002	-0.003	0.005
	72001	-0.034	1.601	-0.535	-0.026	-0.035	0.000	-0.018	0.019
	72004	-0.181	1.969	0.222	-0.004	-0.066	-0.014	-0.002	0.002
3 Exterior Wall @ EL22.50 ~24.60m	64011	-0.147	-0.008	-1.762	0.000	-0.008	0.004	0.001	0.002
	64019	-0.507	0.073	-1.155	-0.005	0.000	-0.011	-0.001	0.001
	74001	-0.151	0.146	0.122	-0.043	-0.002	-0.002	0.027	0.023
	74004	-0.928	0.078	0.662	0.002	0.037	-0.003	0.005	0.007
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	-1.058	4.074	-3.386	1.499	1.314	-0.131	-0.130	0.458
	70801	-0.630	2.169	-1.057	-0.695	-0.071	0.010	0.381	-0.041
	70804	-0.616	4.354	0.247	0.455	0.252	-0.023	0.046	-0.132
	110748	-0.603	1.998	0.158	0.073	-0.104	-0.077	0.151	0.013
5 Basemat	90306	-7.020	-1.678	2.018	4.100	1.283	1.171	-1.859	4.307
	90310	-1.063	-0.549	0.488	-0.168	0.634	-1.187	1.745	-0.066
	90410	0.042	0.193	4.874	-0.356	-1.677	7.604	-0.004	-3.773
5 Basemat @ Spent Fuel Pool	90486	2.142	2.280	0.736	-10.183	-10.226	-0.497	0.384	-1.513
	90490	1.399	3.251	3.471	4.759	-2.599	4.881	-5.794	-2.720
	90526	5.409	1.105	1.445	-5.714	-2.644	1.608	1.465	5.248
6 Slab EL4.65m	93306	1.458	0.168	-0.510	0.291	-0.128	-0.029	0.088	0.071
	93310	0.282	0.424	0.373	-0.135	0.089	-0.014	0.125	-0.076
	93410	-0.178	0.457	0.267	0.080	-0.058	0.102	-0.181	-0.004

Table 3G.3-9

Results of NASTRAN Analysis: Seismic Load (Vertical: Upward Direction)

Location	Element ID	Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	0.237	0.892	0.173	0.094	0.598	0.019	0.041	0.182
	60019	-0.011	1.002	0.045	0.418	0.643	0.024	-0.043	-0.161
	70001	0.086	0.151	-0.057	-0.234	0.061	-0.040	0.078	-0.063
	70004	-0.068	0.734	-0.014	0.088	-0.065	-0.036	-0.049	0.248
	110708	-0.073	0.890	0.252	0.007	-0.104	-0.013	0.020	-0.145
2 Exterior Wall @ EL4.65 ~6.60m	62011	-0.038	0.740	-0.089	-0.046	-0.216	-0.005	-0.006	-0.070
	62019	-0.031	0.479	0.022	0.009	-0.103	0.037	-0.002	-0.030
	72001	-0.037	0.168	-0.046	-0.060	-0.013	0.001	0.001	0.001
	72004	-0.042	0.351	-0.065	0.013	-0.028	-0.010	0.007	-0.001
3 Exterior Wall @ EL22.50 ~24.60m	64011	0.074	0.362	0.009	0.160	0.783	0.007	0.005	-0.104
	64019	0.115	0.434	0.063	0.096	0.554	-0.074	-0.088	-0.081
	74001	0.011	0.008	-0.090	-0.073	0.066	0.067	0.033	0.043
	74004	0.072	0.273	-0.060	0.116	0.496	0.085	-0.025	0.100
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	-0.094	0.776	0.189	0.638	0.313	0.132	-0.012	0.080
	70801	-0.101	0.231	-0.025	-0.577	-0.059	0.022	0.280	-0.005
	70804	-0.108	0.486	-0.056	0.279	0.215	-0.028	0.053	-0.043
	110748	-0.082	0.471	0.276	0.071	0.023	0.012	-0.034	0.023
5 Basemat	90306	0.565	0.217	-0.251	-0.479	0.051	-0.071	0.266	-0.602
	90310	0.074	0.046	0.020	0.081	0.071	0.351	-0.091	0.056
	90410	0.227	0.457	-0.215	0.383	-0.074	-0.688	-0.700	-0.044
5 Basemat @ Spent Fuel Pool	90486	0.238	0.360	0.037	-1.472	-1.155	-0.114	0.048	-0.091
	90490	0.313	0.318	-0.037	0.467	-0.279	-0.063	-0.771	-0.060
	90526	0.280	0.287	0.065	-0.581	-0.217	0.031	0.106	0.572
6 Slab EL4.65m	93306	-0.098	-0.010	-0.024	-0.025	-0.010	-0.006	-0.020	0.063
	93310	-0.016	-0.031	-0.130	-0.017	-0.011	-0.019	0.010	0.002
	93410	-0.230	-0.215	0.188	-0.048	-0.010	0.037	0.019	0.007

Table 3G.3-10

Combined Forces and Moments: Selected Load Combination FB-4

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	OTHR	-2.737	-2.052	-0.803	-0.173	-1.143	0.026	-0.064	-0.924
		TEMP	-1.502	-0.259	-0.400	1.178	1.063	0.057	-0.237	-0.127
	60019	OTHR	-3.148	-1.813	-0.413	0.345	-0.709	0.058	-0.034	-1.048
		TEMP	2.500	-1.832	1.218	-10.903	-13.215	-0.194	0.143	-1.481
	70001	OTHR	-1.015	-0.506	-0.007	-1.461	-1.200	-0.333	0.263	0.084
		TEMP	0.906	1.668	-1.138	-4.770	-4.061	0.192	0.787	0.238
	70004	OTHR	-2.149	-2.119	-0.233	0.198	-3.522	-0.204	-0.329	2.526
		TEMP	1.337	0.972	-0.856	-3.670	-3.690	0.079	0.099	-0.192
	110708	OTHR	-0.962	-1.213	-0.956	0.010	0.285	0.049	-0.065	0.231
		TEMP	-3.138	-2.390	-0.767	-1.994	-2.160	0.063	-0.079	0.004
2 Exterior Wall @ EL4.65 ~6.60m	62011	OTHR	-0.222	-1.100	-0.066	0.029	0.175	0.004	0.001	0.067
		TEMP	7.517	2.231	0.395	-1.422	-1.553	0.008	-0.028	-0.077
	62019	OTHR	-0.370	-0.628	-0.052	0.022	0.104	-0.027	0.014	0.051
		TEMP	9.041	0.487	-2.429	-1.498	-1.822	-0.047	0.040	-0.110
	72001	OTHR	-0.057	-0.198	0.027	-0.277	-0.042	0.055	0.140	0.029
		TEMP	4.859	-1.902	3.179	-0.743	-1.171	0.037	-0.784	0.270
	72004	OTHR	-0.250	-0.676	-0.001	0.391	0.259	0.057	0.064	-0.164
		TEMP	8.100	0.684	3.279	-1.635	-1.894	0.103	-0.037	0.165
3 Exterior Wall @ EL22.50 ~24.60m	64011	OTHR	0.178	-0.303	-0.027	-0.119	-0.575	-0.003	-0.003	0.060
		TEMP	5.733	0.223	0.232	-1.265	-0.551	-0.017	-0.001	-0.097
	64019	OTHR	-0.015	-0.410	-0.094	-0.071	-0.402	0.059	0.066	0.044
		TEMP	6.678	1.813	1.871	-1.322	-0.602	0.017	-0.016	-0.066
	74001	OTHR	-0.022	-0.051	0.139	0.055	-0.051	-0.041	-0.031	-0.028
		TEMP	3.779	-0.963	-4.176	-1.004	-0.608	0.170	-0.383	0.135
	74004	OTHR	-0.007	-0.225	0.123	-0.083	-0.381	-0.060	0.017	-0.060
		TEMP	5.317	0.276	-4.019	-1.229	-0.410	-0.017	0.021	0.115
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	OTHR	-2.334	-1.335	-0.625	0.944	1.214	0.134	0.194	0.083
		TEMP	-3.219	-3.633	-0.077	-8.302	-8.802	-0.940	-0.084	-0.638
	70801	OTHR	-1.608	-0.652	0.059	-3.966	-0.351	-0.356	2.343	-0.304
		TEMP	-0.481	3.632	-0.332	-4.661	-4.190	0.057	0.188	-0.029
	70804	OTHR	-1.403	-1.206	0.000	3.050	1.858	-0.305	0.375	0.172
		TEMP	-1.938	0.338	0.097	-3.821	-4.074	0.238	0.034	0.052
	110748	OTHR	-0.691	-0.518	-0.330	-0.109	-0.094	-0.059	0.084	-0.057
		TEMP	-1.313	-2.347	-0.367	-1.777	-2.122	-0.033	0.178	-0.081
5 Basemat	90306	OTHR	-4.235	-3.033	0.703	0.859	-0.805	0.364	-0.536	1.463
		TEMP	-0.634	-0.066	0.499	2.237	1.085	0.227	-0.205	0.263
	90310	OTHR	-2.501	-2.522	0.251	-0.643	-0.521	0.004	0.388	0.170
		TEMP	0.201	0.370	0.516	1.670	1.771	0.937	0.099	-0.157
	90410	OTHR	-3.273	-5.432	0.721	-2.055	0.014	1.613	1.643	-0.327
		TEMP	-0.110	-1.841	0.661	0.976	2.752	0.401	0.252	-0.103
5 Basemat @ Spent Fuel Pool	90486	OTHR	-3.127	-5.295	-0.362	1.273	0.945	-0.104	0.018	-0.187
		TEMP	-3.174	-1.293	-0.171	-9.075	-9.112	0.593	0.295	0.057
	90490	OTHR	-3.280	-4.336	0.118	-2.228	0.060	0.418	1.301	-0.277
		TEMP	-1.627	3.605	-0.276	-15.412	-11.258	-0.420	1.596	1.460
	90526	OTHR	-4.216	-6.330	-0.372	-0.922	-8.022	-0.214	-0.259	-2.159
		TEMP	3.507	0.114	-0.219	-9.167	-4.524	0.050	-1.095	0.770
6 Slab EL4.65m	93306	OTHR	-0.018	-0.246	-0.064	0.089	0.182	0.016	0.034	-0.161
		TEMP	-1.177	-0.080	-1.177	-0.072	0.022	-0.025	0.087	-0.034
	93310	OTHR	-0.056	-0.047	0.110	0.085	0.051	0.010	-0.042	-0.005
		TEMP	-2.822	-2.799	-3.622	-1.004	-1.005	-0.292	0.367	0.361
	93410	OTHR	-0.075	-0.185	0.056	0.215	0.055	-0.050	-0.097	-0.019
		TEMP	-0.879	-3.076	0.337	-0.163	-0.033	0.012	-0.109	-0.035

OTHR: Loads other than thermal loads
TEMP: Thermal loads

Table 3G.3-11

Combined Forces and Moments: Selected Load Combination FB-8

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	OTHR	-2.164	-1.908	-0.712	-0.166	-1.133	0.018	-0.076	-0.801
		TEMP	-1.034	-0.276	-0.470	0.886	0.701	0.061	-0.213	-0.156
	60019	OTHR	-2.271	-1.678	-0.335	0.058	-0.854	0.029	0.001	-0.766
		TEMP	2.130	-1.517	0.794	-8.495	-10.347	-0.205	0.203	-1.171
	70001	OTHR	-0.784	-0.417	0.017	-0.999	-0.928	-0.239	0.165	0.087
		TEMP	0.665	1.233	-0.737	-3.570	-3.154	0.152	0.567	0.226
	70004	OTHR	-1.534	-1.799	-0.136	0.100	-2.715	-0.140	-0.235	1.870
		TEMP	1.044	0.657	-0.355	-2.833	-2.909	0.079	0.100	-0.124
	110708	OTHR	-0.697	-1.230	-0.802	0.009	0.280	0.040	-0.052	0.232
		TEMP	-2.397	-1.876	-0.602	-1.526	-1.620	0.049	-0.061	0.020
2 Exterior Wall @ EL4.65 ~6.60m	62011	OTHR	-0.173	-1.093	-0.029	0.026	0.136	0.004	0.002	0.048
		TEMP	5.927	1.780	0.309	-1.104	-1.219	0.001	-0.029	-0.064
	62019	OTHR	-0.283	-0.608	-0.059	0.011	0.075	-0.024	0.010	0.032
		TEMP	6.956	0.288	-1.863	-1.152	-1.400	-0.037	0.028	-0.086
	72001	OTHR	-0.033	-0.141	0.053	-0.205	-0.031	0.035	0.113	0.020
		TEMP								
	72004	OTHR	-0.180	-0.584	0.045	0.304	0.196	0.039	0.046	-0.113
		TEMP	6.378	0.376	2.500	-1.249	-1.455	0.078	-0.032	0.128
3 Exterior Wall @ EL22.50 ~24.60m	64011	OTHR	-0.039	-0.321	-0.021	-0.119	-0.592	-0.004	-0.003	0.077
		TEMP	4.746	0.186	0.252	-0.966	-0.394	-0.010	0.000	-0.081
	64019	OTHR	-0.153	-0.423	-0.134	-0.070	-0.416	0.055	0.066	0.057
		TEMP	5.498	1.414	1.600	-1.021	-0.456	0.014	-0.015	-0.050
	74001	OTHR	-0.034	-0.041	0.165	0.044	-0.056	-0.035	-0.028	-0.028
		TEMP	2.909	-0.796	-3.432	-0.753	-0.461	0.131	-0.303	0.097
	74004	OTHR	-0.079	-0.238	0.193	-0.084	-0.398	-0.054	0.014	-0.080
		TEMP	4.062	0.184	-3.546	-0.936	-0.309	-0.011	0.015	0.087
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	OTHR	-1.668	-1.247	-0.543	0.465	0.720	0.043	0.147	0.038
		TEMP	-2.416	-2.905	-0.161	-6.457	-6.777	-0.882	-0.081	-0.506
	70801	OTHR	-1.083	-0.506	0.068	-2.809	-0.253	-0.284	1.684	-0.236
		TEMP	-0.297	2.505	-0.133	-3.413	-3.179	0.038	0.115	-0.021
	70804	OTHR	-0.943	-1.056	0.041	2.230	1.325	-0.227	0.265	0.146
		TEMP	-1.329	0.117	0.288	-2.912	-3.121	0.212	0.007	0.047
	110748	OTHR	-0.470	-0.606	-0.380	-0.127	-0.091	-0.047	0.075	-0.048
		TEMP	-1.035	-1.835	-0.279	-1.382	-1.642	-0.031	0.137	-0.058
5 Basemat	90306	OTHR	-3.546	-2.473	0.817	0.956	-0.727	0.438	-0.628	1.486
		TEMP	-0.913	-0.080	0.219	1.890	0.787	-0.008	0.045	0.256
	90310	OTHR	-1.931	-2.021	0.183	-0.544	-0.487	-0.176	0.264	0.168
		TEMP	0.105	0.315	0.323	1.205	1.335	0.598	0.186	-0.135
	90410	OTHR	-2.673	-4.668	0.639	-1.817	0.063	1.621	1.666	-0.265
		TEMP	-0.147	-1.227	0.653	0.548	2.081	0.464	0.252	-0.198
5 Basemat @ Spent Fuel Pool	90486	OTHR	-2.448	-4.241	-0.247	2.405	1.861	-0.039	-0.002	-0.065
		TEMP	-2.543	-0.964	0.092	-6.708	-6.839	0.557	0.291	0.029
	90490	OTHR	-2.563	-3.765	0.135	-1.916	0.389	0.344	1.602	-0.187
		TEMP	-1.286	2.984	-0.063	-12.028	-8.686	-0.110	1.320	1.060
	90526	OTHR	-3.206	-4.874	-0.524	-0.126	-5.834	-0.409	-0.421	-2.176
		TEMP	2.540	0.079	0.140	-6.918	-3.496	0.413	-0.639	0.524
6 Slab EL4.65m	93306	OTHR	0.000	-0.199	-0.125	0.078	0.143	0.013	0.034	-0.144
		TEMP	-0.743	-0.035	-1.631	-0.052	0.030	-0.015	0.079	-0.027
	93310	OTHR	-0.052	-0.037	0.082	0.072	0.042	0.013	-0.038	-0.006
		TEMP	-2.216	-2.169	-3.228	-0.757	-0.782	-0.242	0.271	0.285
	93410	OTHR	-0.039	-0.083	-0.026	0.160	0.042	-0.052	-0.072	-0.017
		TEMP	-0.804	-2.214	0.295	-0.053	-0.014	0.028	-0.118	-0.029

Table 3G.3-12

Combined Forces and Moments: Selected Load Combination FB-9

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	OTHR	-2.160	-1.894	-0.706	-0.164	-1.116	0.016	-0.073	-0.792
		TEMP	-1.034	-0.276	-0.470	0.886	0.701	0.061	-0.213	-0.156
		EQEW	-0.305	-0.149	-5.998	-0.037	-0.600	-0.106	0.072	-0.114
		EQNS	-5.135	-4.086	-0.865	-0.105	-1.008	-0.082	0.034	-0.339
		EQZ	0.237	0.892	0.173	0.094	0.598	0.019	0.041	0.182
		EQT	-0.003	-0.070	0.879	-0.004	0.029	-0.007	0.020	0.005
		SPKW	-0.784	-0.020	0.008	0.009	0.019	0.006	-0.004	-0.018
		SPKN	-0.181	-0.001	0.246	-0.098	-0.142	0.026	0.037	-0.249
	60019	OTHR	-2.272	-1.671	-0.332	0.061	-0.847	0.030	0.000	-0.765
		TEMP	2.130	-1.517	0.794	-8.495	-10.347	-0.205	0.203	-1.171
		EQEW	0.781	6.824	-4.005	2.516	7.217	-0.246	0.194	1.162
		EQNS	-5.900	-6.560	-0.955	-0.197	-3.119	0.204	-0.371	-0.304
		EQZ	-0.011	1.002	0.045	0.418	0.643	0.024	-0.043	-0.161
		EQT	0.531	-0.081	0.815	-0.345	-0.370	-0.051	0.134	-0.072
		SPKW	-0.630	0.366	-0.119	-0.346	0.711	0.048	0.016	0.295
		SPKN	-1.040	-0.613	-0.054	1.762	-1.406	0.075	-0.219	-1.474
	70001	OTHR	-0.783	-0.416	0.018	-1.002	-0.927	-0.239	0.167	0.086
		TEMP	0.665	1.233	-0.737	-3.570	-3.154	0.152	0.567	0.226
		EQEW	0.578	1.593	-0.568	-0.290	0.836	-0.133	-0.050	-0.353
		EQNS	-0.169	-1.548	-1.870	0.188	-0.964	0.056	-0.590	0.222
		EQZ	0.086	0.151	-0.057	-0.234	0.061	-0.040	0.078	-0.063
		EQT	0.010	0.138	0.371	-0.003	-0.068	0.000	0.156	0.053
		SPKW	-0.193	-0.205	0.255	-0.628	-0.708	-0.228	-0.094	0.000
		SPKN	0.004	0.061	-0.351	-0.680	0.198	0.059	0.332	-0.163
	70004	OTHR	-1.542	-1.793	-0.136	0.102	-2.709	-0.141	-0.235	1.869
		TEMP	1.044	0.657	-0.355	-2.833	-2.909	0.079	0.100	-0.124
		EQEW	1.297	7.233	0.849	0.520	1.606	-0.082	-0.070	-0.170
		EQNS	1.716	-5.368	-4.964	-1.178	-2.731	-0.040	-0.060	0.566
		EQZ	-0.068	0.734	-0.014	0.088	-0.065	-0.036	-0.049	0.248
		EQT	-0.483	0.015	0.818	0.163	0.191	0.001	-0.011	-0.045
		SPKW	-0.692	-0.689	0.187	0.209	-2.329	-0.137	-0.211	1.384
		SPKN	-0.567	0.371	-0.102	0.016	0.508	-0.046	-0.041	-0.201
	110708	OTHR	-0.695	-1.223	-0.795	0.008	0.278	0.040	-0.052	0.231
		TEMP	-2.397	-1.876	-0.602	-1.526	-1.620	0.049	-0.061	0.020
		EQEW	0.389	4.429	-0.006	0.653	1.780	0.058	-0.045	0.720
		EQNS	1.416	-4.879	1.245	-0.119	-0.268	-0.005	-0.048	-0.182
		EQZ	-0.073	0.890	0.252	0.007	-0.104	-0.013	0.020	-0.145
		EQT	-0.011	-0.120	0.049	-0.087	-0.167	-0.007	0.020	-0.063
		SPKW	0.143	0.042	0.240	-0.013	-0.069	0.018	-0.031	-0.045
		SPKN	-1.191	0.402	-1.412	0.026	0.062	0.005	0.011	0.027

OTHR: Loads other than thermal and seismic loads
TEMP: Thermal loads
EQEW: Horizontal seismic loads in the E-W direction
EQNS: Horizontal seismic loads in the N-S direction
EQZ: Vertical seismic loads
EQT: Torsional seismic loads
SPKW: Dynamic soil pressure during a horizontal earthquake in the E-W direction
SPKN: Dynamic soil pressure during a horizontal earthquake in the N-S direction

Table 3G.3-12
Combined Forces and Moments: Selected Load Combination FB-9 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
2 Exterior Wall @ EL4.65 ~6.60m	62011	OTHR	-0.172	-1.079	-0.027	0.026	0.138	0.004	0.003	0.048
		TEMP	5.927	1.780	0.309	-1.104	-1.219	0.001	-0.029	-0.064
		EQEW	0.094	0.084	-3.589	0.029	0.050	-0.003	-0.023	0.015
		EQNS	0.921	-1.364	-0.345	0.048	0.175	0.002	-0.018	0.033
		EQZ	-0.038	0.740	-0.089	-0.046	-0.216	-0.005	-0.006	-0.070
		EQT	-0.087	0.010	0.456	-0.005	-0.009	-0.004	0.003	-0.002
		SPKW	-0.451	0.118	-0.111	0.008	0.003	0.004	-0.001	0.000
		SPKN	0.234	-0.069	-0.044	-0.046	-0.006	-0.020	-0.008	-0.009
	62019	OTHR	-0.283	-0.602	-0.058	0.011	0.075	-0.024	0.010	0.032
		TEMP	6.956	0.288	-1.863	-1.152	-1.400	-0.037	0.028	-0.086
		EQEW	-0.276	1.277	-1.922	0.018	0.013	0.002	-0.003	0.005
		EQNS	0.761	-1.226	-2.242	0.019	0.134	-0.012	0.009	0.018
		EQZ	-0.031	0.479	0.022	0.009	-0.103	0.037	-0.002	-0.030
		EQT	-0.083	-0.034	0.491	-0.004	-0.008	-0.004	-0.001	-0.002
		SPKW	-0.456	0.110	0.287	-0.037	-0.040	0.004	0.012	-0.002
		SPKN	0.008	-0.149	-0.236	0.196	0.216	0.017	-0.013	0.054
	72001	OTHR	-0.033	-0.151	0.062	-0.205	-0.031	0.035	0.113	0.020
		TEMP	3.754	-1.871	2.422	-0.553	-0.895	0.030	-0.600	0.207
		EQEW	-0.034	1.601	-0.535	-0.026	-0.035	0.000	-0.018	0.019
		EQNS	-0.160	-1.387	-3.624	-0.090	-0.064	0.011	-0.001	0.051
		EQZ	-0.037	0.168	-0.046	-0.060	-0.013	0.001	0.001	0.001
		EQT	0.047	-0.061	0.574	0.018	0.011	-0.004	0.003	-0.009
		SPKW	0.024	-0.152	0.213	-0.245	-0.013	0.042	0.170	0.002
		SPKN	-0.585	-0.117	-0.684	-0.223	-0.066	-0.011	0.011	0.019
	72004	OTHR	-0.177	-0.586	0.060	0.304	0.195	0.039	0.046	-0.113
		TEMP	6.378	0.376	2.500	-1.249	-1.455	0.078	-0.032	0.128
		EQEW	-0.181	1.969	0.222	-0.004	-0.066	-0.014	-0.002	0.002
		EQNS	-0.274	-1.755	-4.201	-0.033	-0.035	-0.003	0.016	0.007
		EQZ	-0.042	0.351	-0.065	0.013	-0.028	-0.010	0.007	-0.001
		EQT	0.123	0.026	0.583	0.010	0.011	0.000	-0.002	-0.002
		SPKW	-0.018	-0.199	0.074	0.409	0.284	0.026	0.054	-0.148
		SPKN	-0.700	0.105	-0.515	-0.081	-0.061	0.005	0.024	0.010

Table 3G.3-12
Combined Forces and Moments: Selected Load Combination FB-9 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
3 Exterior Wall @ EL22.50 ~24.60m	64011	OTHR	-0.001	-0.318	-0.023	-0.119	-0.590	-0.004	-0.003	0.077
		TEMP	4.746	0.186	0.252	-0.966	-0.394	-0.010	0.000	-0.081
		EQEW	-0.147	-0.008	-1.762	0.000	-0.008	0.004	0.001	0.002
		EQNS	3.743	-0.254	-0.233	-0.057	-0.192	0.013	0.007	0.030
		EQZ	0.074	0.362	0.009	0.160	0.783	0.007	0.005	-0.104
		EQT	0.019	0.000	0.197	0.000	0.001	-0.002	-0.002	-0.001
		SPKW	-0.131	0.003	-0.003	0.002	0.003	-0.004	-0.002	0.000
		SPKN	0.263	-0.006	-0.035	-0.008	-0.022	0.020	0.011	0.003
	64019	OTHR	-0.129	-0.416	-0.121	-0.070	-0.414	0.054	0.065	0.057
		TEMP	5.498	1.414	1.600	-1.021	-0.456	0.014	-0.015	-0.050
		EQEW	-0.507	0.073	-1.155	-0.005	0.000	-0.011	-0.001	0.001
		EQNS	2.758	-0.032	-0.696	-0.059	-0.139	-0.046	-0.028	0.025
		EQZ	0.115	0.434	0.063	0.096	0.554	-0.074	-0.088	-0.081
		EQT	-0.111	-0.014	0.115	0.007	0.007	0.005	0.003	-0.001
		SPKW	-0.088	-0.001	0.062	0.000	0.017	0.001	-0.001	-0.007
		SPKN	0.237	0.005	-0.129	0.000	-0.044	-0.024	-0.010	0.011
	74001	OTHR	-0.030	-0.042	0.155	0.045	-0.056	-0.035	-0.029	-0.028
		TEMP	2.909	-0.796	-3.432	-0.753	-0.461	0.131	-0.303	0.097
		EQEW	-0.151	0.146	0.122	-0.043	-0.002	-0.002	0.027	0.023
		EQNS	0.085	-0.152	-1.111	0.036	0.049	-0.049	0.041	-0.012
		EQZ	0.011	0.008	-0.090	-0.073	0.066	0.067	0.033	0.043
		EQT	0.059	-0.022	-0.141	0.009	-0.001	0.008	-0.013	-0.001
		SPKW	0.001	-0.011	0.032	-0.002	-0.010	0.027	-0.018	0.003
		SPKN	-0.008	0.018	-0.048	-0.008	0.011	-0.023	0.019	0.004
	74004	OTHR	-0.059	-0.238	0.174	-0.084	-0.396	-0.054	0.014	-0.079
		TEMP	4.062	0.184	-3.546	-0.936	-0.309	-0.011	0.015	0.087
		EQEW	-0.928	0.078	0.662	0.002	0.037	-0.003	0.005	0.007
		EQNS	-1.414	-0.263	-1.644	0.036	0.028	-0.033	0.014	0.010
		EQZ	0.072	0.273	-0.060	0.116	0.496	0.085	-0.025	0.100
		EQT	0.361	0.000	-0.182	-0.001	-0.005	-0.001	0.001	-0.001
		SPKW	0.098	-0.011	0.014	0.003	-0.036	0.014	-0.008	-0.008
		SPKN	-0.163	0.003	-0.056	0.001	0.023	-0.001	0.000	0.010

Table 3G.3-12
Combined Forces and Moments: Selected Load Combination FB-9 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	OTHR	-1.669	-1.240	-0.541	0.467	0.720	0.046	0.147	0.038
		TEMP	-2.416	-2.905	-0.161	-6.457	-6.777	-0.882	-0.081	-0.506
		EQEW	-1.058	4.074	-3.386	1.499	1.314	-0.131	-0.130	0.458
		EQNS	-0.758	-4.288	-2.652	-0.157	-0.613	0.392	0.139	-0.196
		EQZ	-0.094	0.776	0.189	0.638	0.313	0.132	-0.012	0.080
		EQT	0.039	-0.018	0.852	-0.241	-0.053	-0.173	0.006	-0.031
		SPKW	-1.557	0.342	-0.035	-0.975	-0.163	0.150	0.201	0.123
		SPKN	-0.366	-0.506	-0.162	4.585	2.121	0.239	-0.150	-0.403
	70801	OTHR	-1.085	-0.507	0.076	-2.811	-0.254	-0.284	1.684	-0.236
		TEMP	-0.297	2.505	-0.133	-3.413	-3.179	0.038	0.115	-0.021
		EQEW	-0.630	2.169	-1.057	-0.695	-0.071	0.010	0.381	-0.041
		EQNS	0.400	-1.574	-4.088	0.042	-0.070	-0.183	-0.223	-0.086
		EQZ	-0.101	0.231	-0.025	-0.577	-0.059	0.022	0.280	-0.005
		EQT	0.043	-0.041	0.804	0.071	0.010	0.014	0.010	0.012
		SPKW	-0.436	-0.370	0.295	-2.574	-0.195	-0.446	1.645	-0.341
		SPKN	-1.752	-0.185	-0.222	-1.291	-0.267	0.199	0.186	0.091
	70804	OTHR	-0.951	-1.050	0.052	2.231	1.324	-0.227	0.266	0.146
		TEMP	-1.329	0.117	0.288	-2.912	-3.121	0.212	0.007	0.047
		EQEW	-0.616	4.354	0.247	0.455	0.252	-0.023	0.046	-0.132
		EQNS	1.104	-3.154	-4.888	-0.691	-0.169	-0.213	0.013	0.171
		EQZ	-0.108	0.486	-0.056	0.279	0.215	-0.028	0.053	-0.043
		EQT	0.028	-0.034	0.807	0.108	0.000	0.013	-0.006	-0.011
		SPKW	-0.326	-0.404	0.169	2.457	1.246	-0.293	0.247	0.292
		SPKN	-1.538	0.304	-0.069	-0.333	-0.122	-0.061	0.113	-0.065
	110748	OTHR	-0.471	-0.600	-0.376	-0.127	-0.091	-0.047	0.075	-0.048
		TEMP	-1.035	-1.835	-0.279	-1.382	-1.642	-0.031	0.137	-0.058
		EQEW	-0.603	1.998	0.158	0.073	-0.104	-0.077	0.151	0.013
		EQNS	0.513	-1.335	0.892	0.012	0.081	-0.101	-0.050	0.016
		EQZ	-0.082	0.471	0.276	0.071	0.023	0.012	-0.034	0.023
		EQT	0.007	-0.050	0.036	-0.011	0.010	0.007	-0.008	-0.008
		SPKW	0.132	0.148	0.257	0.048	0.020	0.007	0.014	-0.010
		SPKN	-1.340	0.193	-0.712	0.050	-0.032	-0.045	0.009	-0.026
5 Basemat	90306	OTHR	-3.518	-2.459	0.794	0.927	-0.714	0.425	-0.613	1.452
		TEMP	-0.913	-0.080	0.219	1.890	0.787	-0.008	0.045	0.256
		EQEW	-7.020	-1.678	2.018	4.100	1.283	1.171	-1.859	4.307
		EQNS	-1.129	-1.348	5.098	2.431	-0.453	4.997	-4.224	3.195
		EQZ	0.565	0.217	-0.251	-0.479	0.051	-0.071	0.266	-0.602
		EQT	0.711	0.042	0.932	-0.272	-0.239	0.822	-0.789	0.047
		SPKW	-0.153	-0.741	-0.097	-0.210	-0.732	0.016	0.107	0.132
		SPKN	-0.468	0.019	-0.044	-0.232	0.035	-0.067	0.111	-0.049
	90310	OTHR	-1.932	-2.011	0.186	-0.537	-0.478	-0.161	0.268	0.159
		TEMP	0.105	0.315	0.323	1.205	1.335	0.598	0.186	-0.135
		EQEW	-1.063	-0.549	0.488	-0.168	0.634	-1.187	1.745	-0.066
		EQNS	0.257	-1.778	0.199	0.866	-0.448	-1.064	-0.701	2.209
		EQZ	0.074	0.046	0.020	0.081	0.071	0.351	-0.091	0.056
		EQT	0.248	-0.217	-0.089	0.133	-0.109	-0.087	-0.534	0.620
		SPKW	-0.032	-0.534	0.000	-0.001	-0.414	0.109	0.076	0.092
		SPKN	-0.518	-0.108	-0.067	-0.511	-0.059	0.022	0.035	0.203
	90410	OTHR	-2.656	-4.629	0.627	-1.775	0.067	1.586	1.643	-0.262
		TEMP	-0.147	-1.227	0.653	0.548	2.081	0.464	0.252	-0.198
		EQEW	0.042	0.193	4.874	-0.356	-1.677	7.604	-0.004	-3.773
		EQNS	-0.846	-9.305	-0.106	1.325	1.118	2.287	3.027	-0.578
		EQZ	0.227	0.457	-0.215	0.383	-0.074	-0.688	-0.700	-0.044
		EQT	-0.011	-0.048	-1.046	0.064	0.167	-1.141	0.067	0.978
		SPKW	-0.039	-1.239	-0.005	-0.014	0.013	-0.065	0.048	-0.024
		SPKN	-0.799	-0.444	-0.222	-1.042	-0.224	-0.204	0.005	0.285

Table 3G.3-12
Combined Forces and Moments: Selected Load Combination FB-9 (Continued)

Location	Element ID		Nx (MN/m)	Ny (MN/m)	Nxy (MN/m)	Mx (MNm/m)	My (MNm/m)	Mxy (MNm/m)	Qx (MN/m)	Qy (MN/m)
5 Basemat @ Spent Fuel Pool	90486	OTHR	-2.443	-4.237	-0.259	2.310	1.791	-0.038	-0.010	-0.065
		TEMP	-2.543	-0.964	0.092	-6.708	-6.839	0.557	0.291	0.029
		EQEW	2.142	2.280	0.736	-10.183	-10.226	-0.497	0.384	-1.513
		EQNS	-1.781	-3.137	-1.736	10.401	7.567	-0.576	-1.304	0.304
		EQZ	0.238	0.360	0.037	-1.472	-1.155	-0.114	0.048	-0.091
		EQT	0.241	-0.186	0.545	0.034	0.058	0.003	0.063	0.066
		SPKW	0.409	-1.564	0.063	-0.400	-0.525	-0.058	-0.018	-0.178
		SPKN	-1.949	0.191	-0.489	-1.030	-0.405	-0.229	0.188	0.048
	90490	OTHR	-2.556	-3.733	0.125	-1.893	0.373	0.333	1.573	-0.183
		TEMP	-1.286	2.984	-0.063	-12.028	-8.686	-0.110	1.320	1.060
		EQEW	1.399	3.251	3.471	4.759	-2.599	4.881	-5.794	-2.720
		EQNS	-1.008	-8.548	0.724	0.391	3.634	0.468	5.107	-0.686
		EQZ	0.313	0.318	-0.037	0.467	-0.279	-0.063	-0.771	-0.060
		EQT	-0.017	0.643	-0.941	-0.476	-0.201	-1.073	0.096	0.897
		SPKW	0.350	-0.477	-0.026	1.128	-0.066	0.109	-0.362	-0.099
		SPKN	-2.117	-0.870	-0.016	-4.735	-0.918	-0.139	0.657	-0.199
	90526	OTHR	-3.223	-4.868	-0.513	-0.158	-5.830	-0.398	-0.412	-2.142
		TEMP	2.540	0.079	0.140	-6.918	-3.496	0.413	-0.639	0.524
		EQEW	5.409	1.105	1.445	-5.714	-2.644	1.608	1.465	5.248
		EQNS	0.318	-0.881	-5.240	3.620	-0.226	-6.336	-3.821	-3.929
		EQZ	0.280	0.287	0.065	-0.581	-0.217	0.031	0.106	0.572
		EQT	-0.901	-0.065	1.085	0.272	0.296	1.019	0.799	0.021
		SPKW	-0.666	-2.016	0.234	-1.004	-5.108	0.230	0.130	-0.816
		SPKN	-0.777	0.169	-0.292	-0.414	0.494	-0.200	0.059	0.260
6 Slab EL4.65m	93306	OTHR	-0.004	-0.201	-0.094	0.076	0.143	0.012	0.034	-0.144
		TEMP	-0.743	-0.035	-1.631	-0.052	0.030	-0.015	0.079	-0.027
		EQEW	1.458	0.168	-0.510	0.291	-0.128	-0.029	0.088	0.071
		EQNS	2.092	0.406	-0.866	0.344	-0.454	-0.007	-0.050	0.040
		EQZ	-0.098	-0.010	-0.024	-0.025	-0.010	-0.006	-0.020	0.063
		EQT	0.050	0.018	0.055	0.021	-0.027	-0.005	-0.020	-0.010
		SPKW	-0.134	-0.743	-0.167	0.052	0.244	-0.002	0.003	-0.053
		SPKN	-0.311	-0.002	0.109	0.010	-0.010	0.010	-0.010	-0.004
	93310	OTHR	-0.051	-0.036	0.097	0.070	0.043	0.014	-0.036	-0.006
		TEMP	-2.216	-2.169	-3.228	-0.757	-0.782	-0.242	0.271	0.285
		EQEW	0.282	0.424	0.373	-0.135	0.089	-0.014	0.125	-0.076
		EQNS	0.689	0.289	0.932	0.434	-0.376	0.016	-0.422	0.426
		EQZ	-0.016	-0.031	-0.130	-0.017	-0.011	-0.019	0.010	0.002
		EQT	0.054	-0.001	0.148	0.071	-0.050	0.006	-0.067	0.058
		SPKW	0.000	-0.285	0.082	-0.024	0.089	-0.019	0.046	-0.055
		SPKN	-0.266	-0.003	0.098	0.118	-0.026	-0.020	-0.072	0.054
	93410	OTHR	-0.035	-0.087	-0.032	0.158	0.042	-0.053	-0.071	-0.017
		TEMP	-0.804	-2.214	0.295	-0.053	-0.014	0.028	-0.118	-0.029
		EQEW	-0.178	0.457	0.267	0.080	-0.058	0.102	-0.181	-0.004
		EQNS	0.136	1.152	0.896	0.170	0.076	0.058	-0.048	0.010
		EQZ	-0.230	-0.215	0.188	-0.048	-0.010	0.037	0.019	0.007
		EQT	0.010	-0.185	0.079	-0.008	0.006	-0.001	0.014	0.005
		SPKW	0.006	-0.596	0.230	-0.005	0.003	-0.005	-0.002	0.000
		SPKN	-0.926	0.019	0.217	0.248	0.043	0.060	-0.100	0.003

Table 3G.3-13

Sectional Thicknesses and Rebar Ratios Used in the Evaluation

Location	Element ID	Thickness (m)	Primary Reinforcement					Shear Tie	
			Position	Direction 1*		Direction2*			
				Arrangement	Ratio (%)	Arrangement	Ratio (%)	Arrangement	Ratio (%)
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	2.0	Inside	3-#11@200	0.755	3-#11@200	0.755	#6@400x400	0.177
			Outside	3-#11@200	0.755	3-#11@200	0.755		
	60019	3.6	Inside	3-#11@200	0.419	3-#11@200 +2-#11@200	0.699	#6@400x400	0.177
			Outside	3-#11@200	0.419	3-#11@200 +1-#11@200	0.559		
	70001	2.0	Inside	4-#11@200	1.006	4-#11@200	1.006	#6@400x400	0.177
			Outside	4-#11@200	1.006	4-#11@200	1.006		
	70004	2.0	Inside	4-#11@200	1.006	4-#11@200	1.006	#6@200x200	0.710
			Outside	4-#11@200	1.006	4-#11@200 +1-#11@200	1.258		
	110708	1.5	Inside	2-#11@200	0.671	3-#11@200 +1-#11@200	1.342	#6@400x200	0.355
			Outside	2-#11@200	0.671	3-#11@200	1.006		
2 Exterior Wall @ EL4.65 ~6.60m	62011 62019 72001 72004	1.0	Inside	2-#11@200	1.006	2-#11@200	1.006	#5@400x400	0.125
			Outside	3-#11@200	1.510	3-#11@200	1.510		
3 Exterior Wall @ EL22.50 ~24.60m	64011 64019	1.0	Inside	2-#11@200	1.006	2-#11@200	1.006	#5@400x400	0.125
			Outside	2-#11@200	1.006	2-#11@200	1.006		
	74001 74004	1.0	Inside	2-#11@200	1.006	2-#11@200	1.006	#5@400x400	0.125
			Outside	3-#11@200	1.510	3-#11@200	1.510		

Note *: Exterior Wall, Pool Wall Direction1 : Horizontal, Direction2 : Vertical
Basemat, Slab Direction1 : N-S, Direction2 : E-W

Table 3G.3-13
Sectional Thicknesses and Rebar Ratios Used in the Evaluation (Continued)

Location	Element ID	Thickness (m)	Primary Reinforcement					Shear Tie	
			Position	Direction 1*		Direction2*			
				Arrangement	Ratio (%)	Arrangement	Ratio (%)	Arrangement	Ratio (%)
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	3.6	Inside	3-#11@200	0.419	3-#11@200	0.419	#6@400x400	0.177
			Outside	3-#11@200	0.419	3-#11@200	0.419		
	70801	2.0	Inside	4-#11@200	1.006	4-#11@200	1.006	#6@200x200	0.710
			Outside	4-#11@200	1.006	4-#11@200	1.006		
	70804	2.0	Inside	4-#11@200	1.006	4-#11@200	1.006	#6@400x400	0.177
			Outside	4-#11@200	1.006	4-#11@200	1.006		
	110748	1.5	Inside	2-#11@200	0.671	3-#11@200	1.006	#6@400x400	0.177
			Outside	2-#11@200	0.671	3-#11@200	1.006		
5 Basemat	90306 90310 90410	4.0	Top	3-#11@200	0.377	3-#11@200	0.377	#9@400x200	0.807
			Bottom	5-#11@200	0.629	5-#11@200	0.629		
5 Basemat @ Spent Fuel Pool	90486	4.0	Top	3-#11@200	0.377	3-#11@200	0.377	#9@400x400	0.403
			Bottom	5-#11@200	0.629	5-#11@200	0.629		
	90490 90526	4.0	Top	3-#11@200	0.377	3-#11@200	0.377	#9@400x200	0.807
			Bottom	5-#11@200	0.629	5-#11@200	0.629		
6 Slab EL4.65m	93306 93310 93410	1.3	Top	2-#11@200	0.774	2-#11@200	0.774	#5@200x200	0.500
			Bottom	2-#11@200	0.774	2-#11@200	0.774		

Note *: Exterior Wall, Pool Wall Direction1 : Horizontal, Direction2 : Vertical
Basemat, Slab Direction1 : N-S, Direction2 : E-W

Table 3G.3-14

Rebar and Concrete Stresses: Selected Load Combination FB-4

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
				Calculated				Allowable
		Calculated	Allowable	Direction1*		Direction2*		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	-3.4	-29.3	-5.6	-19.5	-6.9	-3.9	372.2
	60019	-3.8	-29.0	-6.7	5.6	-20.3	30.2	370.1
	70001	-7.9	-29.0	-19.5	79.3	-7.3	73.8	370.1
	70004	-10.3	-29.0	-6.2	8.1	-33.7	97.4	370.1
	110708	-7.2	-29.1	-24.2	36.7	-16.1	20.3	370.3
2 Exterior Wall @ EL4.65 ~6.60m	62011	-2.4	-29.3	26.4	74.6	-10.8	14.0	372.2
	62019	-9.2	-29.3	43.9	104.0	-22.0	73.8	372.2
	72001	-9.5	-29.3	21.0	115.9	-19.8	80.7	372.2
	72004	-4.4	-29.3	67.1	47.0	-19.6	33.3	372.2
3 Exterior Wall @ EL22.50 ~24.60m	64011	-8.0	-29.3	21.6	110.0	-12.8	92.6	372.2
	64019	-7.2	-29.3	35.5	135.3	6.4	101.5	372.2
	74001	-4.5	-29.3	21.2	92.2	1.6	78.7	372.2
	74004	-7.7	-29.3	12.8	106.6	1.2	116.3	372.2
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	-3.8	-29.0	-18.8	5.4	-15.6	6.1	370.1
	70801	-13.4	-29.0	-43.0	141.5	7.1	68.8	370.1
	70804	-2.5	-29.0	-14.4	-5.7	-3.7	1.6	370.1
	110748	-6.4	-29.1	-13.0	32.0	-19.1	30.7	370.3
5 Basemat	90306	-2.1	-23.5	-13.9	-3.9	-1.5	-4.8	372.2
	90310	-0.8	-23.5	-4.6	-4.7	-2.6	-1.8	372.2
	90410	-2.6	-23.5	-1.2	-17.8	-7.5	-6.1	372.2
5 Basemat @ Spent Fuel Pool	90486	-3.8	-23.2	2.1	1.3	-20.8	-23.2	370.1
	90490	-4.8	-23.2	29.6	4.5	-29.7	-8.1	370.1
	90526	-5.5	-23.2	7.2	20.6	-7.3	-36.4	370.1
6 Slab EL4.65m	93306	-1.7	-29.3	16.2	3.2	41.4	1.3	372.2
	93310	-7.5	-29.3	-12.3	56.0	-13.3	58.3	372.2
	93410	-2.5	-29.3	-1.5	-3.0	-15.3	-15.7	372.2

Note: Negative value means compression.

Note *: Exterior Wall, Pool Wall Direction1 : Horizontal, Direction2 : Vertical
Basemat, Slab Direction1 : N-S, Direction2 : E-W

Table 3G.3-15

Rebar and Concrete Stresses: Selected Load Combination FB-8

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
				Calculated				Allowable
		Calculated	Allowable	Direction1*		Direction2*		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	-2.6	-29.3	-3.9	-14.6	-9.0	-2.0	372.2
	60019	-3.2	-29.0	-4.0	4.0	-17.6	23.7	370.1
	70001	-5.9	-29.0	-14.0	54.6	-6.1	56.9	370.1
	70004	-8.0	-29.0	-4.2	5.4	-27.2	72.1	370.1
	110708	-5.3	-29.1	-17.3	28.2	-14.6	10.8	370.3
2 Exterior Wall @ EL4.65 ~6.60m	62011	-2.1	-29.3	13.3	50.9	-7.7	5.6	372.2
	62019	-7.8	-29.3	36.5	83.6	-19.2	61.0	372.2
	72001	-7.8	-29.3	14.7	88.0	-18.7	57.2	372.2
	72004	-8.1	-29.3	47.4	53.5	-26.2	57.0	372.2
3 Exterior Wall @ EL22.50 ~24.60m	64011	-7.6	-29.3	18.4	87.1	-12.9	86.0	372.2
	64019	-6.9	-29.3	22.2	100.6	8.3	81.7	372.2
	74001	-3.7	-29.3	19.9	71.7	2.4	62.1	372.2
	74004	-6.1	-29.3	10.7	92.6	1.4	92.7	372.2
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	-3.1	-29.0	-13.8	5.2	-13.6	5.1	370.1
	70801	-9.8	-29.0	-29.7	105.5	5.7	57.9	370.1
	70804	-1.9	-29.0	-10.5	-2.6	-4.6	1.5	370.1
	110748	-5.4	-29.1	-8.4	31.9	-17.1	24.5	370.3
5 Basemat	90306	-1.9	-23.5	-12.9	-2.7	-1.4	-4.3	372.2
	90310	-0.6	-23.5	-3.8	-3.8	-1.9	-1.2	372.2
	90410	-2.1	-23.5	-0.4	-14.3	-7.1	-5.0	372.2
5 Basemat @ Spent Fuel Pool	90486	-2.7	-23.2	-0.7	-0.6	-15.6	-16.9	370.1
	90490	-3.8	-23.2	24.5	2.3	-23.7	-6.2	370.1
	90526	-4.1	-23.2	3.3	13.9	-5.1	-27.0	370.1
6 Slab EL4.65m	93306	-2.0	-29.3	40.0	26.3	57.9	27.9	372.2
	93310	-6.0	-29.3	-4.7	53.8	-6.3	57.1	372.2
	93410	-1.8	-29.3	-0.9	-4.0	-10.6	-11.0	372.2

Note: Negative value means compression.
Note *: Exterior Wall, Pool Wall Direction1 : Horizontal, Direction2 : Vertical
Basemat, Slab Direction1 : N-S, Direction2 : E-W

Table 3G.3-16

Rebar and Concrete Stresses: Selected Load Combination FB-9

Location	Element ID	Concrete Stress (MPa)		Primary Reinforcement Stress (MPa)				
				Calculated				Allowable
		Calculated	Allowable	Direction1*		Direction2*		
				In/Top	Out/Bottom	In/Top	Out/Bottom	
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	-8.5	-29.3	230.5	191.6	247.9	256.1	372.2
	60019	-12.6	-29.0	163.1	241.5	285.3	269.3	370.1
	70001	-12.6	-29.0	-26.9	205.5	34.2	158.9	370.1
	70004	-22.2	-29.0	92.4	229.0	226.7	316.5	370.1
	110708	-14.1	-29.1	39.8	167.7	275.8	211.0	370.3
2 Exterior Wall @ EL4.65 ~6.60m	62011	-10.7	-29.3	175.8	292.7	134.9	293.3	372.2
	62019	-13.2	-29.3	142.7	221.1	77.7	214.3	372.2
	72001	-11.8	-29.3	70.9	276.7	95.1	220.2	372.2
	72004	-14.5	-29.3	203.1	238.5	191.6	272.7	372.2
3 Exterior Wall @ EL22.50 ~24.60m	64011	-27.2	-29.3	198.5	349.2	-79.8	305.5	372.2
	64019	-21.8	-29.3	177.6	292.2	-53.9	214.4	372.2
	74001	-7.2	-29.3	109.1	118.8	73.9	98.0	372.2
	74004	-12.4	-29.3	76.4	172.4	45.3	186.2	372.2
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	-5.6	-29.0	85.1	103.0	252.6	170.4	370.1
	70801	-21.8	-29.0	-68.7	292.1	57.5	242.0	370.1
	70804	-9.8	-29.0	131.1	56.7	243.6	161.7	370.1
	110748	-7.3	-29.1	-18.6	87.5	-32.8	154.4	370.3
5 Basemat	90306	-9.4	-23.5	167.8	64.5	250.0	272.0	372.2
	90310	-2.1	-23.5	14.6	17.1	-26.9	20.8	372.2
	90410	-12.4	-23.5	62.6	137.0	260.0	272.7	372.2
5 Basemat @ Spent Fuel Pool	90486	-12.2	-23.2	218.5	179.0	130.5	44.4	370.1
	90490	-9.6	-23.2	90.0	224.1	267.9	165.6	370.1
	90526	-11.0	-23.2	184.8	100.6	242.7	115.7	370.1
6 Slab EL4.65m	93306	-4.4	-29.3	230.9	111.5	117.9	154.7	372.2
	93310	-8.0	-29.3	79.4	86.3	51.6	112.4	372.2
	93410	-4.7	-29.3	82.0	-21.1	113.4	52.0	372.2

Note: Negative value means compression.

Note *: Exterior Wall, Pool Wall Direction1 : Horizontal, Direction2 : Vertical
Basemat, Slab Direction1 : N-S, Direction2 : E-W

Table 3G.3-17

Transverse Shear of FB

Location	Element ID	Load ID	d (m)	pv (%)	Shear Force (MN/m)				Vu/ϕVn
					Vu	Vc	Vs	ϕVn	
1 Exterior Wall and Pool Wall @ EL-11.50 ~-10.50m	60011	FB-4	1.72	0.177	1.09	3.53	1.26	4.07	0.269
	60019	FB-9	3.35	0.177	3.14	3.08	2.45	4.70	0.669
	70001	FB-9	1.69	0.177	1.80	1.64	1.24	2.44	0.738
	70004	FB-9	1.59	0.710	2.87	0.00	4.68	3.97	0.723
	110708	FB-9	1.11	0.355	1.14	0.07	1.64	1.45	0.782
2 Exterior Wall @ EL4.65 ~6.60m	62011	FB-9	0.74	0.125	0.06	0.00	0.38	0.32	0.181
	62019	FB-4	0.72	0.125	0.06	0.69	0.37	0.90	0.062
	72001	FB-9	0.74	0.125	0.27	0.00	0.38	0.32	0.840
	72004	FB-9	0.75	0.125	0.10	0.08	0.39	0.40	0.246
3 Exterior Wall @ EL22.50 ~24.60m	64011	FB-9	0.81	0.125	0.02	0.00	0.42	0.35	0.059
	64019	FB-4	0.81	0.125	0.07	0.41	0.42	0.71	0.092
	74001	FB-4	0.72	0.125	0.11	0.68	0.37	0.89	0.125
	74004	FB-8	0.72	0.125	0.08	0.65	0.37	0.87	0.094
4 Spent Fuel Pool Wall @ EL-5.10 ~-3.30m	60819	FB-4	3.32	0.177	0.41	6.43	2.43	7.53	0.054
	70801	FB-9	1.69	0.710	4.11	1.99	4.97	5.91	0.696
	70804	FB-4	1.68	0.177	0.46	3.38	1.23	3.92	0.118
	110748	FB-4	1.21	0.177	0.24	1.31	0.88	1.87	0.131
5 Basemat	90306	FB-9	3.70	0.807	6.54	2.05	12.36	12.25	0.534
	90310	FB-4	3.69	0.807	0.47	6.07	12.32	15.63	0.030
	90410	FB-9	3.72	0.807	3.42	2.23	12.42	12.45	0.275
5 Basemat @ Spent Fuel Pool	90486	FB-4	3.50	0.403	0.31	6.31	5.84	10.33	0.030
	90490	FB-9	3.51	0.807	11.20	6.80	11.70	15.72	0.712
	90526	FB-9	3.48	0.807	10.82	7.20	11.61	15.98	0.677
6 Slab EL4.65m	93306	FB-8	1.10	0.500	0.21	0.24	2.27	2.14	0.096
	93310	FB-4	1.10	0.500	0.48	2.87	2.27	4.37	0.110
	93410	FB-4	1.10	0.500	0.21	2.06	2.27	3.68	0.058

Figure 3G.3-1. Sections Where Temperature Loads Are Defined

{{{Security-Related Information - Withheld Under 10 CFR 2.390}}}

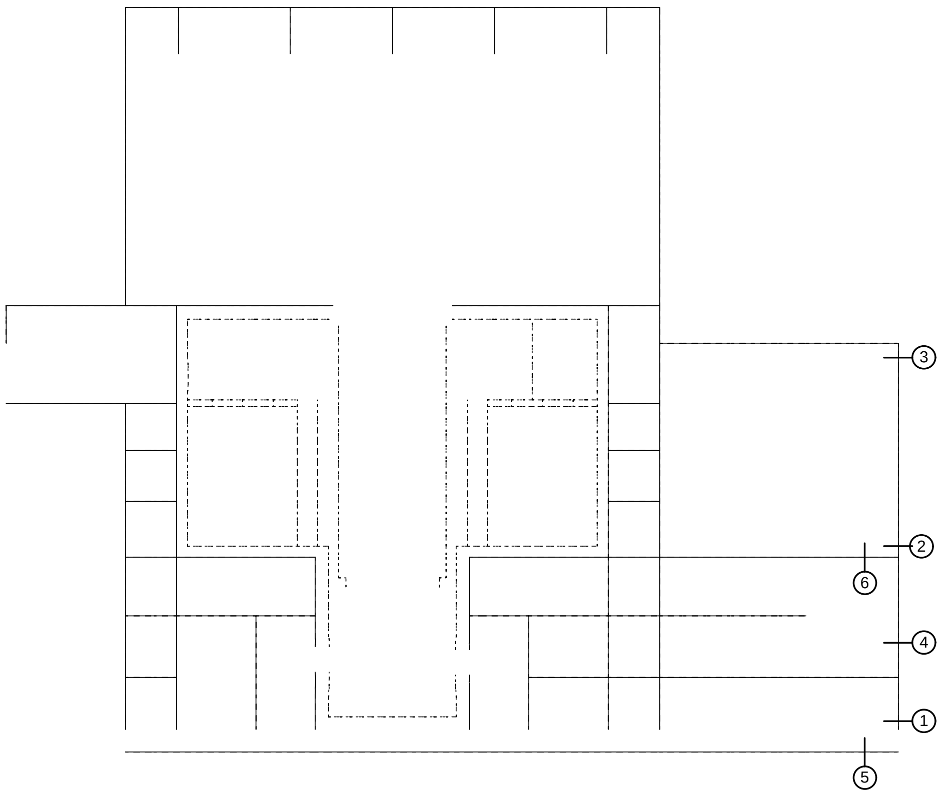
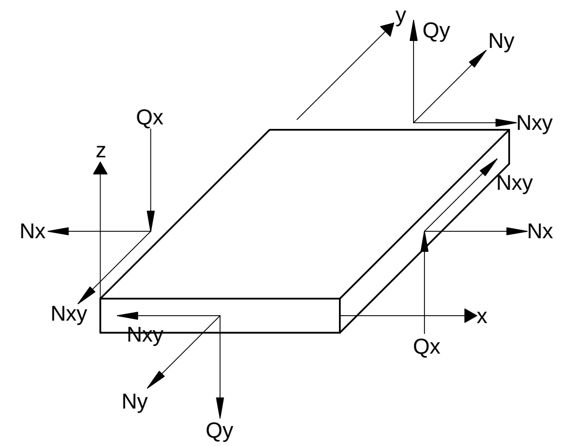
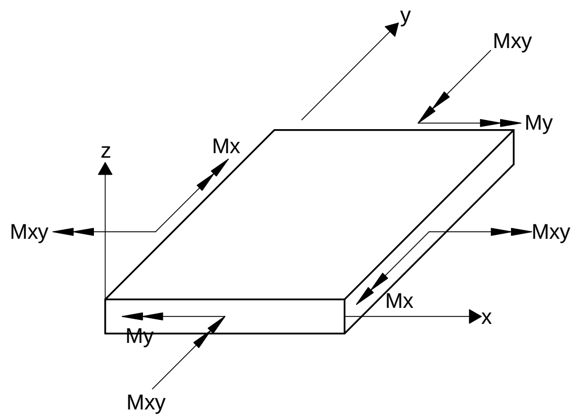


Figure 3G.3-2. Section Considered for Analysis



Membrane and Shear Forces



Moments

Definition of Element Coordinate System

Structure	x	y	z
External Wall	horizontal	vertical	outward
Wall in N-S Direction	horizontal	vertical	toward West
Wall in E-W Direction	horizontal	vertical	toward South
Foundation Mat Floor Slab	toward South	toward West	downward

Figure 3G.3-3. Force and Moment in Shell Element

Figure 3G.3-4. Reinforcing Steel of Spent Fuel Pool Walls

Figure 3G.3-5. List of FB Wall and Slab Reinforcement

3H. EQUIPMENT QUALIFICATION DESIGN ENVIRONMENTAL CONDITIONS

3H.1 INTRODUCTION

This appendix specifies plant environmental conditions, which envelop the actual environment expected over the plant life, for which safety-related equipment (Section 3.11) are to be designed and qualified. The plant conditions considered in defining the environmental conditions are normal operation including anticipated operational occurrences (AOOs) and test, and accident conditions including post-accident operations. The accident condition considered is a hypothesized single event (not reasonably expected during the course of plant operation) that has the potential to cause severe environmental conditions for safety-related equipment. The specified accident conditions are based on significantly conservative assumptions.

The primary environmental parameters addressed are pressure, temperature, relative humidity, radiation, and chemical conditions. Safety-related equipment is to be designed and qualified for the environmental conditions specified in this appendix. The parameters specified in this appendix do not include margins that may be required to satisfy applicable codes and standards for equipment qualification. The radiation data specified in this appendix is intended to provide a conservative basis for equipment qualification and is not intended to limit or justify personnel access.

3H.2 PLANT ZONES

3H.2.1 Containment Vessel

The containment vessel is divided into a drywell region and a pressure wetwell with an interconnecting vent system. The containment vessel is shown in Figure 6.2-1. The drywell volume is partitioned into an upper drywell and lower drywell by the RPV support skirt and support pedestal. Connecting vents through the pedestal provide a path between upper and lower drywells. Table 3.2-1 identifies the safety-related equipment located within the containment vessel.

For normal operating conditions, the containment vessel is divided into three thermodynamic and four radiation zones to represent the enveloping levels of the environmental conditions. The environmental zones are shown in Figure 3H-1. For accident conditions, zones a-1 and a-2 have the same thermodynamic properties and the entire containment vessel (zones b-1 through b-4) has the same radiation properties.

3H.2.2 Outside Containment Vessel

The reduced amount of safety-related equipment in the ESBWR, permits all of it to be housed within the reactor building. The area outside the containment vessel includes:

- Control Building
- Reactor Building outside containment

The region inside the reactor building surrounding the containment encloses penetrations through the containment, except for those of the main steam tunnel and IC/PCC pools. The control room zone includes the main control room, rooms located in elevation -7400 in control building and areas adjacent to the control room containing operator facilities. Major equipment zones are shown on the reactor building arrangement drawing (Figure 3H-2).

3H.3 ENVIRONMENTAL CONDITIONS

Table 3H-1 contains a cross listing of the environmental data tables arranged by location and by type of condition.

3H.3.1 Plant Normal Operating Conditions

Tables 3H-2 through 3H-4 define the thermodynamic conditions (pressure, temperature and humidity) for normal operating conditions for areas containing safety-related equipment. Tables 3H-5 through 3H-7 define the radiation environment for the same areas for normal operating conditions. Figures showing equipment location and system configurations are referenced in each table.

3H.3.2 Accident Conditions

Thermodynamic conditions for safety-related equipment in the containment vessel, control room zone, and reactor building are given in Tables 3H-8 through 3H-10 for accident conditions, including post-accident periods. In general, the most severe conditions result from a postulated reactor coolant (steam or water) line break inside the containment. However, conditions were also considered for ruptures occurring in the steam tunnel and breaks in the RWCU/SDC System outside the containment. Tables 3H-11 through 3H-13 specify the radiation environment for accident conditions, including post-accident periods.

3H.3.3 Water Quality

Reactor water quality characteristics for the DBA LOCA are:

- pH = 5.3 to 8.9
- Conductivity ≤ 2.0 μS/cm
- ≤ 8 ppm O_2, ≤ 1 ppm CO_2
- ≤ 1 ppm dissolved salts available for deposit as dry salts upon evaporation from hot surfaces.
- ≤ 150 ppb undissolved solids
- ≤ 60 ppb dissolved H_2 arising from < 4.0% by volume of H_2O in containment atmosphere.

Water quality characteristics for normal plant operations for auxiliary systems are specified in Chapter 9 and for steam and power conversion systems in Chapter 10.

3H.4 REFERENCES

3H.4-1 10 CFR 50 Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors."

3H.4-2 NUREG-1465, "Accident Source Terms for Light-Water Nuclear Power Plants," February 1995.

Table 3H-1

Cross Reference of Plant Environmental Data and Location

Plant Condition	Location*		
	Containment Vessel	Reactor Building	Control Room Zone
Normal Conditions **			
(a) Thermodynamic	3H-2	3H-3	3H-4
(b) Radiation	3H-5	3H-6	3H-7
Accident Conditions			
(a) Thermodynamic	3H-8	3H-9	3H-10
(b) Radiation	3H-11	3H-12	3H-13

* Specific zones are located on the arrangement drawings, and typical equipment is identified by figure numbers in each table.

** Test and abnormal environments are included with normal operating conditions.

Table 3H-2

Thermodynamic Environment Conditions Inside Containment Vessel for Normal Operating Conditions

Plant Zone/Typical Equipment[1]		Pressure[2][3] (Gauge) kPa (psig)	Temperature[3] °C (°F)	Relative Humidity[3] %
(a-1)	Upper drywell and upper area of lower drywell [Figure 3H-1]	10.3 (16.0)	57(135) Ave 65 (150) Max	50 Nom
(a-2)	Lower area of lower drywell [Figure 3H-1]	10.3 (16.0)	57(135) Max 60(140) Ave	50 Nom
(a-3)	Wetwell - pool and gas space [Figure 3H-1]	4.8(0.7) Nom 9.0(1.3) Max 0 Min	43(110) Max[4]	100

(1) The containment atmosphere is nitrogen.

(2) The containment vessel will be pressurized during leak rate tests once per refueling outage in accordance with 10 CFR 50, Appendix J.

(3) The worst combination of conditions in the table sets the design requirements of equipment.

(4) The suppression pool water may reach 46°C (115°F) during testing. The maximum abnormal temperature is 49°C (120°F).

Table 3H-3

Thermodynamic Environment Conditions Inside Reactor Building for Normal Operating Conditions

Plant Zone/Typical Equipment	**Pressure**(1) **(Gauge)** kPa (psig)	**Temperature**(2) °C (°F)	**Relative Humidity**(2) %
Hydraulic Control Unit (HCU) Rooms CRD HCUs [Figure 3H-3]	-0	40 (104) Max 10 (50) Min	90 Max 10 Min
Control Rod Drive (CRD) Pump Room CRD high pressure makeup line valves [Figure 3H-4]	-0	40 (104) Max 10(50) Min	90 Max 10 Min
Standby Liquid Control (SLC) System Room SLC system valves [Figure 3H-5]	-0	40 (104) Max 21.1 (70) Min	60 Max 35 Min
Battery Rooms (3) Batteries [Figure 3H-6]	+0	25 (77) Nom 29 (85) Max 18 (65) Min	90 Max 10 Min
Electrical Division Rooms DC power system: battery chargers and electrical modules [Figure 3H-7]	+0	29 (85) Max 18 (65) Min	60 Max 35 Min
Uninterruptible Power Supply (UPS) AC power system: battery chargers, inverters and electrical modules [Figure 3H-7]	+0	29 (85) Max 18 (65) Min	60 Max 35 Min
Reactor Protection System (RPS) [Figure 3H-8]	-0	29 (85) Max 18 (65) Min	60 Max 35 Min
Suppression Pool Temperature Monitoring System (SPTMS) [Figure 3H-9]	-0	29 (85) Max 18 (65) Min	60 Max 35 Min
Sensors and electrical modules Leak Detection and Isolation System (LD&IS), Process Radiation Monitoring System (PRMS), Containment Inerting Systems (CIS) [Figure 3H-10]	-0	29 (85) Max 18 (65) Min	60 Max 35 Min
Electrical modules Neutron Monitoring System (NMS), Essential Distributed Control and Information System (E-DCIS) [Figure 3H-11]	-0	29 (85) Max 18 (65) Min	60 Max 35 Min

Table 3H-3

Thermodynamic Environment Conditions Inside Reactor Building for Normal Operating Conditions

Plant Zone/Typical Equipment	Pressure[(1)] (Gauge) kPa (psig)	Temperature[(2)] °C (°F)	Relative Humidity[(2)] %
Isolation valves Fuel and Auxiliary Pool Cooling System (FAPCS), RCCWS, High Pressure Nitrogen Supply System (HPNSS), Containment Inerting System (CIS) [Figure 3H-12]	-0	40 (104) Max 10 (50) Min	90 Max 10 Min
Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) Isolation and shutoff valves [Figure 3H-12]	-0	40 (104) Max 10 (50) Min	90 Max 10 Min
Main Steam (MS) and Feedwater (FW) Tunnel Main Steamline (MSL) isolation valves MSL drain isolation valves FW isolation valves [Figure 3H-13]	–0	57 (135) Max 10 (50) Min	90 Max 10 Min
Isolation Condenser System (ICS) valves outside containment [Figure 3H-14]	–0	40 (104) Max 10 (50) Min	100/Water

(1) The indicated positive or negative pressure is maintained. Pressure difference is not maintained.

(2) Maximum occurs in summer and Minimum in winter. The period for which temperature and humidity reach Max or Min simultaneously is less than 1%. For other times, temperature and humidity are in the middle of Max and Min.

(3) Hydrogen concentrations are maintained below 2% by volume in battery rooms.

Table 3H-4

Thermodynamic Environment Conditions Inside Control Building for Normal Operating Conditions

Plant Zone/Typical Equipment	**Pressure*** **(Gauge)** kPa (psig)	**Temperature** °C (°F)	**Relative Humidity** %
Main control room panels [Figure 3H-15]	+0	25.6 (78) Max 22.8 (73) Min	60 Max 25 Min
Emergency breathing air system (EBAS) [Figure 3H-16]	+0	25.6 (78) Max 22.8 (73) Min	60 Max 35 Min
Safety System Logic and Control (SSLC) [Figure 3H-17]	+0	25.6 (78) Max 22.8 (73) Min	60 Max 25 Min

* The indicated positive or negative pressure is maintained. Pressure difference is not maintained.

Table 3H-5

Radiation Environment Conditions Inside Containment Vessel for Normal Operating Conditions

Plant Zone/Typical Equipment	Operating Dose Rate[(1)(2)]		Integrated Dose[(2)(3)]	
	Gamma (R/h)	Beta (R/h)	Gamma (R)	Beta (R)
(b-1) Upper drywell [Figure 3H-1]	2.61 E+1	Negl.[(4)]	1.4 E+7	Negl.
(b-2) Upper area of lower drywell [Figure 3H-1]	2.61 E+1	Negl.	1.4 E+7	Negl.
(b-3) Lower area of lower drywell [Figure 3H-1]	1.98 E+1	Negl.	1.0 E+7	Negl.
(b-4) Wetwell - Suppression pool and gas space [Figures 6.2-1 and 3H-1]	< 1.4	Negl.	1.7 E+2	Negl.

(1) Operating dose rate is at 100% rated power and away from radiation source.

(2) The doses are based on the radiation sources provided in Chapter 12.

(3) Integrated dose means the integrated value over 60 years.

(4) Negl.- Value less than 0.001 mR/h

Table 3H-6

Radiation Environment Conditions Inside Reactor Building for Normal Operating Conditions

Plant Zone/Typical Equipment	Operating Dose Rate(1)(2)		Integrated Dose(2)(3)	
	Gamma (R/h)	**Beta** (R/h)	**Gamma** (R)	**Beta** (R)
HCU Rooms CRD HCUs [Figure 3H-3]	2.9 E-2	Negl.(4)	1.2 E+4	Negl.
CRD Pump Room CRD high pressure makeup line valves [Figure 3H-4]	5.7 E-3	Negl.	2.4 E+3	Negl.
SLC System Room SLC system valves [Figure 3H-5]	1.1 E-3	Negl.	4.8 E+2	Negl.
Battery Rooms Batteries [Figure 3H-6]	6.9 E-4	Negl.	2.9 E+2	Negl.
Electrical Division Rooms DC power system: battery chargers and electrical modules [Figure 3H-7]	6.9 E-4	Negl.	2.9 E+2	Negl.
UPS AC power system: battery chargers, inverters and electrical modules [Figure 3H-7]	6.9 E-4	Negl.	2.9 E+2	Negl.
RPS [Figure 3H-8]	6.9 E-4	Negl.	2.9 E+2	Negl.
SPTMS [Figure 3H-9]	6.9 E-4	Negl.	2.9 E+2	Negl.
Sensors and electrical modules LD&IS, PRMS, CIS [Figure 3H-10]	1.1 E-3	Negl.	4.8 E+2	Negl.

Table 3H-6

Radiation Environment Conditions Inside Reactor Building for Normal Operating Conditions

Plant Zone/Typical Equipment	Operating Dose Rate(1)(2)		Integrated Dose(2)(3)	
	Gamma (R/h)	Beta (R/h)	Gamma (R)	Beta (R)
Electrical modules NMS, E-DCIS [Figure 3H-11]	6.9 E-4	Negl.	2.9 E+2	Negl.
Isolation valves FAPCS, RCCWS, HPNSS, CIS [Figure 3H-12]	1.15 E-1	Negl.	4.9 E+4	Negl.
RWCU/SDC Isolation and shutoff valves [Figure 3H-12]	1.15 E-1	Negl.	4.9 E+4	Negl.
MS and FW Tunnel MSL isolation valve MSL drain isolation valve Feedwater isolation valve [Figure 3H-13]	1.61 E+1	Negl.	6.8 E+6	Negl.
ICS valves outside containment [Figure 3H-14]	1.13 E-3	Negl.	4.8 E+2	Negl.

(1) Operating dose rate is at 100% rated power and away from radiation source.

(2) The doses are based on the radiation sources provided in Chapter 12.

(3) Integrated dose means the integrated value over 60 years.

(4) Negl.- Value less than 0.001 mR/h

Table 3H-7

Radiation Environment Conditions Inside Control Building for Normal Operating Conditions

Plant Zone/Typical Equipment	Operating Dose Rate(1)(2)		Integrated Dose(2)(3)	
	Gamma (R/h)	**Beta** (R/h)	**Gamma** (R)	**Beta** (R)
Main control room and SSLC panels [Figure 3H-15 and 3H-17]	6.9 E-4	Negl(4).	2.9 E+2	Negl.
Emergency breathing air system [Figure 3H-16]	6.9 E-4	Negl.	2.9 E+2	Negl.

(1) Operating dose rate is at 100% rated power and away from radiation source.

(2) The doses are based on the radiation sources provided in Chapter 12.

(3) Integrated dose means the integrated value over 60 years.

(4) Negl.- Value less than 0.001 mR/h

Table 3H-8

Thermodynamic Environment Conditions Inside Containment Vessel for Accident Conditions

Plant Zone/Typical Equipment						
(a-1 & a-2)	Upper and lower drywell [(1)] [Figure 3H-1]	Time [(2)] Temp. °C (°F) Press. kPa (psig) Humidity %	500 s. 171 (340) 257 (37.3) Steam	1 hr 151 (303) 257 (37.3) Steam	72 hrs 151 (303) 310 (45) Steam	100 days 57 (135) 5.2 (0.75) 50
(a-3)	Wetwell [Figure 3H-1]	Time [(2)] Temp. °C (°F) Press. kPa (psig) Humidity %	500 s 43 (109) 241.3 (35) 100	1 hrs 110 (230) 241.3 (35) 100	72 hrs 110 (230) 310 (45) 100	100 days 43 (110) 4.8 (0.7) 100

Notes:

(1) For a pipe failure inside the containment vessel, water accumulates in the lower drywell. The amount depends upon the break location.

(2) Time denotes the time after the occurrence of LOCA. For example 1 hrs means 1 hours after the occurrence of LOCA and 72 hours means the time from 1 hours to 72 hours after LOCA. The specification of conditions 100 days after a LOCA is consistent with previous BWR and ABWR practice.

Table 3H-9

Thermodynamic Environment Conditions Inside Reactor Building for Accident Conditions

Plant Zone/Typical Equipment			
SLC System Room SLC system valves [Figure 3H-5]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 100
Battery Rooms Batteries [Figure 3H-6]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	 50 (122) Max 0 90 Max	 50 (122) Max 0 90 Max
Electrical Division Rooms DC power system: battery chargers and electrical modules [Figure 3H-7]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	 50 (122) Max 0 90 Max	 50 (122) Max 0 90 Max
UPS AC power system: battery chargers, inverters and electrical modules [Figure 3H-7]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	 50 (122) Max 0 90 Max	 50 (122) Max 0 90 Max
RPS [Figure 3H-8]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	 50 (122) Max 0 90 Max	 50 (122) Max 0 90 Max
SPTMS [Figure 3H-9]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	 50 (122) Max 0 90 Max	 50 (122) Max 0 90 Max
Sensors and electrical modules LD&IS, PRMS, CIS [Figure 3H-10]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 100
Electrical modules NMS, E-DCIS [Figure 3H-11]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 100

Table 3H-9

Thermodynamic Environment Conditions Inside Reactor Building for Accident Conditions

Plant Zone/Typical Equipment			
Isolation valves FAPCS, RCCWS, HPNSS, CIS [Figure 3H-12]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 100
HCU Rooms CRD HCUs [Figure 3H-3]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 90 Max
CRD Pump Room CRD high pressure makeup line valves [Figure 3H-4]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 90 Max
RWCU/SDC Isolation and shutoff valves [Figure 3H-12	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 90 Max
MS and FW Tunnel MSL isolation valve MSL drain isolation valve Feedwater isolation valve [Figure 3H-13]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 90 Max
ICS valves outside containment [Figure 3H-14]	Time * Temp. °C (°F) Press. kPa (psig) Humidity %	12 h 66 (151) 3.43 (0.49) 100	100 days 66 (151) 0 90 Max

* Time indicates the time after the occurrence of LOCA. The specification of conditions 100 days after a LOCA is consistent with previous BWR and ABWR practice.

Table 3H-10

Thermodynamic Environment Conditions Inside Control Room Zone for Accident Conditions

Plant Zone/Typical Equipment			
Control Room Habitability Area Main control room and SSLC panels [Figure 3H-15 and 3H-17]	Time* Temp. °C Press. Pa (psig) Humidity	10 days 30 Max 0 60 Max	100 days 30 max 0 60 Max
Emergency Breathing Air System [Figure 3H-16]	Time* Temp. °C Press. Pa (psig) Humidity	10 days 50 Max 0 90 Max	100 days 50 Max 0 90 Max

* Time indicates the time after the occurrence of LOCA. The specification of conditions 100 days after a LOCA is consistent with previous BWR and ABWR practice.

Table 3H-11

Radiation Environment Conditions Inside Containment Vessel for Accident Conditions

Plant Zone/Typical Equipment	Operating Dose Rate[(1)(2)]		Integrated Dose[(2)(3)]	
	Gamma (R/h)	**Beta** (R/h)	**Gamma** (R)	**Beta** (R)
(b-1) Upper drywell [Figure 3H-1]	2.64 E+7	2.64 E+8	2.64 E+8	2.64 E+9
(b-2) Upper area of lower drywell [Figure 3H-1]	2.64 E+7	2.64 E+8	2.64 E+8	2.64 E+9
(b-3) Lower area of lower drywell [Figure 3H-1]	2.64 E+7	2.64 E+8	2.64 E+8	2.64 E+9
(b-4) Wetwell - Suppression pool and gas space [Figures 6.2-1 and 3H-1]	4.0 E+7	5.3 E+8	4.0 E+8	6.6 E+9

(1) The radiation sources developed in accordance with NUREG-1465 are used.

(2) The gamma and beta doses are bounding values based upon generic design considerations, and are to be revised and/or verified by the COL applicant based upon the site-specific equipment considerations (exact design, specific location, materials of construction and leakage characteristics).

(3) Integrated dose is for 6 months.

Table 3H-12

Radiation Environment Inside Reactor Building for Accident Conditions

Plant Zone/Typical Equipment	Operating Dose Rate$^{(1)(2)}$		Integrated Dose$^{(2)(3)}$	
	Gamma (R/h)	Beta (R/h)	Gamma (R)	Beta (R)
HCU Rooms CRD HCUs [Figure 3H-3]	2.65 E+5	1.3 E+7	8.0 E+7	1.06 E+10
CRD Pump Room CRD high pressure makeup line valves [Figure 3H-4]	2.65 E+5	1.3 E+7	8.0 E+7	1.06 E+10
SLC System Room SLC system valves [Figure 3H-5]	1.1 E+1	2.6 E+2	2.6 E+3	4.0 E+4
Battery Rooms Batteries [Figure 3H-6]	4.0 E0	2.6 E+2	6.6 E+2	6.6 E+4
Electrical Division Rooms DC power system: battery chargers and electrical modules [Figure 3H-7]	4.0 E0	2.6 E+2	6.6 E+2	6.6 E+4
UPS AC power system: battery chargers, inverters and electrical modules [Figure 3H-7]	4.0 E0	2.6 E+2	6.6 E+2	6.6 E+4
RPS [Figure 3H-8]	4.0 E0	2.6 E+2	6.6 E+2	6.6 E+4
SPTMS [Figure 3H-9]	4.0 E0	2.6 E+2	6.6 E+2	6.6 E+4
Sensors and electrical modules LD&IS, PRMS, CIS [Figure 3H-10]	1.1 E+1	2.6 E+2	2.6 E+3	4.0 E+4
Electrical modules NMS, E-DCIS [Figure 3H-11]	4.0	2.6 E+2	6.6 E+2	6.6 E+4

Table 3H-12

Radiation Environment Inside Reactor Building for Accident Conditions

Plant Zone/Typical Equipment	Operating Dose Rate(1)(2)		Integrated Dose(2)(3)	
	Gamma (R/h)	**Beta** (R/h)	**Gamma** (R)	**Beta** (R)
Isolation valves FAPCS, RCCWS, HPNSS, CIS [Figure 3H-12]	2.6 E+5	1.3 E+7	8.0 E+7	1.0 E+10
RWCU/SDC Isolation and shutoff valves [Figure 3H-12]	2.6 E+5	1.3 E+7	8.0 E+7	1.0 E+10
MS and FW Tunnel MSL isolation valve MSL drain isolation valve Feedwater isolation valve [Figure 3H-13]	1.2 E+2	9.2 E+2	2.6 E+2	1.2 E+3
ICS valves outside containment [Figure 3H-14]	1.1 E+1	2.6 E+2	2.6 E+3	4.0 E+4

(1) The radiation sources developed in accordance with NUREG-1465 are used.

(2) The gamma and beta doses are bounding values based upon generic design considerations, and are to be revised and/or verified by the COL applicant based upon the site-specific equipment considerations (exact design, specific location, materials of construction and leakage characteristics).

(3) Integrated dose is for 6 months.

Table 3H-13

Radiation Environment Conditions Inside Control Room Zone for Accident Conditions

Plant Zone/Typical Equipment	LOCA[1][2]		Integrated Dose[2][3]	
	Gamma (R/h)	**Beta** (R/h)	**Gamma** (R)	**Beta** (R)
Sealed Emergency Operating Area Main control room and SSLC panels [Figure 3H-15 and 3H-17]	4.0 E-2	5.0 E-1	5.3 E0	9.2 E+1
Emergency Breathing Air System [Figure 3H-16]	4.0 E-2	5.0 E-1	5.3 E0	9.2 E+1

(1) The radiation sources developed in accordance with NUREG-1465 are used.

(2) The gamma and beta doses are bounding values based upon generic design considerations, and are to be revised and/or verified by the COL applicant based upon the site-specific equipment considerations (exact design, specific location, materials of construction and leakage characteristics).

(3) Integrated dose is for 6 months.

Figure 3H-1. Environmental Zones in the Containment Vessel

Figure 3H-2. Reactor Building Arrangements

Figure 3H-3. HCU Rooms

Figure 3H-4. CRD Pump Room

Figure 3H-5. SLC System Room

Figure 3H-6. Battery Rooms

Figure 3H-7. Electrical Division Rooms

Figure 3H-8. RPS Arrangement

Figure 3H-9. SPTMS Arrangement

Figure 3H-10. Sensors & Electrical Modules Arrangements For LD&IS, PRMS, CMS

Figure 3H-11. Electrical Modules Arrangements For NMS, E-DCIS

Figure 3H-12. Isolation & Shutoff Valves Arrangements For RWCU/SDC

Figure 3H-13. MS and FW Tunnel Isolation Valve Arrangements

Figure 3H-14. ICS Condenser and Piping Arrangement Outside Containment

Figure 3H-15. Main Control Room Panel Arrangement

Figure 3H-16. Emergency Breathing Air System Arrangement

Figure 3H-17. 1E DCIS Rooms Arrangement

{{{Security-Related Information - Withheld Under 10 CFR 2.390}}}

3I. DESIGNATED NEDE-24326-1-P MATERIAL WHICH MAY NOT CHANGE WITHOUT PRIOR NRC APPROVAL

This appendix presents the necessary NEDE-24326-1-P (Reference 3I-1), "General Electric Environmental Qualification Program," material for *identifying the material, by italics, which shall not be changed without prior NRC approval*. (See Section 3.10.)

3I.1 GENERAL REQUIREMENTS FOR DYNAMIC TESTING

(Paragraph 4.4.2.5.1 of Ref. 3I-1)

(a) ***Mounting** – Specimens to be tested will be mounted in a manner that adequately simulates the installed configuration or as described in the applicable GE mounting documentation.* Mounting will be specified in the Product Performance Qualification Specification (PPQS).

(b) ***Monitoring** – Sufficient monitoring equipment will be used to evaluate the performance of the specimen before, during, and after the test. Monitoring product is used to allow determination of applied vibration levels and equipment responses. The location of monitoring sensors* shall be specified by the PPQS and *will be documented in the test report.*

When required by the PPQS, *the response of the product will be measured using accelerometers. When required* by the PPQS, *the accelerometers shall be located at a sufficient number of locations on the product to define the mode shapes and/or frequencies which would be required to allow dynamic qualification of individual safety-related components and devices, to support analytical extrapolation of test results, or to verify frequency requirements.*

(c) ***Exploratory Tests** – Exploratory vibration tests may be performed on the product to aid in the determination of the test method that will best qualify or determine the dynamic characteristics of the product. If it can be shown that the equipment is not resonant at any frequency within the expected frequency range, it may be considered a rigid body and tested according to methods and procedures discussed in Subsection 4.4.2.5.6 of Reference 3I-1 or analyzed according to the methods of Subsection 4.4.4.1.4.5 of Reference 3I-1.*

If the product contains a single resonance or multiple resonances, one of the methods outlined in Subsection 4.4.2.5.3 of Reference 3I-1 will be used to qualify the product by test.

The exploratory test may be performed in the form of a low-level, continuous sinusoidal sweep at a rate no greater than 2 octave per minute over the frequency range equal to or greater than that to which the equipment is to be qualified. All resonances will be recorded for use in determining the test method to be used or the dynamic characteristics of the equipment. If the configuration of the product is such that critical natural frequencies cannot be ascertained, dynamic qualification will be accomplished by testing by the Response Spectrum method as specified in Paragraph 4.4.2.5.3.6 of Reference 3I-1. An acceptable alternative qualification method is a fragility test as described in Subsection 4.4.2.5.7 of Reference 3I-1.

(d) ***Dynamic Event Aging Tests*** *– The dynamic tests simulate the effect of low level earthquake loads combined with Service Level B RBV dynamic loads. The dynamic tests are performed on aged products unless otherwise justified.* (See Section 3.10)

The test sequence to be used will be:

(1) Vibration aging (if required);

(2) Low level earthquake loads combined with Service level B RBV dynamic loads; and

(3) SSE loads combined with Service level D RBV dynamic loads

Because most testing is biaxial rather than triaxial, the above sequence and durations are applied twice with the equipment being rotated 90 degrees on the table between the two tests. (See Section 3.10)

The Test Response Spectra (TRS) will envelop the RRS as specified in 4.2.2.a(6) of Reference 3I-1. (See Section 3.10)

(e) ***Loading*** *– Dynamic tests will be performed with the product subjected to nominal operating service conditions. If significant, normal operating loads such as electrical, mechanical, pressure, and thermal will be included. Where normal operating loads cannot be included in the dynamic tests, supplemental analysis will be used to qualify the product for those effects*. (See Section 3.10)

3I.2 PRODUCT AND ASSEMBLY TESTING

(Paragraph 4.4.2.5.2 of Ref. 3I-1)

(a) *Products will be tested simulating nominal operating conditions. In addition, dynamic coupling between interacting equipment will be considered*. See Section 3.10. The product shall be mounted on the shaker table as stated in Paragraph 4.4.2.5.1(a) of Reference 3I-1. If the product is intended to be mounted on a panel, the panel will be included in the test mounting.

Alternatively, the response at the product mounting location may be measured in the assembly test as specified in Paragraph 4.4.2.5.1(a) of Reference 3I-1. Then the product will be mounted directly to the shaker table, with the dynamic input being that which was determined at the product mounting location.

3I.3 MULTIPLE-FREQUENCY TESTS

(Paragraph 4.4.2.5.3 of Ref. 3I-1)

(a) ***General*** *– When the dynamic ground motion has not been strongly filtered, the mounting location retains the broadband characteristics. In this case, multi-frequency testing is applicable to dynamic qualification.* (See Section 3.10)

(b) **Response Spectrum Test** – Testing shall be performed by applying artificially generated input excitation to the product, the amplitude of which is controlled in 1/3 octave or narrower bands. *The excitation will be controlled to provide a test response spectrum (TRS) which meets or exceeds the required response spectrum (RRS). The peak value of the input excitation equals or exceeds the zero period acceleration (ZPA) of the RRS*. (See Section 3.10)

3I.4 SINGLE- AND MULTI-AXIS TESTS

(Paragraph 4.4.2.5.4 of Ref. 3I-1)

Single-axis tests may be allowed if the tests are designed to conservatively reflect the dynamic event at the equipment mounting locations or if the product being tested can be shown to respond independently in each of the three orthogonal axis or otherwise withstand the dynamic event at its mounting location.

If the preceding considerations do not apply, multi-axis testing will be used. The minimum is biaxial testing with simultaneous inputs in a principal horizontal axis and the vertical axis. Independent random inputs are preferred, and, if used, the test will be performed in two steps with the equipment rotated 90° in the horizontal plane for the second step. If independent random inputs are not used (such as with single frequency tests), four tests would be run; first, with the inputs in phase; second, with one input 180° out of phase; third, with the equipment rotated 90° horizontally and the inputs in phase; and, finally, with the same equipment orientation as in the third step but with one input 180° out of phase. (See Section 3.10)

3I.5 SINGLE FREQUENCY TESTS

(Paragraph 4.4.2.5.6 of Ref. 3I-1)

If it can be shown that the products, as defined in Regulatory Guide 1.92 have no resonances, or only one resonance, or if resonances are widely spaced and do not interact to reduce the fragility level in the frequency range of interest or, if otherwise justified, single frequency tests may be used to fully test the product. (See Section 3.10)

3I.6 DAMPING

(Paragraph 4.4.2.5.7 of Ref. 3I-1)

The product damping value used for dynamic qualification shall be established. See (Reference 3I-1) Section 5 of IEEE-344. (Also see Subsections 3.9.2.2, 3.9.3, and Section 3.10)

3I.7 QUALIFICATION DETERMINATION

(Paragraph 4.4.3.3 of Ref. 3I-1)

In order for equipment to be qualified by reason of operating experience, documented data will be available confirming that the following criteria have been met:

(a) the product providing the operating experience is identical or justifiably similar to the equipment to be qualified;

(b) the product providing the operating experience has operated under service conditions which equal or exceed, in severity, the service conditions and performance requirements for which the product is to be qualified; and

(c) the installed product must, in general, be removed from service and subjected to partial type testing to include the dynamic and design basis event environments for which the product is to be qualified. (See Section 3.10)

3I.8 DYNAMIC QUALIFICATION BY ANALYSIS

(Paragraph 4.4.4.1.4 of Ref. 3I-1)

(a) The analytical procedures described in this section may be used for dynamic qualification of products.

(b) Many factors control the design of a qualification program. Paragraphs 4.2.2.c(3) and 4.2.2.d(1) of Reference 3I-1 provide general guidelines on dynamic analysis techniques. Analytical techniques and modeling assumptions will, when possible, be based on a correlation of the analytical approach with testing or operating experience performed on similar equipment or structures. *Analysis may be used as a qualification method for the following conditions:*

(1) *if maintaining structural integrity is the only required assurance of the safety function* (see Section 3.10);

(2) if the response of the equipment is linear or has a simple nonlinear behavior which can be predicted by conservative analytical methods; or

(3) if the product is too large to test.

3I.9 REQUIRED RESPONSE SPECTRA

(Paragraph 4.4.4.1.4.6.2 of Ref. 3I-1)

(a) *The required response spectra that define the dynamic criteria for the location(s) of the product under consideration are to be given in the PPQS. If the equipment under consideration is attached to the structural system at more than one location, then the dynamic analysis performed takes into consideration the different response spectra at the different support locations. The effect of multiple support attachment points or multiple locations of the particular product can also be accounted for by selecting a single spectrum which will effectively produce the critical maximum responses due to different accelerations existing at different points.* (See Section 3.10.) This may be conservatively accomplished by enveloping the response spectra for the different applicable locations.

Alternatively, actual multi-support excitation effects may be taken into account by performing a multi-support excitation analysis.

3I.10 TIME HISTORY ANALYSIS

(Paragraph 4.4.4.1.4.6.3 of Ref. 3I-1)

Time history analysis will be performed when conditions arise invalidating the response spectrum method of analysis due to nonlinear phenomena, or when generation of in-equipment response spectra or a more exact result is desired. To integrate or differentiate, the analysis will be done by an applicable numerical integration technique. The largest time step used in the analysis will be 1/10 of the period of the highest significant mode of vibration of the equipment. *The dynamic input will be the time history motion at the equipment support location.* (See Section 3.10.) For products supported at several locations, the responses will be determined by simultaneous excitations using appropriate time history input at each support location. The scaled time interval will be varied as per Paragraph 4.4.2.a(6) of Reference 3I-1.

If the product frequency is within the range of the supporting structure, then a time interval will be chosen such that the peak of the response spectrum shall be at the product resonance frequency. The total time interval range will be provided with the time history.

3I.11 REFERENCES

3I-1 GE Nuclear Energy, "General Electric Environmental Qualification Program," NEDE-24326-1-P, Proprietary Document, January 1983.

3J. EVALUATION OF POSTULATED RUPTURES IN HIGH ENERGY PIPES

3J.1 BACKGROUND AND SCOPE

The need for an evaluation of the dynamic effects of fluid dynamic forces resulting from postulated ruptures in high energy piping systems is included by Standard Review Plan (SRP) Sections 3.6.1 and 3.6.2. The criteria for performing this evaluation is defined in Subsections 3.6.1 and 3.6.2, SRP Sections 3.6.1 and 3.6.2 and ANS 58.2.

This Appendix defines an acceptable procedure for performing these evaluations. The procedure is based on use of analytical methodology, computer programs and pipe whip restraints used by GE, but it is intended to be applicable to other computer programs and to pipe whip restraints of alternate design. Applicability of alternate programs will be justified by the Combined Operating License (COL) applicant.

The evaluation is performed in four major steps:

(1) Identify the location of the postulated rupture and whether the rupture is postulated as circumferential or longitudinal.

(2) Select the type and location of the pipe whip restraints.

(3) Perform a complete system dynamic analysis or a simplified dynamic analysis of the ruptured pipe and its pipe whip restraints to determine the total movement of the ruptured pipe, the loads on the pipe, strains in the pipe whip restraint, and the stresses in the penetration pipe.

(4) Evaluate safety-related equipment that may be impacted by the ruptured pipe or the target of the pipe rupture jet impingement.

The criteria for locations where pipe ruptures must be postulated and the criteria for defining the configuration of the pipe rupture are defined in Subsection 3.6.2. Also defined in Subsection 3.6.2 are:

- the fluid forces acting at the rupture location and in the various segments of the ruptured pipe, and
- the jet impingement effects including jet shape and direction and jet impingement load.

The high energy fluid systems are defined within Subsection 3.6.2.1, and identified in Tables 3.6-3 and 3.6-4. Safety-related systems, components and equipments, or portions thereof, specified in Tables 3.6-1 and 3.6-2, are to be protected from pipe break effects, which would impair their ability to facilitate safe shutdown of the plant.

The information contained in Subsections 3.6.1 and 3.6.2 and in the SRPs and ANS 58.2 is not repeated in this appendix.

3J.2 IDENTIFICATION OF RUPTURE LOCATIONS AND RUPTURE GEOMETRY

3J.2.1 Ruptures in Containment Penetration Area.

Postulation of pipe ruptures in the portion of piping in the containment penetration area is not allowed. This includes the piping between the inner and outer isolation valves. Therefore, examine the final stress analysis of the piping system and confirm that, for piping in containment penetration areas, the design stress and fatigue limits specified within Subsection 3.6.2.1 are not exceeded.

3J.2.2 Ruptures in Areas other than Containment Penetration.

Postulate breaks in Class 1 piping in accordance with Subsection 3.6.2.1.1.

Postulate breaks in Classes 2 and 3 piping in accordance with Subsection 3.6.2.1.1.

Postulate breaks in seismically analyzed non-ASME Class piping in accordance with the above requirements for Classes 2 and 3 piping.

3J.2.3 Determine the Type of Pipe Break

Determine whether the high energy line break is longitudinal or circumferential in accordance with Subsection 3.6.2.1.3.

3J.3 DESIGN AND SELECTION OF PIPE WHIP RESTRAINTS

3J.3.1 Make Preliminary Selection of Pipe Whip Restraint

The load carrying capability of the GE U-Bar pipe whip restraint is determined by the number, size, bend radius and the straight length of the U-bars. The pipe whip restraint must resist the thrust force at the pipe rupture location and the impact force of the pipe. The magnitude of these forces is a function of the pipe size, fluid, and operating pressure.

A preliminary selection of one of the standard GE pipe whip restraints is made by matching the thrust force at the rupture location with a pipe whip restraint capable of resisting this thrust force. This is done by access to the large database contained in the GE REDEP computer file. This file correlates the pipe size and the resulting thrust force at the pipe rupture with the U-bar pipe whip restraints designed to carry the thrust force. REDEP then supplies the force/deflection data for each pipe whip restraint.

3J.3.2 Prepare Simplified Computer Model of Piping-Pipe Whip Restraint System.

Prepare a simplified computer model of piping system as described in Subsection 3J.4.2.1 and as shown in Figure 3J-1 and Figure 3J-2. Critical variables are length of pipe, type of end condition, distance of pipe from structure and location of the pipe whip restraint. Locate the pipe whip restraint as near as practical to the ruptured end of the pipe but establish location to minimize interference to inservice inspection.

3J.3.3 Run Pipe Dynamic Analysis

Run the Pipe Dynamic Analysis (PDA) computer program using the following input.

- The information from the simplified piping model, including pipe length, diameter, wall thickness and pipe whip restraint location.
- Piping information such as pipe material type, stress/strain curve and pipe material mechanical properties.
- Pipe whip restraint properties such as force-deflection data and elastic plastic displacements.
- Force time-history of the thrust at the pipe rupture location.

3J.3.4 Select Pipe Whip Restraint for Pipe Whip Restraint Analysis

PDA provides displacements of pipe and pipe whip restraint, pipe whip U-bar strains, pipe forces and moments at fixed end, time at peak load and lapsed time to achieve steady state using thrust load and pipe characteristics.

Check displacements at the pipe broken end and at the pipe whip restraint and compare loads on the piping and strains of pipe whip restraint U-bars with allowable loads and strains. If not satisfied with output results rerun PDA with different pipe whip restraint parameters.

3J.4 PIPE RUPTURE EVALUATION

3J.4.1 General Approach

There are several analytical approaches, which may be used in analyzing the pipe/pipe whip restraint system for the effects of pipe rupture. This procedure defines two acceptable approaches.

(1) **Dynamic Time-History Analysis With Simplified Model** - A dynamic time history analysis of a portion of a piping system may be performed in lieu of a complete system analysis when it can be shown to be conservative by test data or by comparison with a more complete system analysis. For example, in those cases where pipe stresses in the containment penetration region need not be calculated, it is acceptable to model only a portion of the piping system as a simple cantilever with a fixed or pinned end or as a beam with both ends fixed or with one end pinned and one end fixed.

When a circumferential break is postulated, the pipe system is modeled as a simple cantilever, the thrust load is applied opposite the fixed (or pinned) end and the pipe whip restraint acts between the fixed (or pinned) end and the thrust load. It is then assumed that deflection of the pipe is in one plane. As the pipe moves a resisting bending moment in the pipe is created and later a restraining force at the pipe whip restraint. Pipe movement stops when the resisting moments about the fixed (or pinned) end exceed the applied thrust moment.

When a longitudinal break is postulated, the pipe system has both ends supported. To analyze this case, two simplifications are made to allow the use of the cantilever model described above. First, an equivalent point mass is assumed to exist at D (Figure 3J-2) instead of pipe length DE. The inertia characteristics of this mass, as it rotates about point B, are calculated to be identical to those of pipe length DE, as it rotates about point E. Second, an equivalent resisting force is calculated (from the bending moment-angular deflection relationships for end DE) for any deflection for the case of a built-in end. This equivalent force is subtracted from the applied thrust force when calculating the net energy.

See Figure 3J-1 and Figure 3J-2 for the models described above.

(2) **Dynamic Time-History Analysis with Detailed Piping Model**—In many cases it is necessary to calculate stresses in the ruptured pipe at locations remote from the pipe whip restraint location. For example, the pipe in the containment penetration area must meet the limits of SRP 3.6.2. In these cases it is required that the ruptured piping, the pipe supports, and the pipe whip restraints be modeled in sufficient detail to reflect their dynamic characteristics. A time-history analysis using the fluid forcing functions at the point of rupture and the fluid forcing functions of each pipe segment is performed to determine deflections, strains, loads to structure and equipment and pipe stresses.

3J.4.2 Procedure For Dynamic Time-History Analysis With Simplified Model

3J.4.2.1 Modeling of Piping System

For many piping systems, required information on the response to a postulated pipe rupture can be determined by modeling a portion of the piping system as a cantilever with either a fixed or pinned end. The fixed end model, as shown in Figure 3J-1, is used for piping systems where the stiffness of the piping segment located between A and B is such that the slope of the pipe length, BD, at B, would be approximately zero. The pinned end model, as shown in Figure 3J-1, is used for piping systems where the slope of the pipe length, BD, at B, is much greater than zero. The pinned end model is also used whenever it is not clear that the pipe end is fixed.

A simplified cantilever model may also be used for a postulated longitudinal break in a pipe supported at both ends, as shown in Figure 3J-2. The pipe can have both ends fixed or have pinned end at B and a fixed end at E, as shown in Figure 3J-2. Subsection 3J.4.1(1) discusses the simplification techniques used to allow the use of a cantilever model. A fixed end is used when rotational stiffness of the piping at that location is such that the slope of the pipe at that end is approximately zero. A pinned end is used when the pipe slope at that end is much greater than zero. If it is not clear whether an end is fixed or pinned, the end condition giving more conservative results should be assumed.

The pipe whip restraint is modeled as two components acting in series; the restraint itself and the structure to which the restraint is attached. The restraint and piping behave as determined by an experimentally or analytically determined force-deflection relationship. The structure deflects as a simple linear spring of representative spring constant.

The model must account for the maximum clearance between the restraint and the piping. The clearance is equal to the maximum distance from the pipe during normal operation to the position of the pipe when the pipe whip restraint starts picking up the rupture load. This simplified model is not used if the piping has snubbers or restraints strong enough to affect the pipe movement following a postulated rupture.

3J.4.2.2 Dynamic Analysis of Simplified Piping Model

When the thrust force (as defined in Subsection 3.6.2.2) is applied at the end of the pipe, rotational acceleration would occur about the fixed (or pinned) end. As the pipe moves, the net rotational acceleration would be reduced by the resisting bending moment at the fixed end and by the application of the restraining force at the pipe whip restraint. The kinetic energy would be absorbed by the deflection of the restraint and the bending of the pipe. Movement would continue until equilibrium is reached. The primary acceptance criteria is the pipe whip restraint deflection or strain must not exceed the design strain limit of 50% of the restraint material ultimate uniform strain capacity.

The analysis may be performed by a general purpose computer program with capability for nonlinear time-history analysis such as ANSYS, or by a special purpose computer program especially written for pipe rupture analysis such as the GE computer program, "Pipe Dynamic Analysis".

3J.4.3 Procedure For Dynamic Time-History Analysis Using Detailed Piping Model

3J.4.3.1 Modeling of Piping System

In general, the rules for modeling the ruptured piping system are the same as the modeling rules followed when performing seismic/dynamic analysis of Seismic Category I piping. These rules are outlined in Subsection 3.7.3.3. The piping, pipe supports and pipe whip restraints are modeled in sufficient detail to reflect their dynamic characteristics. Inertia and stiffness effects of the system and gaps between piping and the restraints must be included.

If the snubbers or other seismic restraints are included in the piping model they should be modeled with the same stiffness used in the seismic analysis of the pipe. However, credit for seismic restraints cannot be taken if the applied load exceeds the Level D rating.

The pipe whip restraints are modeled the same as for the simplified model described in Subsection 3J.4.2.1. For piping designed with the GE U-Bar pipe whip restraints, the selected size and dimensions, and the resulting force-deflection and elastic/plastic stiffness is first determined according to the procedure previously defined in Section 3J.3.

3J.4.3.2 Dynamic Analysis using Detail Piping Model

The pipe break nonlinear time-history analysis can be performed by ANSYS or other NRC approved non-linear computer programs. The force time histories acting at the break location and in each of the segments of the ruptured pipe are determined according to the criteria defined in ANS 58.2. The time step used in the analysis must be sufficiently short to obtain convergence of the solution. (GE has shown that for a rupture of the main steam pipe a time step of 0.001 second is adequate for convergence.) The analysis must not stop until the peaks of the dynamic load and the pipe response are over.

The primary acceptance criteria are:

- The piping stresses between the primary containment isolation valves are within the allowable limits specified in Subsection 3.6.2.1.

- The pipe whip restraint loads and displacements due to the postulated break are within the design limits.
- Specified allowable loads on safety-related valves or equipment to which the ruptured piping is attached are not exceeded.

3J.5 JET IMPINGEMENT ON ESSENTIAL PIPING

Postulated pipe ruptures result in a jet of fluid emanating from the rupture point. Safety-related systems and components require protection if they are not designed to withstand the results of the impingement of this jet. Subsection 3.6.2.3.1 provides the criteria and procedure for:

(1) defining the jet shape and direction;

(2) defining the jet impingement load, temperature and impingement location; and

(3) analysis to determine effects of jet impingement on safety-related equipment.

The paragraphs below provide some additional criteria and procedure for the analysis required to determine the effects of jet impingement on piping.

- Jet impingement is a faulted load and the primary stresses it produces in the piping must be combined with the stresses caused by SSE to meet the faulted stress limits for the designated ASME class of piping.
- If a pipe is subjected to more than one jet impingement load, each jet impingement load is applied independently to the piping system and the load which supplies the largest bending moment at each node is used for evaluation.
- A jet impingement load may be characterized as a two part load applied to the piping system—a dynamic portion when the applied force varies with time and a static portion which is considered steady state.

For the dynamic load portion, when static analysis methods are used, apply a dynamic load factor of 2. Snubbers are assumed to be activated. Stresses produced by the dynamic load portion are combined by SRSS with primary stresses produced by SSE.

For the static load portion, snubbers are not activated and stresses are combined with SSE stresses by absolute sum.

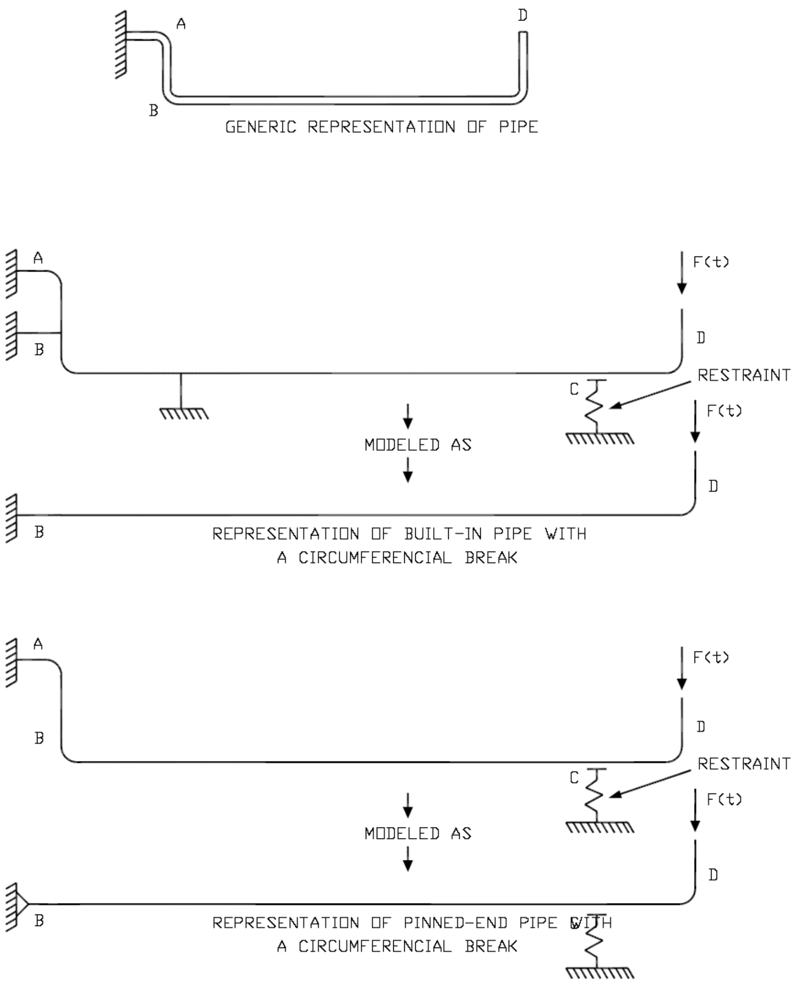


Figure 3J-1. Simplified Piping Models

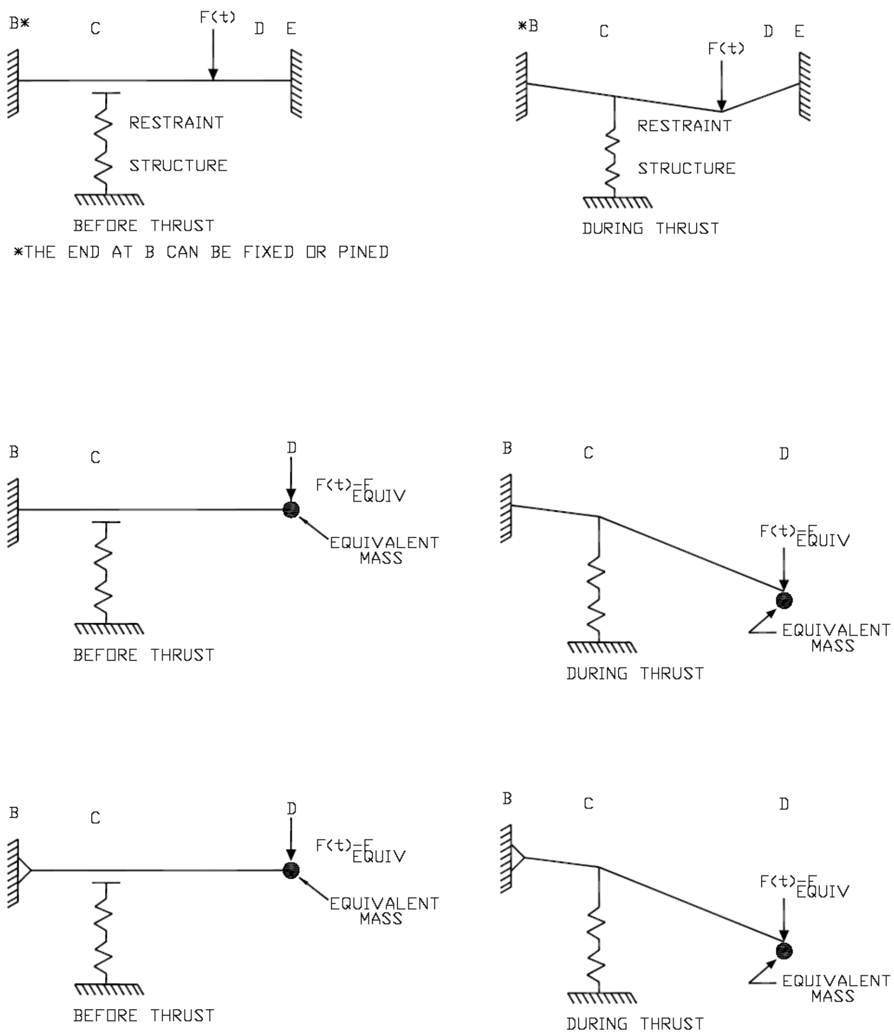


Figure 3J-2. Representation of Pipe With Both Ends Supported With a Longitudinal Break

3K. RESOLUTION OF INTERSYSTEM LOSS OF COOLANT ACCIDENT

3K.1 INTRODUCTION

An Intersystem Loss of Coolant Accident (ISLOCA) is postulated to occur when a series of failures or inadvertent actions occur that allow the high pressure from one system to be applied to the low design pressure of another system, which could potentially rupture the pipe and release coolant from the reactor system pressure boundary. This may also occur within the high and low pressure portions of a single system. Future advanced light water reactor (ALWR) designs like the ESBWR are expected to reduce the possibility of a LOCA outside the containment by designing to the extent practicable all piping systems, major system components (pumps and valves), and subsystems connected to the reactor coolant pressure boundary (RCPB) to an ultimate rupture strength at least equal to the full RCPB pressure. The general Ultimate Rupture Strength (URS) criteria was recommended by the Reference 1 and the NRC Staff recommended specific ultimate rupture strength design characteristics by Reference 2.

3K.2 REGULATORY POSITIONS

In SECY-90-016 and SECY-93-087 (References 3 and 4), the NRC staff resolved the ISLOCA issue for advanced light water reactor plants by requiring that low-pressure piping systems that interface with the reactor coolant pressure boundary be designed to withstand reactor pressure to the extent practicable. However, the staff believes that for those systems that have not been designed to withstand full reactor pressure, evolutionary ALWRs should provide (1) the capability for leak testing the pressure isolation valves, (2) valve position indication that is available in the control room when isolation valve operators are de-energized and (3) high-pressure alarms to warn main control room operators when rising reactor pressure approaches the design pressure of attached low-pressure systems or when both isolation valves are not closed. The staff noted that for some low-pressure systems attached to the RCPB, it may not be practical or necessary to provide a higher system ultimate pressure capability for the entire low-pressure connected system. The staff will evaluate such exceptions on a case-by-case basis during specific design certification reviews.

GE provided a proposed implementation of the issue resolution for the ABWR in Reference 5 and again in Reference 6. The staff in the Civil Engineering and Geosciences Branch of the Division of Engineering completed its evaluation of the Reference 5 proposal. Specifically, as reported by Reference 2 and summarized below, the staff has evaluated the minimum pressure for which low-pressure systems should be designed to ensure reasonable protection against burst failure should the low-pressure system be subjected to full RCPB pressure.

The design pressure for the low-pressure piping systems that interface with the RCPB should be equal to 0.4 times the normal operating RCPB pressure, the minimum wall thickness of low-pressure piping should be no less than that of a standard weight pipe, and that Class 300 valves are adequate. The design is to be in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Subarticle NC/ND-3600. Furthermore, the staff will continue to require periodic surveillance and leak rate testing of the pressure isolation valves via Technical Specifications, as a part of the ISI program.

The periodic surveillance and leak rate testing requirements for high-pressure to low-pressure isolation valves are not applicable to the ESBWR, because, as shown in this appendix, the ESBWR design does not contain a pressure isolation valve between the reactor coolant pressure boundary and a low pressure piping system.

3K.3 BOUNDARY LIMITS OF ULTIMATE RUPTURE STRENGTH

Guidance given by Reference 3 provides provision for applying practical considerations for the extent to which systems are upgraded to the ultimate rupture strength design pressure. The following items form the basis of what constitutes practicality and set forth the test of practicality used to establish the boundary limits of ultimate rupture strength for the ESBWR:

- It is impractical to consider a disruptive open flow path from reactor pressure to a low pressure sink. A key assumption to understanding the establishment of the boundary limits from this practicality basis is that only static pressure conditions are considered. Static conditions are assumed when the valve adjacent to a low pressure sink remains closed. Thus, the dynamic pressurization effects accompanied by violent high flow transients and temperature escalations are precluded that would occur if the full RCPB pressure was connected directly to the low pressure sink. As a consequence, the furthest downstream valve in such a path is assumed closed so that essentially all of the static reactor pressure is contained by the ultimate rupture strength upgraded region.
- It is impractical to design or construct large tank structures to the ultimate rupture strength design pressure that are vented to atmosphere and have a low design pressure.
- It is impractical to design piping systems that are connected to low pressure sink features to the ultimate rupture strength design pressure when the piping is always locked open to a low pressure sink by locked open valves. These piping sections are extensions of the low pressure sink and need no greater design pressure than the low pressure sink to which they are connected.

3K.4 EVALUATION PROCEDURE

The pressures of each system piping boundary on the ESBWR system drawings were reviewed to identify where changes were needed to provide ultimate rupture strength protection. Where low pressure piping interfaces with higher pressure piping connected to piping with reactor coolant at reactor pressure, design pressure values are at least rated to the ultimate rupture strength design pressure. The low pressure piping boundaries were upgraded to ultimate rupture strength pressures and extend to the last closed valve connected to piping interfacing a low pressure sink.

3K.5 SYSTEMS EVALUATED

The following systems, interfacing directly with the RCPB, were evaluated.

- Control Rod Drive (CRD) system — Section 4.6
- Standby Liquid Control (SLC) system — Section 9.3
- Reactor Water Cleanup/Shutdown Cooling (RWCU/SDC) system — Section 5.4
- Fuel and Auxiliary Pools Cooling System (FAPCS) — Section 9.1

- Nuclear Boiler System (NBS) Section 5.1
- Condensate and Feedwater System (C&FS) Section 10.4

Attachment 3KA contains a system-by-system evaluation of potential reactor pressure application to piping and components, discussing the ultimate rupture strength boundary and listing the upgraded components. For some systems, certain regions of piping and components not upgraded are also listed.

3K.6 PIPING DESIGN PRESSURE FOR ULTIMATE RUPTURE STRENGTH COMPLIANCE

Guidelines for ultimate rupture strength compliance were established by Reference 2, which concluded that for the ESBWR:

- The design pressure for the low-pressure piping systems that interface with the RCPB pressure boundary should be equal to 0.4 times the normal operating RCPB pressure, and
- The minimum wall thickness of the low-pressure piping should be no less than that of a standard weight pipe.

3K.7 APPLICABILITY OF ULTIMATE RUPTURE STRENGTH NON-PIPING COMPONENTS

Reference 2 also provided the NRC Staff's position that:

(1) The remaining components in the low-pressure systems should also be designed to a design pressure of 0.4 times the normal operating reactor pressure. This is accomplished in DCD by the revised boundary symbols on system design drawings to the design pressure, which includes the piping and components associated with the boundary symbols. A stated parameter (e.g., design pressure) of a boundary symbol on the system design drawing applies to the piping and components that extend away from the boundary symbol, including along any branch line, until another boundary symbol occurs on the drawing. The components include flanges, and pump seals, etc.

(2) A Class 300 valve is adequate for ensuring the pressure of the low-pressure piping system under full reactor pressure. The rated working pressure for Class 300 valves varies widely depending on material and temperature (ASME/ANSI B16.34).

3K.8 RESULTS

The results of this work are incorporated into the ESBWR system drawings.

3K.9 VALVE MISALIGNMENT DUE TO OPERATOR ERROR

The ESBWR design with the ISLOCA ultimate rupture strength applied for the boundary described by this appendix and its attachment, has extended the increased design pressure (ultimate rupture strength) over the full extent of regions that could potentially experience reactor pressure, so that operator misaligned valves will not expose piping to reactor pressure not designed to the ultimate rupture strength pressure.

3K.10 SUMMARY

Based on the NRC staff's new guidance cited in References 1 through 4, the ESBWR is in full compliance. For ISLOCA considerations, a design pressure of at least the ultimate rupture strength design pressure and pipe having a minimum wall thickness equal to standard grade has been provided as an adequate margin with respect to the full reactor operating pressure, by applying the guidance recommended by Reference 2. This design pressure was applied to the low pressure piping at their boundary symbols on the system drawings, therefore, imposes the requirement on the associated piping, valves, pumps, tanks, instrumentation and other equipment shown between boundary symbols. Notes were added to each ultimate rupture strength upgraded drawing, requiring pipe to have a minimum wall thickness equal to standard grade and requiring valves with a design pressure of at least the ultimate rupture strength design pressure to be a minimum of Class 300.

3K.11 REFERENCES

3K-1 USNRC, Dino Scaletti, NRC, to Patrick Marriott, “GE, Identification of New Issues for the General Electric Company Advanced Boiling Water Reactor Review,” September 6, 1991.

3K-2 Chester Poslusny, NRC, to Patrick Marriott, “GE, Preliminary Evaluation of the Resolution of the Intersystem Loss-of-Coolant Accident (ISLOCA) Issue for the Advanced Boiling Water Reactor (ABWR) - Design Pressure for Low-Pressure Systems,” December 2, 1992, Docket No. 52-001.

3K-3 James M. Taylor, NRC, to The Commissioners, SECY-90-016, “Evolutionary Light Water Reactor (LWR) Certification Issues and Their Relationship to Current Regulatory Requirements,” January 12, 1990.

3K-4 James M. Taylor, NRC, to The Commissioners, SECY-93-087, “Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs,” April 2, l993.

3K-5 Jack Fox, GE, to Chet Poslusny, NRC, “Proposed Resolution of ISLOCA Issue for ABWR,” October 8, 1992.

3K-6 Jack Fox, GE, to Chet Poslusny, NRC, “Resolution of Intersystem Loss of Coolant Accident for ABWR,” April 30, 1993.

ATTACHMENT 3KA. ULTIMATE RUPTURE STRENGTH SYSTEM BOUNDARY EVALUATION

3KA.1 CONTROL ROD DRIVE SYSTEM

3KA.1.1 System URS Boundary Description

The Control Rod Drive (CRD) system interfaces with the reactor in a manner that makes low pressure piping over pressurization very unlikely. The minimum failure path from the reactor to the low pressure piping has three check valves in series and the second check valve is 12.7 mm in size. This path is from the purge flow channels of the CRD, out through the first check valve in the CRD housing, through the purge supply line that has the second 12.7 mm check valve, and to the pump discharge check valve. An alternate path through the accumulator charging line has additionally the normally closed scram valve, and this path is less likely for failure, therefore not considered. The path from the pump discharge, back through the pump to its suction, and back through the suction lines to the condensate storage tank or the condensate feedwater source is an open path. The open pump suction pipeline is a minimum 100 mm diameter through the pump suction filters in the normal mode of operation, and 200 mm diameter when the suction filter bypass lines are open during the reactor high pressure makeup mode of operation. The CRD pumps run continuously while the reactor is at operating pressure, which prevents reactor pressure from reaching the low pressure piping except for the unlikely case when both CRD pumps have failed. Therefore, an ISLOCA condition from a 12.7 mm diameter source could only occur when three check valves in series fail open at the same time both CRD pumps have failed. The ISLOCA guidelines do not provide credit for this rare condition, so the low pressure piping has been upgraded to the URS design criteria over the entire low pressure piping region of the CRD system. The suction path through the Condensate Storage and Transfer System (CS&TS) to the Condensate Storage Tank (CST) from the CRD interface is an open path whose design pressure was not upgraded to URS design criteria. The piping design of the primary suction path through the Condensate and Feedwater System has not been established, but if a check valve is in the path, the design pressure up to and including the check valve will be the URS design pressure.

The normal key assumption, as stated in the Boundary Limits of URS section above, that the valve adjacent to a low pressure sink remains closed, means that the pump discharge check valve remains closed as a given. However, this valve is in the high pressure piping, which is unique for the CRD system according to this accepted line of reasoning. The low pressure piping would not have to be upgraded because it would not experience the high reactor pressure. However, the low-pressure piping has been designed to the URS design pressure based on the guidance that states “for all interfacing systems and components which do not meet the full URS criteria, justification is required, which must include engineering feasibility; not solely a risk benefit analysis.” Designing the low-pressure piping to the URS design pressure is feasible and was done.

3KA.1.2 Downstream Interfaces

Other systems are listed below that interface with the CRD system and could possibly be exposed to reactor pressure. A description of the interface location and a statement of its applicability to ISLOCA are given.

- RWCU/SDC system at the output of the CRD pump discharge filter units. The RWCU/SDC design pressure exceeds the URS design pressure without upgrade.
- NBS at the output of the CRD pump discharge filter units. The NBS design pressure exceeds the URS design pressure without upgrade.
- CS&TS provides an alternate source of water for the CRD system if the C&FS is not available. Its interfaces with the CRD system are located at pump suction from and system return to the CST. This line cannot be pressurized because of the open communication to the CST, and the CST is vented to atmosphere. There is no source to pressurize the CS&TS line because of closed pump discharge check valves in the CRD URS region.
- C&FS provides a source of water for the CRD pump suction from the turbine building condensate supply. This system is expected to be an open path to a large source similar to CS&TS. Because of the open path, the piping was not considered practical for upgrade to the URS design pressure.
- Process Sampling System (PSS) at the output of the CRD pump discharge filter units. The PSS design pressure exceeds the URS design pressure without upgrade.

3KA.1.3 Low-Pressure Piping Systems and Components Designed to URS Pressure

The following is a listing of low-pressure piping systems and components within CRD that are designed to the minimum URS design pressure of 2.82 MPaG based on the ISLOCA considerations outlined in Appendix 3K.

Pipeline / Component Description (see Figure 4.6-8)

CRD Pump Suction Piping and Associated Components

3KA.2 STANDBY LIQUID CONTROL SYSTEM

3KA.2.1 System URS Boundary Description

The SLC system is a high pressure system which injects enriched sodium pentaborate solution inside the reactor through normally closed squib valves. The leakage path includes two 80 mm check valves in series in addition to a redundant set of normally closed pyrotechnic-type squib valves. The entire SLC system is designed for pressure higher than reactor pressure except the low pressure section from piston pump suction to open mixing drum used for preparation of sodium pentaborate solution. Instrumentation, pressure relief, drain piping and valving are designed to higher than URS design criteria to reduce the level of pressure challenge to these components. The system does not require upgrade to URS design pressure.

3KA.2.2 Downstream interfaces

The SLC system has no further downstream system interfaces that could possibly be exposed to reactor pressure.

3KA.2.3 Low Pressure Piping Systems and Components Designed to URS Pressure

None

3KA.3 REACTOR WATER CLEANUP/SHUTDOWN COOLING SYSTEM

3KA.3.1 System URS Boundary Description

The RWCU/SDC system is a high pressure system that is designed above the URS pressure with the following exception. Low pressure piping connected to the condenser and the liquid waste management system are provided at the downstream of the overboarding line isolation valves. On the upstream side of the isolation valves is provided a pressure reducing control valve that reduces the pressure before the flow enters the low pressure piping.

3KA.3.2 Downstream Interfaces

Other systems are listed below that interface with RWCU/SDC system and could possibly be exposed to reactor pressure. A description of the interface location and a statement of its applicability to ISLOCA are given.

- FAPCS interfacing piping from the reactor well at the upstream of the Train B of RWCU/SDC system non-regenerative heat exchanger has two locked closed isolation valves in series and the piping provides an open free path to reactor well which is an atmospheric pressure pool.
- FAPCS Low Pressure Coolant Injection (LPCI) interfacing piping with Train B of RWCU/SDC system return piping to Feedwater Line A is designed to a pressure that is above the URS pressure.
- CRD system interfacing piping with Train A of RWCU/SDC system return piping to Feedwater Line B is designed to a pressure that is above the URS pressure.

3KA.3.3 Low-Pressure Piping Systems and Components Designed to URS Pressure

The RWCU/SDC system low pressure piping connected at the downstream side of the overboarding line isolation valves is designed to pressure so that the stresses do not exceed the allowable stresses if the piping is subjected to full reactor pressure.

3KA.4 FUEL AND AUXILIARY POOLS COOLING SYSTEM

3KA.4.1 System URS Boundary Description

FAPCS is a low pressure piping system. Its LPCI line is connected to RWCU/SDC system Loop B discharge line, which has an interface with reactor coolant pressure boundary via the Feedwater Loop A discharge line [Figure 9.1-A]. During reactor power operation, an unisolated break outside the reactor coolant pressure boundary could lead to an ISLOCA with the release of reactor coolant from the reactor system pressure boundary. In the FAPCS case, it would require multiple failures before a LOCA could occur, i.e., a break in the FAPCS piping plus failures of the Feedwater line check valves, which maintain the reactor coolant pressure boundary.

3KA.4.2 Downstream Interfaces

The following design features are provided to the interface between the high and low pressure interfaces to prevent an intersystem LOCA from occurring in FAPCS piping:

- Normally closed isolation valves consisting of an air-operated check valve and a motor-operated gate valve are provided on the LPCI line to separate the low pressure FAPCS piping from the high pressure condition in the RWCU/SDC pipe during reactor power operation.
- Valve position lights are provided to the operator in the main control room (MCR) to confirm these isolation valves in the closed positions.
- The isolation valves are provided with a reactor pressure interlock that closes these valves and prevents them from opening whenever a high reactor pressure signal from the NBS is present. Reactor pressure signals ensure high reliability that the isolation valves remain closed.
- The FAPCS LPCI pipe and components between its interface with RWCU/SDC system and the motor-operated gate valve, including the gate valve are Quality Group B components designed to above URS pressure.

3KA.4.3 Low-Pressure Piping Systems and Components Designed to URS Pressure

The low pressure side of LPCI line and the rest of FAPCS piping are not required to be designed to the URS pressure because they are properly protected by the interlock closed isolation valves described above and by a relief valve installed on the LPCI line that protects the line from the overpressure condition, in case of leakage from the RWCU/SDC system side through the isolation valves.

3KA.5 NUCLEAR BOILER SYSTEM

3KA.5.1 System URS Boundary Description

The Main Steam (MS) and Feedwater piping and instrumentation are designed for reactor pressure and do not require upgrading to URS design pressure.

3KA.5.2 Downstream Interfaces

Other systems are listed below that interface with MS and could possibly be exposed to reactor pressure. A description of the interface location and a statement of its applicability to ISLOCA are given.

- The outlet of the CRD pump discharge filter units provide flow to the NBS.
- The CRD design pressure exceeds the URS design pressure without upgrade.
- RWCU/SDC provides high pressure return flow to the Feedwater lines. The RWCU/SDC design pressure exceeds the URS design pressure without upgrade.
- The Isolation Condenser system connects to a piping stub that connects the DPVs to the RPV, and also there are IC vent lines that connect to the main steam lines. The IC design pressure exceeds the URS design pressure without upgrade.

3KA.5.3 Low-Pressure Piping Systems and Components Designed to URS Pressure

None

3KA.6 CONDENSATE AND FEEDWATER SYSTEM

3KA.6.1 System URS Boundary Description

The feedwater subsystem of the C&FS provides high pressure feedwater to the reactor. The feedwater subsystem is designed for high pressure except for the feedwater pump suction and the outlet of the feedwater cleanup valve.

In the feedwater pump, the transition to low pressure occurs from the feedwater pump suction into the direct contact feedwater heater (feedwater tank). The feedwater tank is a low pressure sink. The last closed valve in the path from the reactor is the feedwater pump discharge check valve. The piping to the feedwater pump suction can remain below the URS design pressure because it connects to the low pressure heat sink feedwater tank. The maintenance block valves in the feedwater pump suction lines were upgraded to a LOCK OPEN status.

In the feedwater cleanup control valve, the transition to low pressure occurs from the feedwater cleanup control valve outlet connection into the condenser shell (hotwell). The hotwell is a low pressure sink. The last closed valve in the path from the reactor in the feedwater cleanup control valve is the normally closed block valve. The piping from the feedwater cleanup control valve to the condenser can remain below the URS design pressure because it connects to the low pressure heat sink hotwell.

The Condensate subsystem of the C&FS provides condensate to the feedwater tank, and the condensate subsystem is designed for a pressure higher than the feedwater tank, except for the condensate pump suction. The high pressure design includes the condensate polishing (hollow fiber filters and demineralizers) units and the feedwater bypass valve. The transition to low pressure occurs from the condensate suction into the HP condenser shell (hotwell, which is a low pressure sink). The last closed valve in the path from the feedwater tank is the condensate pump discharge check valve. The piping to the condensate pump suction can remain below the feedwater tank design pressure because it connects the low pressure heat sink hotwell. The maintenance block valves in the condensate pump suction lines were upgraded to a LOCK OPEN status.

3KA.6.2 Downstream Interfaces

None

3KA.6.3 Low-Pressure Piping Systems and Components Designed to URS Pressure

The maintenance block valves in the condensate pump suction lines were upgraded to a LOCK OPEN status.

3L. REACTOR INTERNALS FLOW INDUCED VIBRATION PROGRAM

3L.1 INTRODUCTION

A flow-induced vibration (FIV) testing program of the reactor internal components of the ESBWR prototype plant is to be completed to demonstrate that the ESBWR internals design can safely withstand expected FIV forces for reactor operating conditions up to and including 100% power and core flow. This program includes an initial evaluation phase that has the objective of demonstrating that the reactor internals are not subject to FIV issues that can lead to failures due to material fatigue, or fretting and wear issues. Throughout this part of the program, the emphasis will be placed on demonstrating that the reactor components will safely operate for the design life of the plant. The results of this evaluation are shown in Reference 3L-1. The second phase of the program is focused on preparing and performing the startup test program that demonstrates through instrumentation and inspection that no FIV problems exist. This part of the program meets the requirements of Regulatory Guide 1.20 with the exception of those requirements related to preoperational testing that are not applicable to a natural circulation plant.

3L.2 REACTOR INTERNAL COMPONENTS FIV EVALUATION

The ESBWR reactor internals are part of an evolutionary BWR design, but fundamentally the components and operation of the reactor vessel and internals are very similar to past BWRs. To a large extent the ESBWR design of the components relies heavily on the prior design of internals in operating plants to assure that new vibration issues are not introduced. Also, to assure that the flow of steam or water in the reactor vessel is comparable to prior reactors, efforts were made to maintain traditional spacing and dimensional relationships of components. A unique feature of the ESBWR, with respect to FIV, is the fact that it is a natural circulation plant where no recirculation motors exist that would create pressure pulses from the pump vanes that would travel into the reactor vessel. In previous BWR product lines, the pump vane passing frequency, that is variable with flow, typically has a maximum frequency of 120 Hz at full reactor flow. This source of excitation has caused failures in small components inside BWR reactor vessels. For ESBWR this source of flow excitation does not exist. The design of the ESBWR reactor internals is shown in Figure 5.5-3.

3L.2.1 Evaluation Process – Part 1

The first step in the evaluation process was to establish selection criteria for reactor internal components related to susceptibility to vibration. All reactor internal components were considered as potential candidates for further evaluation. Each component is evaluated against the following selection criteria:

- Is the component critical to safety?
- Is the component of a significantly different or new design compared to earlier BWRs?
- Does the component have a history of FIV-related problems?
- Is the component subjected to significantly different or new flow conditions?

Based on these criteria, the following internal component structures are considered to be candidates for additional evaluation and potential to be instrumented in the startup FIV test program:

- Steam Dryer Bank Hoods and End Plates based on history of past FIV related problems (fatigue cracking between hood and endplate).
- Steam Dryer Skirt based on history of past FIV-related problems (fatigue cracking between skirt and drain channels).
- Steam Dryer Drain Channels based on history of FIV-related problems (fatigue cracking between skirt and drain channels).
- Steam Dryer Support Ring based on history of FIV-related problems (dryer rocking) and the resulting new design features for replacement dryer designs (e.g., strengthened weld joints, castings).
- Chimney partition assembly based on new design features (elongated chimney shell, partition assembly, chimney restraint), potential new flow conditions, difficulty of repair in event of failure, and limited ability to change the design due to dimensional constraints.

- Chimney Head / Steam Separator assembly based on new design (flat head with beam reinforcement and elongated standpipes).
- Shroud /Chimney assembly based on new design features (discrete shroud support members and the chimney connection), potential new flow conditions and difficulty of repair in event of failure.
- Standby Liquid Control (SLC) internal piping based on new design and being critical to safety.

Components that were evaluated but were not considered important for further evaluation were the following components:

- Control Rod Guide Tubes (CRGTs)
- In-Core Monitor Guide Tubes (ICMGTs)
- In-Core Monitor Housings (ICMHs)

For each of these components, the length of the components has decreased from prior BWR product lines due to the plant having shorter fuel. This increases the natural frequency of these components and moves it well beyond the predominated frequency measured at the prototype ABWR plant. Also, the flow conditions in the RPV bottom head region have decreased and the calculated vortex shedding frequencies are well below the natural frequencies of components.

Other components that are not specifically identified as candidates for the instrumentation program are basically proven by past trouble-free BWR experience, and have designs and flow conditions that are similar to prior operating BWR plants.

From this list, the first priority was determined to be the chimney partition assembly. This selection was made since it was a new component where only limited operating experience was available. Also, it is a structure where the geometry of the partitions places limitations on the plate thicknesses, has a long extended length, and is subject to high velocity two-phase steam flow. From this initial selection, a test and analysis program was established and the results are discussed in Subsection 3L.3.3. For this case, testing was required since no prior relevant test data was available for this component.

The steam dryer was established as the second priority. An initial analysis program was started to study the acoustic and flow effects of the ESBWR configuration in comparison to the ABWR steam dryer design. It was determined that the increase in the size of the steam dryer support ring and skirt design, and the increase in steam velocity did not have any adverse effects on the steam dryer structural integrity. At the time of the initial assessment, it was also recognized that the evaluation of BWR operating plant dryer loads was an ongoing program that would need to be ultimately factored into the ESBWR steam dryer design and evaluation effort. The progress of the generic steam dryer program is now at a stage that a meaningful effort can now be planned for the ESBWR steam dryer. The detailed program that is planned is described in Section 3L.4. As a result of the advances in the understanding of dryer vibration and differential pressure loads and steam dryer design improvements, the ESBWR will use a steam dryer design patterned after the replacement steam dryer design developed for BWR operating plants.

The next part of the evaluation phase will be to complete a more quantitative evaluation of the remaining components with the objective of documenting the existing facts regarding the individual components. This part of the evaluation will focus on the following:

(1) Similarities and differences of the ESBWR component design configurations as compared to prior designs. In most cases the comparison design will be with the ABWR components.

(2) A review of prior component calculations for the components being evaluated, to establish the mode shapes and natural frequencies. Estimates of the ESBWR component natural frequencies will then be determined based on this data.

(3) Prior plant startup instrumentation data from the prototype ABWR plant will be reviewed to establish the magnitude and frequency of the measured vibration data, and to review the resulting calculated stress for the components that were instrumented.

(4) A comparison of the flow paths and characteristics of the ESBWR design will be compared to prior BWR designs where a startup vibration test program was conducted.

(5) Using the results of the above items, an assessment as to likelihood of FIV issues will be completed and documented in a supplemental report. The objective in some cases will be to conclusively demonstrate that FIV will not be an issue and that safety will not be adversely affected. In other cases, the conclusions may determine that additional evaluation or instrumentation is necessary. For these cases, no FIV issues are anticipated, and the objective is to provide additional supporting information that clearly demonstrates that FIV is not an issue.

3L.2.2 Evaluation Process – Part 2

The next phase of the evaluation program will be to perform additional work to demonstrate the adequacy of components where it was determined that additional evaluations were required, and to do the next steps that are necessary for those components that are planned for instrumentation in the ESBWR startup test program. During this phase, the process as identified in Subsection 3.9.2.3 will be followed to prepare finite element analysis models per the details shown in Subsection 3L.5.5.1, establish correlation functions based on prior instrumentation data, and apply the correlation functions to the model to determine expected stress amplitude. The results of these evaluations will be documented in a supplemental report.

Because most of the reactor internal components are large durable components where there has been no history of FIV issues, no FIV issues are anticipated. Also, because it is still early in the program, there is still the opportunity to make adjustments as necessary in the component designs to make them more resistant to FIV.

3L.3 CHIMNEY PARTITION ASSEMBLY EVALUATION

3L.3.1 Design and Materials

The chimney partition assembly design consists of a bottom ring of the partition assembly that rests on and is bolted and pinned to the bottom flange of the chimney. The top ring of the partition assembly is supported against the inside of the chimney shell. The partitions are a grid of square structures, each of which encompasses 16 fuel assemblies. The partitions are to be fabricated using austenitic stainless steel plate that is full length welded at the junctions of the partitions. The austenitic stainless steel material has a 0.02% maximum carbon content to resist Intergranular Stress Corrosion Cracking (IGSCC). The chimney structure that houses the partition structure is cylindrical and similar to the core shroud. A sketch of the chimney and partition assembly is shown in Figure 3L-2. Because the chimney has structural characteristics similar to the shroud, this component is considered under the generic reactor internals vibration program, and the partition assembly is considered to be the unique component that requires special vibration consideration

3L.3.2 Prior Operating Experience

Prior to the ESBWR design, only one other BWR plant had operating experience with this chimney design. This was the BWR-1 Dodewaard plant, which did not have a vibration instrumentation program. For this plant, the partition size was a square configuration that encompassed four fuel assemblies within the cell, which is ¼ the dimension of the ESBWR partitions. Also, the height was approximately ½ the length of the ESBWR design. The partition thickness was 3 mm (0.125 inch) as compared to 9 mm for ESBWR, and the partitions were welded together using intermittent fillet welds as compared to full-length welds for ESBWR. Although the partitions were not instrumented, the plant operated for almost 30 years without any issues related to the chimney structure. Since the design of the ESBWR chimney partitions is more robust, this Dodewaard operational history provides additional assurance that the ESBWR will not have FIV issues.

3L.3.3 Testing and Two-phase Flow Analysis

For the ESBWR, the chimney lattice partition assembly constitutes a structure that needs to have a unique vibration evaluation program as part of the ESBWR reactor internals. In order to assess its capability to maintain structural integrity under plant operating conditions, a flow induced vibration evaluation has been performed in which the fluctuating fluid force acting on the partition plates has been evaluated by a combination of scale tests and two-phase flow analysis.

The test scope comprised both 1/6-scale (100mm × 100mm) and 1/12-scale (50mm × 50mm) air and water two-phase flow testing of a single chimney cell. The superficial velocities of the gas and liquid components of the two-phase flow were adjusted to be consistent with ESBWR values to simulate the actual two-phase flow pattern. Different inlet flow conditions were used to investigate the influence of inlet mixing within the partition to simulate different power conditions. Pressure fluctuation was measured on the inner surface of the partition wall with pressure transducers.

The results of the scale testing were extrapolated by a two-phase flow analysis to determine the characteristics of the pressure fluctuations acting on the partition wall of a full size cell in steam-water conditions. This extrapolation included the use of a 1/12 and full scale analytical model. The resulting peak-to-peak pressure fluctuation was determined to be 15 kPa at a peak frequency of approximately 2 Hz.

A structural analysis of the chimney and partition design was then conducted using finite element methods. First, an eigenvalue analysis determined that the lowest natural frequency of the chimney structure is approximately 56 Hz. This was sufficiently greater than the predominant frequency of pressure fluctuation determined by testing (2 Hz) that a static analysis of the structure was concluded to be proper. Based on the results of that static analysis, a maximum stress of 41 MPa was calculated near the edge of the partition plate joint. This stress value is bounded by the allowable vibration peak stress amplitude of 68.9 MPa specified in Subsection 3.9.2.3.

3L.4 STEAM DRYER EVALUATION PROGRAM

3L.4.1 Steam Dryer Design and Performance

The ESBWR steam dryer will be designed using modules of dryer vanes enclosed in a housing to make up the steam dryer assembly. The modules or subassemblies of dryer vanes, called dryer units, will be arranged in six parallel rows called banks. The dryer banks will be attached to an upper support ring, which is supported by steam dryer support brackets that are welded attachments to the reactor pressure vessel (RPV). The steam dryer assembly will not physically connect to the shroud head and steam separator assembly and will have no direct connection with the core support or shroud. A cylindrical skirt will attach to the upper support ring and will project downward to form a water seal around the array of steam separators. Normal operating water level will be approximately mid-height on the dryer skirt.

Wet steam from the core will flow upward from the steam separators into an inlet header, horizontally through the dryer vanes, the outlet side perforated plates, vertically in the outlet header and out into the RPV dome. Dry steam will then exit the RPV through the steam outlet nozzles. Moisture (liquid) will be separated from the steam by the vane surface and the hooks attached to the vanes. The captured moisture will flow downward, under the force of gravity, to a collection trough that carries the liquid flow to vertical drain channels. The liquid will flow by gravity through the vertical drain channels to the lower end of the skirt where the flow will then exist below normal water level. Table 3L-1 provides a comparison between major configuration parameters of the ESBWR and an ABWR steam dryer.

During normal refueling outages, the ESBWR steam dryer will be supported from the floor of the equipment pool by the lower support ring that is located at the bottom edge of the skirt. The steam dryer will be installed and removed from the RPV by the reactor building overhead crane. A steam separator and dryer lifting device, which attaches to four steam dryer lifting rod eyes, will be used for lifting the dryer. Guide rods in the RPV will be used to aid dryer installation and removal. Upper and lower guides on the dryer assembly will be used to interface with the guide rods. The ESBWR steam dryer assembly is shown in Figure 3L-2.

3L.4.2 Materials and Fabrication

Current industry practice will be applied to the materials and fabrication of the ESBWR steam dryer. The steam dryer materials are selected to be resistant to corrosion and stress corrosion cracking in the BWR steam/water environment. New industry dryers are currently constructed from wrought 300 series stainless steel and Grade CF3 stainless steel castings. Except for the dryer vane material, the maximum carbon content of the wrought stainless steel will be limited to 0.02% and the maximum hardness of wrought 300 series stainless steel will be limited to Rockwell B92. Fabrication process controls are applied to minimize the degradation of material properties by forming, cold working, etc. Susceptibility to stress corrosion cracking will be avoided by careful control of the solution heat treatment, sensitization testing and testing for intergranular attack (IGA).

3L.4.3 Load Combinations

Design loads for the steam dryer will be based on evaluation of the ASME load combinations provided in Table 3.9-2 except that the load definitions that pertain to the steam dryer are modified as shown in Table 3L-2. These load combinations consist of dryer deadweight loads, static and fluctuating differential pressure loads (including turbulent and acoustic sources), seismic, thermal, and transient acoustic and fluid impact loads.

3L.4.4 Fluid Loads on the Dryer

During normal operation, the dryer experiences a static differential pressure loading across the dryer plates resulting from the pressure drop of the steam flow across the vane banks. The dryer also experiences fluctuating pressure loads resulting from turbulent flow across the dryer and acoustic sources in the vessel and main steamlines. During transient and accident events, the dryer may also experience acoustic and flow impact loads that result from system actions (e.g., turbine stop valve closure) or from the system response (e.g., the two-phase level swell following a main steamline break).

Of particular interest are the fluctuating pressure loads that act on the dryer during normal operation that has led to fatigue damage in previous dryer designs. Scale model testing has identified the likely sources of fluctuating pressure loading acting on the steam dryer. The results of this testing showed that the fluctuating pressure load frequency spectrum can be divided into four regions based on the postulated source of the loading:

- **0-10 Hz:** The pressure loads in this frequency range are dominated by the fundamental main steamline piping acoustics. The source of these pressure loads is believed to be turbulence in the main steamline or vortex shedding in steam dome.
- **10-30 Hz:** The source of the pressure loads in this frequency range is postulated to be a stationary vortex on the outer hood of the steam dryer adjacent to the vessel outlet nozzles. The frequency characteristics of this pressure loading may be governed by harmonics of the main steamline acoustics.
- **>30 Hz:** The lowest steam plenum acoustic modes are located in this frequency range. The dominant excitation is due to broadband turbulent sources located in main steamlines but the acoustic modes may also be excited by sources in the vessel. The plenum acoustic modes have a very high amplification effect on pressure oscillations in this frequency range. The lower frequency vessel acoustic modes exhibit the most significant response to the turbulent excitation present in the system. Higher frequency vessel acoustics exist but are not significantly excited except as discussed below.
- **120-200 Hz:** Strong narrow band pressure loads in this frequency range are caused by acoustic resonances in safety and relief valve branch lines attached to the main steamlines. Higher frequency steam plenum acoustic modes can be excited if the vessel is acoustically coupled to the branch line. The ESBWR SRV standpipe design is intended to reduce or eliminate acoustic resonances in these branch lines.

The steam dryer acoustic load definition process consists of three primary elements:

- Scale model testing (physical testing using an ESBWR scale model to acquire load definition data, pressure and frequency, monitored by approximately 60 transducers),
- Acoustic finite element modeling of the reactor steam dome region to determine the natural frequencies and mode shapes of the steam volume, and

- A load interpolation algorithm to refine the measured fluctuating load into a fine mesh consistent with the structural finite element model nodalization in order to perform an accurate stress analysis of the dryer.

Flow induced turbulent and acoustic loads for the design of the ESBWR steam dryer will be determined from scale model testing of the dryer design and resultant acoustic modeling performed in the GE scale model testing facility located at the Vallecitos Nuclear Center in Sunol, California. The scale model test apparatus models the outside surface of the steam dryer above the vessel water level, the vessel steam dome region, and the main steamline piping to the turbine inlet, including major branch lines (e.g., SRV standpipes, turbine bypass piping). The testing is performed in ambient air conditions. Because the fluctuating pressure loads are primarily acoustic in nature, the test results are scaled to reactor conditions while preserving an equivalent Mach number between the model and the plant. GE has recently completed a power ascension test program with an instrumented BWR 3 steam dryer. The scale model test has been benchmarked against the plant data acquired from this instrumented dryer and confirms the capability of the GE scale model test methodology to predict the steam dryer acoustic load definitions.

The acoustic finite element modeling models the steam dryer and reactor steam dome cavity. This model is used to predict the acoustic mode shapes of the cavity and provides the framework for the load interpolation algorithm.

The load interpolation algorithm is used to provide a fine mesh load definition for input to the dynamic structural analysis. The algorithm uses the acoustic normal modes of the RPV steam plenum as a basis to describe the domain of interest. The algorithm uses the test measurements taken from the approximately 60 transducer locations on the scale model test and the acoustic finite element model to develop a fine-mesh array of pressure time histories that are consistent with the structural finite element model nodalization.

3L.4.5 Structural Evaluation

A finite element analysis (FEA) will be performed to confirm that the ESBWR steam dryer is structurally acceptable for operation. The FEA will use the scale model test loads as input. The finite element analysis will be performed using a whole dryer analysis model of the ESBWR steam dryer to determine the most highly stressed locations. The FEA consists of time history dynamic analyses for the load combinations identified in Table 3.9-2. If required, locations of high stress identified in the whole dryer analysis will be further evaluated using solid finite element models to more accurately predict stresses at these locations. The analysis will also confirm that the RPV dryer support lugs will accommodate the predicted dryer loads under normal operation and transient and accident conditions. (Also see 3.L.5.5.1.5.)

The structural evaluation of the ESBWR steam dryer design will be presented during the certification phase.

3L.4.6 Instrumentation and Startup Testing

The ESBWR steam dryer will be instrumented with temporary vibration sensors to obtain flow induced vibration data during power operation. The primary function of this vibration measurement program is to confirm the actual pressure loading on the dryer during power operation is consistent with the pressure loading assumed in the structural fatigue evaluation and to verify that the new steam dryer can adequately withstand flow induced vibration forces for extended period as designed. The detailed objectives are as follows:

- Determine the dryer as-built modal parameters: This will be achieved by impact (hammer) testing the dryer components. The results will yield natural frequencies, mode shapes and damping of the dryer components for the as-built dryer. These results will be used to verify portions of the analytical model of the dryer.
- Confirm the pressure loading: In order to confirm the pressure loading on the dryer due to turbulence, acoustics and other sources, dynamic pressure sensors will be installed on the dryer. These measurements will provide the actual pressure loading on the dryer under various operating conditions.
- Verify the new dryer design: Based on past knowledge gained from different dryers, as well as information gleaned from analysis of the new dryer design, selected areas of the dryer will be instrumented with strain gages and accelerometers to measure vibratory stresses and displacements on the dryer during power operation. The measured strain values will be compared with the allowable values (acceptance criteria) obtained from the analytical model to confirm that the dryer alternating stresses are within allowable limits.

The steam dryer vibration sensors will consist of strain gauges, accelerometers and dynamic pressure sensors, appropriate for the application and environment. A typical list of vibration sensors with their model numbers is provided in Table 3L-3. The selection and total number of sensors will be based on past experience of similar tests conducted on other BWR steam dryers. These sensors will be specifically designed to withstand the reactor environment.

Each of the sensors will be pressure tested in an autoclave prior to assembly and installation on the dryer. An uncertainty analysis will be performed to calculate the expected uncertainty in the measurements.

Prior to initial plant start-up, strain gauges will be resistance spot-welded directly to the dryer surface. Accelerometers will be tack welded to pads that are permanently welded to the dryer surface. Surface mounted pressure sensors will be welded underneath a specially designed dome cover plate to minimize flow disturbances that may affect the measurement. The dome cover plate with the pressure transducer will be welded to an annular pad that is welded permanently to the dryer surface. The sensor conduits will be routed along a mast on the top of the dryer and fed through the RPV instrument nozzle flange to bring the sensor leads out of the pressure boundary. Sensor leads will be routed through the drywell to the data acquisition area outside the primary containment.

Pressure transducers and accelerometers are typically piezoelectric devices, requiring remote charge converters that will be located in junction boxes inside the drywell. The data acquisition system will consist of strain gauges, pressure transducers and accelerometer signal conditioning electronics, a multi-channel data analyzer and a data recorder. The vibration data from all sensors will be recorded on magnetic or optical media for post processing and data archival. The strain gauges, accelerometer and pressure transducers will be field calibrated prior to data collection and analysis. The temporary vibration sensors will be removed after the first outage.

During power ascension, the steam dryer instrumentation (strain gages, accelerometers and dynamic pressure transducers) will be monitored against established limits to assure the structural integrity of the dryer is maintained. If resonant frequencies are identified and increase above the predetermined criteria, power ascension will stop. The acceptability of the dryer for the measured loading will be evaluated and revised operating limits defined as required.

Future steam dryer inspections will be in accordance with Reference 3L-2, and in accordance with Boiling Water Reactor Vessel Internals Program (BWRVIP) guidance.

3L.5 STARTUP TEST PROGRAM

This section summarizes the program for preparing and performing the startup FIV testing including the methods and analysis that will be performed when the startup test data is available. This section assumes that the initial selection of components identified in Subsection 3L.2.1 will be part of the analysis and instrumentation associated with the startup testing program.

3L.5.1 Component Selections

The components that are selected for instrumentation are determined from the initial evaluation phase as discussed in Subsection 3L.2.1. Many different sensors of four different types are utilized to measure vibration related data on several different reactor internal component structures.

3L.5.2 Sensor Locations

Having determined the components to instrument during the test, sensor locations on those structures are determined based upon the analytically predicted mode shapes for each structure or, in some cases, based upon the location of past FIV-related failures. Strain gages, accelerometers and linear variable differential transformer (LVDT) type relative displacement sensors are used for monitoring vibration levels. Strain gages measure local strain from which local stress can be calculated. Based on knowledge of the natural mode shapes of the structure, peak stresses at other locations on the structure are determined from these data. Accelerometers (with double integration of the output signal) and LVDTs provide measurements of local structural displacement. This information, together with knowledge of the natural mode shapes of the structure, allows the peak stresses to be calculated at other locations. Pressure sensors are also utilized at various locations in the vessel. These are not used to measure structural vibration directly, but rather to measure the pressure variation that is often a forcing function that causes the structural vibration. These pressure sensor data are very useful for determining the source of any excessive vibration amplitudes, if they are to occur during testing. Typical sensor types and potential locations are listed in Table 3L-4.

3L.5.3 Test Conditions

Test conditions are selected early in the FIV test program to consider a variety of steady-state and transient operating conditions that could be expected to occur during the life of the plant.

Reactor pressure vessel (RPV) internals vibration at steady-state conditions is more important than transient conditions for evaluating the structural integrity of components. This is because steady-state normal operating conditions can exist for long periods of time, allowing a very large number of vibration cycles to accumulate. Flow-induced vibration caused by transient operating conditions is far less influential because of the relatively low number of vibration cycles that will occur over the lifetime of the plant. The purpose in including transient test conditions is to confirm that extremely high stresses do not occur during transients. This check is accomplished during the actual startup transient tests by the vibration engineers monitoring the test equipment. Transient stress levels near the allowable limit would be easily and immediately detected by the vibration engineers. No such high stress levels are expected to occur during the ESBWR prototype plant FIV transient tests. Therefore, for the purposes of confirming the structural capability of the internals, steady-state test conditions are the most important conditions to evaluate.

Total volumetric core flow rate is also an important parameter that affects the vibration magnitude of the internals. Vibration amplitude generally increases as the volumetric flow rate increases.

3L.5.4 Data Reduction Methods

Basically, two types of data reduction are performed: (1) time history analyses and (2) spectrum analyses. In either data reduction method, the measured peak-to-peak (p-p) value of each sensor signal is compared to the allowable p-p value. Even though both time history and spectrum analyses are performed for each selected sensor and test condition, the results from only one data reduction method are used for comparison to the allowable values. The selection of the method is dependent on the analysis method used for data evaluation. The different methods of data evaluation are described in detail in Section 3L.5.5. Briefly, Method I is used for components that have many closely spaced natural vibration modes and utilizes the strain energy weighting method applied to all modes over the frequency range of interest. This method has previously been applied to the In-core Monitor (ICM) housings, shroud, top guide, and steam dryer skirt and support ring. Method II is similar to Method I, except that it is applied to two frequency bands, 0-100 Hz and 100-200 Hz. This method has previously been applied to the steam dryer drain channels and hood. Method III is used for components that have relatively few, distinct dominant natural modes that are matched to the analytical modes. This method has previously been applied to the in-core guide tubes. Table 3L-5 describes the method of data reduction that is applicable to each component.

3L.5.4.1 Time History Analysis

The time history method uses the analyzer's time capture mode of operation. The time capture is performed for a period of several minutes for all the selected sensors and test conditions. The frequency bandwidth for the time capture is chosen to accommodate 0-200 Hz as a minimum for most channels.

For comparison to the allowable vibration amplitude, the measured peak-to-peak (p-p) value over specified bandwidths needs to be obtained for sensors in specific components. The bandwidths used for p-p measurements for various components are shown in Table 3L-5. There are four bandwidths for time history p-p measurement: 0-200 Hz, 0-100 Hz, 100-200 Hz and 0-1600 Hz. The 0-1600 Hz is used only for the accelerometer for the purpose of detecting impacts. The other three bandwidths are used for normal vibrations.

For the 0-200 Hz bandwidth, the maximum p-p values over several minutes of data for selected sensors and test conditions are obtained directly from the time capture. Specification of the bandwidth for time capture (0-200 Hz) automatically results in a low-pass filtered signal.

In order to obtain the maximum p-p in the 0-100 Hz range, the histogram operation is employed on the time capture traces. When the bandwidth (0-100 Hz) is specified in the histogram operation, the signal is automatically low-pass filtered in the specified frequency range. The histogram measurement shows how the amplitude of the input signal is distributed between its maximum and minimum values. The horizontal axis is the amplitude axis and usually the center of the horizontal axis is the zero point with positive and negative amplitudes on either side of the zero. The vertical axis is the number of counts or the number of times a particular amplitude value occurs in a time-history. From the histogram, the maximum positive and maximum negative values in a time history can be obtained, from which the maximum p-p of the time history can be obtained.

For the 100-200 Hz bandwidth range, the time captured traces are filtered in the 100-200 Hz range and the p-p is obtained over a period of several minutes. The filtered time history between 100 and 200 Hz is scanned to obtain maximum and minimum values to get p-p values.

For the 0-1600 Hz range for accelerometers, the time history signal is examined for the presence of any impacts.

3L.5.4.2 Frequency Analysis

The spectrum shows the signal in the frequency domain. There are several different types of spectra. The linear spectrum is the Fourier transform of the time history signal. The auto power spectrum is the magnitude squared of the linear spectrum, which is computed by multiplying the Fourier transform of the signal by its complex conjugate. This spectrum contains magnitude information only. The spectra generated for ESBWR data reduction are auto power spectra. The spectra for selected sensors and test conditions are obtained from the captured time history described previously.

Signal averaging is used to obtain better statistical properties. It is possible to select the number of averages and the type of averaging. There are three types of averaging:

- Stable (normal)
- Exponential
- Peak Hold

The averaging method used for ESBWR is “Peak Hold”, which compares the current spectral value of each individual frequency during the analysis interval to the last spectral value and holds the larger of the two. The resultant spectrum is a composite spectrum which envelopes the spectrums of all analysis intervals. The parameters used in the spectrum generation are described in Table 3L-6**.**

In order to obtain greater accuracy on amplitude of the frequency spectrum, a flat top window is selected.

From the spectrum, the dominant frequencies of vibration and their root mean square (RMS) magnitudes can be identified. The frequency is in the horizontal axis and the RMS magnitude is in the vertical axis. The p-p value of vibration at each dominant frequency is obtained by multiplying the RMS value (from the peak hold spectrum) by a factor of 6. This factor is obtained from many years of reactor experience and is a conservative estimate of the p-p value. This p-p value is then used to compute the stress at the sensor location and the maximum stress in the structure.

3L.5.5 Data Evaluation Methods

This section describes the methods used to evaluate the reduced test data for the purpose of determining whether maximum stress levels are below the maximum allowable fatigue stress limits for the materials. A significant portion of this evaluation lies in the determination of the natural vibration modes of the instrumented components as determined using finite element models. Subsection 3L.5.5.1 describes the finite element models used in this process. Subsection 3L.5.5.2 describes the steps involved in determining the maximum stress amplitudes from the reduced data.

3L.5.5.1 Finite Element Models

Dynamic analytical finite-element models are developed for the following ESBWR prototype plant reactor internal components:

- Chimney Head and Steam Separators
- Shroud and Chimney
- Steam Dryer
- Standby Liquid Control Line

The dynamic analytical finite-element models are used to predict the natural vibration frequency, modal displacement, and modal strain and stress for each of the dominant vibration response modes. Descriptions of the finite-element models are given in the following sections.

3L.5.5.1.1 Chimney Head and Steam Separators

In order to determine the chimney head and steam separator vibration frequencies and mode shapes, an axisymmetric model is developed using the ANSYS computer code (Reference 3L-3) or equivalent qualified program. The detailed model consists of the components that provide structural members within the assembly. Since the separator assembly units are the standard product used on prior BWR product lines, and that operates within the range of the design steam flow rates, detailed modeling is not required. In this model, each nodal point has four degrees of freedom, namely:

- radial displacement;
- tangential displacement;
- vertical displacement; and
- meridian rotation.

3L.5.5.1.2 Shroud and Chimney

In order to determine the shroud vibration frequencies and mode shapes, an axisymmetric shell model is developed using the ANSYS computer code (Reference 3L-3) or equivalent qualified program. The detailed shell model consists of both the reactor pressure vessel (RPV), chimney, chimney support, and shroud such that the hydrodynamic interaction effects between the components are accounted for. In this model, each nodal point has four degrees of freedom, namely:

- radial displacement;
- tangential displacement;

- vertical displacement; and
- meridian rotation.

This shell model is applicable only to the axisymmetric finite element analysis of the shroud and vessel. Responses calculated from this model, other than that of the shroud, shall not be construed as being representative of other reactor components.

The following assumptions are made in generating the axisymmetric shell model:

(1) Discrete components move in unison for guide tubes, steam separators, standpipes, and control rod drive housings and guide tubes.

(2) Masses are lumped at the nodal points. Rotational inertias of the masses are neglected.

(3) Stiffnesses of control rods, control rod drives, steam dryers, and incore housings are neglected.

(4) Top guide beam and core plate are assumed to have zero rotational stiffness.

(5) Masses of CRD housings below the vessel are lumped to the bottom head.

Equivalent shells are used to model the mass and stiffness characteristics of the guide tubes, steam separators, and standpipes such that they match the frequencies obtained from a horizontal beam model.

Diagonal hydrodynamic mass terms are selected such that the beam mode frequencies of the shell model agree with those from the beam model.

The RPV, chimney and shroud are modeled as thin shell elements. Discrete components such as guide tubes are modeled as equivalent thin shell elements. The shell element data are defined in terms of thickness, mass density, modulus of elasticity, and Poisson’s ratio for the appropriate material and temperature.

The natural frequencies and mode shapes of the shroud shell model are given in terms of two parameters, termed “n” and “m”. The “n” parameter refers to the number of circumferential waves, while the “m” parameter refers to the number of axial half-waves. Thus, for beam types of 1 vibration, n=1.

3L.5.5.1.3 Steam Dryer

The design of the steam dryer assembly for the ESBWR prototype plant is somewhat different from the past BWR designs. Specifically, the major differences are in:

(1) the skirt and support ring diameters;

(2) the annulus size between the skirt and reactor pressure vessel;

(3) the flow path between the dryer banks and the vessel head; and

(4) the design details of the dryer skirt, drain channels and hoods.

In addition, the total steam flow rate of the ESBWR prototype plant is different from past designs. These differences warrant a detailed vibration analysis and test monitoring to assure the adequacy of the new design to withstand the flow-induced vibration.

In the ESBWR prototype plant FIV test program of the dryer assembly, accelerometers and strain gages are located directly on the skirt, drain channels, support ring and hoods. In addition, pressure sensors are used to measure the pressure differentials between the inside and outside of the dryer hood and dryer skirt. The differential pressure fluctuation across the dryer hoods is the primary forcing function causing vibration of the upper part of the dryer structure. The differential pressure fluctuation across the dryer skirt is the primary forcing function causing the vibration of the steam dryer skirt.

A dynamic finite element model of the dryer assembly is developed using the ANSYS computer code (Reference 3L-3). Due to the complicated geometry and the large size of the analytical model, major components may be modeled with coarse meshes such that their dynamic contributions are accounted for in the whole dryer assembly vibration responses. Separate refined dynamic finite element models of the major components are then developed to provide a high resolution of the component's response calculation.

The structural material properties and density for the dryer components at temperature are used in the model. The effect of the water on the dynamic responses is accounted for by using a direct lumped mass input. These added mass inputs include the submerged portions of the dryer skirt, drain channels, and the lower support ring.

Prior analytical models have predicted that the vibration modes are very closely spaced.

3L.5.5.1.4 Standby Liquid Control Lines

In the ESBWR prototype plant reactor, there are two standby liquid control pipes that enter the reactor vessel and are routed to the shroud. To accurately predict the vibration characteristic of the standby liquid control line, a dynamic finite element model of the entire line is developed using the ANSYS computer code. In the model the ends of the line are fixed anchor points since the lines are welded at the vessel nozzle and the shroud attachment points.

3L.5.5.2 Stress Evaluation

Maximum stress amplitude values for evaluation against allowable limits are determined from the test data and finite element models using one of three different evaluation methods. The method used for a particular component depends on the complexity of that component's vibration characteristics. All three methods yield conservatively high predictions of the maximum stress anywhere on the structure. These conservatively high stress predictions are compared against conservatively low acceptance criteria to assure that none of the components is experiencing high stress vibrations that might cause fatigue failures. Table 3L-7 lists the methods that are used for each instrumented component for the ESBWR prototype plant FIV test program.

Method I is used for components that have many closely spaced vibration frequencies and/or closely spaced natural vibration modes distributed over a relatively narrow frequency range. The method utilizes a strain energy weighting method applied to all modes over the entire frequency range. It is applied by determining the maximum peak-to-peak (p-p) amplitude from an unfiltered time history segment. This maximum value is multiplied by a combined shape factor (derived from the strain energy weighting method) and stress concentration factors to yield the maximum stress value that could be expected to be found anywhere on the structure. This value is then compared against the acceptable fatigue limit stress amplitude for the material [68.9 MPa (10,000 psi)].

Method II is used for components that have many closely spaced vibration frequencies and/or closely spaced natural vibration modes that are unevenly distributed over several frequency ranges. The method is very similar to Method I, except that it is applied over several separate frequency bands. The maximum stress amplitude values for each frequency band are then added together absolutely to yield a conservatively high value for the overall maximum stress amplitude that could be found anywhere on the structure. This value is compared to the same [68.9 MPa (10,000 psi)] limit for the material.

Method III is used for components that have relatively few, distinct dominant natural modes that can be easily identified and matched to the modes predicted by the finite element models. This method utilizes a mode shape factor for each vibration mode that relates the stress at the sensor location to the stress at the maximum stress location for that mode. Appropriate stress concentration factors are also considered in this process. Response spectra are generated from the sensor output, from which the equivalent maximum p-p strain amplitude for each mode can be determined. The mode shape and stress concentration factors are applied mode by mode to determine the maximum stress amplitude associated with each mode. Then the maximum stress amplitudes from each of the modes are added together absolutely to yield a conservatively high maximum overall stress amplitude for the structure. This value is compared to the same [68.9 MPa (10,000 psi)] limits allowed for the material.

All three methods have identical initial steps to obtain mode shape factors for each natural mode. The first five steps for all three methods are as follows (Note: The evaluation method described here relates to strain gages. Similar steps are used for accelerometers used in their displacement mode and for LVDTs.):

(1) The dynamic finite element model of each instrumented component is used to predict the natural vibration modal displacement, frequency and stress for each vibration response mode. Specifically, the computer model provides the following results for each mode:

ω_i = Natural frequency for vibration mode i

$\{\phi\}_i$ = Mass normalized displacement mode shape for vibration mode i.

(Normalized such that the generalized mass, $\{\phi\}_i^T[M]\{\phi\}_i$, is unity, where [M] is the mass matrix.)

$\{\sigma\}_i$ = Normalized stress distribution for vibration mode i.
(The stress corresponding to the mass normalized mode shape, $\{\phi\}_i$)

The theory and methods for calculation of these parameters may be found in text books on the subject of basic vibration analysis, such as Reference 3L-4.

(2) For each vibration mode, stress concentration factors are applied at weld locations and regions with high stress gradient. From this information, the maximum stress intensity location and value is determined for each vibration mode.

$\sigma_{i,\max} = Max\{SCF_i \cdot \sigma_i\}$ considered over the entire structure

where

SCF_i = Stress concentration factor at some location

σ_i = Normalized stress intensity at the same location

$\sigma_{i,max}$ = Normalized maximum stress intensity for mode i

(3) From the stress distribution of Step 1, a mode shape factor is derived relating the stress at the sensor to the stress at the maximum stress location as determined in Step 2:

$$MSF_i = \frac{\sigma_i \text{(at maximum stress intensity location)}}{\sigma_{i,sensor}}$$

where

MSF_i = Mode shape factor

$\sigma_{i,sensor}$ = Normalized stress at sensor location for vibration mode i

(4) The mode shape factor from Step 3 and the maximum allowable stress amplitude for the material [68.9 MPa (10,000 psi)] are used to determine the maximum allowable stress value at the sensor location for each mode.

$$\sigma_{i,sensor,allowed} = \frac{68.9\ MPa}{(MSF_i)\cdot(SCF_i)}$$

where

$\sigma_{i,sensor,allowed}$ = Maximum allowed zero to peak stress amplitude at sensor location for vibration mode i (stress amplitude at sensor when maximum stress amplitude in structure is 68.9 MPa)

(5) The allowable strain for mode i ($\varepsilon_{i,allowed}$) is then calculated from this maximum allowed stress amplitude at the sensor location:

$$\varepsilon_{i,allowed} = \frac{\sigma_{i,sensor,allowed}}{E}$$

where

E = Young's modulus [e.g., 1.862 x 105 MPa (27.0 x 106 psi) at 160°C]

This equation is for uniaxial stress components. A similar, but more complex procedure will be used for biaxial stress structures such as the dryer skirt, drain channel and hood.

At this point, Methods I and II diverge from Method III.

3L.5.5.2.1 Methods I and II

The next two steps are identical for Methods I and II.

(6) A weighting factor is determined by the strain energy method, which begins by obtaining the solution to the following equation based on the expected forcing function:

$$\{U\} = q_1\{\phi\}_1 + q_2\{\phi\}_2 + \ldots = \sum_{i=1}^{N} q_i\{\phi\}_i$$

where

$\{U\}$ = A vector representing the displacement response of the structure when subjected to the expected forcing function shape. This displacement response to an input forcing function is calculated from the finite element model on the computer.

$\{\phi\}_i$ = Mass normalized mode shape for vibration mode i. Mode shapes were determined from the modal analysis of the finite element model on the computer. The modes shapes are normalized such that the generalized mass, $\{\phi\}_i^T[M]\{\phi\}_i$, is unity (where [M] is the mass matrix).

q_i = Mode i response, dependent on load distribution. These coefficients are calculated from the previously calculated $\{U\}$ and $\{\phi\}_i$ using formulas derived from the generalized Fourier Theorem.

This is an application of the generalized Fourier Theorem, which establishes that a displacement function such as $\{U\}$ can be represented by a linear sum of the eigenfunctions, $\{\phi\}_i$. The theory and methods for calculation of these coefficients may be found in any good text book on the subject of basic vibration analysis, such as Reference 3L-4.

(7) The strain energy contribution, e_i, for each mode is then calculated:

$$e_i = \frac{1}{2} \cdot q_i^2 \cdot \{\phi\}_i^T \cdot [K] \cdot \{\phi\}_i$$

where

[K] = The structural stiffness matrix (For a more detailed explanation of the theory and calculation methods, see any good vibration analysis textbook, such as Reference 3L-4.)

The next step is similar for both Methods I and II, the only difference being that Method I will include the entire frequency range into one group, while Method II will break into several frequency ranges.

(8) Then the strain energy weighted allowable strain vibration amplitude is calculated over a given frequency range by combining the weighted strain allowable values for each mode as follows:

For

$$\omega_I < \omega_1, \omega_2, \ldots, \omega_n \le \omega_{II}$$

$$\varepsilon_{II,allowed} = \frac{e_1 \cdot \varepsilon_{1,allowed} + e_2 \cdot \varepsilon_{2,allowed} + \ldots + e_n \cdot \varepsilon_{n,allowed}}{e_1 + e_2 + \ldots + e_n}$$

where

$\varepsilon_{II,allowed}$ = Allowable strain value between ω_I and ω_{II}, which includes the stress concentration factor, SCF

It should be noted that this step conservatively assumes that the peak stress of each mode occurs at the same physical location on the structure. In reality, the maximum stress locations for different modes may occur at different locations. Since the purpose of this calculation is just to confirm that the maximum stress is less than an acceptable limit, it is quite acceptable to add this conservatism. However, it should be understood that the value calculated is conservatively high, and it is not an accurate prediction of the actual stress amplitude. If a stress calculated in this manner should exceed the limit in a few situations, then a less conservative calculation can be used in those few cases.

The strain value in the above equation is the allowable strain used during the actual execution of the test. It represents the strain level at the sensor location when the maximum stress on the structure is 68.9 MPa (10,000 psi).

Step 9 is the same for both Methods I and II, except that it is applied to each of the multiple frequency ranges associated with Method II; whereas, Method I is only for one frequency range.

(9) The combined shape factor (CSF) is derived to relate the maximum zero-to-peak strain value measured at the sensor location to the corresponding maximum zero-to-peak stress intensity value on the structure.

$$\sigma_{II,\max} = \frac{\varepsilon_{II,measured,\max}}{\varepsilon_{II,allowed}} \cdot (68.9\ MPa) = \varepsilon_{II,measured,\max} \cdot CSF$$

where

$CSF = \dfrac{(68.9\ MPa)}{\varepsilon_{II,allowed}}$ = Combined Shape Factor with the SCF included.

$\sigma_{II,max}$ = Maximum zero-to-peak stress value anywhere on the structure for modes within the frequency range of ω_I to ω_{II}.

$\varepsilon_{II,measured,max}$ = Maximum measured zero-to-peak strain (one-half of maximum measured peak-to-peak) from time history of sensor band pass filtered over the frequency range ω_I to ω_{II}.

This is the maximum zero-to-peak stress value anywhere on the structure as determined by Method I. For Method I, this value is compared to 68.9 MPa (10,000 psi) for determination of acceptability. One additional step remains for Method II.

(10) The maximum stress values for each frequency band are added together absolutely to determine the overall maximum stress on the structure for comparison to the 68.9 MPa (10,000 psi) limit for the material.

$$\sigma_{MAX} = \sigma_{II,\max} + \sigma_{III,\max} + \ldots + \sigma_{N,\max}$$

where

σ_{MAX} = Maximum overall zero-to-peak stress anywhere on structure as determined by Method II.

$\sigma_{N,max}$ = Maximum zero-to-peak stress anywhere on structure within the frequency range of ω_{N-1} to ω_N (N-1 frequency ranges total).

σ_{MAX} is compared to the 68.9 MPa (10,000 psi) limit in order to determine acceptability under Method II.

It should be noted that this step conservatively assumes that the peak stress of each mode occurs at the same time. In reality, the maximum stress occurs at different times. Since the purpose of this calculation is just to confirm that the maximum stress is less than an acceptable limit, it is quite acceptable to add this conservatism. However, it should be understood that the value calculated is conservatively high, and it is not an accurate prediction of the actual stress amplitude. If a stress calculated in this manner should exceed the limit in a few situations, then a less conservative calculation can be used in those few cases.

3L.5.5.2.2 Method III

Method III uses the mode shape factor (MSF) from Step 3, the stress concentration factor (SCF) and the measured strain value to determine the maximum stress amplitude anywhere on the structure for each natural mode. Picking up after Step 5 from Section 3L.5.5.2:

(6) Maximum stress in the structure is calculated from the measured strain value at the sensor location.

$$\sigma_{i,MAX} = \varepsilon_{i,measured,\max} \cdot E \cdot MSF_i \cdot SCF_i$$

where

$\sigma_{i,MAX}$ = Maximum zero-to-peak stress anywhere on structure for mode i.

$\varepsilon_{i,measured,max}$ = Maximum zero-to-peak strain for mode i as determined from power spectrum from sensor signal.

E = Young's Modulus

MSF_i = Mode Shape Factor for mode i.

SCF_i = Stress Concentration Factor as applicable for maximum stress location for mode i.

(7) The maximum stress values for each mode are added together absolutely to determine the overall maximum stress on the structure for comparison to the 68.9 MPa (10,000 psi) limit for the material.

$$\sigma_{MAX} = \sigma_{1,MAX} + \sigma_{2,MAX} + \ldots + \sigma_{n,MAX}$$

where

σ_{MAX} = Maximum overall zero-to-peak stress anywhere on structure as determined by Method III.

$\sigma_{i,MAX}$ = Maximum zero-to-peak stress anywhere on structure for mode i (n total dominant modes).

σ_{MAX} is compared to the 68.9 MPa (10,000 psi) limit in order to determine acceptability under Method III.

It should be noted that this step conservatively assumes that the peak stress of each mode occurs at the same physical location on the structure and at the same time. In reality, the maximum stress locations for different modes may occur at different locations and at different times. Since the purpose of this calculation is just to confirm that the maximum stress is less than an acceptable limit, it is quite acceptable to add these conservatisms. However, it should be understood that the value calculated is conservatively high, and it is not an accurate prediction of the actual stress amplitude. If a stress calculated in this manner should exceed the limit in a few situations, then a less conservative calculation can be used in those few cases.

In summary, all three methods involve two significant conservatisms:

- The assumption of the maximum stresses occurring at the same location in a component, and
- The assumption that the maximum stresses for different modes occur at the same time.

Inclusion of these two significant conservatisms results in significantly higher calculated stresses.

3L.6 REFERENCES

3L-1 General Electric Company, "ESBWR Reactor Internals Flow Induced Vibration Program – Part 1", NEDE-33259P, Class III (Proprietary), January 2006, and NEDO-33259, Class I (Non-proprietary), January 2006.

3L-2 General Electric Company, "BWR Steam Dryer Integrity", SIL 644 Revision 1, November 9, 2004.

3L-3 *ANSYS Engineering Analysis System User's Manual*, G.J. DeSalvo and R.W. Gorman, Swanson Analysis Systems, Inc., Houston, PA, Revision 4.4a, May 1989.

3L-4 *Elements of Vibration Analysis*, Leonard Meirovitch, McGraw Hill Book Co., 1975.

Table 3L-1

Comparison of Major Steam Dryer Configuration Parameters

Steam Dryer Configuration Parameter	ESBWR Dryer	ABWR Dryer
Number of Banks	6	6
Active height (flow area) for vane modules	1829 mm (65.6 m^2)	1829 mm (56.6 m^2)
Approximate weight	60,000 Kg	50,000 Kg
Outside diameter of upper support ring	6920 mm	6630 mm
Overall height	5700 mm	5695 mm
Length of skirt	2736 mm	2731 mm
Skirt thickness	9 mm	7 mm
Cover plate thickness	25.4 mm	16 mm
Hood thickness	25.4 mm (outer bank) 12.7 mm (inner banks)	16 mm (outer bank) 8 mm (inner banks)
Upper support ring cross-section	89 x 242 mm	89 x 242 mm
Average steamline flow velocity	49.7 m/s	42.7 m/s

Table 3L-2

Specific Steam Dryer Load Definition Legend

Normal (N)	Normal and/or abnormal loads associated with the system operating conditions, including thermal loads, depending on acceptance criteria. These include deadweight, static differential pressure, and fluctuating pressure loads.
TSV	Turbine stop valve closure induced loads in the main steam piping and components integral to or mounted thereon. For the dryer, these include acoustic and flow impact loads. Separate load cases will be evaluated for load components that are separated in time (e.g., acoustic impact and flow impact).
LOCA8	Acoustic impact loads on the dryer due to a postulated steamline break. Separate load cases will be evaluated for load components that are separated in time (e.g., acoustic impact and level swell impact).
LOCA9	Level swell impact loads on the dryer due to a postulated steamline break. Separate load cases will be evaluated for load components that are separated in time (e.g., acoustic impact and level swell impact).

Table 3L-3

Typical Vibration Sensors

Vibration sensor type	Typical sensor model
Strain gauge	Kyowa Model KHC-10-120-G9
Accelerometer	Vibro-meter Model CA901
Dynamic pressure transducer	Vibro-meter Model CP104 and/or Model CP211

Table 3L-4

Typical Sensor Locations and Types

Equipment Item	Location on Equipment	Sensor Type	Location Basis
Steam Dryer Support Ring	On top of dryer support	Accelerometer (Acceleration Mode)	Past experience of dryer rocking.
Steam Dryer Skirt	At bottom of dryer	Accelerometer (Displacement Mode)	Modal analysis.
Steam Dryer Hood	At edge of dryer bank hood and end plate.	Strain Gage Pressure Transducer	Past experience of cracks at weld & to obtain forcing function data if problem occurs
Steam Dryer Drain Channel	At top & bottom, side edge of dryer channels.	Strain Gage	Modal analysis. Past experience of cracks at weld.
Steam Dryer Skirt	At top & bottom of dryer skirt.	Strain Gage Pressure Transducer	Modal analysis & to obtain forcing function data if problem occurs
Shroud	On the outside diameter	Strain Gage	Modal analysis.
Top Guide	On the outside diameter of the top guide mounted to measure tangential & radial relative displacements between top guide and vessel.	Linear Variable Differential Transformer (LVDT)	Past experience to measure shroud motion.
Vessel Dome Region	On steam dryer FIV instrument post.	Pressure Transducer	To obtain forcing function data if problem occurs.
Vessel Annulus	On the vertical FIV mounting bar in the annulus between the shroud and vessel walls.	Pressure Transducer	To obtain forcing function data if problem occurs.
Standby Liquid Control Line	On the joints between the vertical and horizontal runs	Strain Gage	New design

Table 3L-5

Applicable Data Reduction Method for Comparison to Criteria

Component	Sensor Type	Applicable Data Reduction Method		Frequency Bandwidth (Hz)
Shroud	Strain Gages	I	Time History	0-100
Steam Dryer Skirt	Strain Gages	I	Time History	0-100
Steam Dryer Drain Channels	Strain Gauges	II	Time History	0-100, 100-200
Steam Dryer Hoods	Strain Gages	II	Time History	0-100, 100-200
Steam Dryer Support Ring	Accelerometer	Impact	Time History	0-1600 0-80, 80-200
Top Guide	Displacement	I	Time History	0-100
Vessel Annulus	Pressure sensors	I	Time History	0-200
Standby Liquid Control Lines	Strain Gages	I	Time History	0-200

Table 3L-6

Parameters Used in Spectrum Generation

Parameter	Value
Bandwidth	0-200 Hz
Time length	3 minutes
No. of Fourier Lines	400
Resolution	0.5 Hz
Window	Flat Top
No. of averages	90
Overlap	0%
Noise reduction	None
Average Type	Peak-hold
P-P Value	= RMS x 6

Table 3L-7

Data Evaluation Methods to be Used for Each Component

Internal Component	Data Evaluation Method Used
Shroud and Chimney	I
Steam Dryer	I & II
Standby Liquid Control Line	I

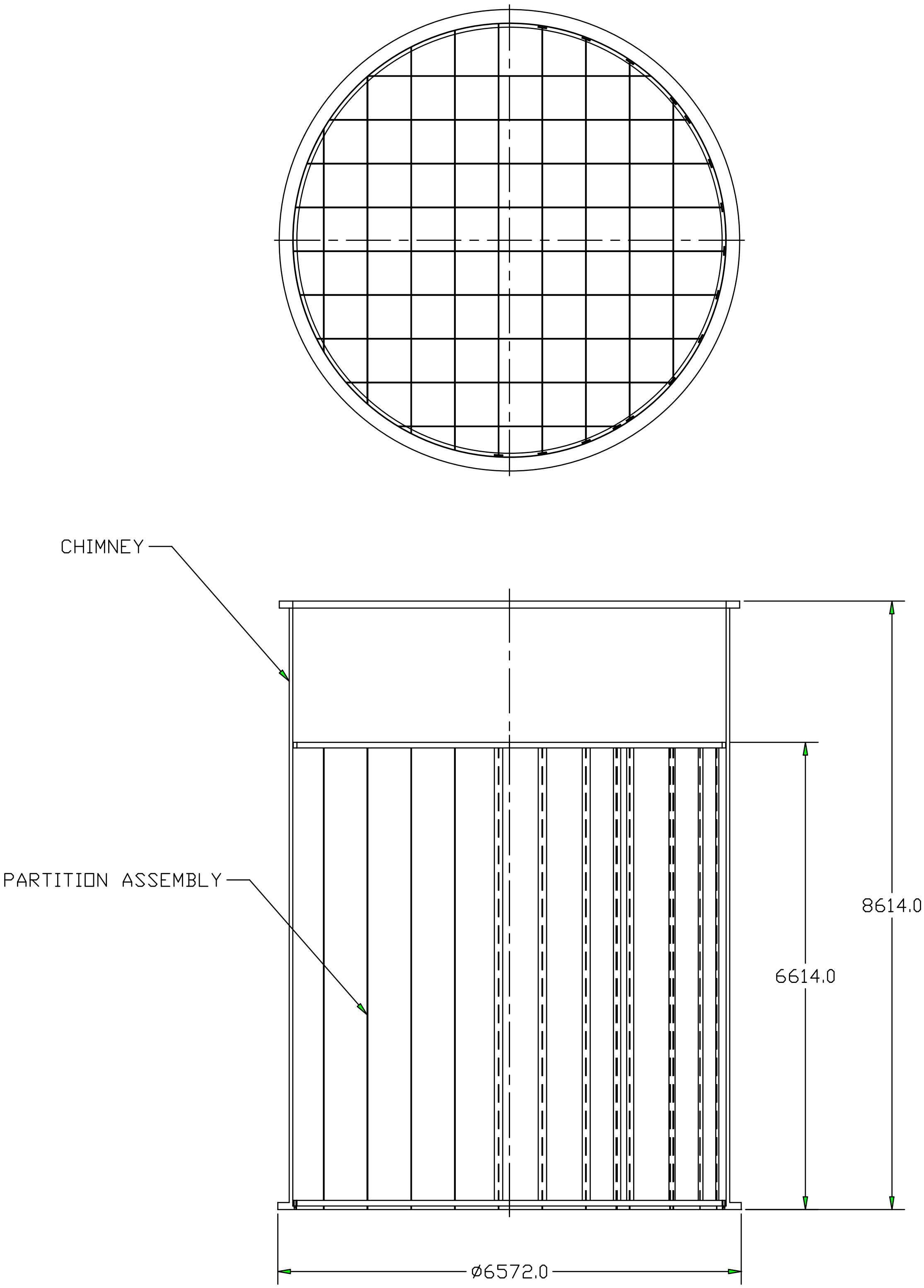


Figure 3L-1. Chimney and Partition Assembly

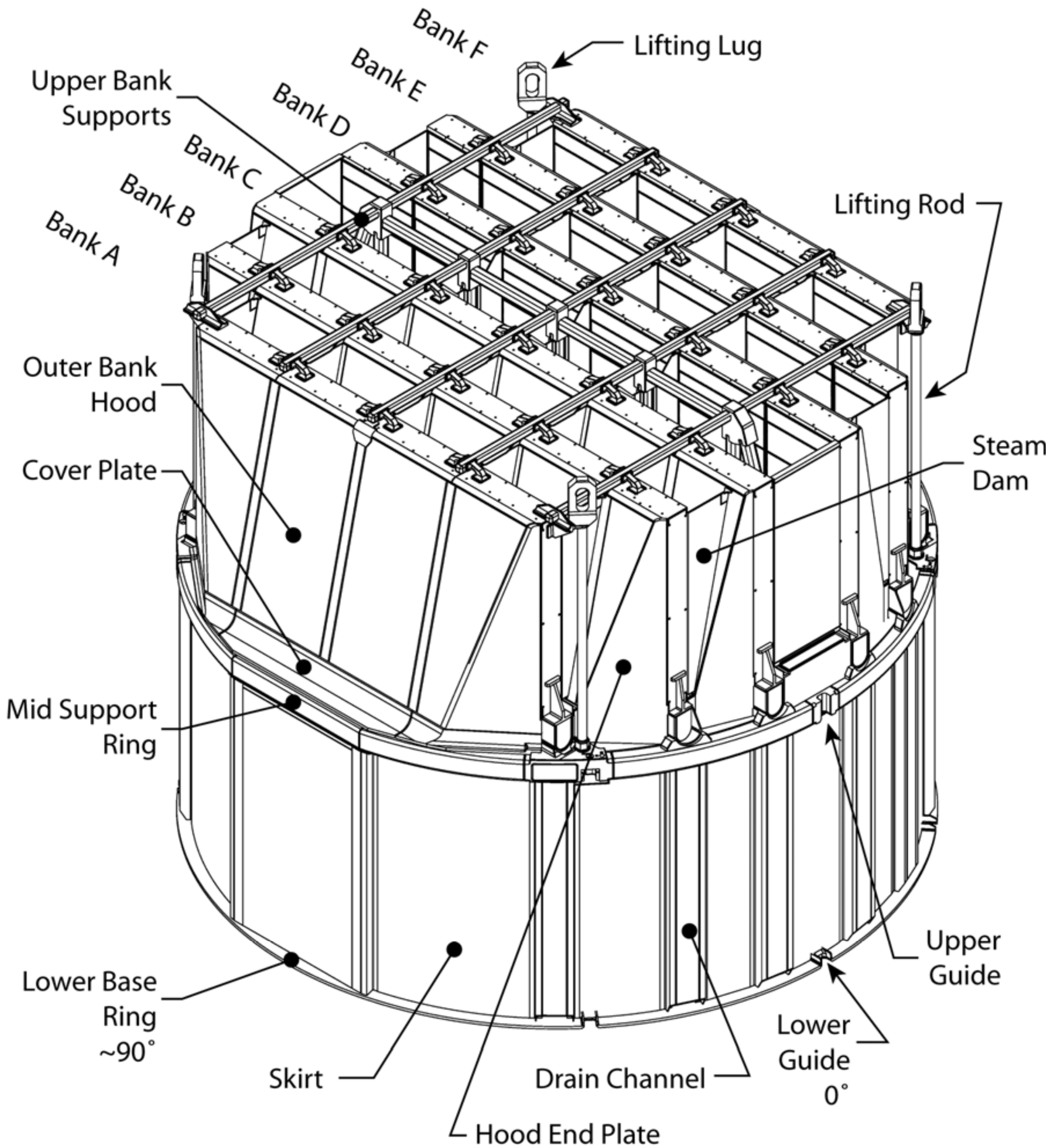


Figure 3L-2. ESBWR Steam Dryer Assembly