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Subject: **Reactor Building/Fuel Building Truncated Finite Element Model Analysis Data**

Enclosures 1 and 2 provide the data for the subject truncated Reactor Building/Fuel Building Finite Element (FE) model analysis. This information is provided in response to the NRC's request during the audit on the DCD section 3.8 RAIs held in July 2006.

If you have any questions about the information provided here, please let me know.

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

D068

Enclosures:

1. MFN 06-262 – Shimizu Engineering Report SER-ESB-027, "Reactor Building/ Fuel Building Truncated Finite Element Model Analysis Data," August 2006
2. MFN 06-262 - NASTRAN Analysis Input Data and NASTRAN Analysis Results (CD)

cc:	WD Beckner	USNRC (w/o enclosures)
	AE Cubbage	USNRC (with enclosures)
	LA Dudes	USNRC (w/o enclosures)
	GB Stramback	GE/San Jose (with enclosures)
	eDRF	0000-0056-8111

ENCLOSURE 1

MFN 06-262

Shimizu Engineering Report SER-ESB-027, "Reactor Building/ Fuel Building Truncated Finite Element Model Analysis Data," August 2006

Shimizu Engineering Report

Project	General Electric Company ESBWR Project	Shimizu Document No.	SER-ESB-027
Title	Reactor Building/Fuel Buildings Truncated FE Model Analysis Data	Rev.	0
		Issued Date	8/2/06
		Revised Date	

NOTE:

This document provides the data for the truncated Reactor/Fuel Buildings Finite Element (FE) model analysis in response to NRC's request in the DCD audit for RAI 3.8 held on July, 2006.

Rev.	Date	Note	Approve	Review	Prepare
0	8/2/06	Initial Issue	Y.O.	T.T.	T.T.

Shimizu Corporation	Prepared by	T. Toyota	8/2/06
	Reviewed by	T. Takahashi	8/2/06
	Approved by	Y. Orito	8/2/06

1. Outline

At NRC's audit on the ESBWR DCD RAI 3.8, NRC requested GE to provide the data needed to perform their verification analyses using a truncated Reactor Building and Fuel Building (RB/FB) Finite Element (FE) model.

This document provides the data requested by NRC.

2. Provided Data

The analysis model provided is truncated from the RB/FB global FE model shown in Figure 1. The truncated model is shown in Figure 2. The model includes the RBFB basemat including soil springs and the half of B3F walls.

As for loads, the data needed to perform analyses for the following five loads are provided.

- Dead Load
- Drywell Unit Pressure Load
- Horizontal Seismic Load in N-S Direction
- Horizontal Seismic Load in E-W Direction
- Vertical Seismic Load

For the load data, not only the data of loads directly applied to the model but the loads applied to the boundary nodes, i.e., the nodes located at the top of the model, which are necessary to reproduce the same stress conditions as global model analyses, are prepared. In addition to the load data, boundary displacement data, which have the same functions as the loads applied to the boundary nodes, are also provided.

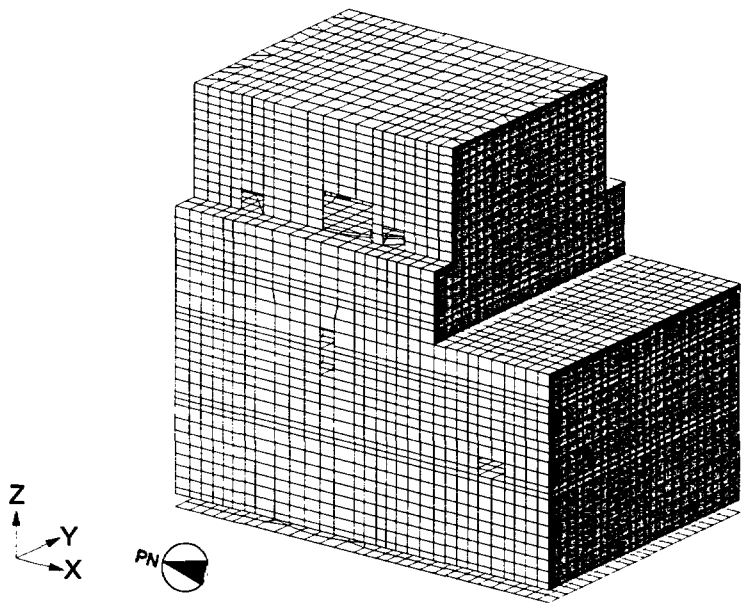
Provided data are included in the following appendices.

Appendix A: NASTRAN Analysis Data

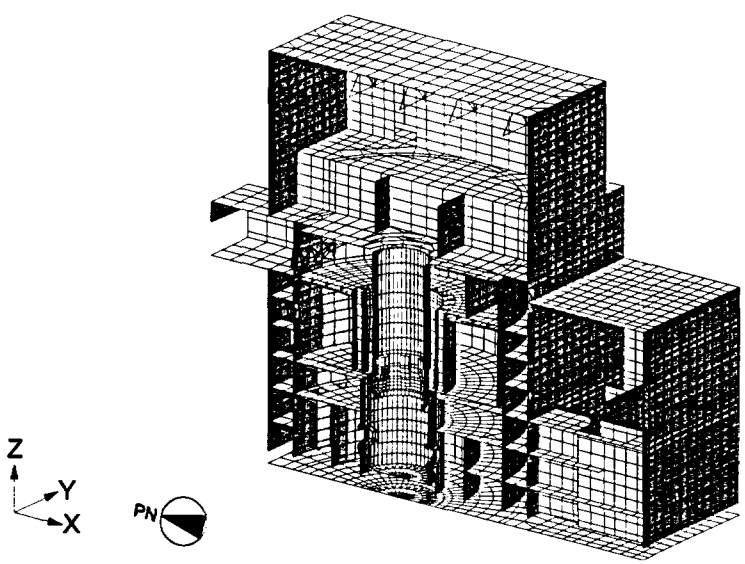
Appendix B: NASTRAN Analysis Results

Appendix C: Concrete outline drawings

Appendix D: Verification of truncated model analysis data



Whole View



Cut View

Figure 1 RB/FB Global FE Analysis Model

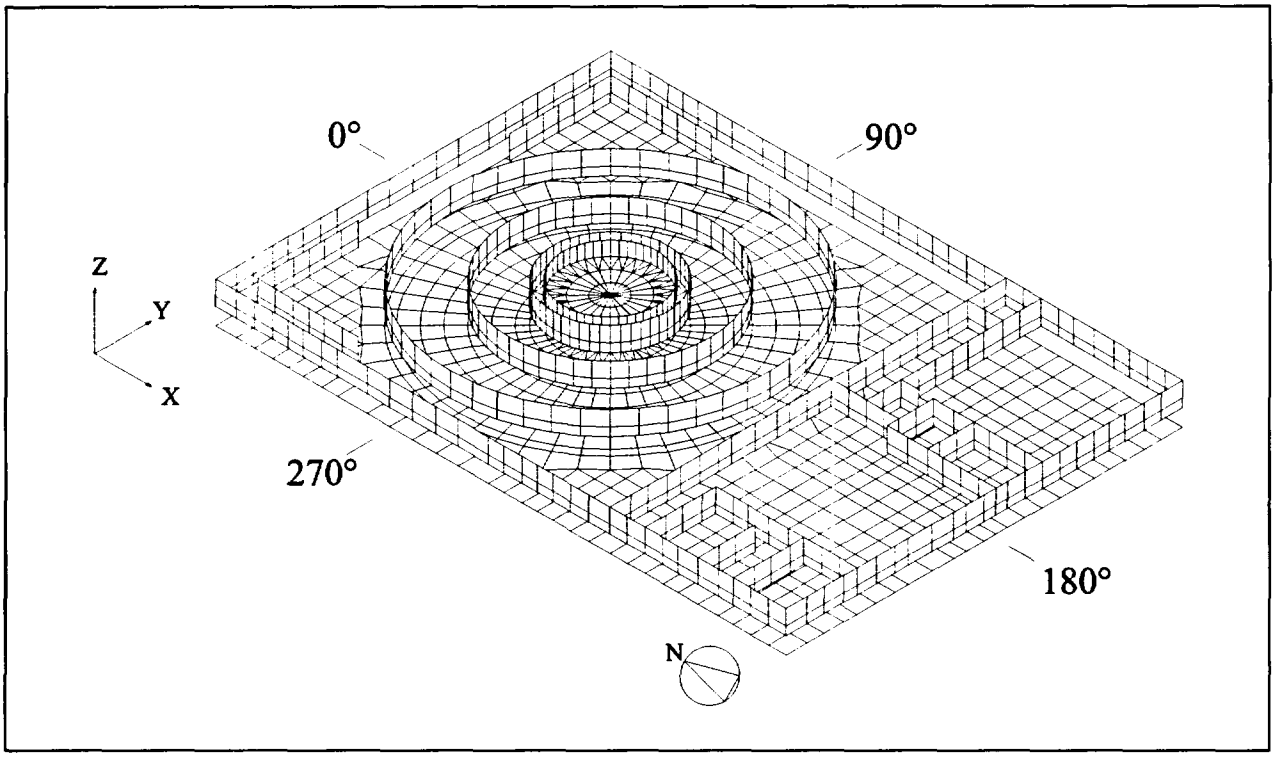


Figure 2 RB/FB Truncated FE Analysis Model

Appendix A NASTRAN Analysis Input Data

Contents of NASTRAN input data provided are summarized in Tables A-1 through A-3.

In Tables A-2 and A-3, "Boundary Load Analyses" means the analyses in which loads are applied to the boundary nodes, i.e., the nodes located at the top of the model, and "Boundary Displacement Analyses" means the analyses in which displacements are applied to the boundary nodes.

Boundary loads and displacements are listed in the following Excel files. They are defined in the global Cartesian coordinate system shown in Figure 2.

- BoundaryLoad.xls
- BoundaryDisp.xls

FE meshes of the global FE model are shown in Figures A-1 through A-19 for the structures which are included in the truncated FE model.

Table A-1 NASTRAN Model Data Files

How to apply	Building Data (External File)	
	Data File	note
always (common)	cood	Coordinate System Definition
	node_truncated.txt	Defines the grid points (Building)
	soil_node.prn	Defines the grid points (Soil)
	elem_truncated.txt	Defines shell and bar elements
	rbar_truncated.txt	Defines a rigid bar
	pshell_truncated.txt	Defines the properties of shell elements.
	pbar_truncated.txt	Defines the properties of bar elements.
	mat_truncated.txt	Defines the material properties
Soil Spring	elas_o.prn	Defines soil spring for vertical loads
	elas_s.prn	Defines soil spring for horizontal loads

Table A-2 NASTRAN Load Data Files for Boundary Load Analyses

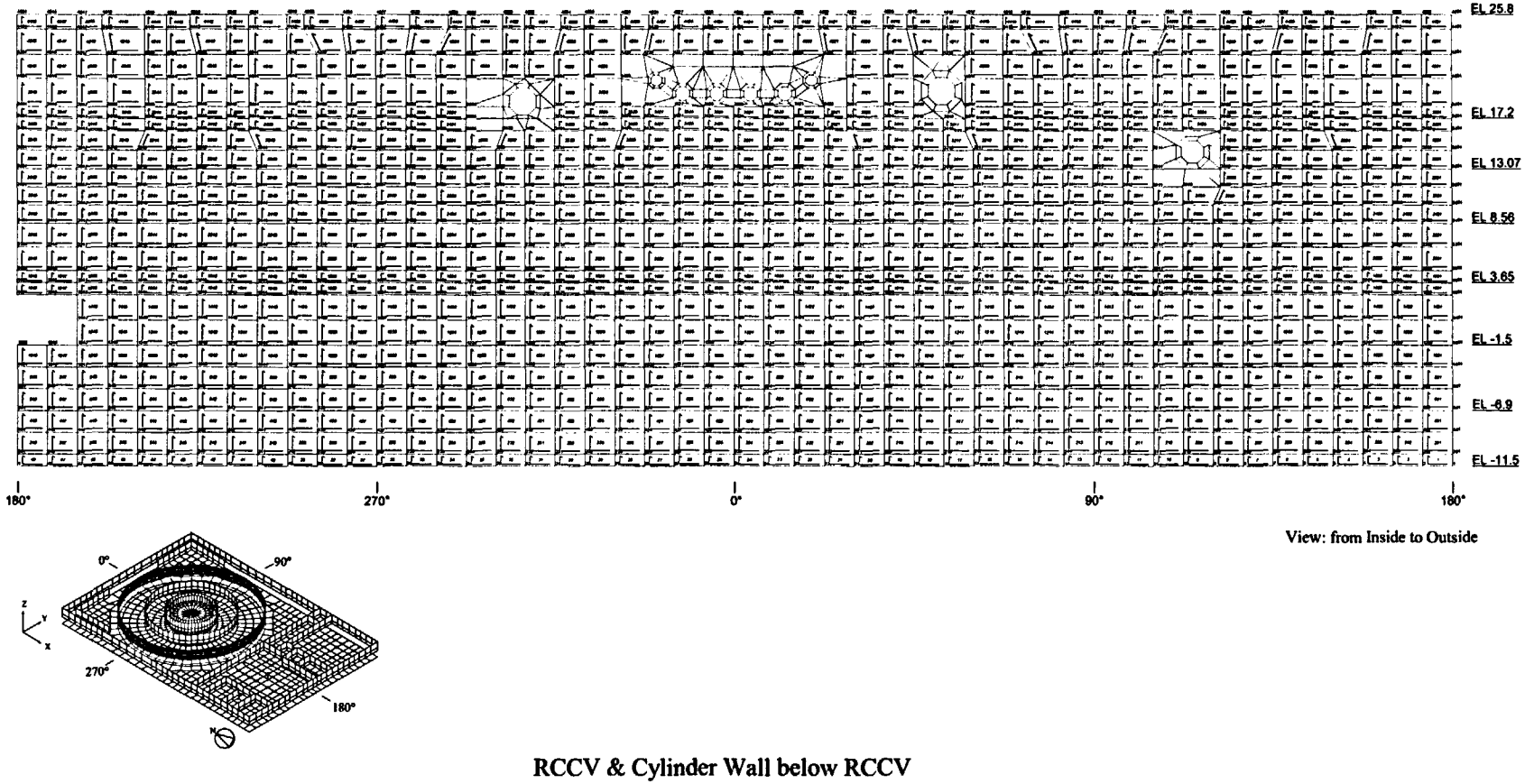
Load Name	NASTRAN Input File	Label	Load ID	Load Data (External File)			Boundary Data (External File)			Model Data*	
				Unit Load ID	Load Data File	note	SPC ID	Load Data File	note	Soil Spring	other
Dead	DL_force.dat	DLO	100	1010	grav.txt	Modeled main structure's weight	100	DL_force.prn	Boundary force at Dead Load	elas_o.prn	common
				1100	ml_truncated.prn	Miscellaneous structure weight					
				1100	ml_lin_truncated.prn	Liner Weight (except RCCV Liner)					
				1100	el_truncated.txt	Equipment Load					
				1100	fl_truncated.txt	Hydrostatic Load					
				1100	ol_truncated.txt	Finishing Load, Additional Concrete Weight, etc.					
Pressure	PDW_force.dat	PDW	31	3010	pl_truncated.txt	Drywell unit area load (1MPa)	100	PDW_force.prn	Boundary force at Pressure Load	elas_o.prn	common
Seismic	EQNS_force.dat	EQNS	811	8110	shearNS_truncated.txt	Shear Force (x; NS)	100	EQNS_force.prn	Boundary force at Seismic Load (NS)	elas_s.prn	common
				8210	emx_truncated.txt	Overturning Moment (x; NS)					
	EQEW_force.dat	EQEW	812	8120	shearEW_truncated.txt	Shear Force (y; EW)	100	EQEW_force.prn	Boundary force at Seismic Load (EW)		
				8220	emy_truncated.txt	Overturning Moment (y; EW)					
	EQZ_force.dat	EQZ	820	8400	vertical_truncated.txt	Vertical	100	EQZ_force.prn	Boundary force at Seismic Load (Vert)	elas_o.prn	

* : Refer to Table A-1.

Table A-3 NASTRAN Load Data Files for Boundary Displacement Analyses

Load Name	NASTRAN Input File	Label	Load ID	Load Data (External File)			Boundary Data (External File)			Model Data*	
				Unit Load ID	Load Data File	note	SPC ID	Load Data File	note	Soil Spring	other
Dead	DL_disp.dat	DLO	100	1010	grav.txt	Modeled main structure's weight	100	DL_spc.txt	Boundary Enforced Displacement at Dead Load	elas_o.prn	common
				1100	ml_truncated.prn	Miscellaneous structure weight					
				1100	ml_lin_truncated.prn	Liner Weight (except RCCV Liner)					
				1100	el_truncated.txt	Equipment Load					
				1100	fl_truncated.txt	Hydrostatic Load					
				1100	ol_truncated.txt	Finishing Load, Additional Concrete Weight, etc.					
Pressure	PDW_disp.dat	PDW	31	3010	pl_truncated.txt	Drywell unit area load (1MPa)	100	PDW_spc.txt	Boundary Enforced Displacement at Pressure Load	elas_o.prn	common
Seismic	EQNS_disp.dat	EQNS	811	8110	shearNS_truncated.txt	Shear Force (x; NS)	100	EQNS_spc.txt	Boundary Enforced Displacement at Seismic Load (NS)	elas_s.prn	common
				8210	emx_truncated.txt	Overturning Moment (x; NS)					
	EQEW_disp.dat	EQEW	812	8120	shearEW_truncated.txt	Shear Force (y; EW)	100	EQEW_spc.txt	Boundary Enforced Displacement at Seismic Load (EW)		
				8220	emy_truncated.txt	Overturning Moment (y; EW)					
	EQZ_disp.dat	EQZ	820	8400	vertical_truncated.txt	Vertical	100	EQZ_spc.txt	Boundary Enforced Displacement at Seismic Load (Vert)	elas_o.prn	

* : Refer to Table A-1.



RCCV & Cylinder Wall below RCCV

Figure A-1 FE Mesh of RCCV Wall and Cylindrical Wall below RCCV Wall

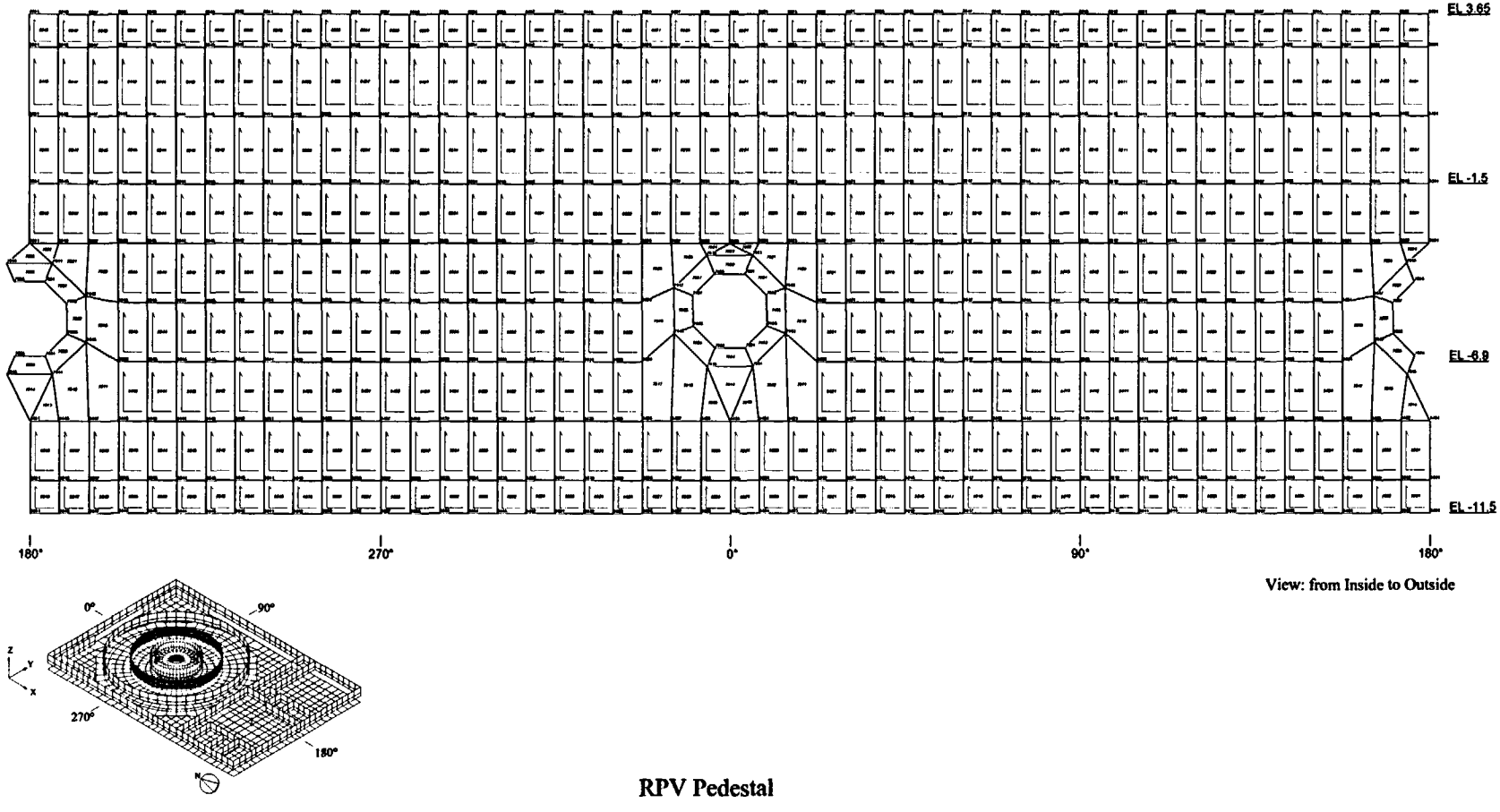


Figure A-2 FE Mesh of RPV Pedestal

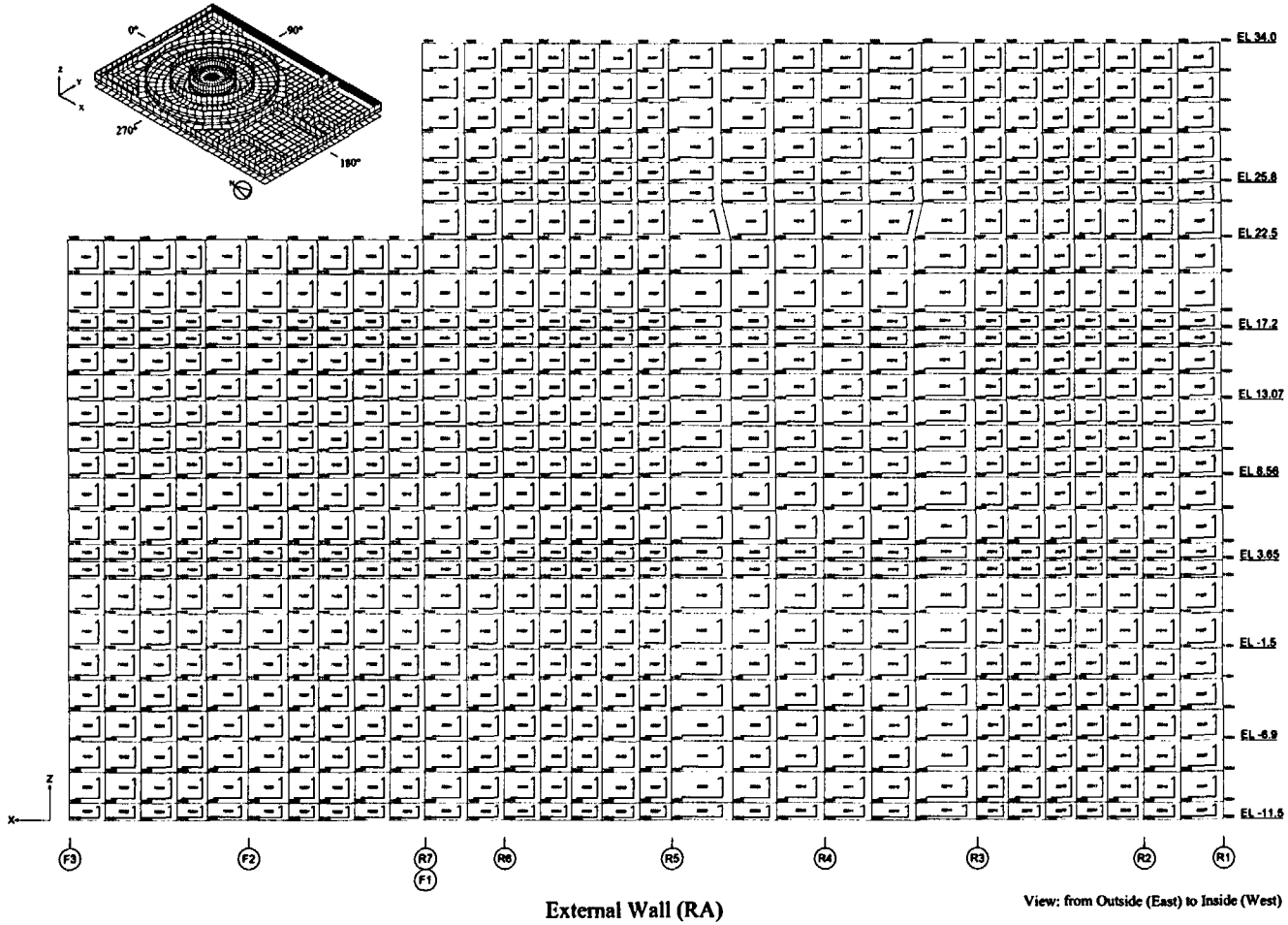


Figure A-3 FE Mesh of External Wall (RA)

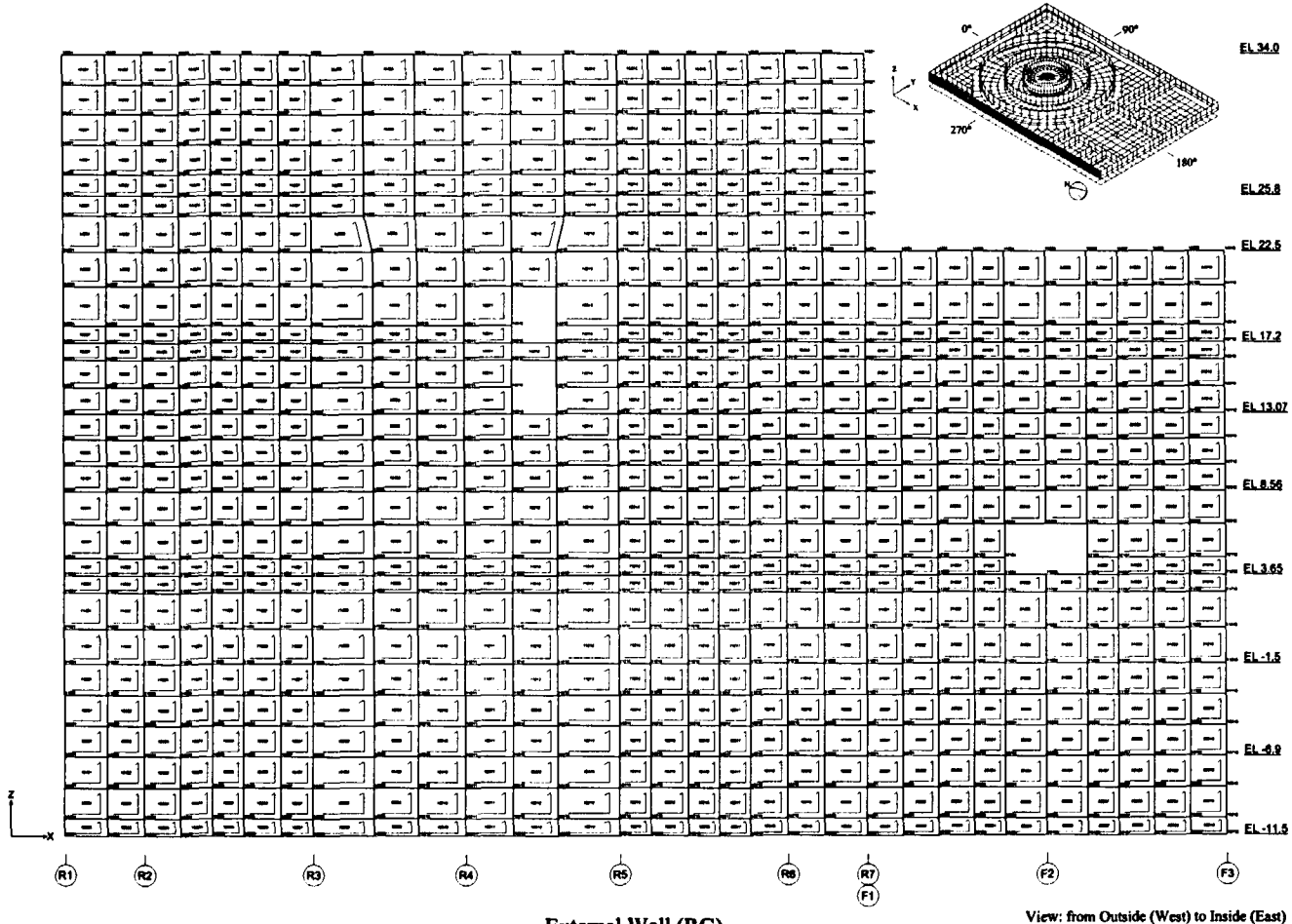


Figure A-4 FE Mesh of External Wall (RG)

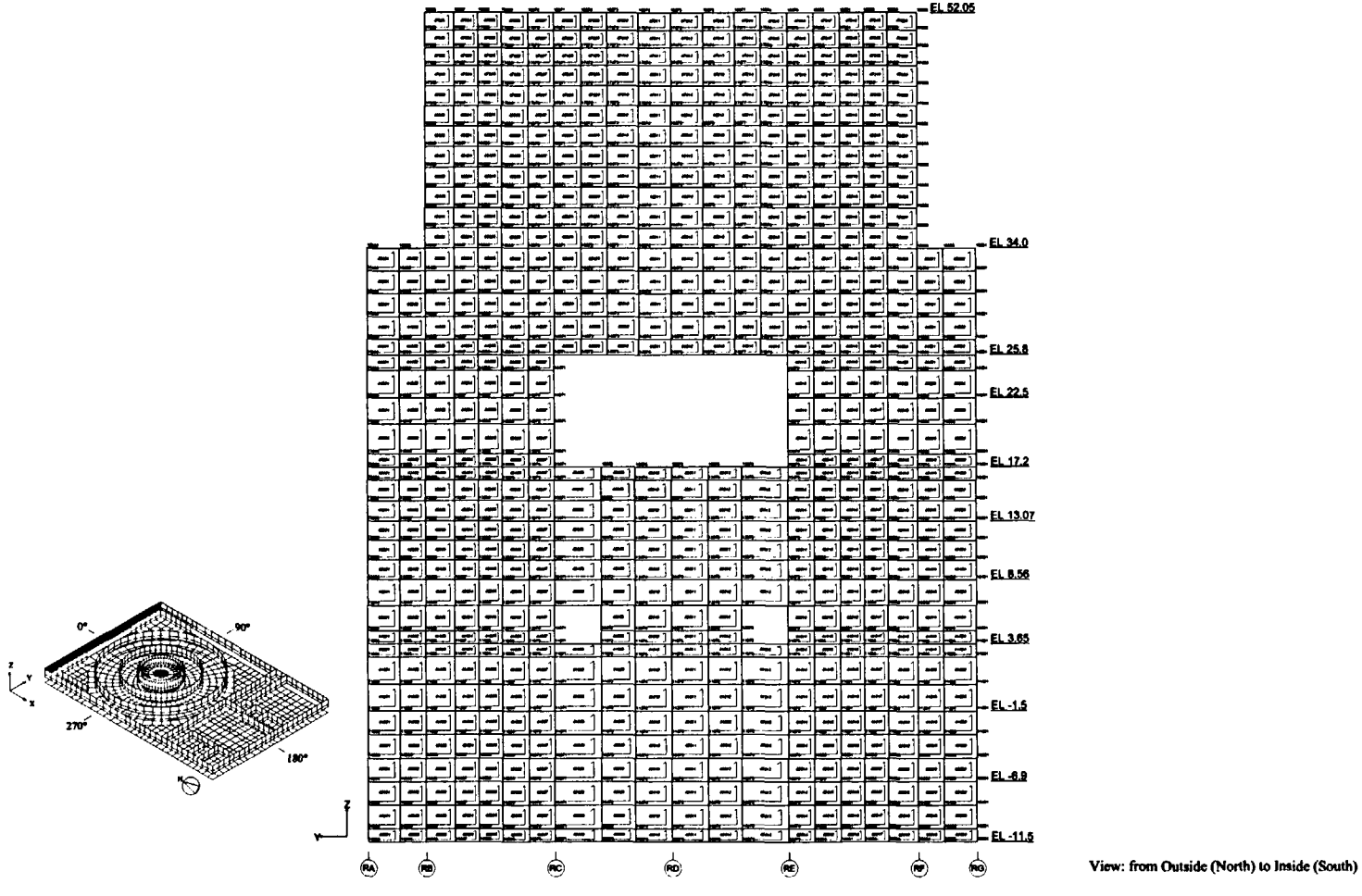


Figure A-5 FE Mesh of External Wall (R1)

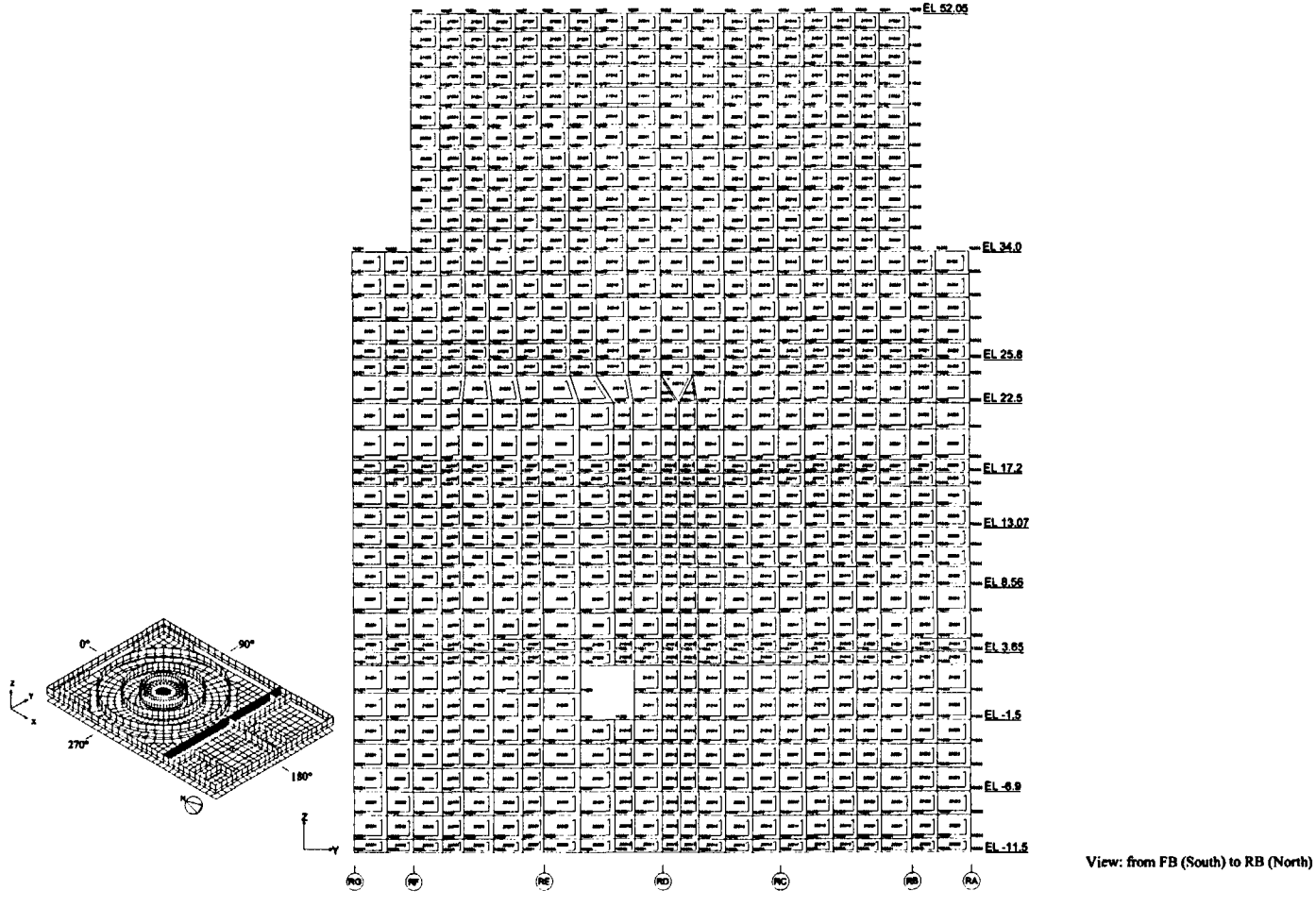


Figure A-6 FE Mesh of External Wall (R7 F1)

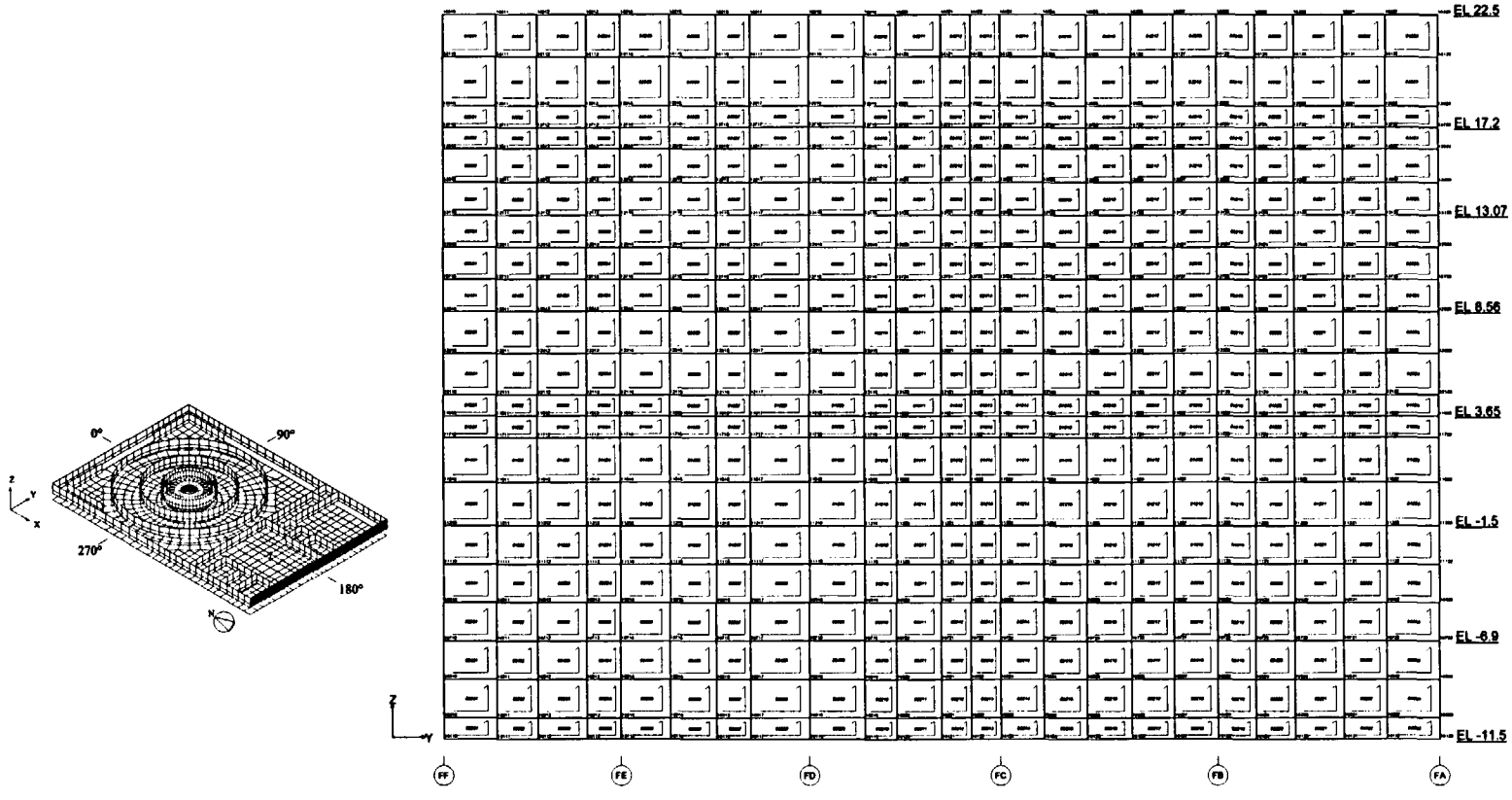


Figure A-7 FE Mesh of External Wall (F3)

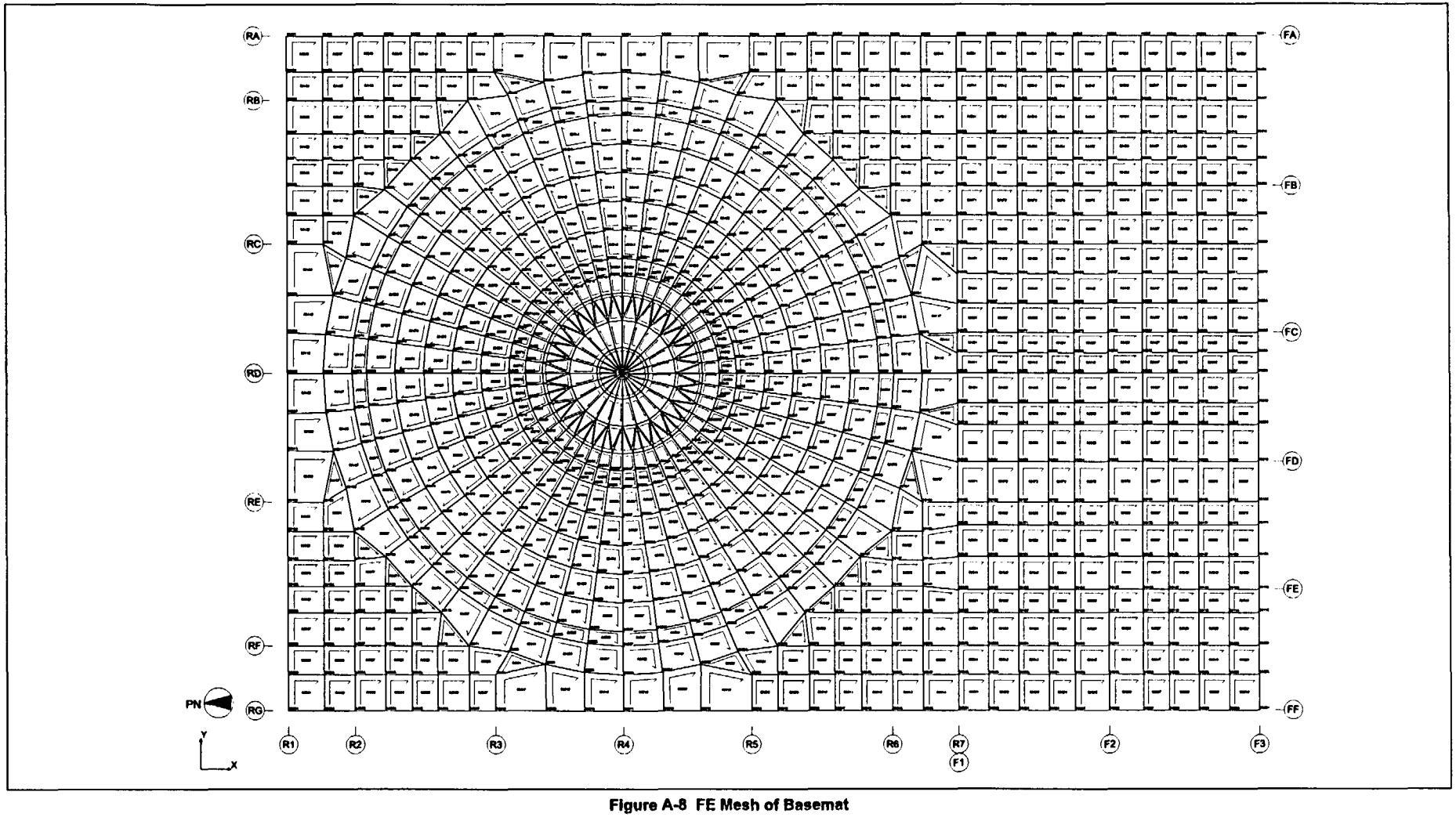


Figure A-8 FE Mesh of Basemat

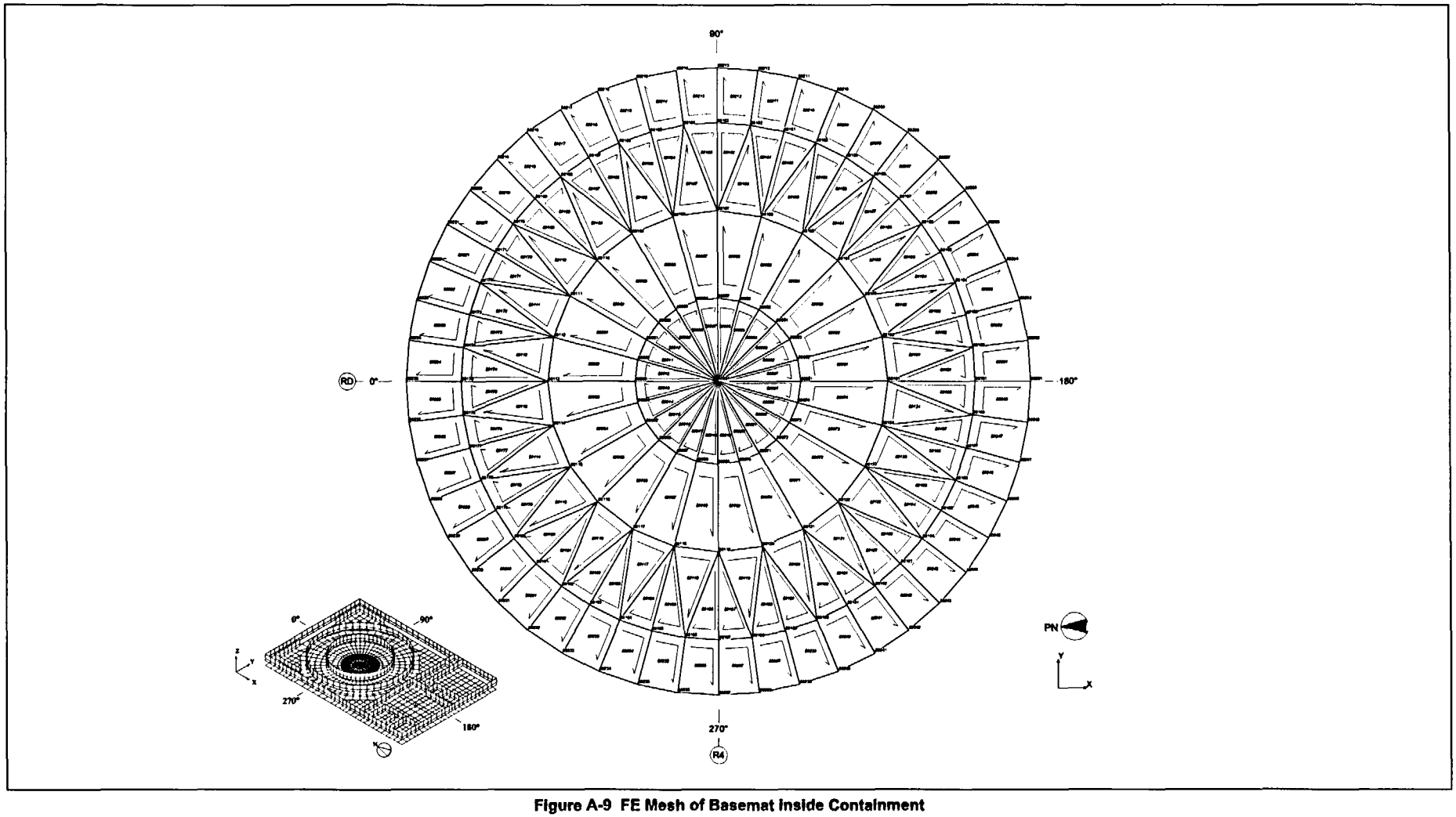


Figure A-9 FE Mesh of Basemat Inside Containment

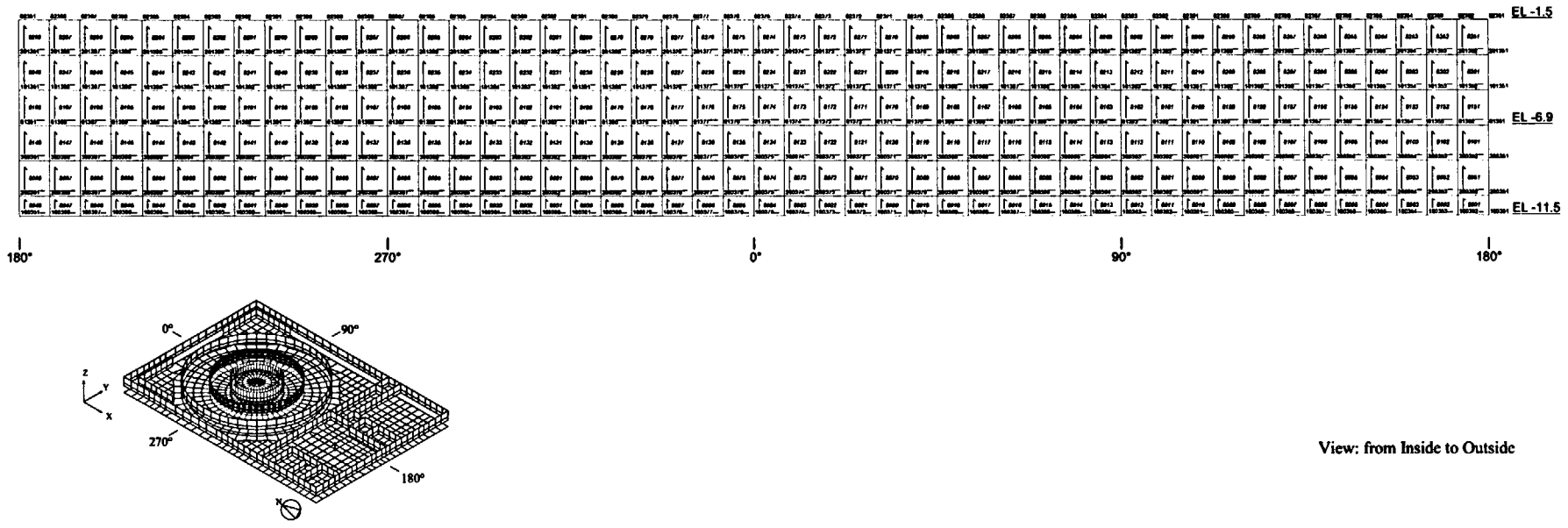


Figure A-10 FE Mesh of Cylindrical Inner Wall

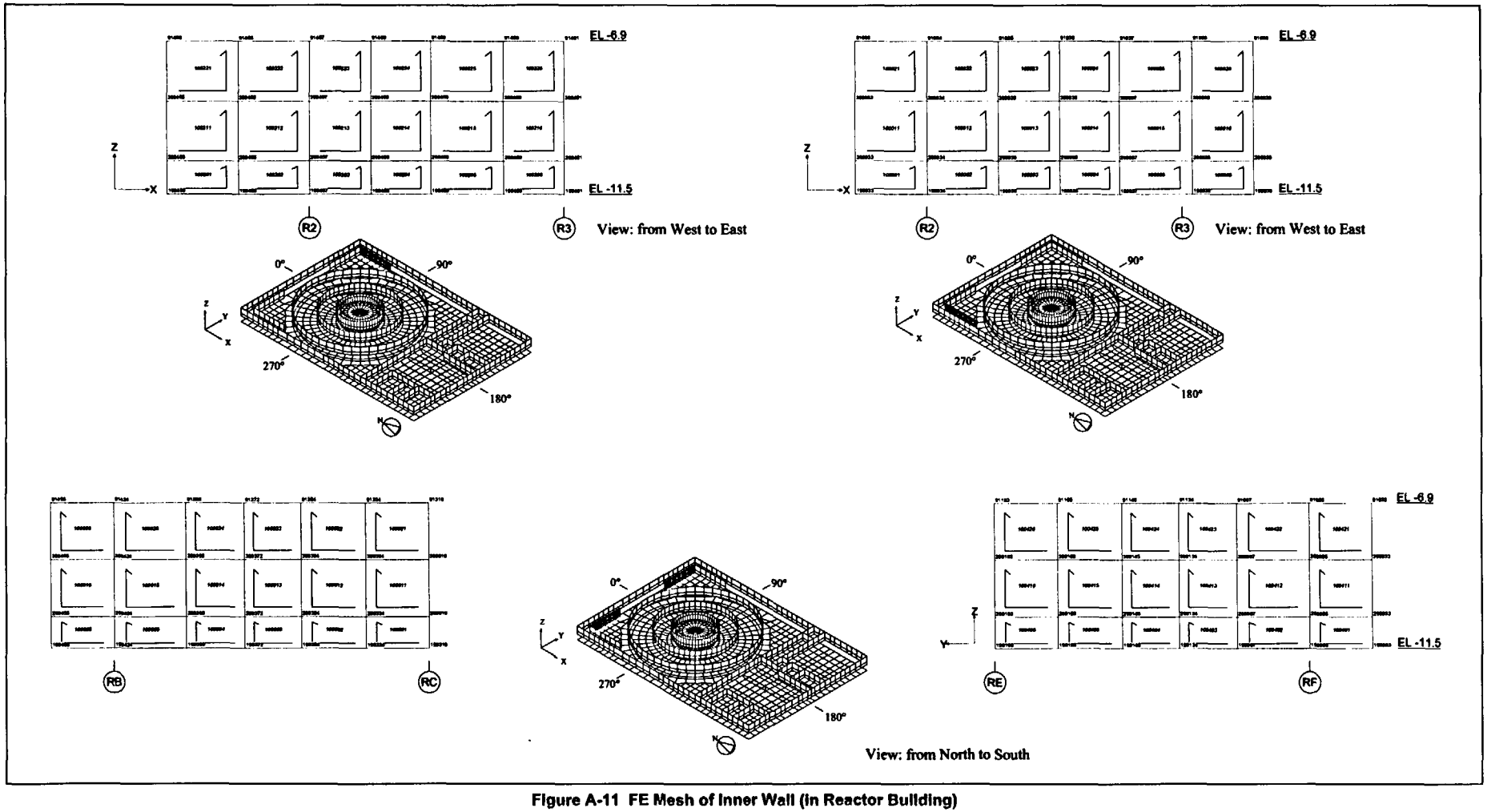


Figure A-11 FE Mesh of Inner Wall (in Reactor Building)

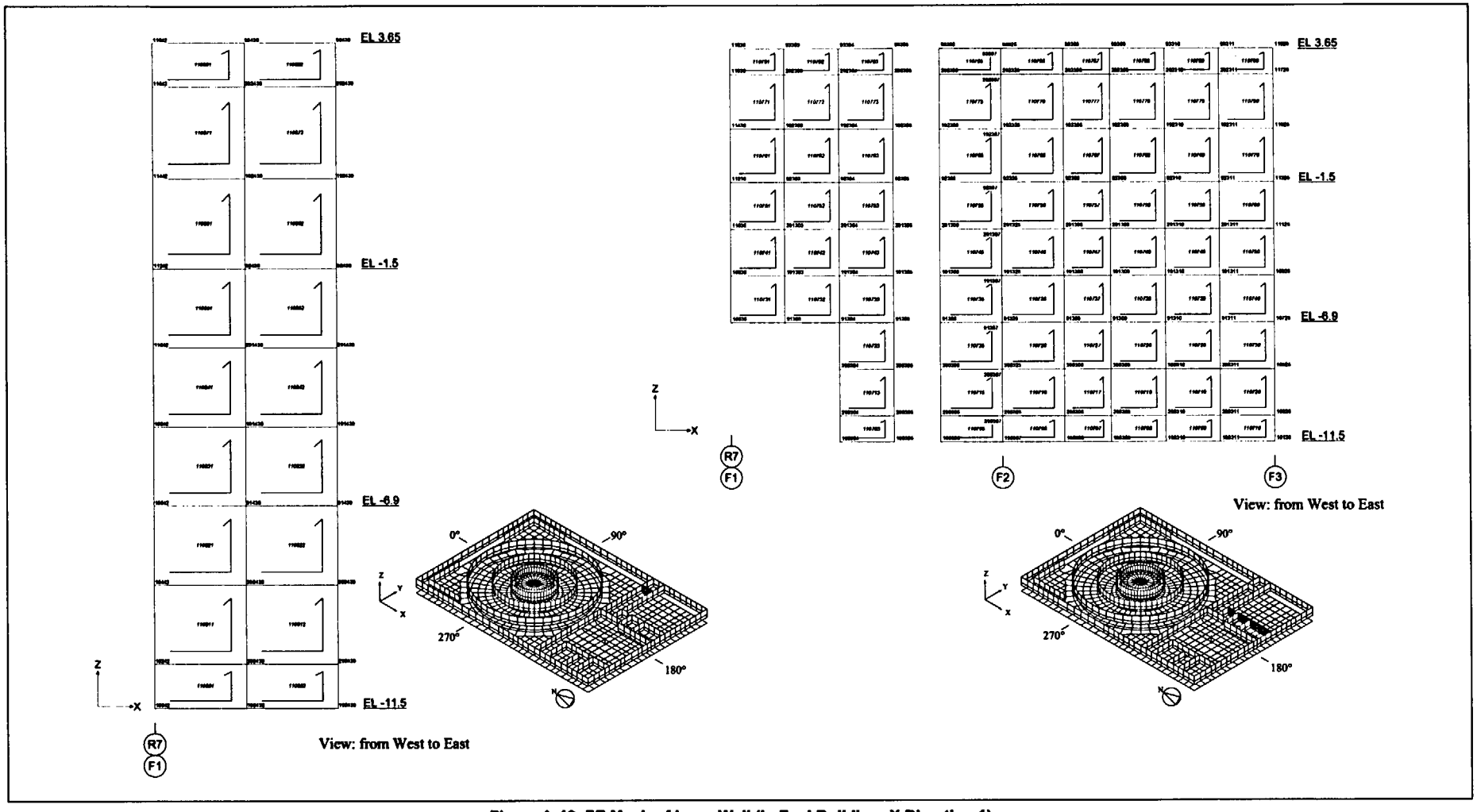


Figure A-12 FE Mesh of Inner Wall (in Fuel Building; X Direction 1)

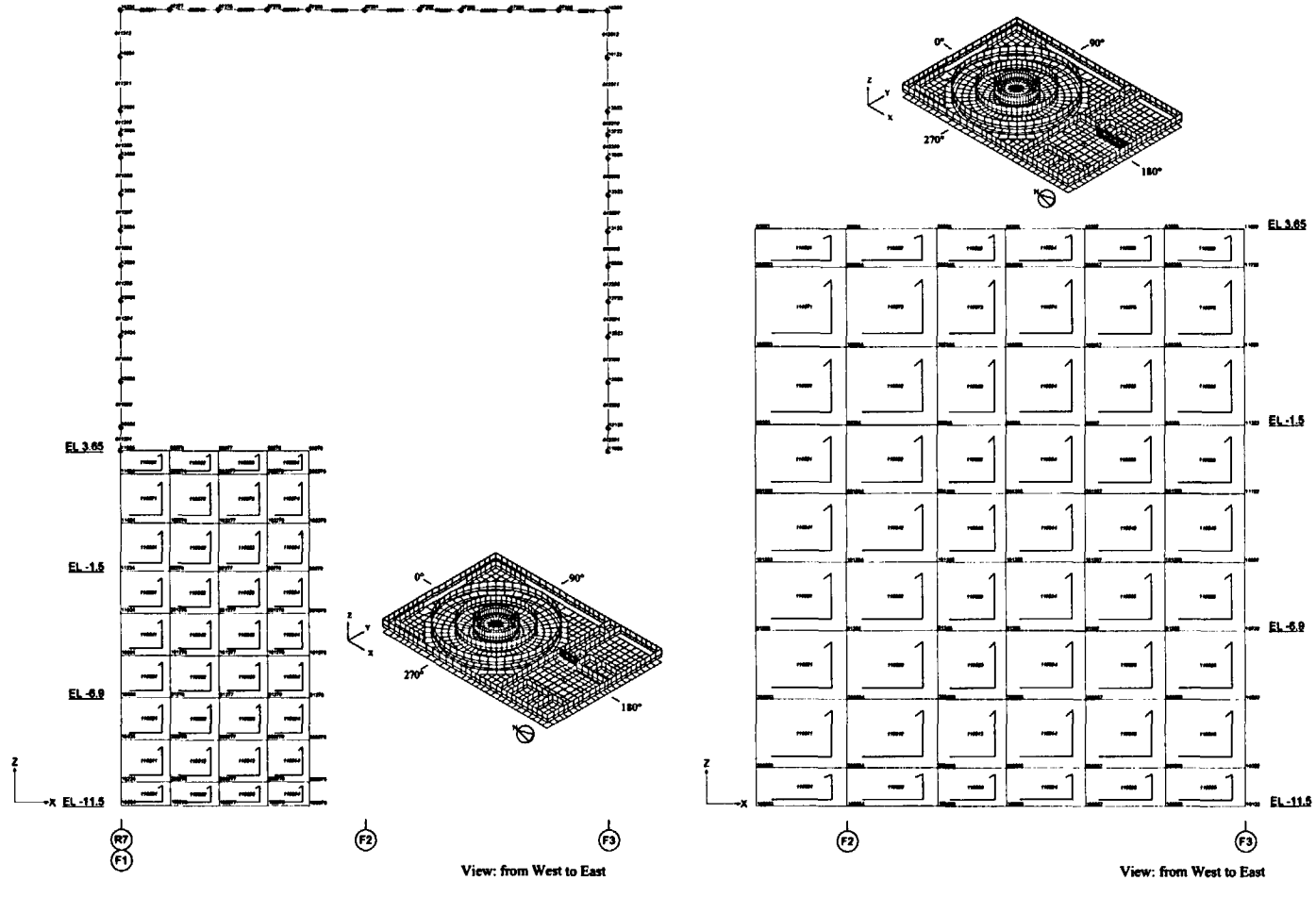


Figure A-13 FE Mesh of Inner Wall (In Fuel Building; X Direction 2)

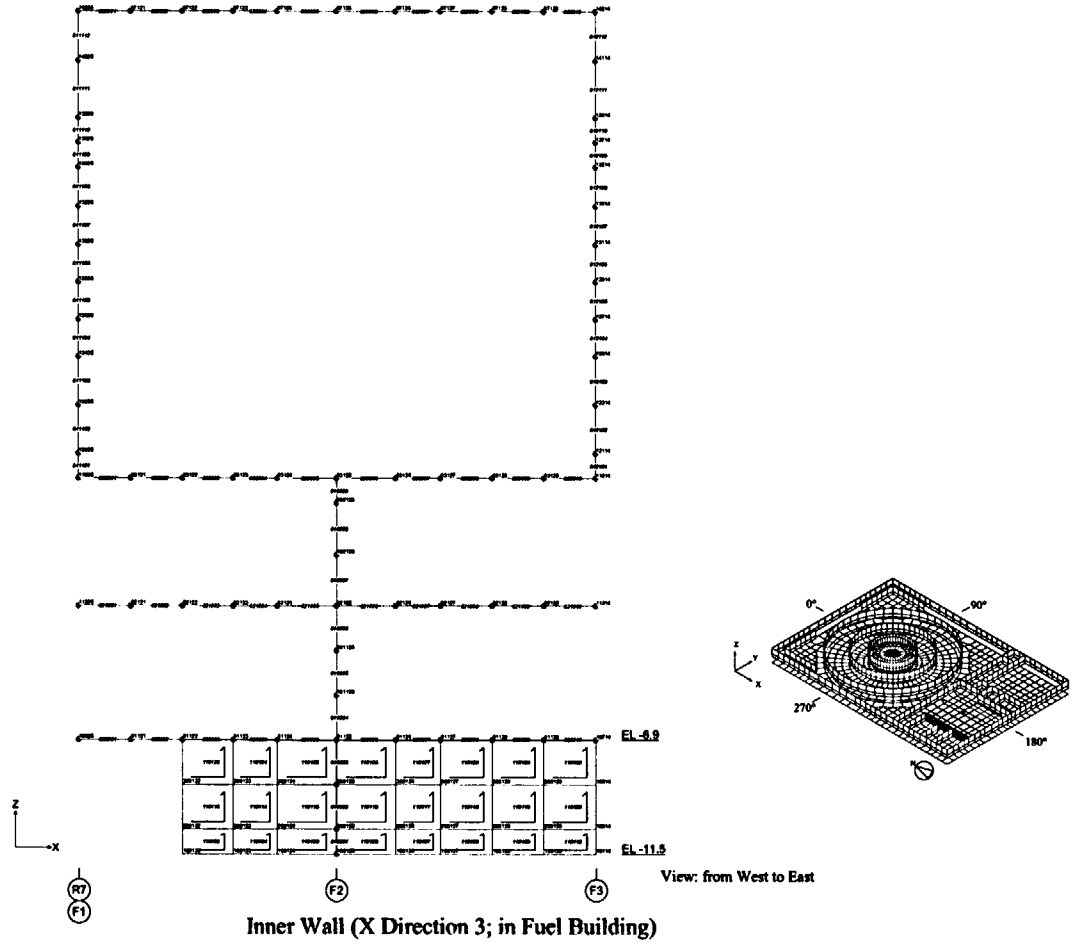


Figure A-14 FE Mesh of Inner Wall (in Fuel Building; X Direction 3)

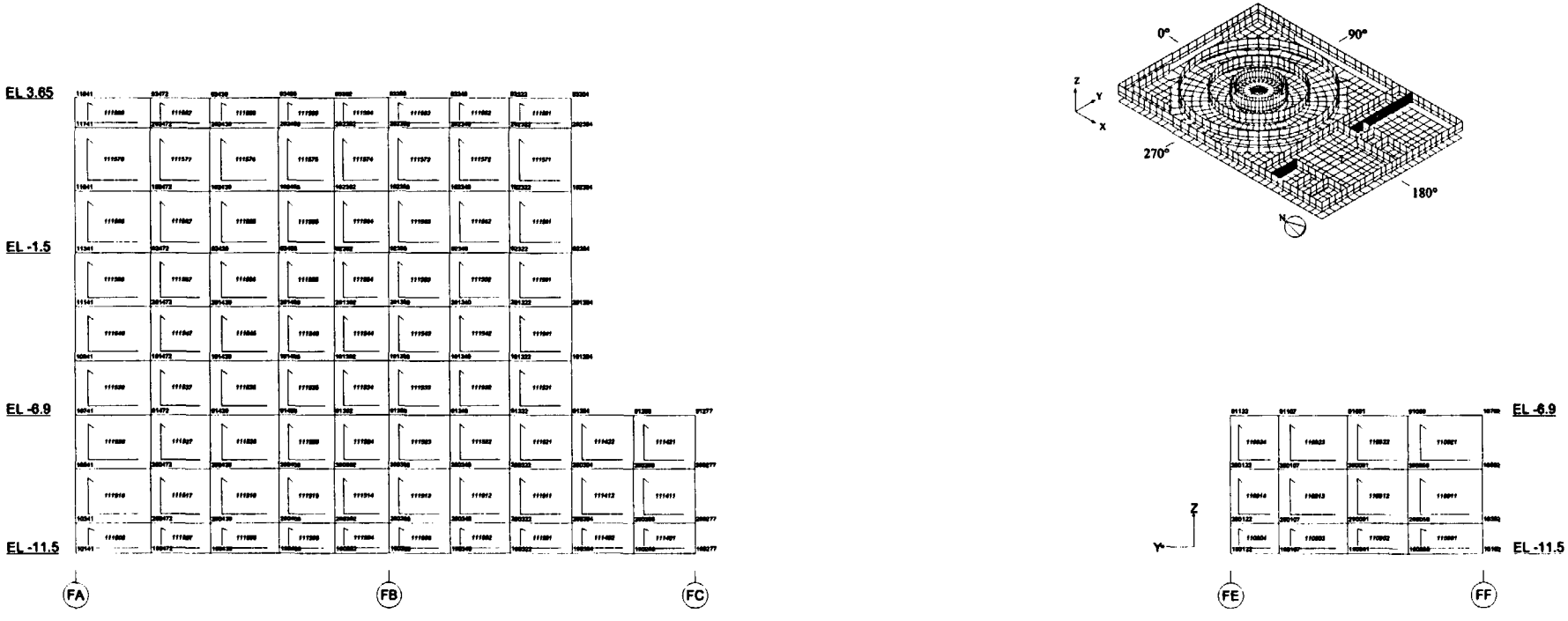


Figure A-15 FE Mesh of Inner Wall (In Fuel Building; Y Direction 1)

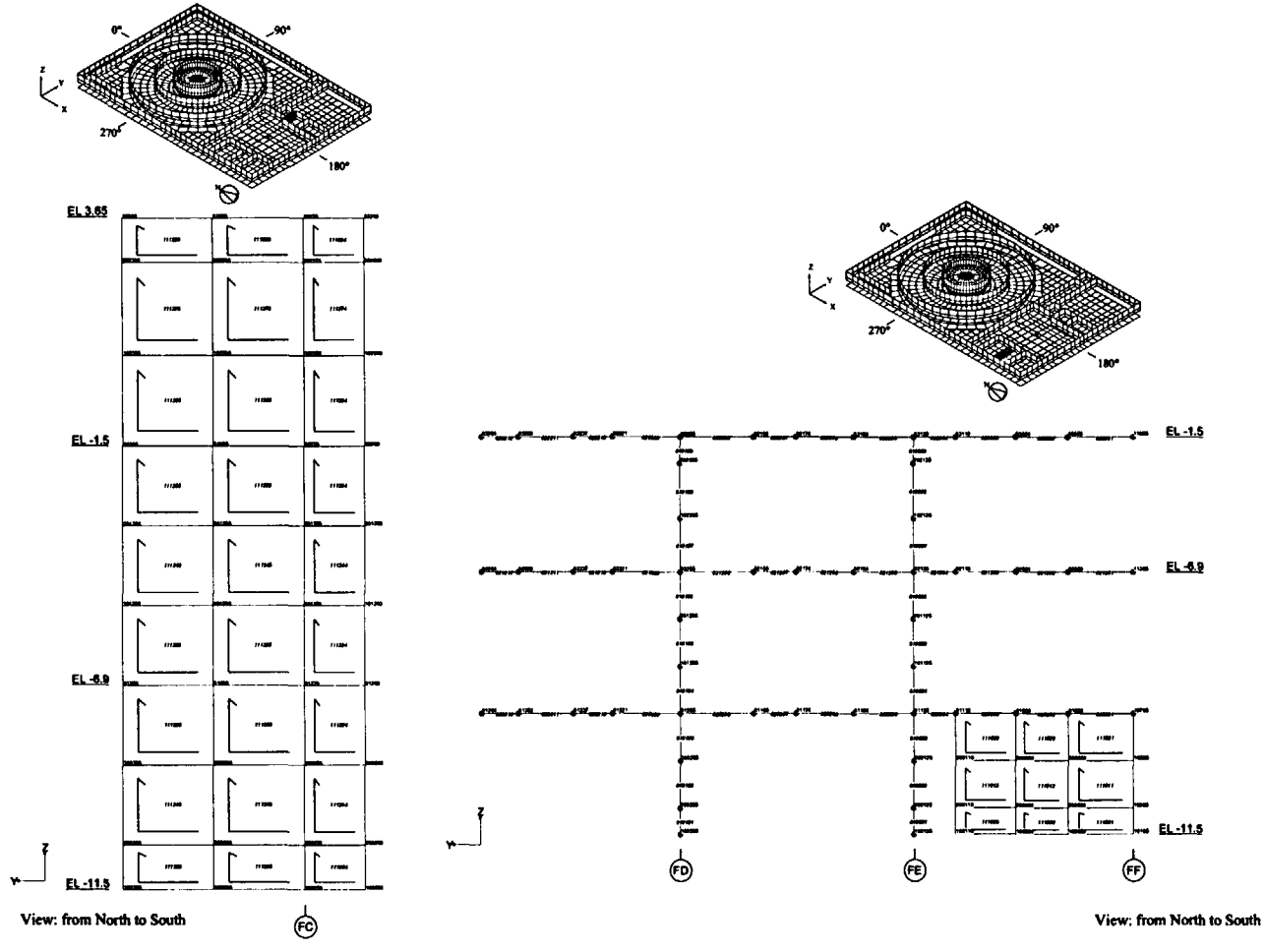


Figure A-16 FE Mesh of Inner Wall (In Fuel Building; Y Direction 2)

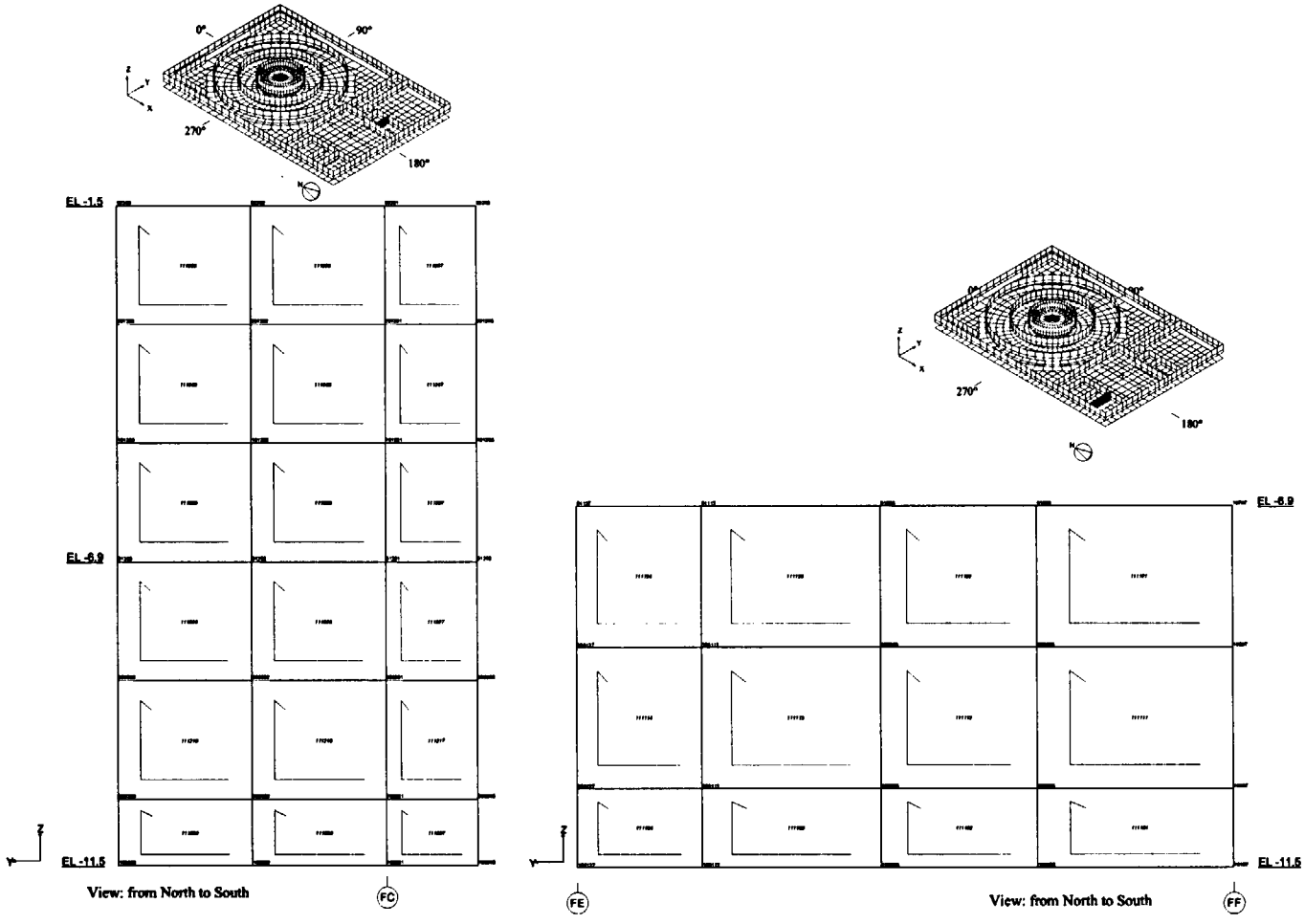


Figure A-17 FE Mesh of Inner Wall (In Fuel Building; Y Direction 3)

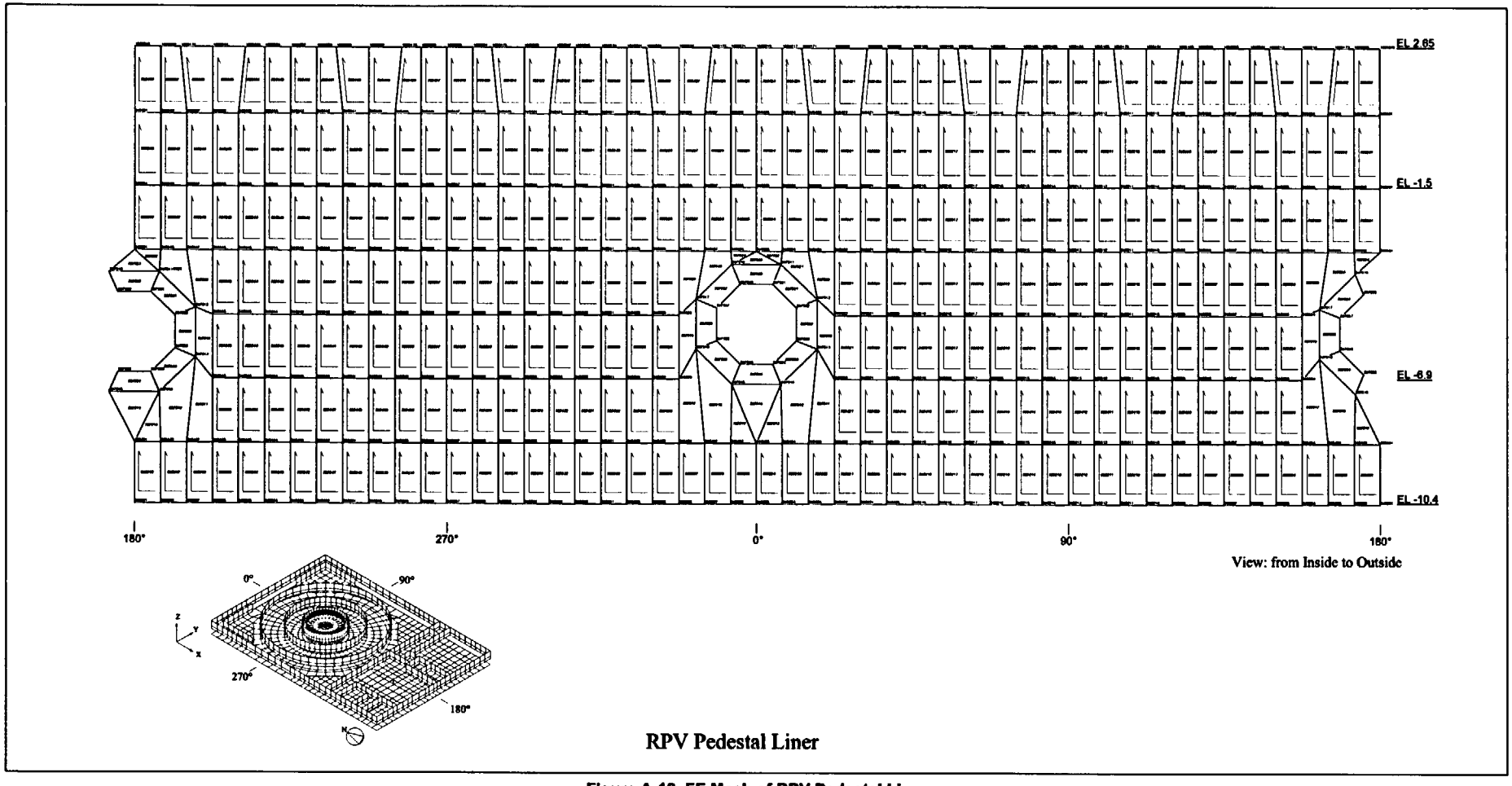


Figure A-18 FE Mesh of RPV Pedestal Liner

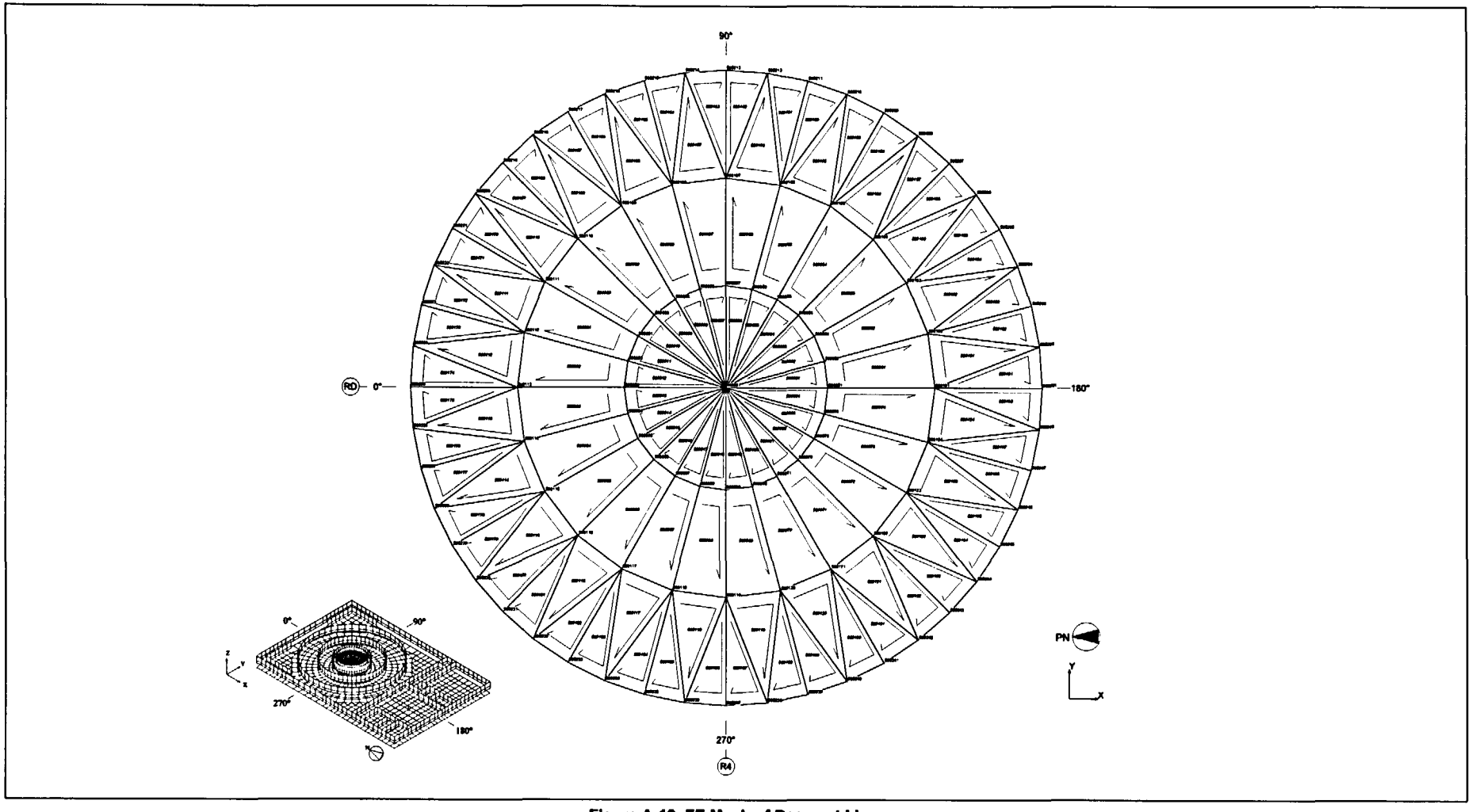


Figure A-19 FE Mesh of Basemat Liner

Appendix B NASTRAN Analysis Results

NASTRAN output files provided are summarized in Table B-1.

Element forces and moments obtained from each analysis are shown in the following Excel files.

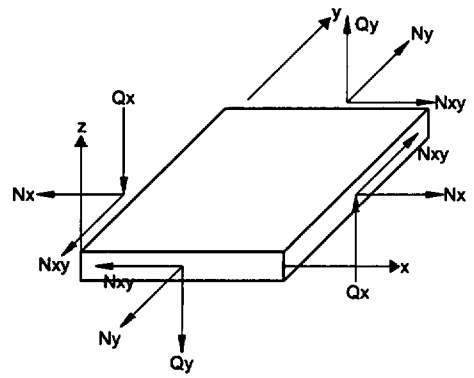
- EachCase_BoundaryLoad.xls
- EachCase_BoundaryDisp.xls

Element forces and moments which are obtained by the combination of all analysis results are shown in "Combined.xls."

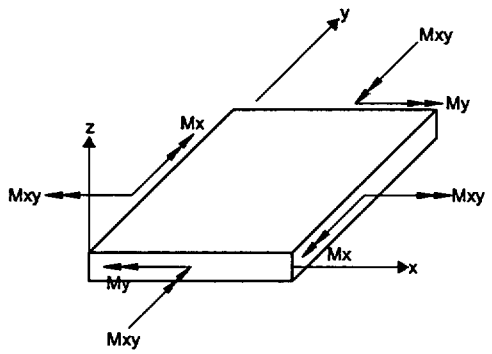
Element forces and moments listed in the Excel files are defined with relation to the element coordinate system shown in Figure B-1.

Table B-1 NASTRAN Output File

File Name	Type of Analysis	Load
DL_force.f06	Boundary Load	Dead Load
PDW_force.f06	Boundary Load	Drywell Unit Pressure
EQNS_force.f06	Boundary Load	Horizontal Seismic Load in N-S Direction
EQEW_force.f06	Boundary Load	Horizontal Seismic Load in E-W Direction
EQZ_force.f06	Boundary Load	Vertical Seismic Load
DL_disp.f06	Boundary Displacement	Dead Load
PDW_disp.f06	Boundary Displacement	Drywell Unit Pressure
EQNS_disp.f06	Boundary Displacement	Horizontal Seismic Load in N-S Direction
EQEW_disp.f06	Boundary Displacement	Horizontal Seismic Load in E-W Direction
EQZ_disp.f06	Boundary Displacement	Vertical Seismic Load



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 B-1 Force and Moment in Shell Element

Appendix C Concrete Outline Drawings

Concrete outline drawings are shown as follows.

Figure C-1 Floor Plan at EL -11500 29
Figure C-2 Floor Plan at EL -6400 30
Figure C-3 Floor Plan at EL -1000 31
Figure C-4 Floor Plan at EL 4650 32
Figure C-5 Floor Plan at EL 9060 33
Figure C-6 Floor Plan at EL 13570 34
Figure C-7 Floor Plan at EL 17500 35
Figure C-8 Floor Plan at EL 27000 36
Figure C-9 Floor Plan at EL 34000 37
Figure C-10 Section Looking East 38
Figure C-11 Section Looking North 39

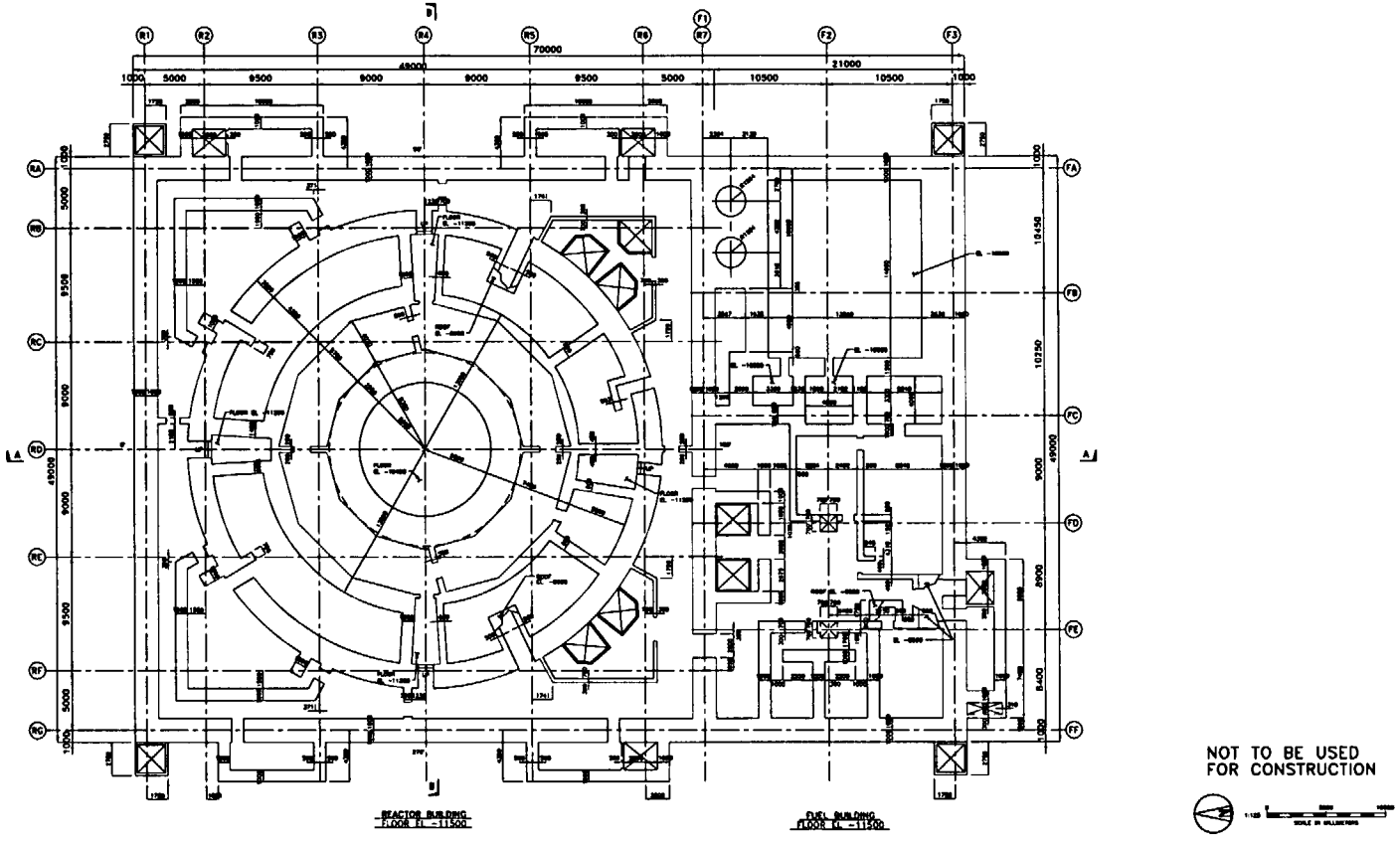


Figure C-1 Floor Plan at EL -11500

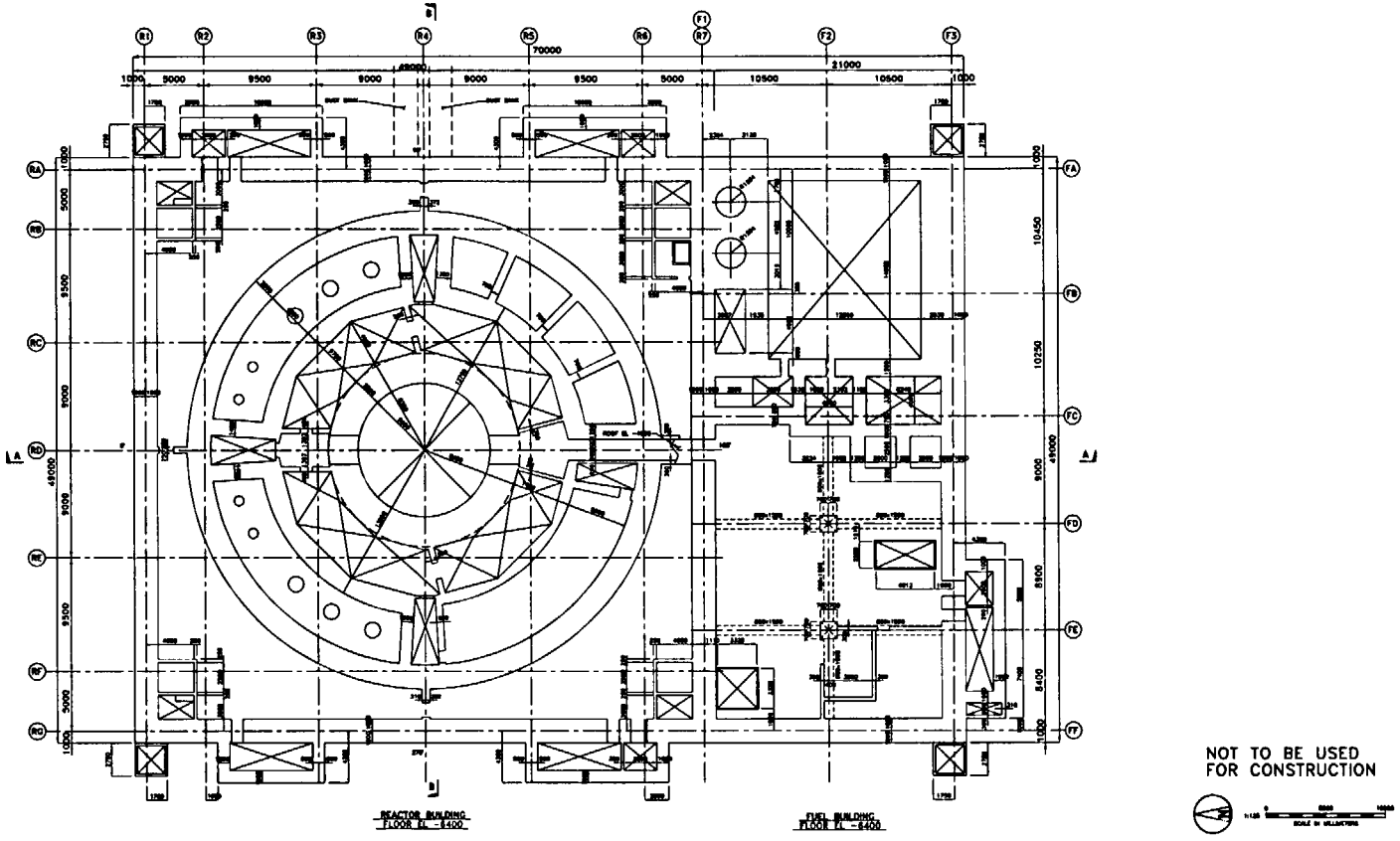


Figure C-2 Floor Plan at EL -6400

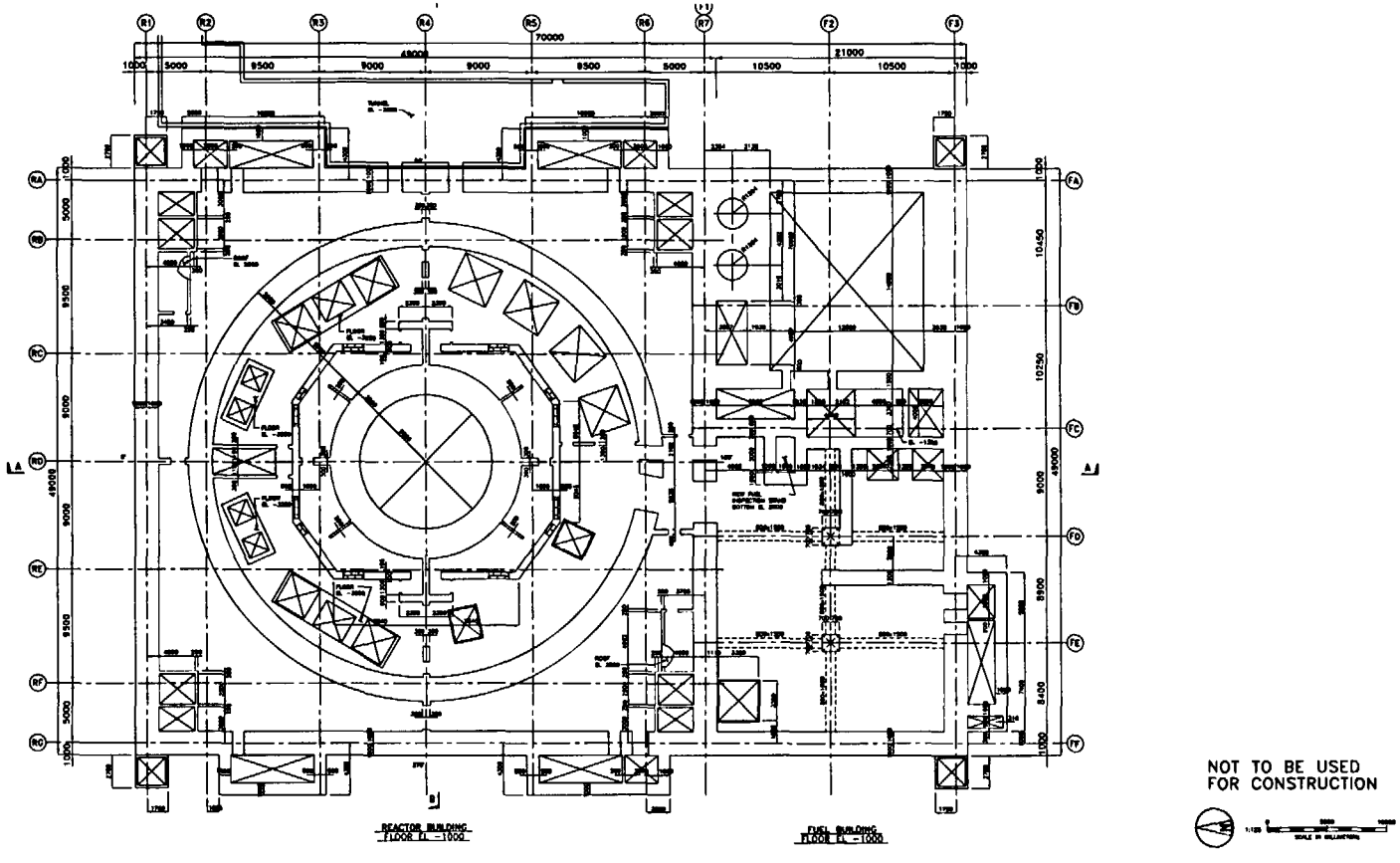
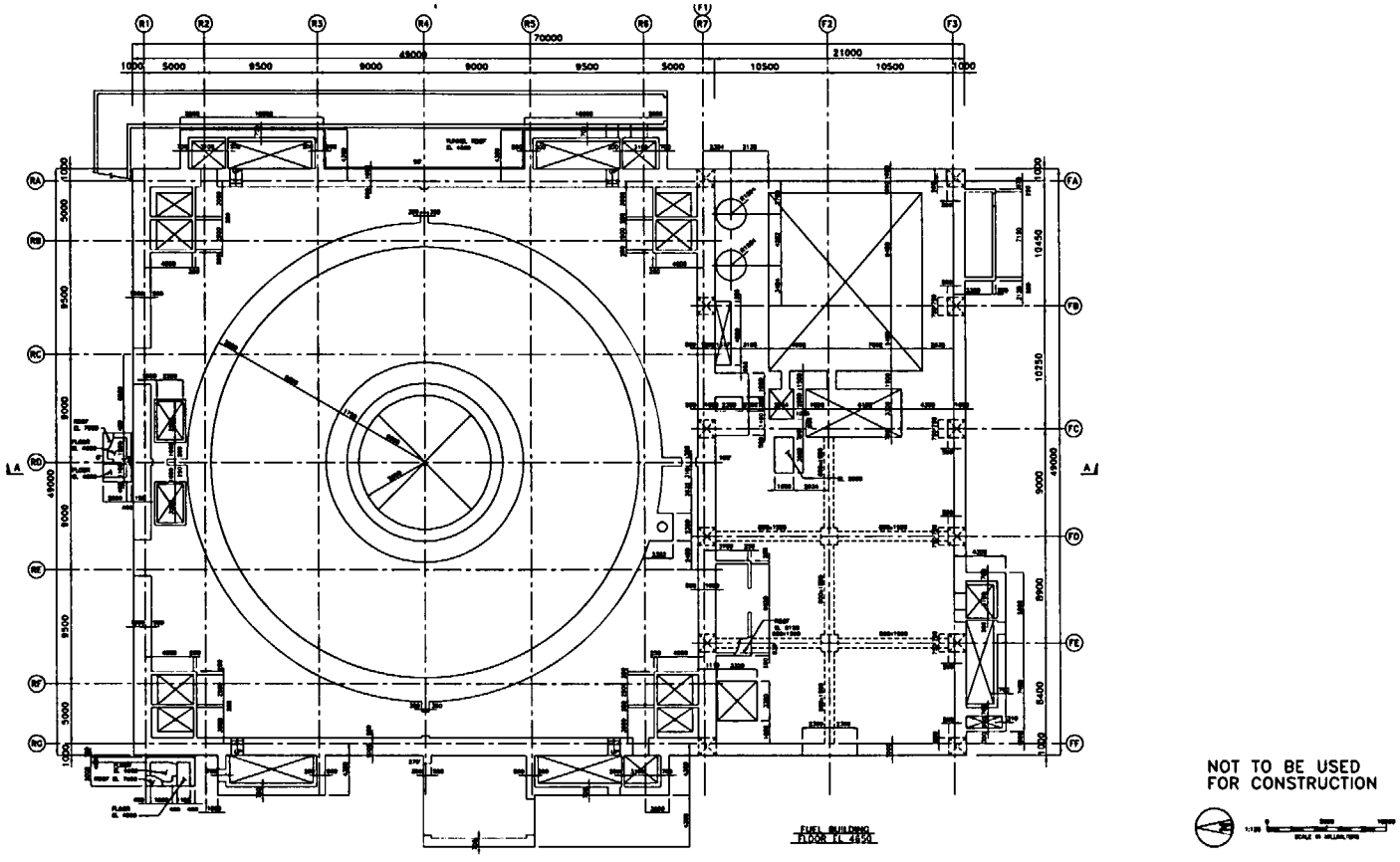


Figure C-3 Floor Plan at EL -1000



NOT TO BE USED
FOR CONSTRUCTION

Figure C-4 Floor Plan at EL 4650

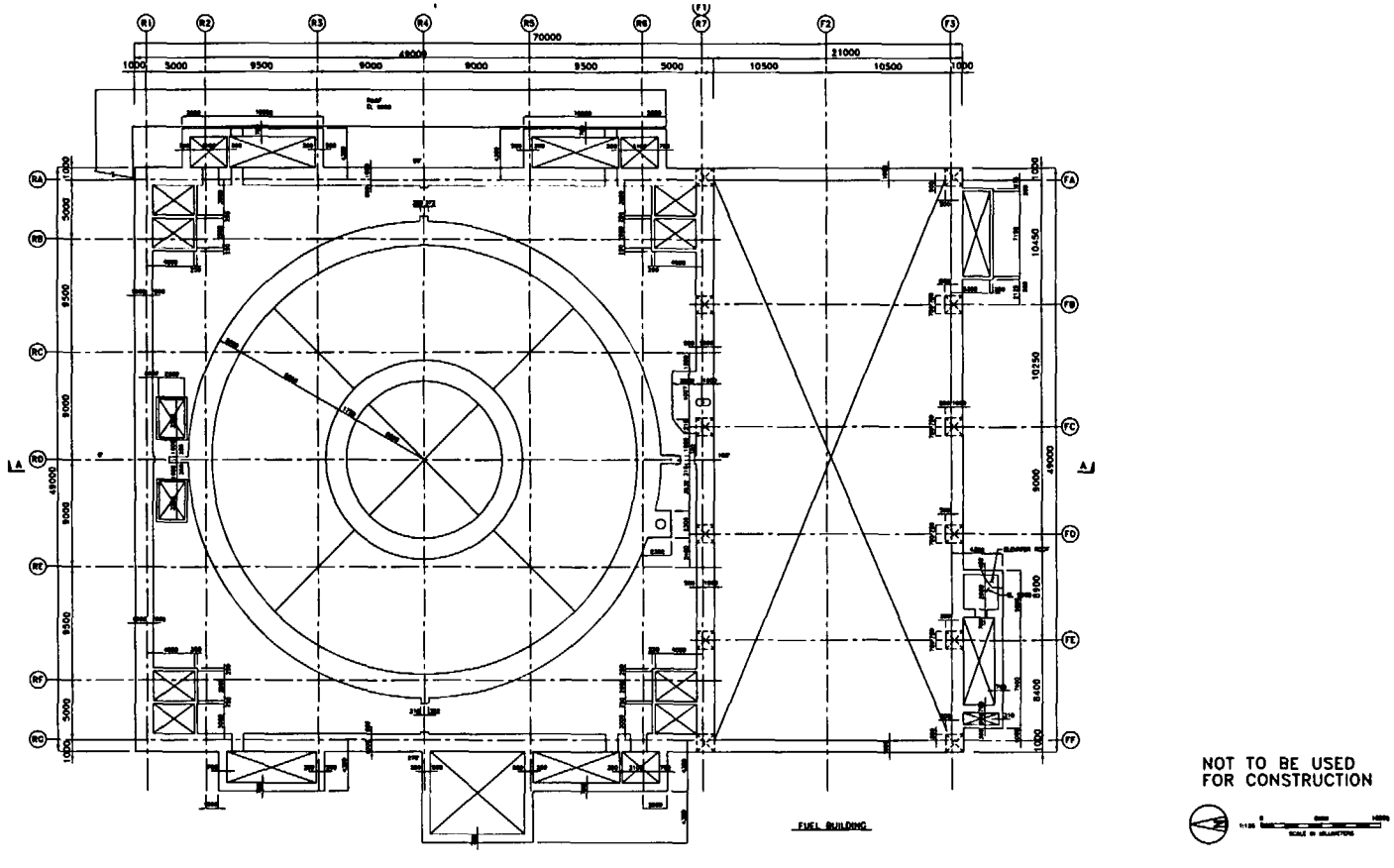


Figure C-5 Floor Plan at EL 9060

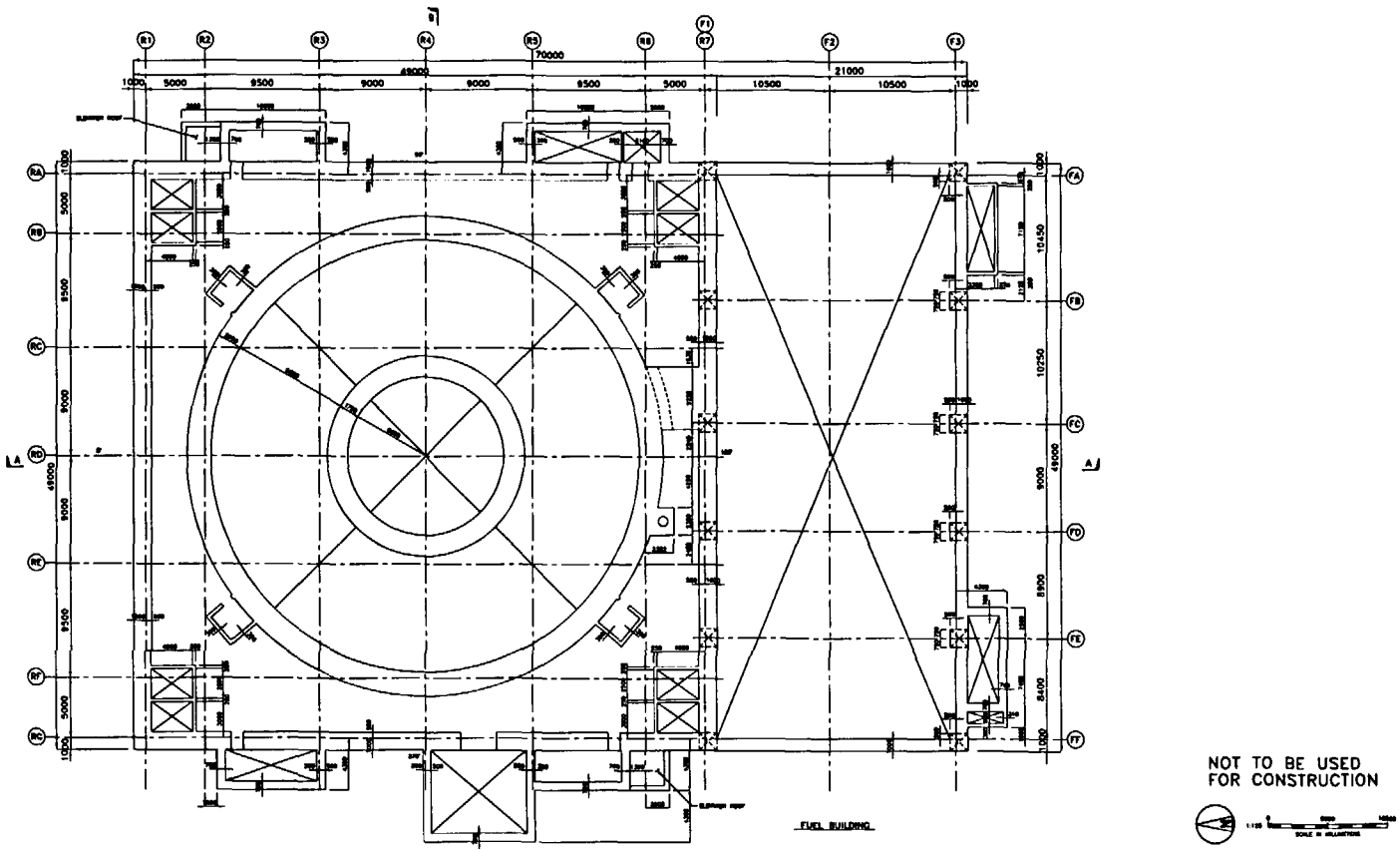
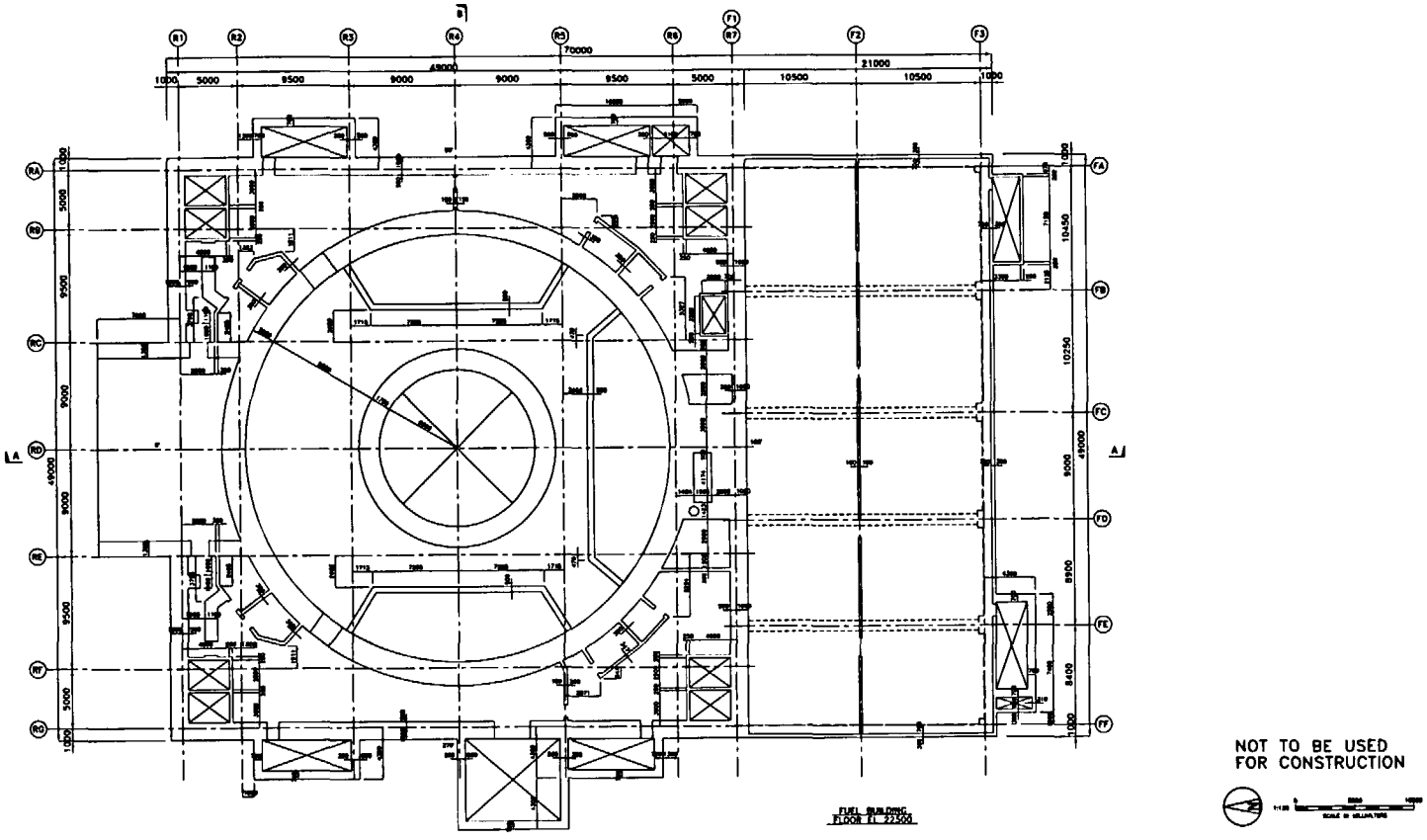


Figure C-6 Floor Plan at EL 13570



NOT TO BE USED
FOR CONSTRUCTION

Figure C-7 Floor Plan at EL 17500

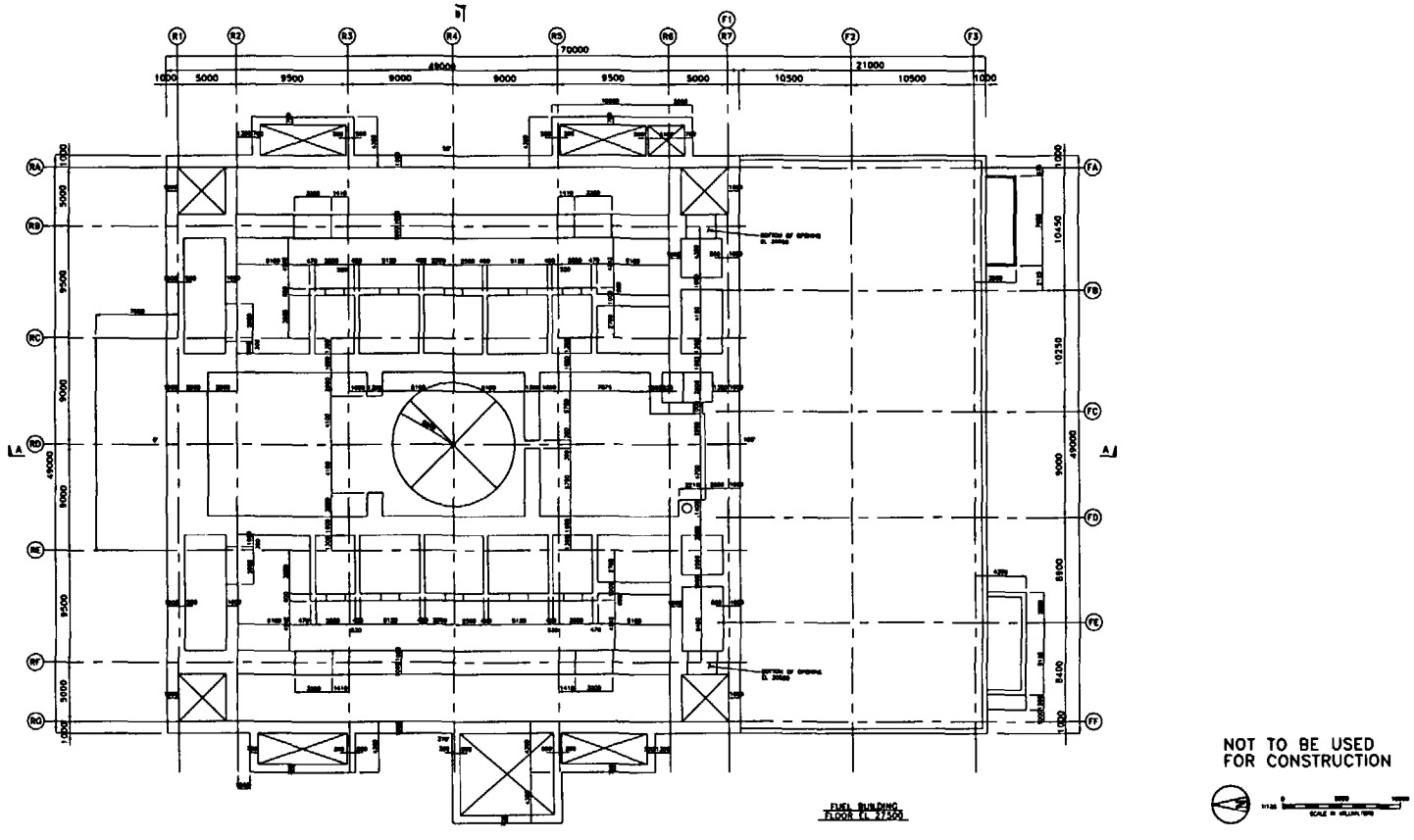


Figure C-8 Floor Plan at EL 27000

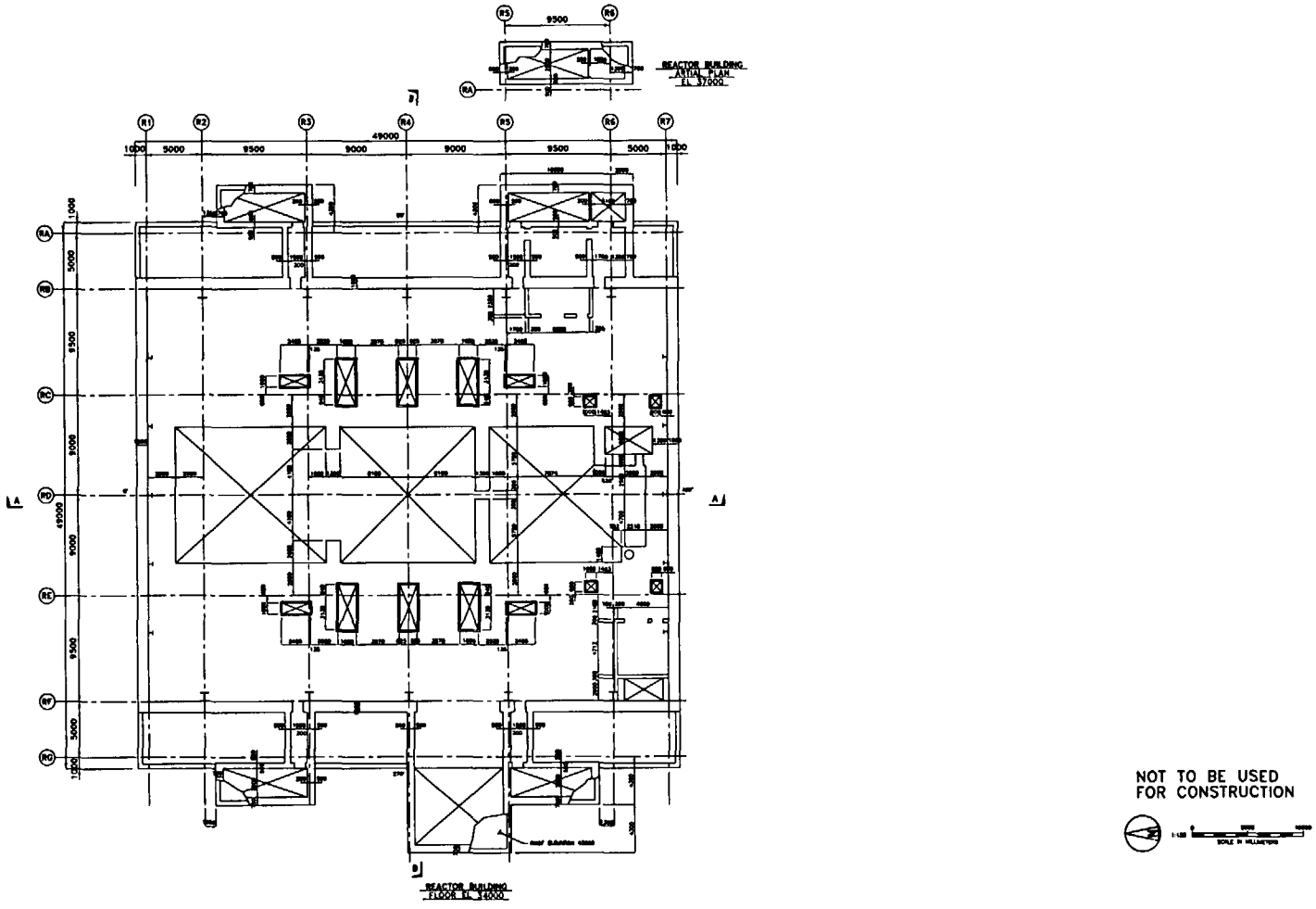
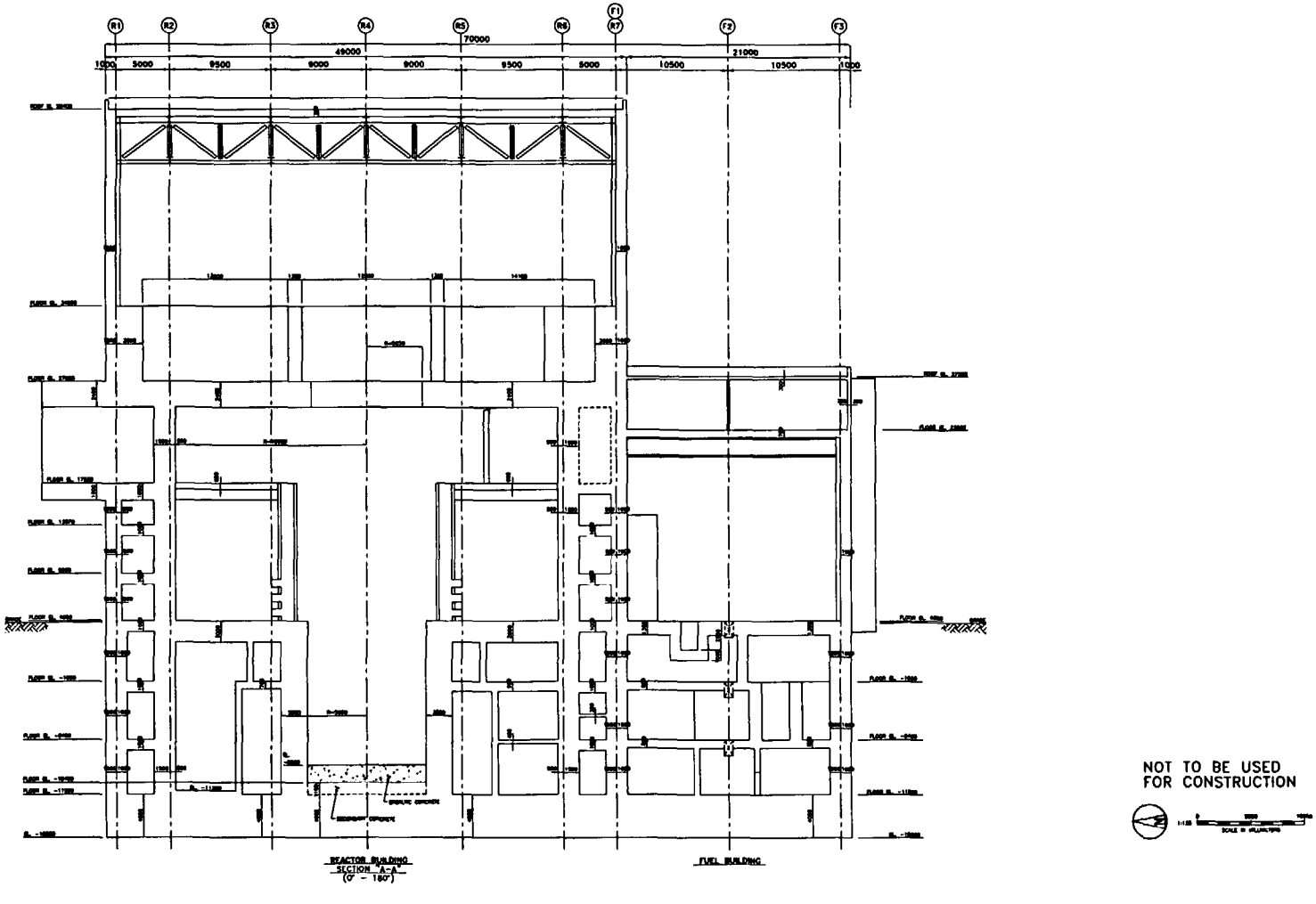


Figure C-9 Floor Plan at EL 34000



NOT TO BE USED
FOR CONSTRUCTION

Figure C-10 Section Looking East

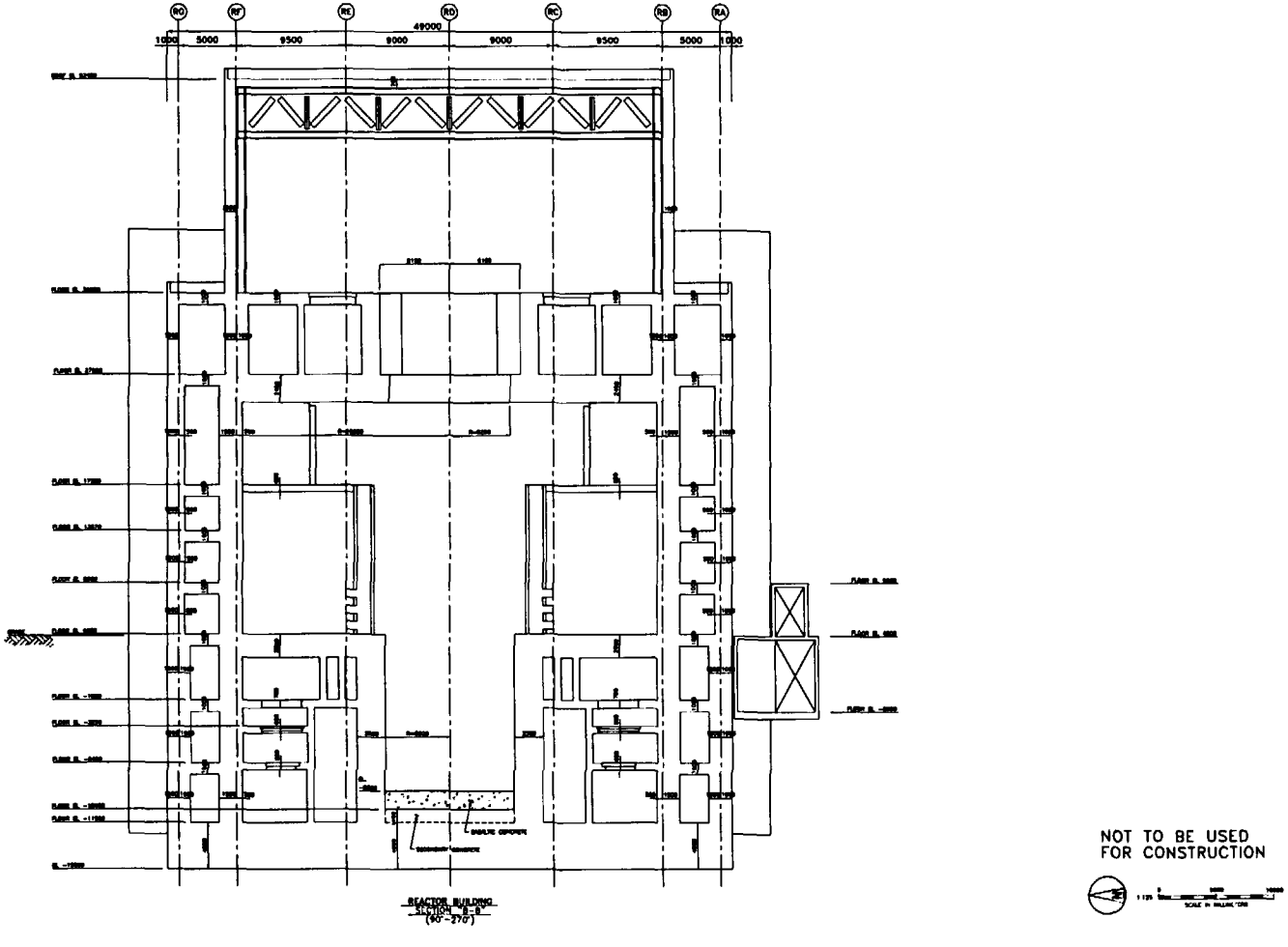


Figure C-11 Section Looking North

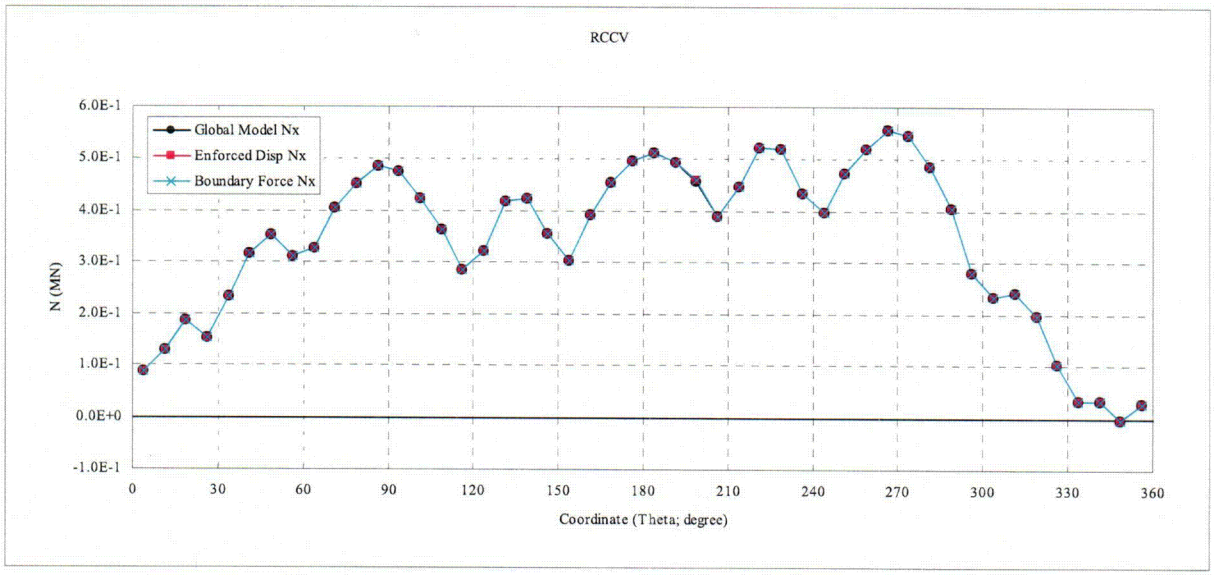
Appendix D Verification of Truncated Model Analysis Data

In order to verify the correctness of the truncated model analysis data, their analysis results are compared with the results of the RBFB global FE model analyses. They are shown in Figures D-1 through D-20. Comparisons are performed for the bottom elements of the following structures.

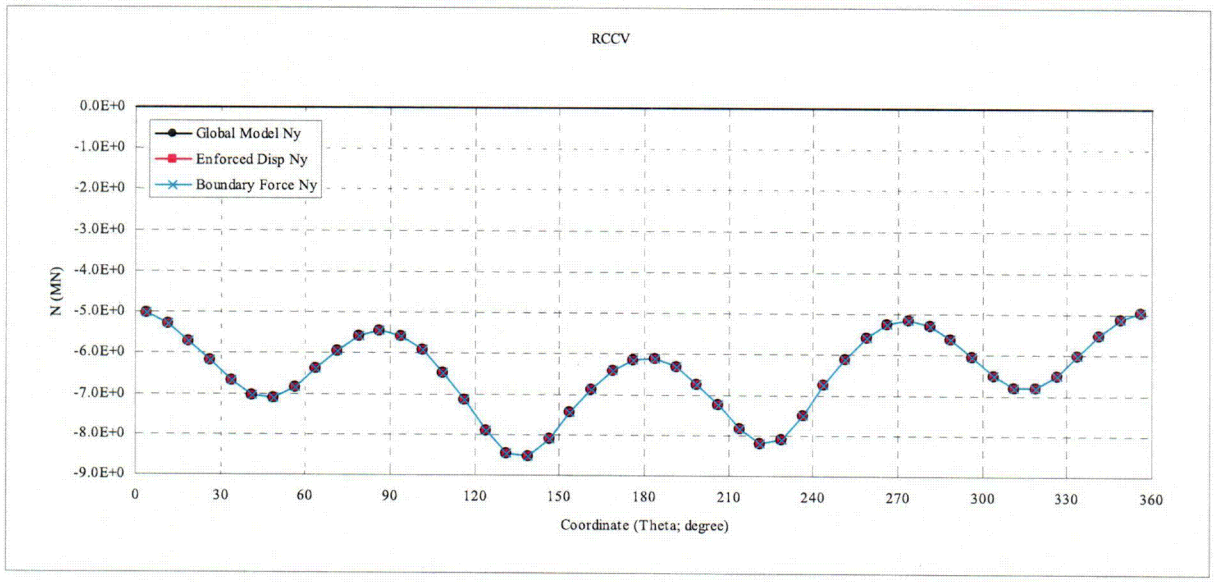
- Cylindrical wall below RCCV wall
- RPV pedestal
- Exterior wall on RA column line
- Exterior wall on R7 column line

Results of truncated model analyses agree well with those of the global model analyses.

Therefore, it can be concluded that the analysis data of the truncated model are prepared correctly.

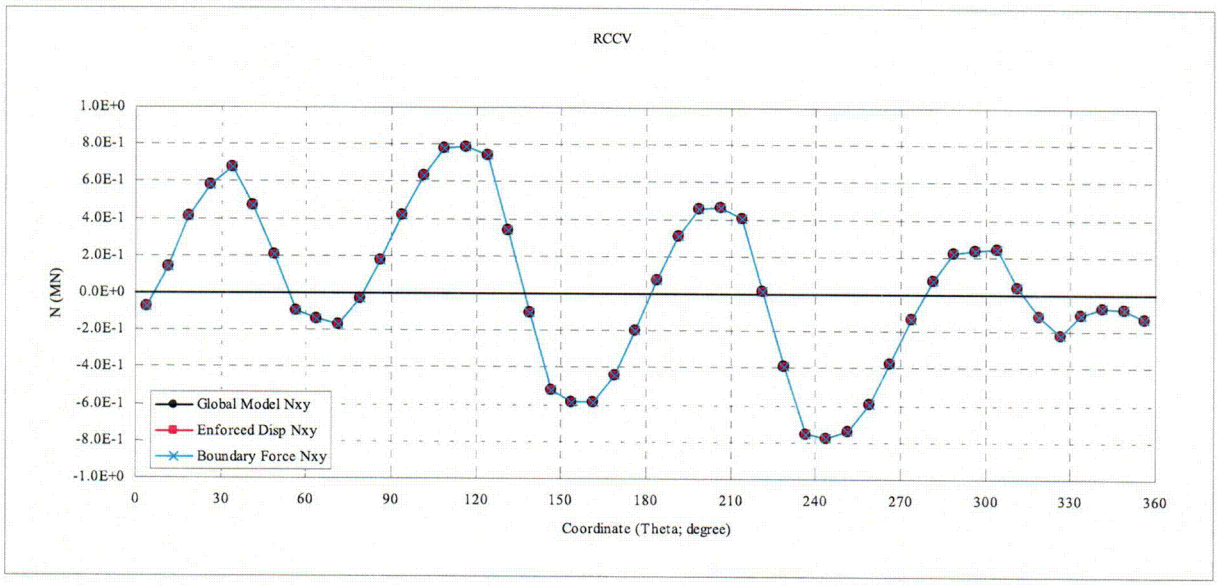


(a) Axial Force in Horizontal Direction

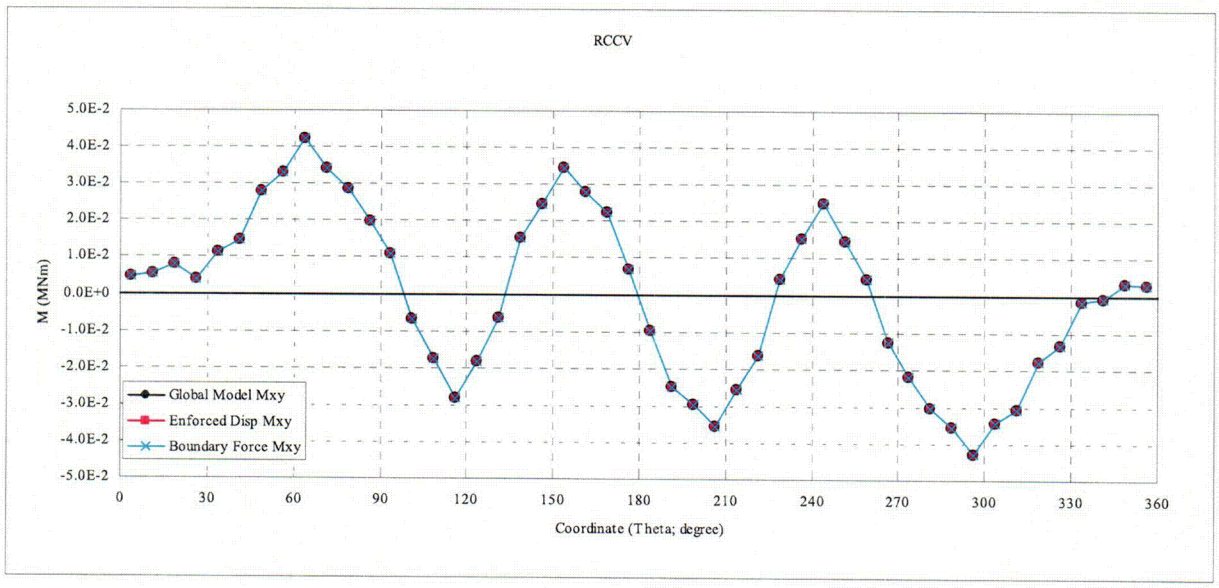


(b) Axial Force in Vertical Direction

Figure D-1(a) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Dead Load)

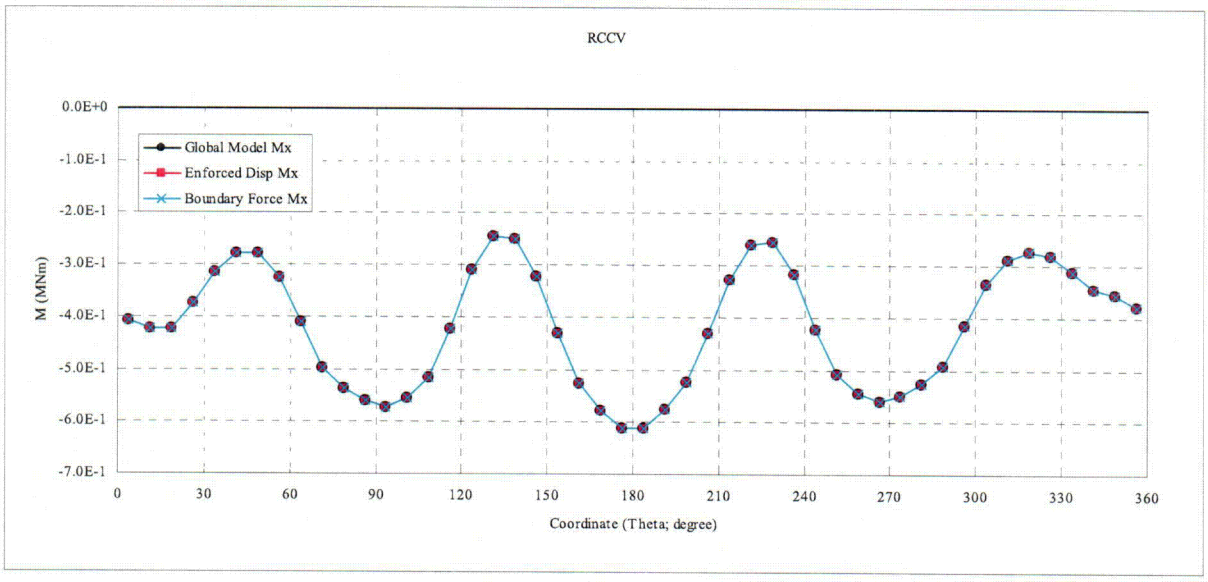


(c) In-plane Shear

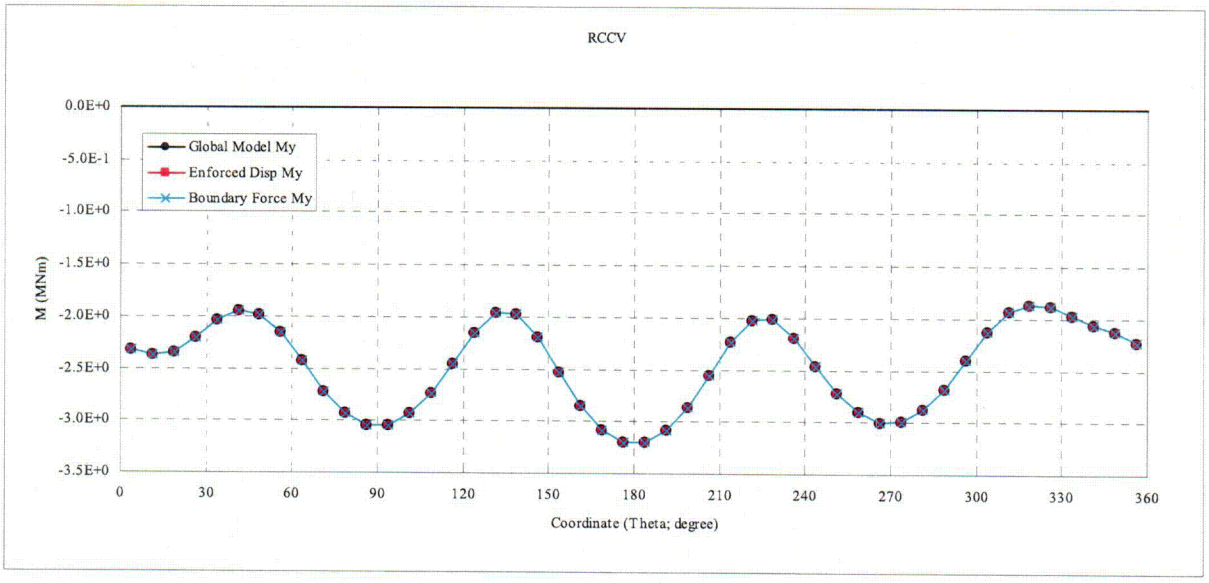


(d) Torsional Moment

Figure D-1(b) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Dead Load)

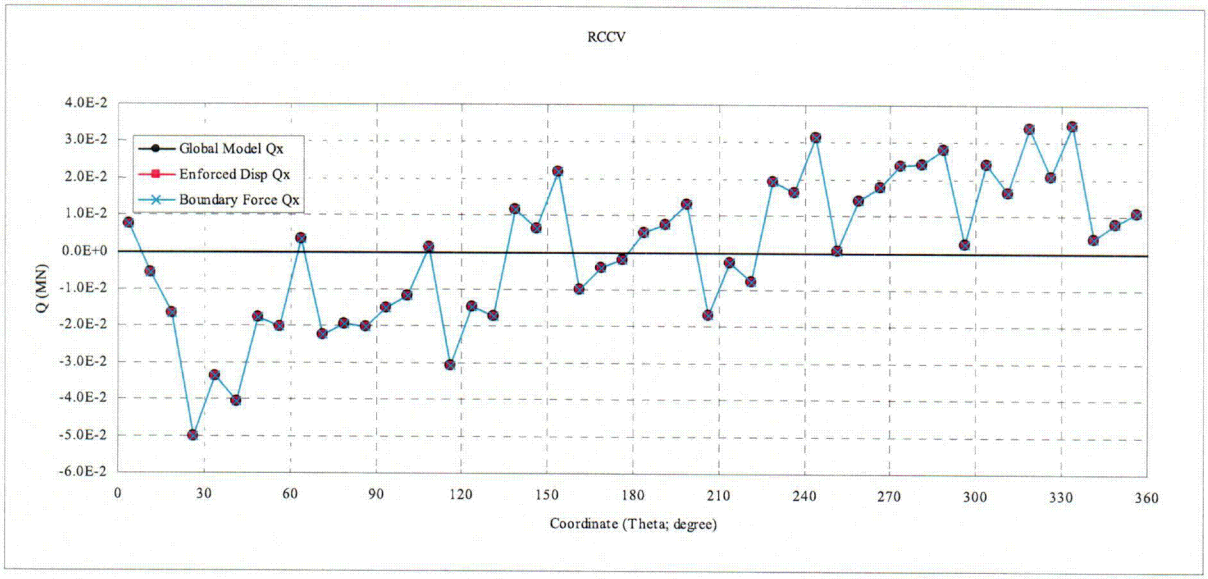


(e) Bending Moment in Horizontal Direction

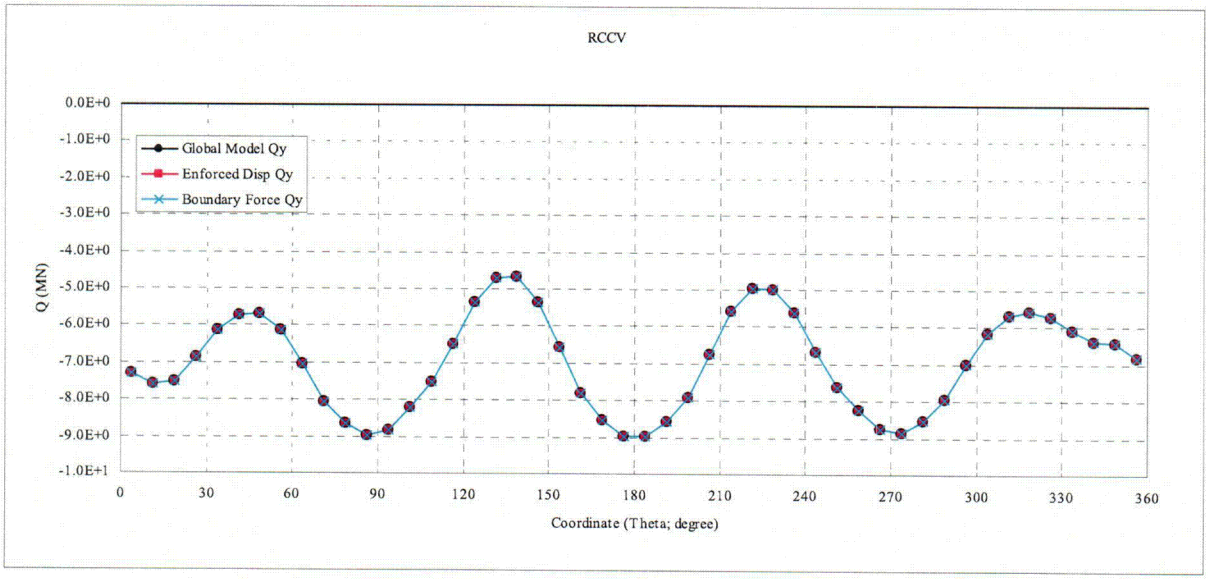


(f) Bending Moment in Vertical Direction

Figure D-1(c) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Dead Load)

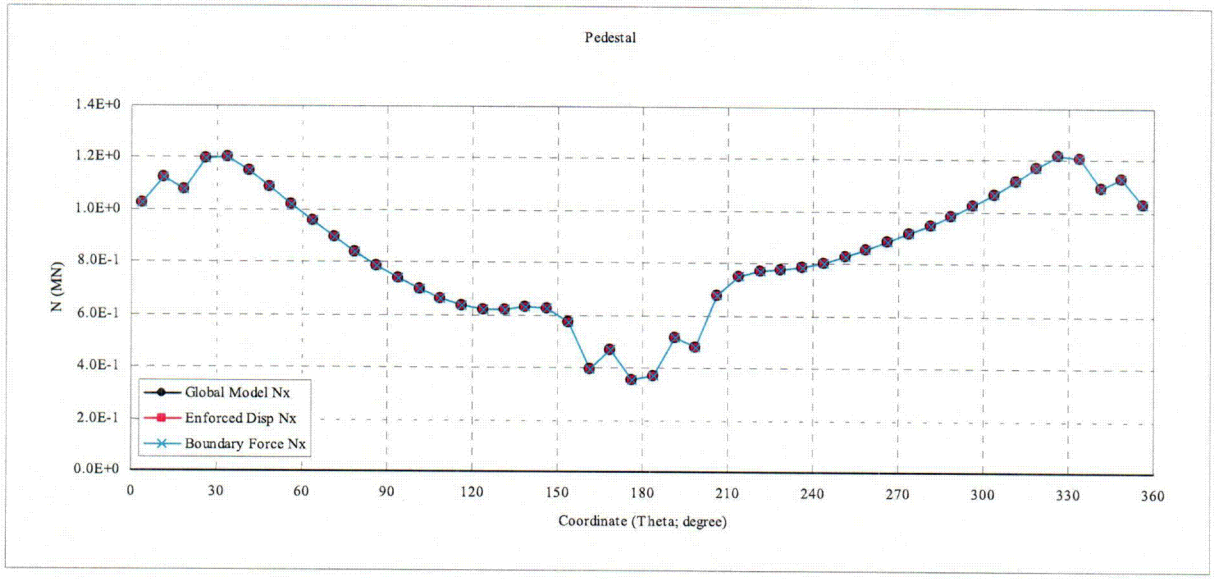


(g) Transverse Shear in Horizontal Direction

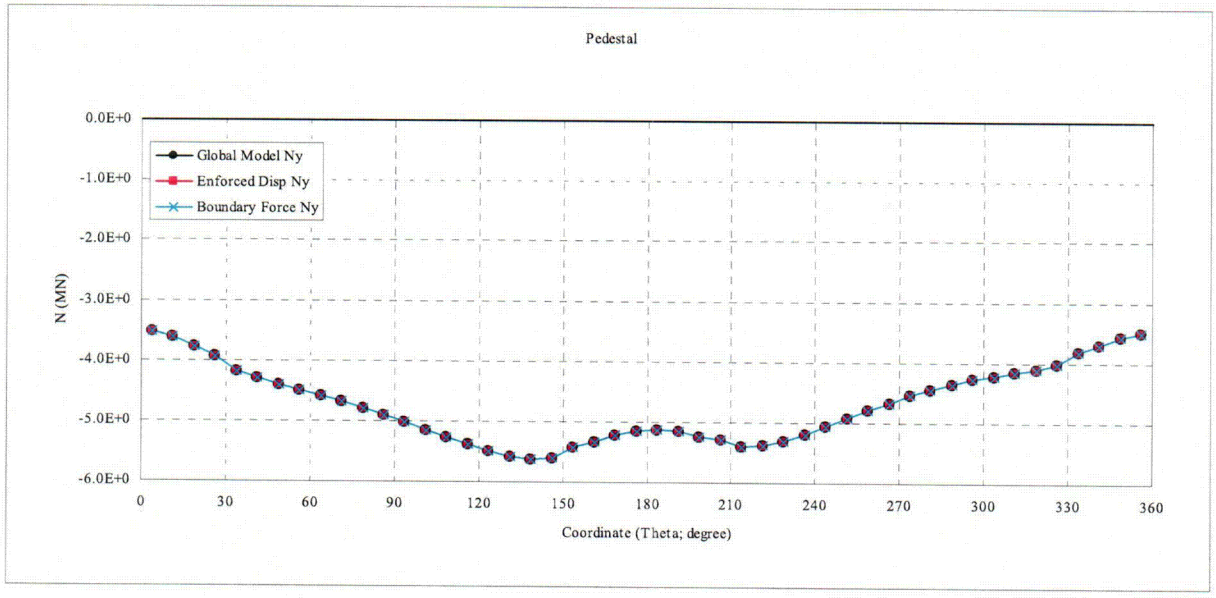


(h) Transverse Shear in Vertical Direction

Figure D-1(d) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Dead Load)

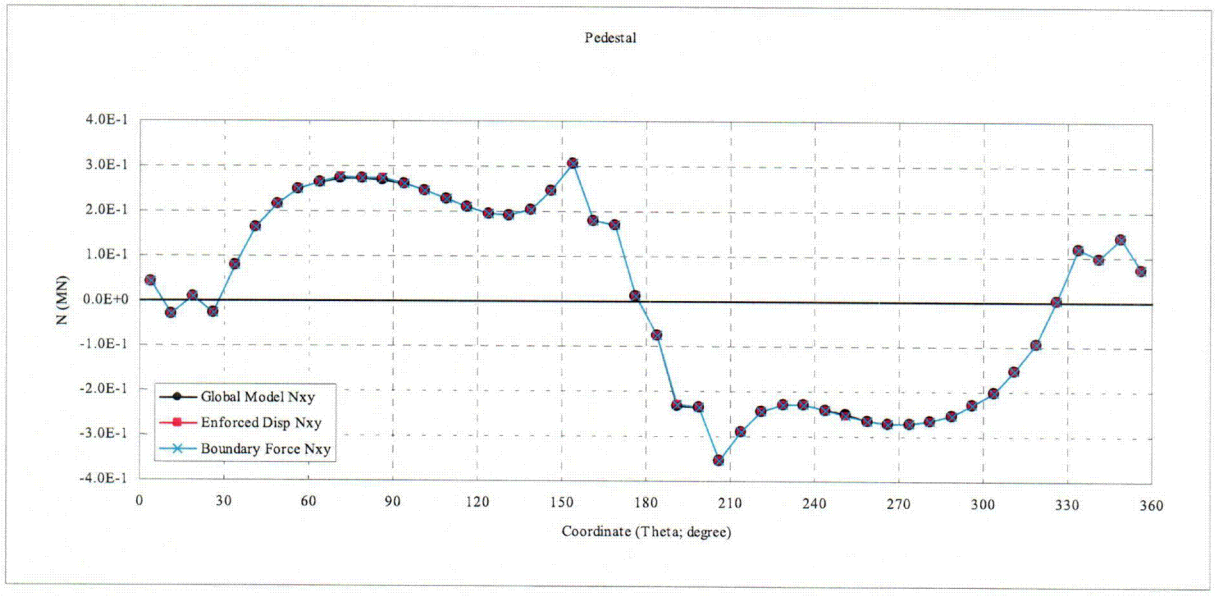


(a) Axial Force in Horizontal Direction

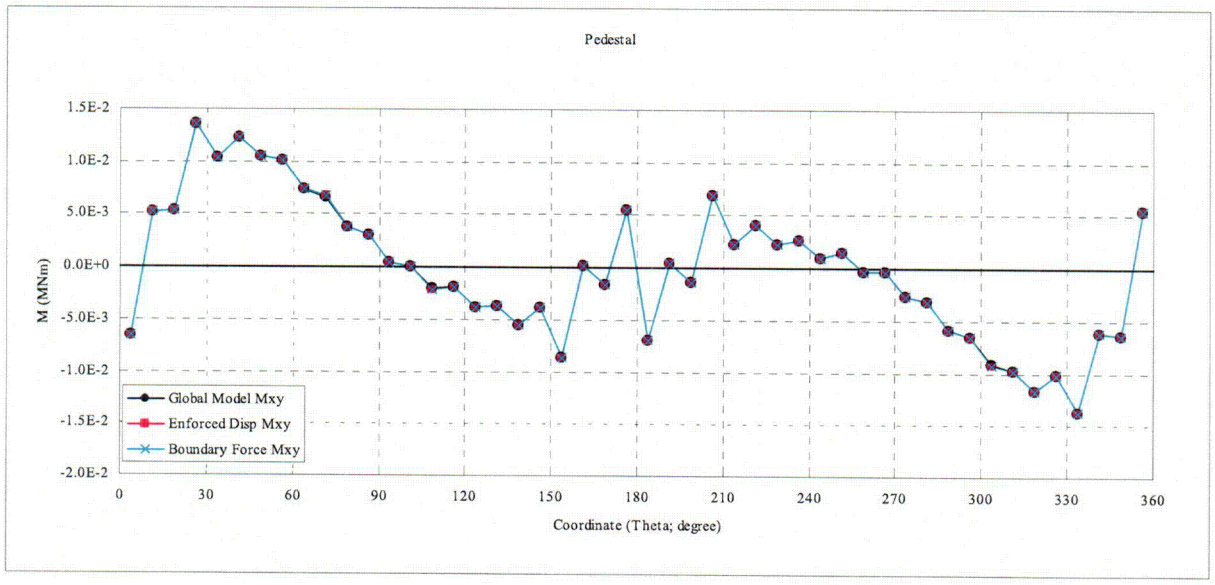


(b) Axial Force in Vertical Direction

Figure D-2(a) Comparison of Section Forces and Moments (RPV Pedestal: Dead Load)

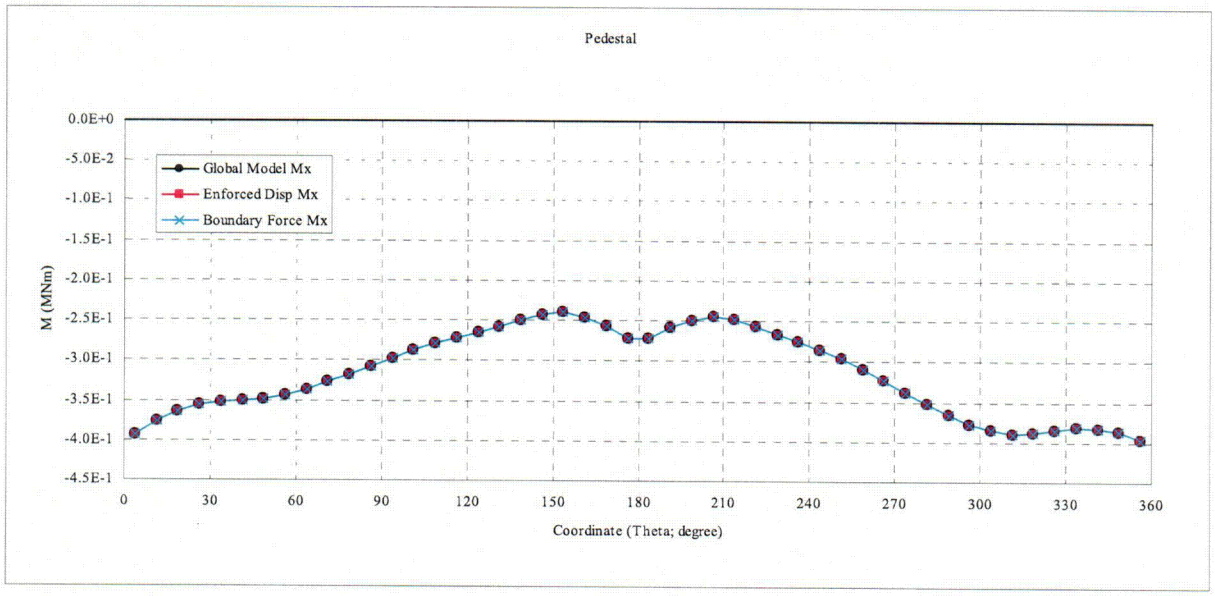


(c) In-plane Shear

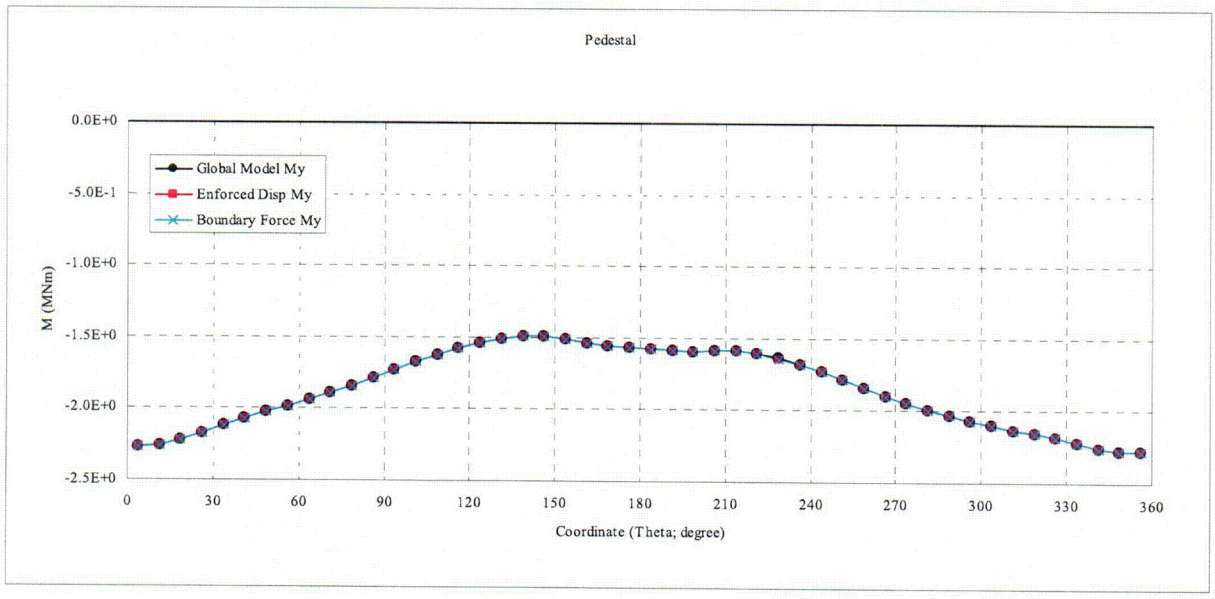


(d) Torsional Moment

Figure D-2(b) Comparison of Section Forces and Moments (RPV Pedestal: Dead Load)

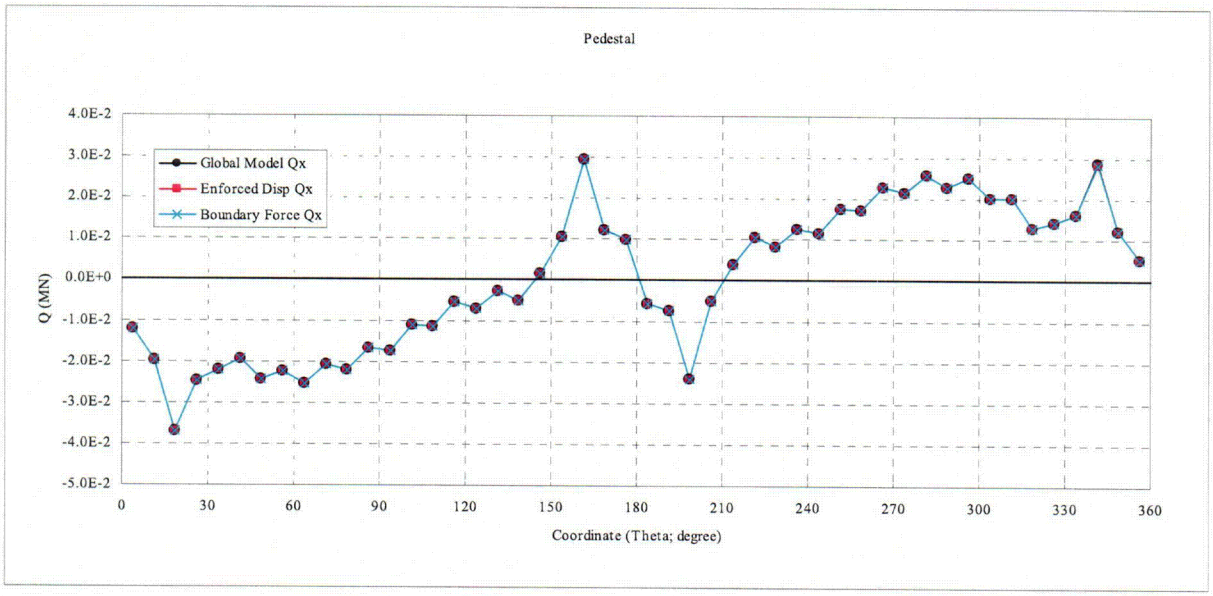


(e) Bending Moment in Horizontal Direction

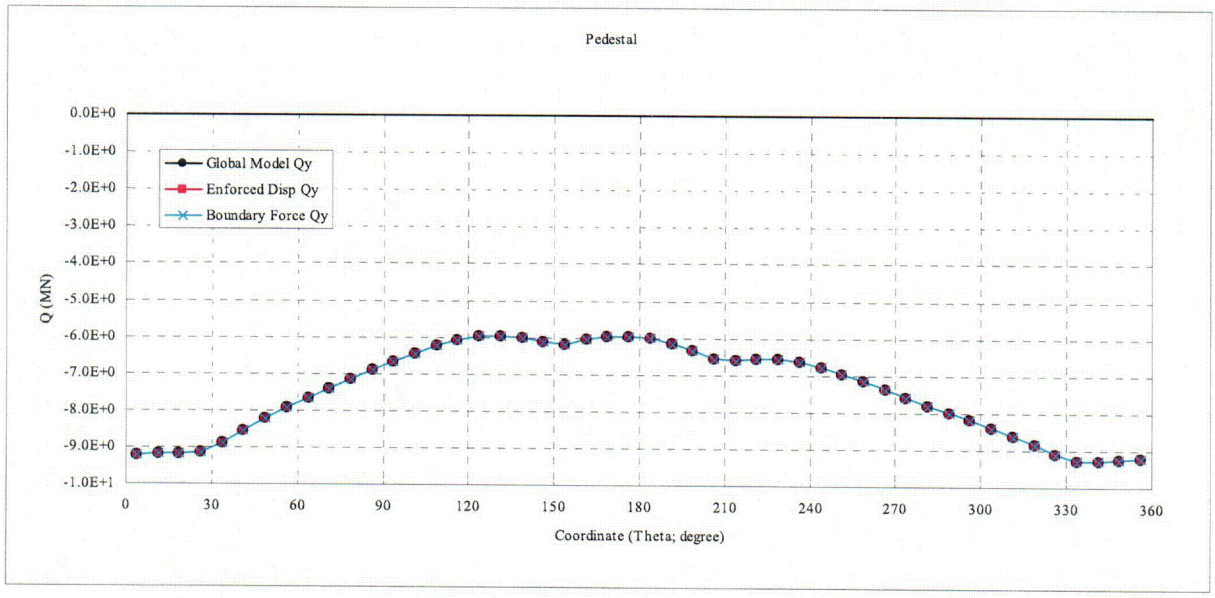


(f) Bending Moment in Vertical Direction

Figure D-2(c) Comparison of Section Forces and Moments (RPV Pedestal: Dead Load)

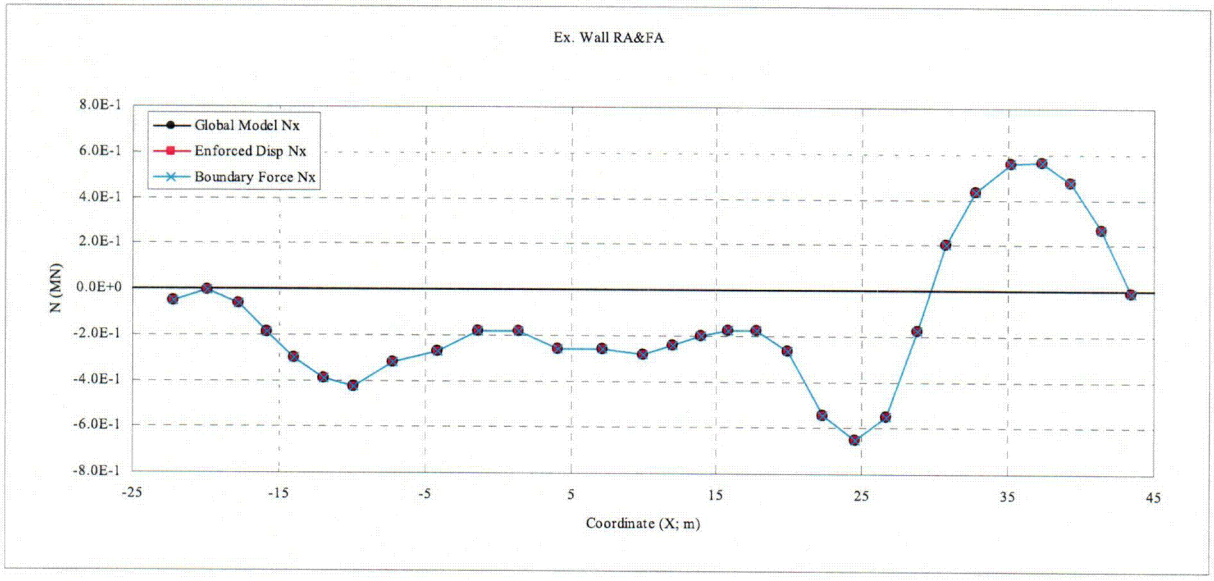


(g) Transverse Shear in Horizontal Direction

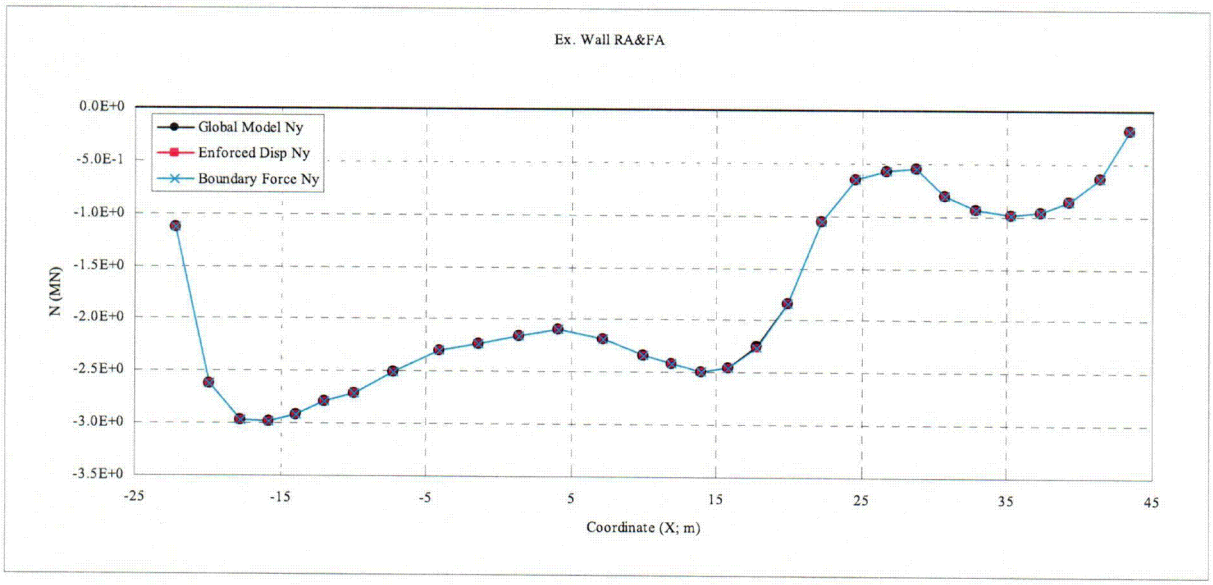


(h) Transverse Shear in Vertical Direction

Figure D-2(d) Comparison of Section Forces and Moments (RPV Pedestal: Dead Load)

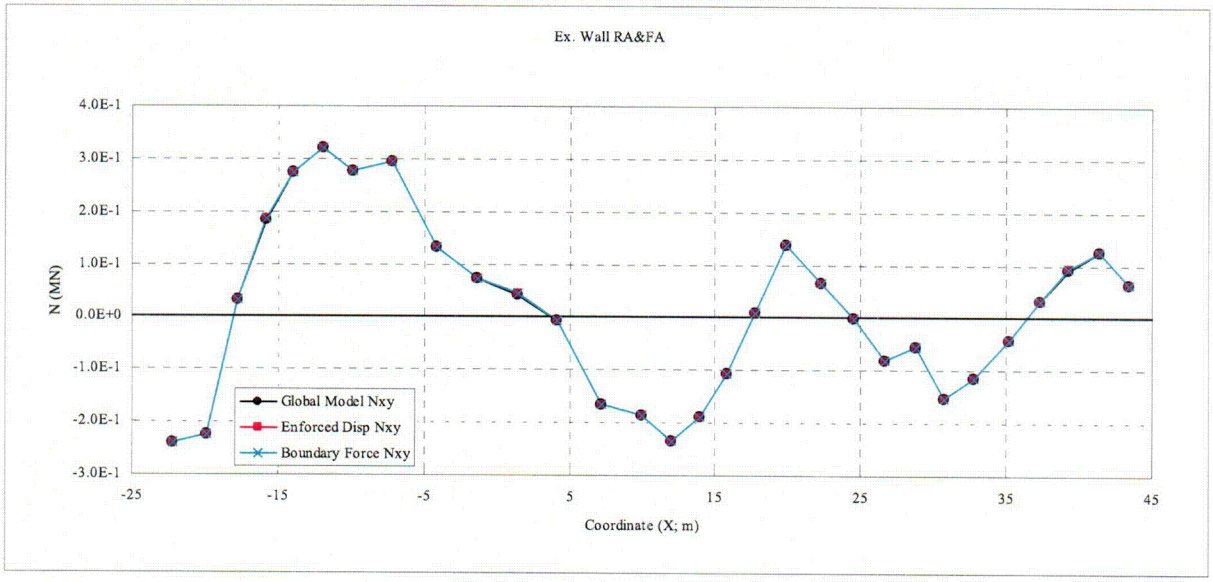


(a) Axial Force in Horizontal Direction

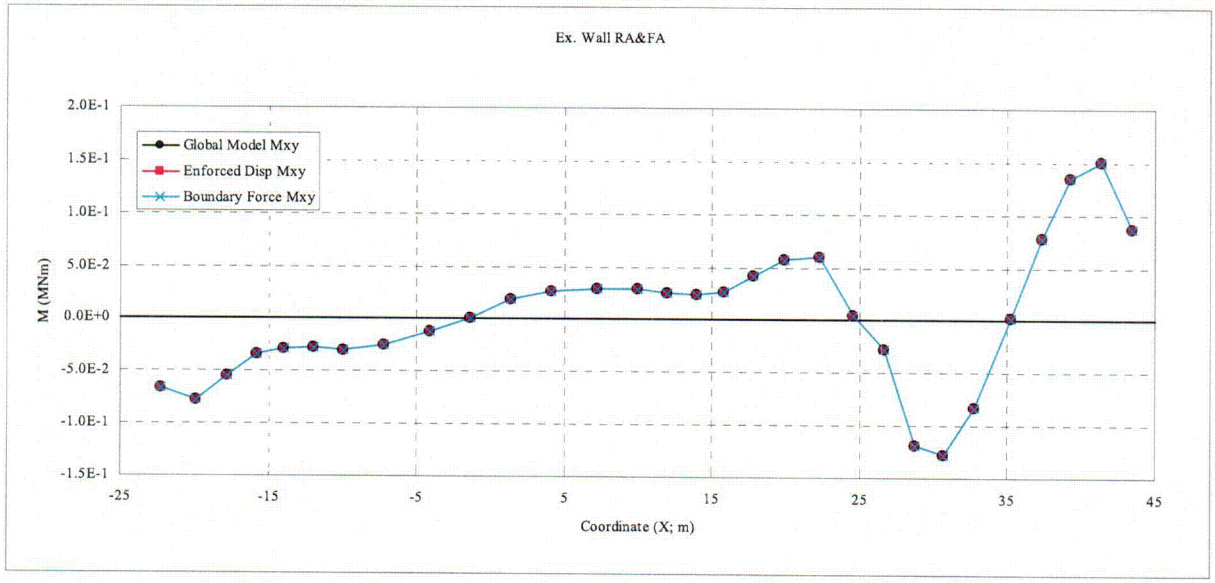


(b) Axial Force in Vertical Direction

Figure D-3(a) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Dead Load)

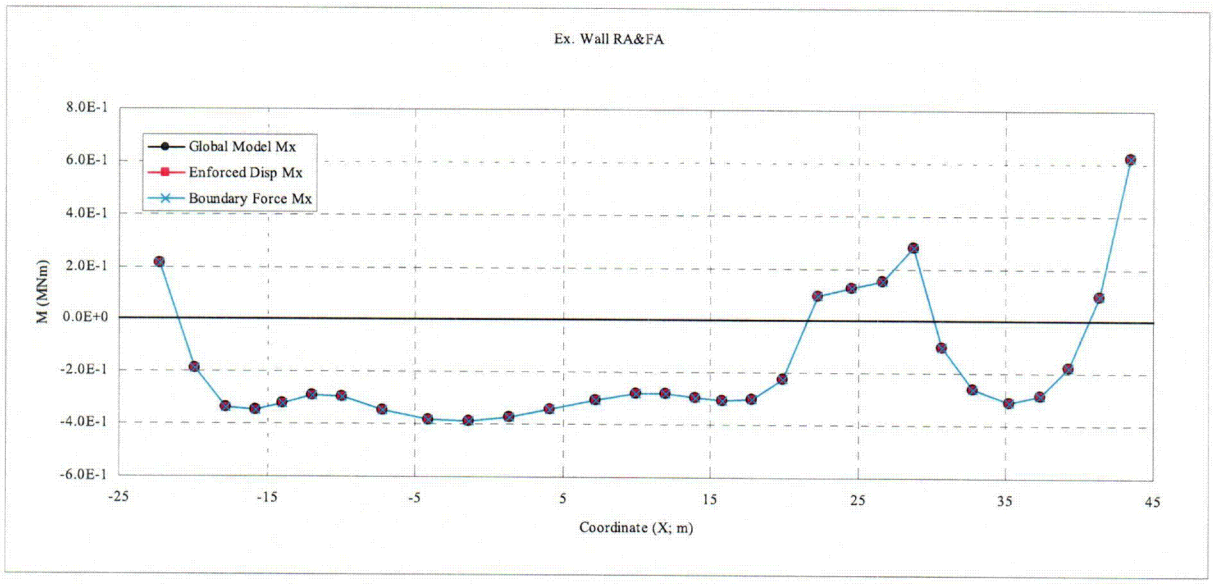


(c) In-plane Shear

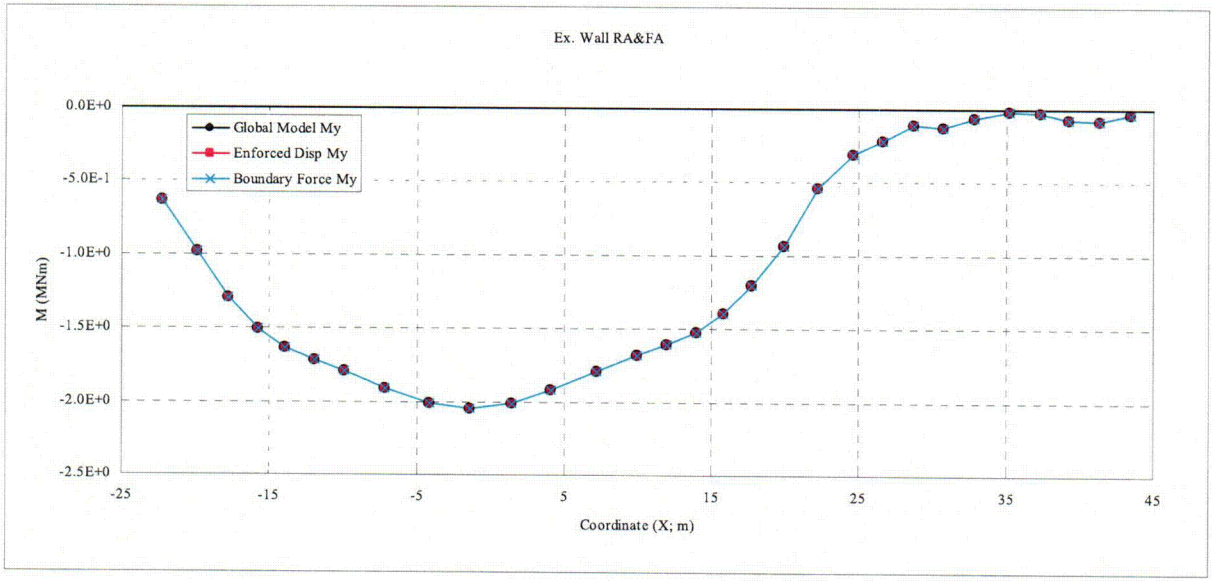


(d) Torsional Moment

Figure D-3(b) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Dead Load)

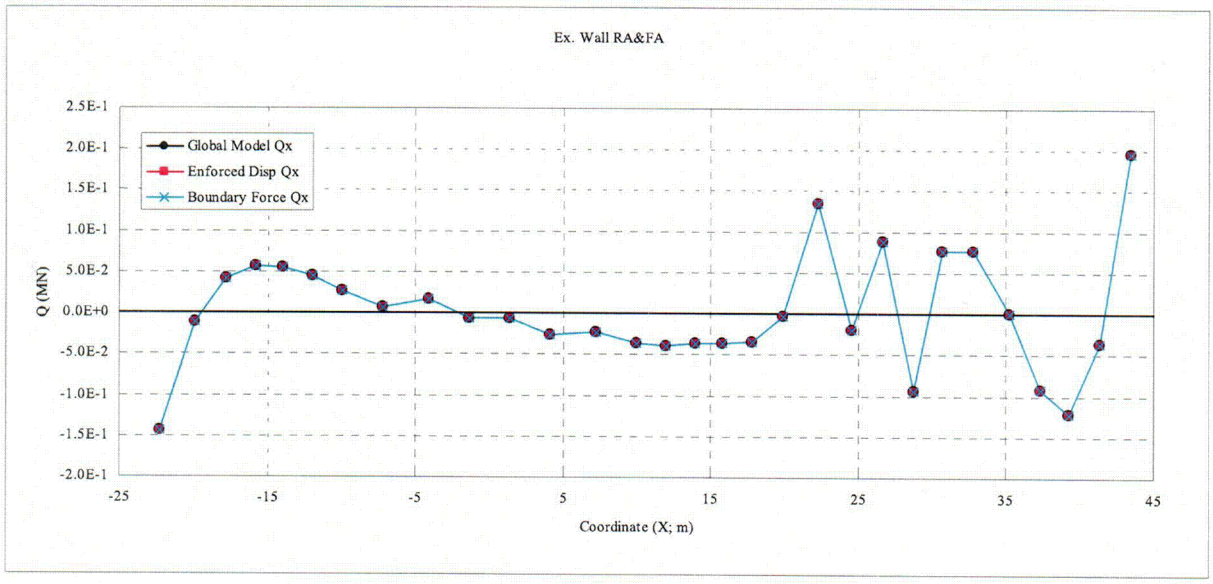


(e) Bending Moment in Horizontal Direction

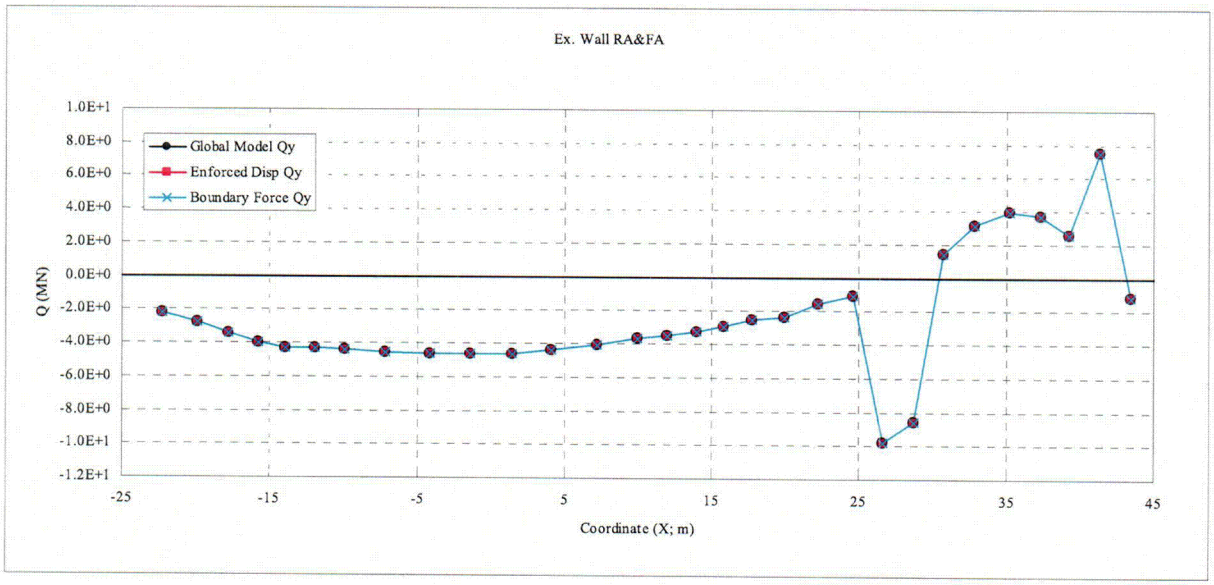


(f) Bending Moment in Vertical Direction

Figure D-3(c) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Dead Load)

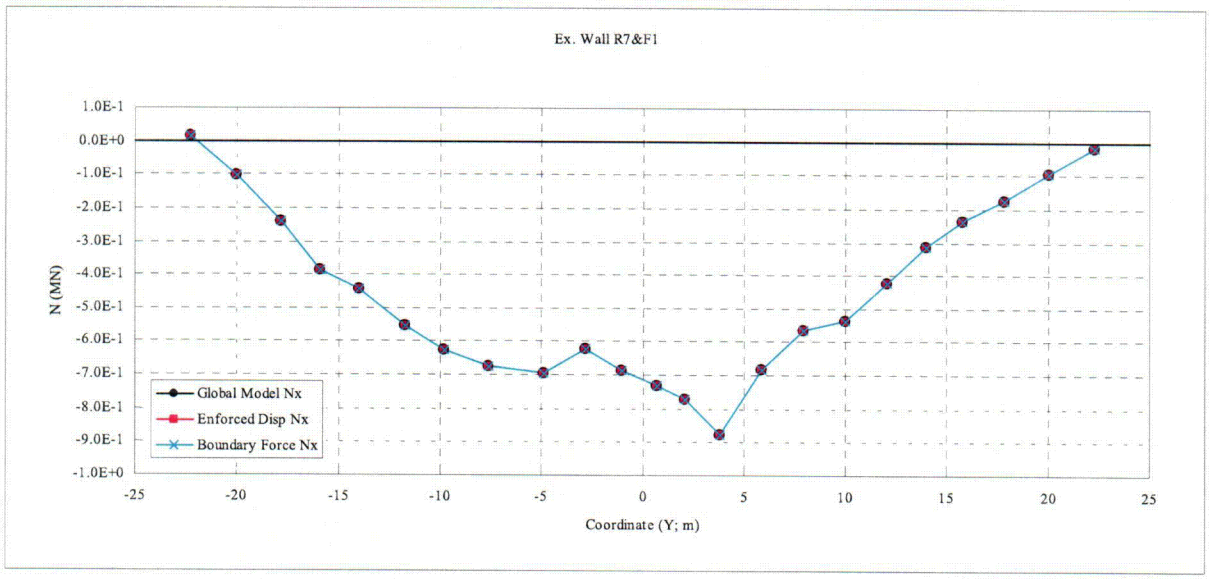


(g) Transverse Shear in Horizontal Direction

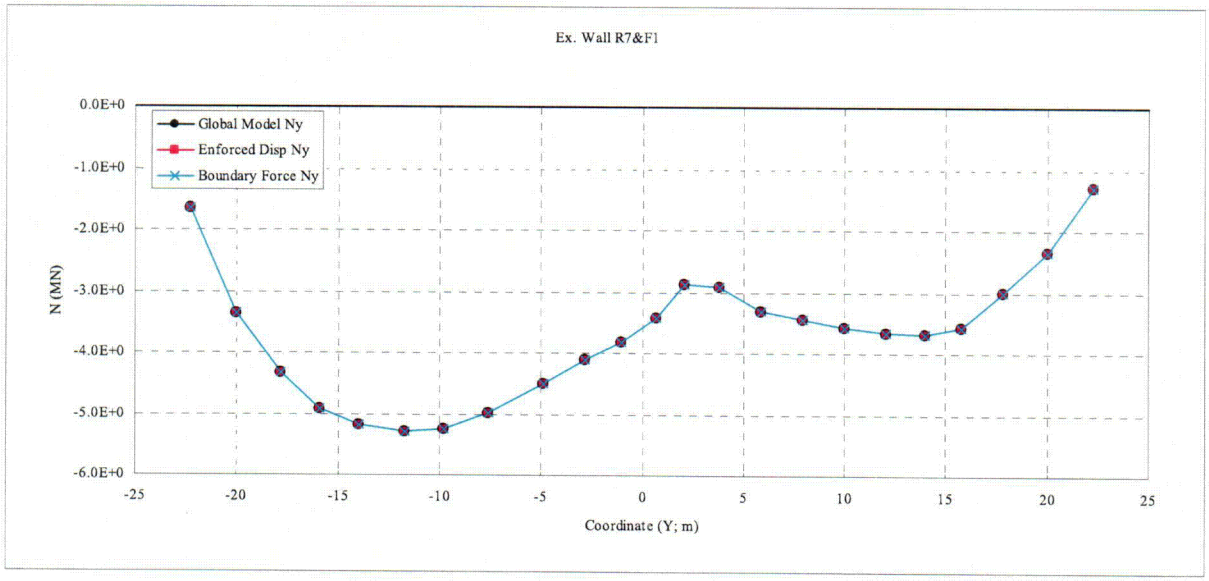


(h) Transverse Shear in Vertical Direction

Figure D-3(d) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Dead Load)

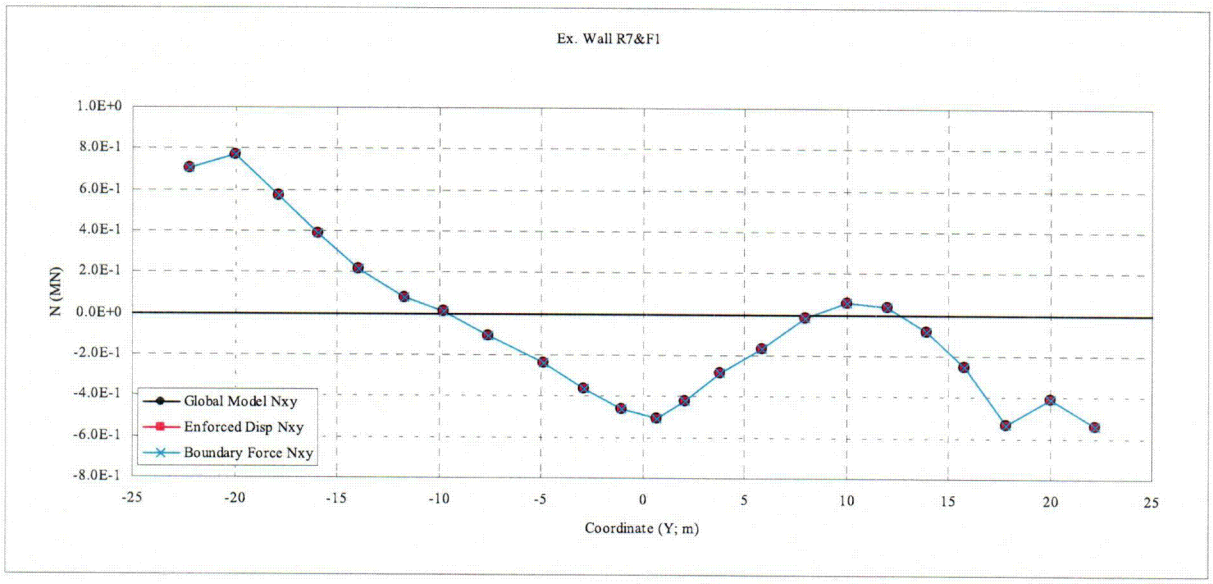


(a) Axial Force in Horizontal Direction

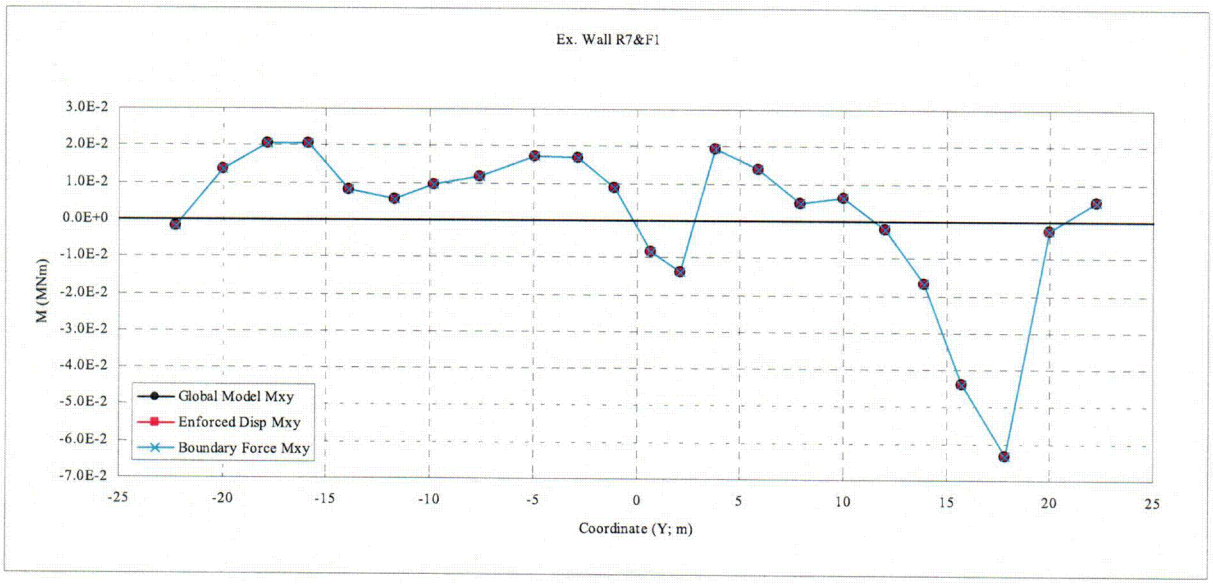


(b) Axial Force in Vertical Direction

Figure D-4(a) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Dead Load)

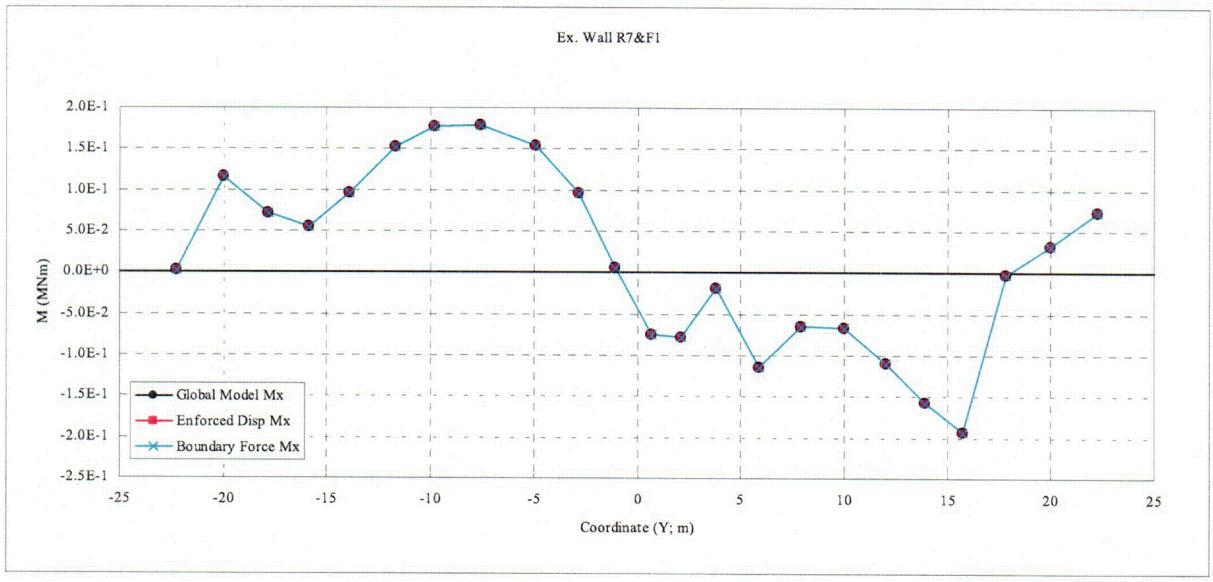


(c) In-plane Shear

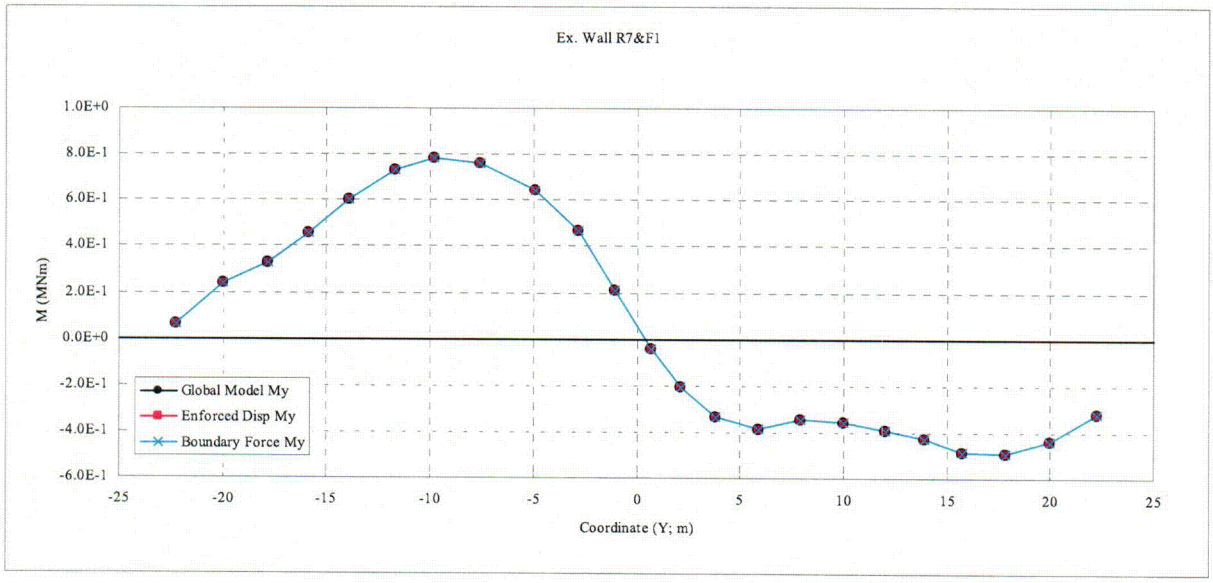


(d) Torsional Moment

Figure D-4(b) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Dead Load)

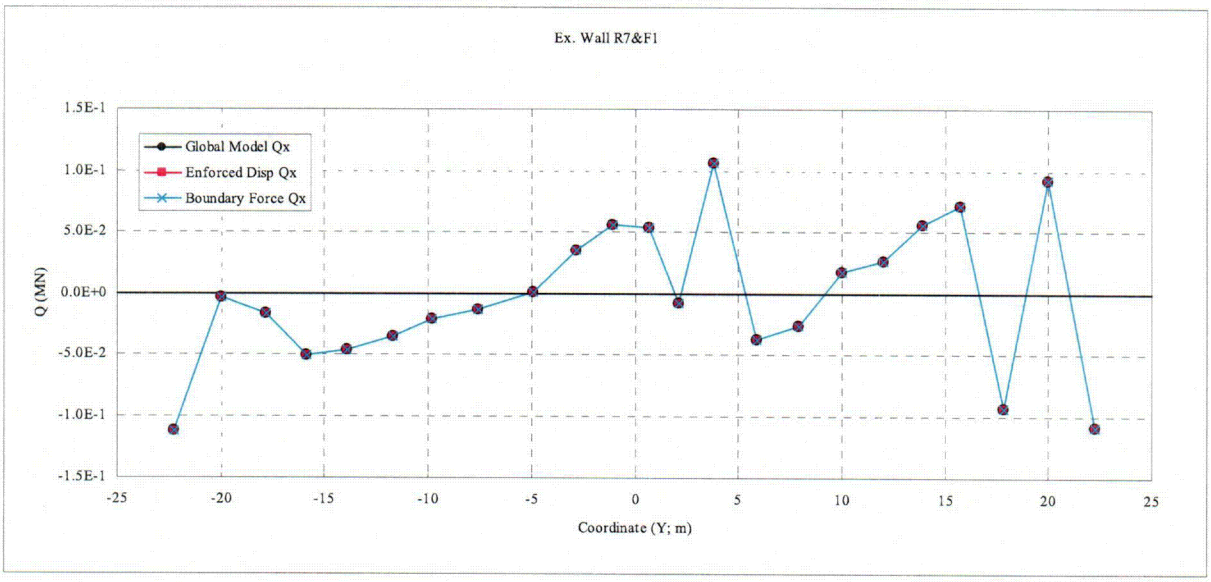


(e) Bending Moment in Horizontal Direction

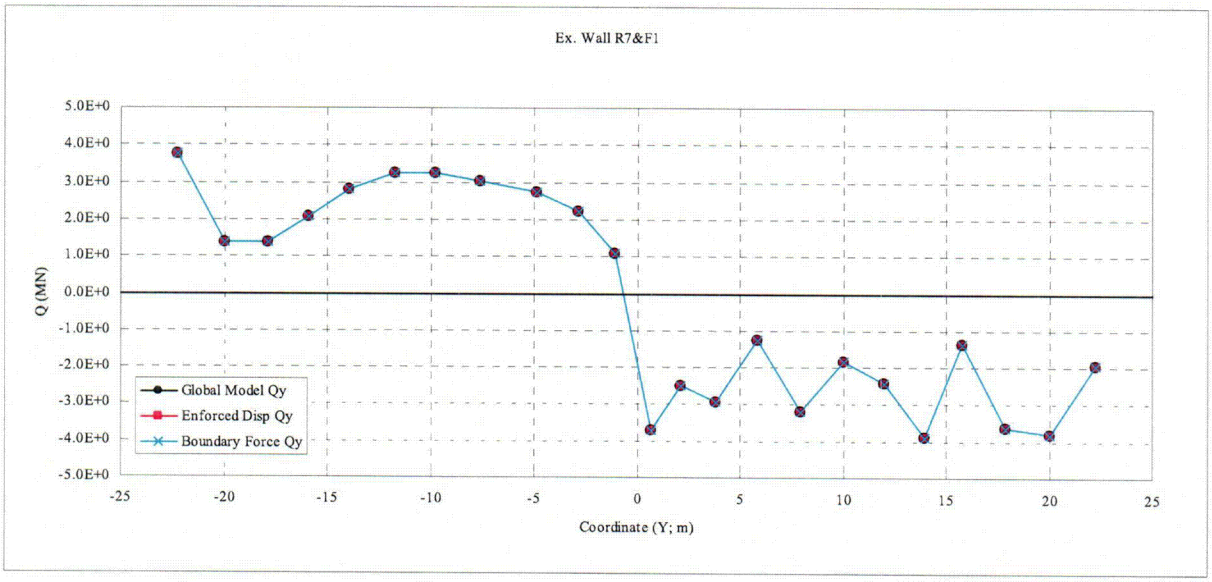


(f) Bending Moment in Vertical Direction

Figure D-4(c) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Dead Load)

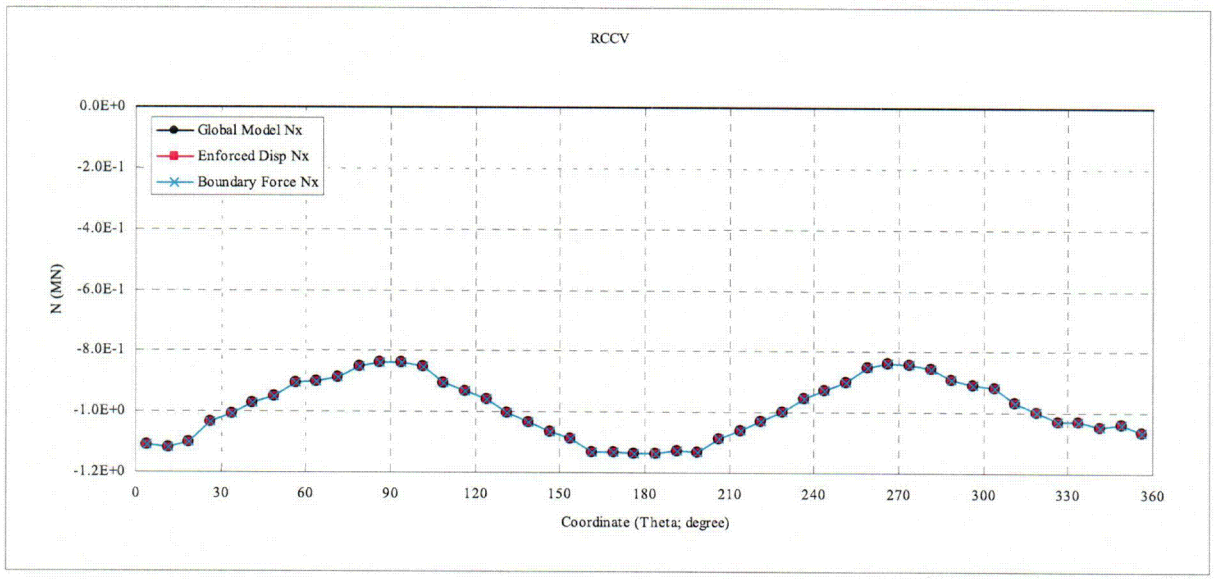


(g) Transverse Shear in Horizontal Direction

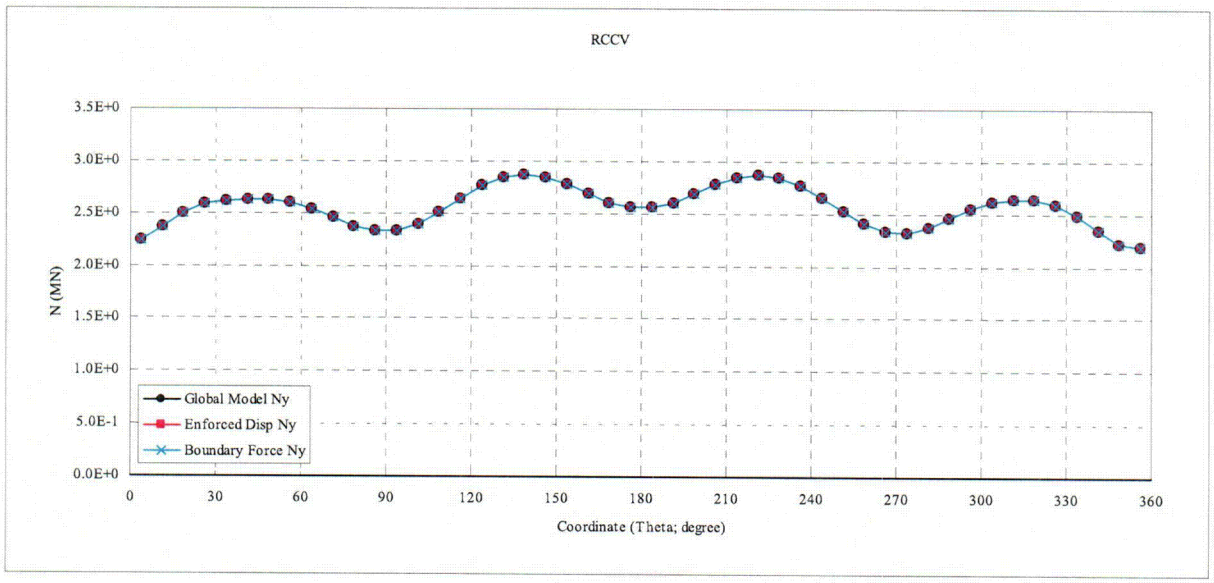


(h) Transverse Shear in Vertical Direction

Figure D-4(d) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Dead Load)

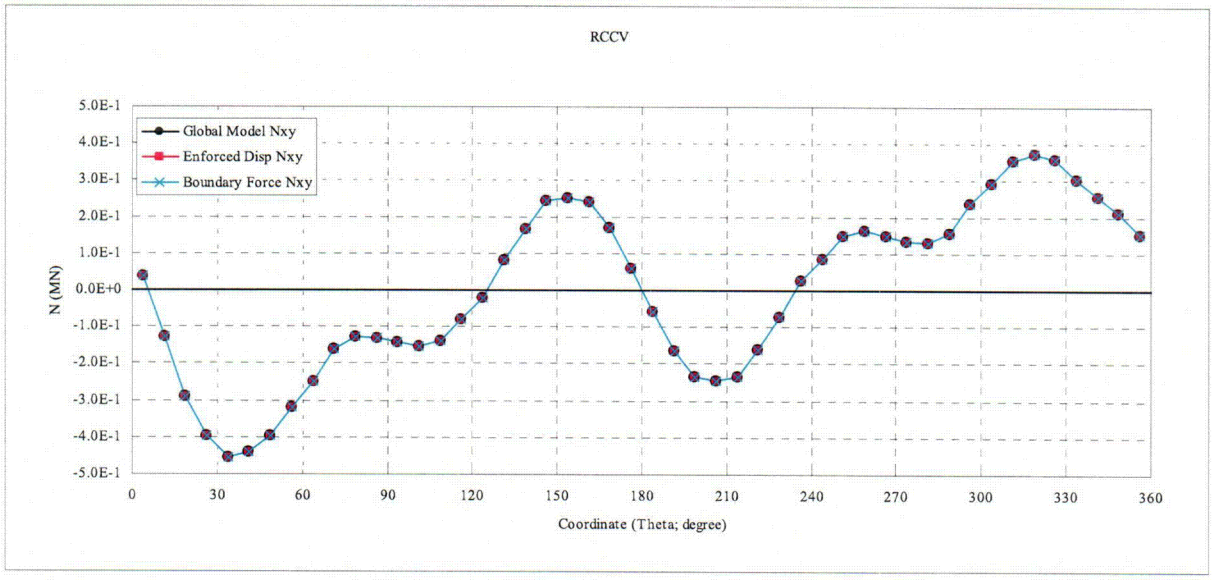


(a) Axial Force in Horizontal Direction

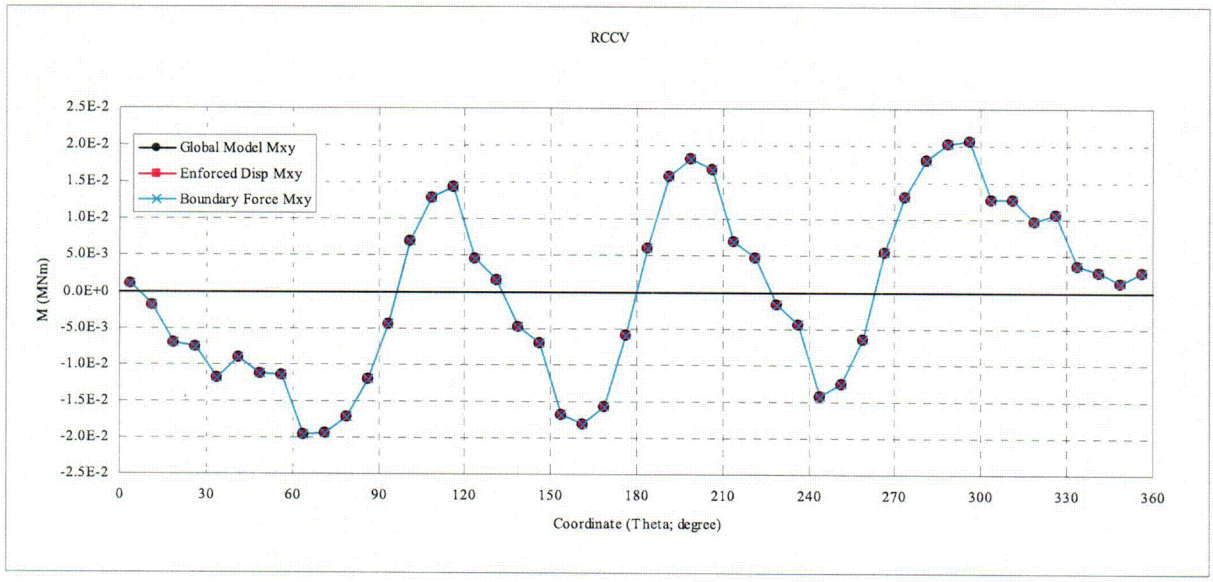


(b) Axial Force in Vertical Direction

Figure D-5(a) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Drywell Unit Pressure)

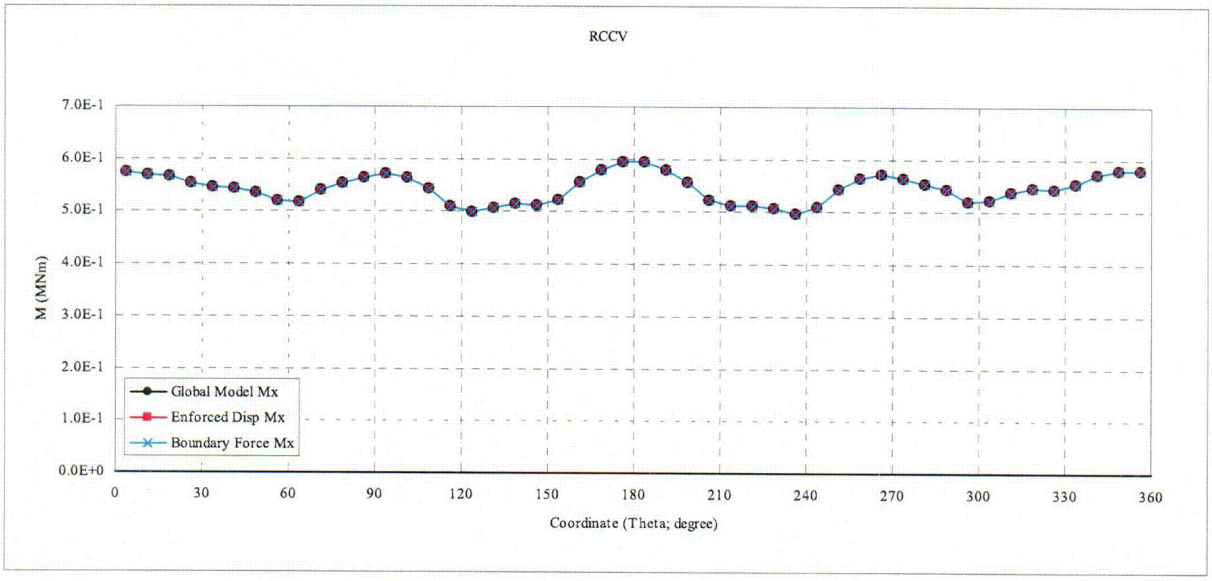


(c) In-plane Shear

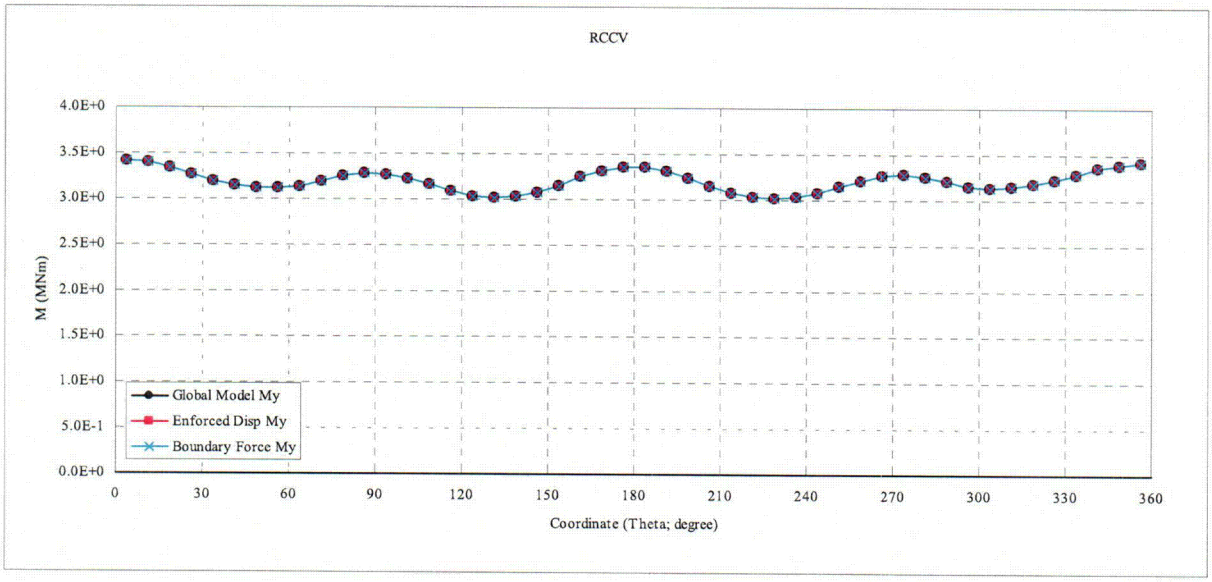


(d) Torsional Moment

Figure D-5(b) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Drywell Unit Pressure)

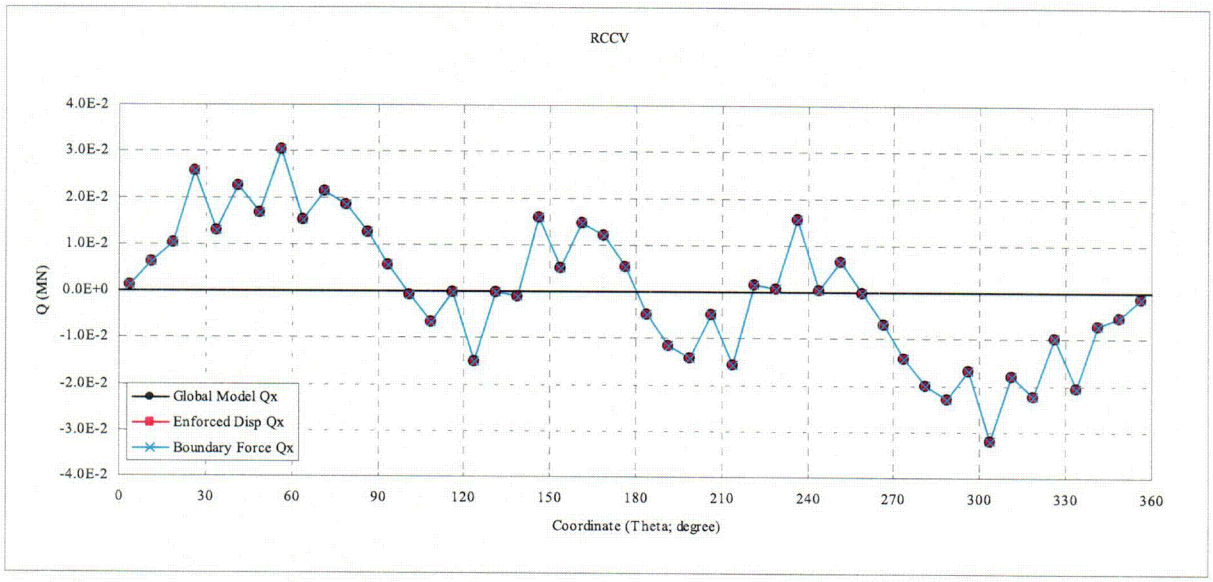


(e) Bending Moment in Horizontal Direction

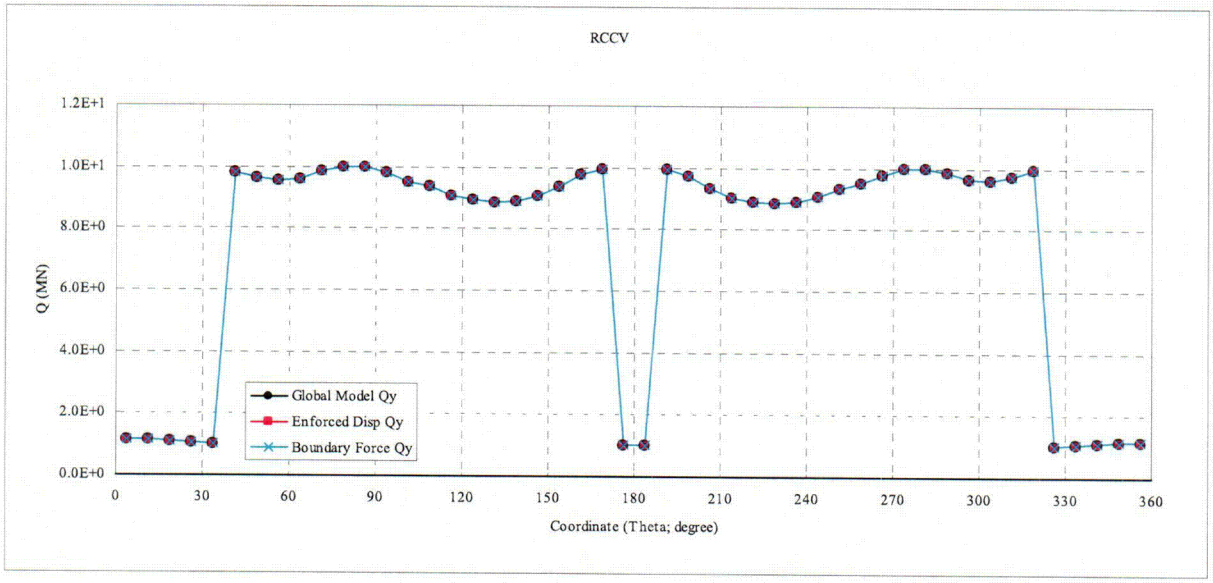


(f) Bending Moment in Vertical Direction

Figure D-5(c) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Drywell Unit Pressure)

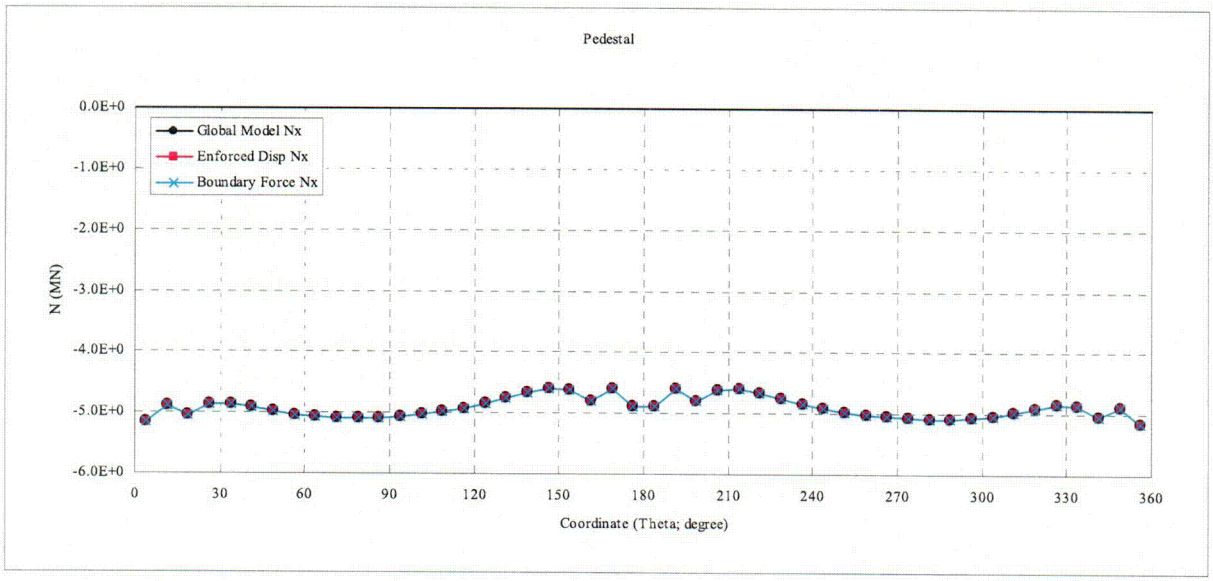


(g) Transverse Shear in Horizontal Direction

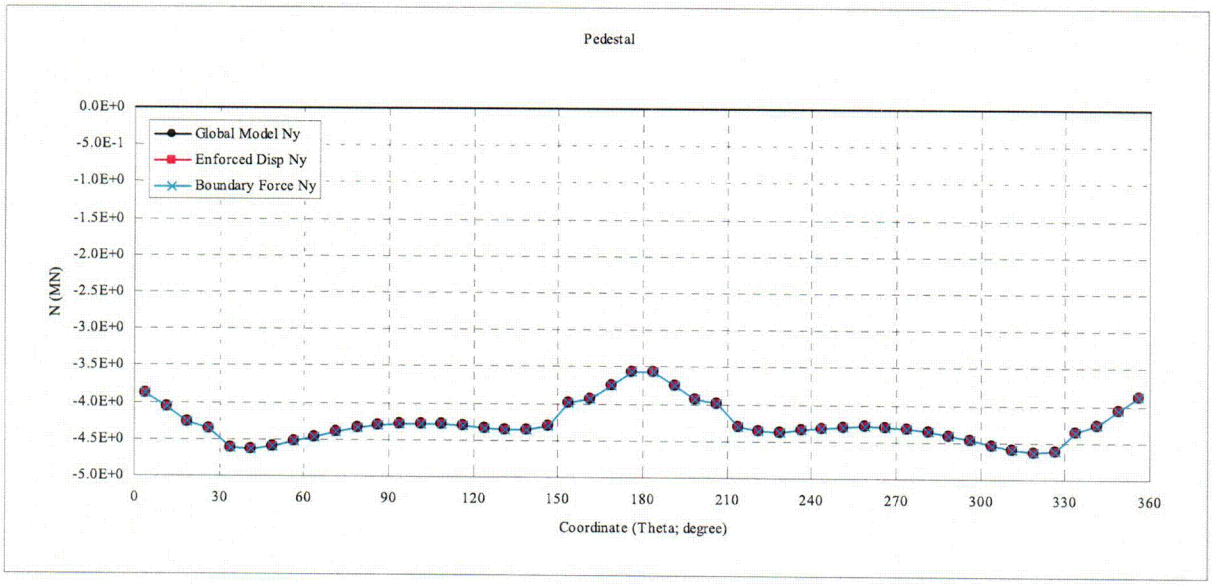


(h) Transverse Shear in Vertical Direction

Figure D-5(d) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Drywell Unit Pressure)

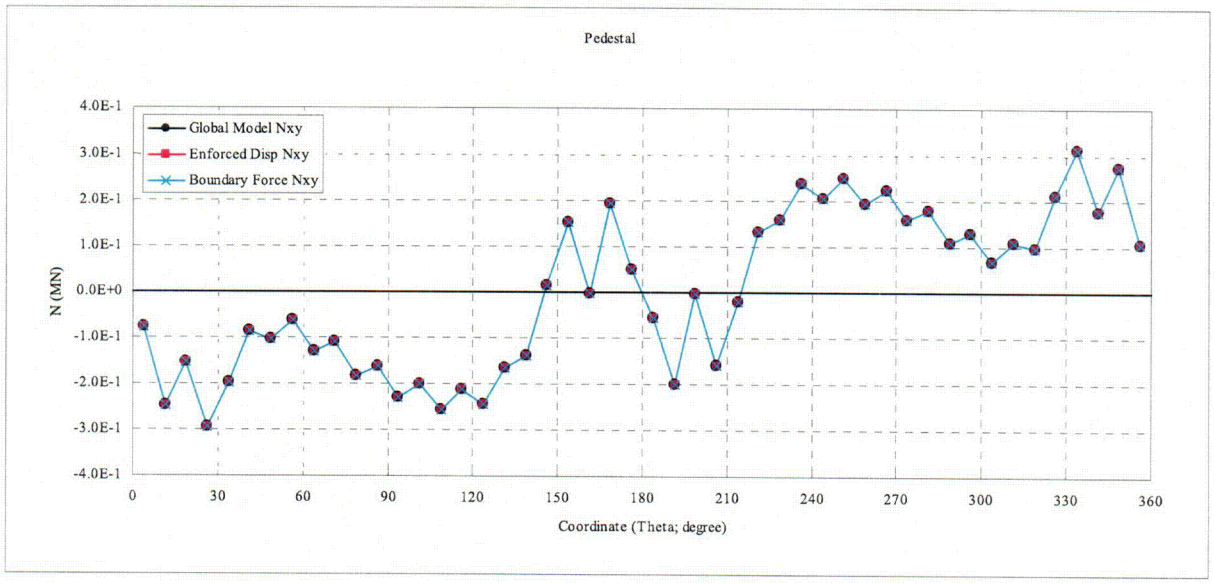


(a) Axial Force in Horizontal Direction

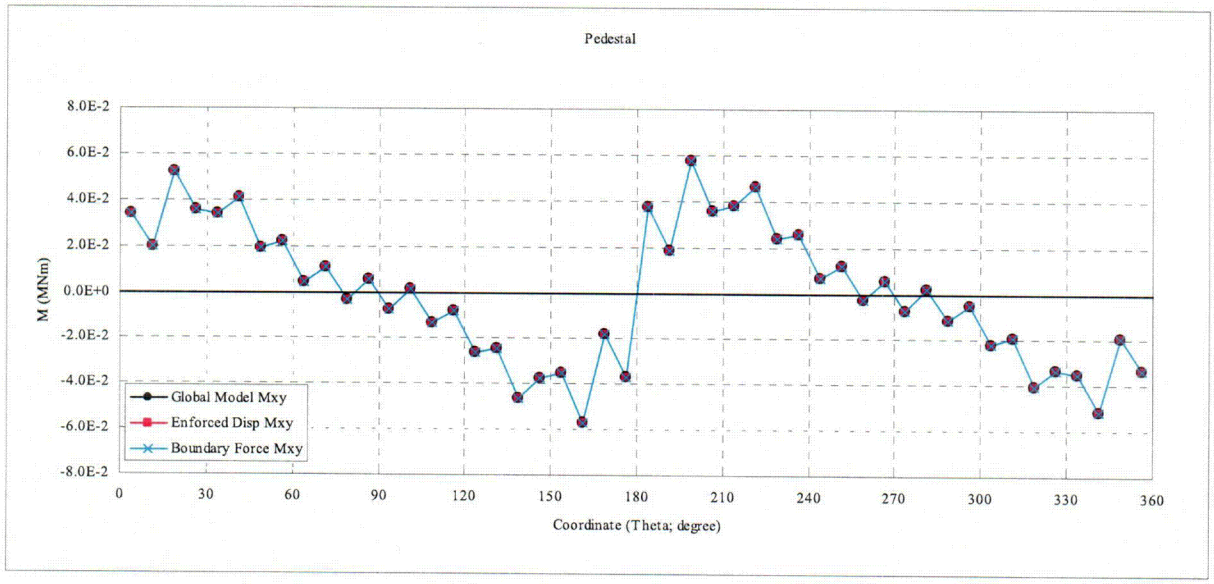


(b) Axial Force in Vertical Direction

Figure D-6(a) Comparison of Section Forces and Moments (RPV Pedestal: Drywell Unit Pressure)

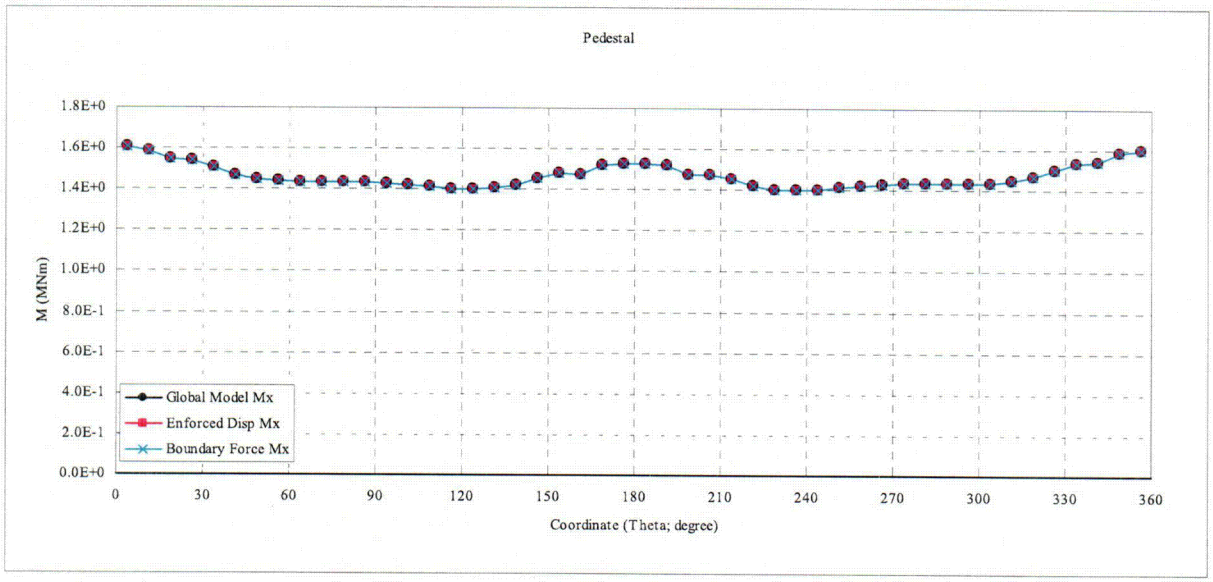


(c) In-plane Shear

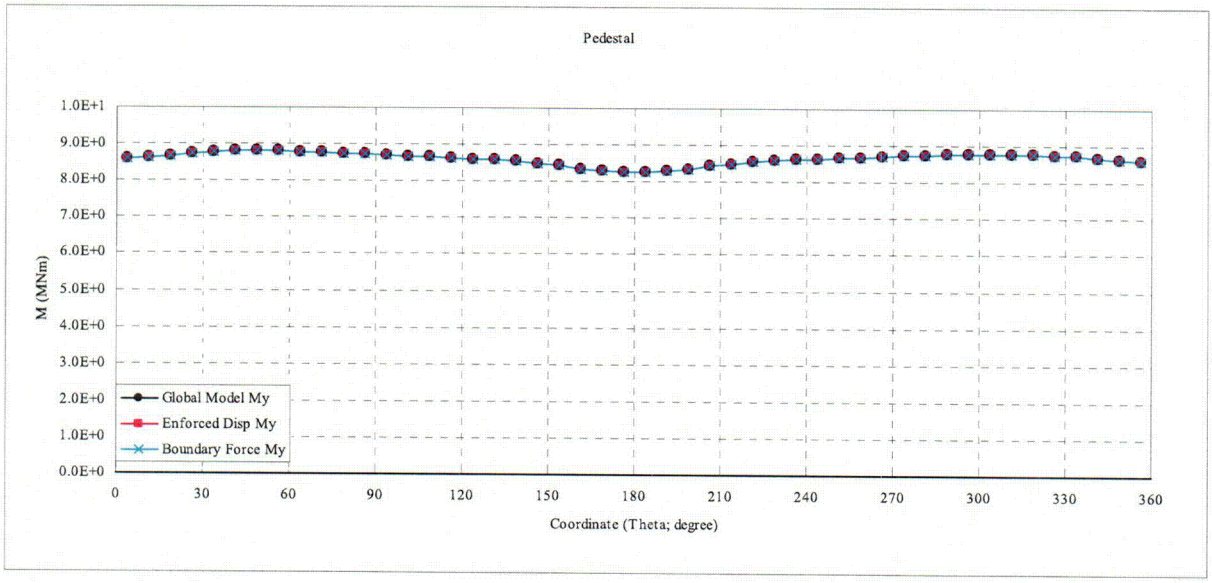


(d) Torsional Moment

Figure D-6(b) Comparison of Section Forces and Moments (RPV Pedestal: Drywell Unit Pressure)

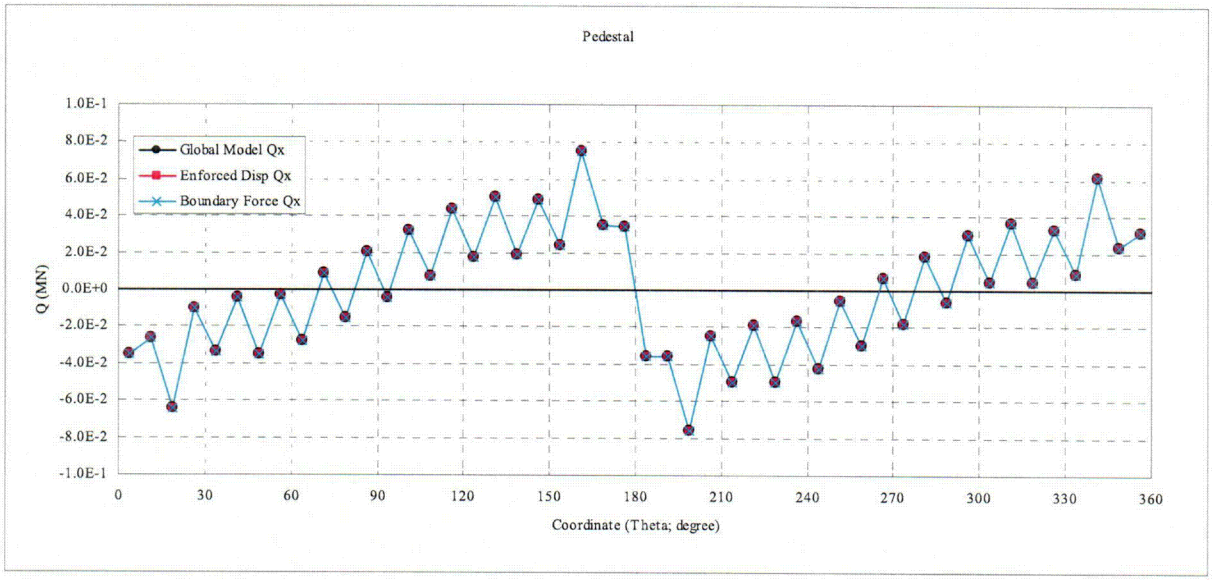


(e) Bending Moment in Horizontal Direction

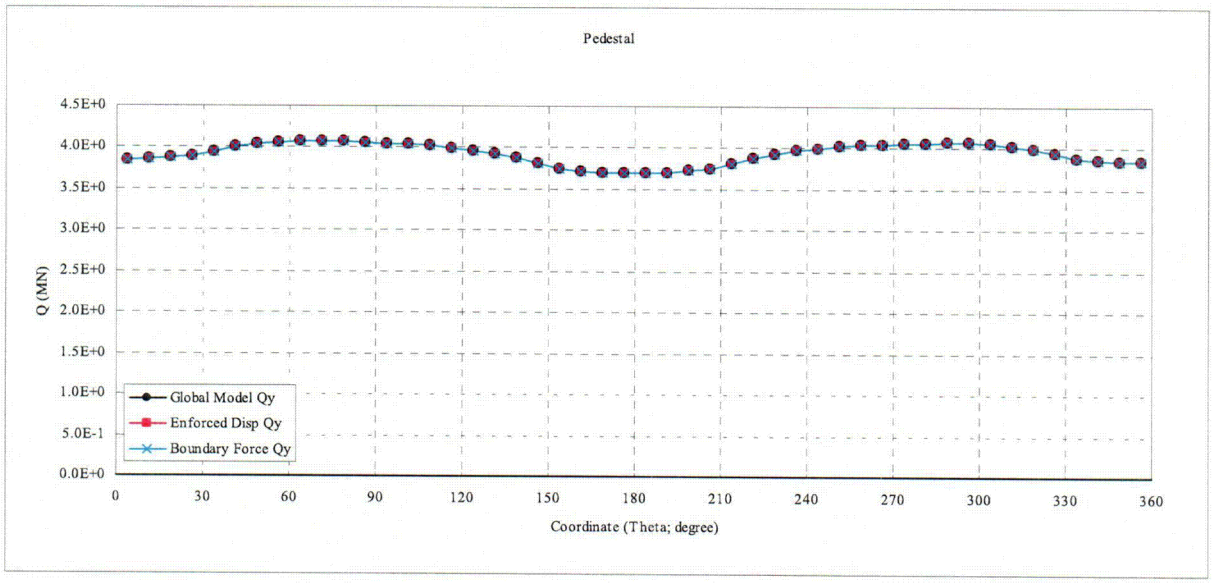


(f) Bending Moment in Vertical Direction

Figure D-6(c) Comparison of Section Forces and Moments (RPV Pedestal: Drywell Unit Pressure)

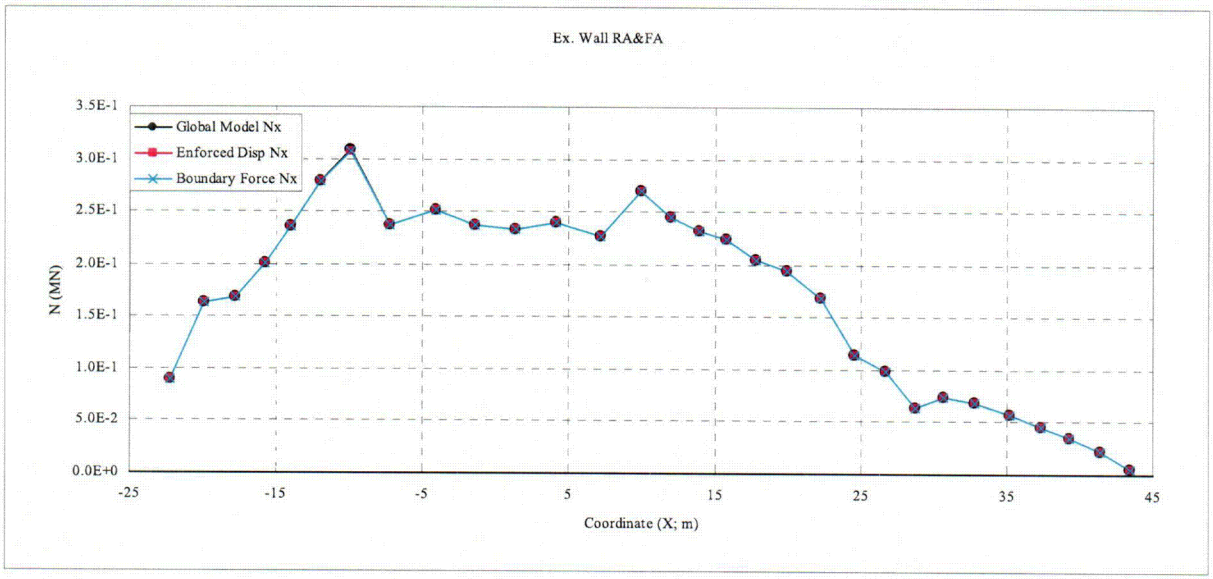


(g) Transverse Shear in Horizontal Direction

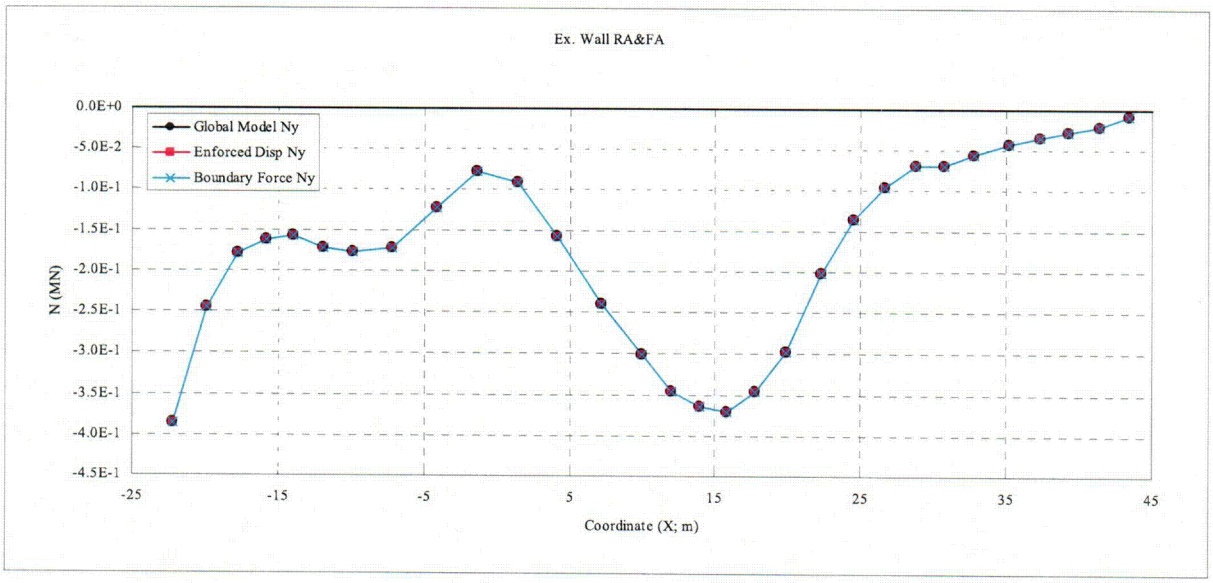


(h) Transverse Shear in Vertical Direction

Figure D-6(d) Comparison of Section Forces and Moments (RPV Pedestal: Drywell Unit Pressure)

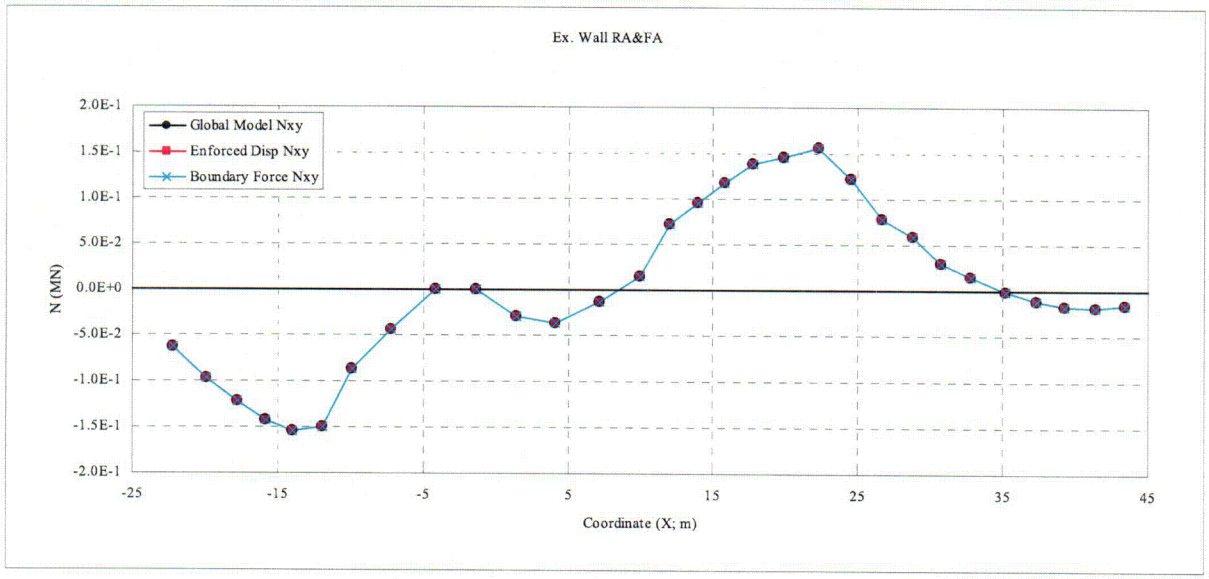


(a) Axial Force in Horizontal Direction

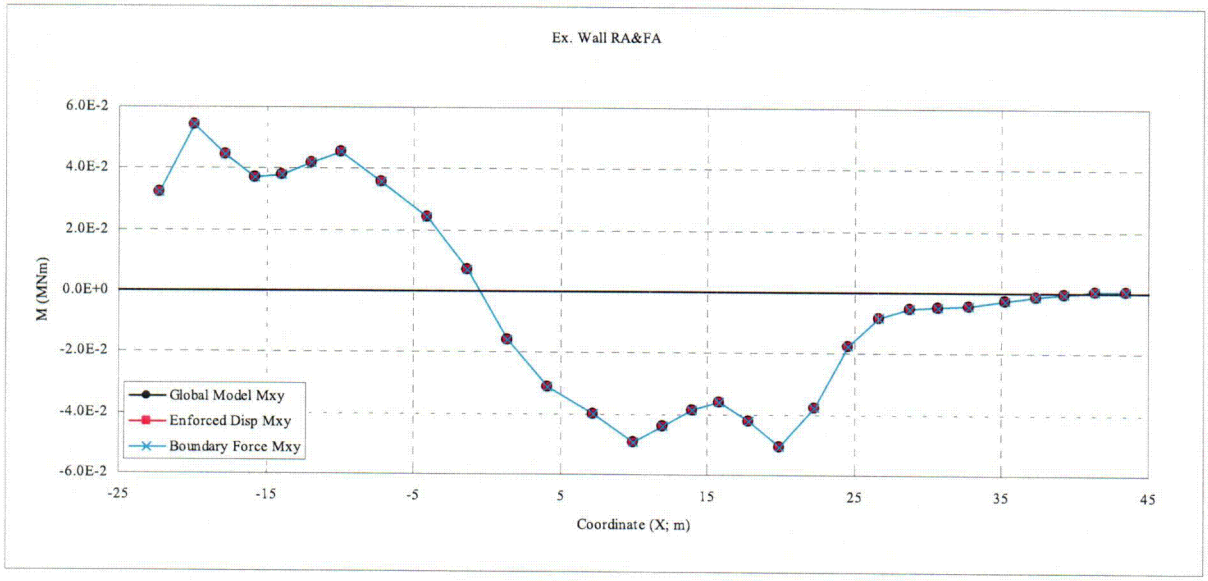


(b) Axial Force in Vertical Direction

Figure D-7(a) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Drywell Unit Pressure)

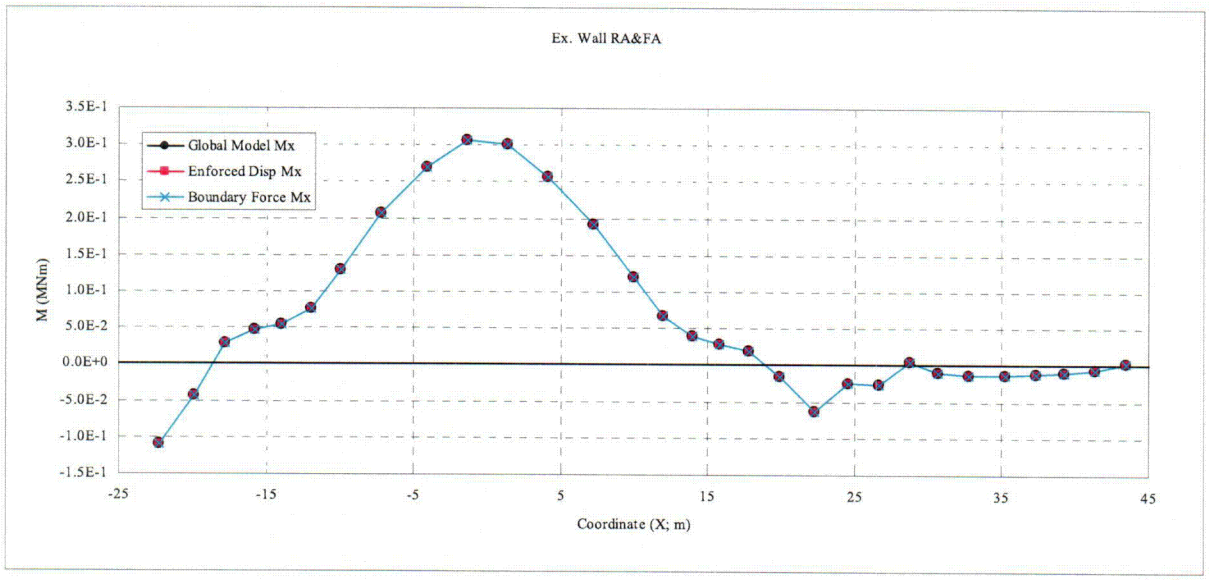


(c) In-plane Shear

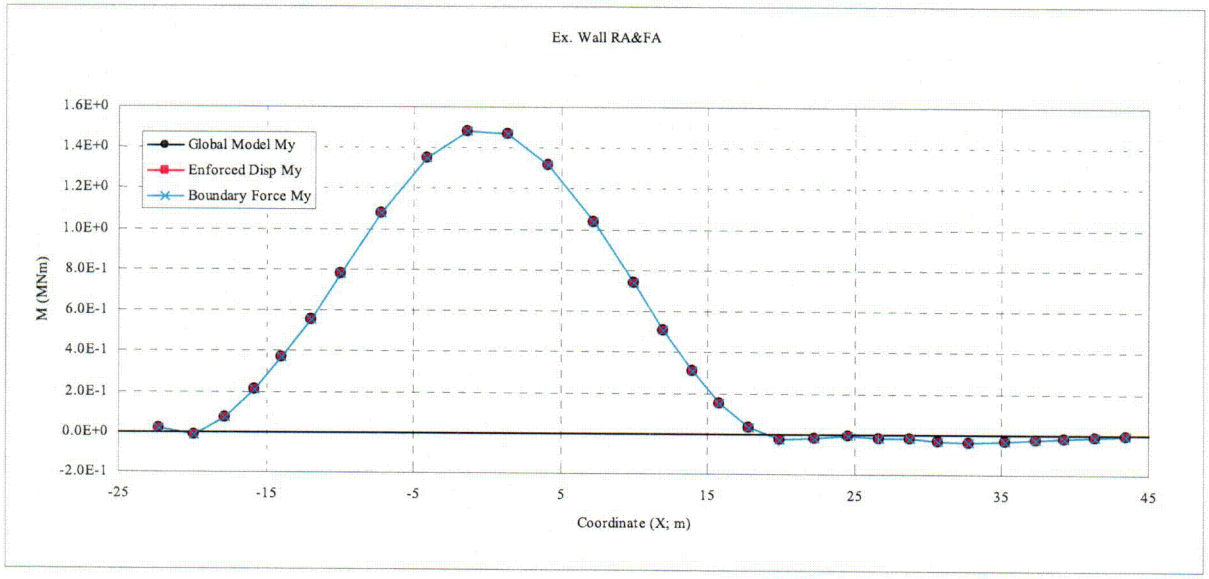


(d) Torsional Moment

Figure D-7(b) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Drywell Unit Pressure)

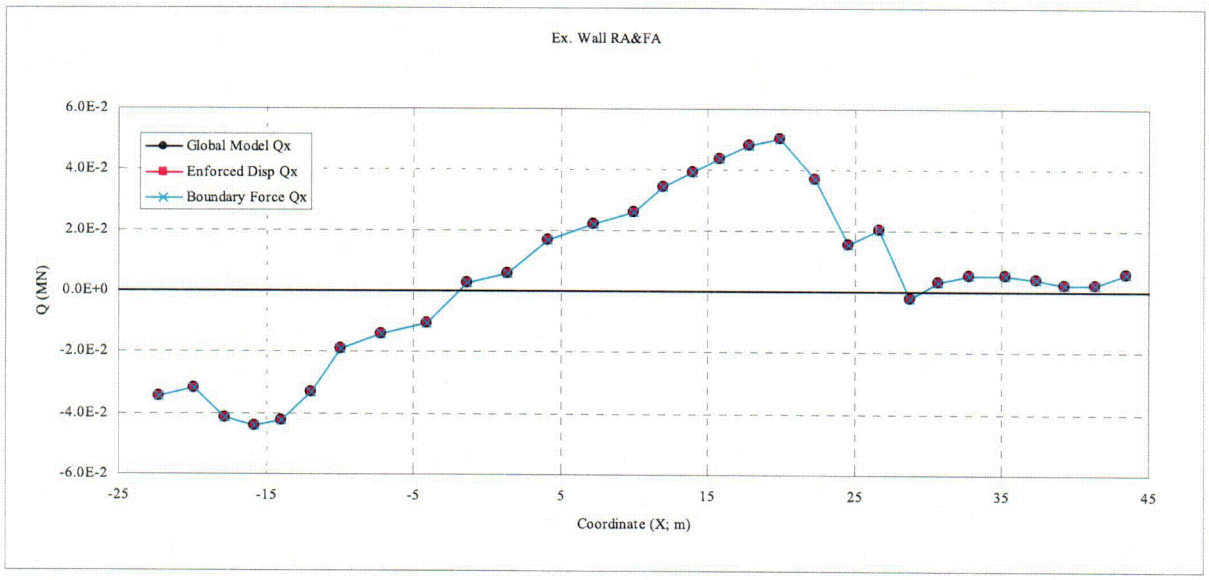


(e) Bending Moment in Horizontal Direction

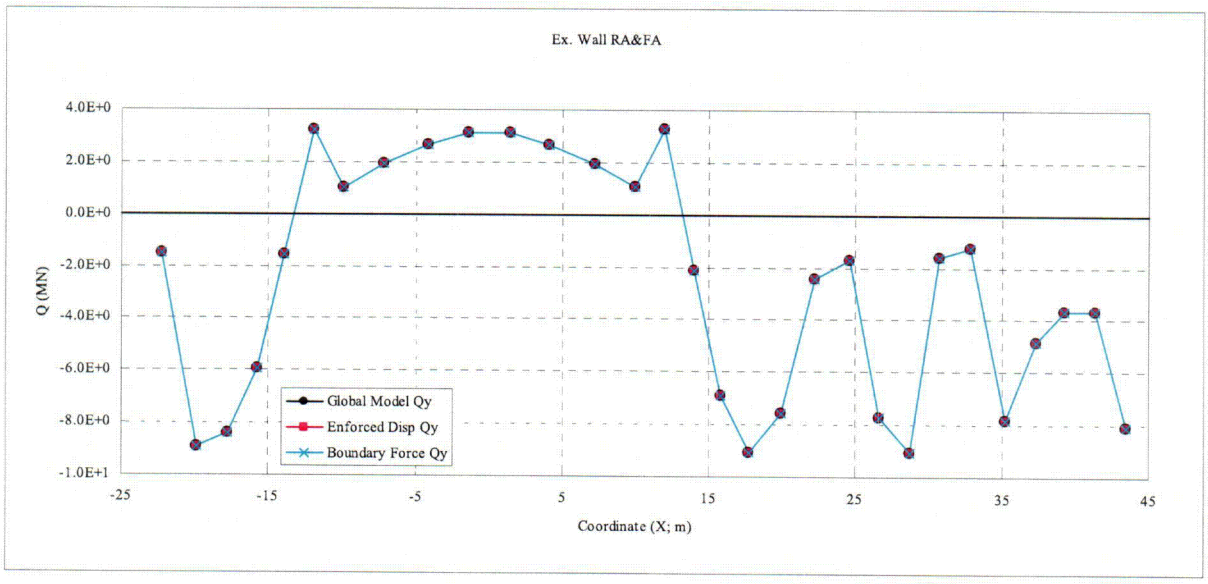


(f) Bending Moment in Vertical Direction

Figure D-7(c) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Drywell Unit Pressure)

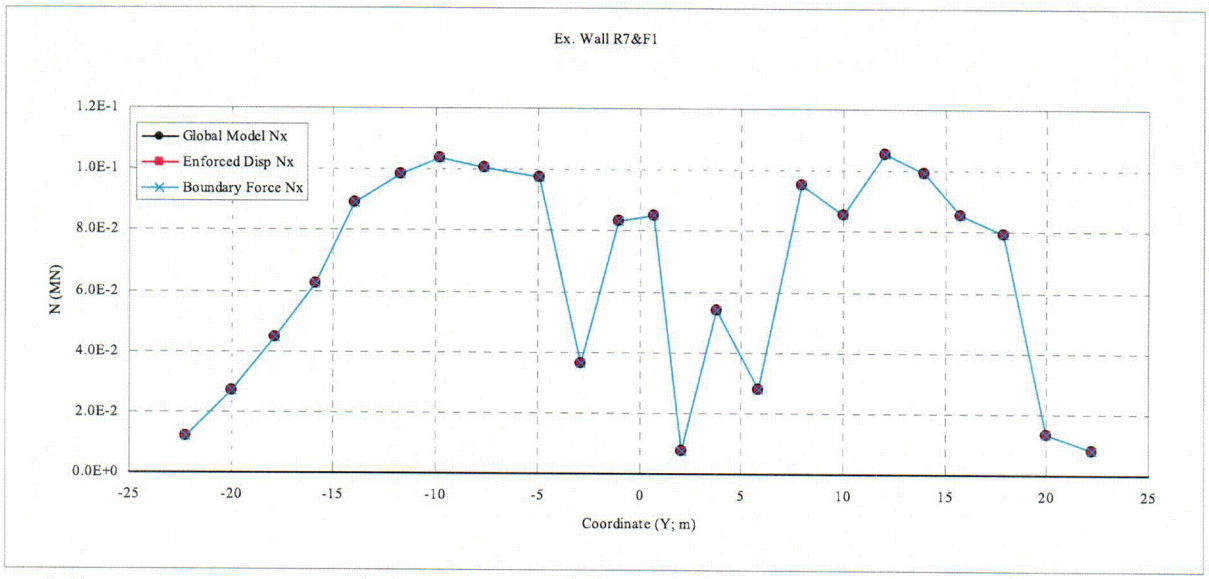


(g) Transverse Shear in Horizontal Direction

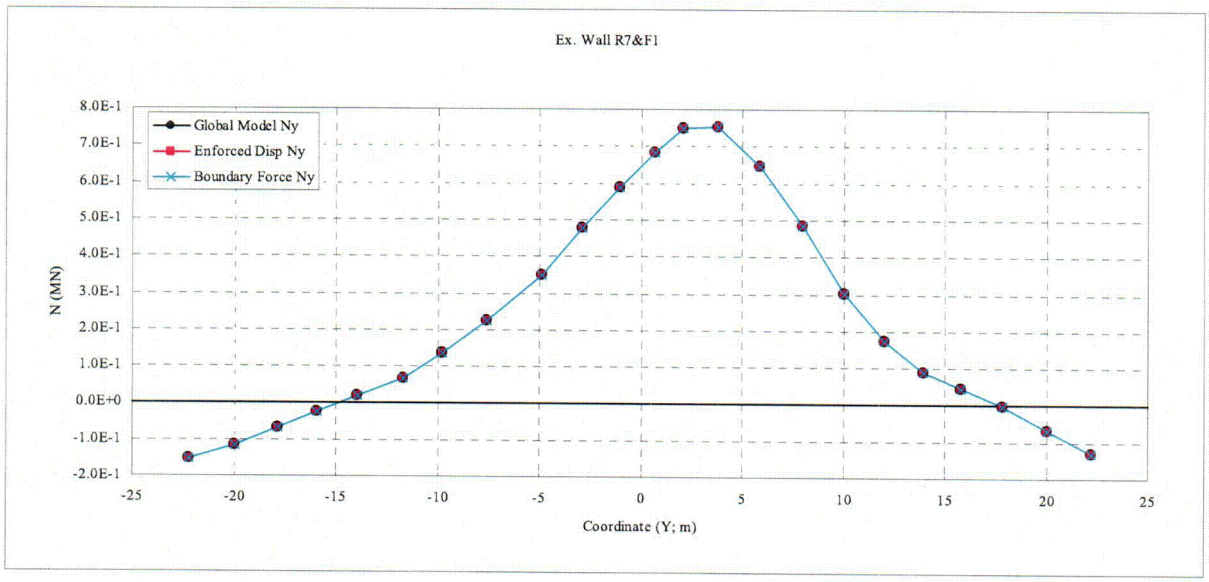


(h) Transverse Shear in Vertical Direction

Figure D-7(d) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Drywell Unit Pressure)

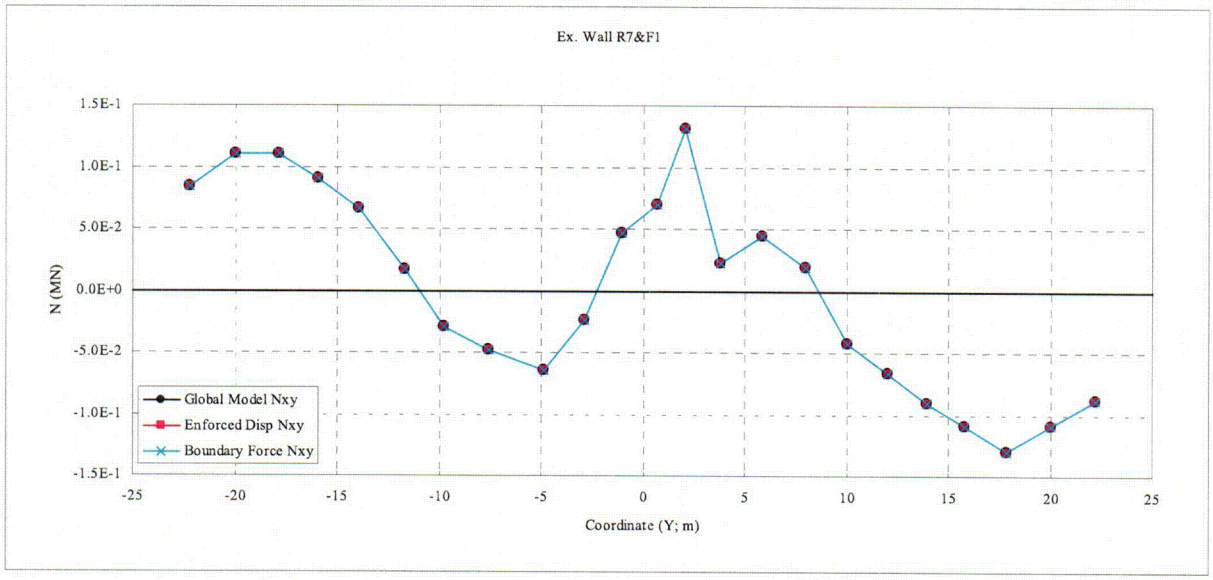


(a) Axial Force in Horizontal Direction

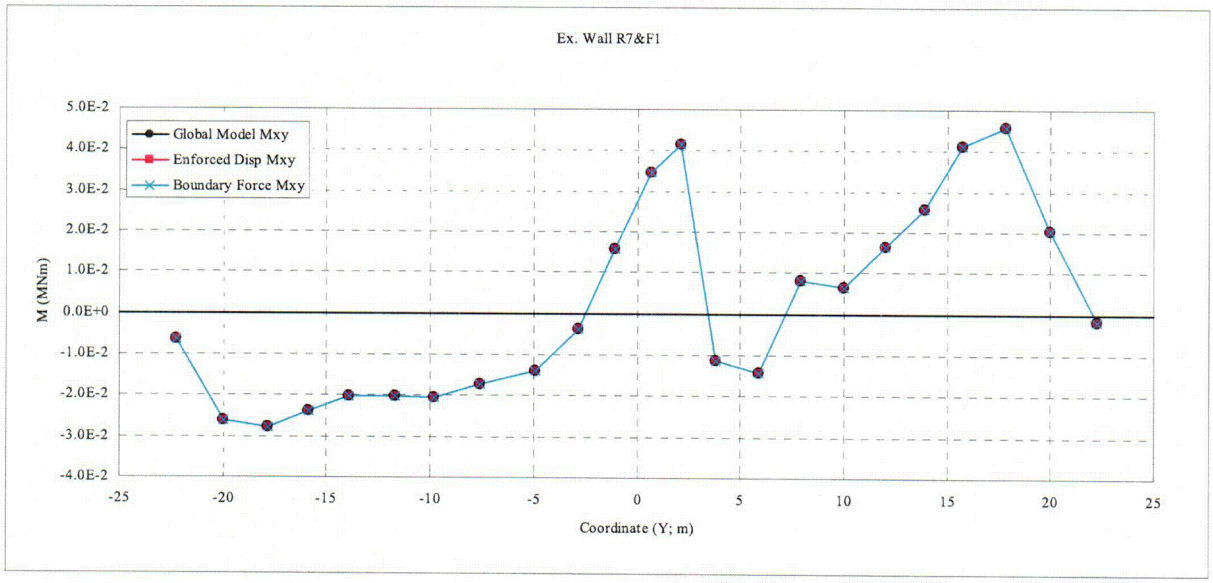


(b) Axial Force in Vertical Direction

Figure D-8(a) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Drywell Unit Pressure)

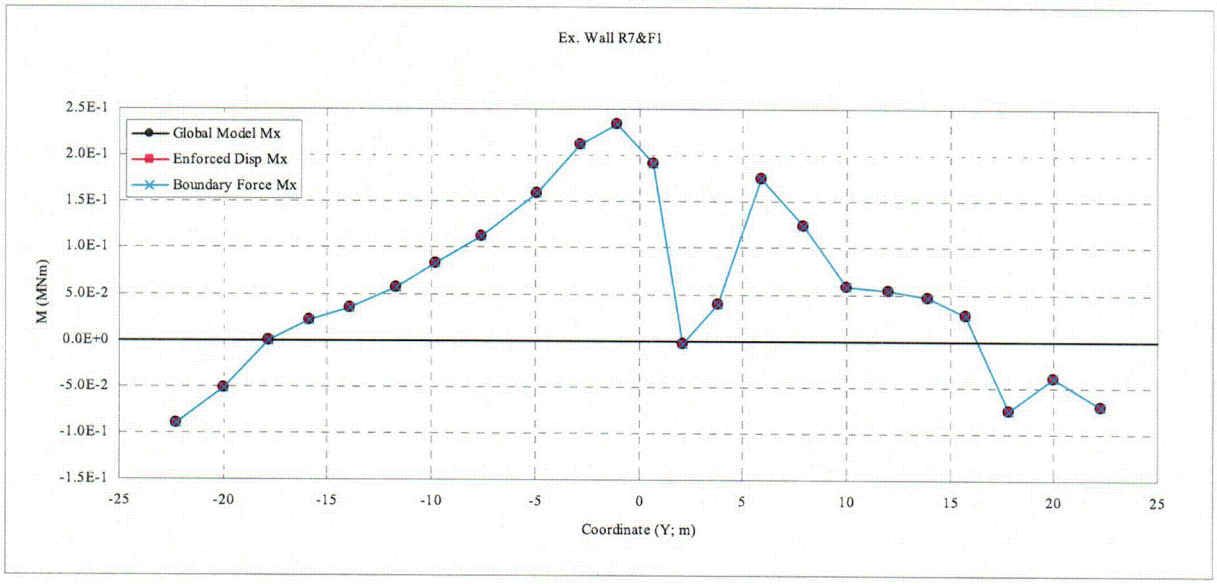


(c) In-plane Shear

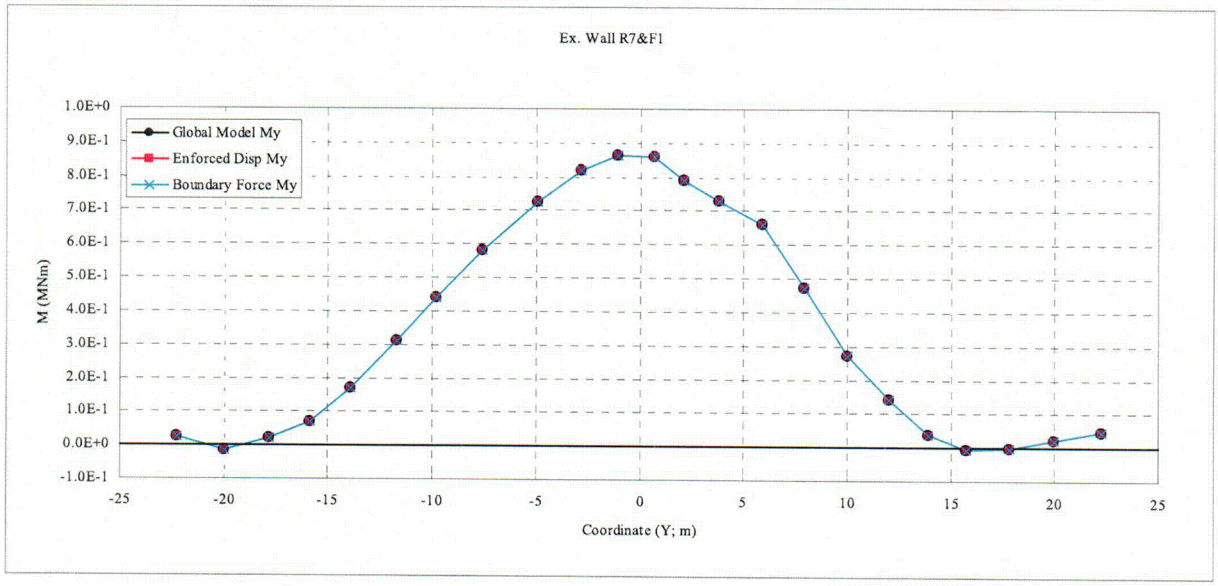


(d) Torsional Moment

Figure D-8(b) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Drywell Unit Pressure)

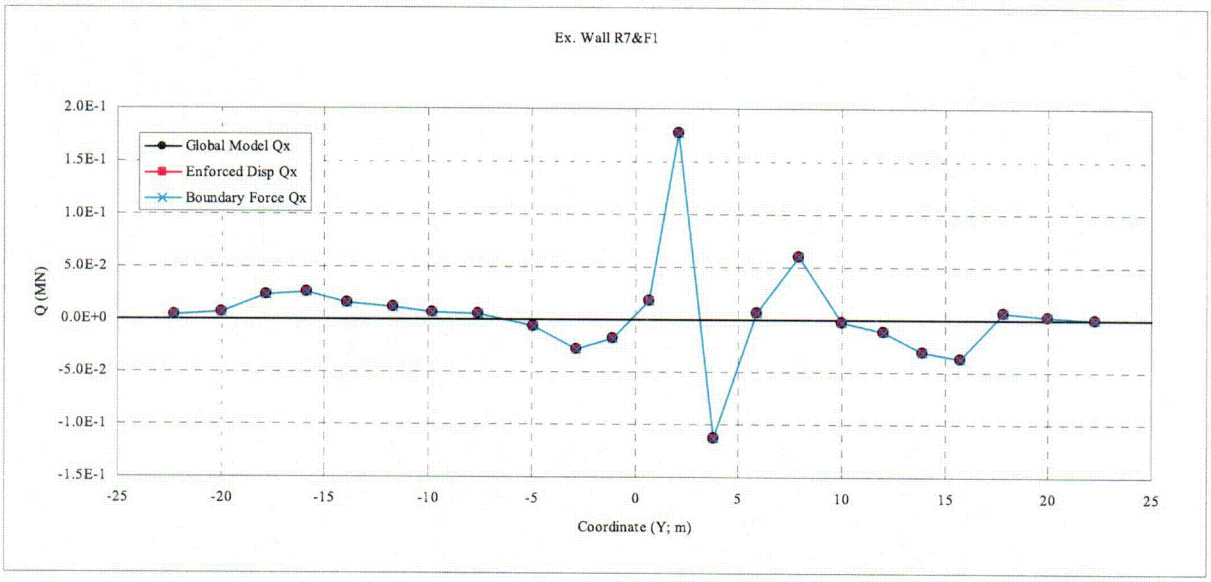


(e) Bending Moment in Horizontal Direction

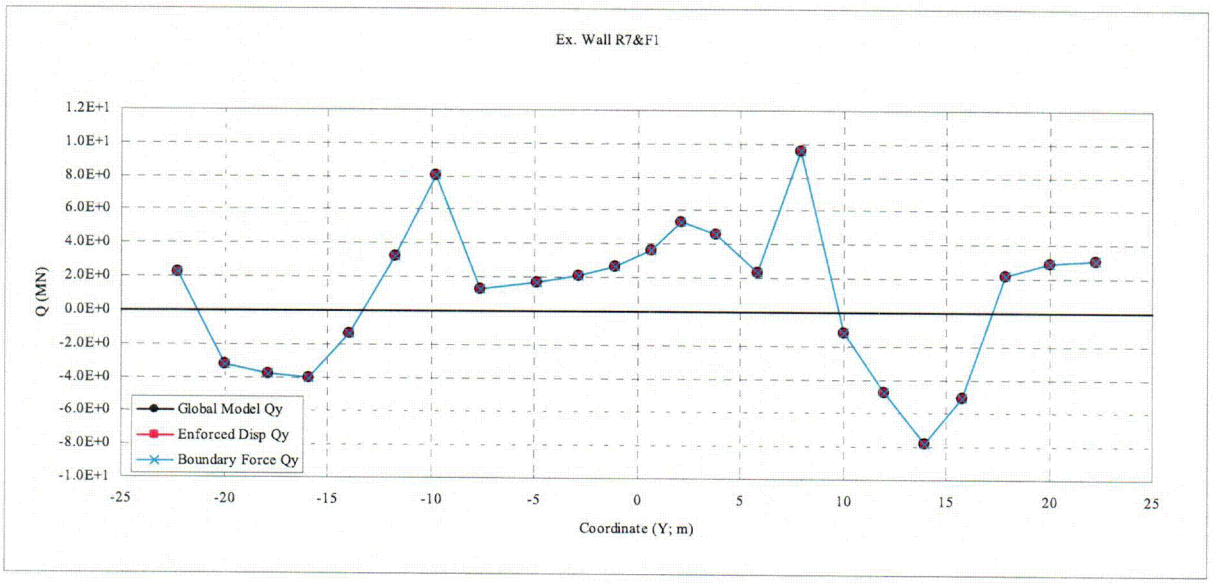


(f) Bending Moment in Vertical Direction

Figure D-8(c) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Drywell Unit Pressure)

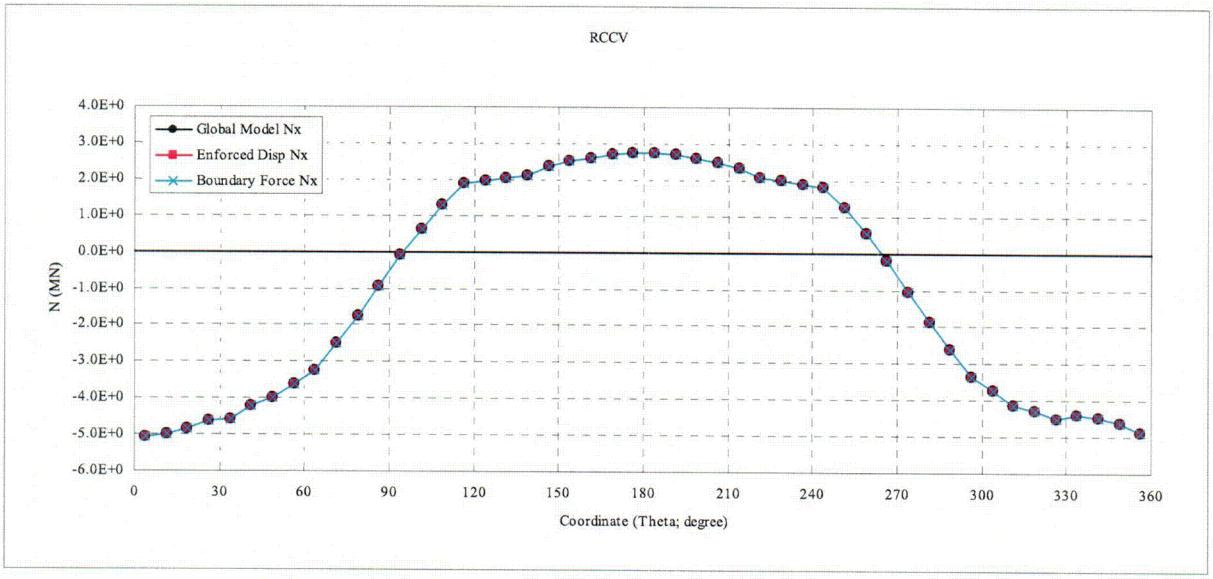


(g) Transverse Shear in Horizontal Direction

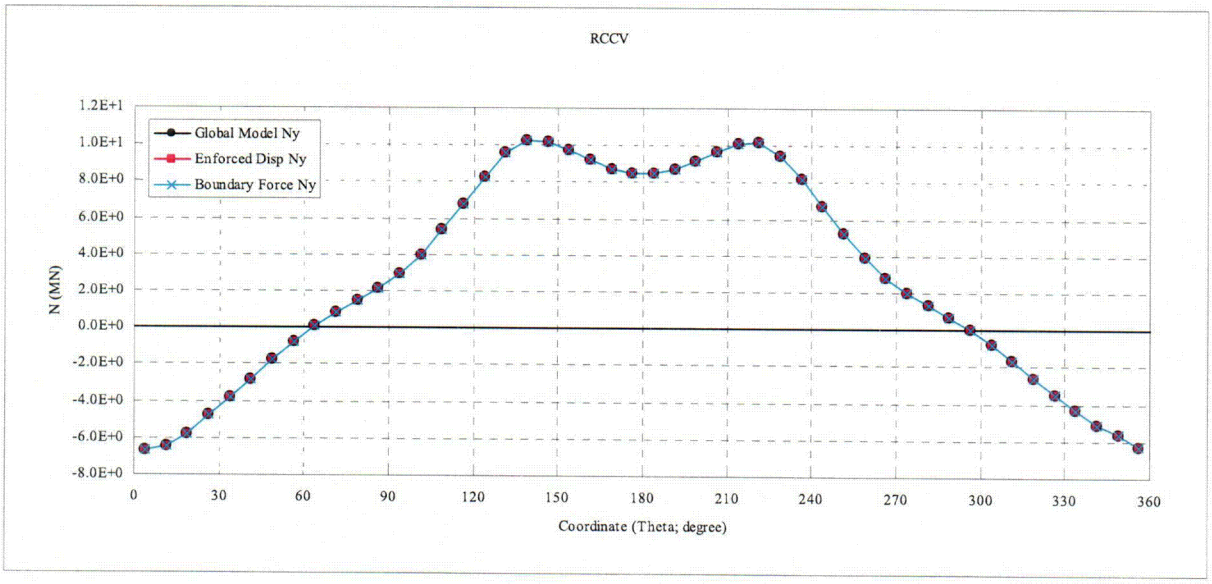


(h) Transverse Shear in Vertical Direction

Figure D-8(d) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Drywell Unit Pressure)

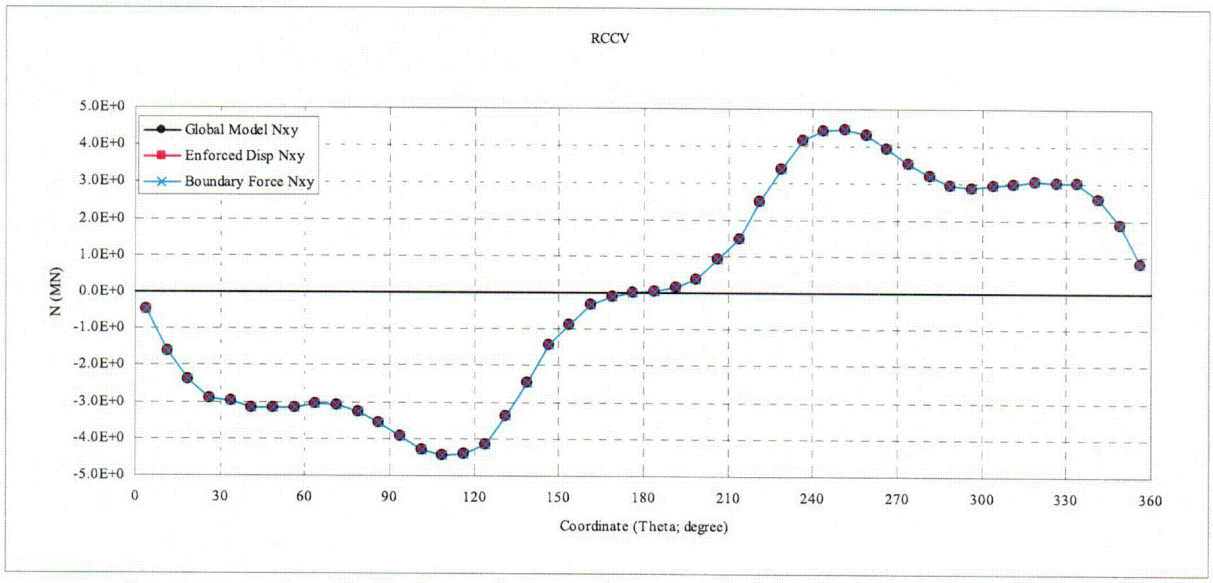


(a) Axial Force in Horizontal Direction

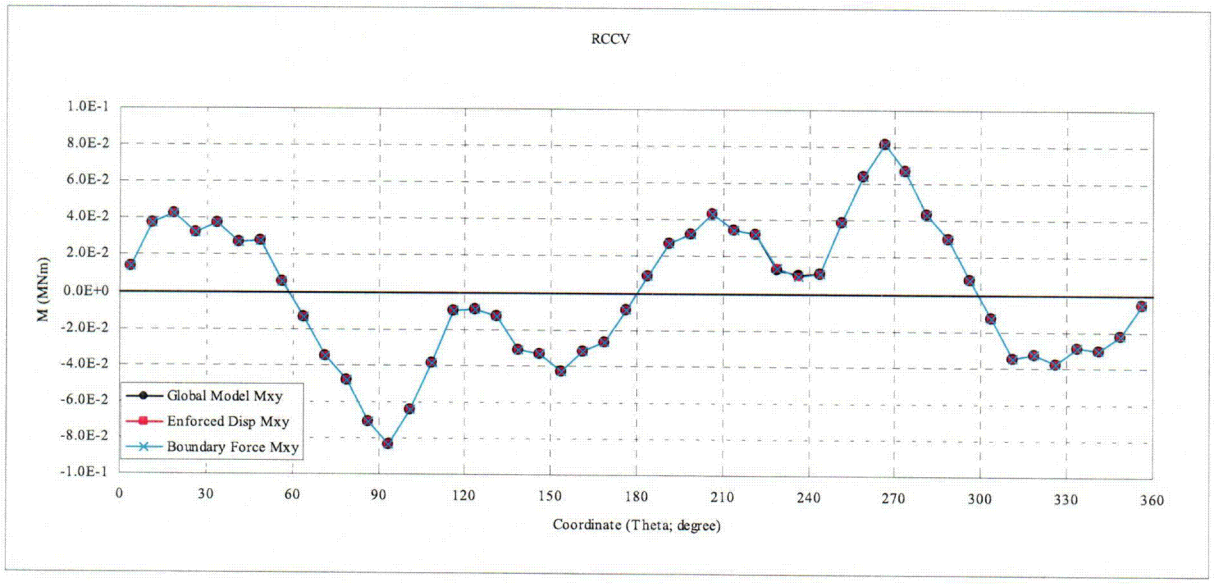


(b) Axial Force in Vertical Direction

Figure D-9(a) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Horizontal Seismic Load in N-S Direction)

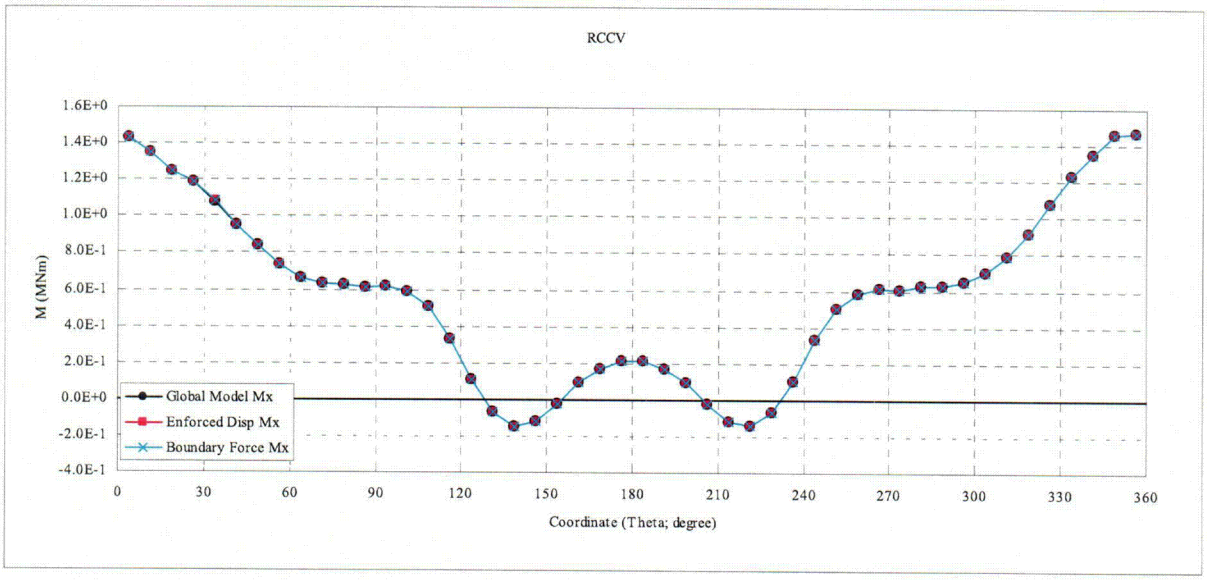


(c) In-plane Shear

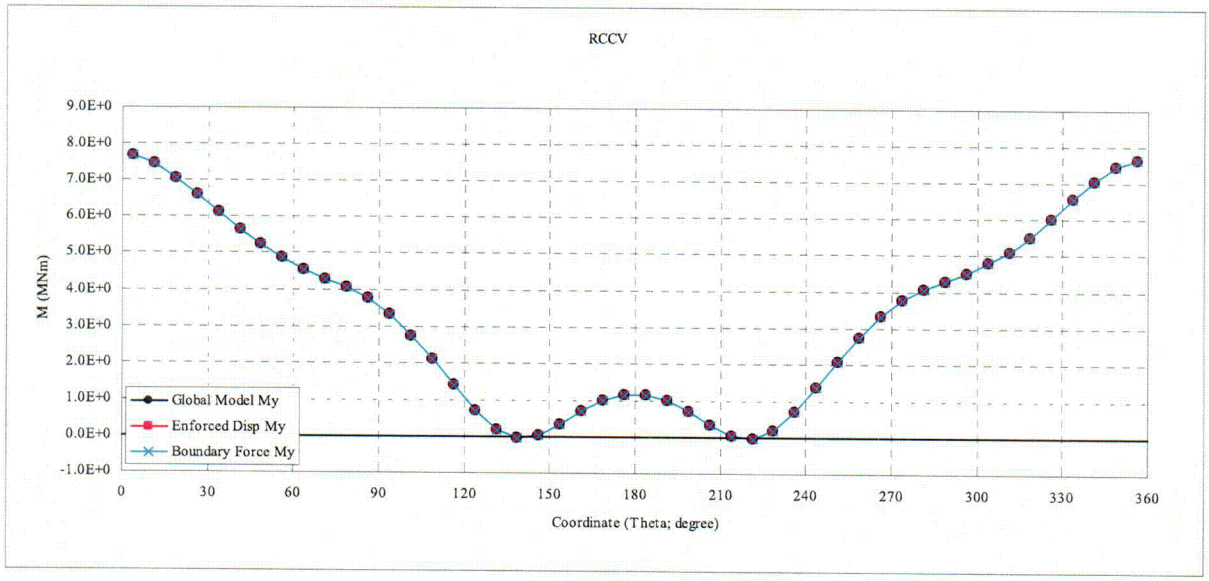


(d) Torsional Moment

Figure D-9(b) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Horizontal Seismic Load in N-S Direction)

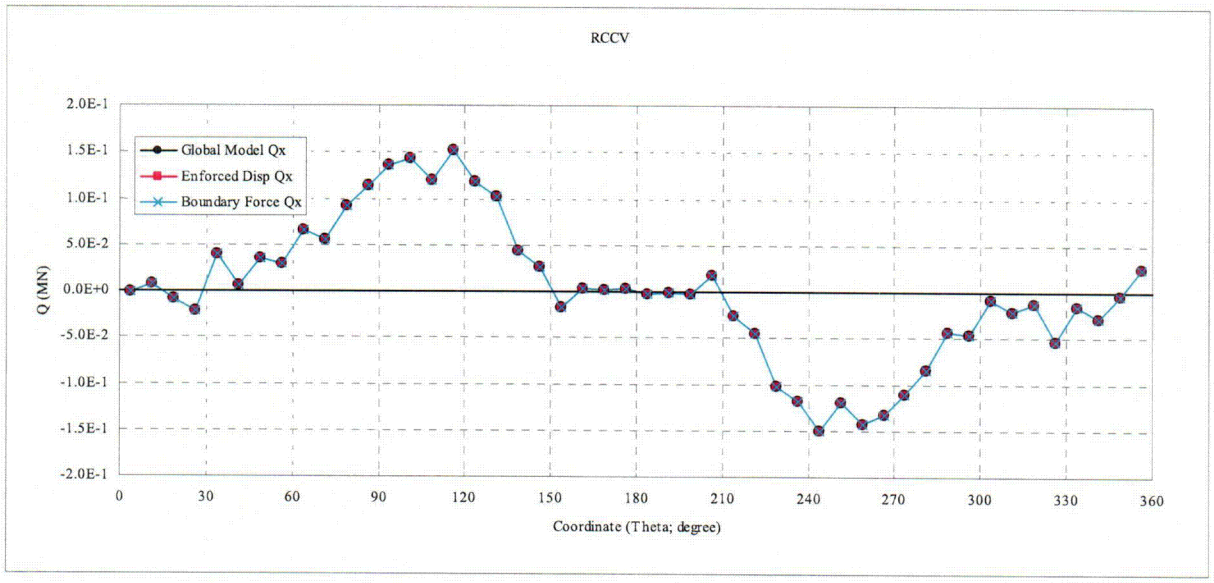


(e) Bending Moment in Horizontal Direction

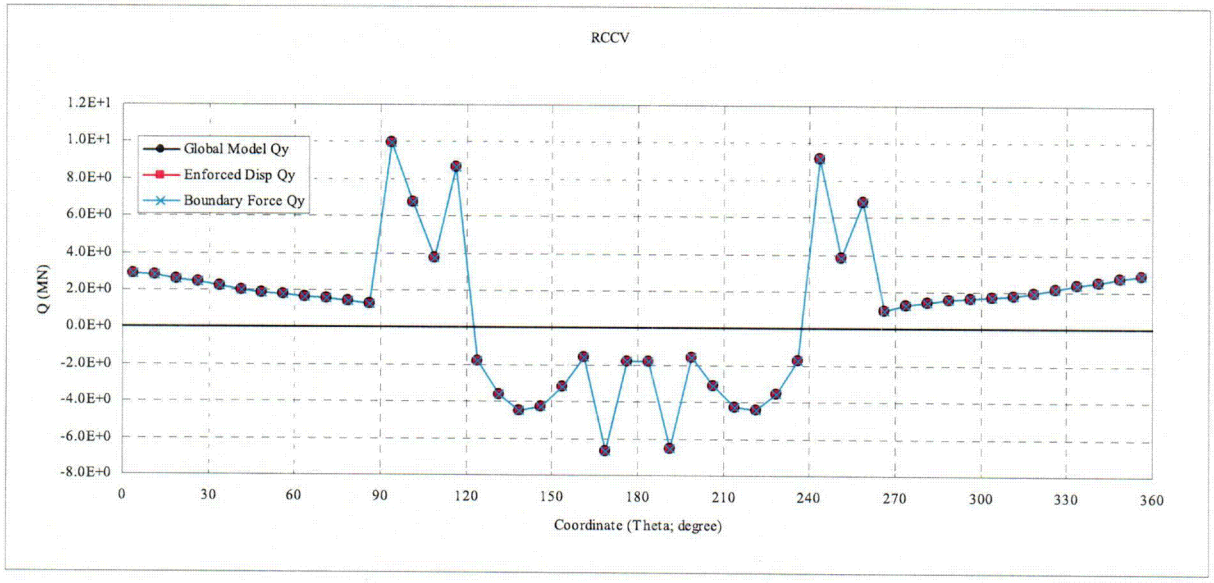


(f) Bending Moment in Vertical Direction

Figure D-9(c) Comparison of Section Forces and Moments
(Cylindrical Wall below RCCV Wall: Horizontal Seismic Load in N-S Direction)

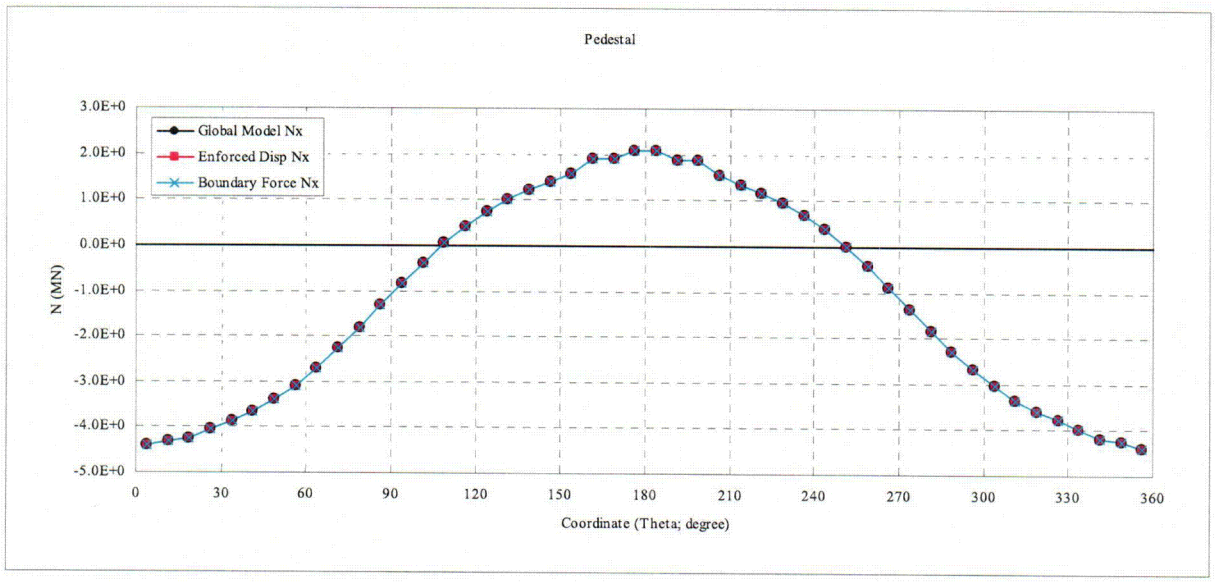


(g) Transverse Shear in Horizontal Direction

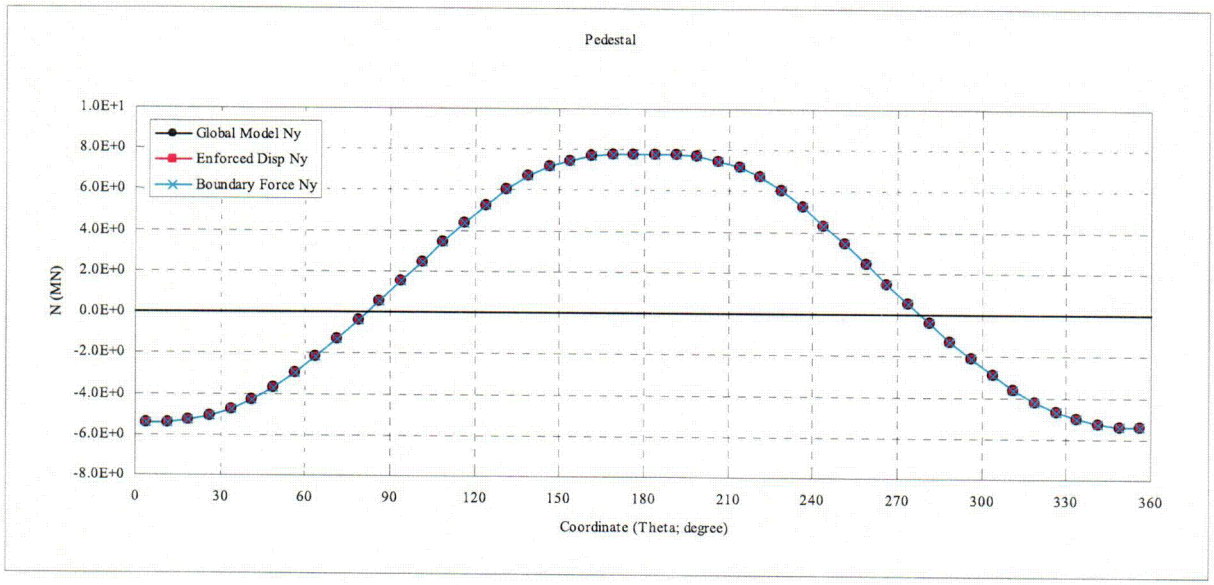


(h) Transverse Shear in Vertical Direction

Figure D-9(d) Comparison of Section Forces and Moments
(Cylindrical Wall below RCCV Wall: Horizontal Seismic Load in N-S Direction)

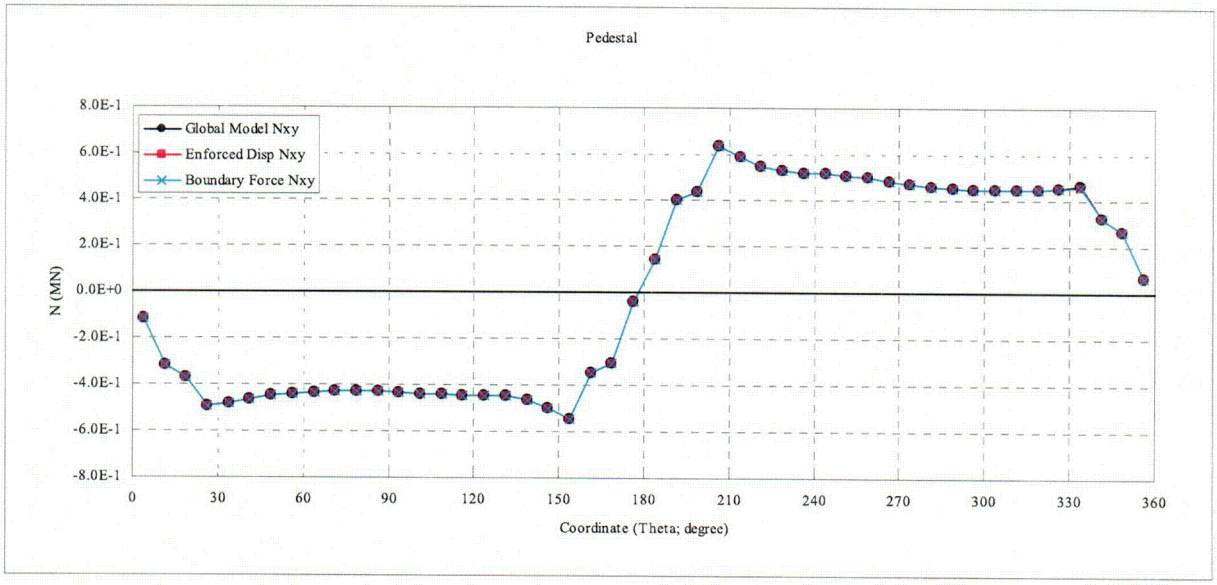


(a) Axial Force in Horizontal Direction

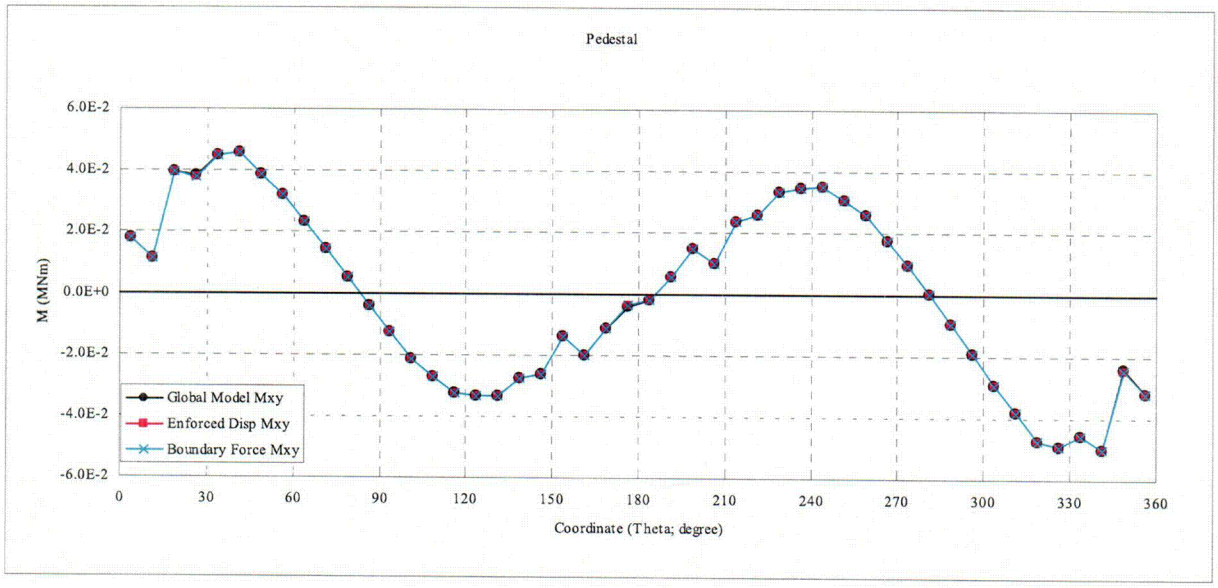


(b) Axial Force in Vertical Direction

Figure D-10(a) Comparison of Section Forces and Moments (RPV Pedestal: Horizontal Seismic Load in N-S Direction)

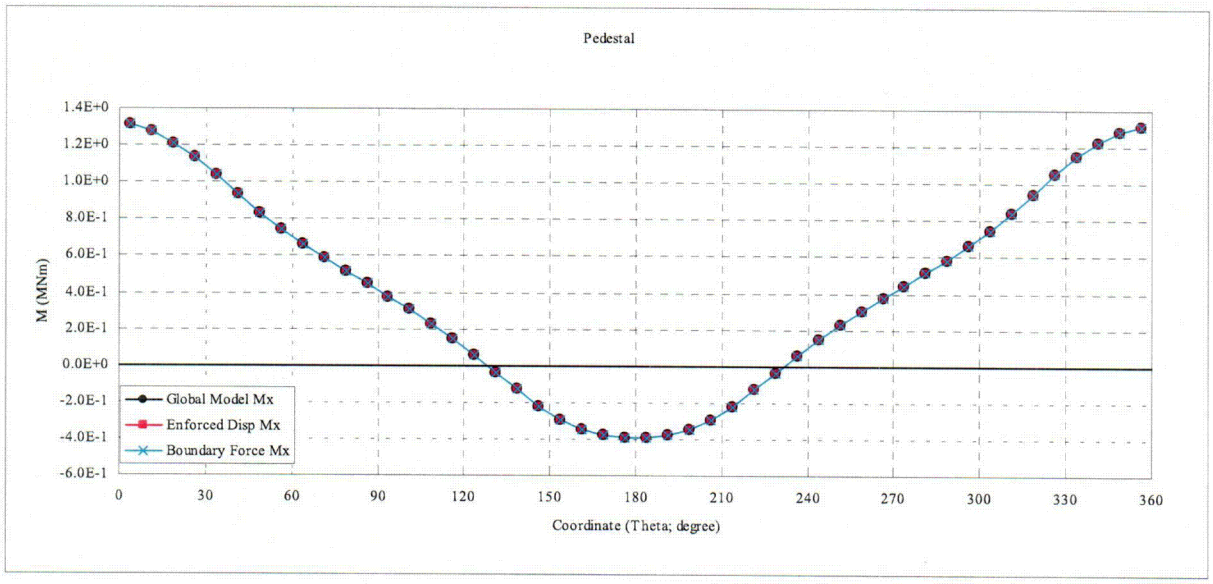


(c) In-plane Shear

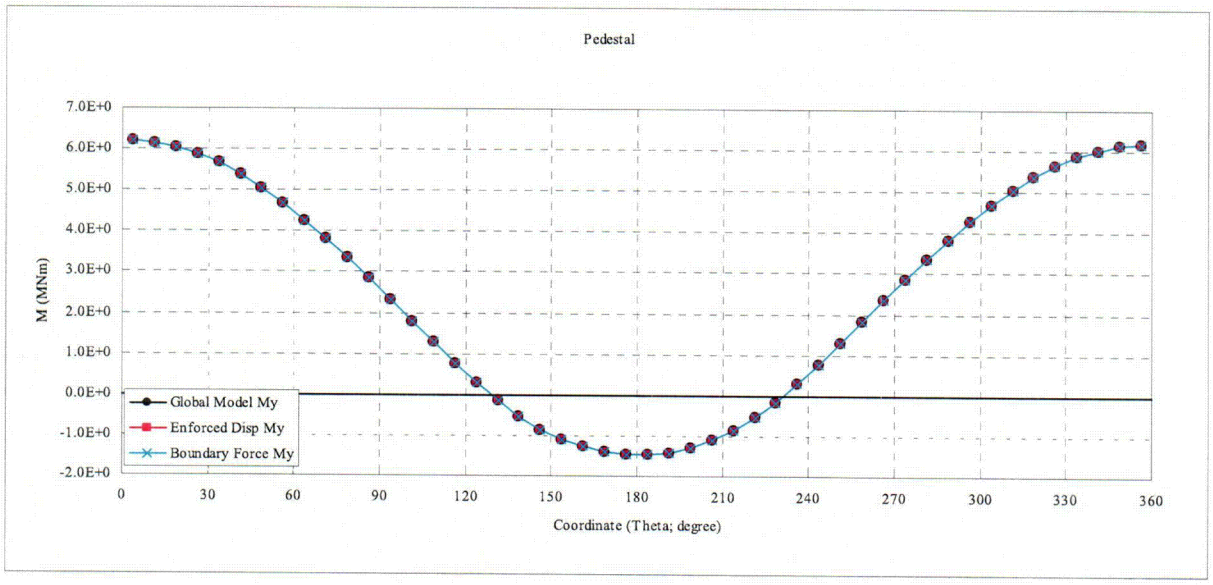


(d) Torsional Moment

Figure D-10(b) Comparison of Section Forces and Moments (RPV Pedestal: Horizontal Seismic Load in N-S Direction)

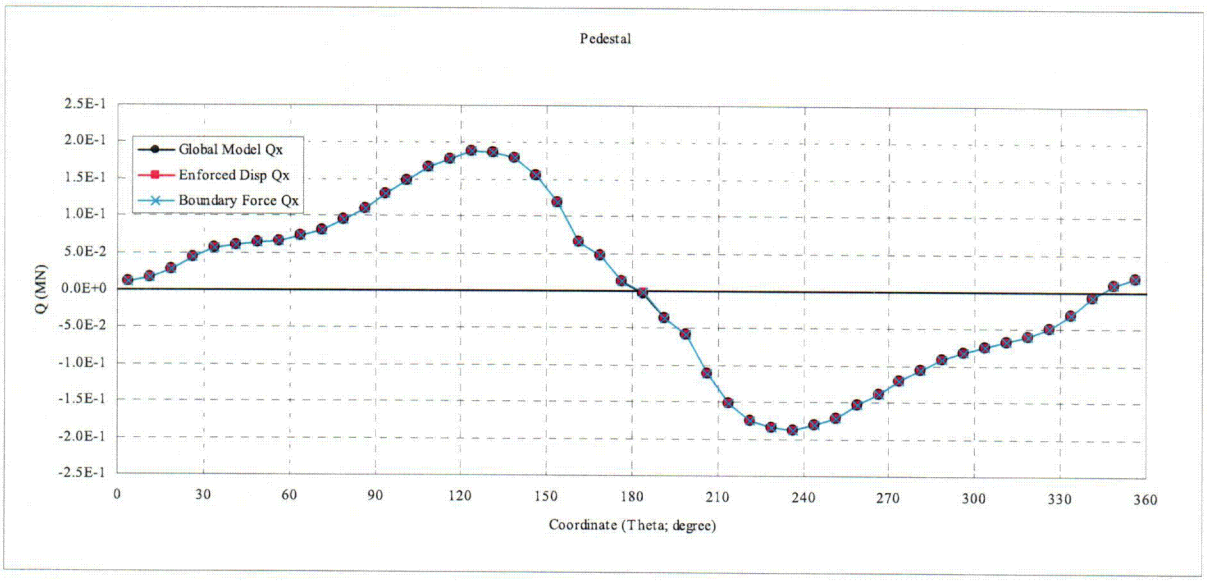


(e) Bending Moment in Horizontal Direction

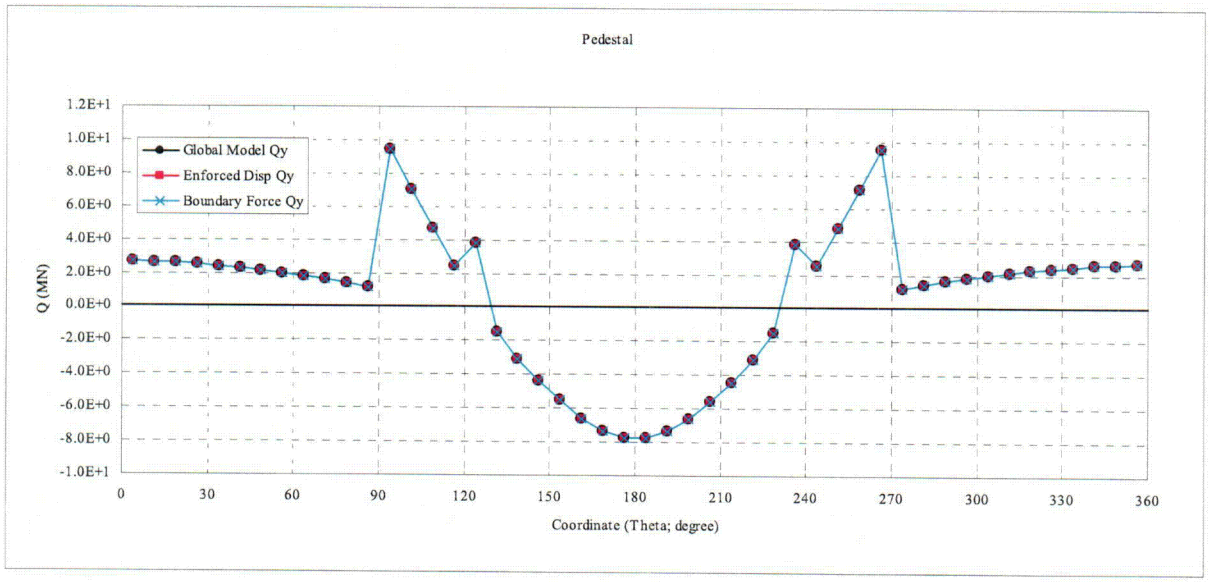


(f) Bending Moment in Vertical Direction

Figure D-10(c) Comparison of Section Forces and Moments (RPV Pedestal: Horizontal Seismic Load in N-S Direction)

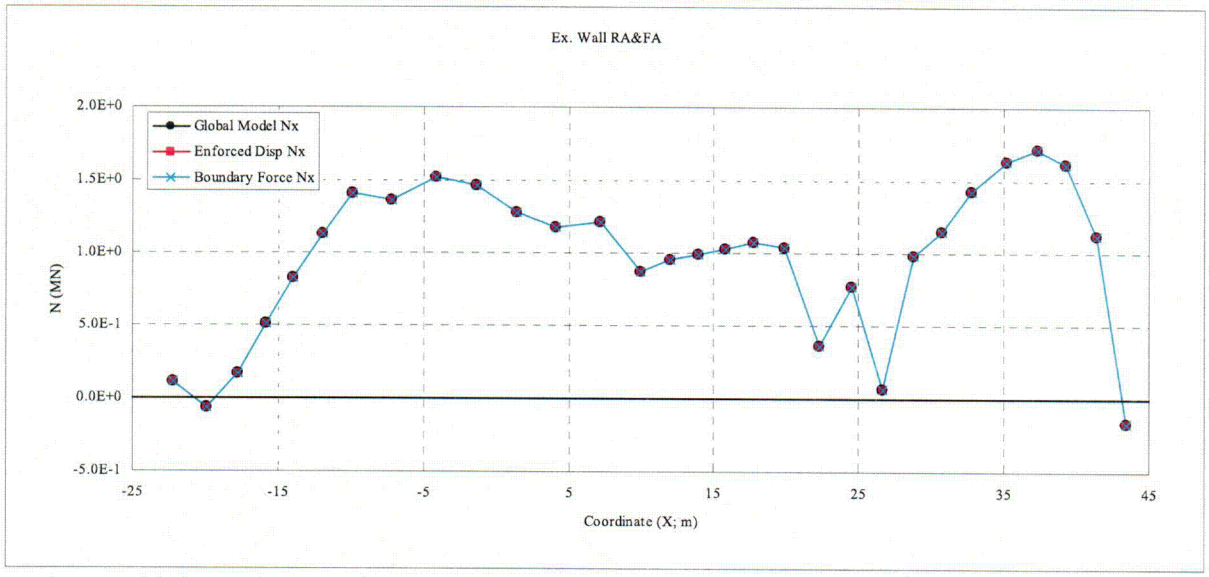


(g) Transverse Shear in Horizontal Direction

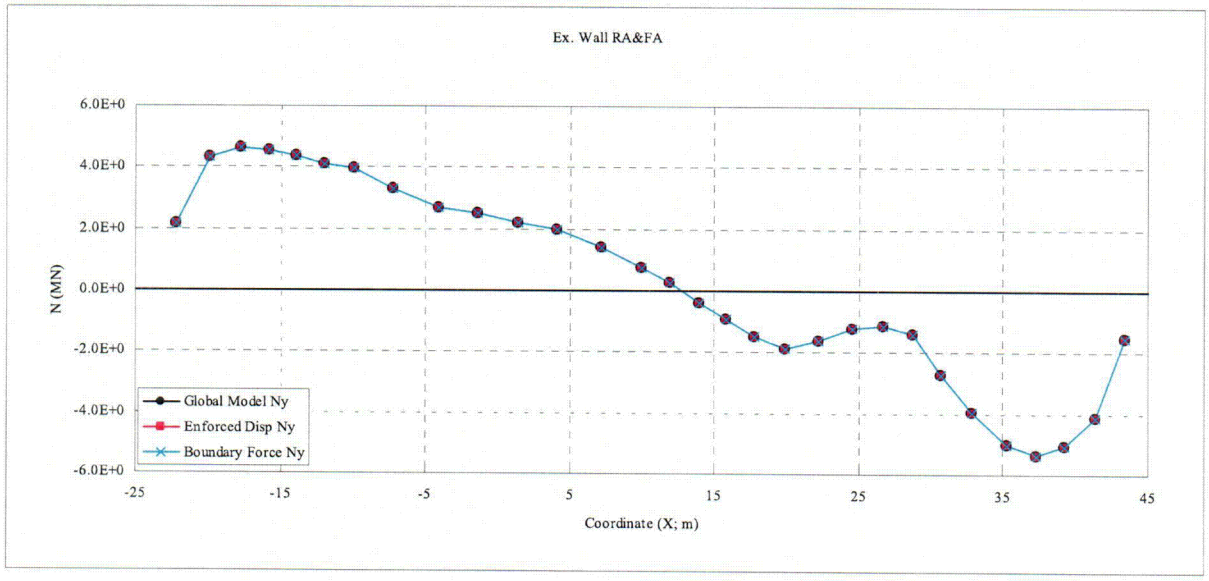


(h) Transverse Shear in Vertical Direction

Figure D-10(d) Comparison of Section Forces and Moments (RPV Pedestal: Horizontal Seismic Load in N-S Direction)

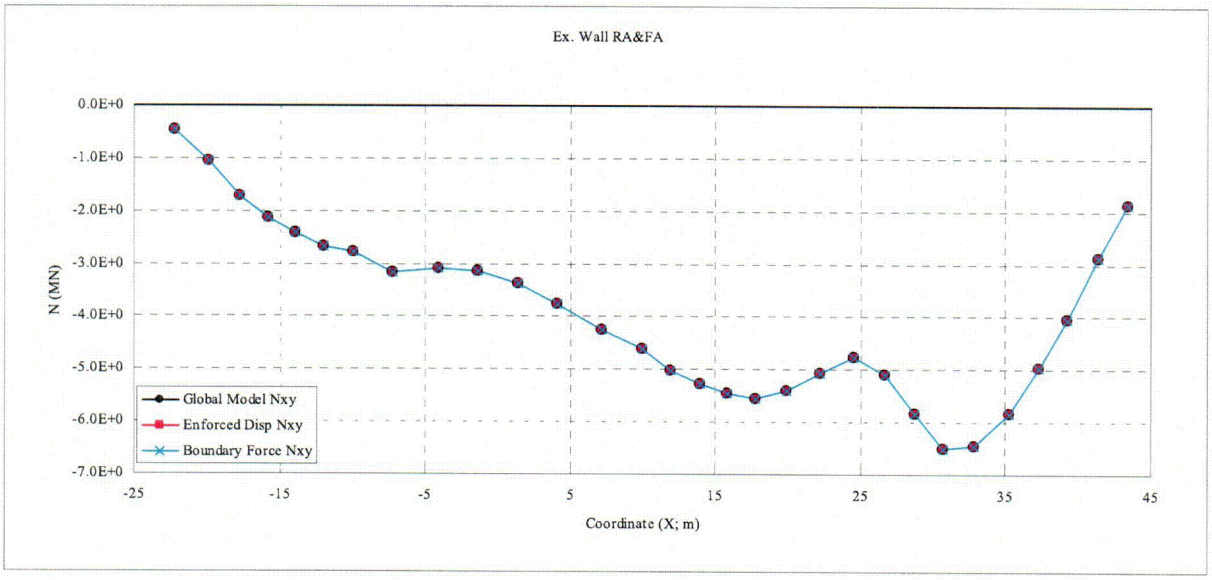


(a) Axial Force in Horizontal Direction

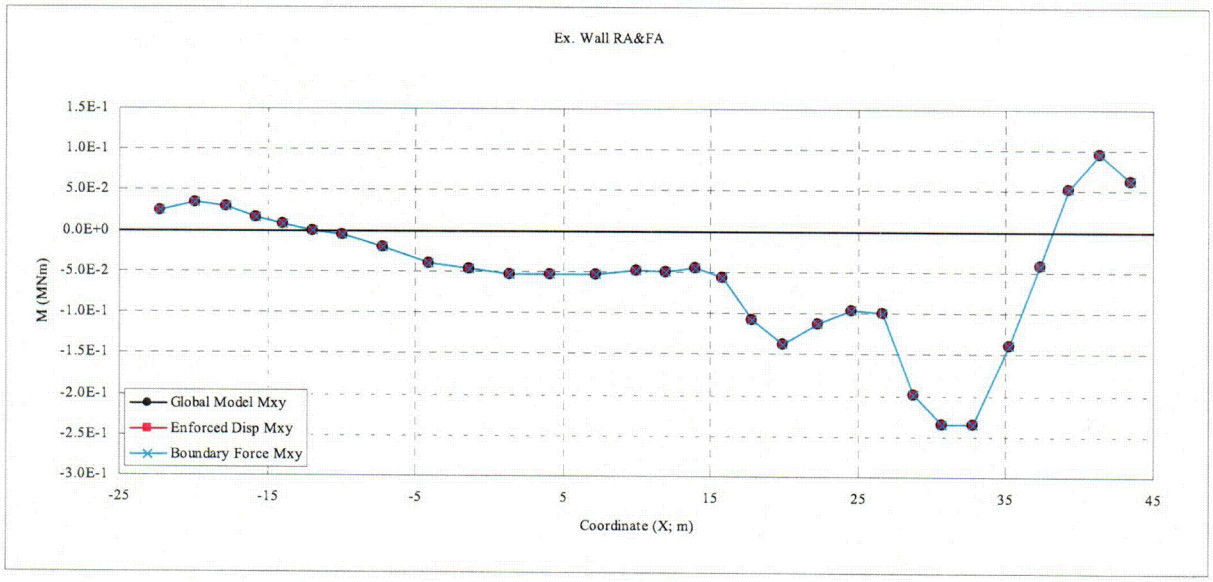


(b) Axial Force in Vertical Direction

Figure D-11(a) Comparison of Section Forces and Moments
(Exterior Wall on RA Column Line: Horizontal Seismic Load in N-S Direction)

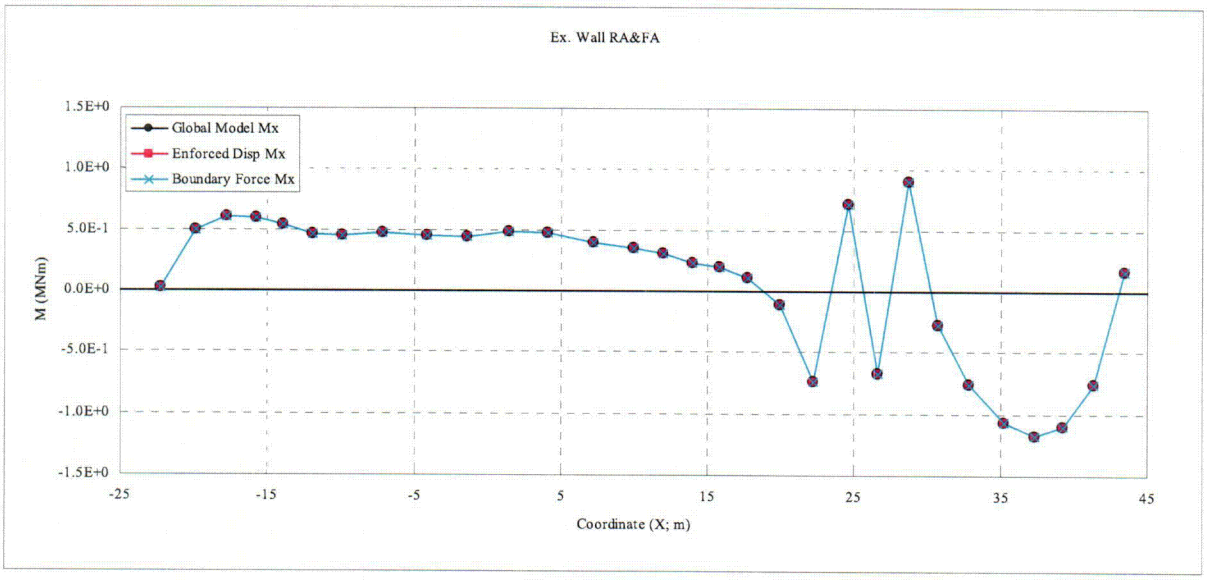


(c) In-plane Shear

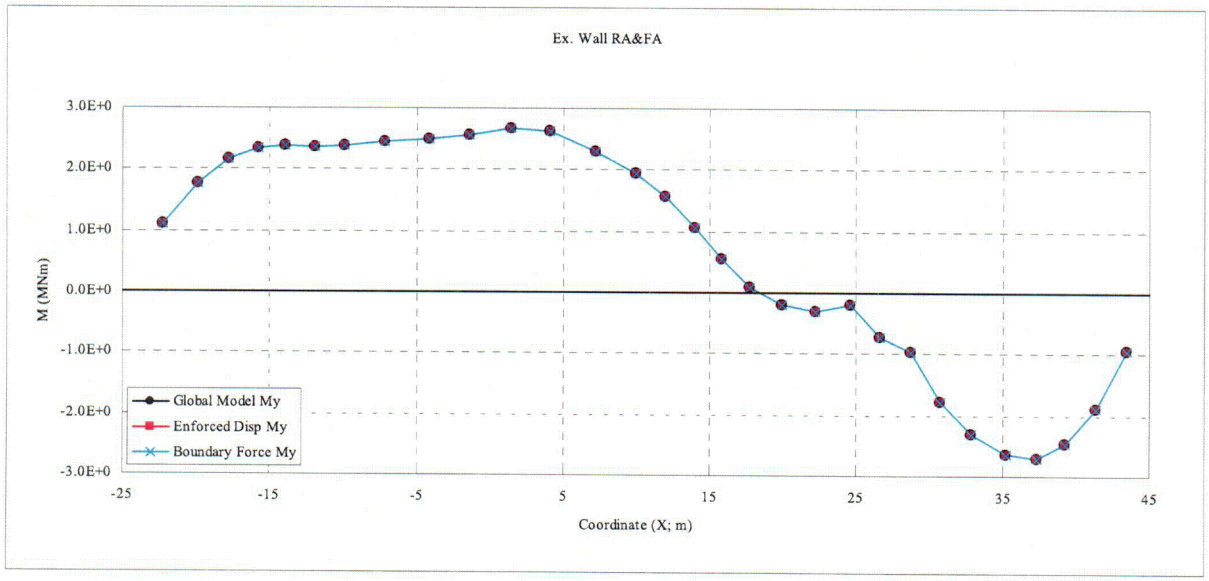


(d) Torsional Moment

Figure D-11(b) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Horizontal Seismic Load in N-S Direction)

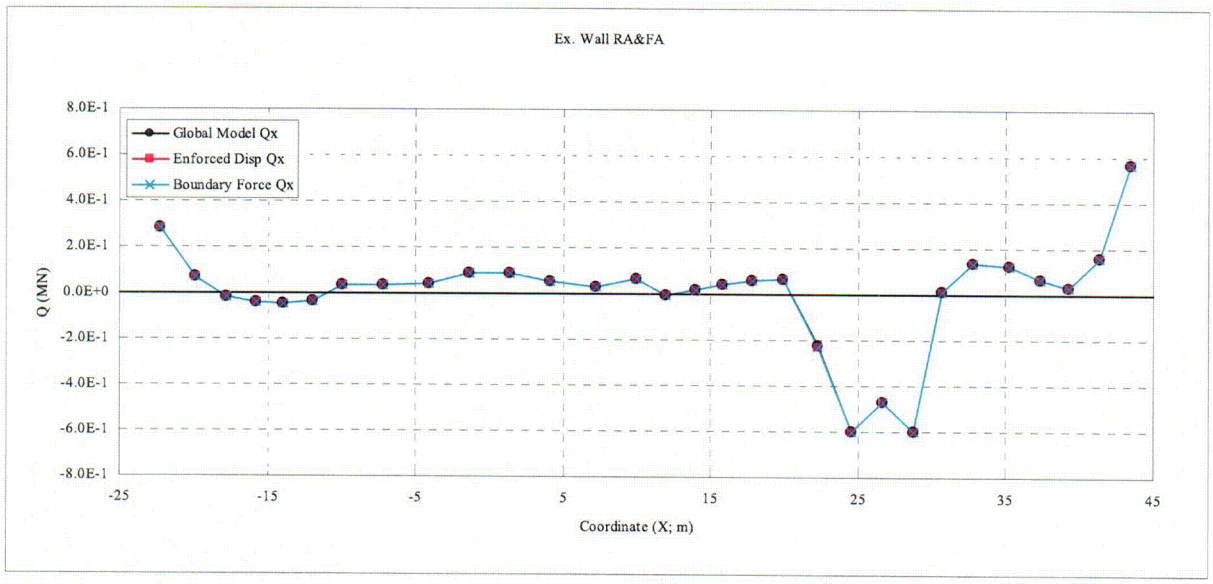


(e) Bending Moment in Horizontal Direction

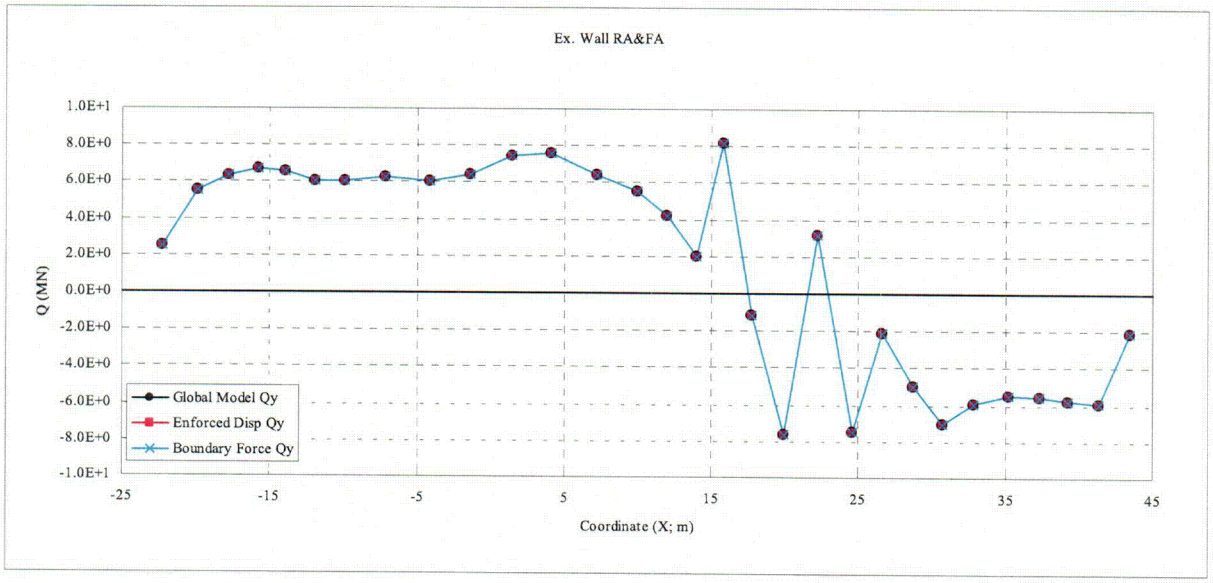


(f) Bending Moment in Vertical Direction

Figure D-11(c) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Horizontal Seismic Load in N-S Direction)

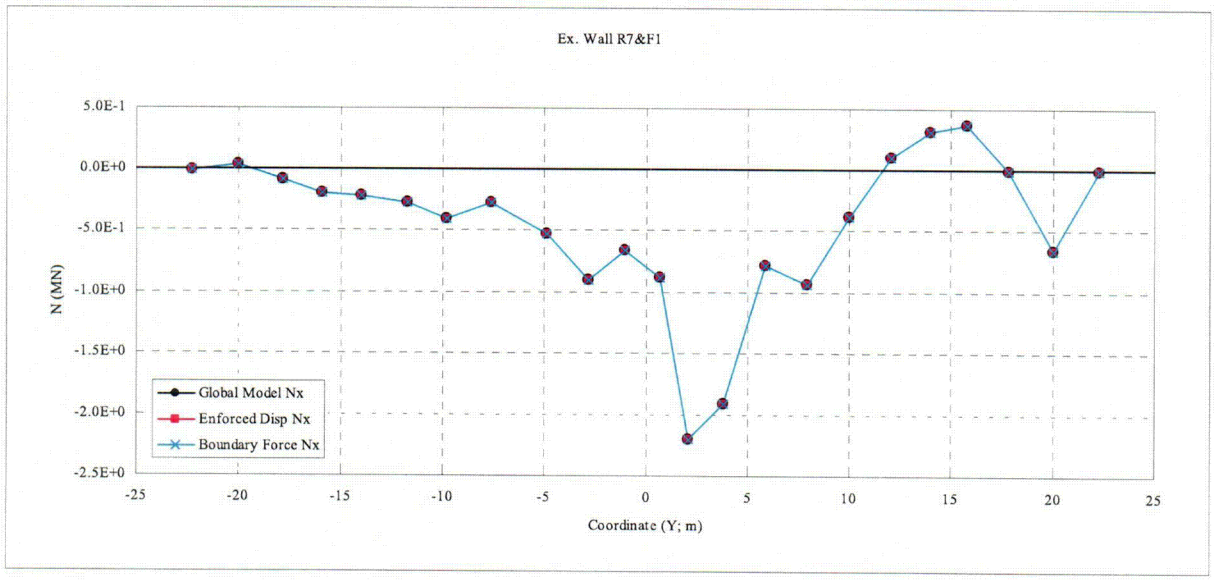


(g) Transverse Shear in Horizontal Direction

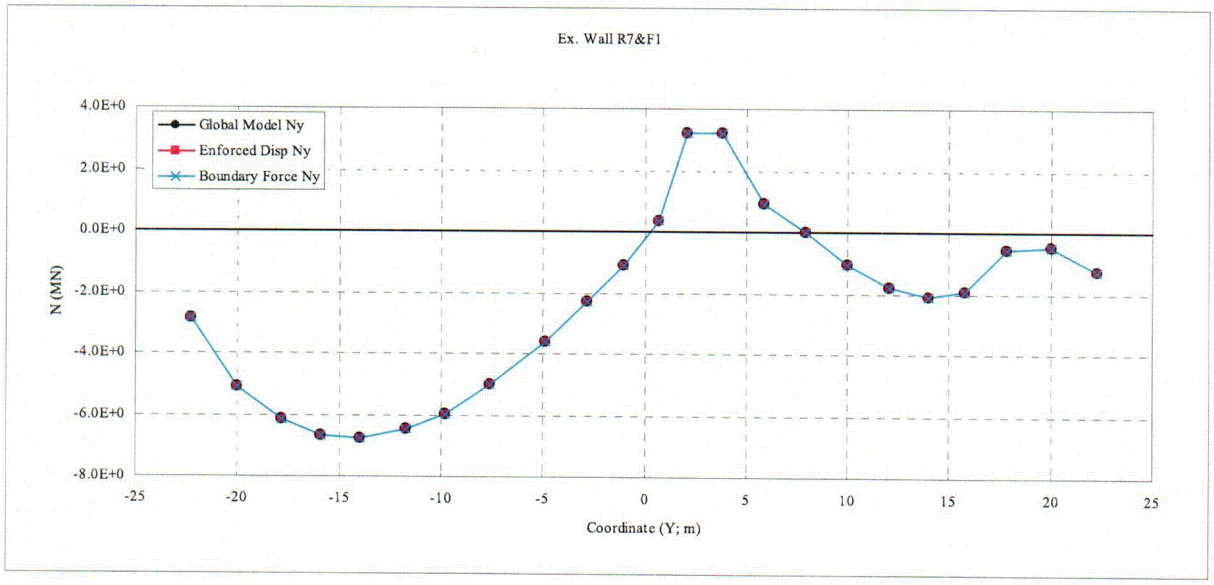


(h) Transverse Shear in Vertical Direction

Figure D-11(d) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Horizontal Seismic Load in N-S Direction)

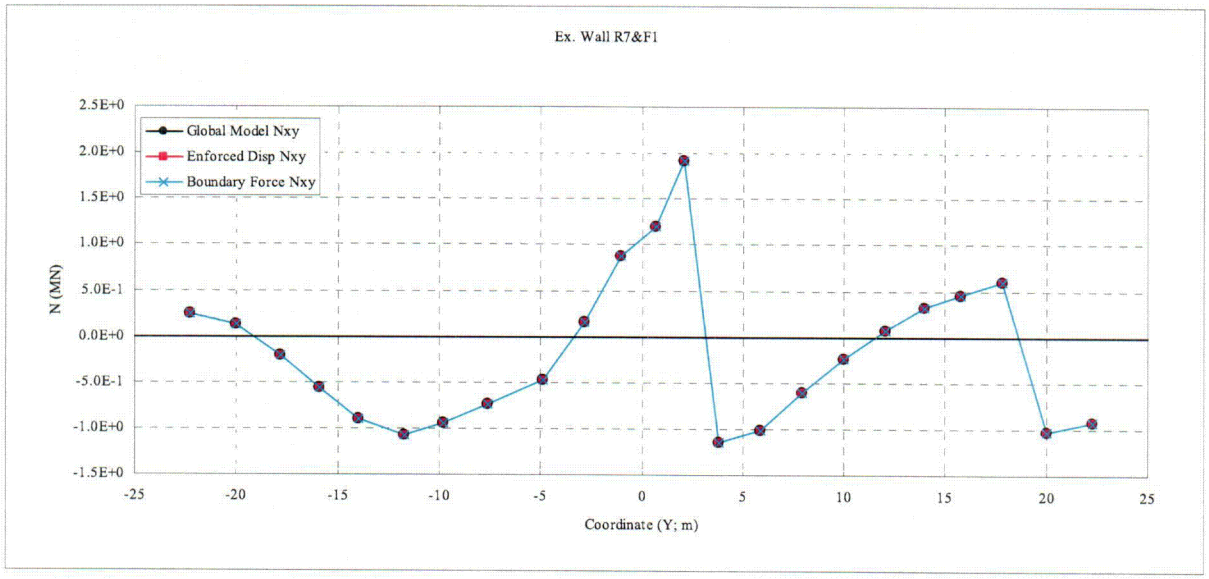


(a) Axial Force in Horizontal Direction

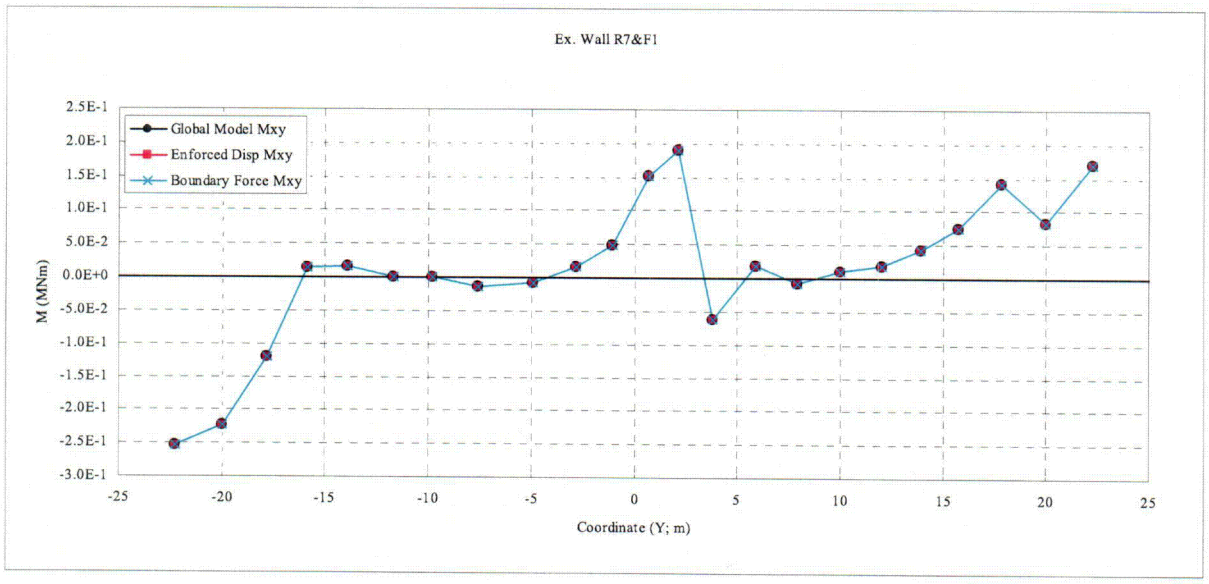


(b) Axial Force in Vertical Direction

Figure D-12(a) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Horizontal Seismic Load in N-S Direction)

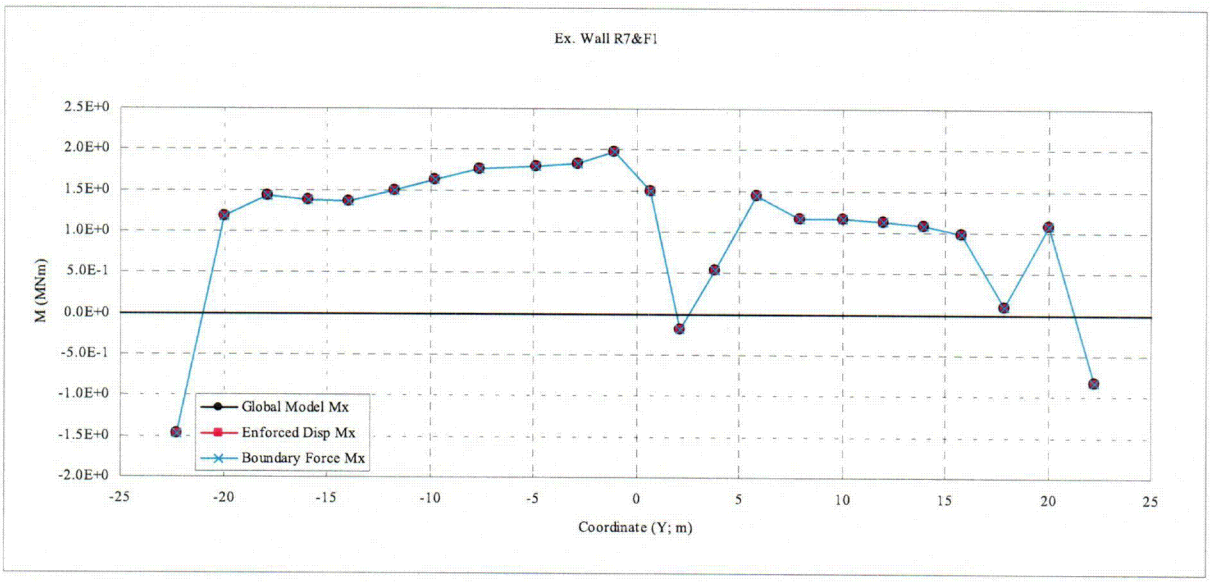


(c) In-plane Shear

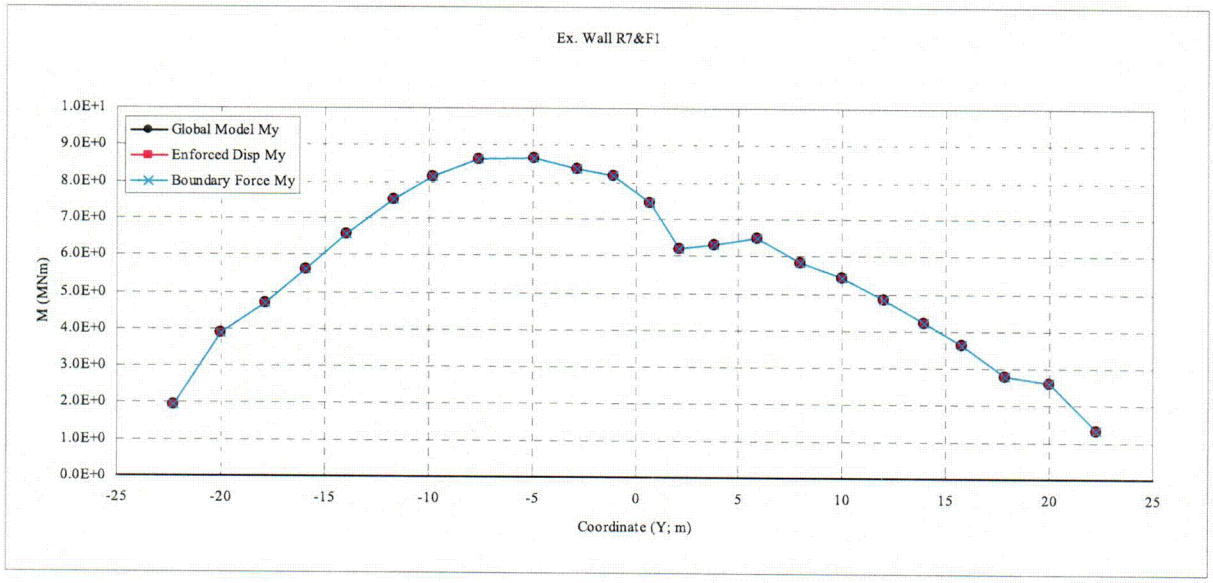


(d) Torsional Moment

Figure D-12(b) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Horizontal Seismic Load in N-S Direction)

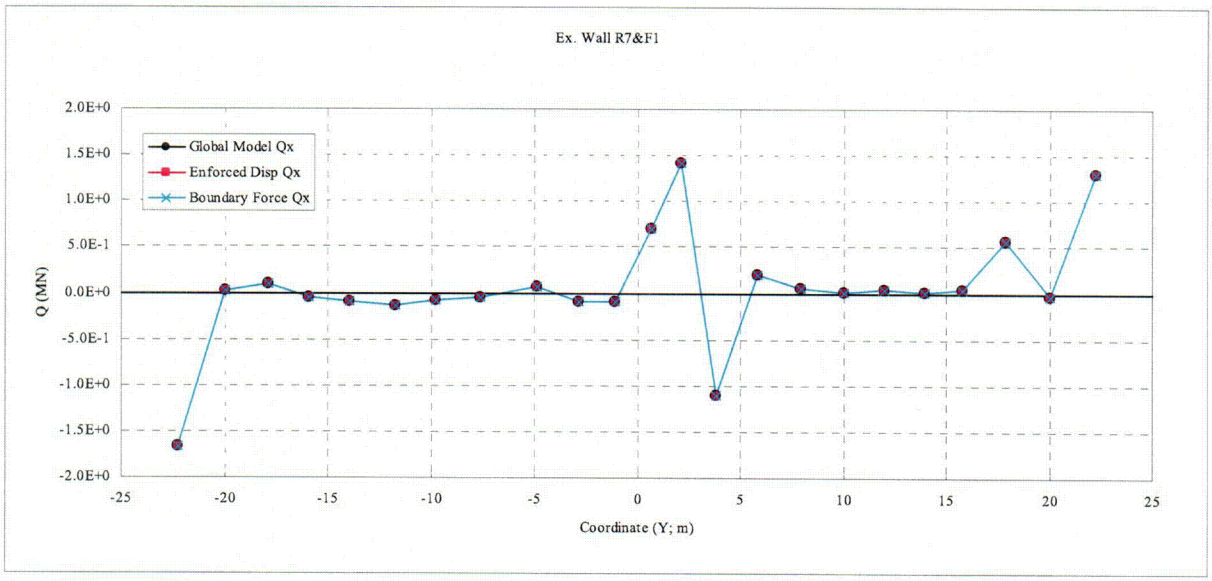


(e) Bending Moment in Horizontal Direction

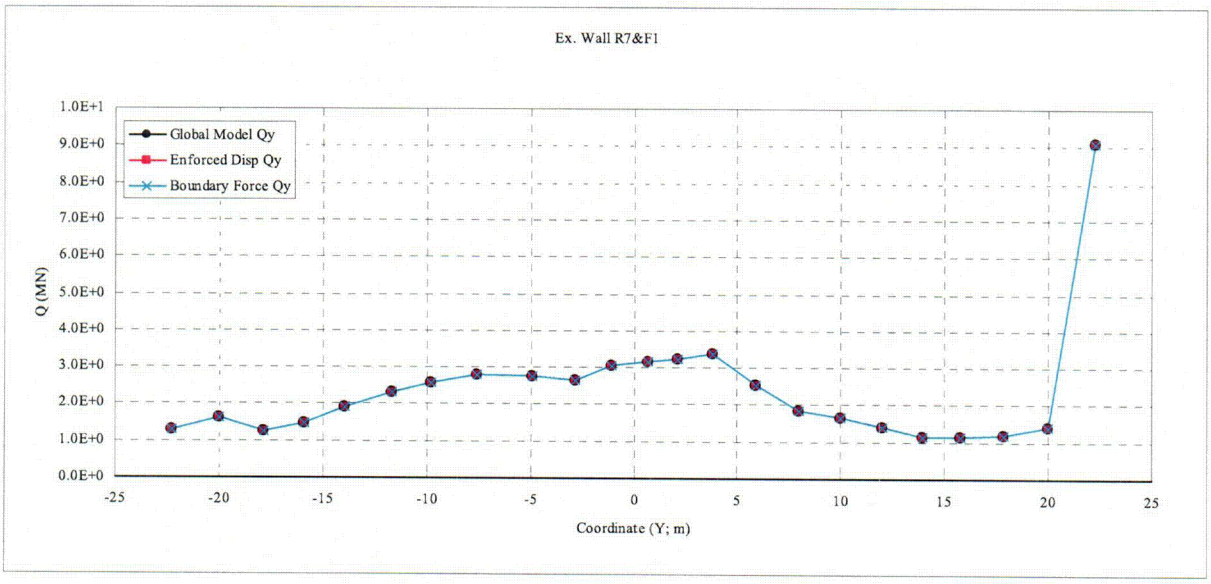


(f) Bending Moment in Vertical Direction

Figure D-12(c) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Horizontal Seismic Load in N-S Direction)

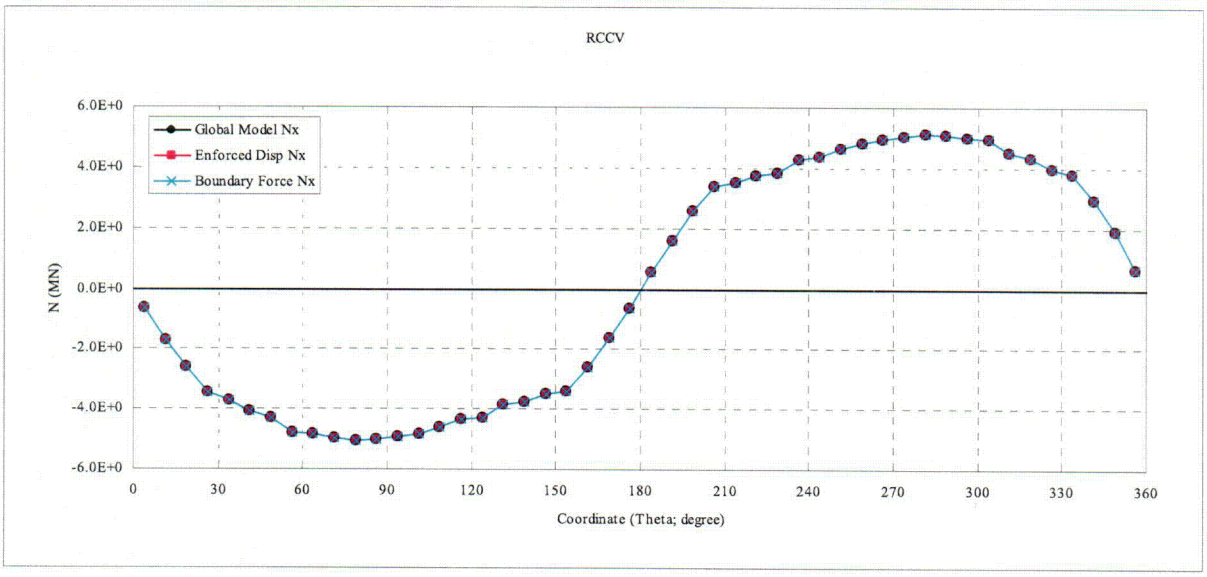


(g) Transverse Shear in Horizontal Direction

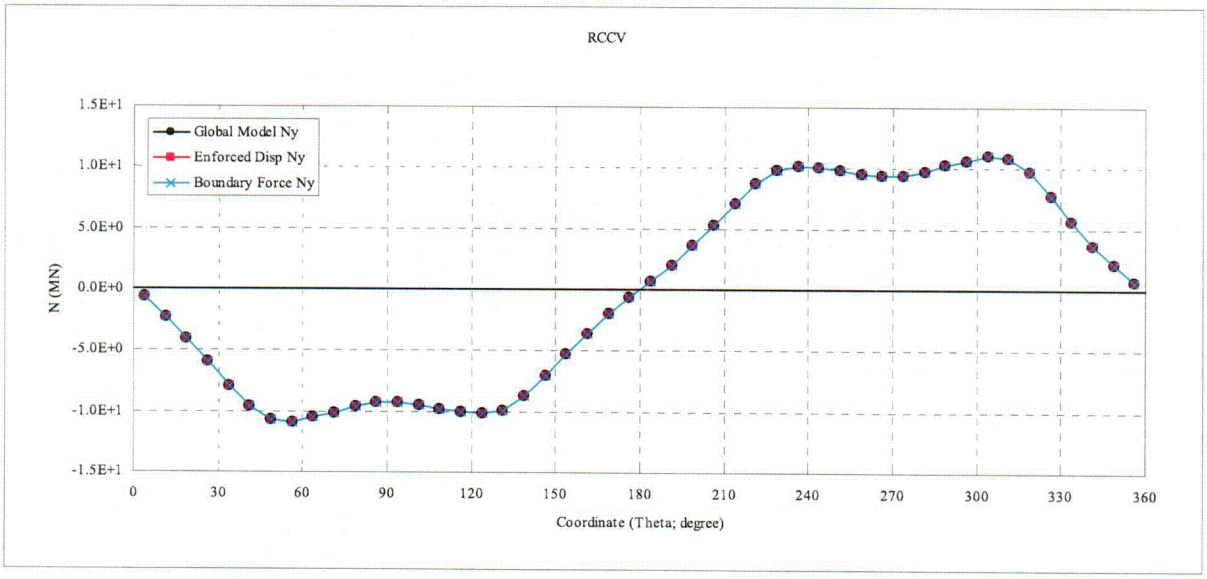


(h) Transverse Shear in Vertical Direction

Figure D-12(d) Comparison of Section Forces and Moments
(Exterior Wall on R7 Column Line: Horizontal Seismic Load in N-S Direction)

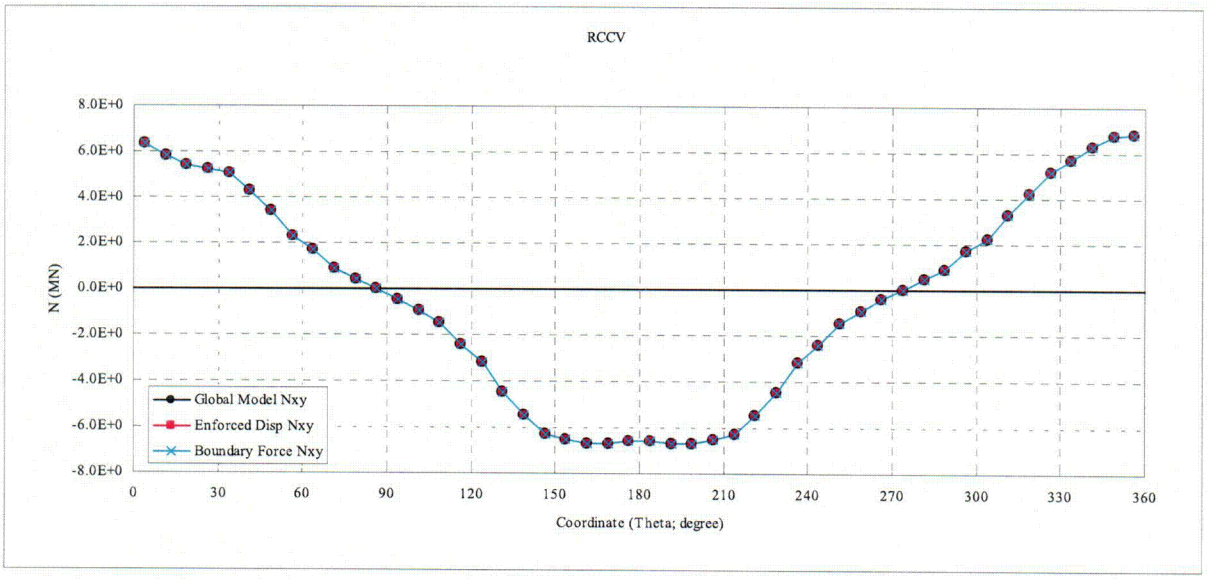


(a) Axial Force in Horizontal Direction

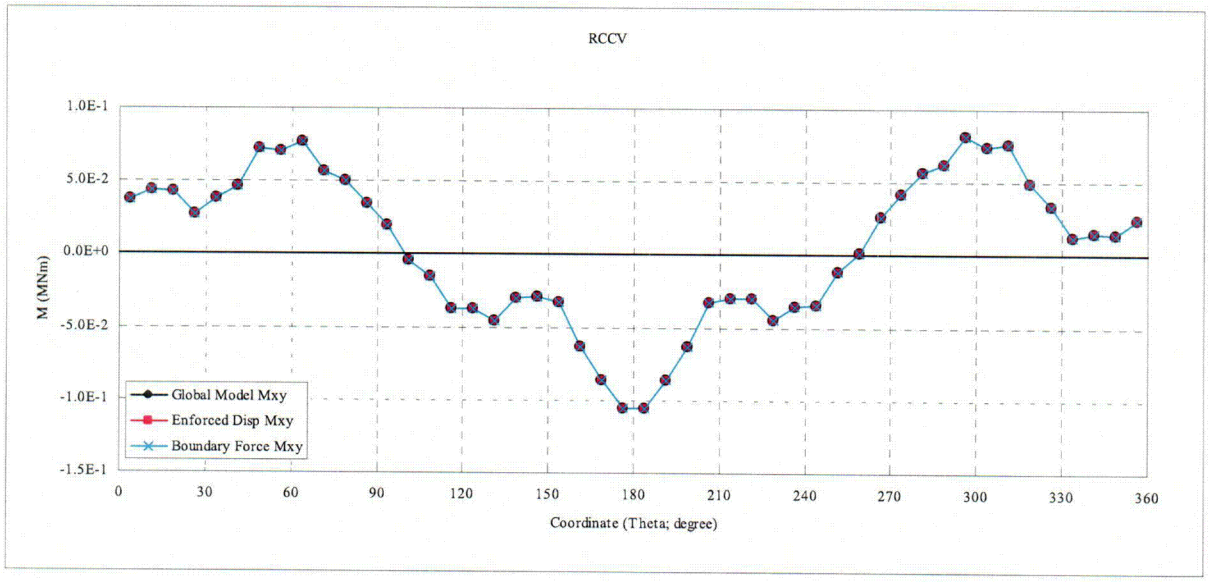


(b) Axial Force in Vertical Direction

Figure D-13(a) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Horizontal Seismic Load in E-W Direction)

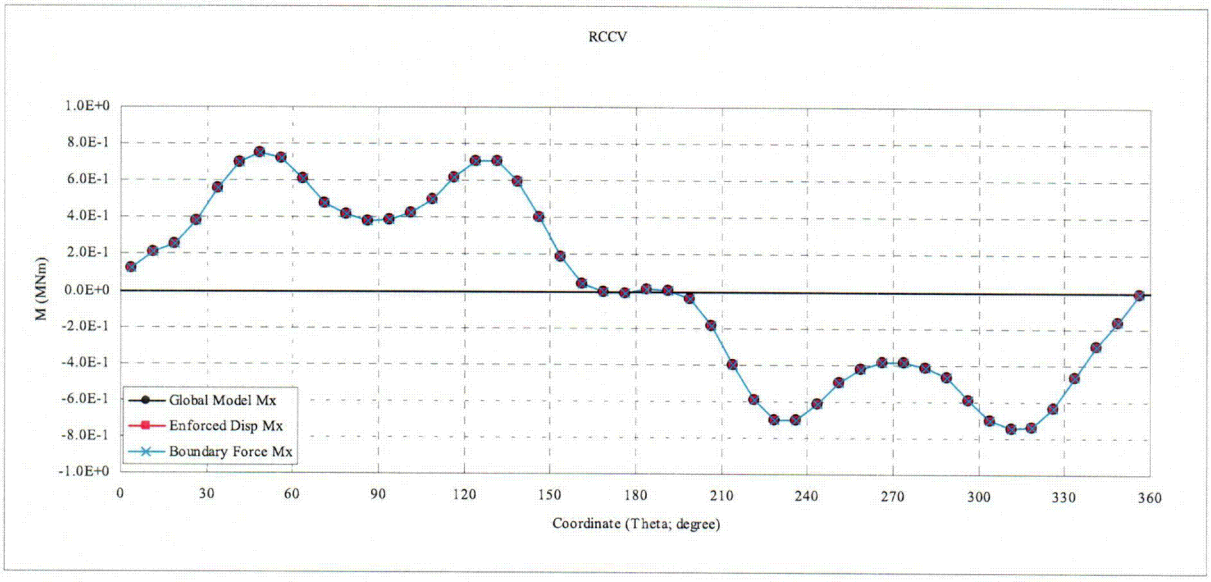


(c) In-plane Shear

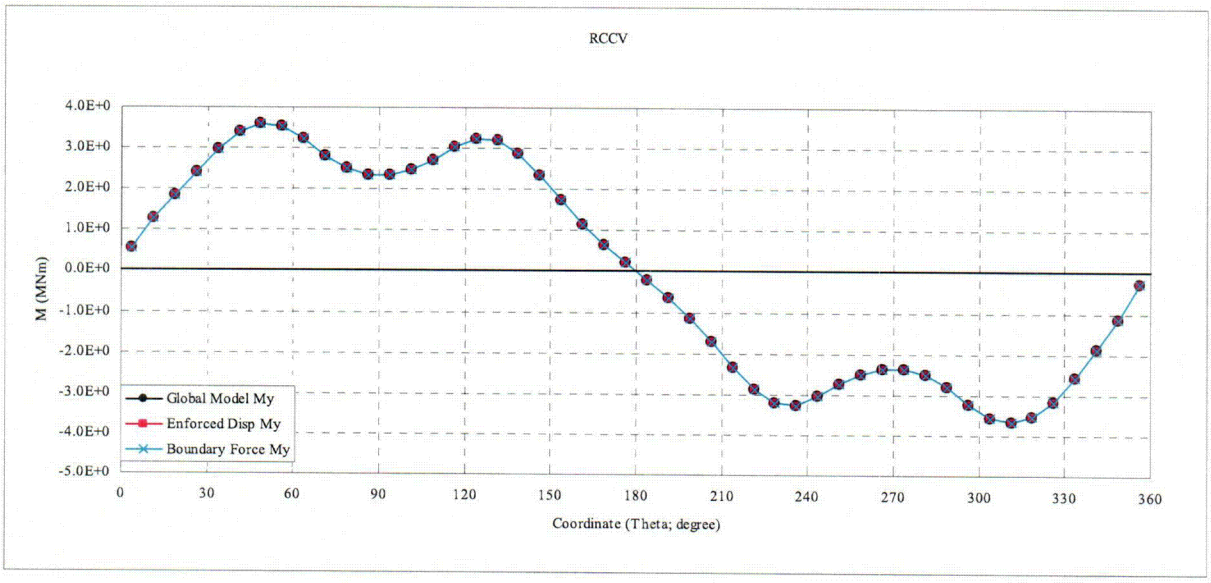


(d) Torsional Moment

Figure D-13(b) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Horizontal Seismic Load in E-W Direction)

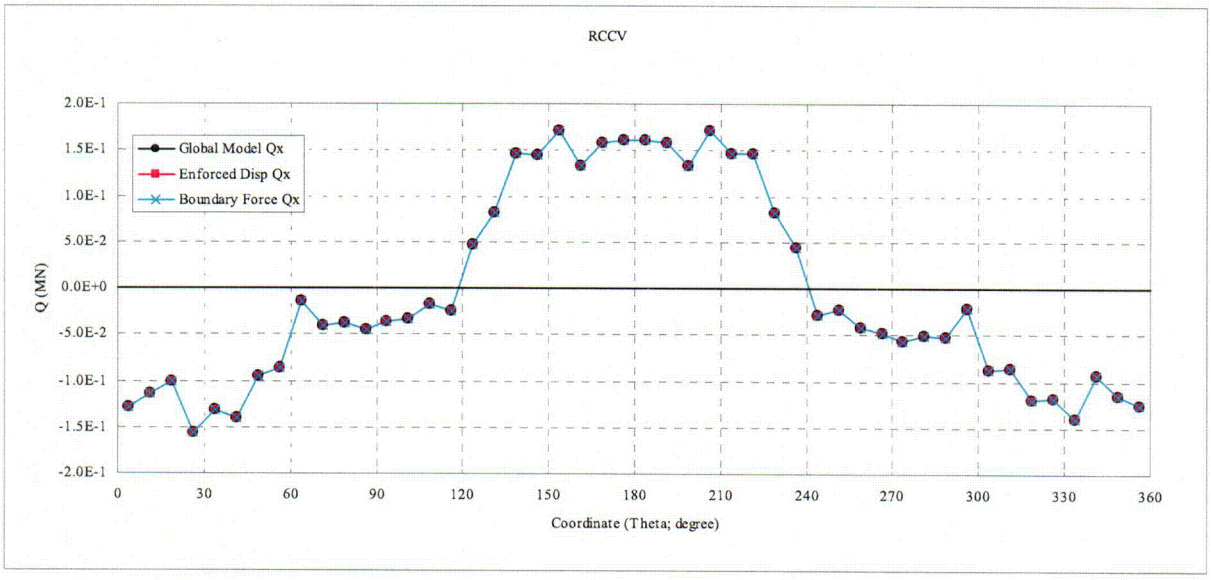


(e) Bending Moment in Horizontal Direction

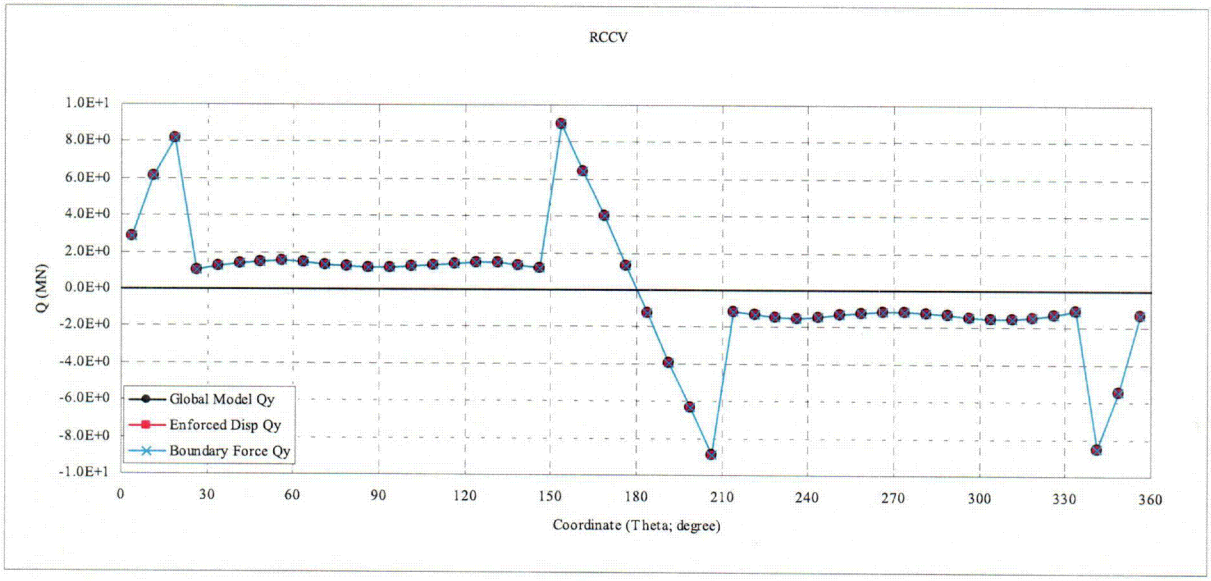


(f) Bending Moment in Vertical Direction

Figure D-13(c) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Horizontal Seismic Load in E-W Direction)

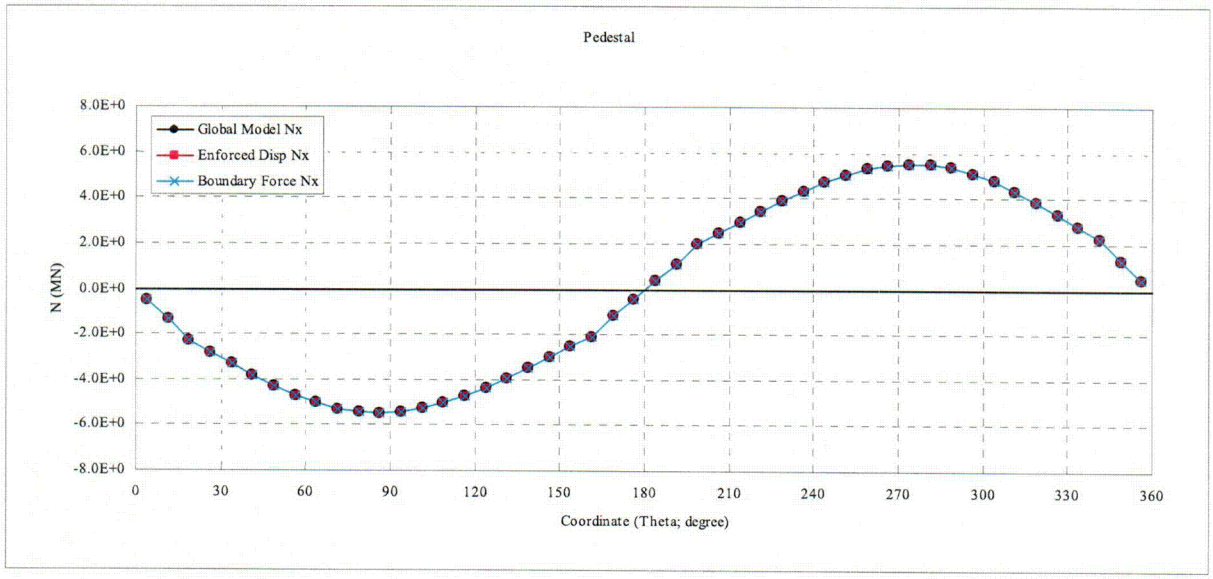


(g) Transverse Shear in Horizontal Direction

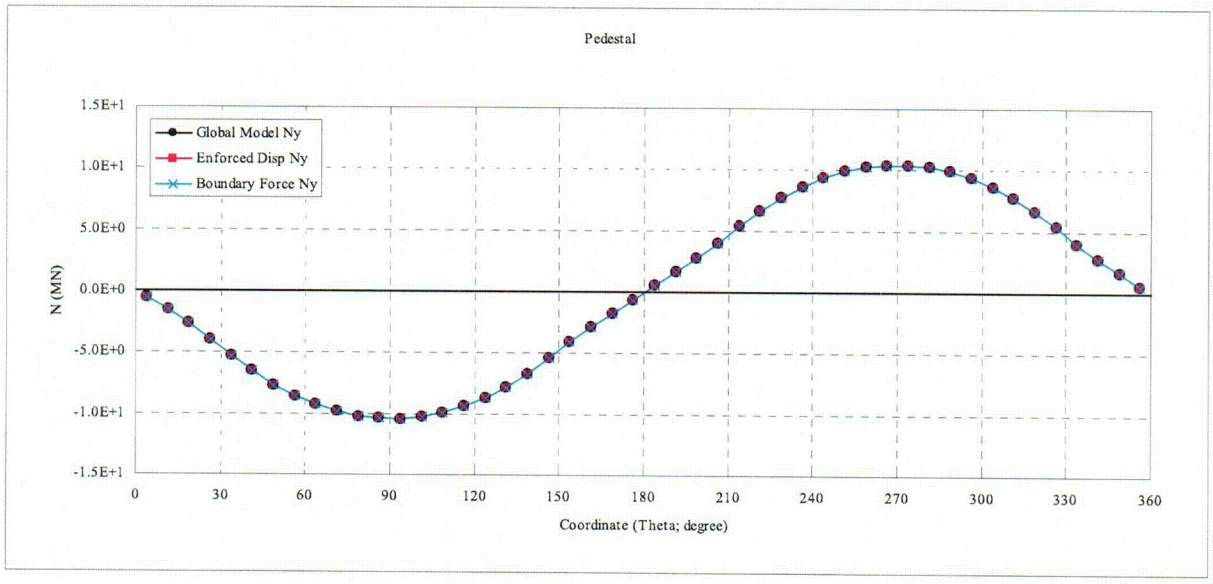


(h) Transverse Shear in Vertical Direction

Figure D-13(d) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Horizontal Seismic Load in E-W Direction)

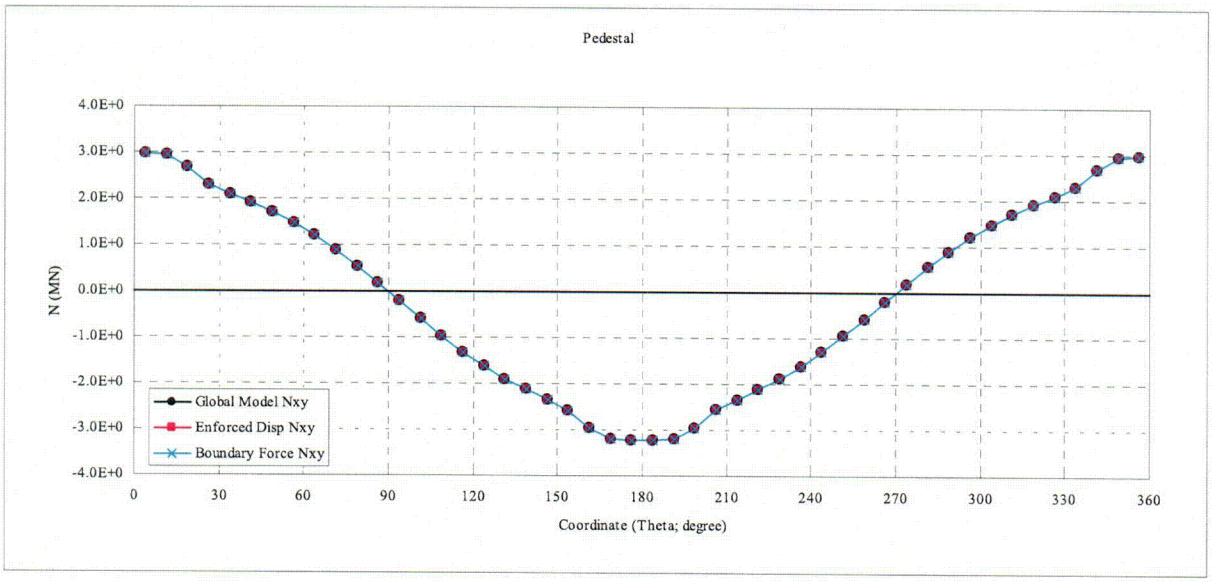


(a) Axial Force in Horizontal Direction

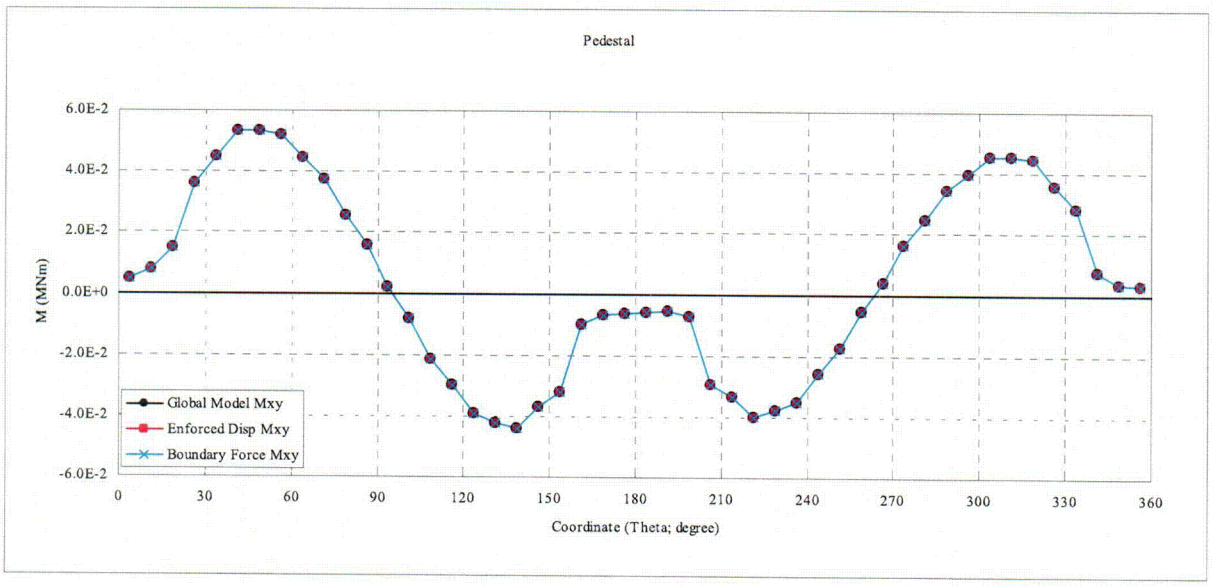


(b) Axial Force in Vertical Direction

Figure D-14(a) Comparison of Section Forces and Moments (RPV Pedestal: Horizontal Seismic Load in E-W Direction)

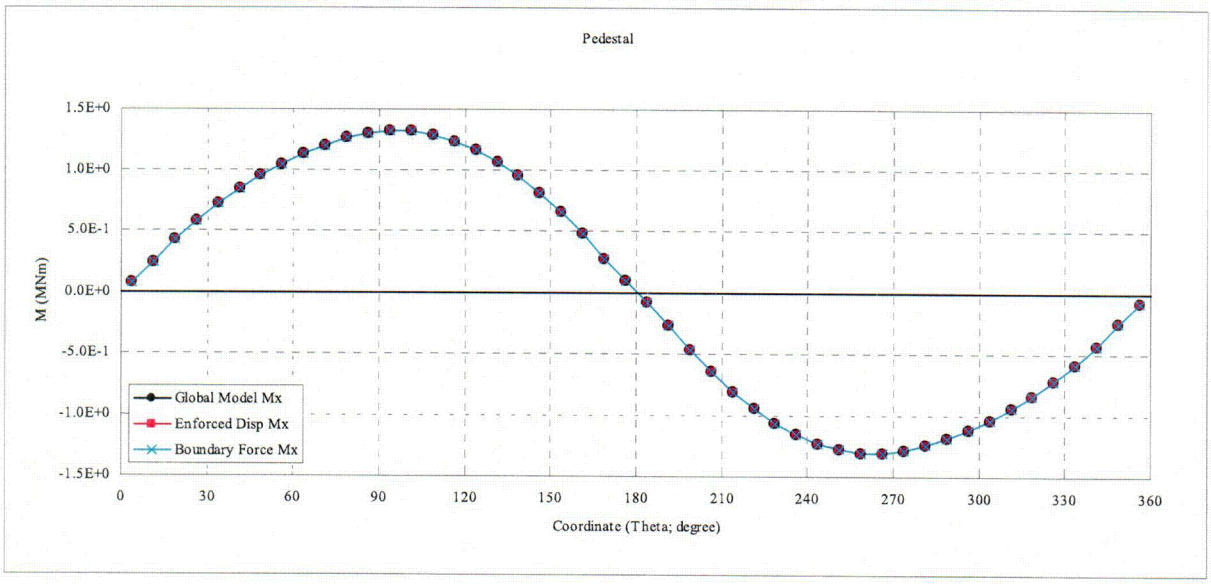


(c) In-plane Shear

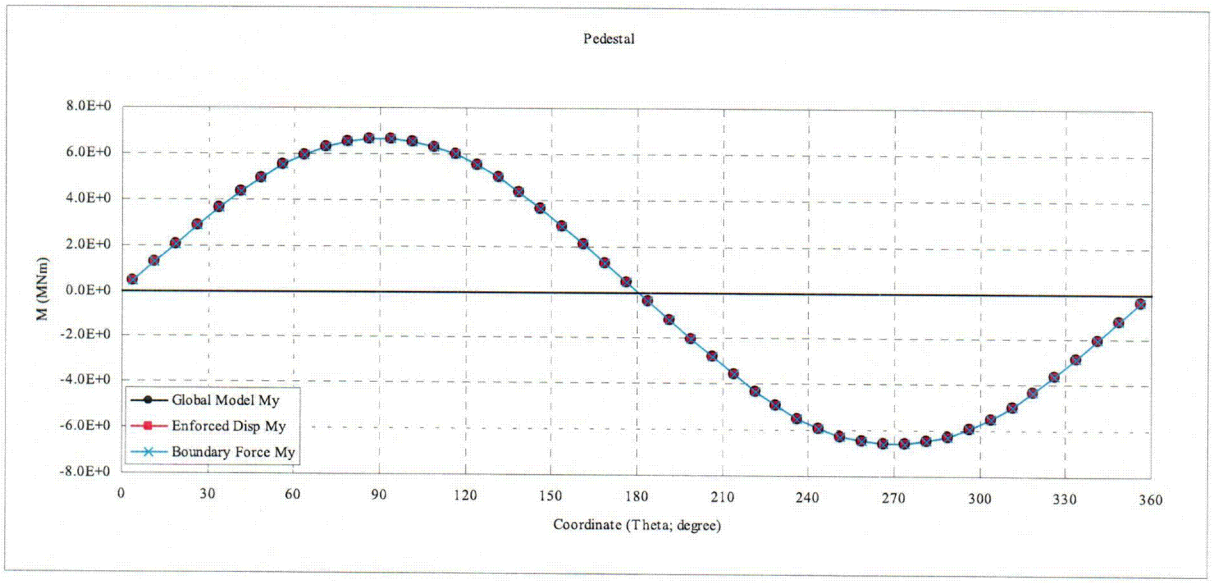


(d) Torsional Moment

Figure D-14(b) Comparison of Section Forces and Moments (RPV Pedestal: Horizontal Seismic Load in E-W Direction)

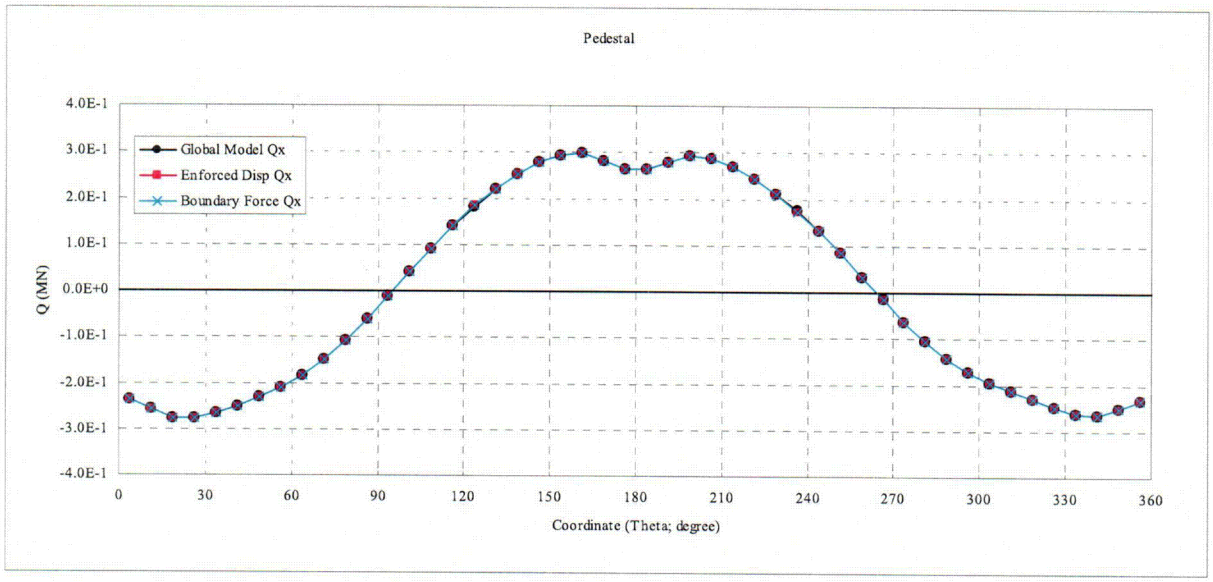


(e) Bending Moment in Horizontal Direction

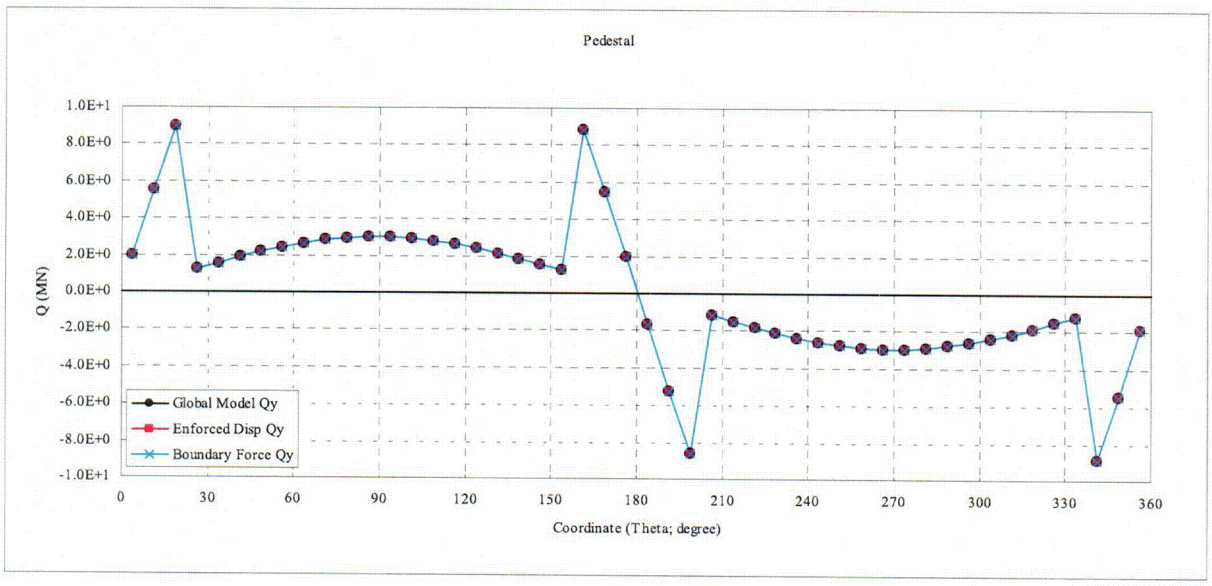


(f) Bending Moment in Vertical Direction

Figure D-14(c) Comparison of Section Forces and Moments (RPV Pedestal: Horizontal Seismic Load in E-W Direction)

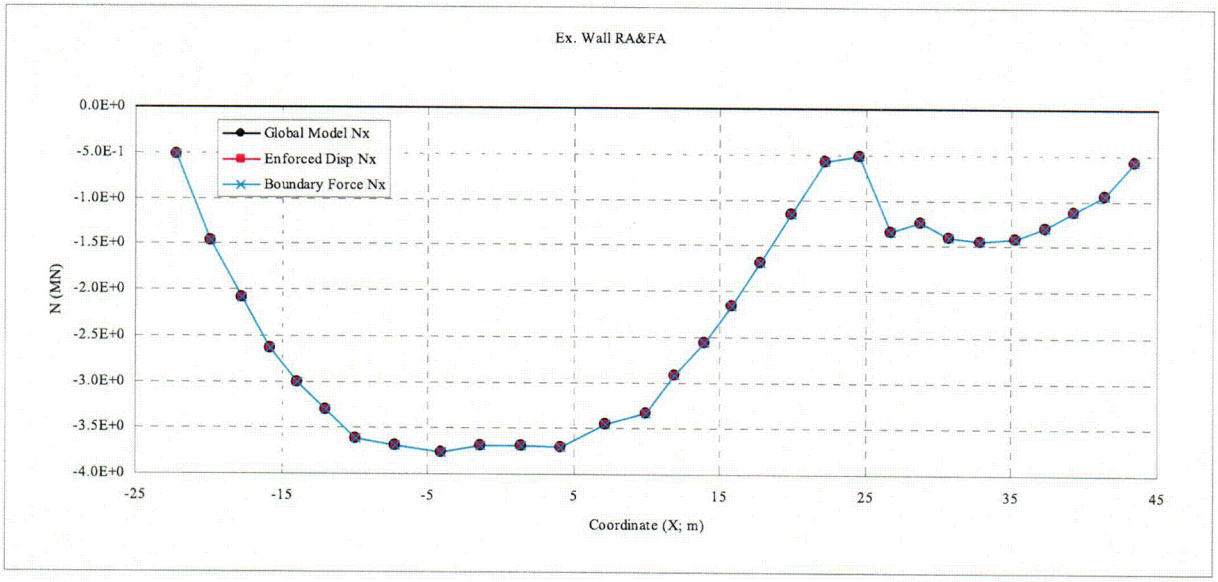


(g) Transverse Shear in Horizontal Direction

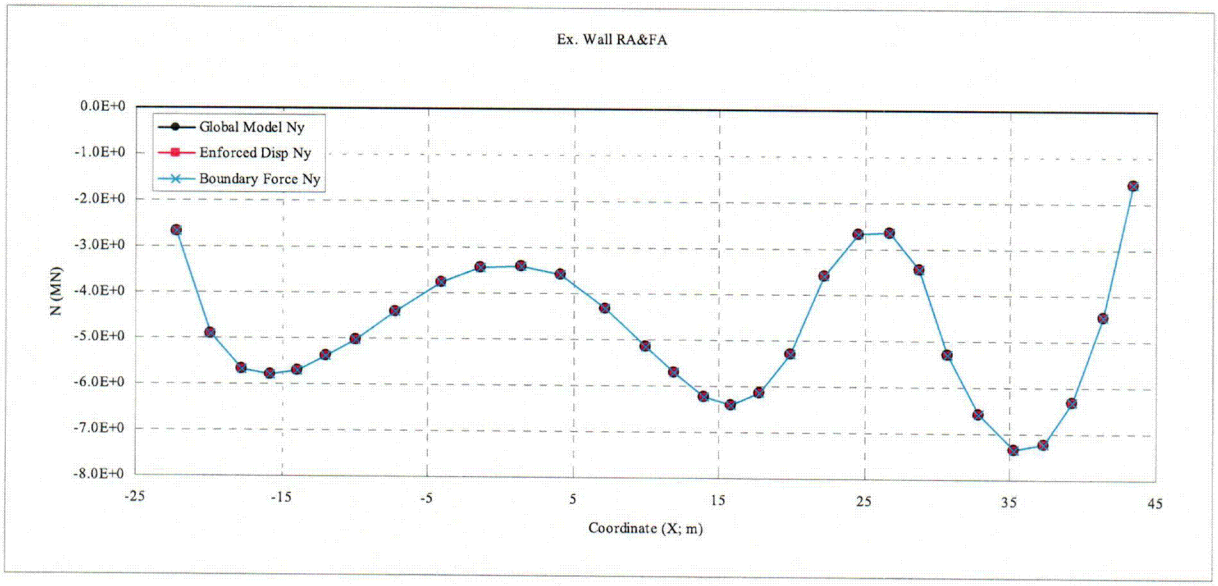


(h) Transverse Shear in Vertical Direction

Figure D-14(d) Comparison of Section Forces and Moments (RPV Pedestal: Horizontal Seismic Load in E-W Direction)

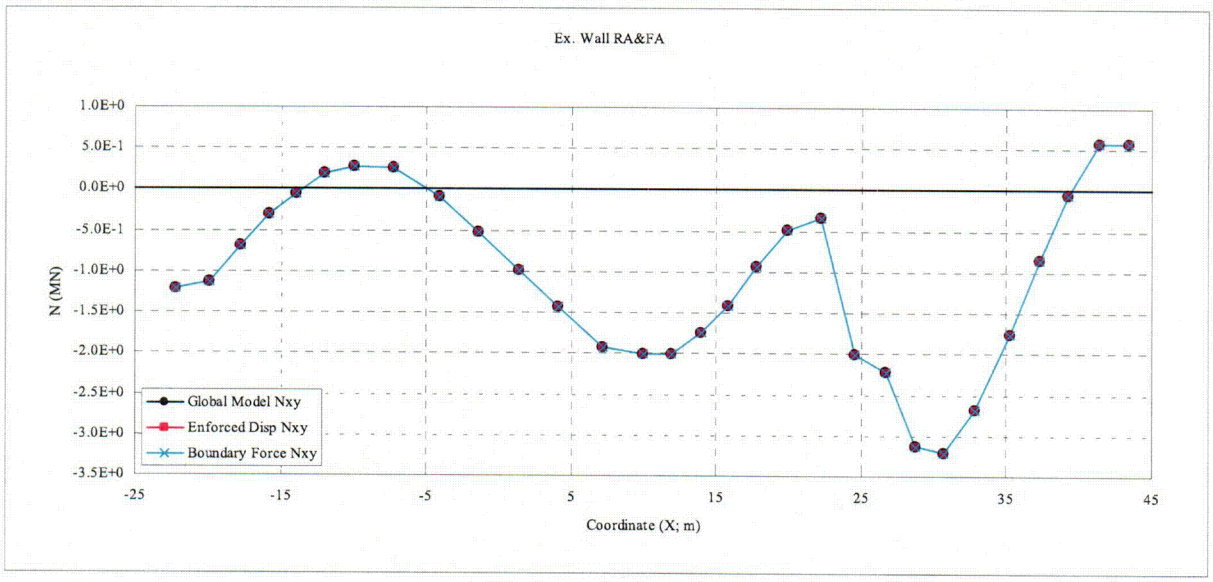


(a) Axial Force in Horizontal Direction

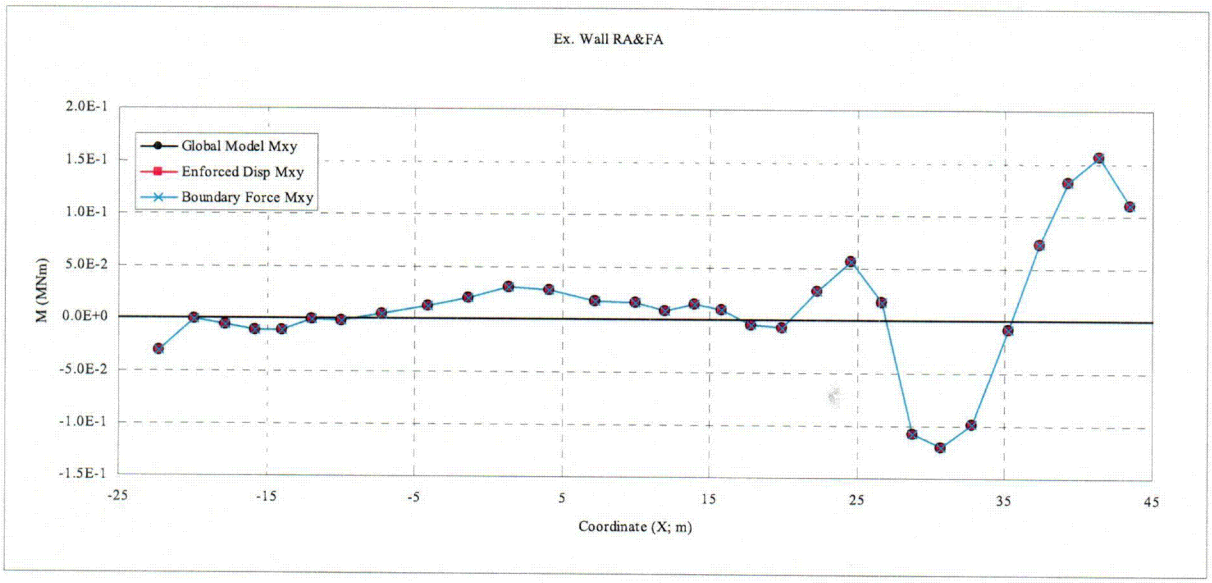


(b) Axial Force in Vertical Direction

Figure D-15(a) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Horizontal Seismic Load in E-W Direction)

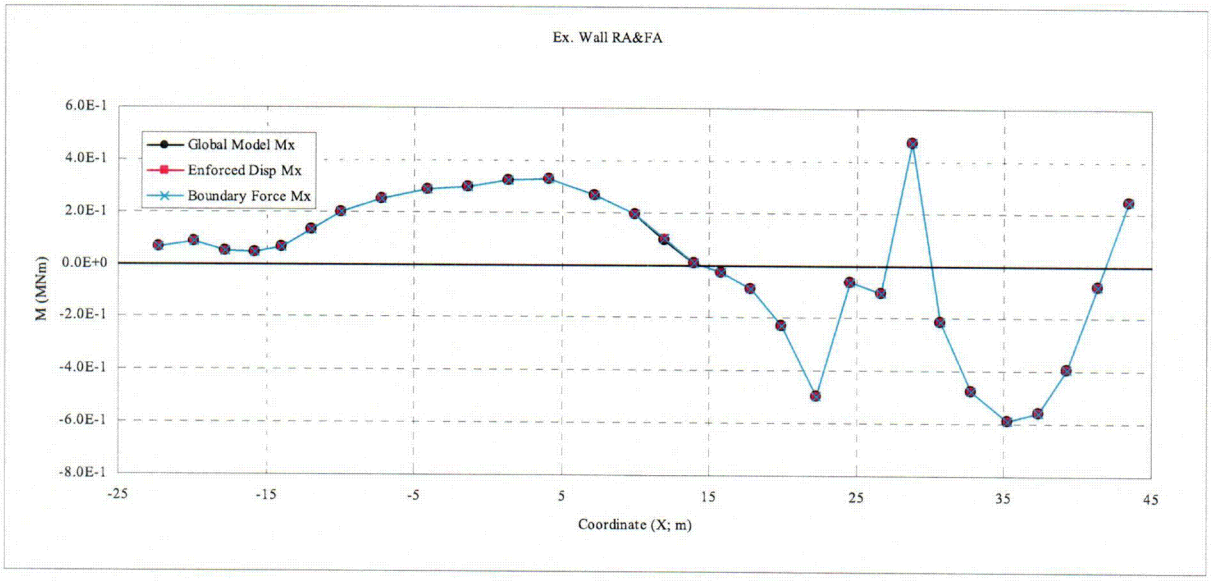


(c) In-plane Shear

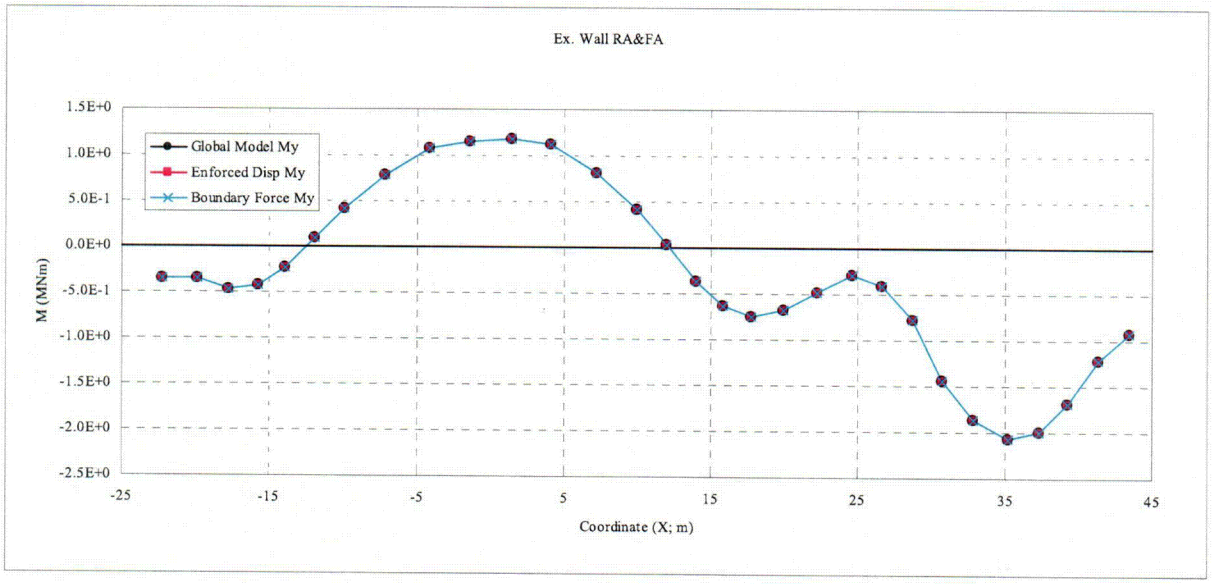


(d) Torsional Moment

Figure D-15(b) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Horizontal Seismic Load in E-W Direction)

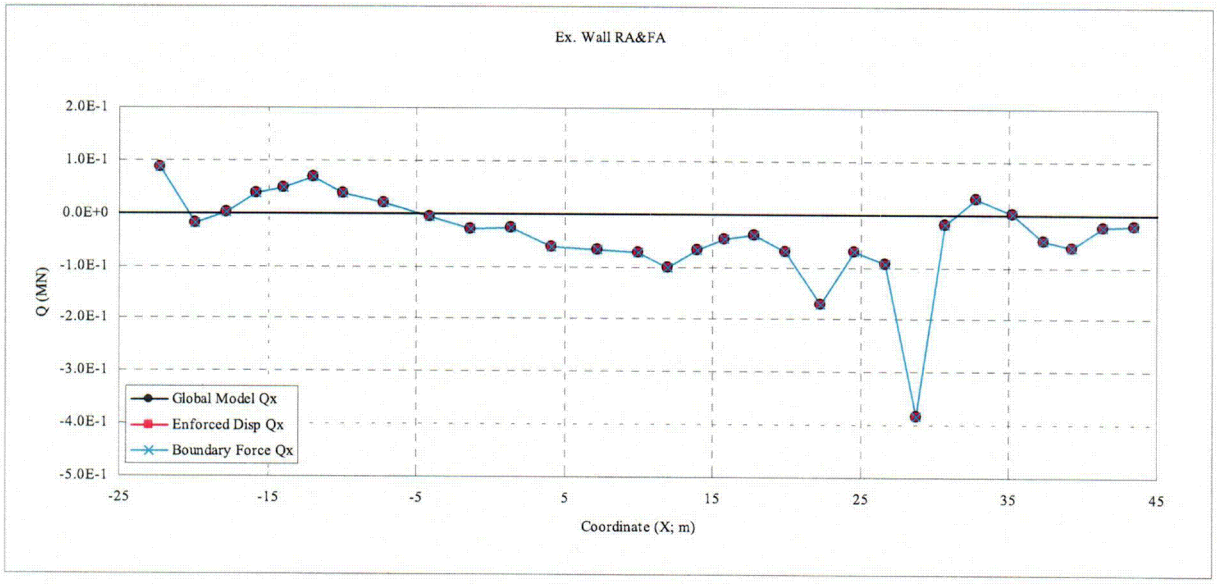


(e) Bending Moment in Horizontal Direction

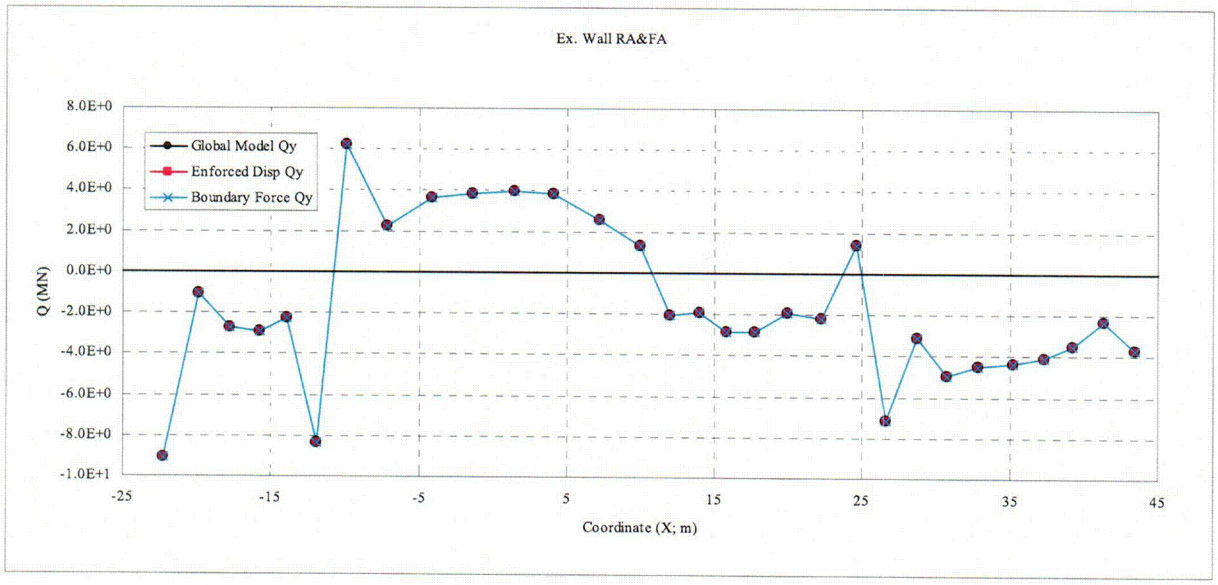


(f) Bending Moment in Vertical Direction

Figure D-15(c) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Horizontal Seismic Load in E-W Direction)

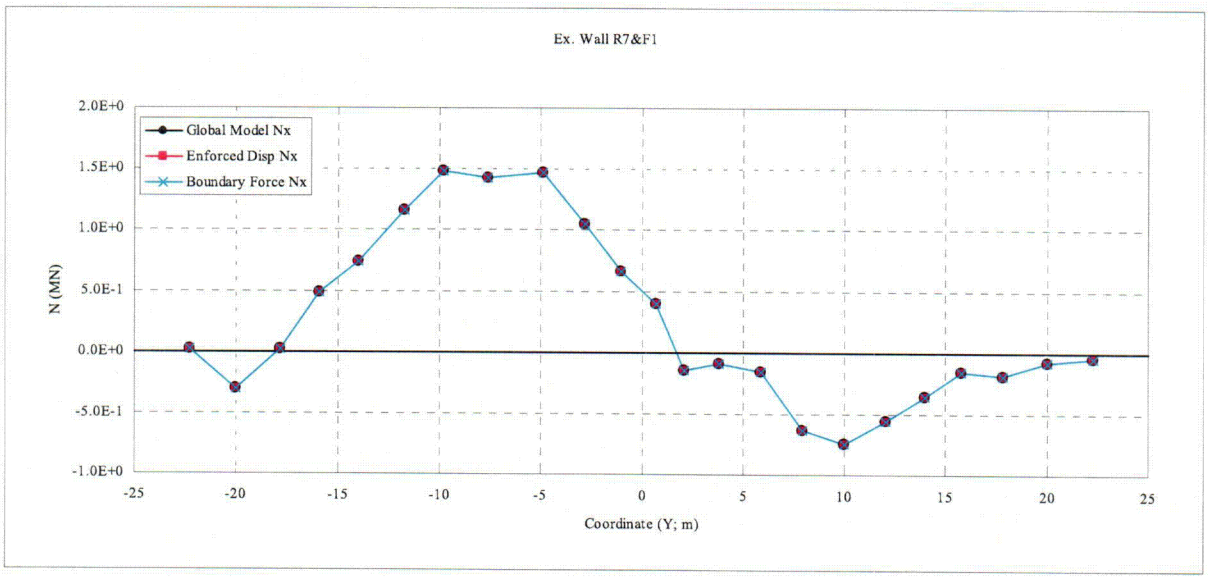


(g) Transverse Shear in Horizontal Direction

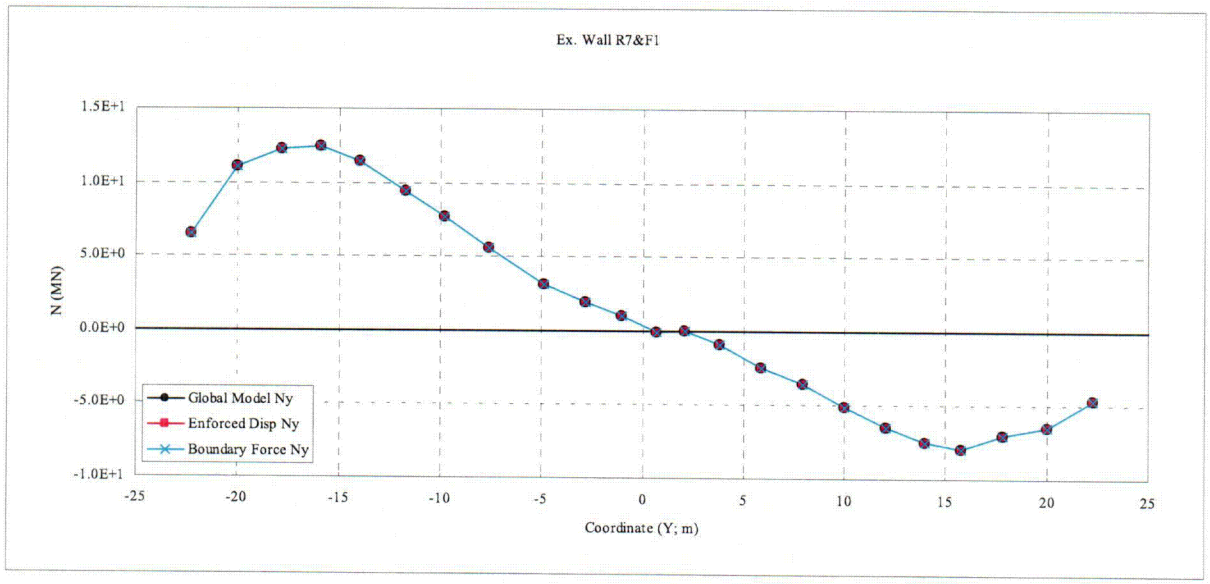


(h) Transverse Shear in Vertical Direction

Figure D-15(d) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Horizontal Seismic Load in E-W Direction)

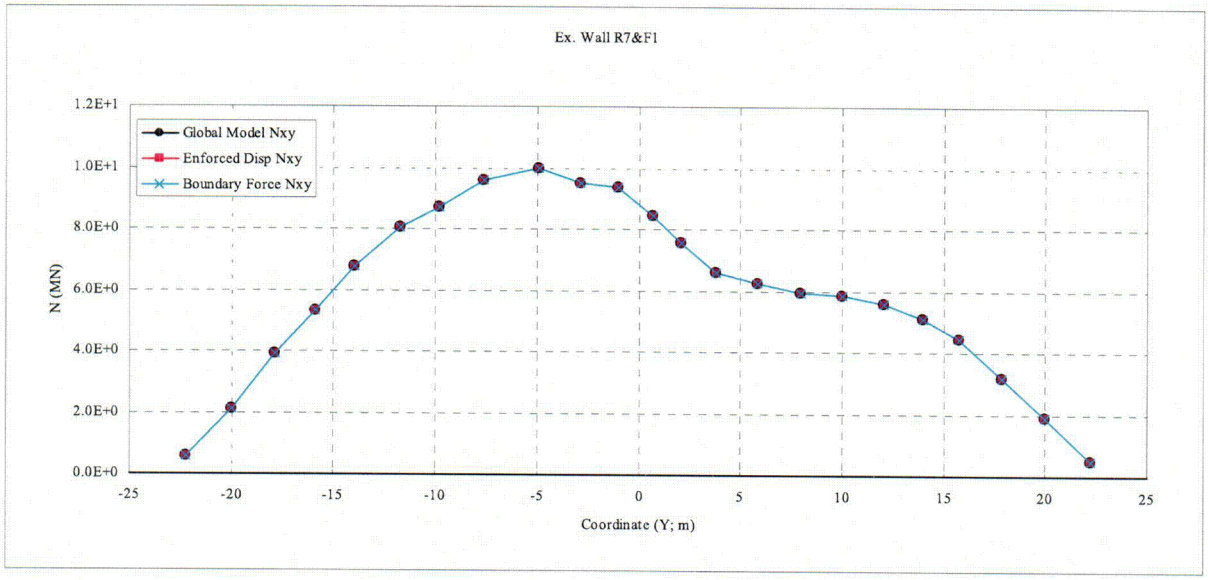


(a) Axial Force in Horizontal Direction

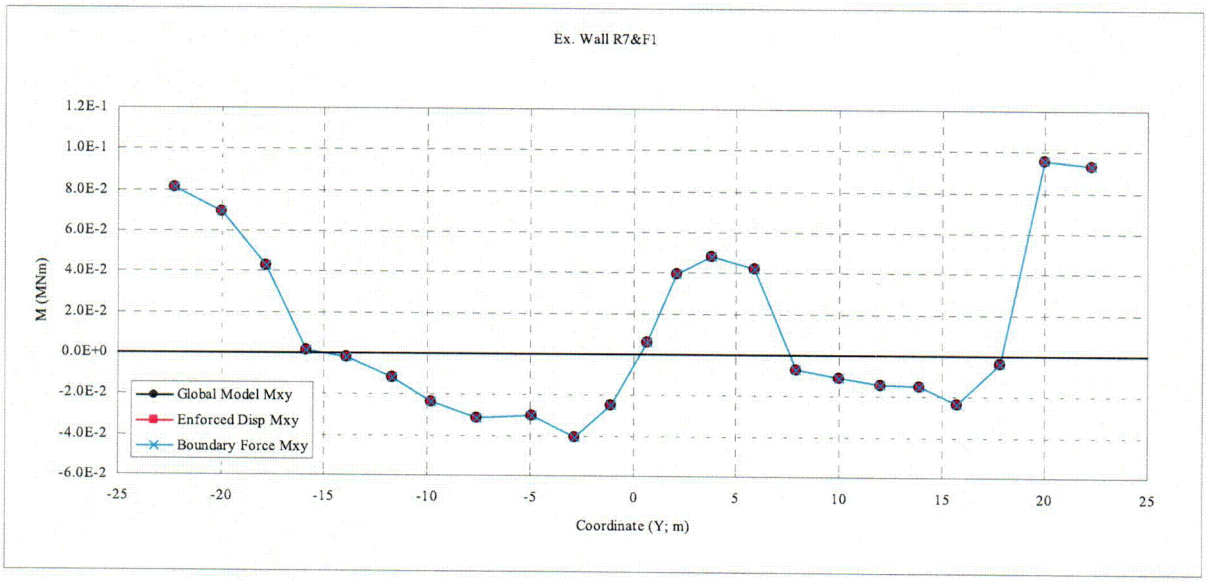


(b) Axial Force in Vertical Direction

Figure D-16(a) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Horizontal Seismic Load in E-W Direction)

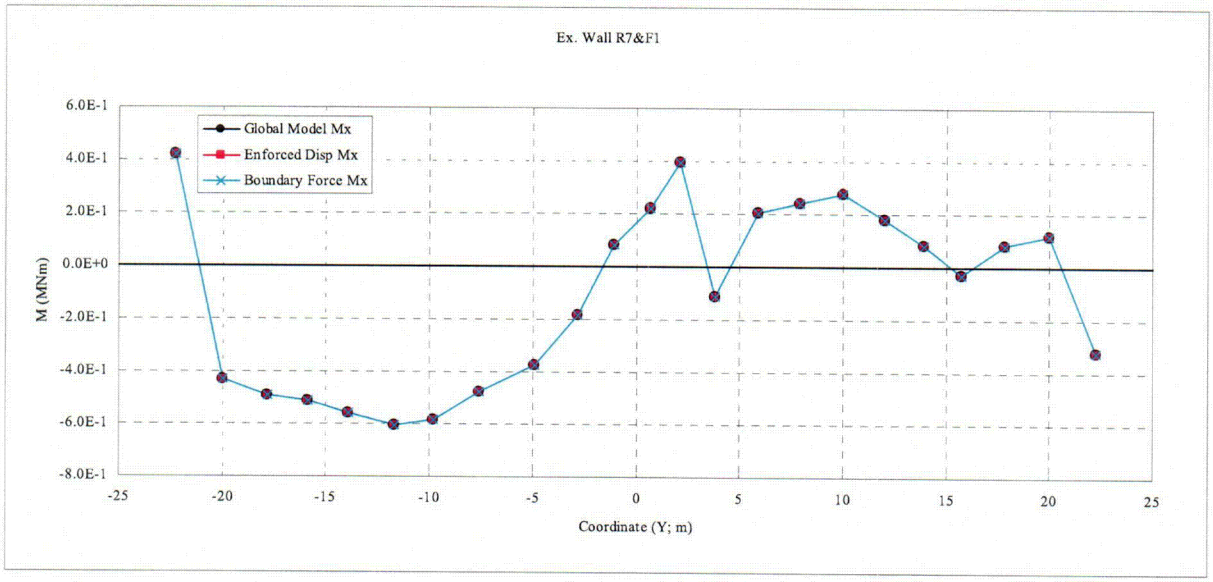


(c) In-plane Shear

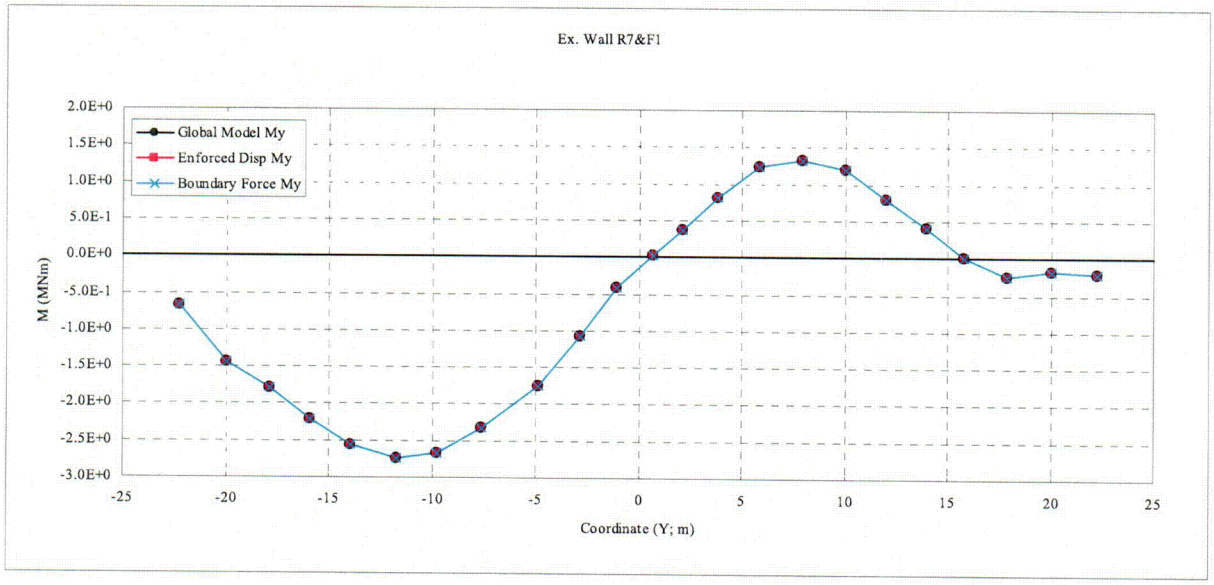


(d) Torsional Moment

Figure D-16(b) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Horizontal Seismic Load in E-W Direction)

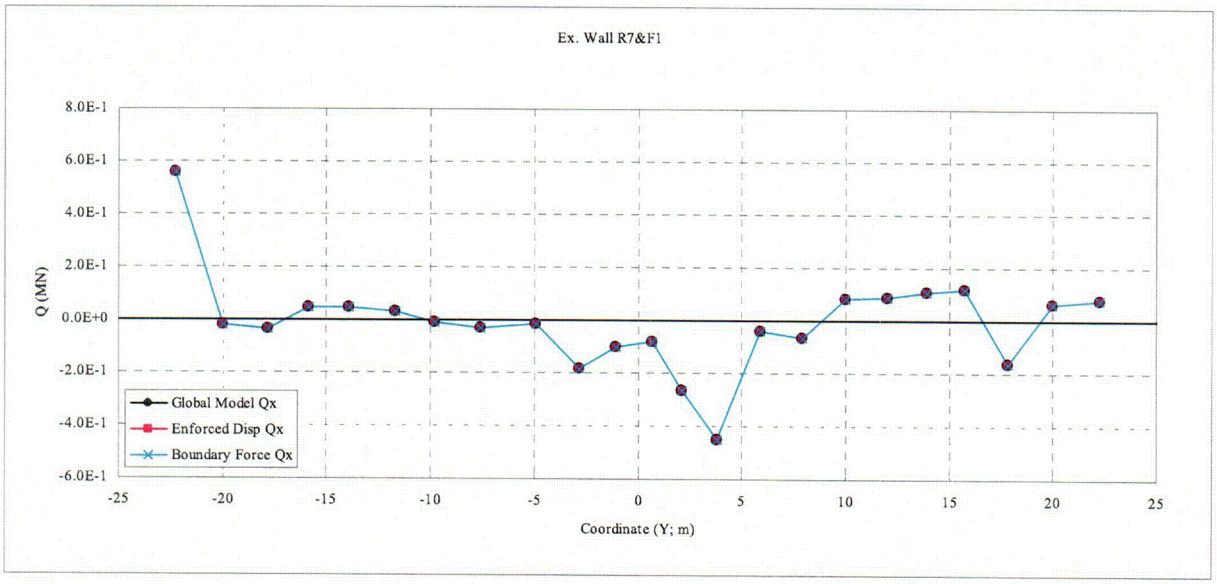


(e) Bending Moment in Horizontal Direction

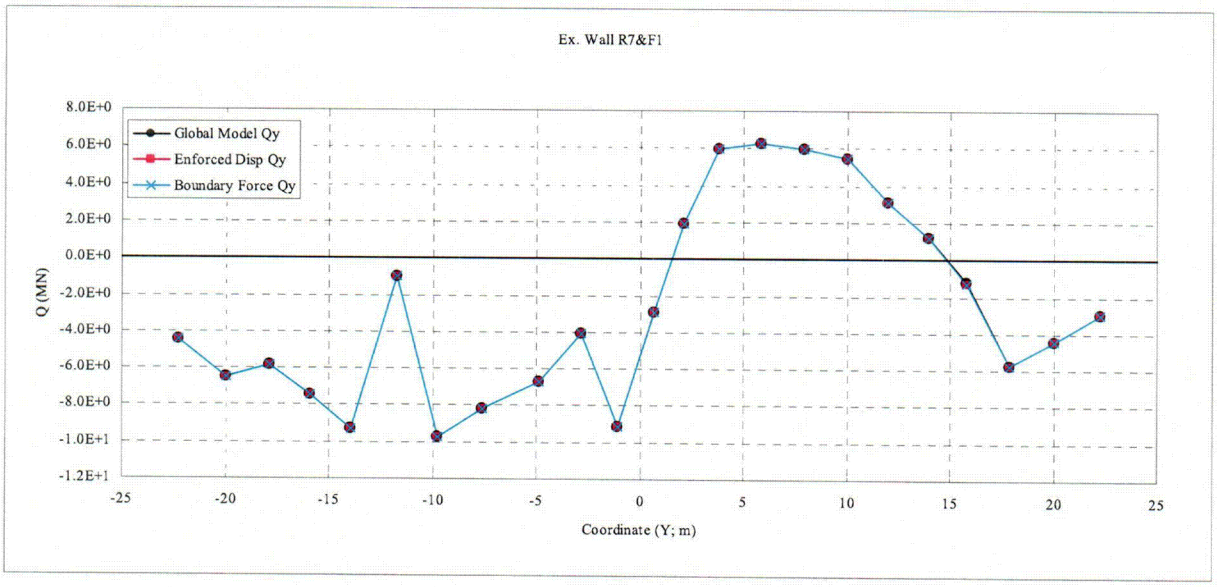


(f) Bending Moment in Vertical Direction

Figure D-16(c) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Horizontal Seismic Load in E-W Direction)

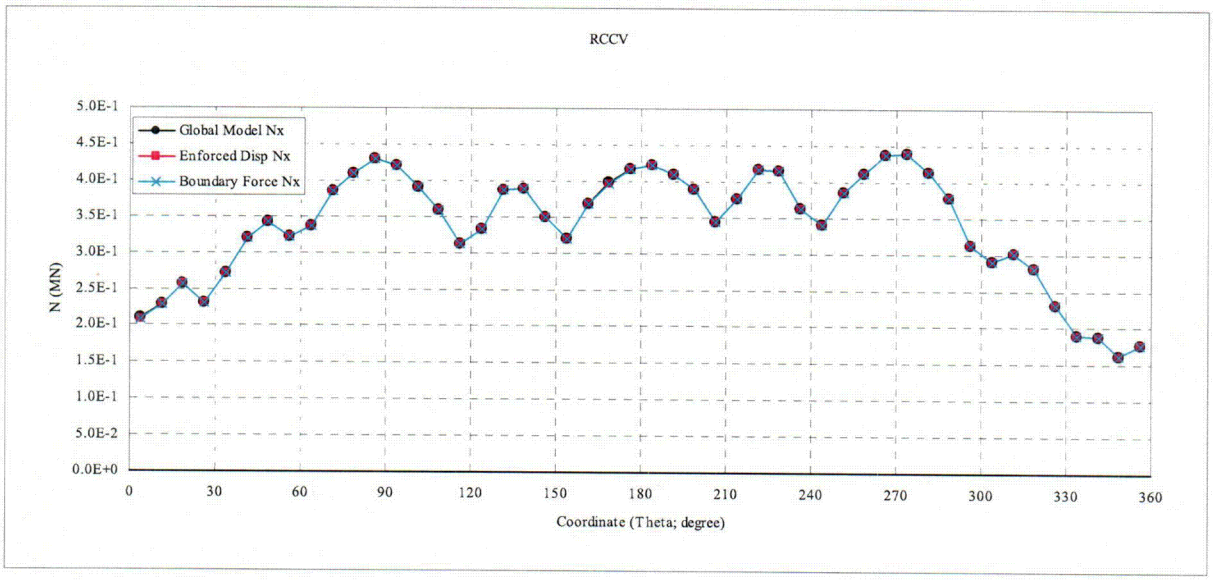


(g) Transverse Shear in Horizontal Direction

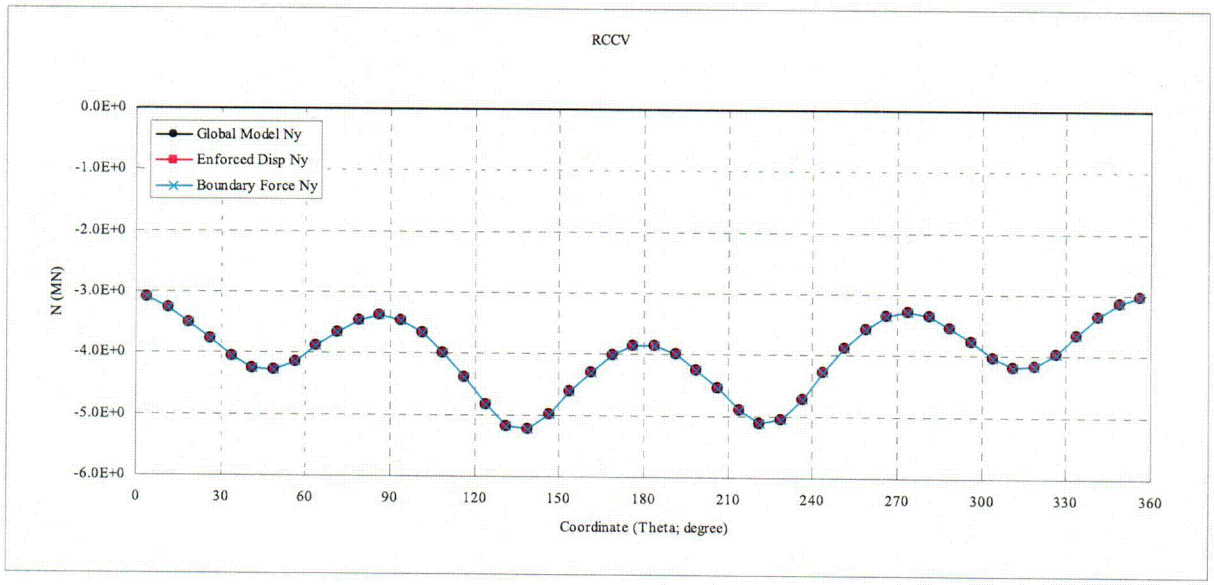


(h) Transverse Shear in Vertical Direction

Figure D-16(d) Comparison of Section Forces and Moments
(Exterior Wall on R7 Column Line: Horizontal Seismic Load in E-W Direction)

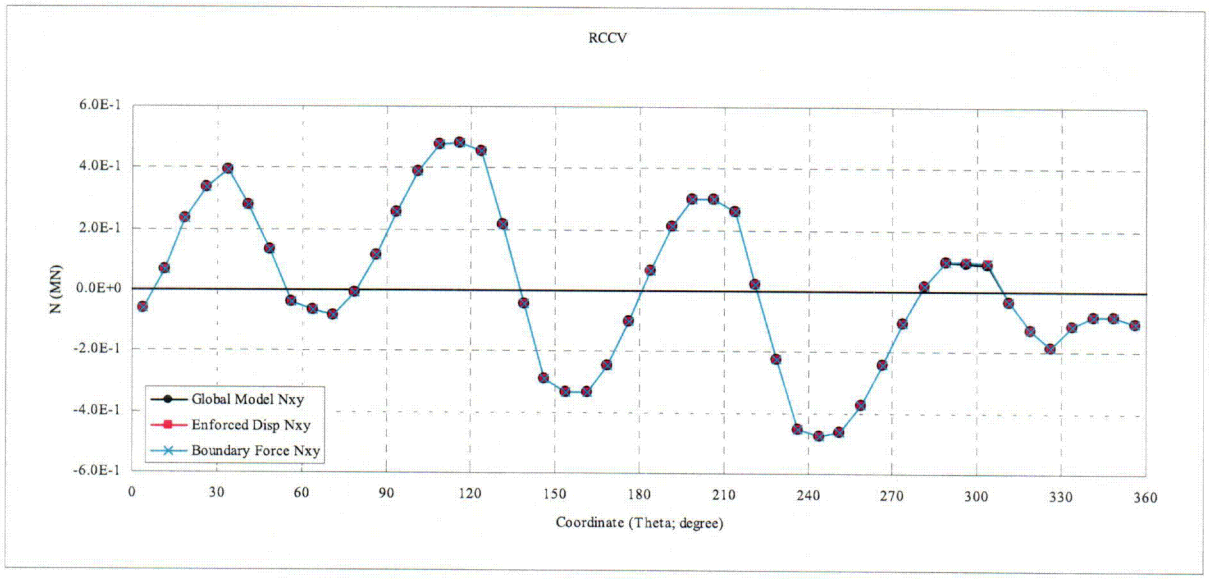


(a) Axial Force in Horizontal Direction

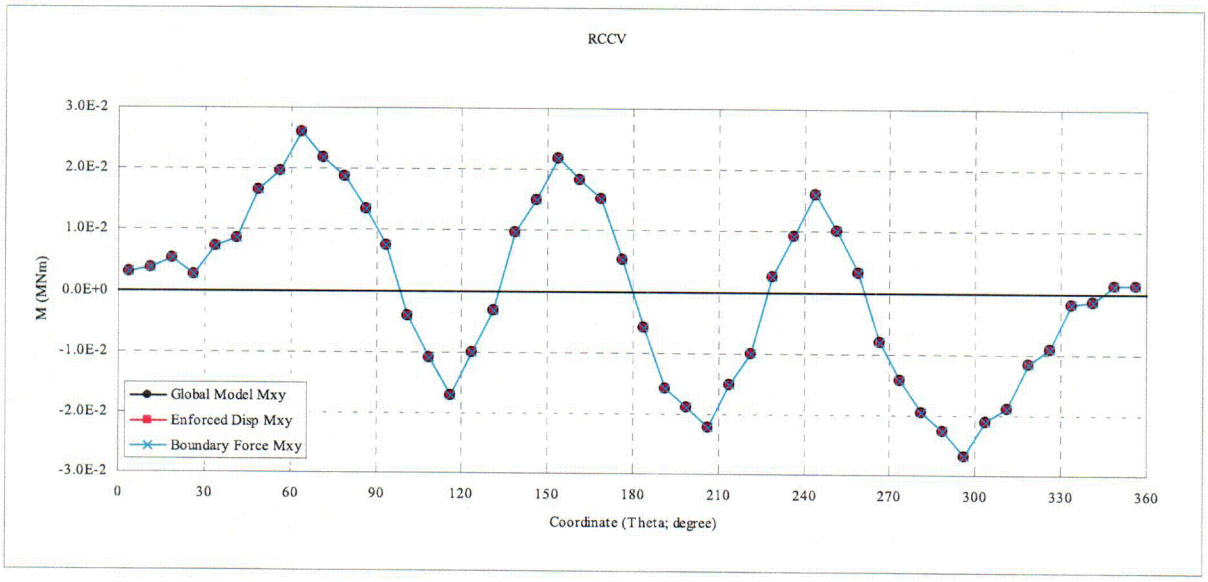


(b) Axial Force in Vertical Direction

Figure D-17(a) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Vertical Seismic Load)

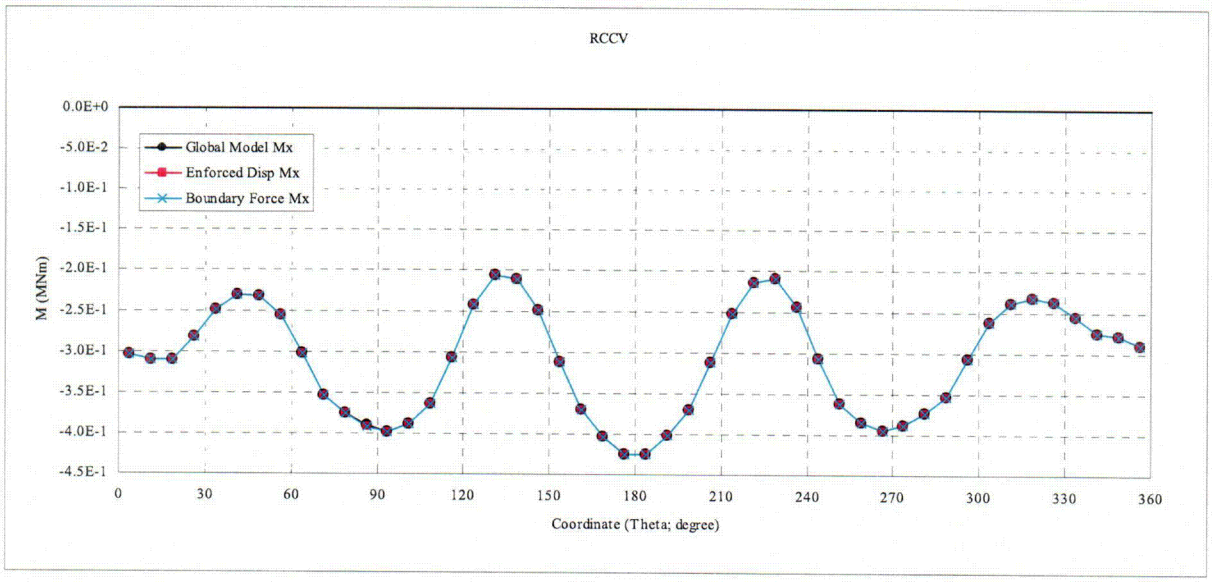


(c) In-plane Shear

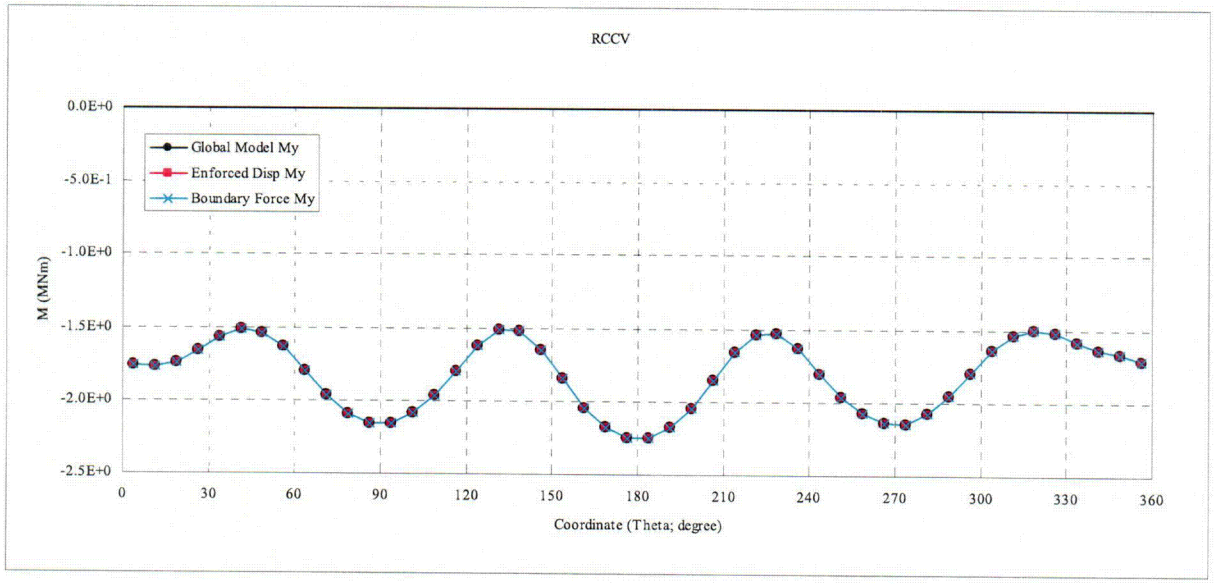


(d) Torsional Moment

Figure D-17(b) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Vertical Seismic Load)

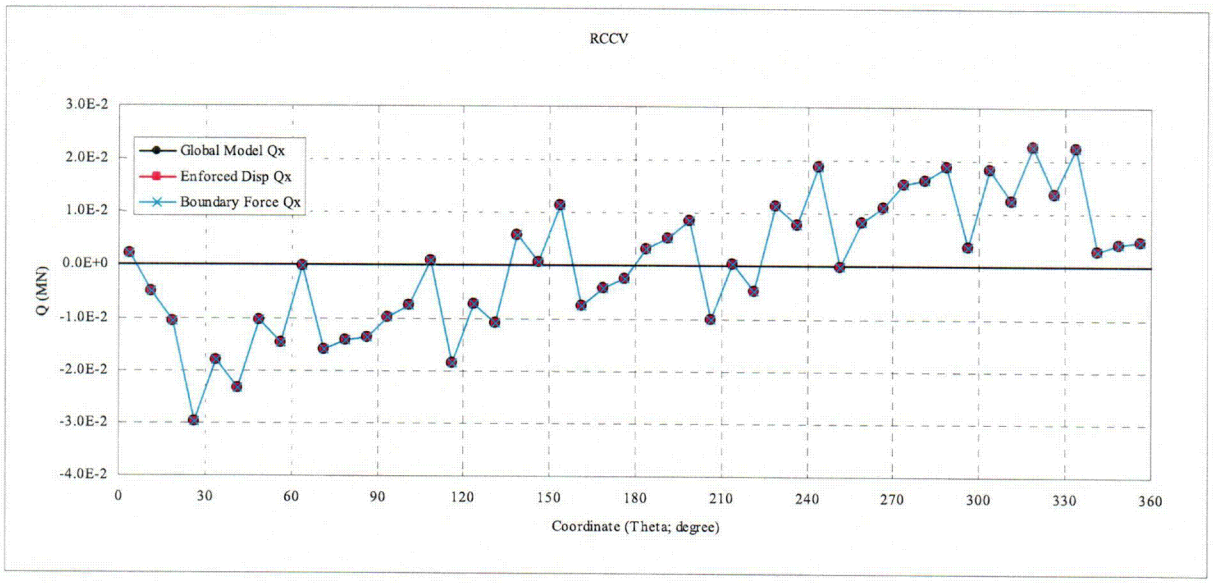


(e) Bending Moment in Horizontal Direction

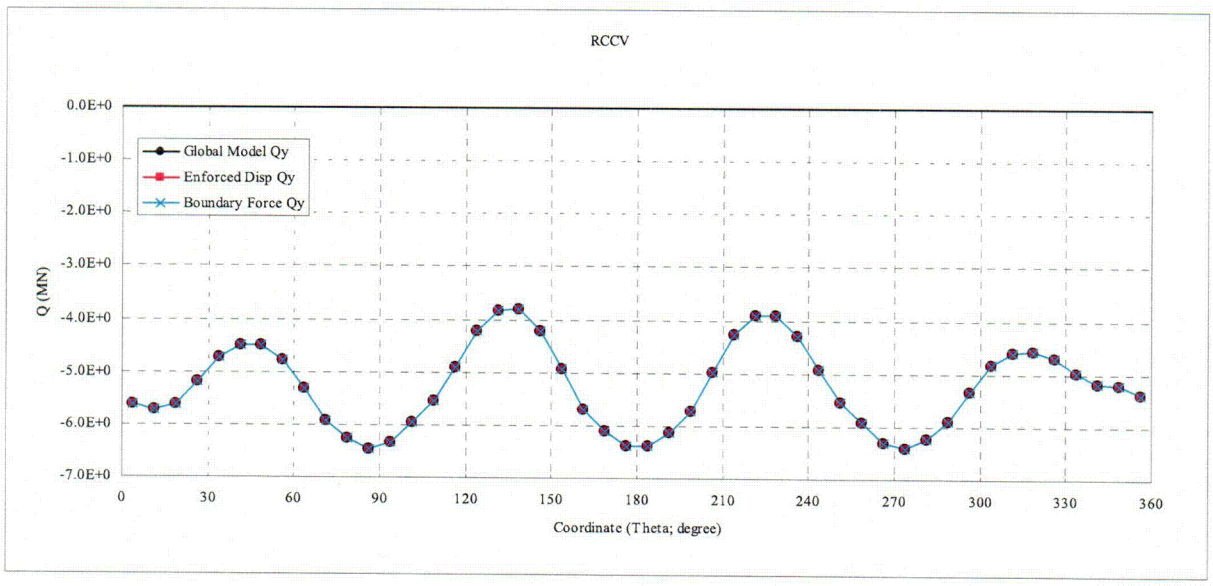


(f) Bending Moment in Vertical Direction

Figure D-17(c) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Vertical Seismic Load)

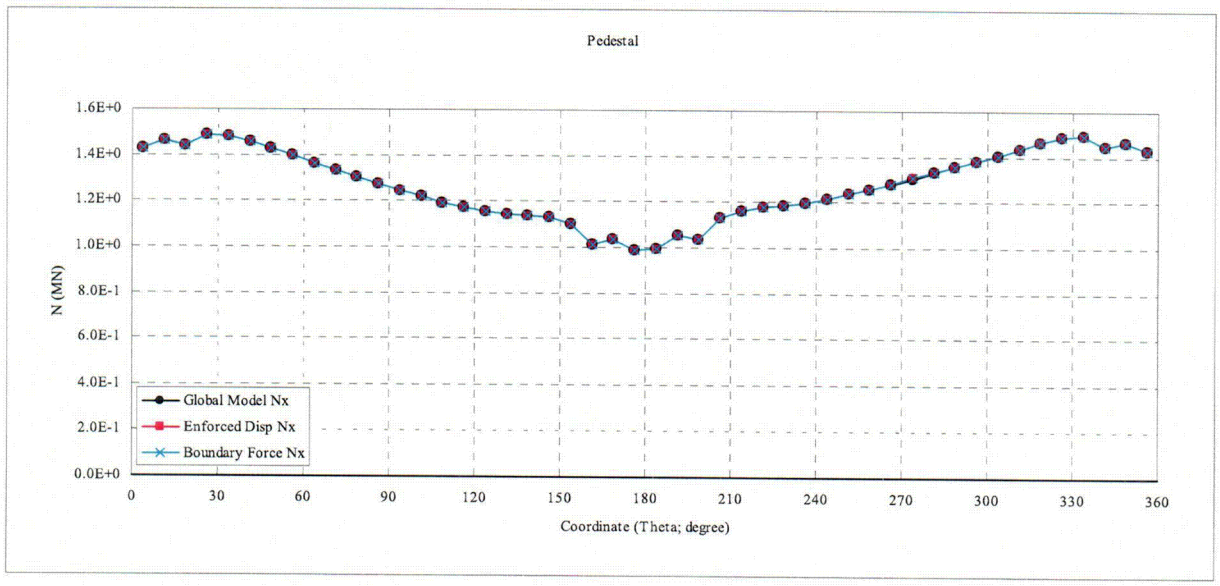


(g) Transverse Shear in Horizontal Direction

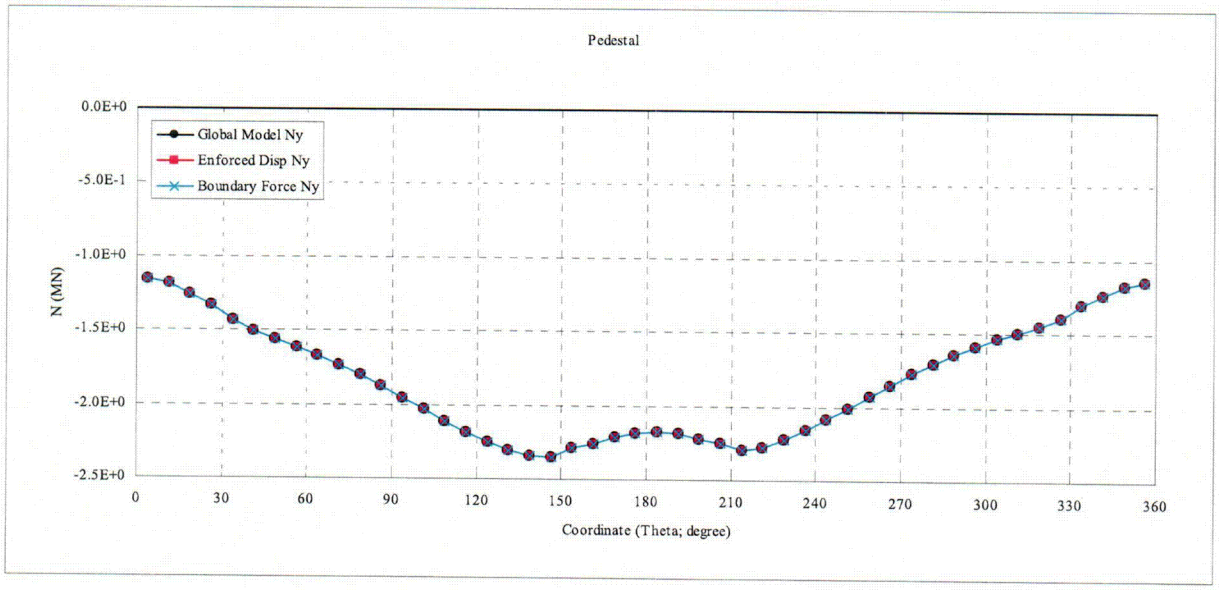


(h) Transverse Shear in Vertical Direction

Figure D-17(d) Comparison of Section Forces and Moments (Cylindrical Wall below RCCV Wall: Vertical Seismic Load)

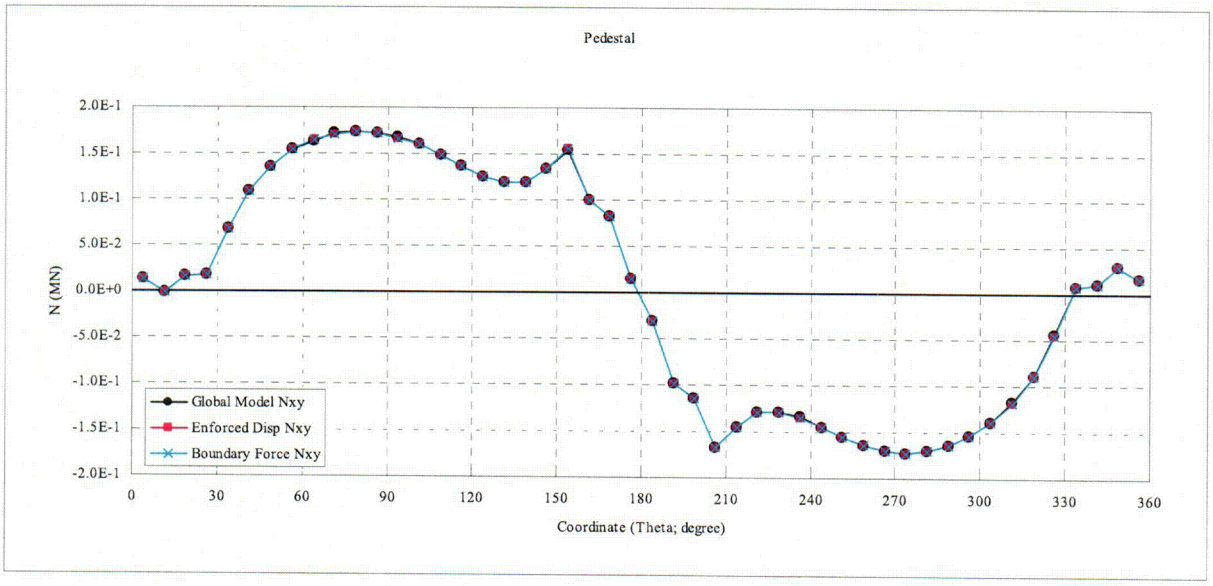


(a) Axial Force in Horizontal Direction

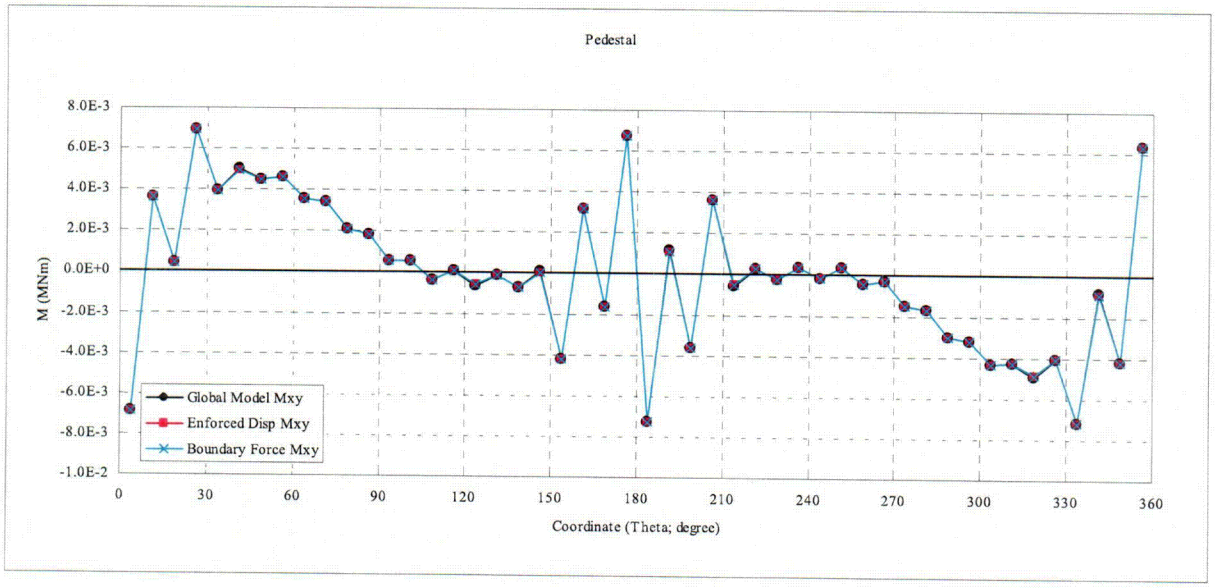


(b) Axial Force in Vertical Direction

Figure D-18(a) Comparison of Section Forces and Moments (RPV Pedestal: Vertical Seismic Load)

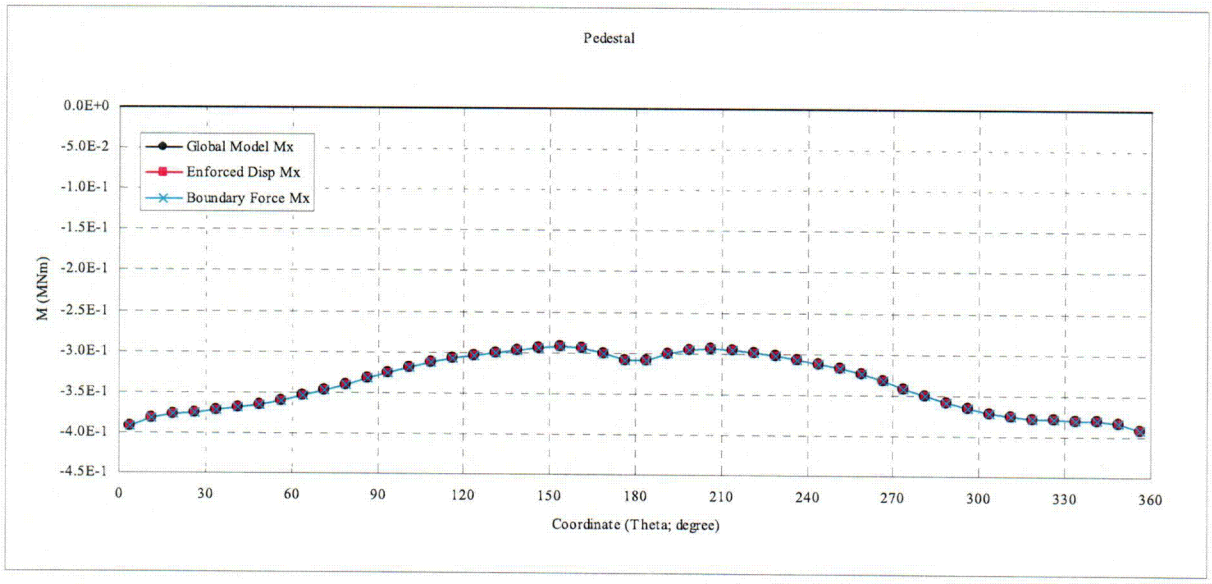


(c) In-plane Shear

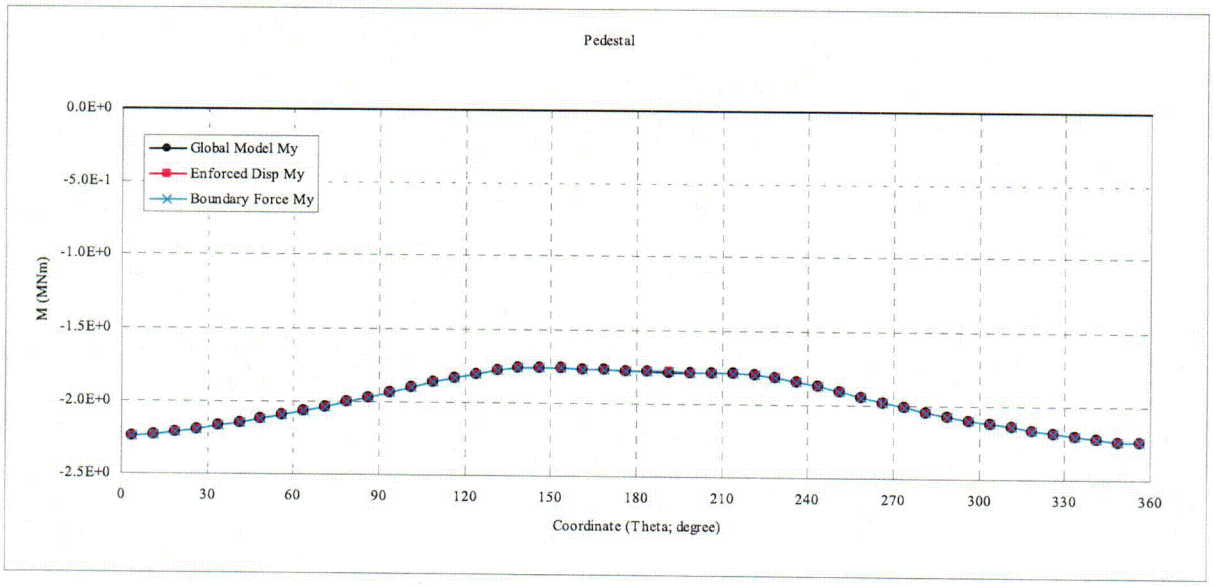


(d) Torsional Moment

Figure D-18(b) Comparison of Section Forces and Moments (RPV Pedestal: Vertical Seismic Load)

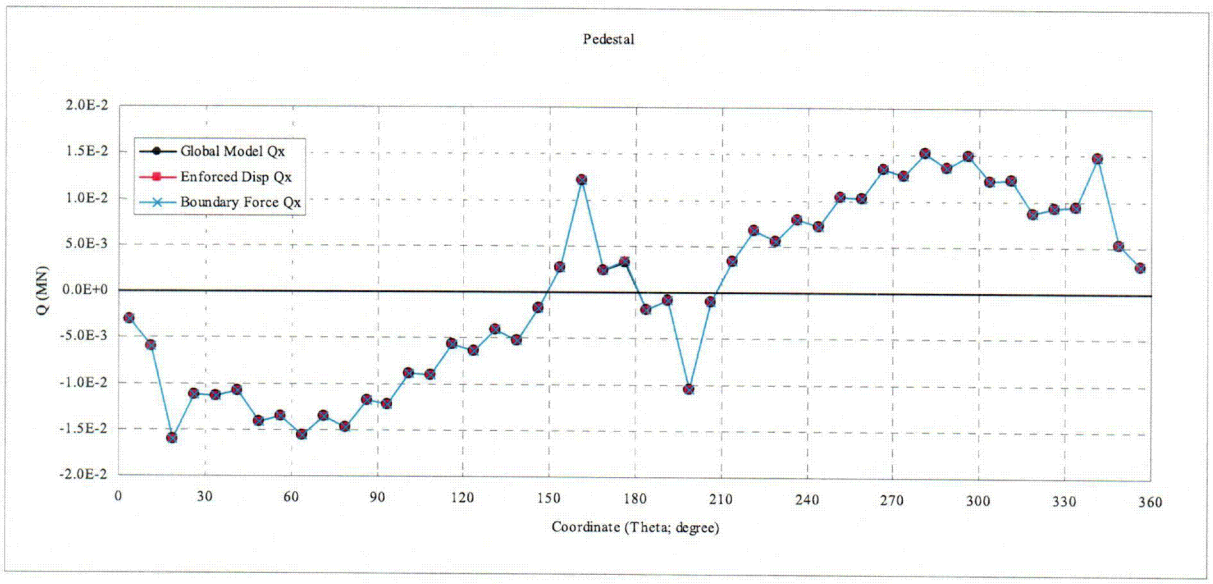


(e) Bending Moment in Horizontal Direction

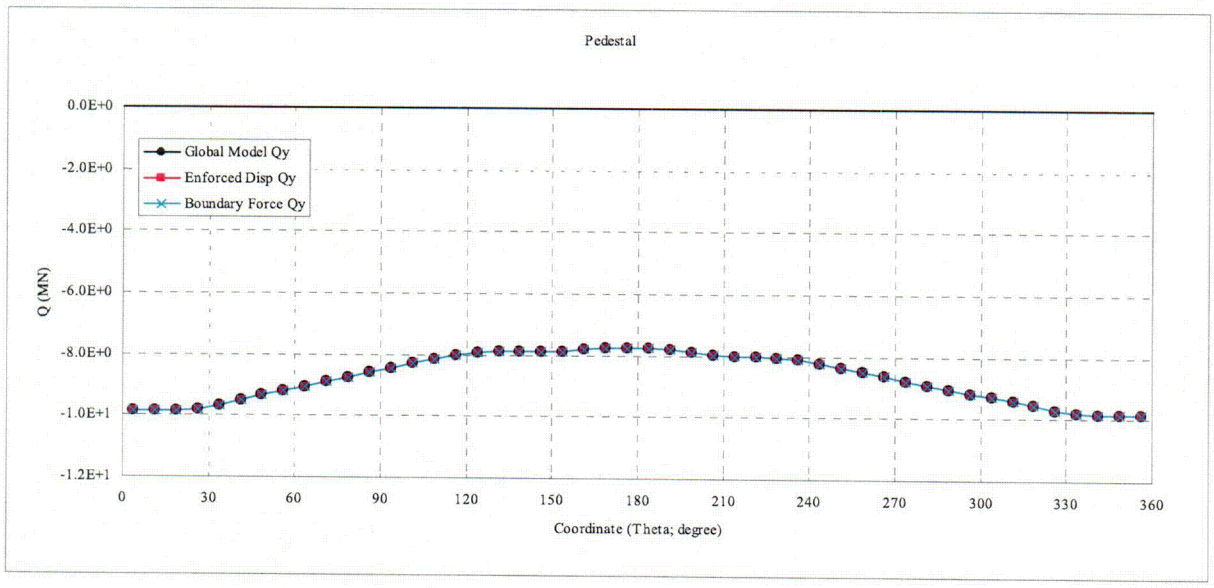


(f) Bending Moment in Vertical Direction

Figure D-18(c) Comparison of Section Forces and Moments (RPV Pedestal: Vertical Seismic Load)

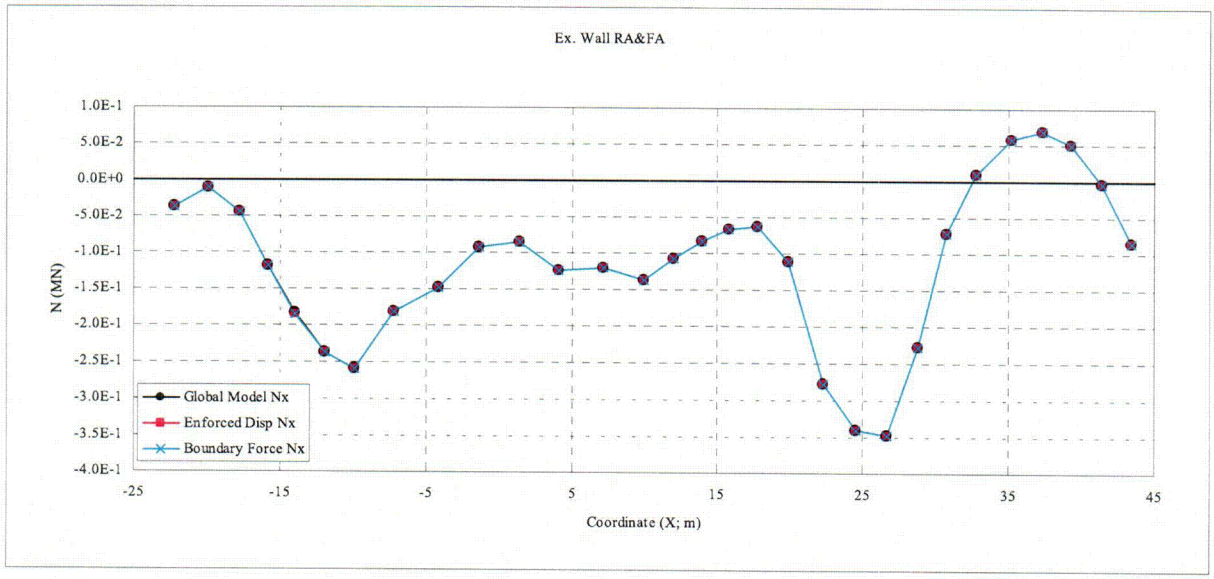


(g) Transverse Shear in Horizontal Direction

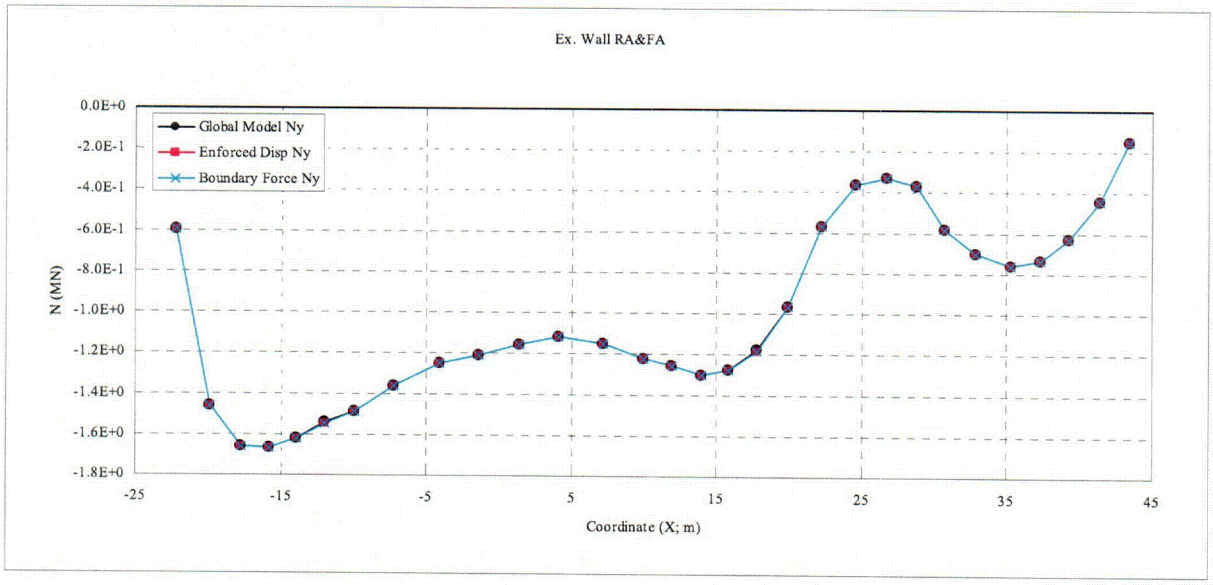


(h) Transverse Shear in Vertical Direction

Figure D-18(d) Comparison of Section Forces and Moments (RPV Pedestal: Vertical Seismic Load)

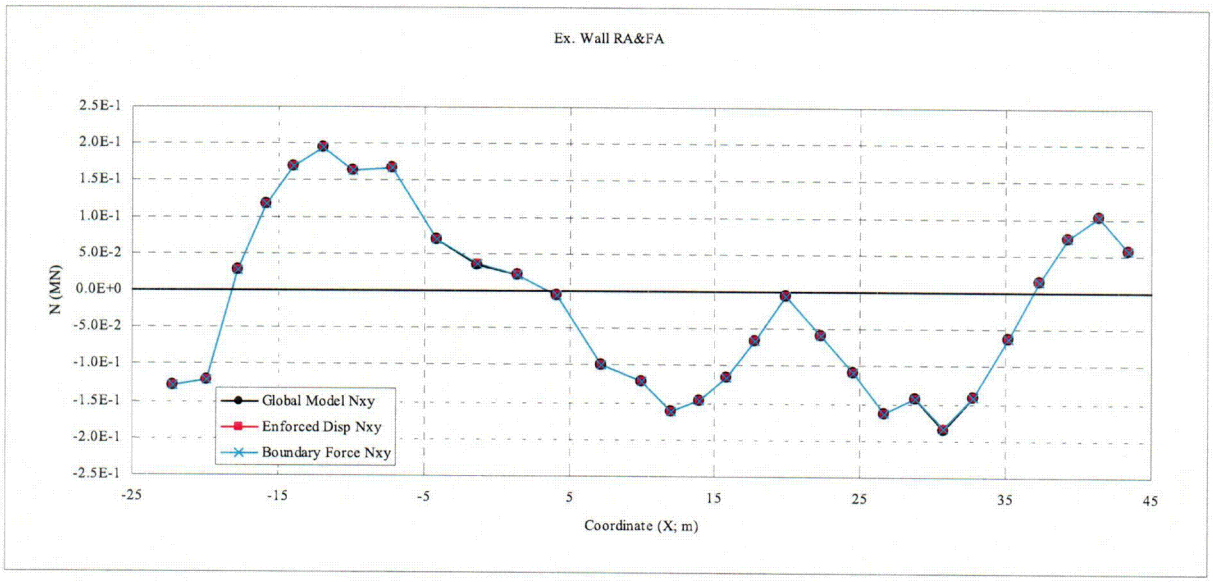


(a) Axial Force in Horizontal Direction

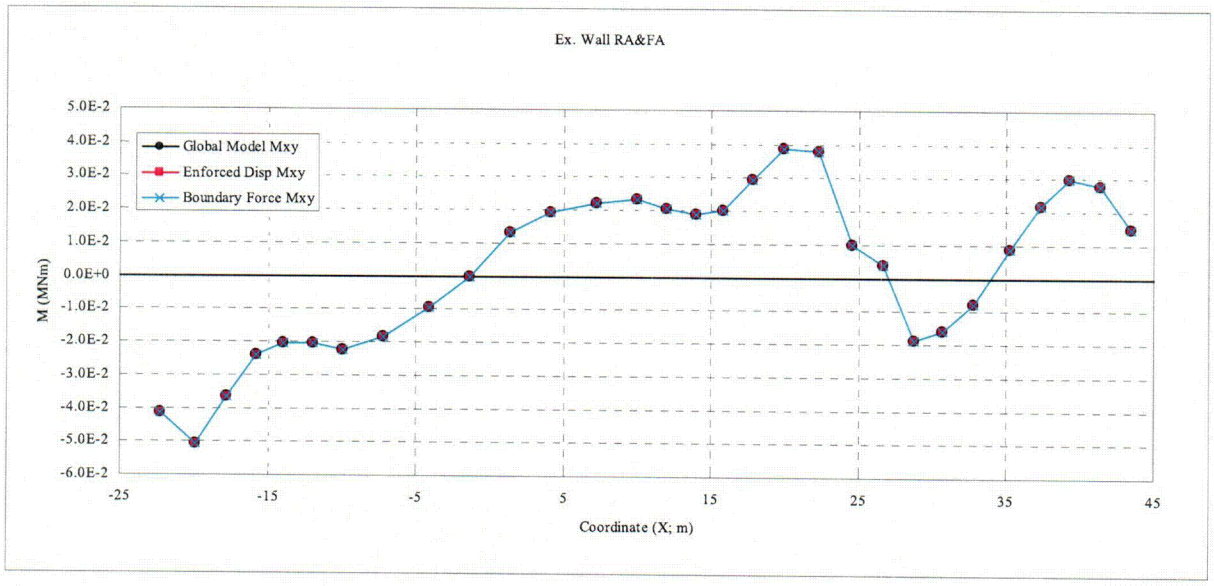


(b) Axial Force in Vertical Direction

Figure D-19(a) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Vertical Seismic Load)

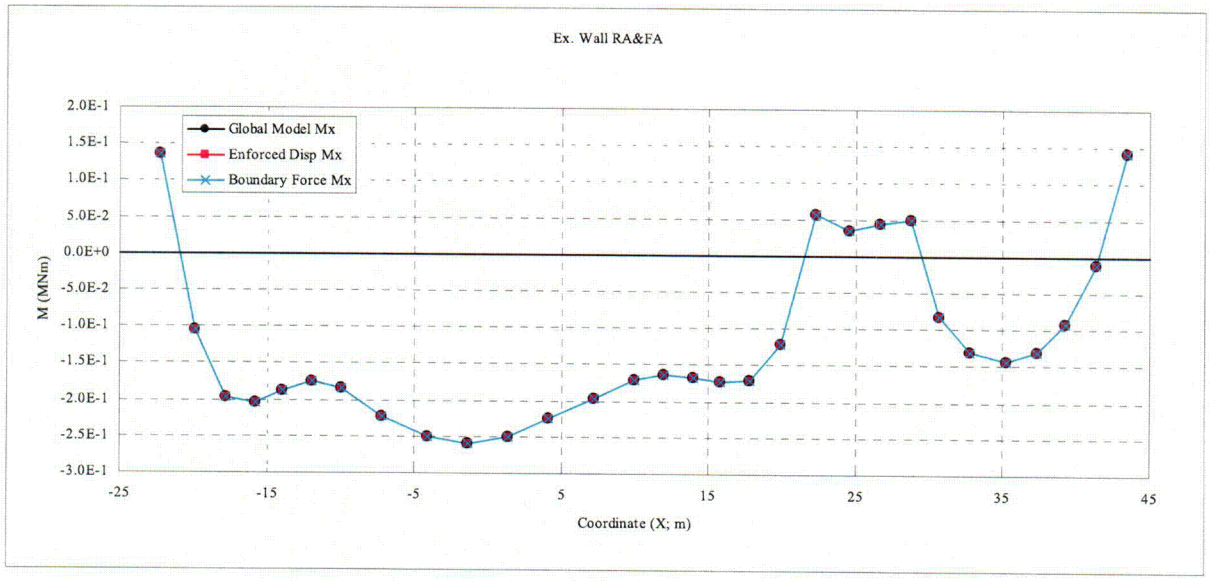


(c) In-plane Shear

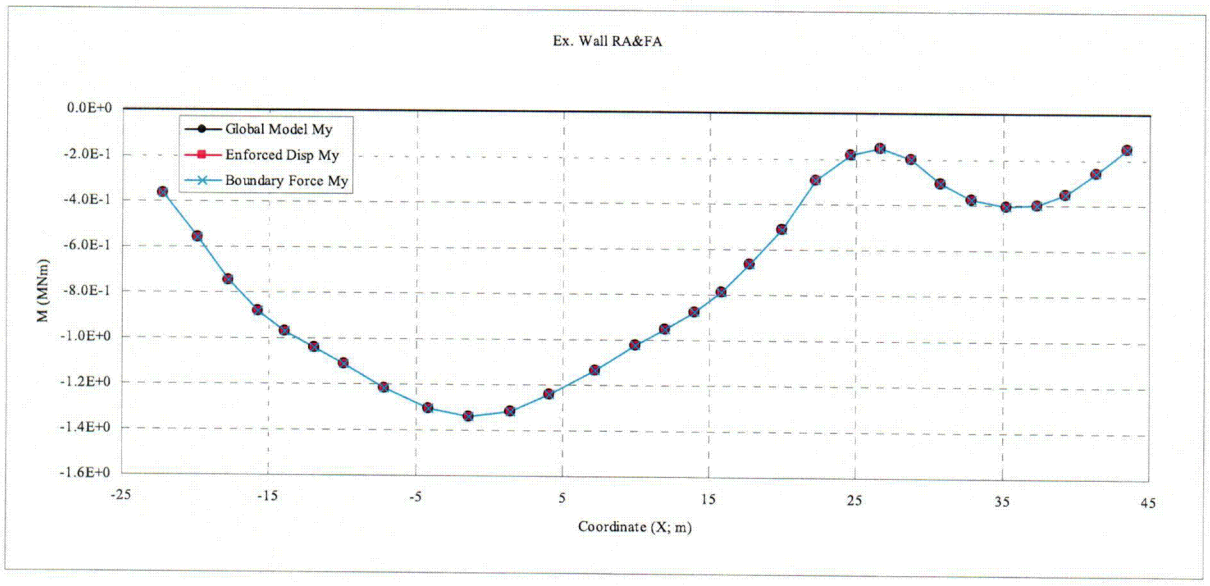


(d) Torsional Moment

Figure D-19(b) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Vertical Seismic Load)

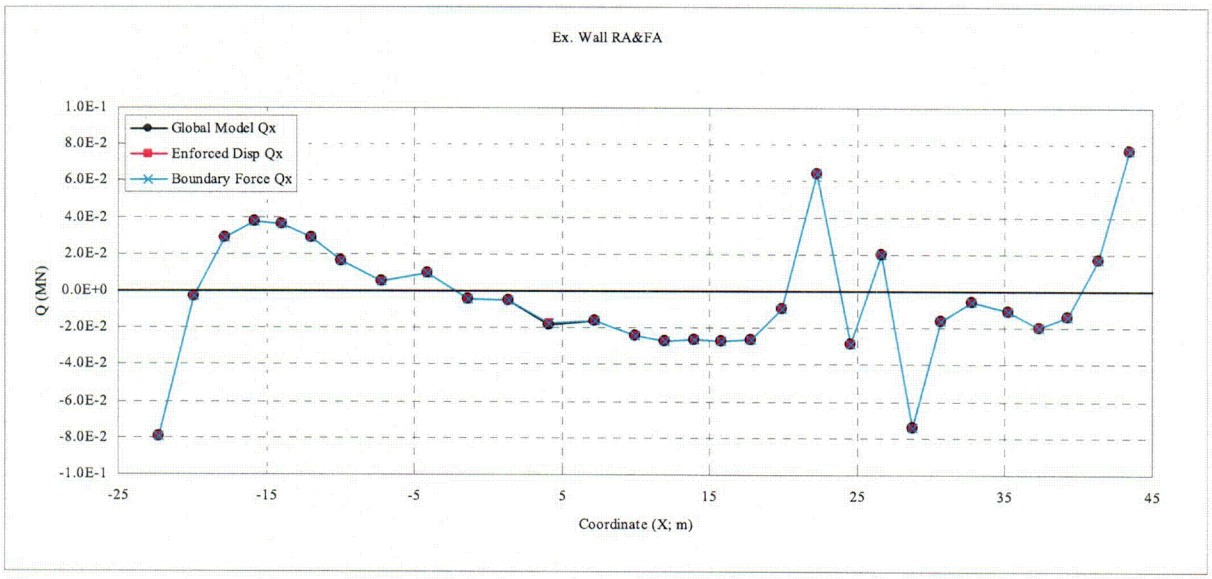


(e) Bending Moment in Horizontal Direction

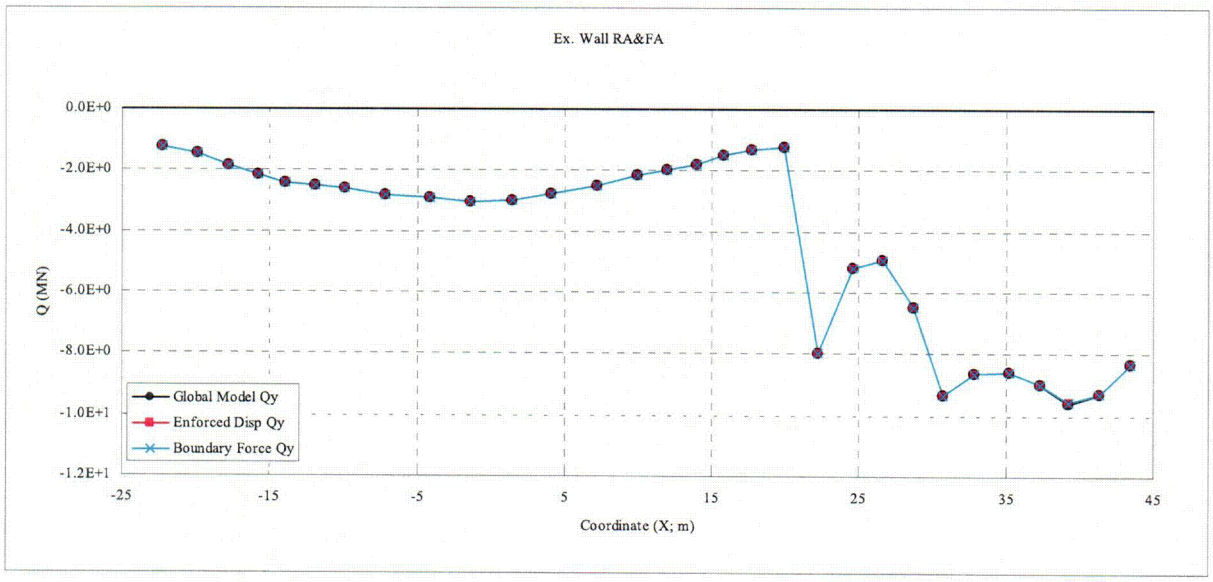


(f) Bending Moment in Vertical Direction

Figure D-19(c) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Vertical Seismic Load)

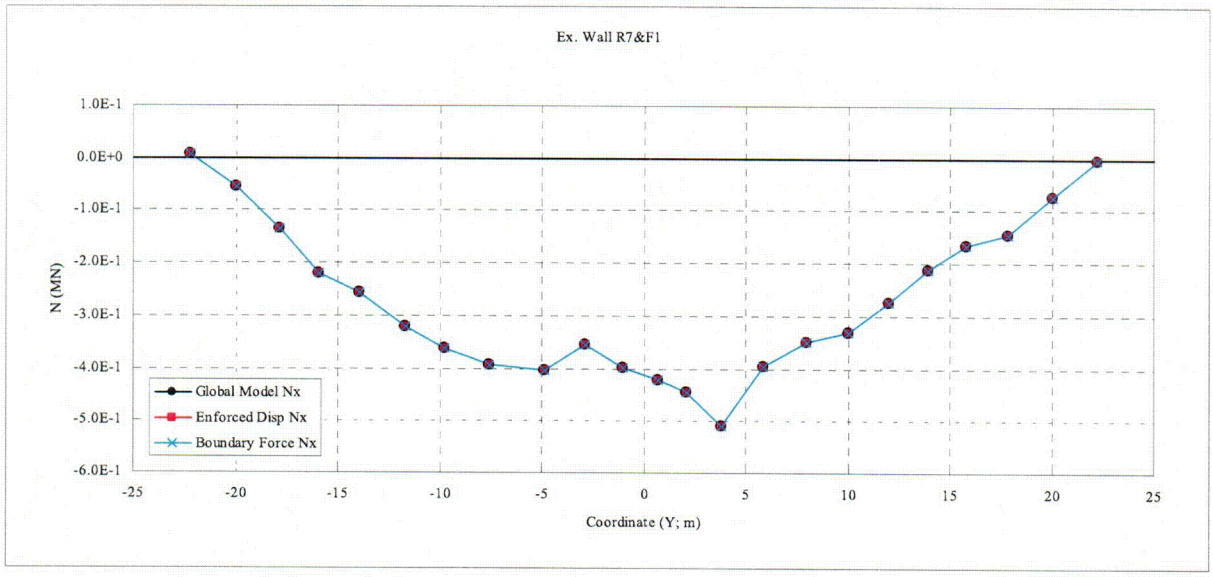


(g) Transverse Shear in Horizontal Direction

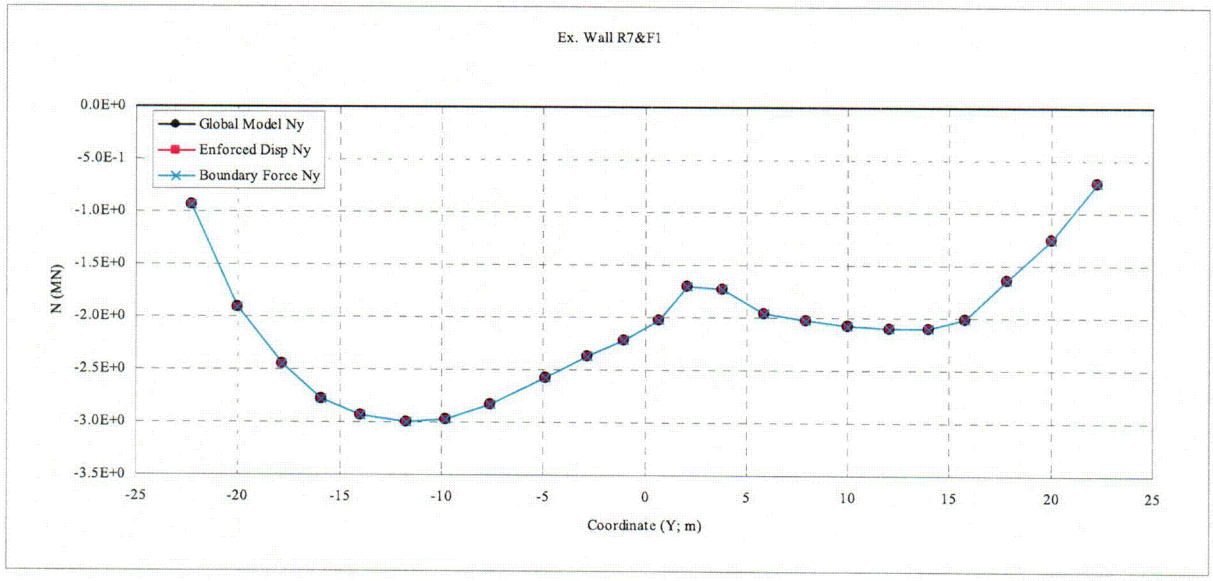


(h) Transverse Shear in Vertical Direction

Figure D-19(d) Comparison of Section Forces and Moments (Exterior Wall on RA Column Line: Vertical Seismic Load)

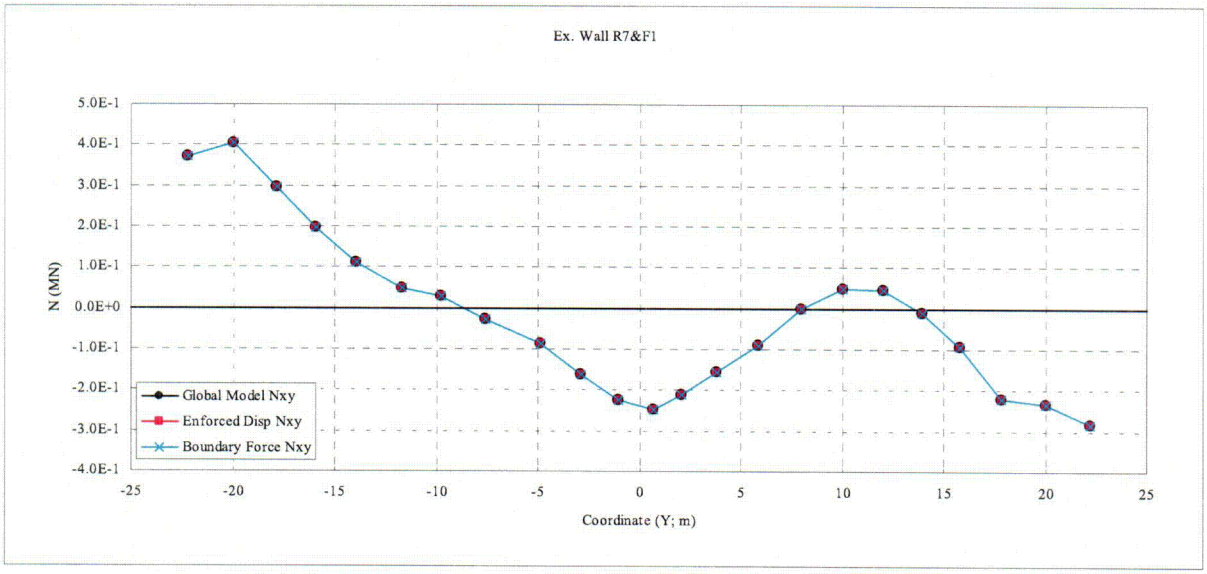


(a) Axial Force in Horizontal Direction

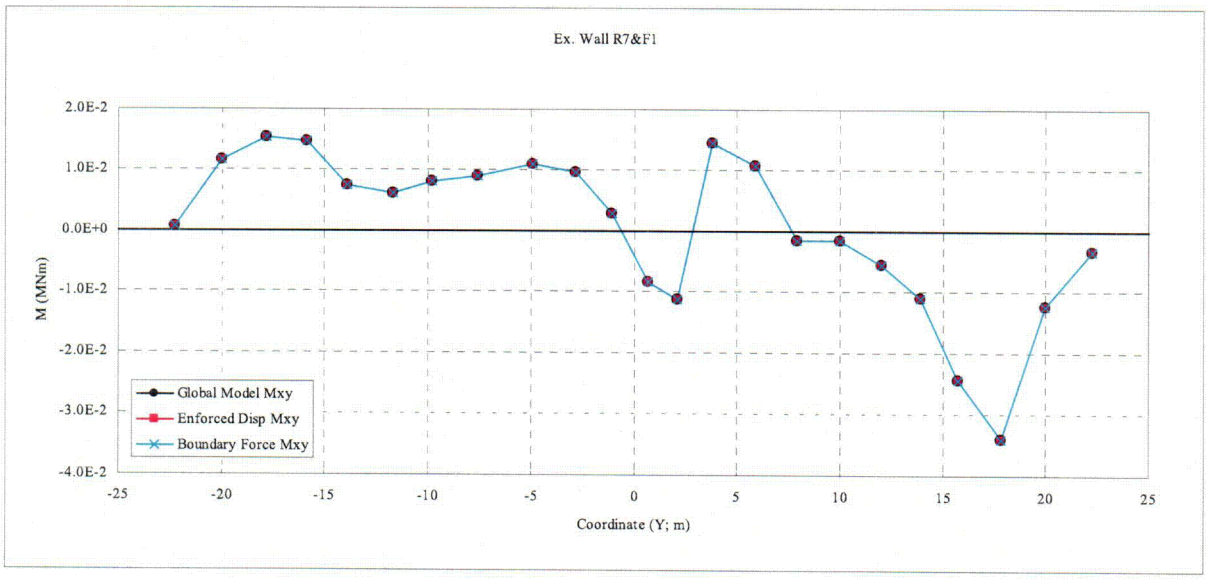


(b) Axial Force in Vertical Direction

Figure D-20(a) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Vertical Seismic Load)

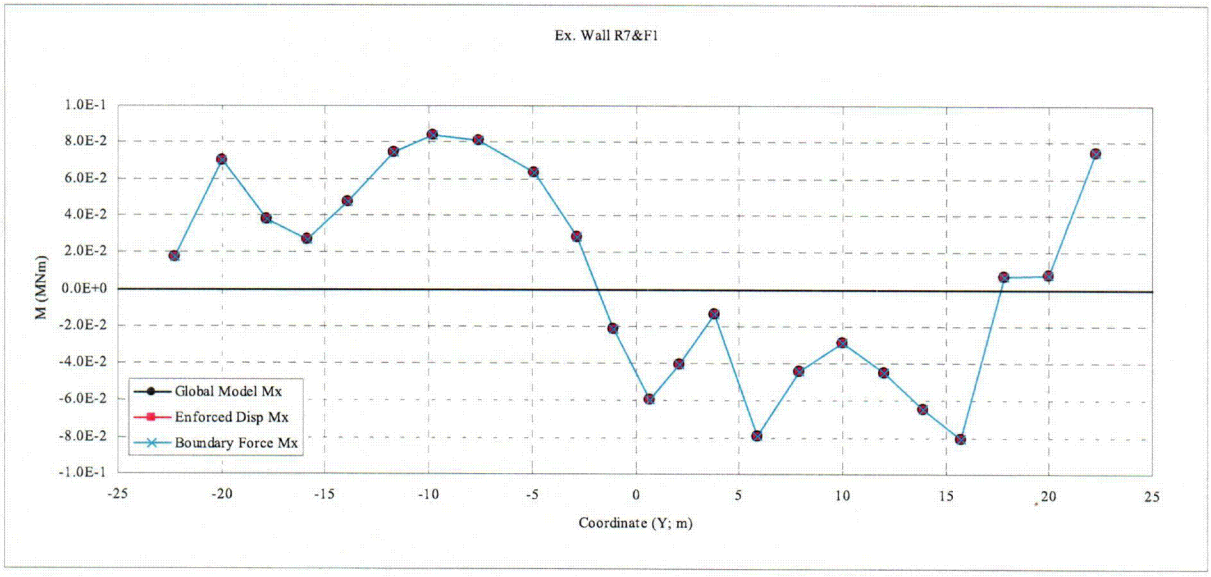


(c) In-plane Shear

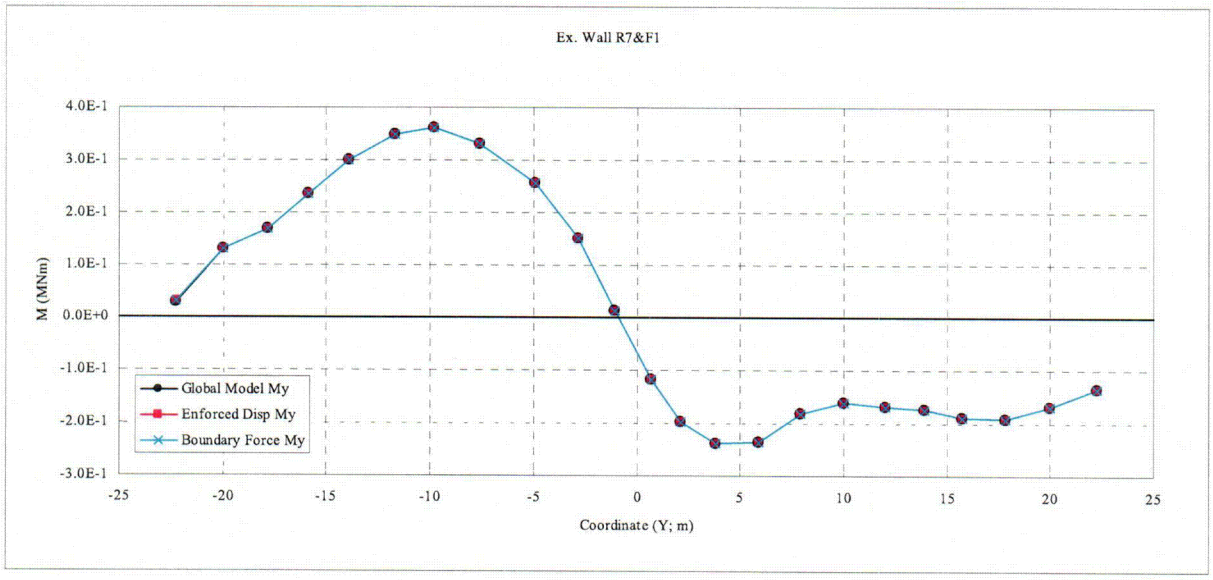


(d) Torsional Moment

Figure D-20(b) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Vertical Seismic Load)

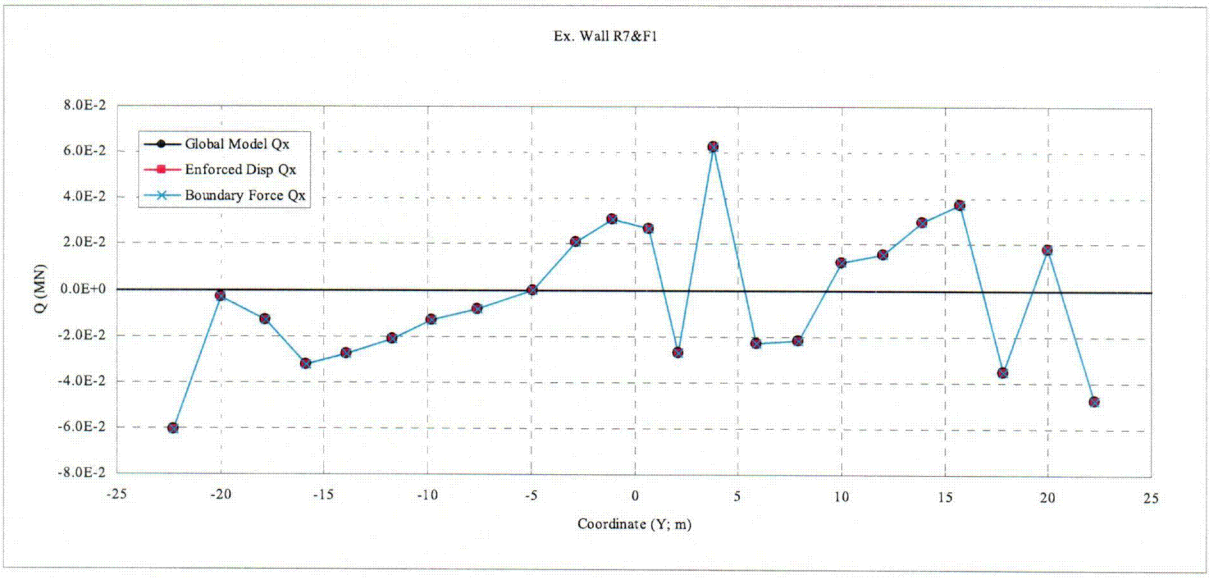


(e) Bending Moment in Horizontal Direction

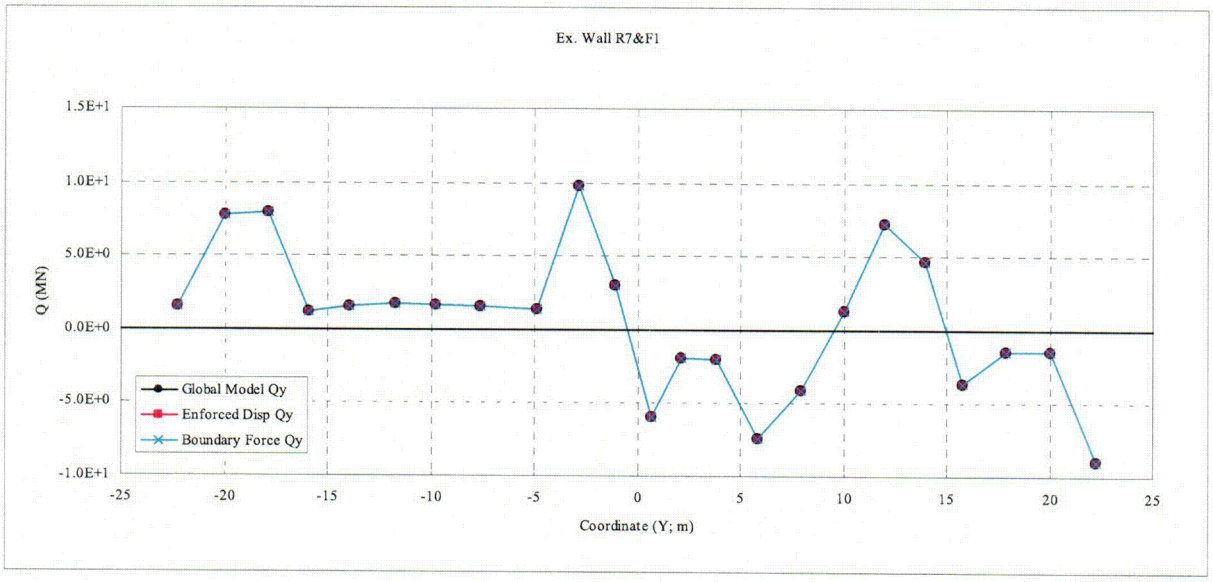


(f) Bending Moment in Vertical Direction

Figure D-20(c) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Vertical Seismic Load)



(g) Transverse Shear in Horizontal Direction



(h) Transverse Shear in Vertical Direction

Figure D-20(d) Comparison of Section Forces and Moments (Exterior Wall on R7 Column Line: Vertical Seismic Load)

ENCLOSURE 2

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NASTRAN Analysis Input Data and

NASTRAN Analysis Results