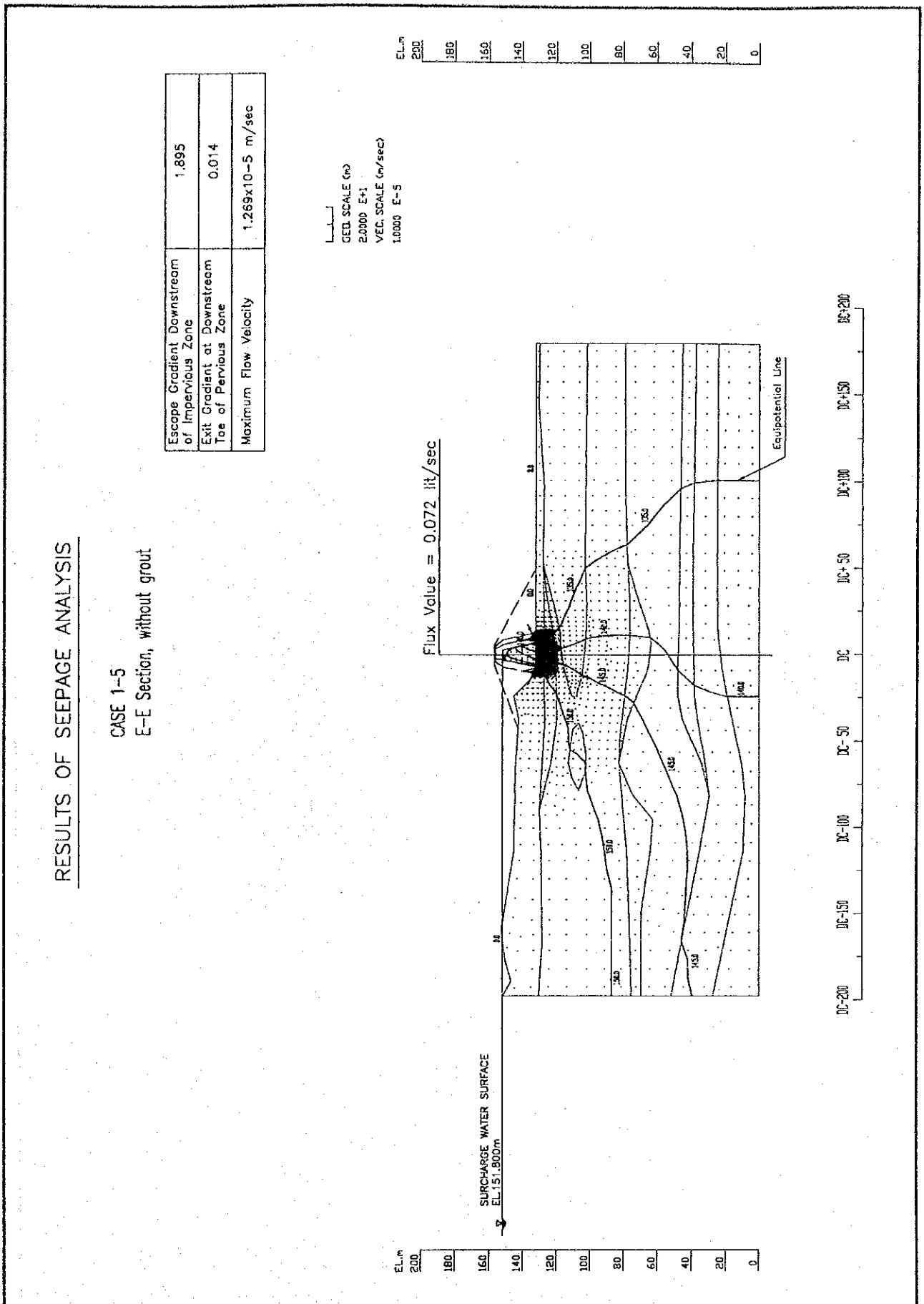


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.2.23 (5/8) RESULTS OF SEEPAGE ANALYSIS (WITHOUT GROUT)
JAPAN INTERNATIONAL COOPERATION AGENCY	

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

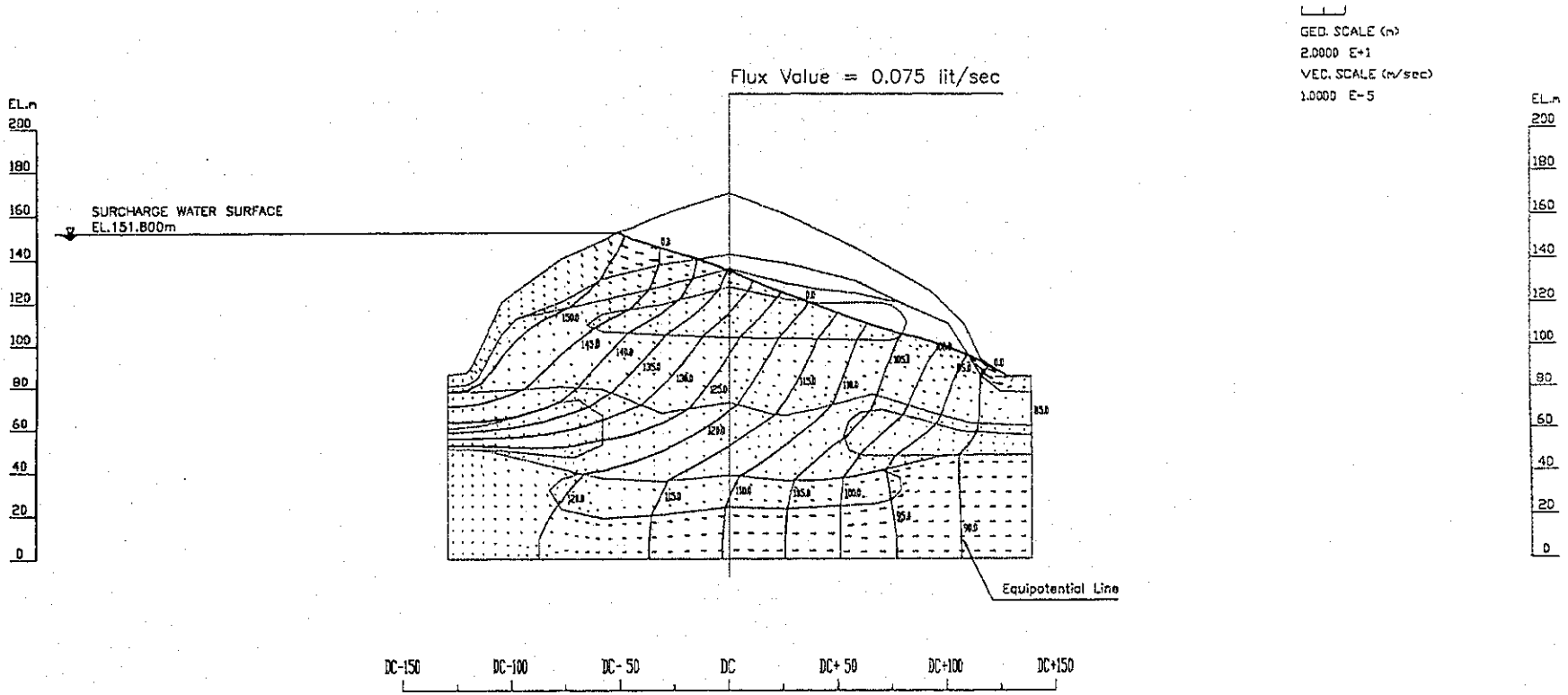
Fig. 7.2.23 (6/8)

RESULTS OF SEEPAGE ANALYSIS (WITHOUT GROUT)

RESULTS OF SEEPAGE ANALYSIS

CASE 1-6
F-F Section, without grout

Escape Gradient Downstream of Impervious Zone	-
Exit Gradient at Downstream River	0.450
Maximum Flow Velocity	3.017x10-6 m/sec



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

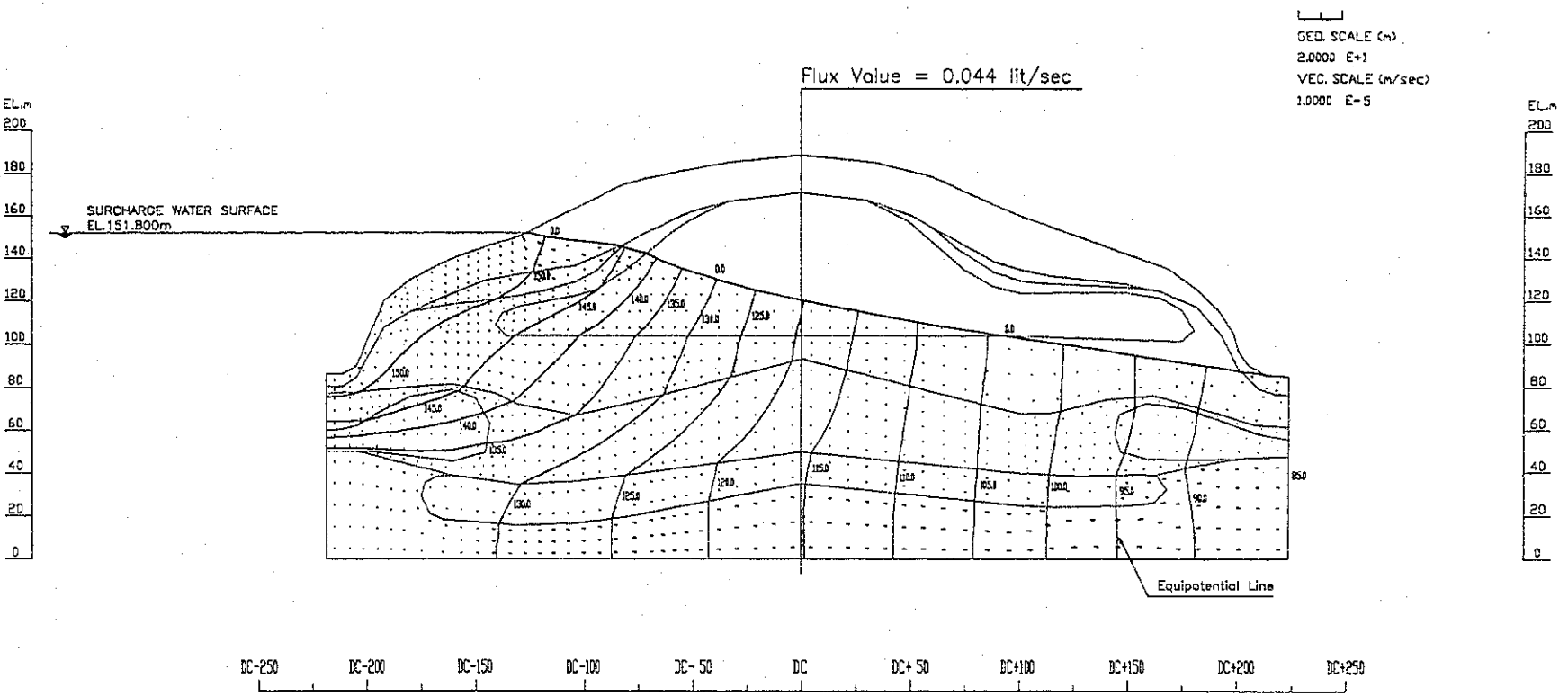
Fig. 7.2.23 (7/8)

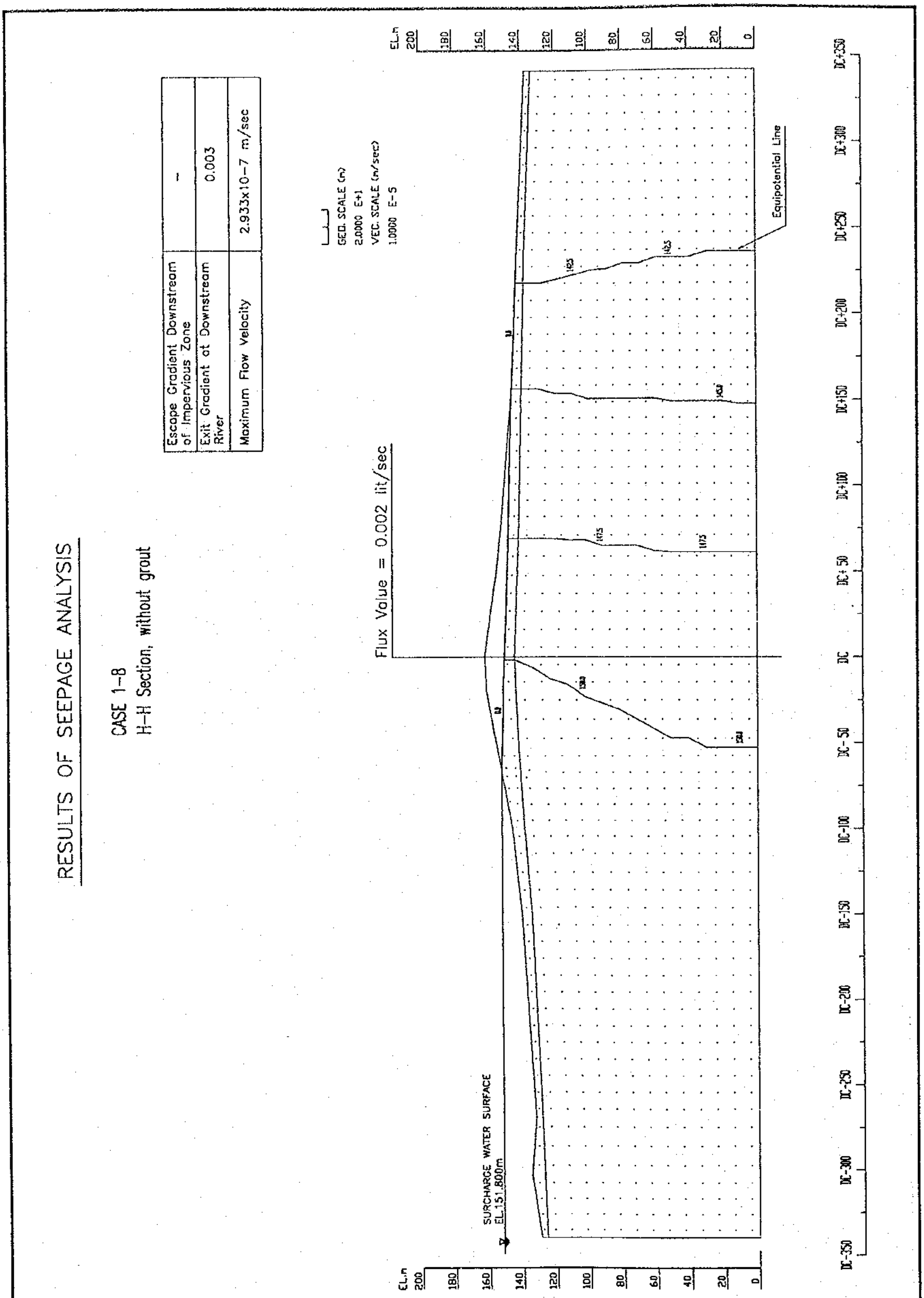
RESULTS OF SEEPAGE ANALYSIS (WITHOUT GROUT)

RESULTS OF SEEPAGE ANALYSIS

CASE 1-7
G-G Section, without grout

Escape Gradient Downstream of Impervious Zone	-
Exit Gradient at Downstream River	0.082
Maximum Flow Velocity	1.099x10-6 m/sec



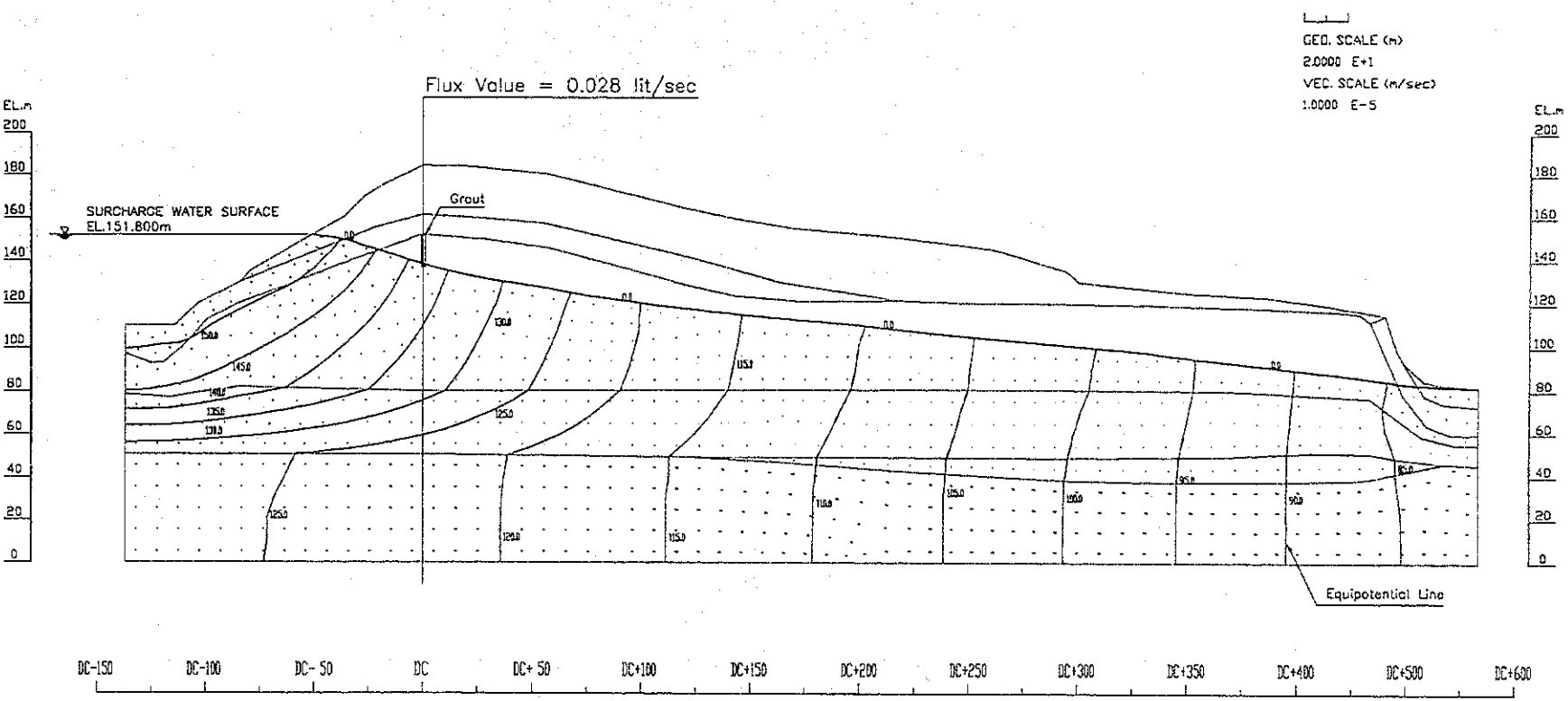


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. **7.2.23 (8/8)**
JAPAN INTERNATIONAL COOPERATION AGENCY	**RESULTS OF SEEPAGE ANALYSIS (WITHOUT GROUT)**

RESULTS OF SEEPAGE ANALYSIS

CASE 2-1
A-A Section, with grout

Escape Gradient Downstream of Impervious Zone	-
Exit Gradient at Downstream River	0.026
Maximum Flow Velocity	8.151x10-7 m/sec



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

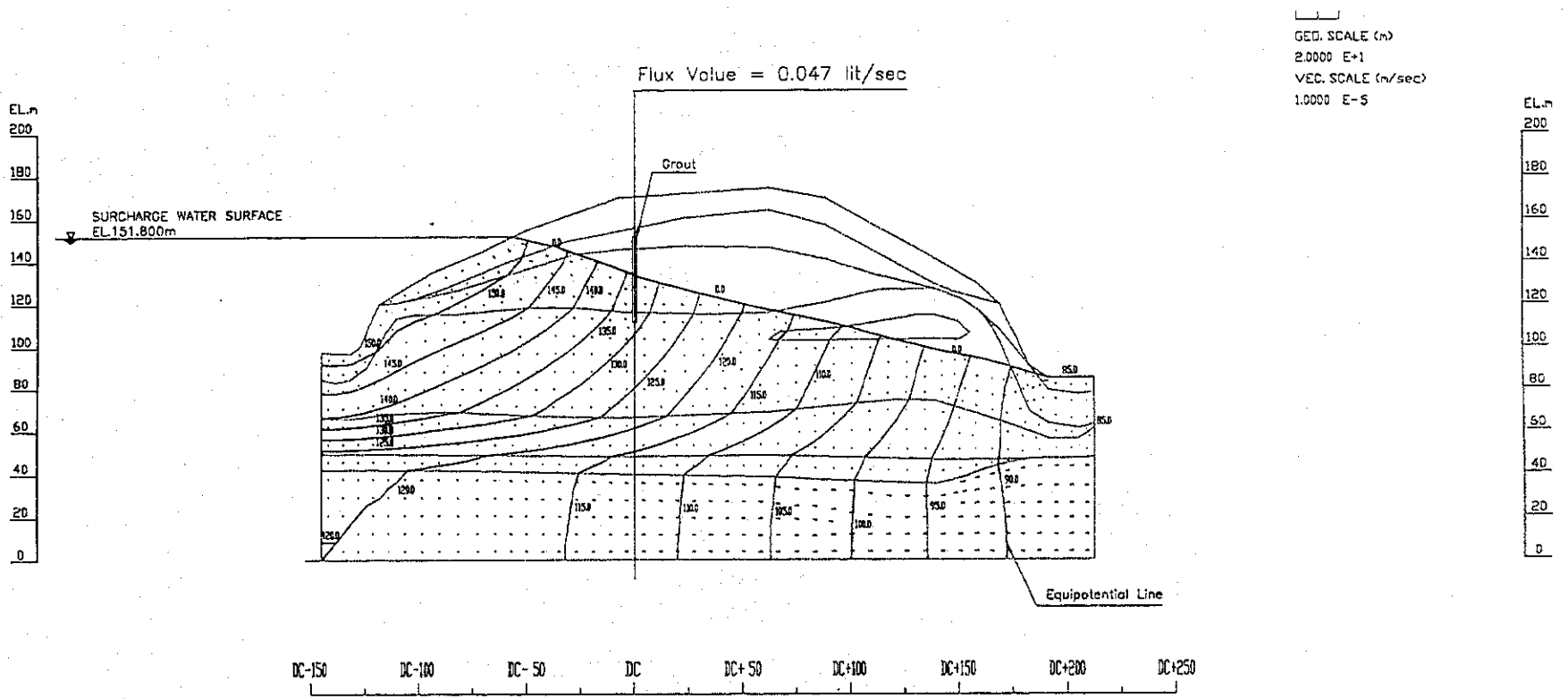
Fig. 7.2.24 (1/7)

RESULTS OF SEEPAGE ANALYSIS (WITH GROUT)

RESULTS OF SEEPAGE ANALYSIS

CASE 2-2
B-B Section, with grout

Escape Gradient Downstream of Impervious Zone	-
Exit Gradient at Downstream River	0.207
Maximum Flow Velocity	1.388x10-6 m/sec



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2.24 (27)

RESULTS OF SEEPAGE ANALYSIS (WITH GROUT)

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2.24 (3/7)

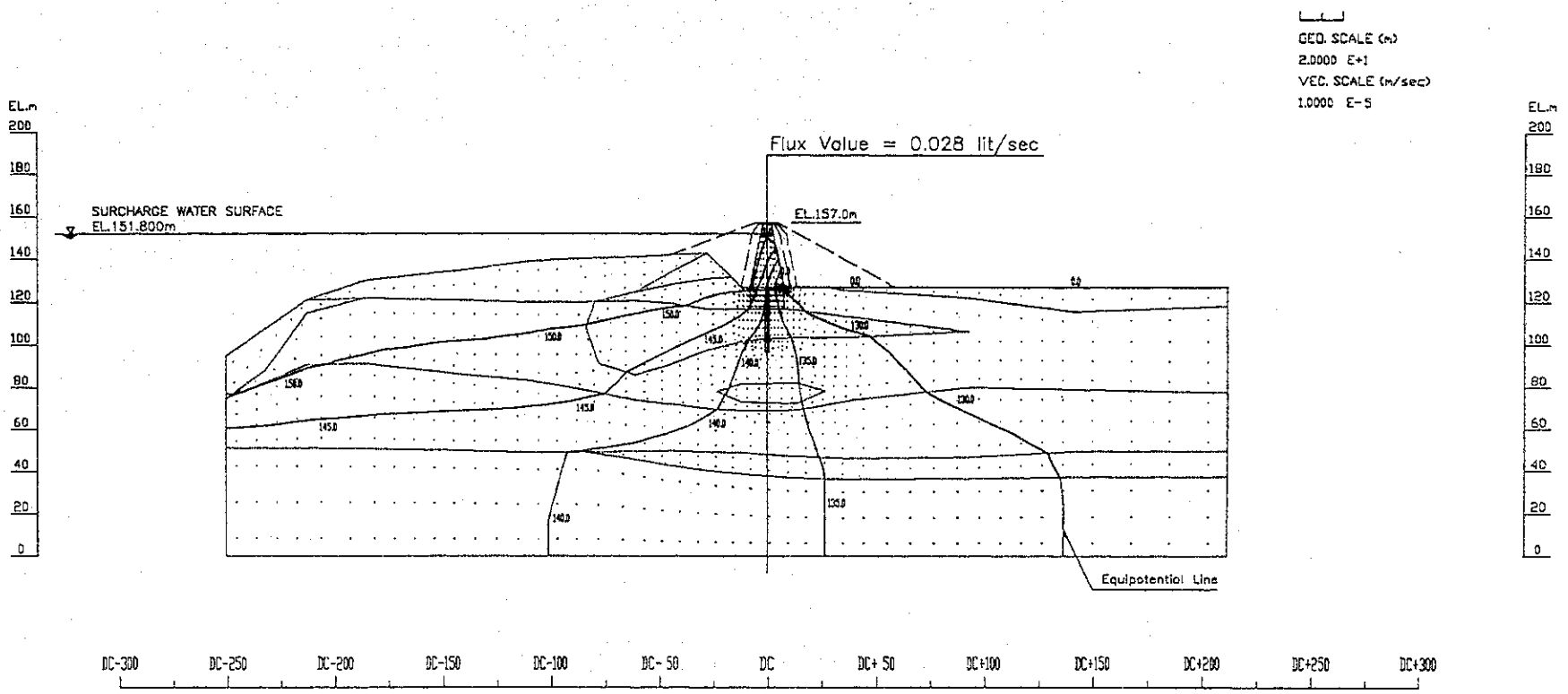
RESULTS OF SEEPAGE ANALYSIS (WITH GROUT)

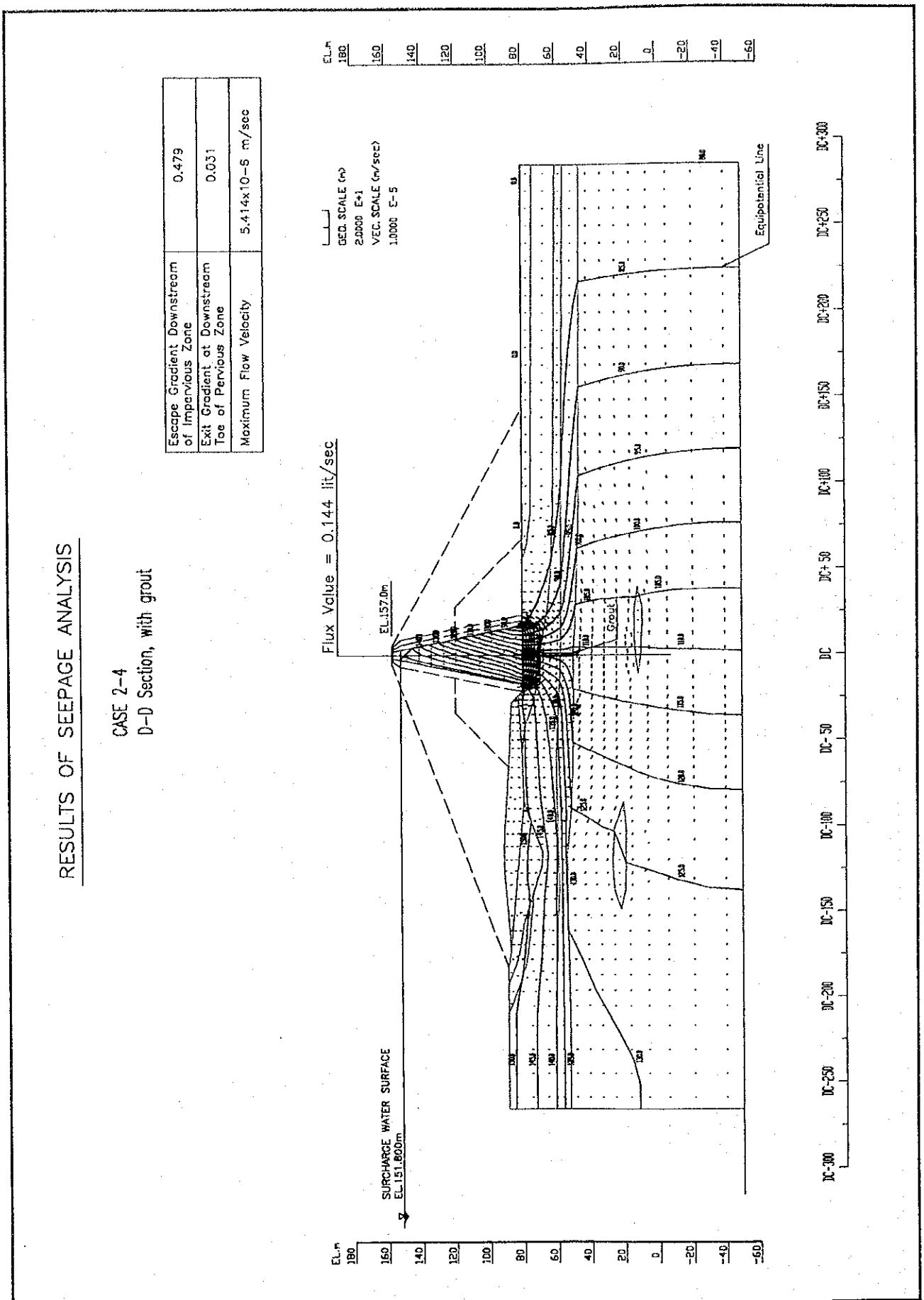
RESULTS OF SEEPAGE ANALYSIS

CASE 2-3

C-C Section, with grout

Escape Gradient Downstream of Impervious Zone	1.972
Exit Gradient at Downstream Toe of Pervious Zone	0.009
Maximum Flow Velocity	1.321x10-6 m/sec



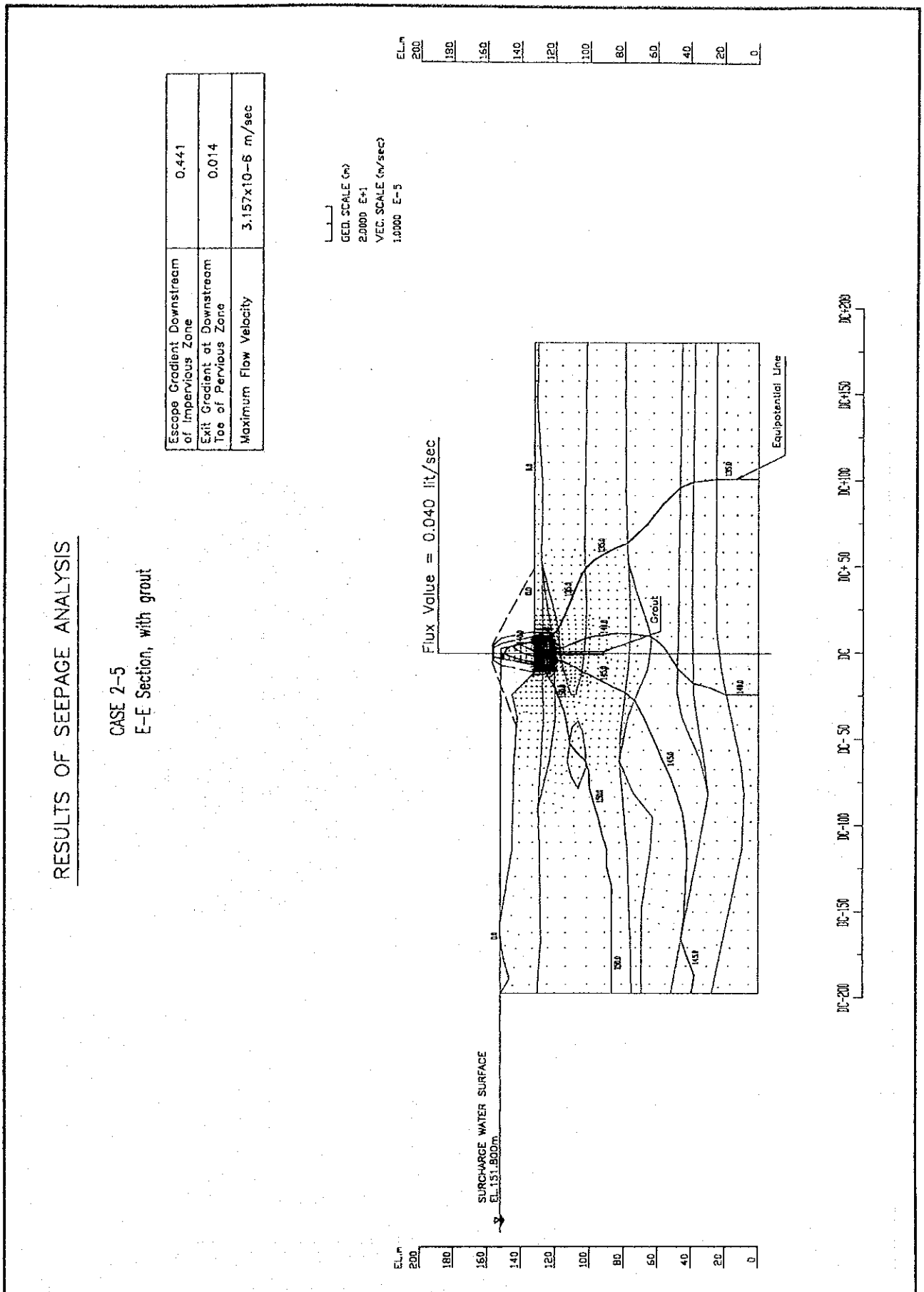


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. **7.2.24 (4/7)**

RESULTS OF SEEPAGE ANALYSIS (WITH GROUT)



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2.24 (5/7)

RESULTS OF SEEPAGE ANALYSIS (WITH GROUT)

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

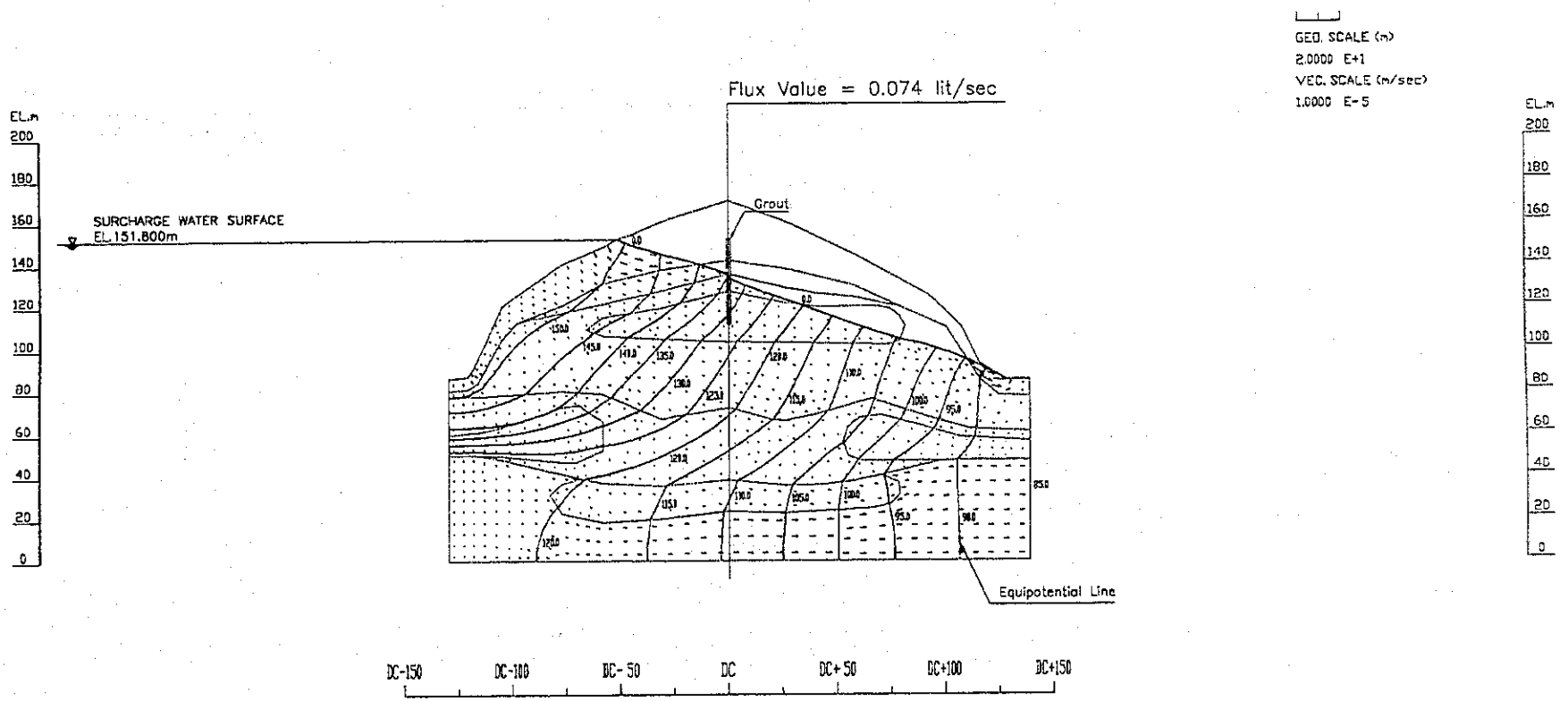
Fig. 7.2.24 (6/7)

RESULTS OF SEEPAGE ANALYSIS (WITH GROUT)

RESULTS OF SEEPAGE ANALYSIS

CASE 2-6
F-F Section, with grout

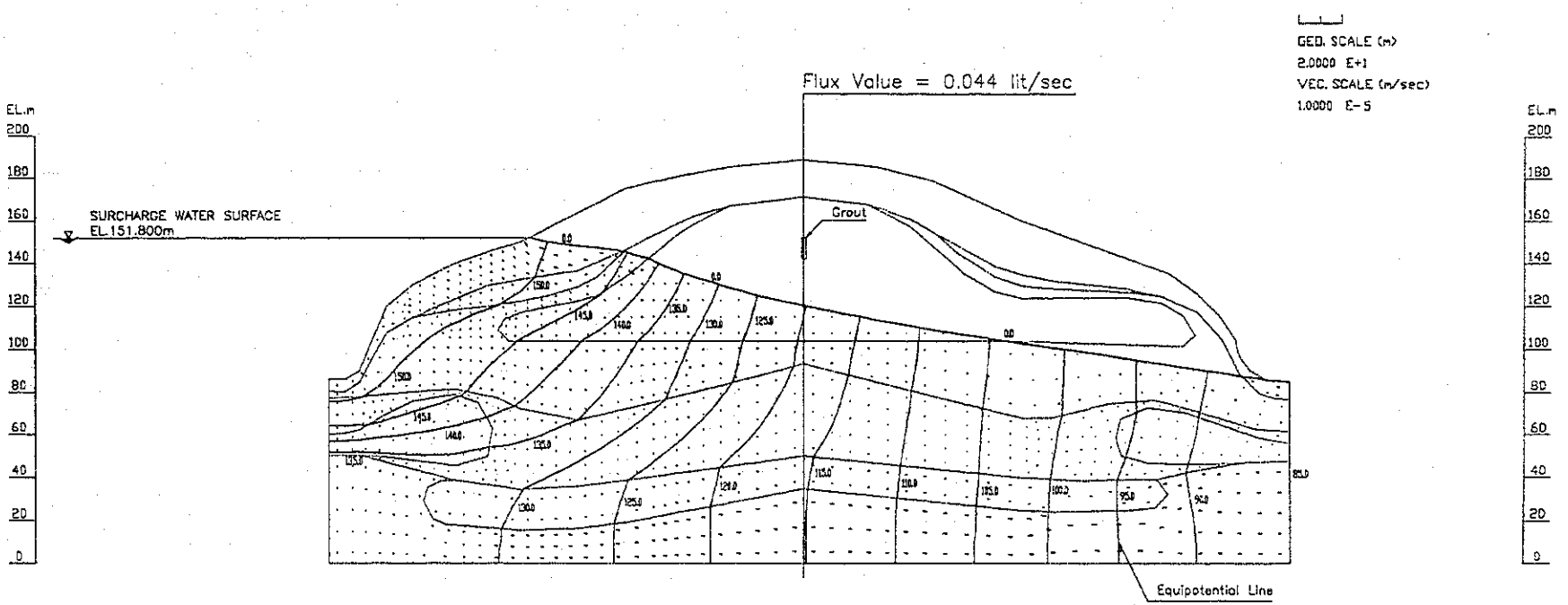
Escape Gradient Downstream of Impervious Zone	-
Exit Gradient at Downstream River	0.437
Maximum Flow Velocity	2.926x10-6 m/sec



RESULTS OF SEEPAGE ANALYSIS

CASE 2-7
G-G Section, with grout

Escape Gradient Downstream of Impervious Zone	-
Exit Gradient at Downstream River	0.082
Maximum Flow Velocity	1.099x10-6 m/sec

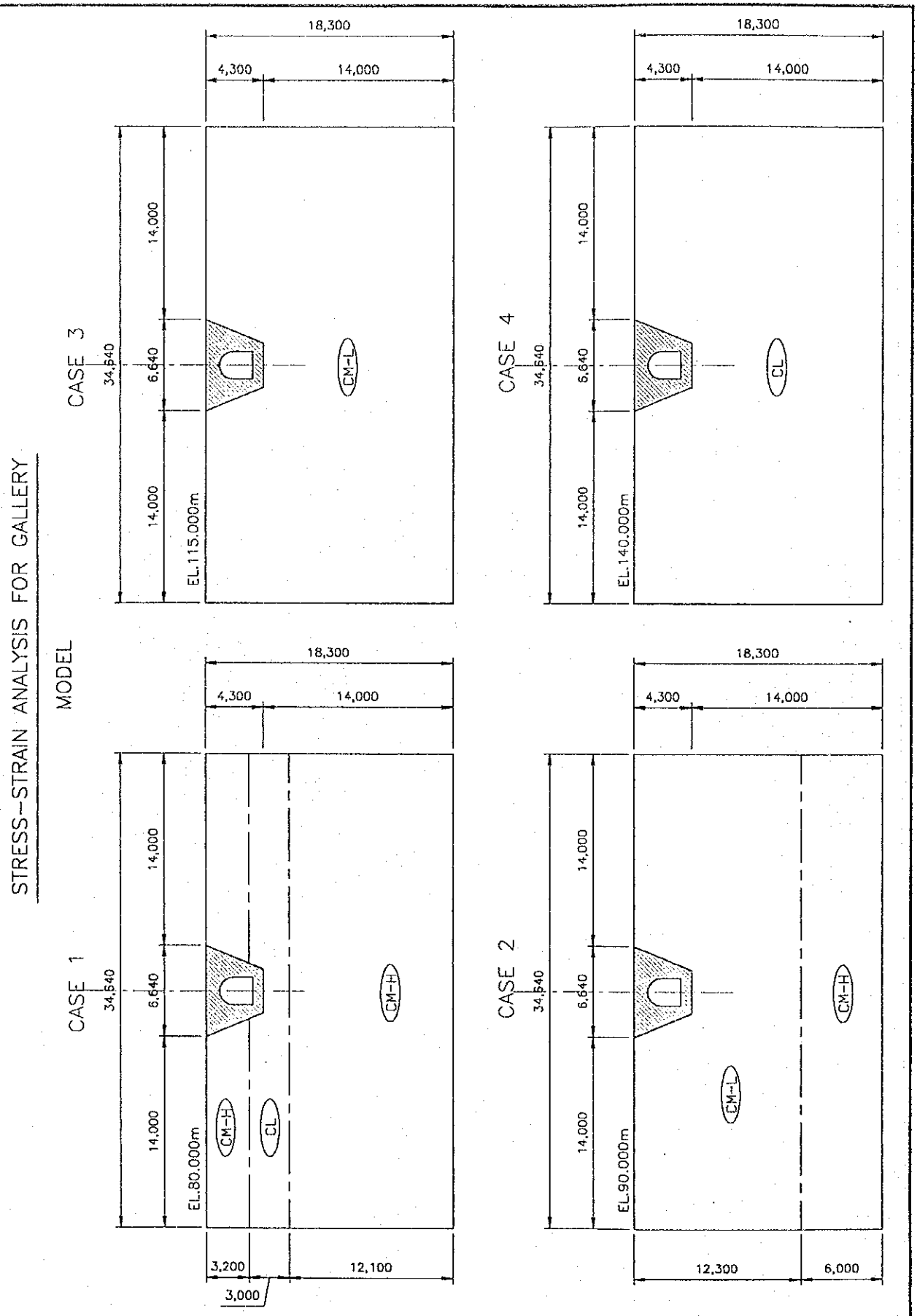


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2.24 (7/7)

RESULTS OF SEEPAGE ANALYSIS (WITH GROUT)



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

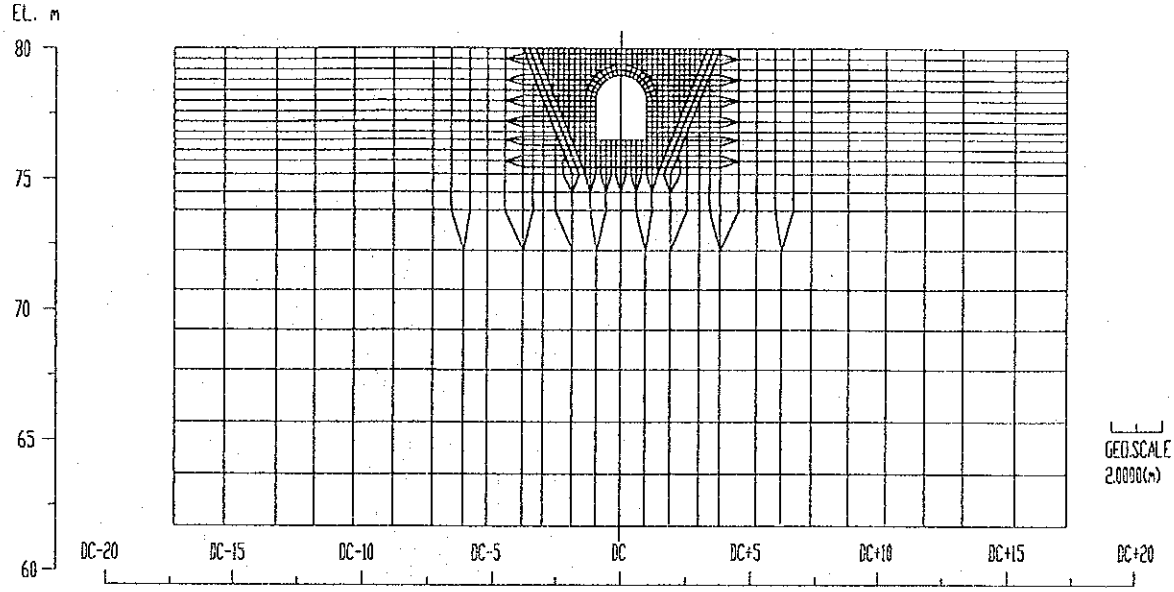
JAPAN INTERNATIONAL COOPERATION AGENCY

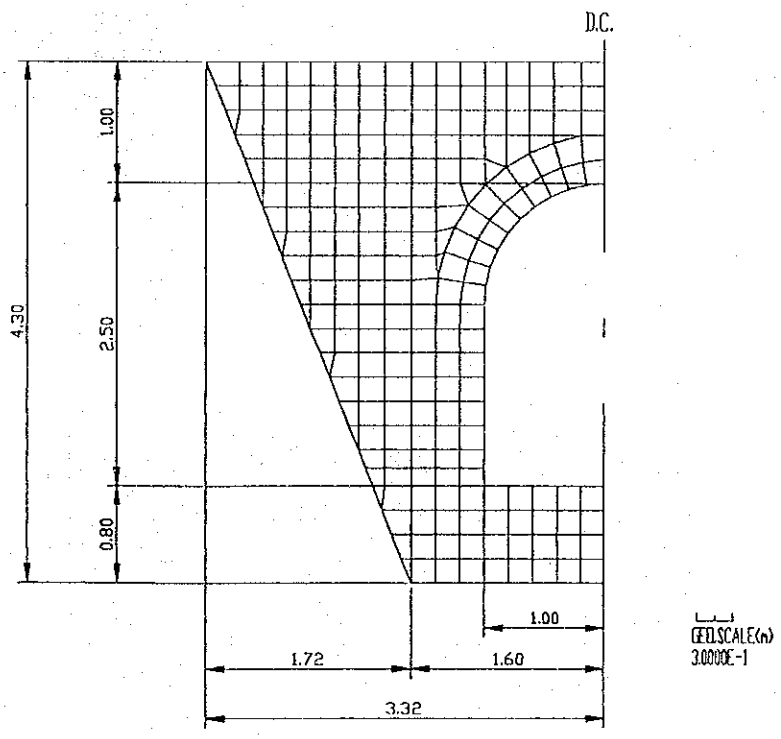
Fig. 7.2.25

SECTION OF STRESS-STRAIN ANALYSIS FOR GALLERY

STRESS-STRAIN ANALYSIS FOR GALLERY

Finite Element Mesh



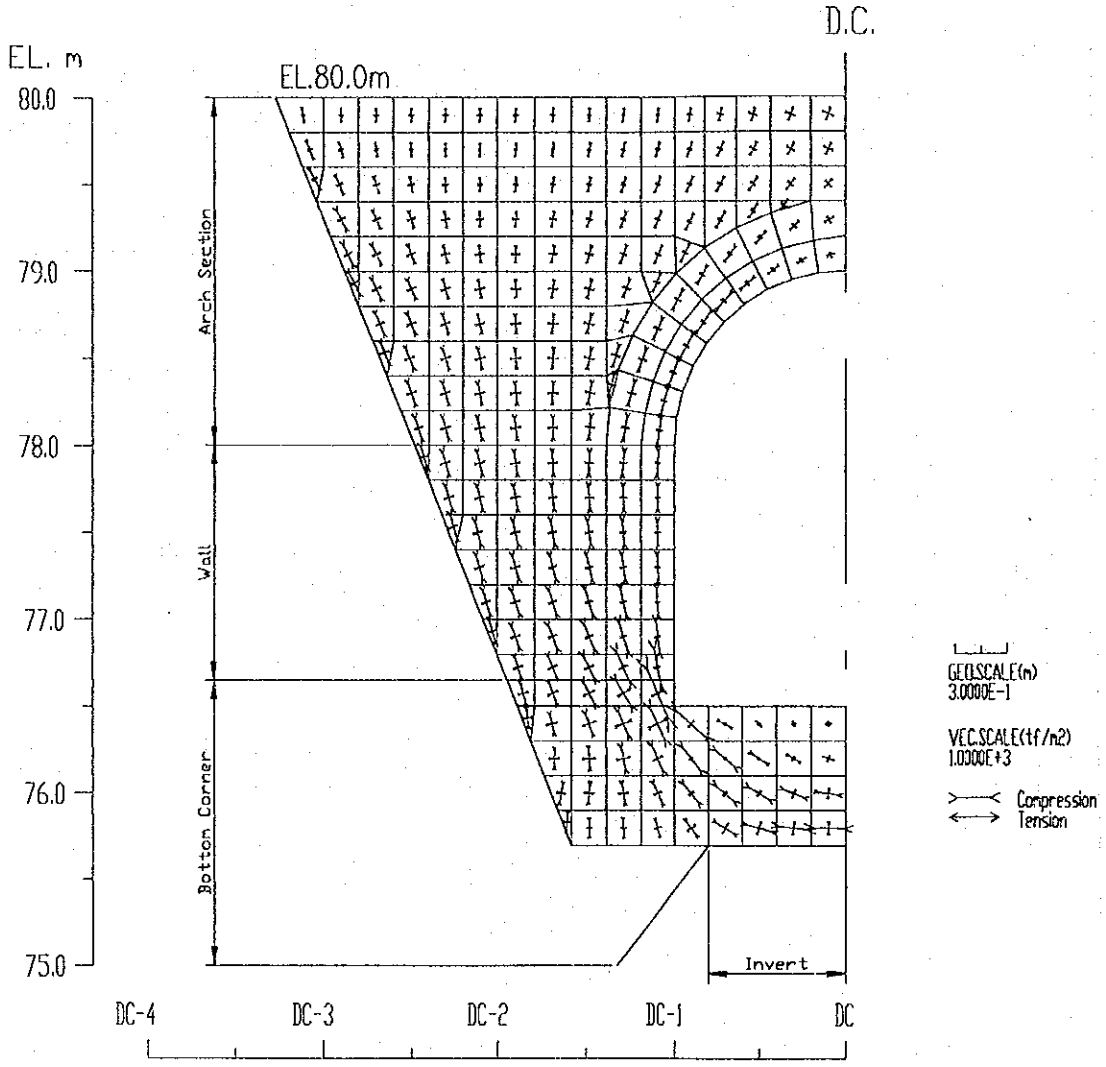


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.2.26 **FINITE ELEMENT MESH OF STRESS-STRAIN ANALYSIS FOR GALLERY**
JAPAN INTERNATIONAL COOPERATION AGENCY	

STRESS-STRAIN ANALYSIS FOR GALLERY

CASE 1 (TOP ELEVATION EL.80.0m)

Principal Stress Vector



Section	Maximum Principal Stress(tf/m2)	
	Compression	Tension
Arch Section	425.9	-121.1
Wall	674.2	-
Bottom Corner	969.6	-8.6
Invert	588.6	-123.9

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

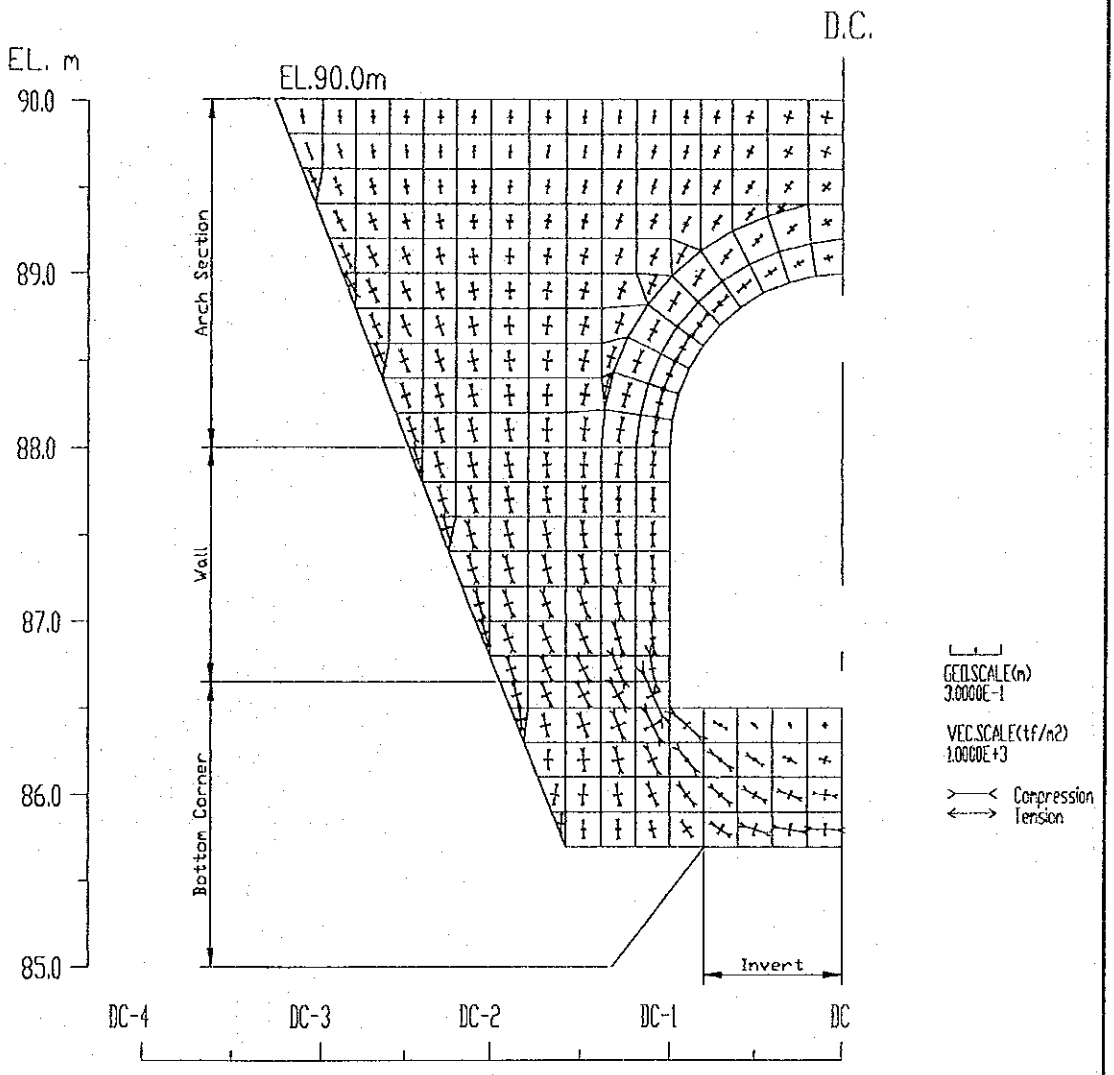
Fig. **7.2.27 (1/4)**

RESULTS OF STRESS-STRAIN ANALYSIS FOR GALLERY (VECTORS)

STRESS-STRAIN ANALYSIS FOR GALLERY

CASE 2 (TOP ELEVATION EL.90.0m)

Principal Stress Vector



Section	Maximum Principal Stress(tf/m2)	
	Compression	Tension
Arch Section	372.0	-112.4
Wall	578.2	-
Bottom Corner	837.2	-1.9
Invert	480.5	-88.6

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

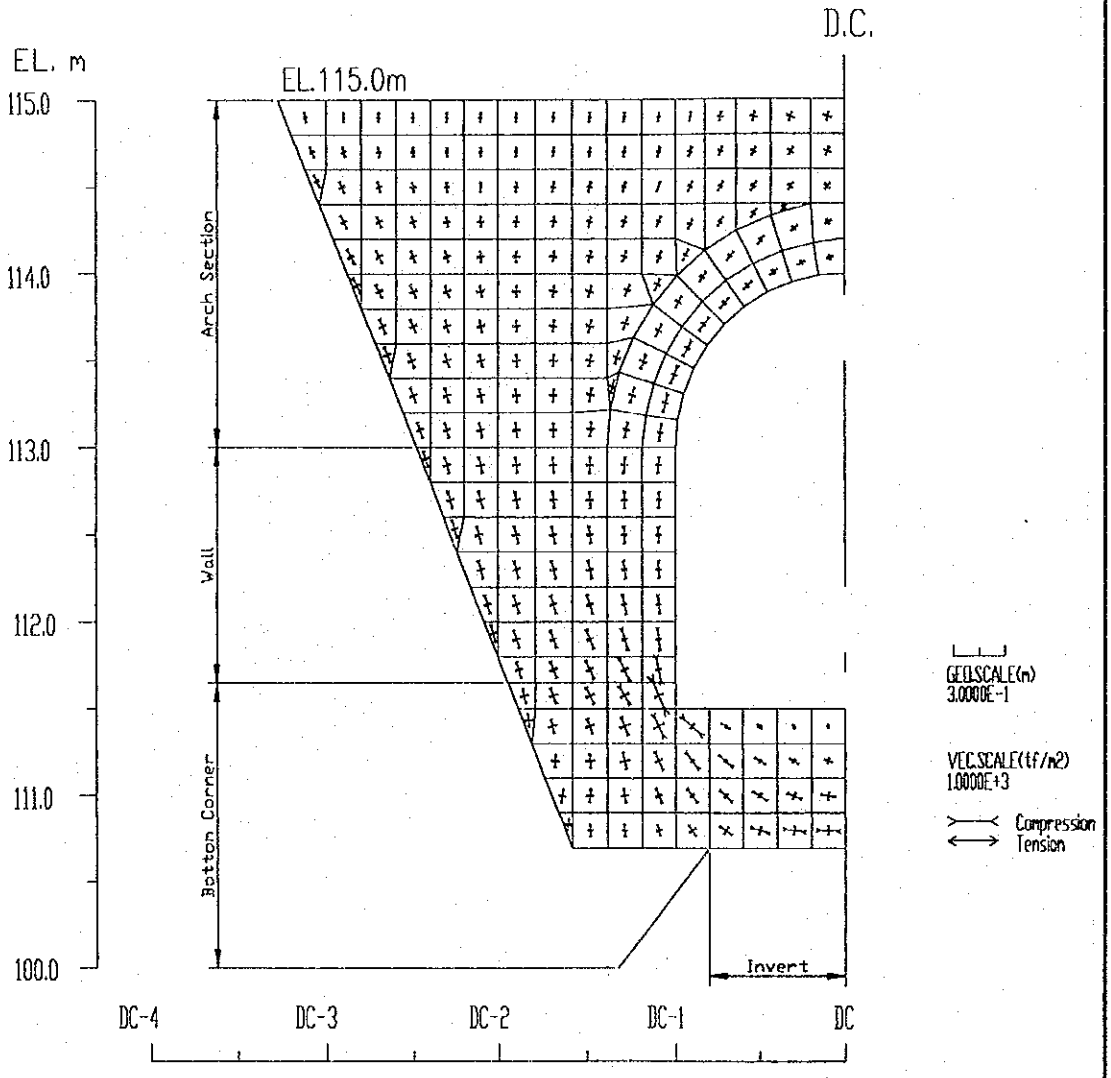
Fig. **7.2.27 (2/4)**

RESULTS OF STRESS-STRAIN ANALYSIS FOR GALLERY (VECTORS)

STRESS-STRAIN ANALYSIS FOR GALLERY

CASE 3 (TOP ELEVATION EL.115.0m)

Principal Stress Vector



Section	Maximum Principal Stress(tf/m2)	
	Compression	Tension
Arch Section	235.8	-68.7
Wall	366.5	-
Bottom Corner	529.1	-1.7
Invert	302.4	-57.4

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

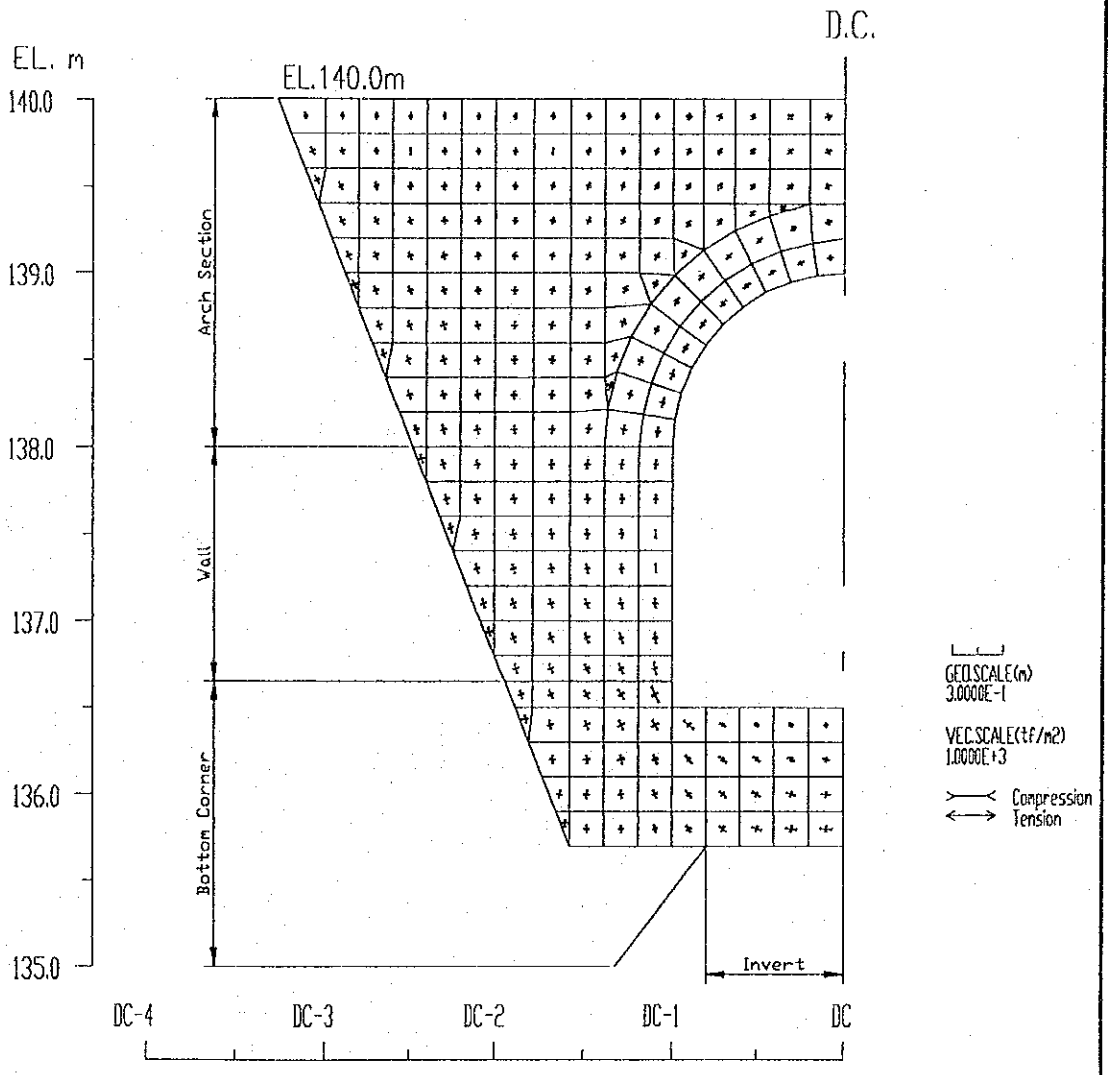
Fig. **7.2.27 (3/4)**

RESULTS OF STRESS-STRAIN ANALYSIS FOR GALLERY (VECTORS)

STRESS-STRAIN ANALYSIS FOR GALLERY

CASE 4 (TOP ELEVATION EL.140.0m)

Principal Stress Vector



Section	Maximum Principal Stress(tf/m2)	
	Compression	Tension
Arch Section	96.0	-18.9
Wall	150.4	-
Bottom Corner	222.3	-2.4
Invert	131.8	-18.6

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

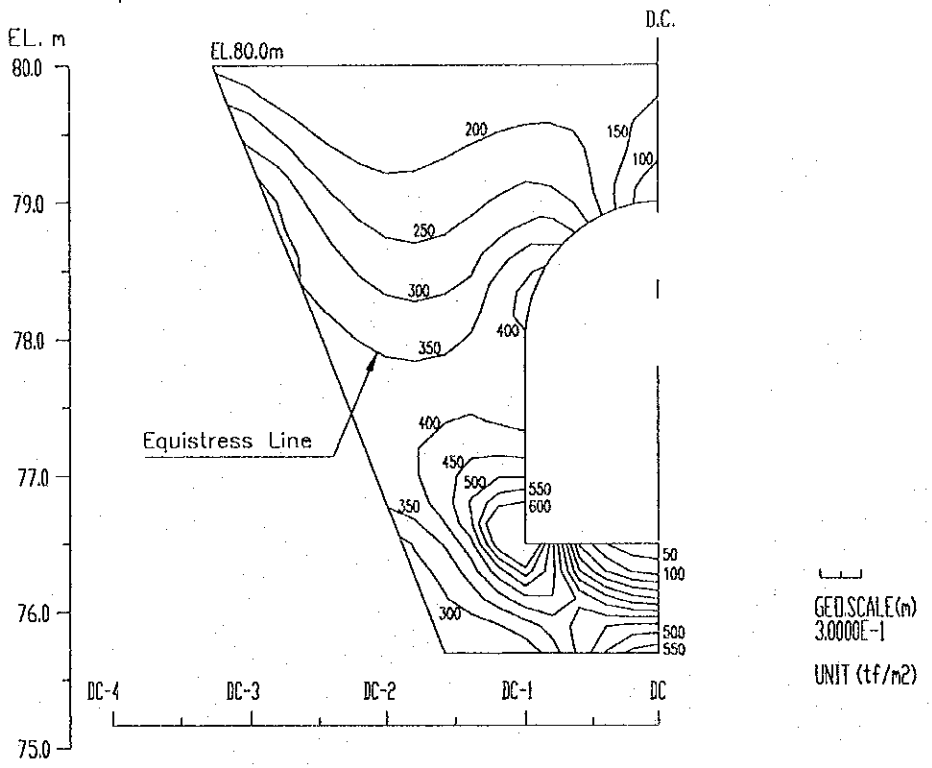
Fig. 7.2.27 (4/4)

RESULTS OF STRESS-STRAIN ANALYSIS FOR GALLERY (VECTORS)

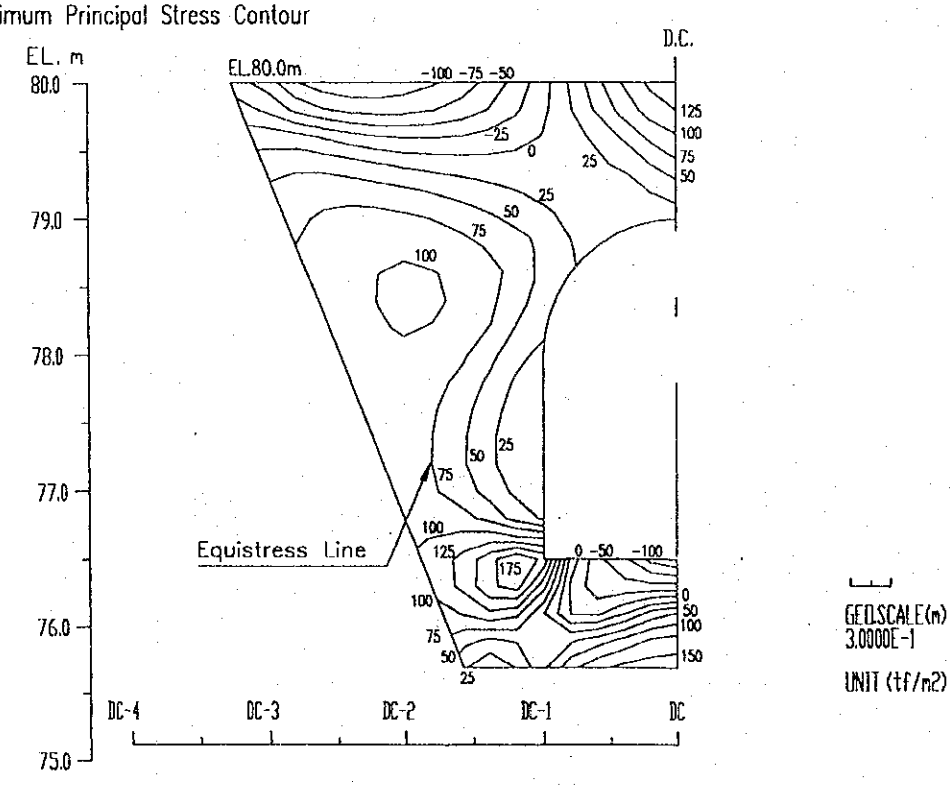
STRESS-STRAIN ANALYSIS FOR GALLERY

CASE 1 (TOP ELEVATION EL.80.0m)

Maximum Principal Stress Contour



Minimum Principal Stress Contour



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

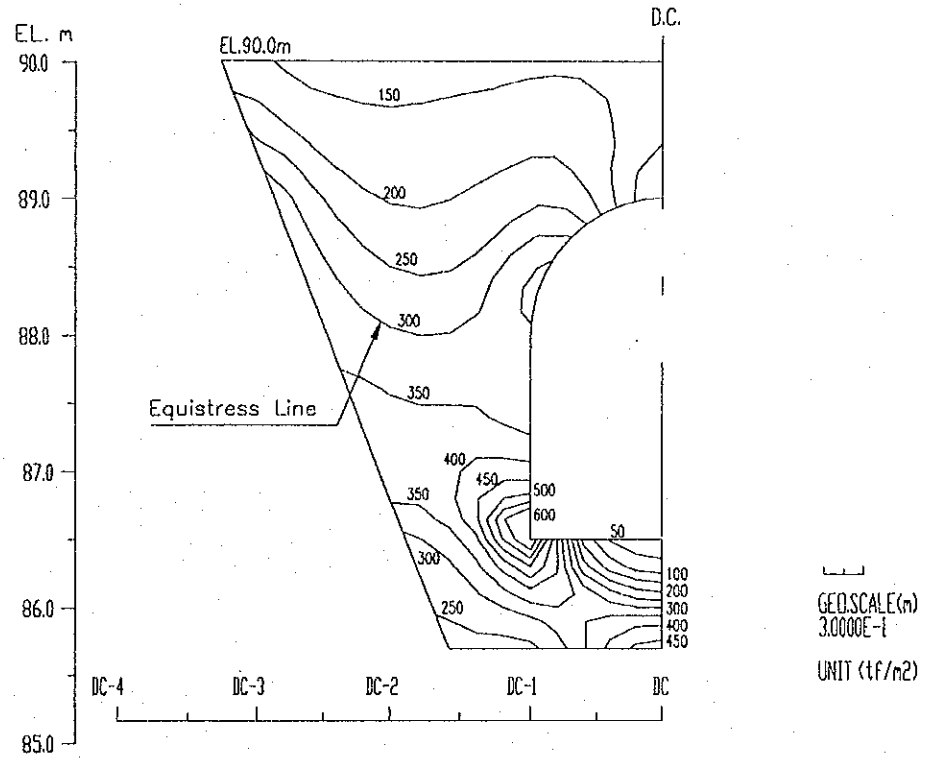
Fig. 7.2.28 (1/4)

RESULTS OF STRESS-STRAIN ANALYSIS FOR GALLERY (CONTOURS)

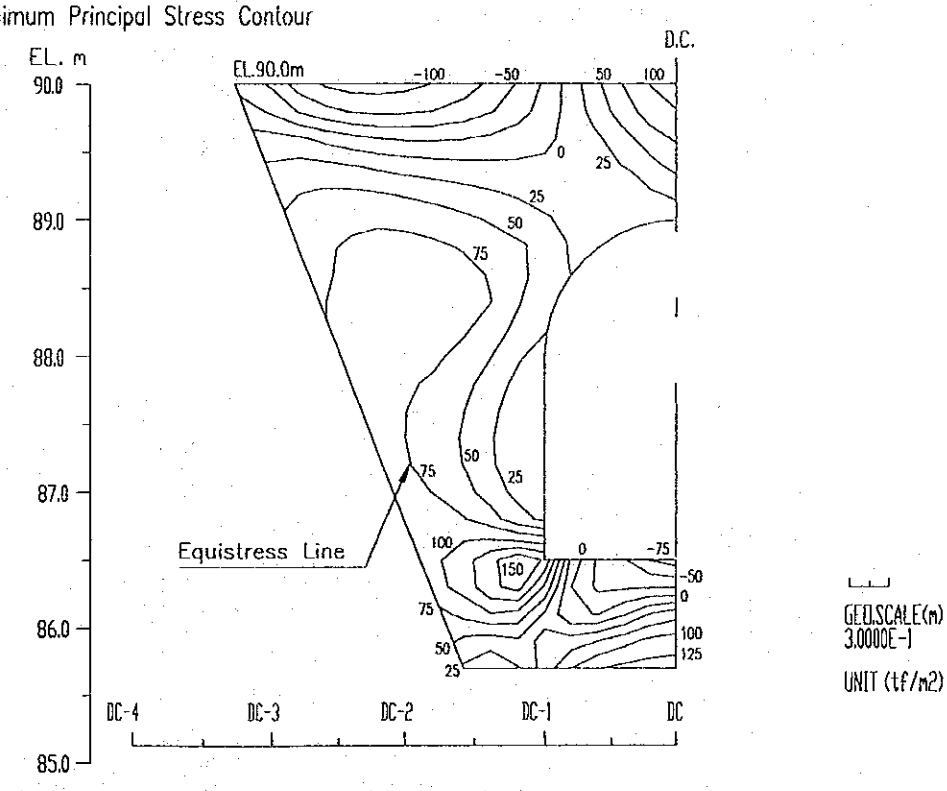
STRESS-STRAIN ANALYSIS FOR GALLERY

CASE 2 (TOP ELEVATION EL.90.0m)

Maximum Principal Stress Contour



Minimum Principal Stress Contour

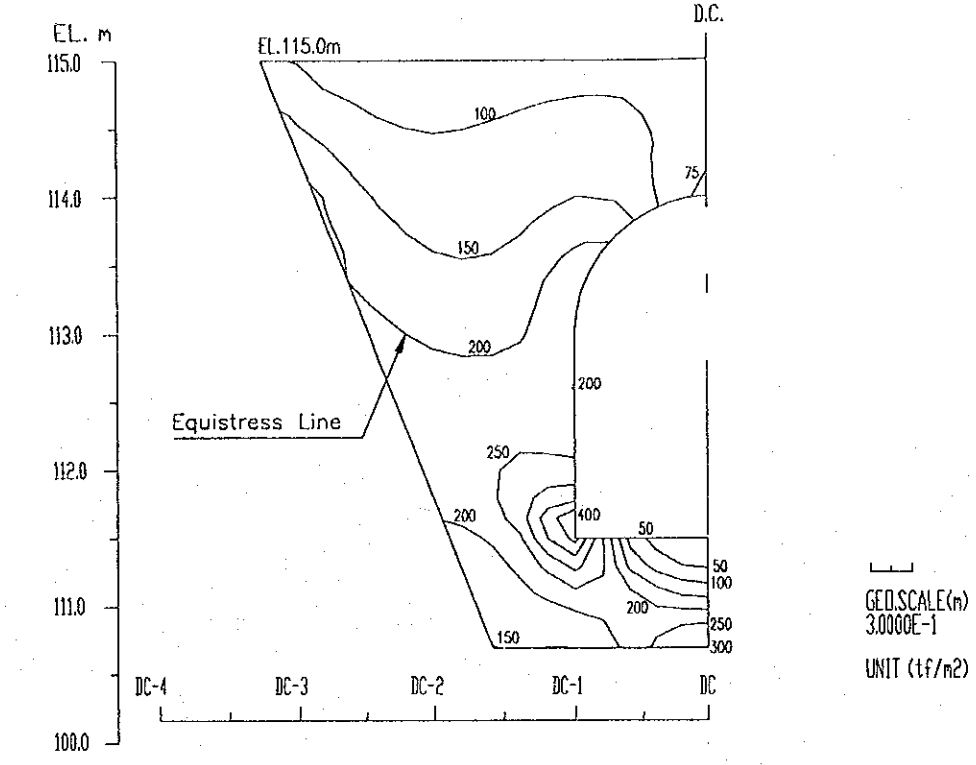


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.2.28 (2/4)
JAPAN INTERNATIONAL COOPERATION AGENCY	**RESULTS OF STRESS-STRAIN ANALYSIS FOR GALLERY (CONTOURS)**

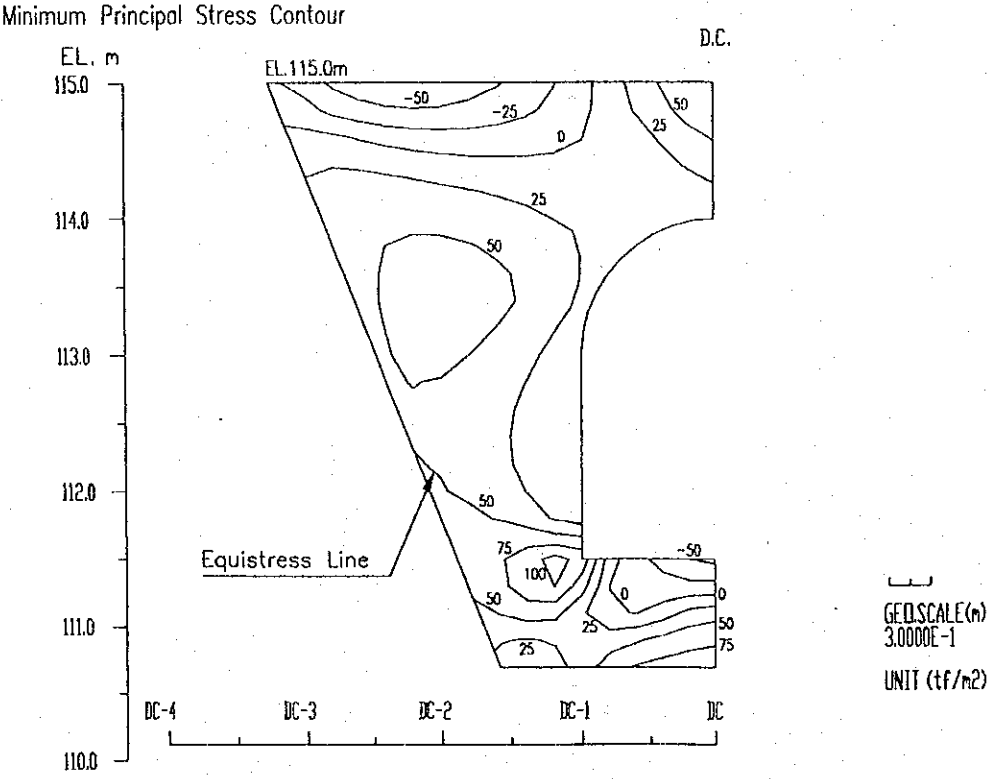
STRESS-STRAIN ANALYSIS FOR GALLERY

CASE 3 (TOP ELEVATION EL.115.0m)

Maximum Principal Stress Contour



Minimum Principal Stress Contour

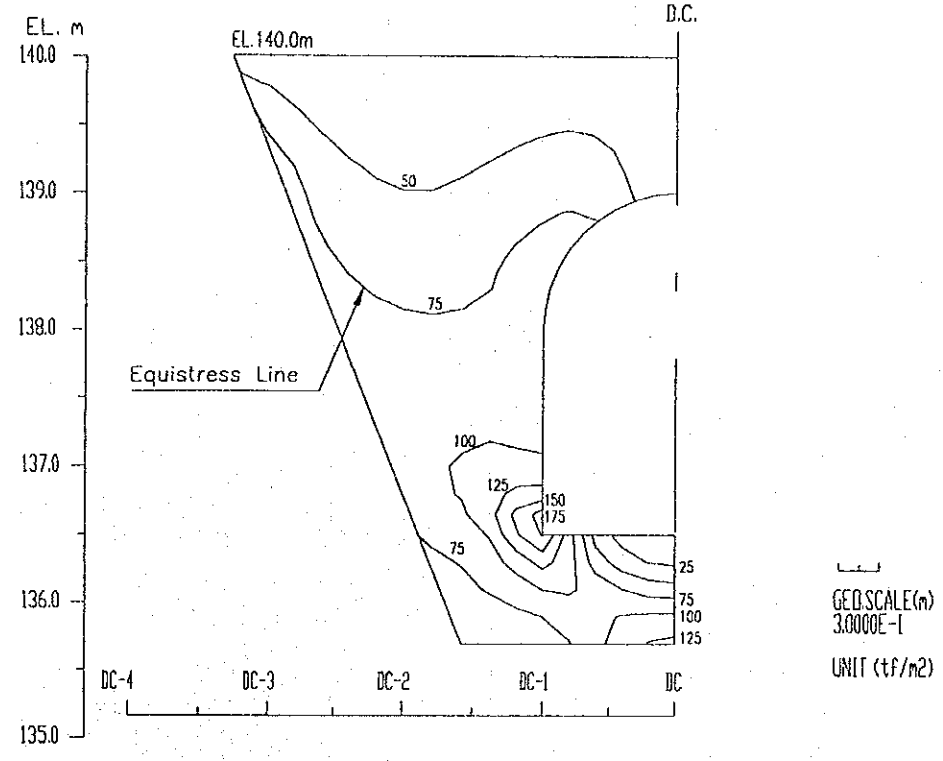


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. **7.2.28 (3/4)**
JAPAN INTERNATIONAL COOPERATION AGENCY	**RESULTS OF STRESS-STRAIN ANALYSIS FOR GALLERY (CONTOURS)**

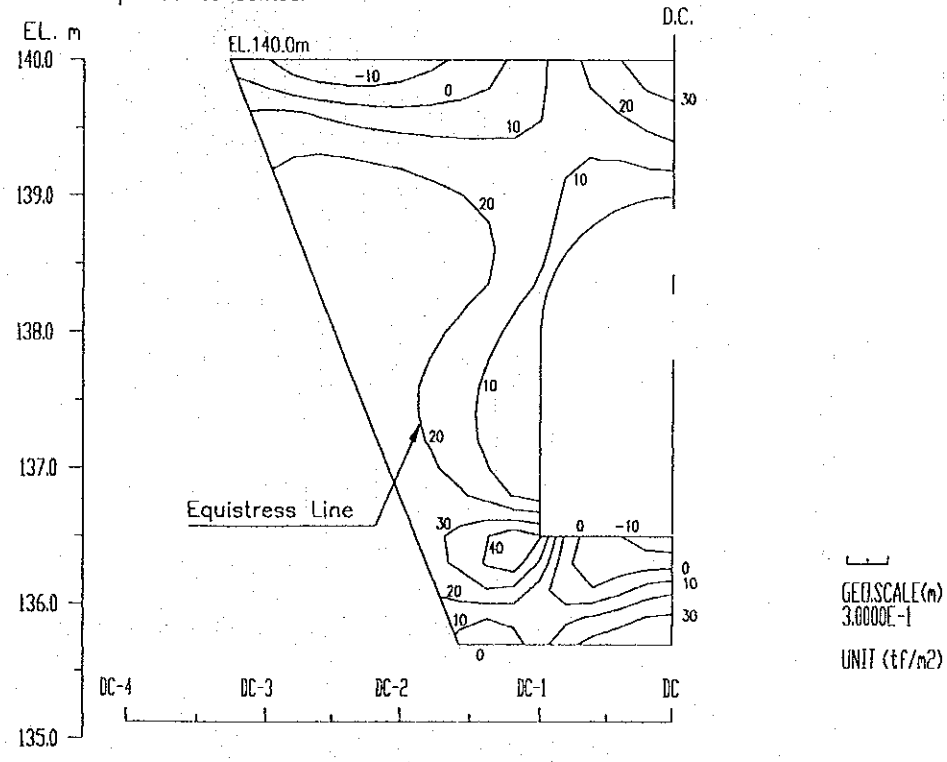
STRESS-STRAIN ANALYSIS FOR GALLERY

CASE 4 (TOP ELEVATION EL.140.0m)

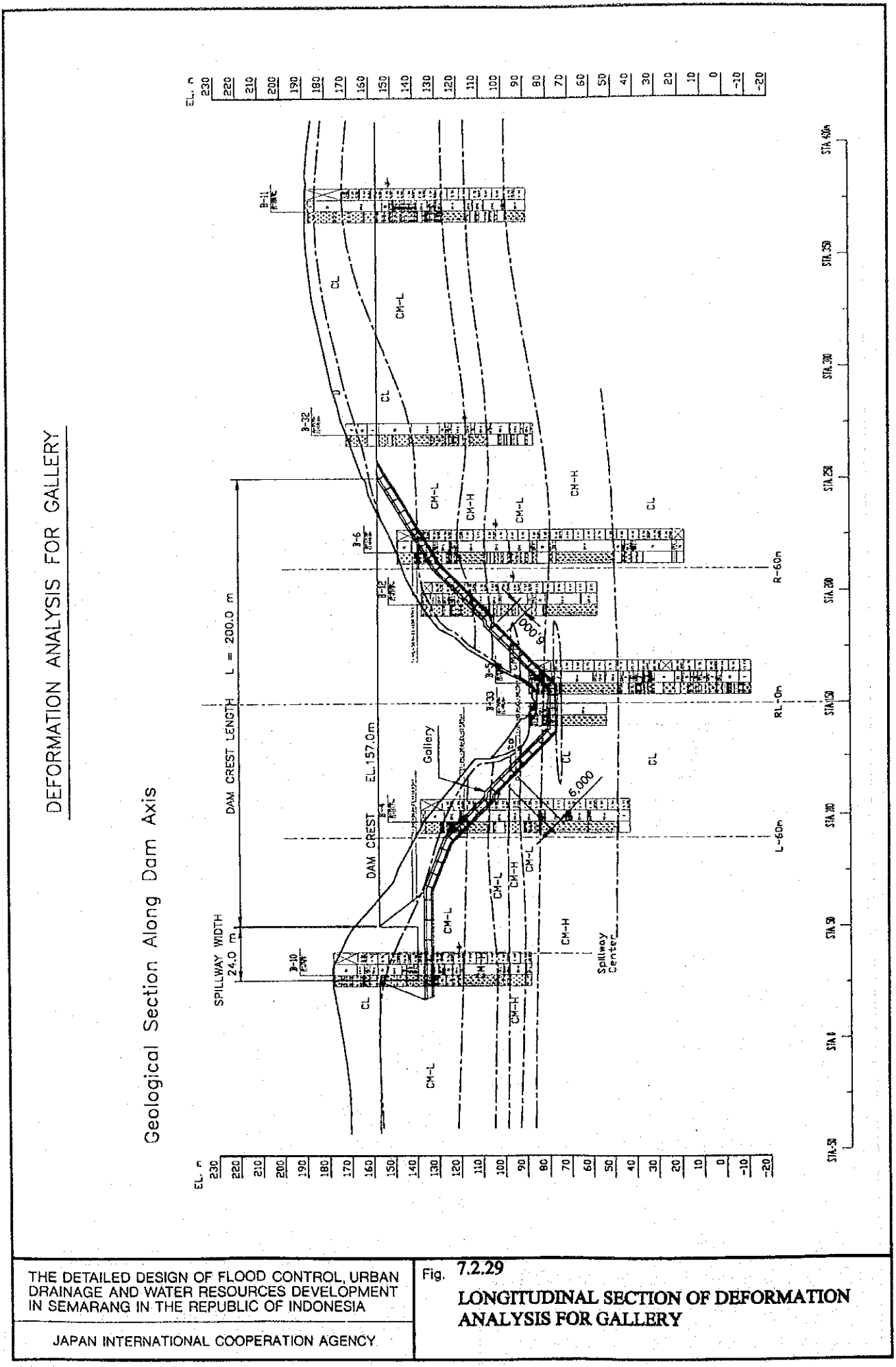
Maximum Principal Stress Contour



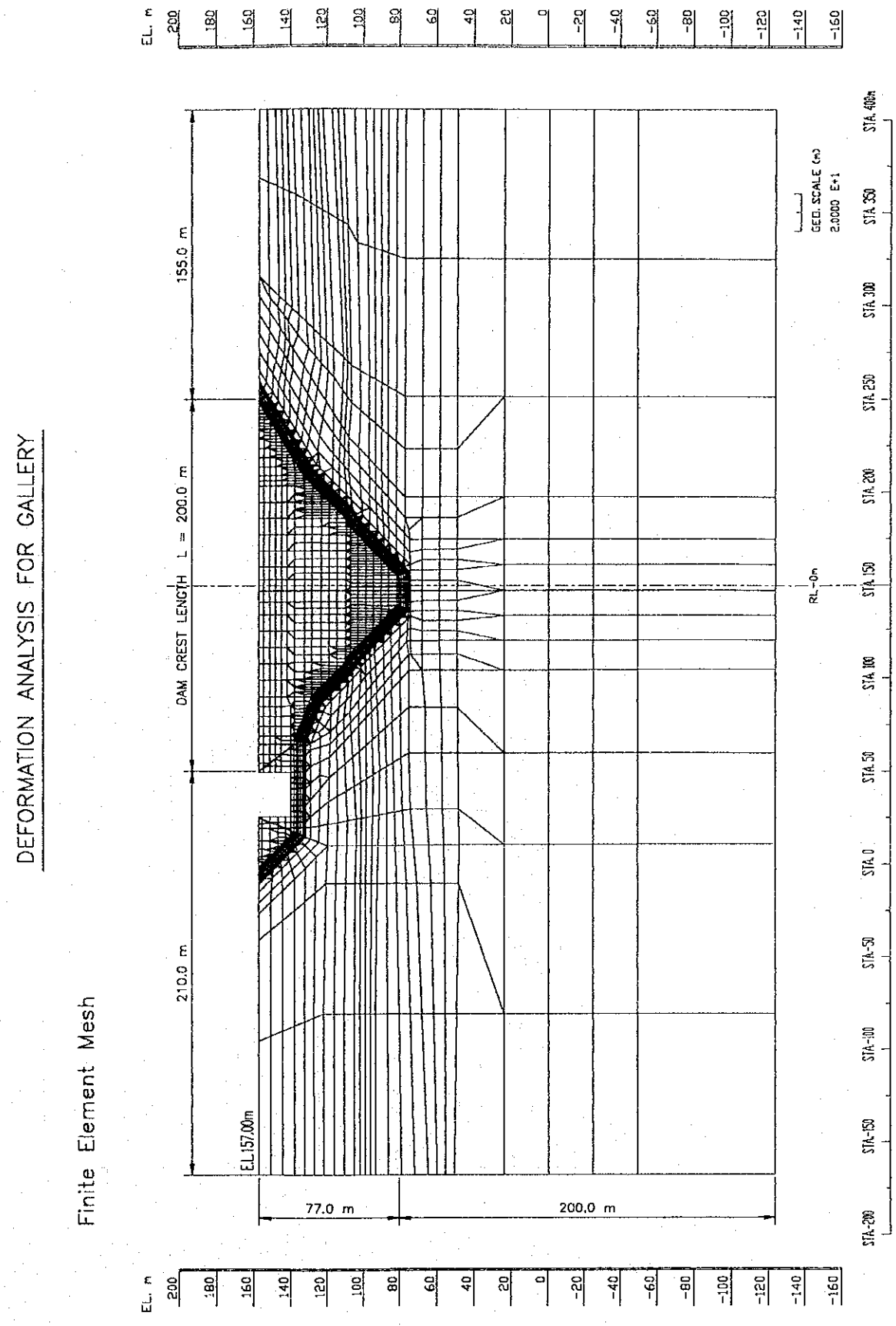
Minimum Principal Stress Contour



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.2.28 (4/4)
JAPAN INTERNATIONAL COOPERATION AGENCY	**RESULTS OF STRESS-STRAIN ANALYSIS FOR GALLERY (CONTOURS)**



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.2.29 LONGITUDINAL SECTION OF DEFORMATION ANALYSIS FOR GALLERY
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2.30

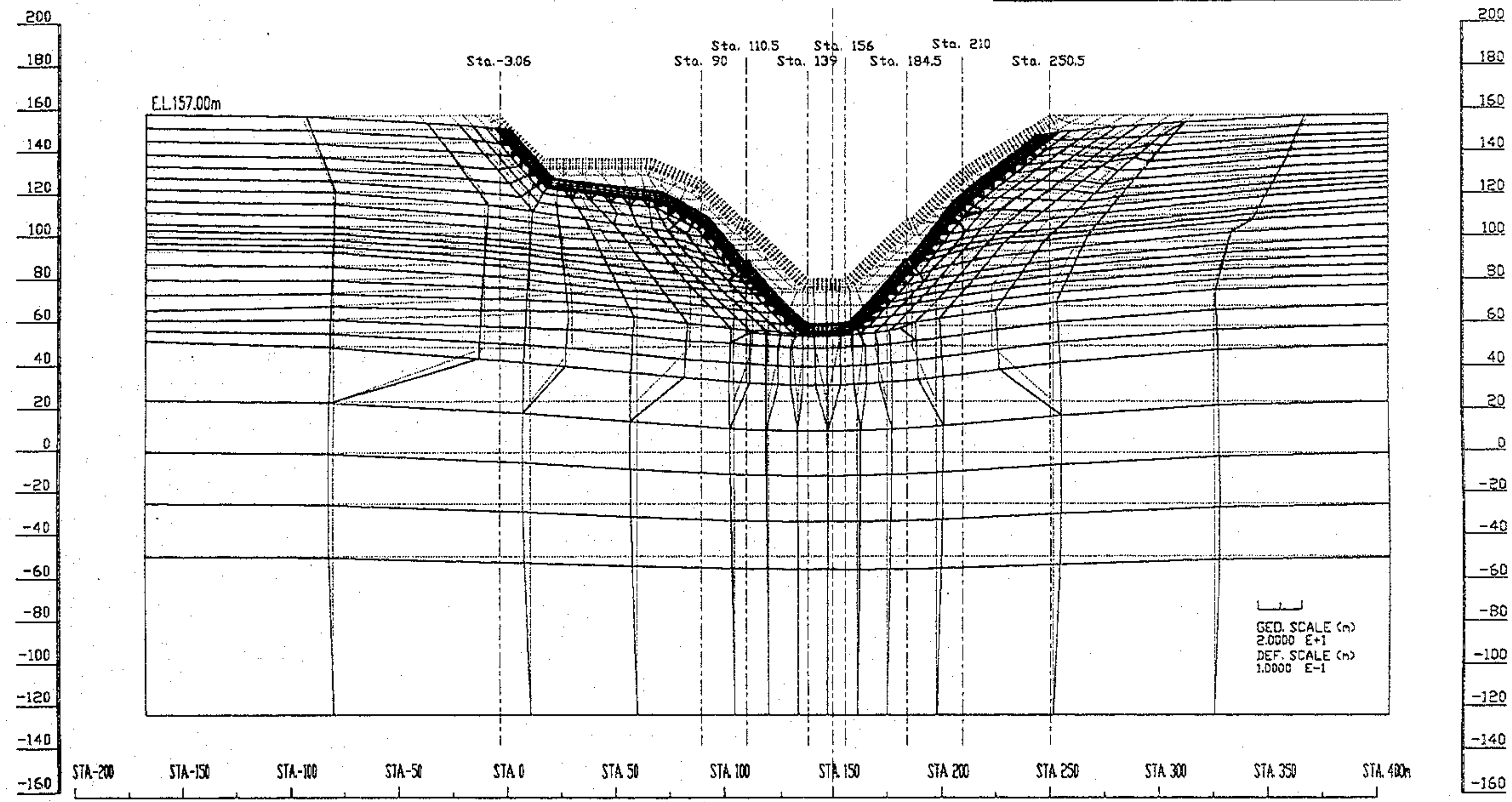
FINITE ELEMENT MESH OF DEFORMATION ANALYSIS FOR GALLERY

DEFORMATION ANALYSIS FOR GALLERY

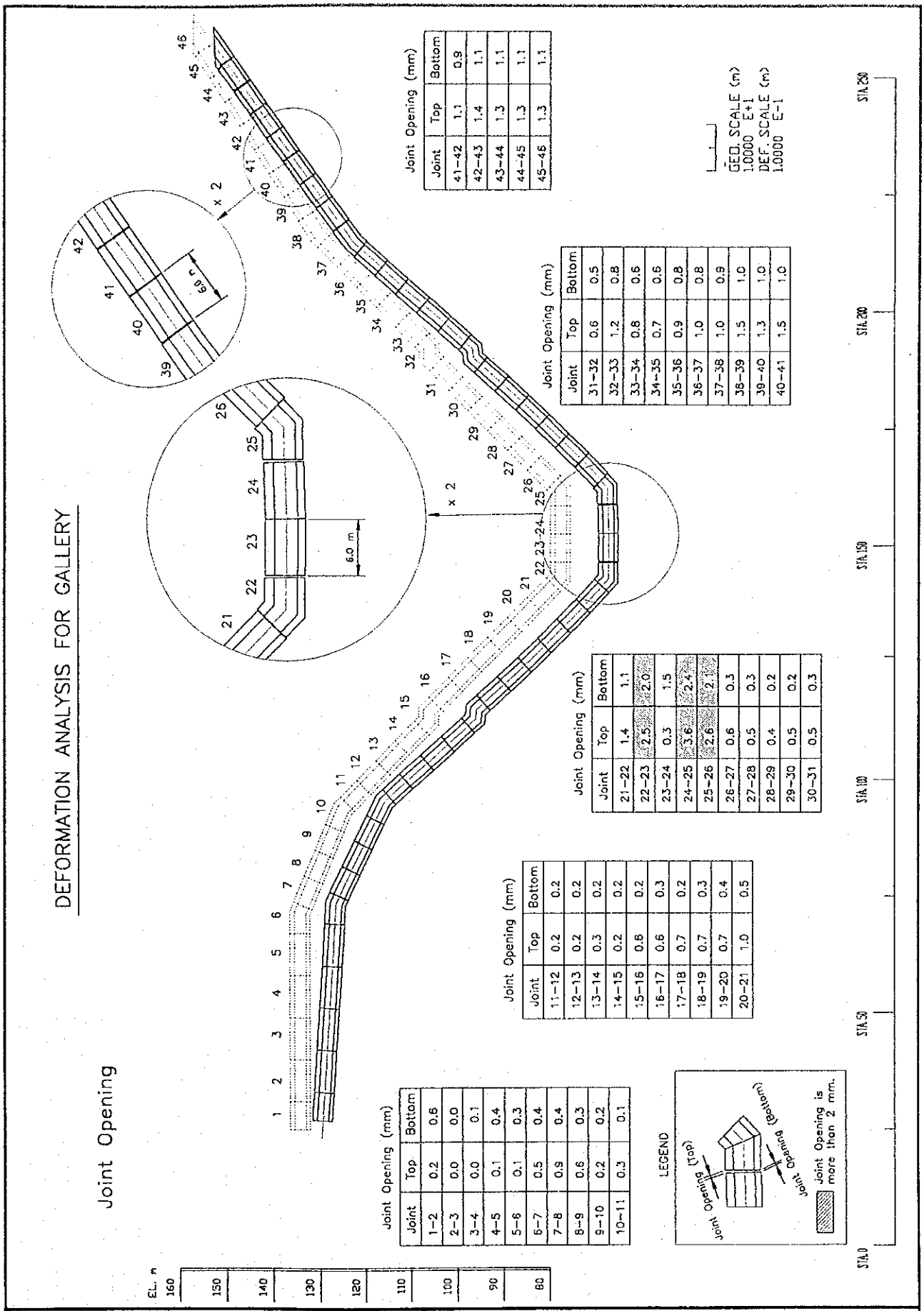
Deformation

Displacement (cm)

Location		Elevation	Vertical	Horizontal
Left Abutment	Sta.-3.06	EL.157.0m	3.47	2.29
	Sta. 90	EL.127.0m	9.20	1.74
	Sta. 110.5	EL.108.5m	10.36	0.56
	Sta. 139	EL.80.0m	10.50	-0.22
Right Abutment	Sta. 156	EL.80.0m	10.27	-0.43
	Sta. 184.5	EL.108.5m	9.70	0.55
	Sta. 210	EL.132.0m	7.80	2.08
	Sta. 250.5	EL.157.0m	4.71	2.79



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. **7.2.31**
JAPAN INTERNATIONAL COOPERATION AGENCY	**RESULTS OF DEFORMATION ANALYSIS FOR GALLERY (DISPLACEMENT)**



Joint	Top	Bottom
1–2	0.2	0.6
2–3	0.0	0.0
3–4	0.0	0.1
4–5	0.1	0.4
5–6	0.1	0.3
6–7	0.5	0.4
7–8	0.9	0.4
8–9	0.6	0.3
9–10	0.2	0.2
10–11	0.3	0.1

Joint Opening (mm)

Joint	Top	Bottom
11–12	0.2	0.2
12–13	0.2	0.2
13–14	0.3	0.2
14–15	0.2	0.2
15–16	0.6	0.2
16–17	0.6	0.3
17–18	0.7	0.2
18–19	0.7	0.3
19–20	0.7	0.4
20–21	1.0	0.5

Joint Opening (mm)

Joint	Top	Bottom
21–22	1.4	1.1
22–23	2.5	2.0
23–24	0.3	1.5
24–25	3.6	2.4
25–26	2.6	2.1
26–27	0.6	0.3
27–28	0.5	0.3
28–29	0.4	0.2
29–30	0.5	0.2
30–31	0.5	0.3

Joint Opening (mm)

Joint	Top	Bottom
31–32	0.6	0.5
32–33	1.2	0.8
33–34	0.8	0.6
34–35	0.7	0.6
35–36	0.9	0.8
36–37	1.0	0.8
37–38	1.0	0.9
38–39	1.5	1.0
39–40	1.3	1.0
40–41	1.5	1.0

Joint Opening (mm)

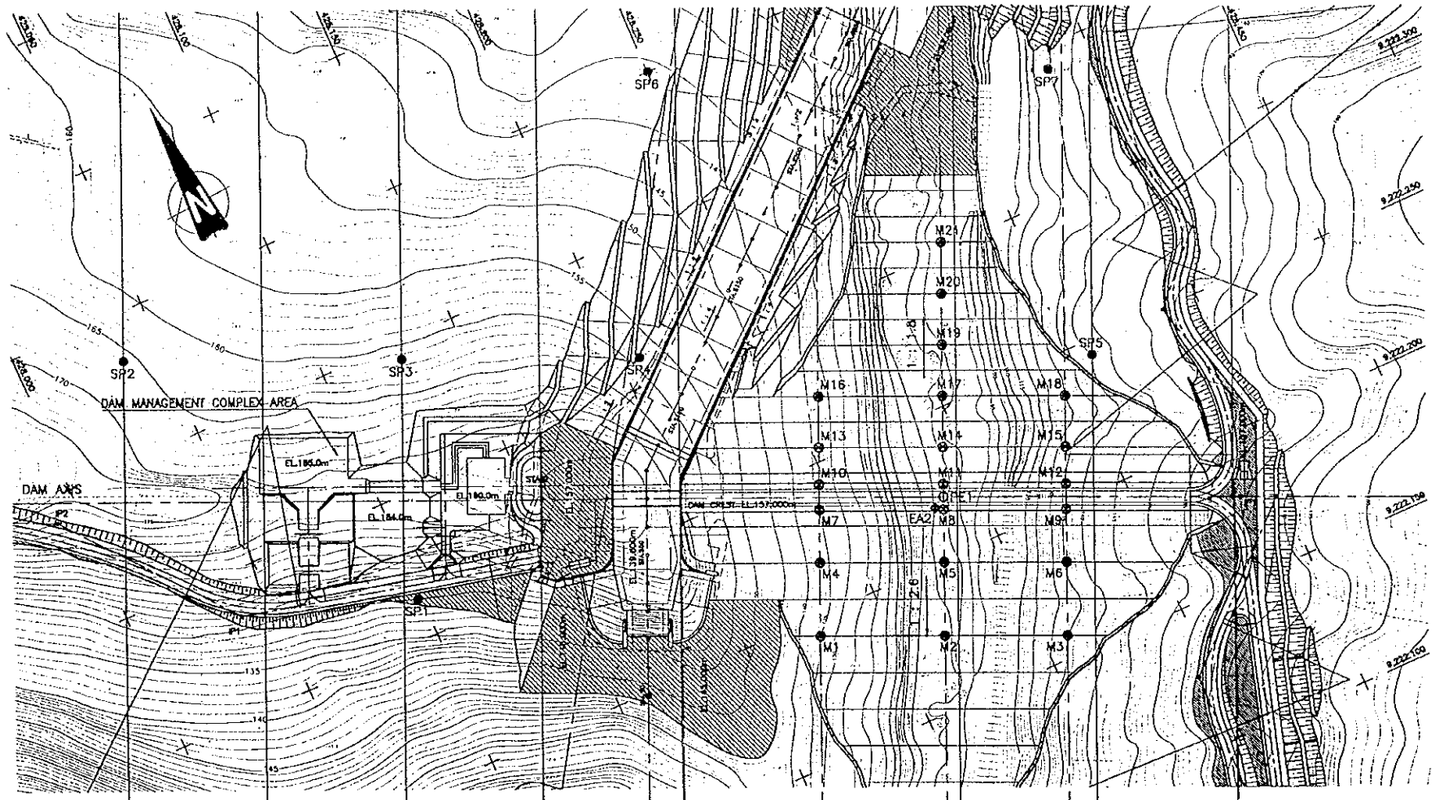
Joint	Top	Bottom
41–42	1.1	0.9
42–43	1.4	1.1
43–44	1.3	1.1
44–45	1.3	1.1
45–46	1.3	1.1

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. **7.2.32**

RESULTS OF DEFORMATION ANALYSIS FOR GALLERY (JOINT OPENING)



PLAN

LONGITUDINAL PROFILE

TYPE OF INSTRUMENT	SYMBOL PLAN	SYMBOL SECTION	DESIGNATION	LOCATION STA.	LOCATION OFFSET FROM DAM AXIS	ELEVATION	READOUT POINT	REMARKS
SURFACE MOVEMENT MARKER	⊗		M1	100	49.2m U/S	EL.140.000m	--	
			M2	145	49.2m U/S	EL.140.000m	--	
			M3	190	49.2m U/S	EL.140.000m	--	
			M4	100	23.2m U/S	EL.150.000m	--	
			M5	145	23.2m U/S	EL.150.000m	--	
			M6	190	23.2m U/S	EL.150.000m	--	
			M7	100	4.5m U/S	EL.157.000m	--	
			M8	145	4.5m U/S	EL.157.000m	--	
			M9	190	4.5m U/S	EL.157.000m	--	
			M10	100	4.5m D/S	EL.157.000m	--	
			M11	145	4.5m D/S	EL.157.000m	--	
			M12	190	4.5m D/S	EL.157.000m	--	
			M13	100	17.8m U/S	EL.150.000m	--	
			M14	145	17.8m U/S	EL.150.000m	--	
			M15	190	17.8m U/S	EL.150.000m	--	
			M16	100	35.6m U/S	EL.140.000m	--	
			M17	145	35.6m U/S	EL.140.000m	--	
			M18	190	35.6m U/S	EL.140.000m	--	
			M19	190	53.8m U/S	EL.130.000m	--	
			M20	190	71.8m U/S	EL.120.000m	--	
			M21	190	89.6m U/S	EL.110.000m	--	
CASAGRANDE STANDPIPE PIEZOMETER	●		SP1	-45	35.0m U/S	EL.45.000m	--	ELEVATION REFER TO PIEZOMETER TIP
			SP2	-150	50.0m D/S	EL.100.000m	--	
			SP3	-50	50.0m D/S	EL.100.000m	--	
			SP4	38	50.0m D/S	EL.100.000m	--	
			SP5	200	50.0m D/S	EL.100.000m	--	
			SP6	40	150.0m D/S	EL.45.000m	--	
			SP7	185	150.0m D/S	EL.45.000m	--	
ELECTRICAL PIEZOMETER		⊠	P1	100	8.0m U/S	EL.115.000m	TB1	ELEVATION REFER TO PIEZOMETER TIP
			P2	100	8.0m D/S	EL.115.000m	TB1	
			P3	100	5.5m U/S	EL.120.000m	TB1	
			P4	100	5.5m D/S	EL.120.000m	TB1	
			P5	100	3.0m U/S	EL.140.000m	TB1	
			P6	100	3.0m D/S	EL.140.000m	TB1	
			P7	145	14.0m U/S	EL.73.000m	TB2	
			P8	145	14.0m D/S	EL.73.000m	TB2	
			P9	145	14.0m U/S	EL.78.000m	TB2	
			P10	145	14.0m D/S	EL.78.000m	TB2	
			P11	145	10.0m U/S	EL.82.000m	TB2	
			P12	145	10.0m D/S	EL.82.000m	TB2	
			P13	145	8.0m U/S	EL.100.000m	TB3	
			P14	145	8.0m D/S	EL.100.000m	TB3	
			P15	145	5.5m U/S	EL.120.000m	TB3	
			P16	145	5.5m D/S	EL.120.000m	TB3	
			P17	145	3.0m U/S	EL.140.000m	TB3	
			P18	145	3.0m D/S	EL.140.000m	TB3	
			P19	190	8.0m U/S	EL.110.000m	TB3	
			P20	190	8.0m D/S	EL.110.000m	TB3	
			P21	190	5.5m U/S	EL.120.000m	TB3	
			P22	190	5.5m D/S	EL.120.000m	TB3	
			P23	190	3.0m U/S	EL.140.000m	TB3	
			P24	190	3.0m D/S	EL.140.000m	TB3	
PROBE EXTENSOMETER	○	⊥	PE1	145	DAM AXIS	EL.80.000m EL.157.000m	--	
FOUNDATION DEFORMATION METER		▌	FD1	145	0.5m U/S	EL.78.500m EL.50.000m	TB2	
TRI-AXIAL JOINT METER		⊢	JM1	153.5	3.0m U/S	EL.79.500m	TB2	
			JM2	158.5	3.0m D/S	EL.80.000m	TB2	
SEEPAGE MEASURING DEVICE		⋈	SM1	150.15	21.4m D/S	EL.78.500m	--	
			SM2	150.65	21.4m D/S	EL.78.500m	--	
STRONG MOTION ACCELEROGRAPH	◆	⋔	EA1	143	0.75m U/S	EL.78.500m	--	
			EA2		4.0m U/S	EL.157.000m	--	
TERMINAL BOX		▣	TB1	108.5	1.0m D/S	EL.105.800m	--	6 POINTS
			TB2	148	1.0m D/S	EL.77.300m	--	9 POINTS
			TB3	188.5	1.0m D/S	EL.105.800m	--	12 POINTS

SCALE 0 20 40 60 80 100m

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE NOTED.
2. INSTRUMENTATION LOCATIONS AND ELEVATION ARE APPROXIMATE AND WILL BE FINALIZED BY THE ENGINEER AS PER SITE CONDITIONS.

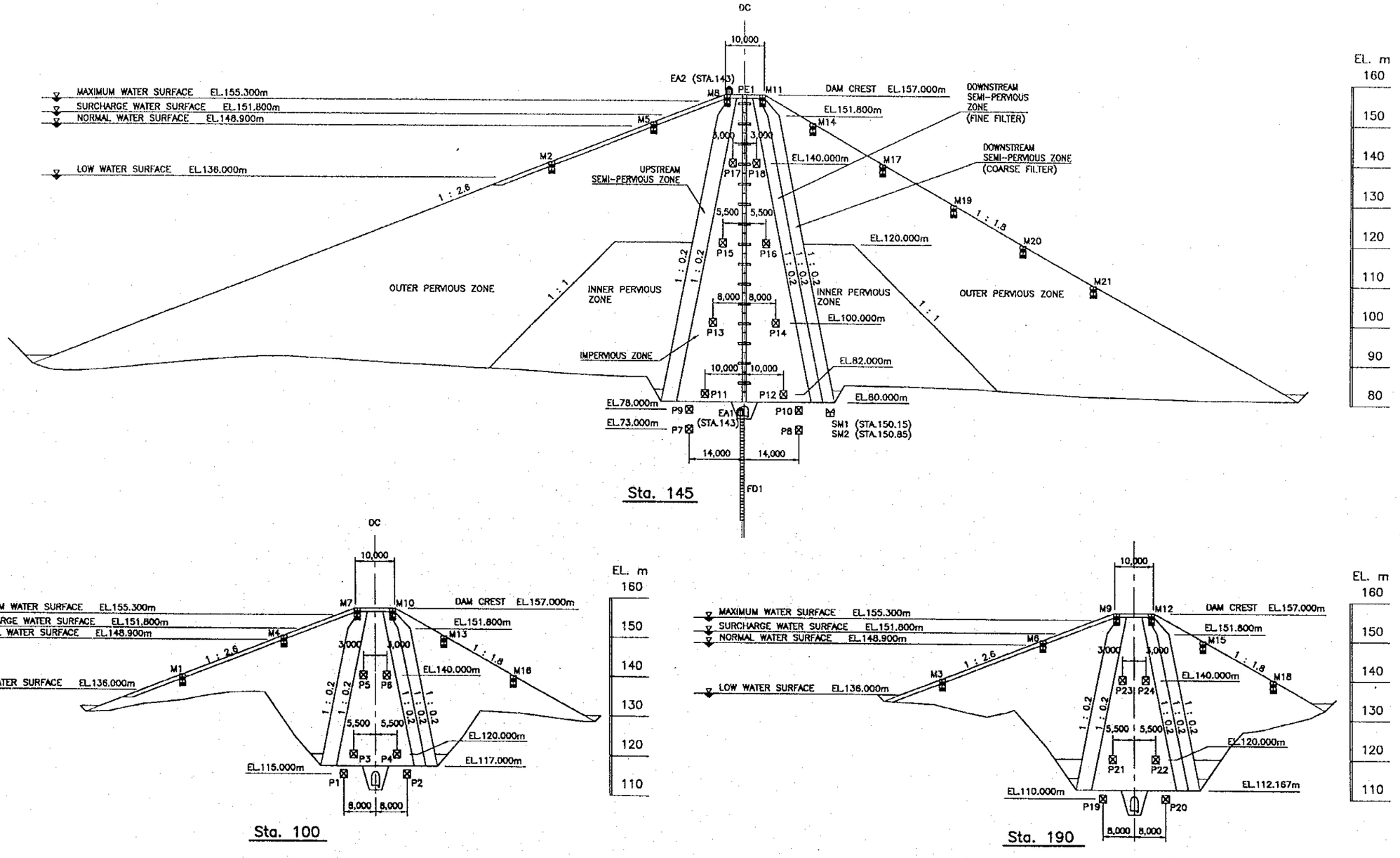
REFERENCE DRAWINGS

JD-P1-ED-In-2 INSTRUMENTATION - SECTIONS

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2.33 (1/2)
LAYOUT OF INSTRUMENTS



NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE NOTED.
2. SECTIONS ARE REFERRED FROM DRAWING NO. JD-P1-ED-In-1.
3. INSTRUMENTATION LOCATIONS AND ELEVATION ARE APPROXIMATE AND WILL BE FINALIZED BY THE ENGINEER AS PER SITE CONDITIONS.

REFERENCE DRAWINGS

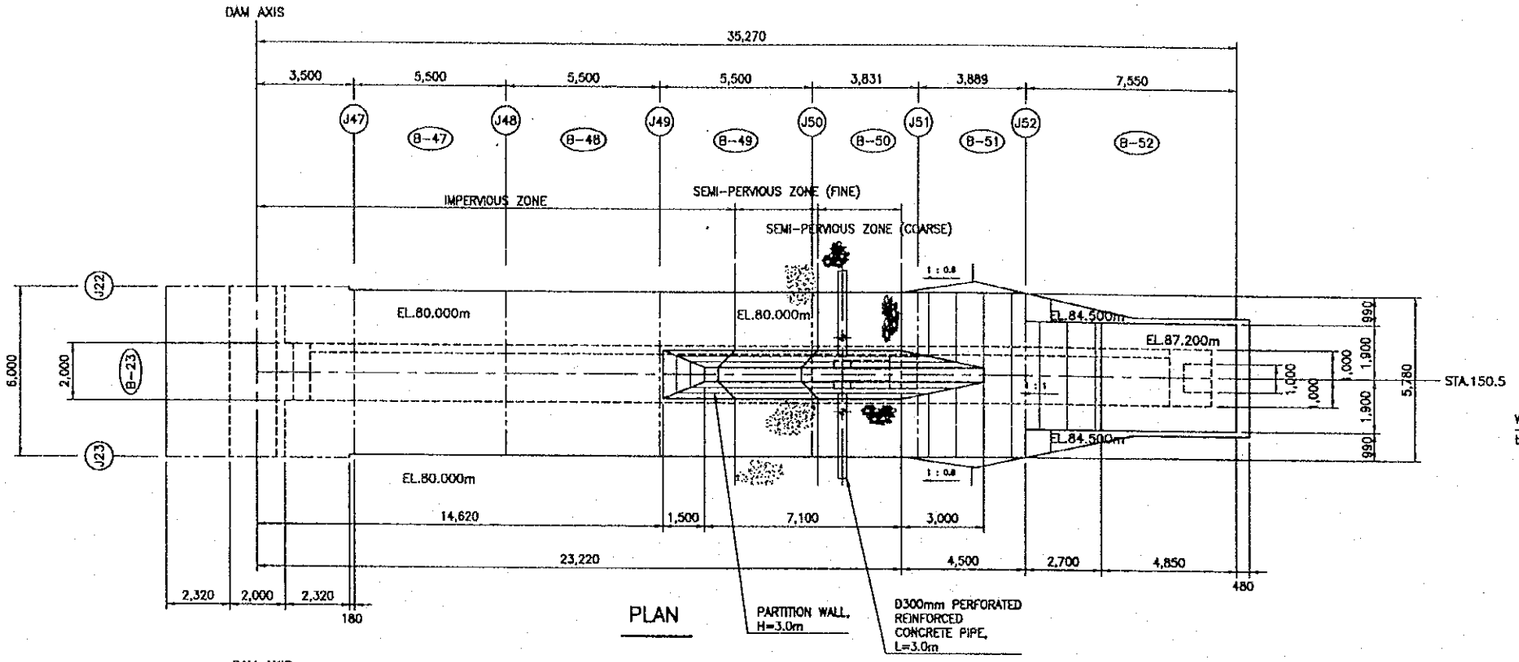
JD-P1-ED-In-1 INSTRUMENTATION - LAYOUT PLAN AND PROFILE

LEGEND

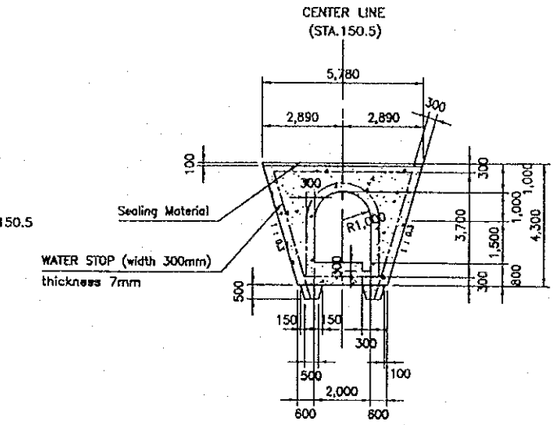
TYPE OF INSTRUMENT	SYMBOL	DESIGNATION
SURFACE MOVEMENT MARKER		M
ELECTRICAL PIEZOMETER		P
PROVE EXTENSOMETER		PE
FOUNDATION DEFORMATION METER		FD
SEEPAGE MEASURING DEVICE		SM
STRONG MOTION ACCELEROGRAPH		EA

SCALE 0 10 20 30 40 50m

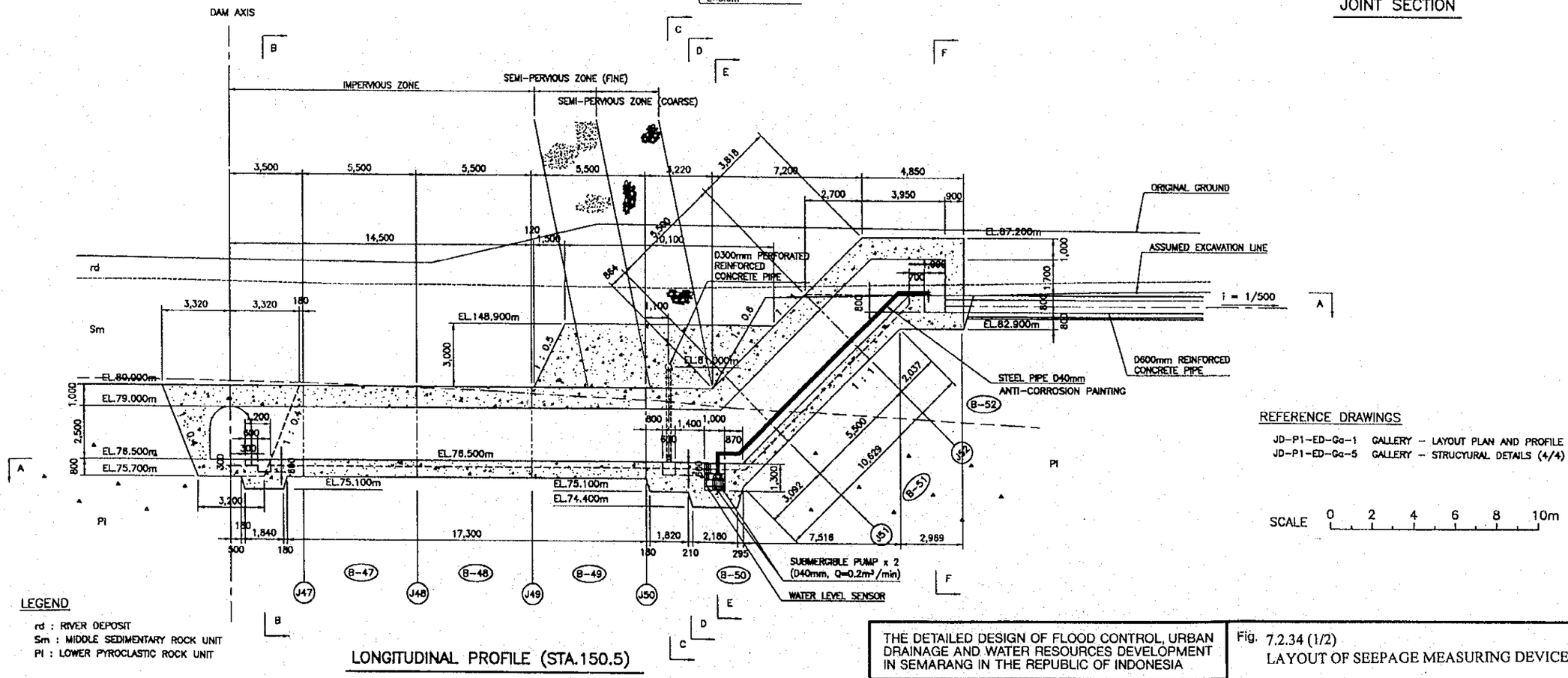
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.2.33 (2/2) LAYOUT OF INSTRUMENTS
JAPAN INTERNATIONAL COOPERATION AGENCY	



PLAN



JOINT SECTION



LONGITUDINAL PROFILE (STA.150.5)

LEGEND

rd : RIVER DEPOSIT
Sm : MIDDLE SEDIMENTARY ROCK UNIT
PI : LOWER PYROCLASTIC ROCK UNIT

REFERENCE DRAWINGS

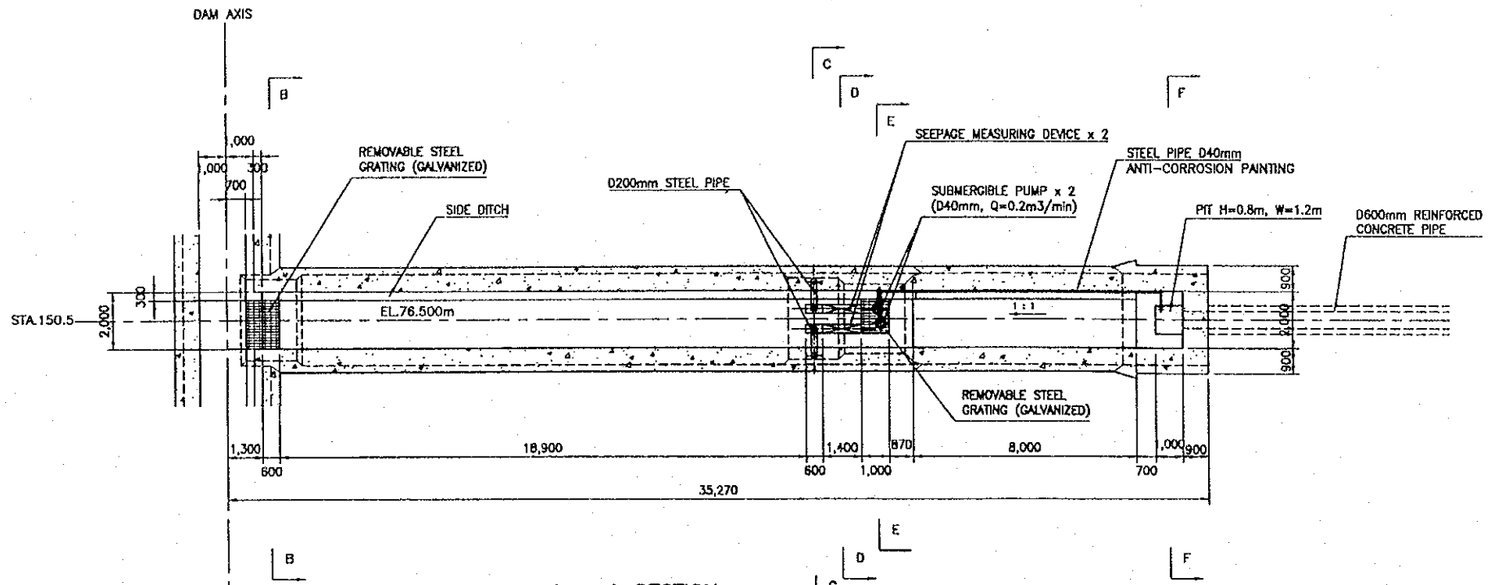
JD-P1-ED-Ga-1 GALLERY -- LAYOUT PLAN AND PROFILE
JD-P1-ED-Ga-5 GALLERY -- STRUCYURAL DETAILS (4/4)

SCALE 0 2 4 6 8 10m

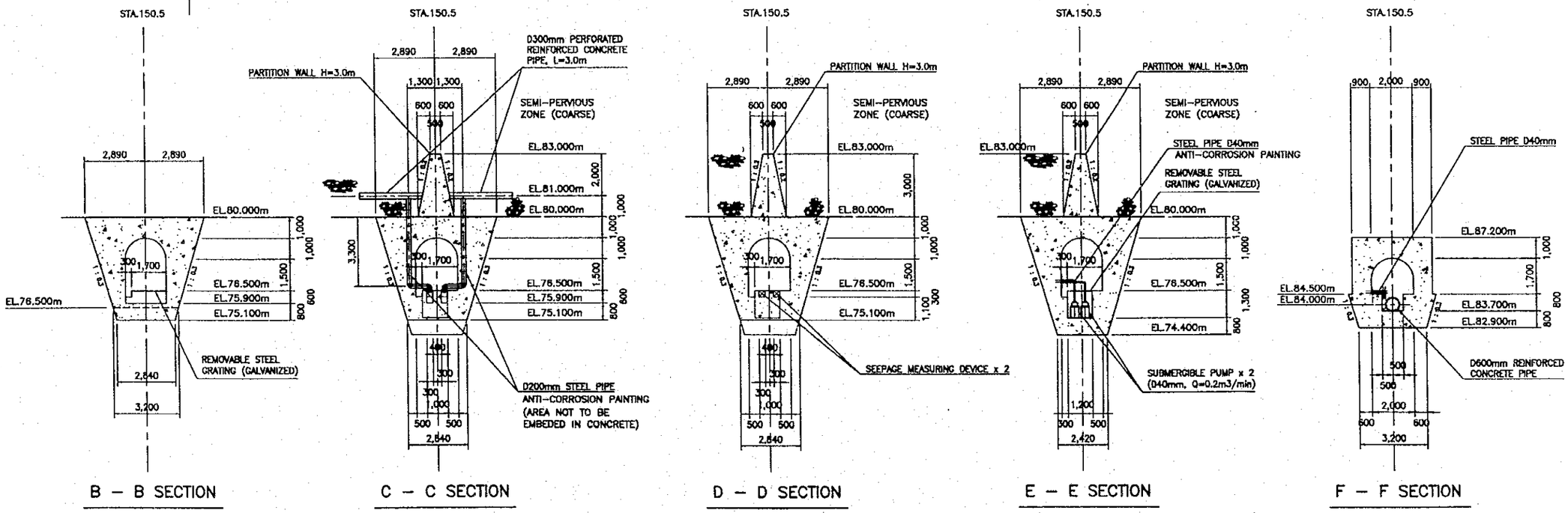
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2.34 (1/2)
LAYOUT OF SEEPAGE MEASURING DEVICES



A – A SECTION



B – B SECTION

C – C SECTION

D – D SECTION

E – E SECTION

F – F SECTION

REFERENCE DRAWINGS

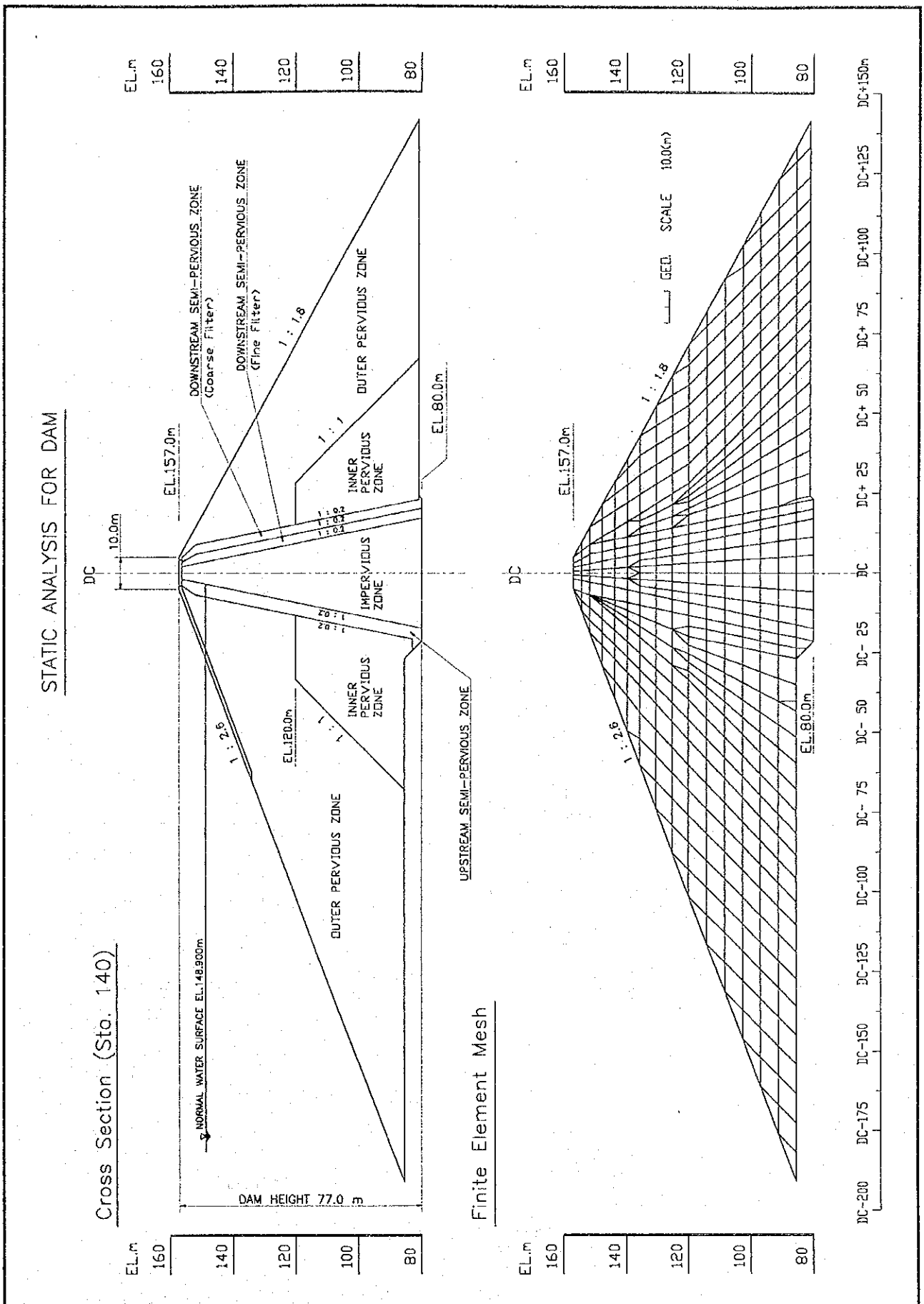
JD-P1-ED-Ga-1	GALLERY – LAYOUT PLAN AND PROFILE
JD-P1-ED-Ga-4	GALLERY – STRUCYURAL DETAILS (3/4)

SCALE 0 2 4 6 8 10m

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.2.34 (2/2)
LAYOUT OF SEEPAGE MEASURING DEVICES



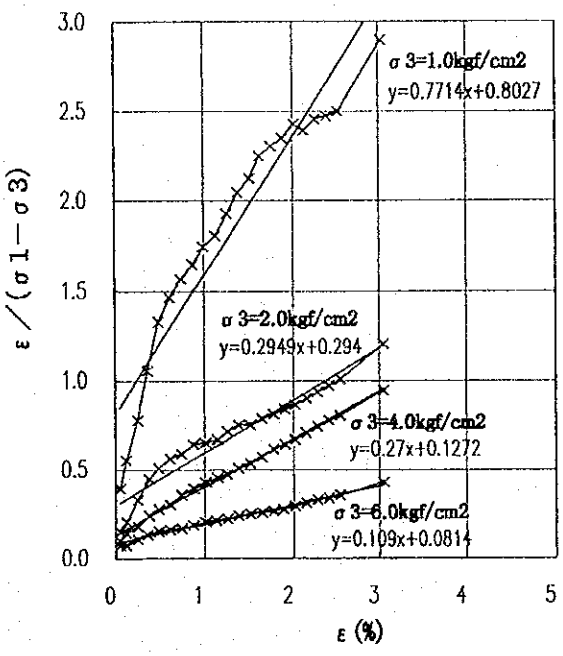
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

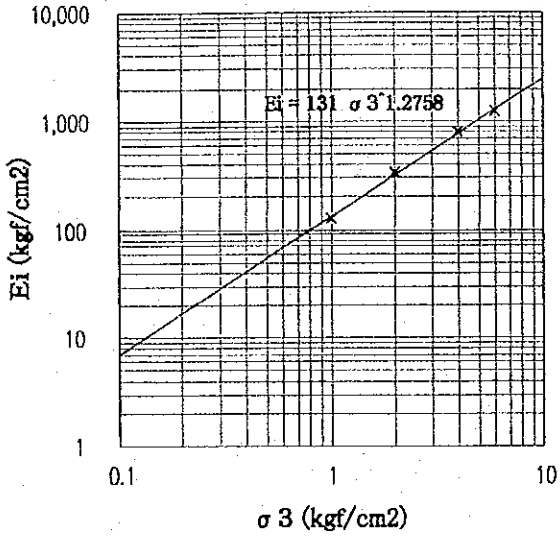
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.3.1

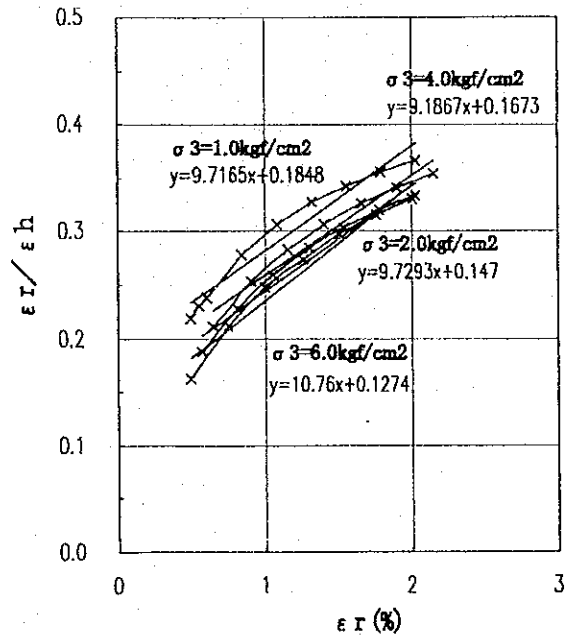
FINITE ELEMENT MESH OF STATIC ANALYSIS FOR DAM

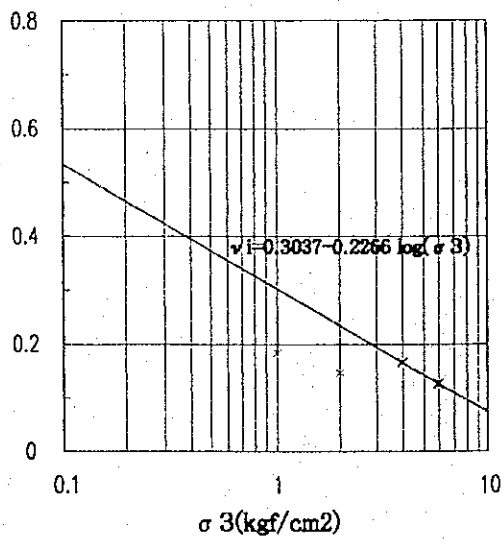
PROPERTIES OF IMPERVIOUS MATERIAL





ELASTIC MODULUS

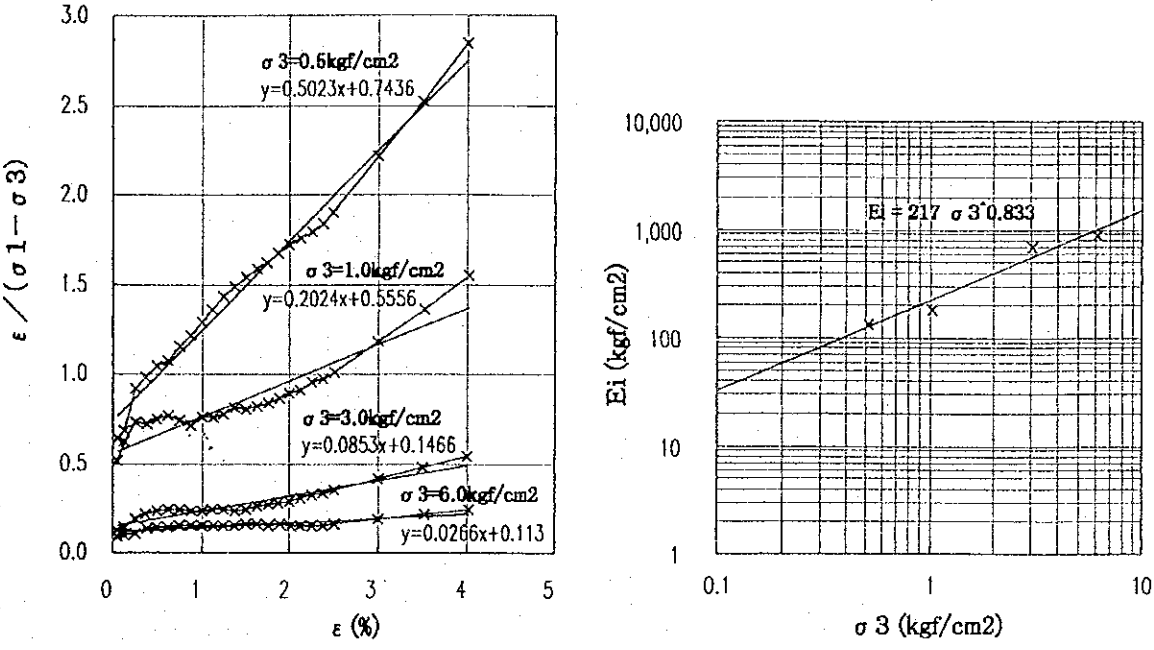




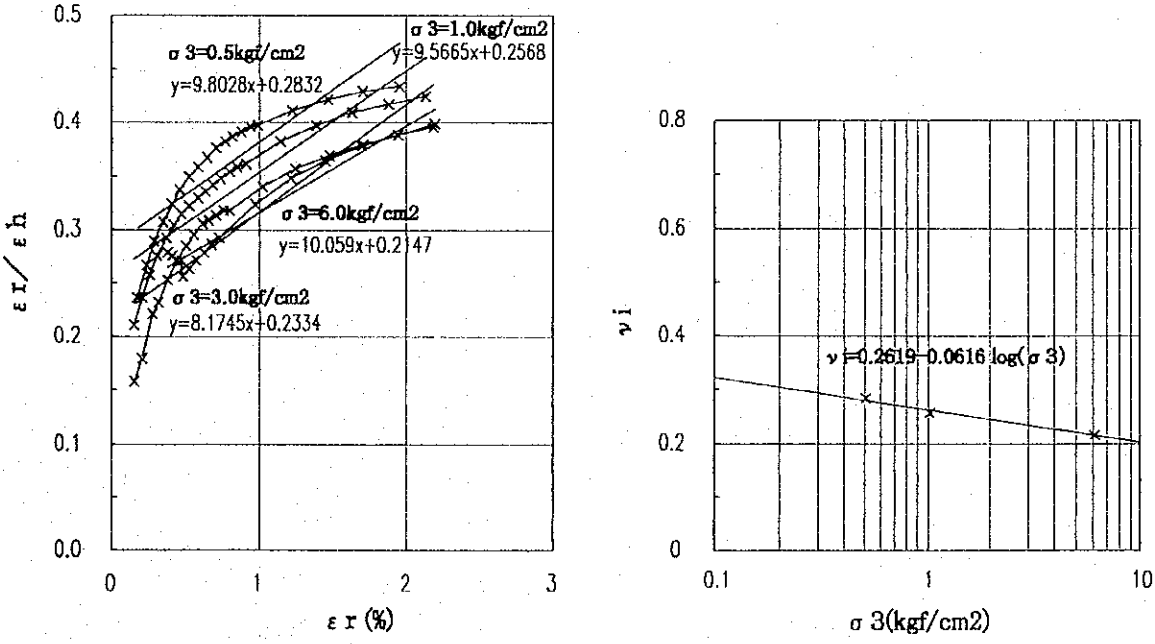
POISSON'S RATIO

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.2 (1/3) **DETERMINATION PROCEDURE OF STATIC MATERIAL PROPERTIES**
JAPAN INTERNATIONAL COOPERATION AGENCY	

PROPERTIES OF SEMI-PERVIOUS MATERIAL



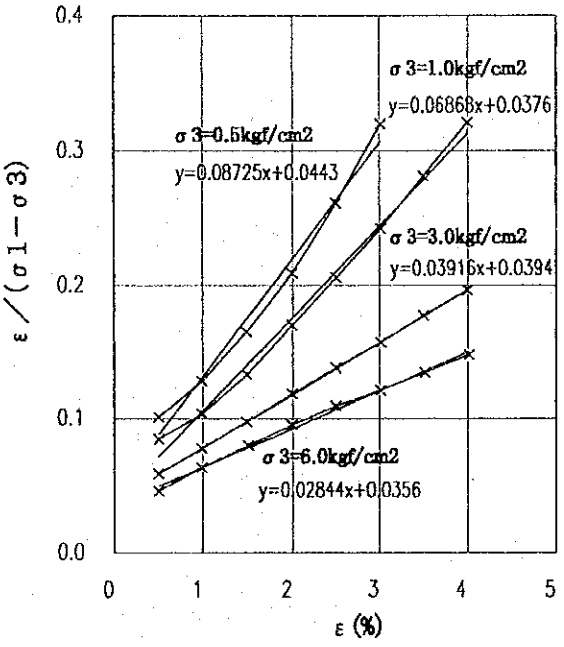
ELASTIC MODULUS

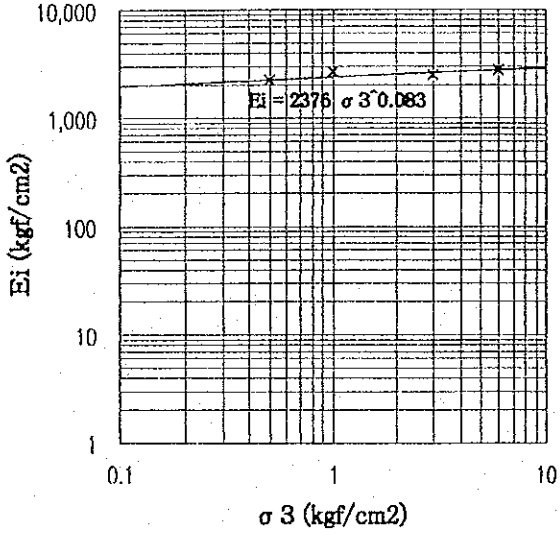


POISSON'S RATIO

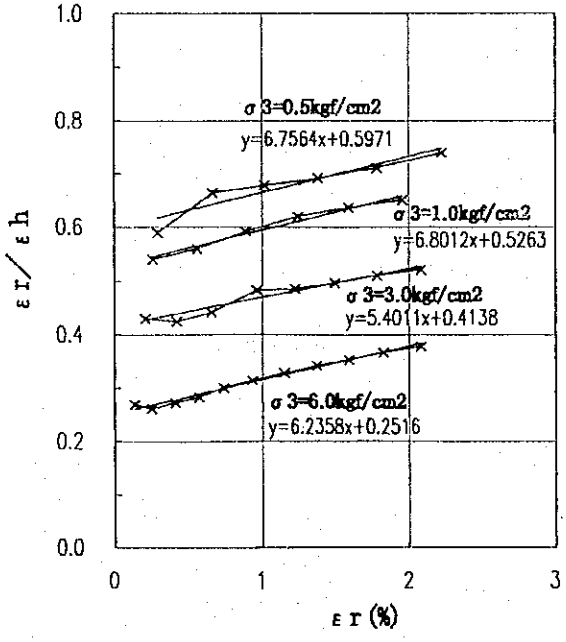
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.2 (2/3) **DETERMINATION PROCEDURE OF STATIC MATERIAL PROPERTIES**
JAPAN INTERNATIONAL COOPERATION AGENCY	

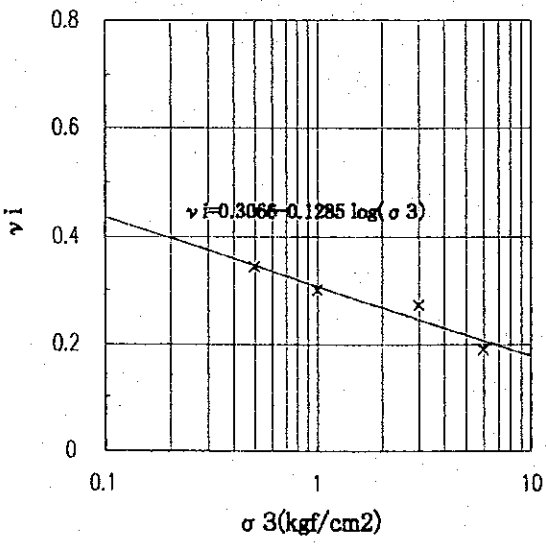
PROPERTIES OF PERVIOUS MATERIAL





ELASTIC MODULUS





POISSON'S RATIO

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.2 (3/3) **DETERMINATION PROCEDURE OF STATIC MATERIAL PROPERTIES**
JAPAN INTERNATIONAL COOPERATION AGENCY	

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.3.3

RESULTS OF STATIC ANALYSIS FOR DAM (END OF CONSTRUCTION, STRESSES)

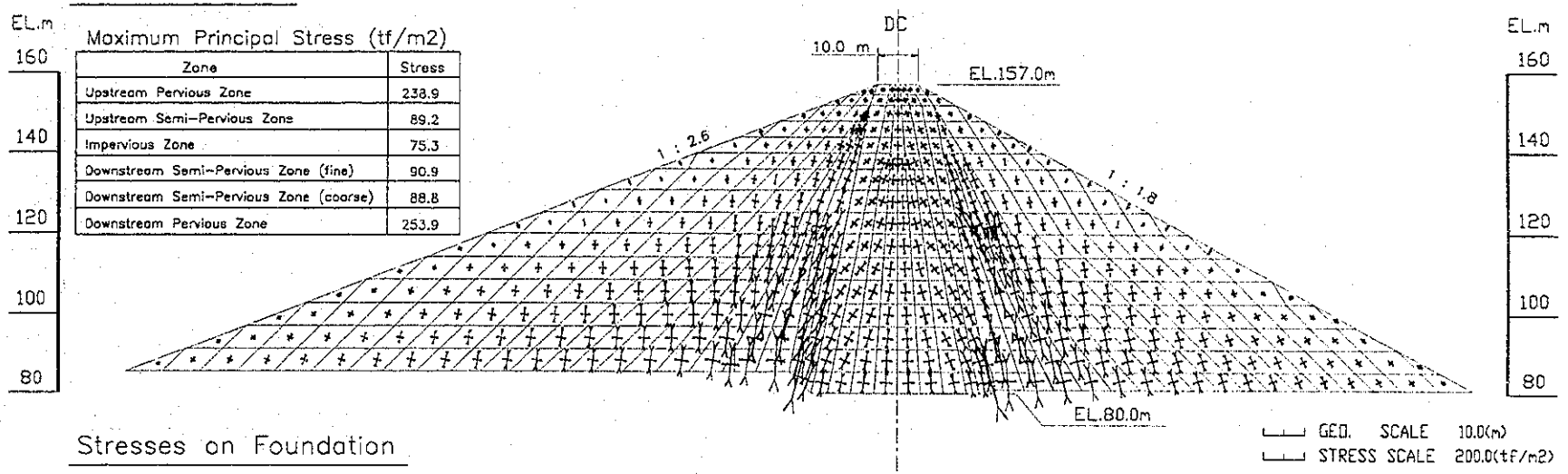
STATIC ANALYSIS FOR DAM

At End of Construction

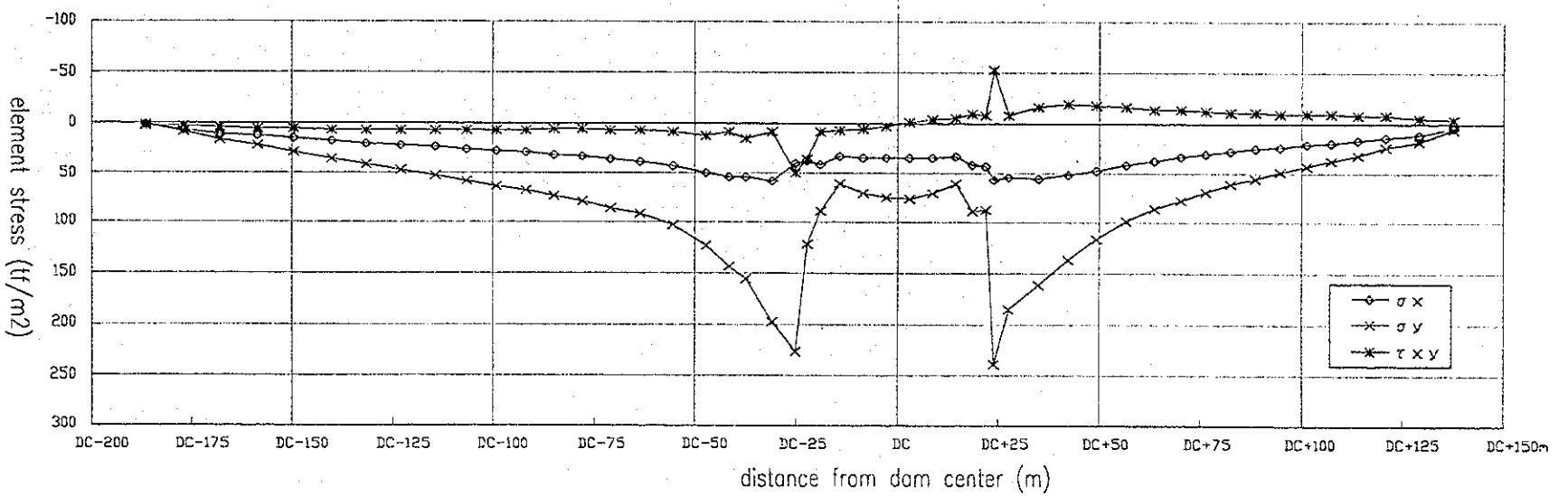
Stress Vectors

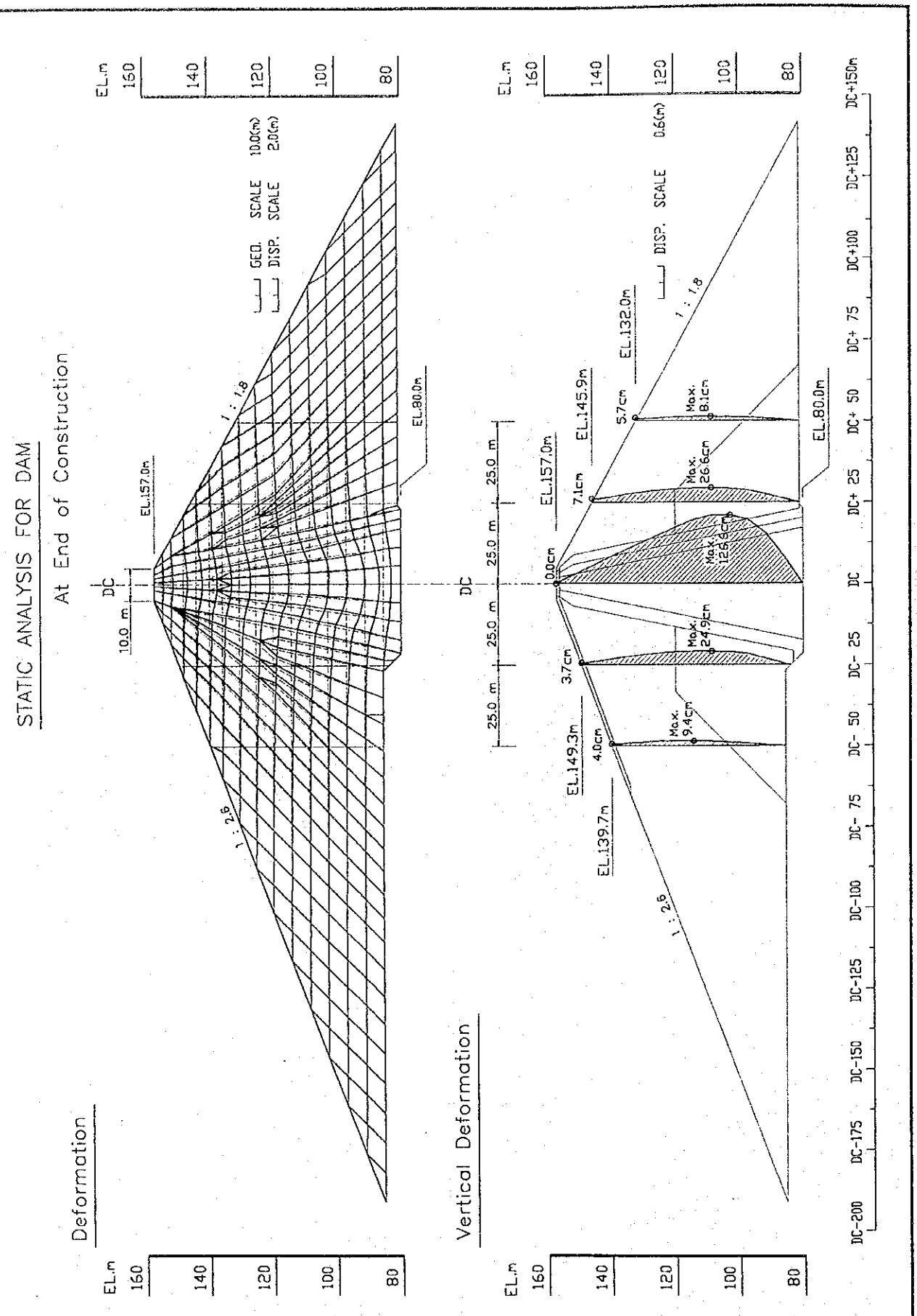
Maximum Principal Stress (tf/m2)

Zone	Stress
Upstream Pervious Zone	238.9
Upstream Semi-Pervious Zone	89.2
Impervious Zone	75.3
Downstream Semi-Pervious Zone (fine)	90.9
Downstream Semi-Pervious Zone (coarse)	88.8
Downstream Pervious Zone	253.9



Stresses on Foundation





THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. **7.3.4**

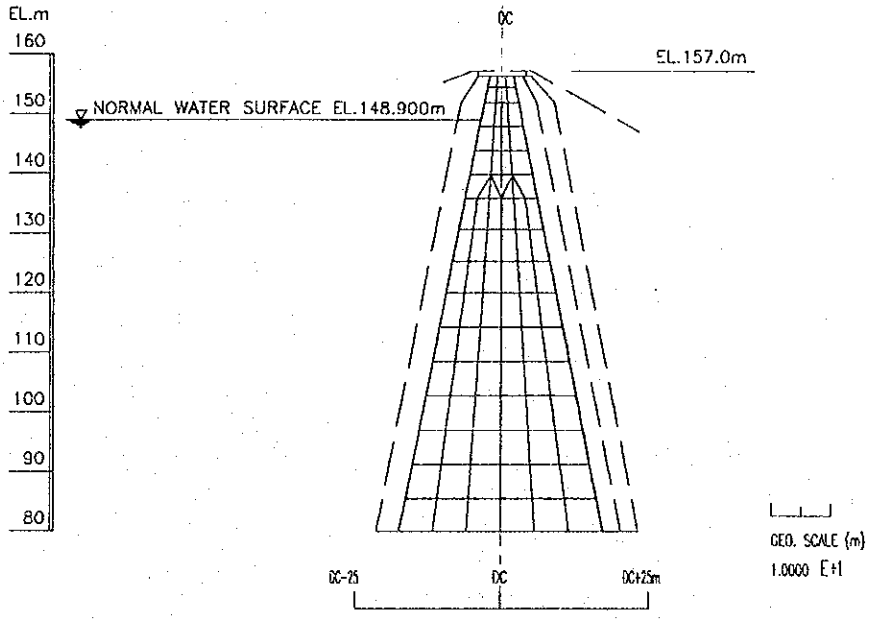
RESULTS OF STATIC ANALYSIS FOR DAM (END OF CONSTRUCTION, DISPLACEMENTS)

STRESS-STRAIN ANALYSIS FOR DAM

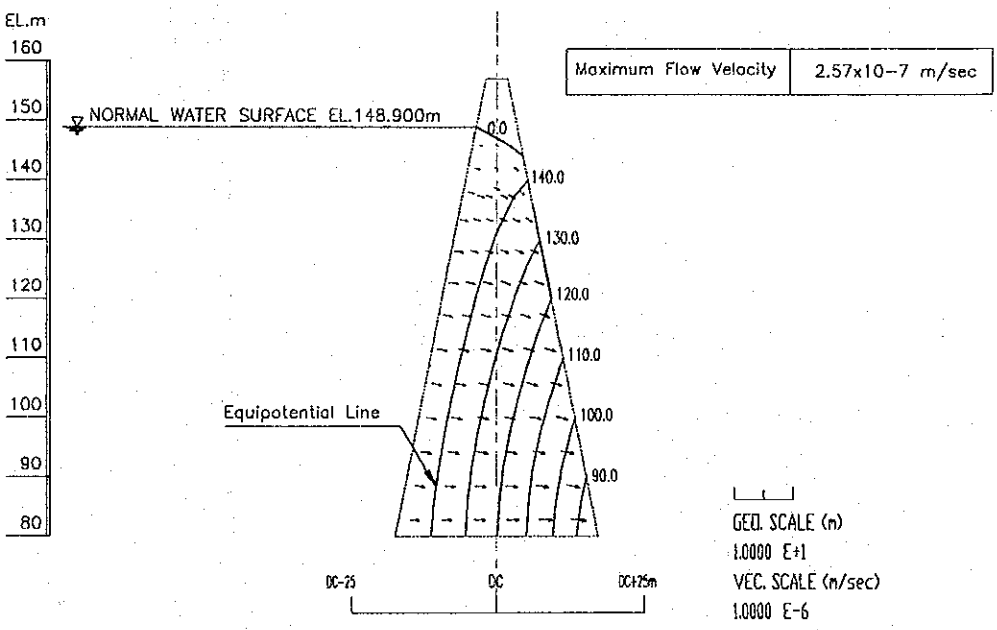
After Reservoir Filling

Seepage Analysis

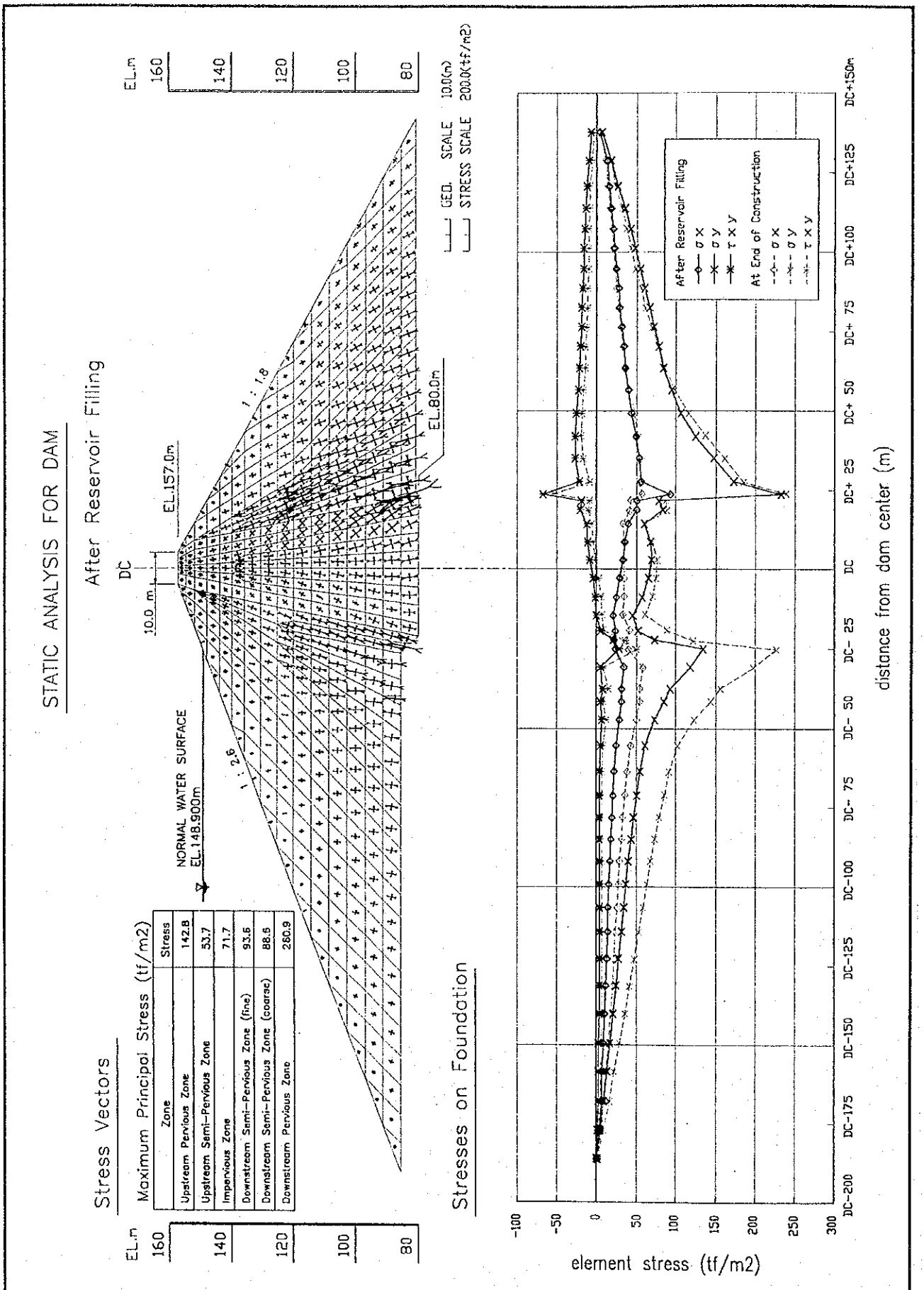
Finite Element Mesh



Flow Velocity



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.5 **RESULTS OF SEEPAGE ANALYSIS FOR STATIC ANALYSIS**
JAPAN INTERNATIONAL COOPERATION AGENCY	

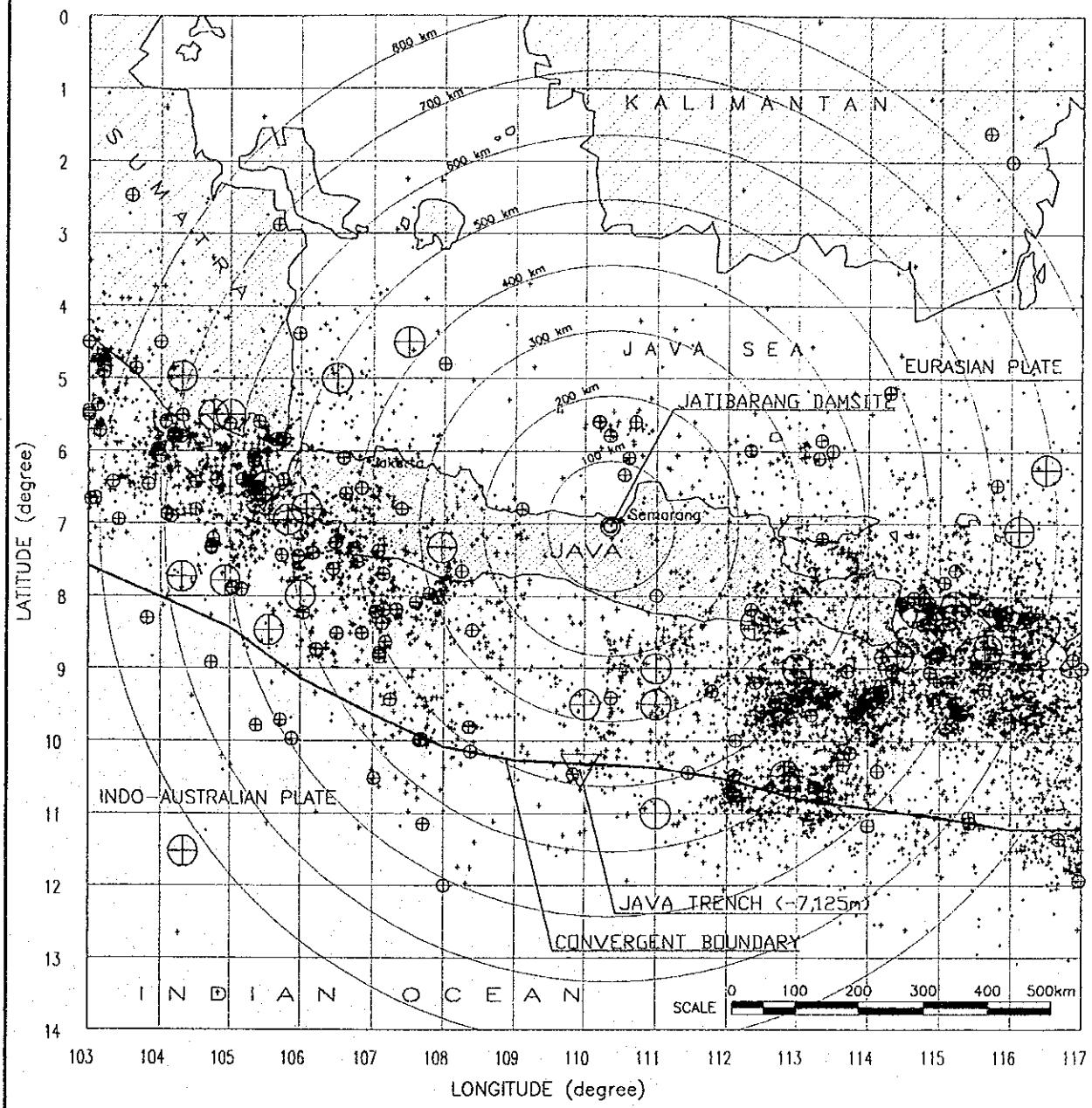


THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. **7.3.6**

RESULTS OF STATIC ANALYSIS FOR DAM (AFTER RESERVOIR FILLING, STRESSES)



LEGEND

MAGNITUDE OF EARTHQUAKE	· 4.0 – 4.9 ⊕ 6.0 – 6.9 + 5.0 – 5.9 ⨁ 7.0 – 7.9
LOCATION OF JATIBARANG DAMSITE	LATITUDE 7° 2′ 10″ S LONGITUDE 110° 21′ 3″ E

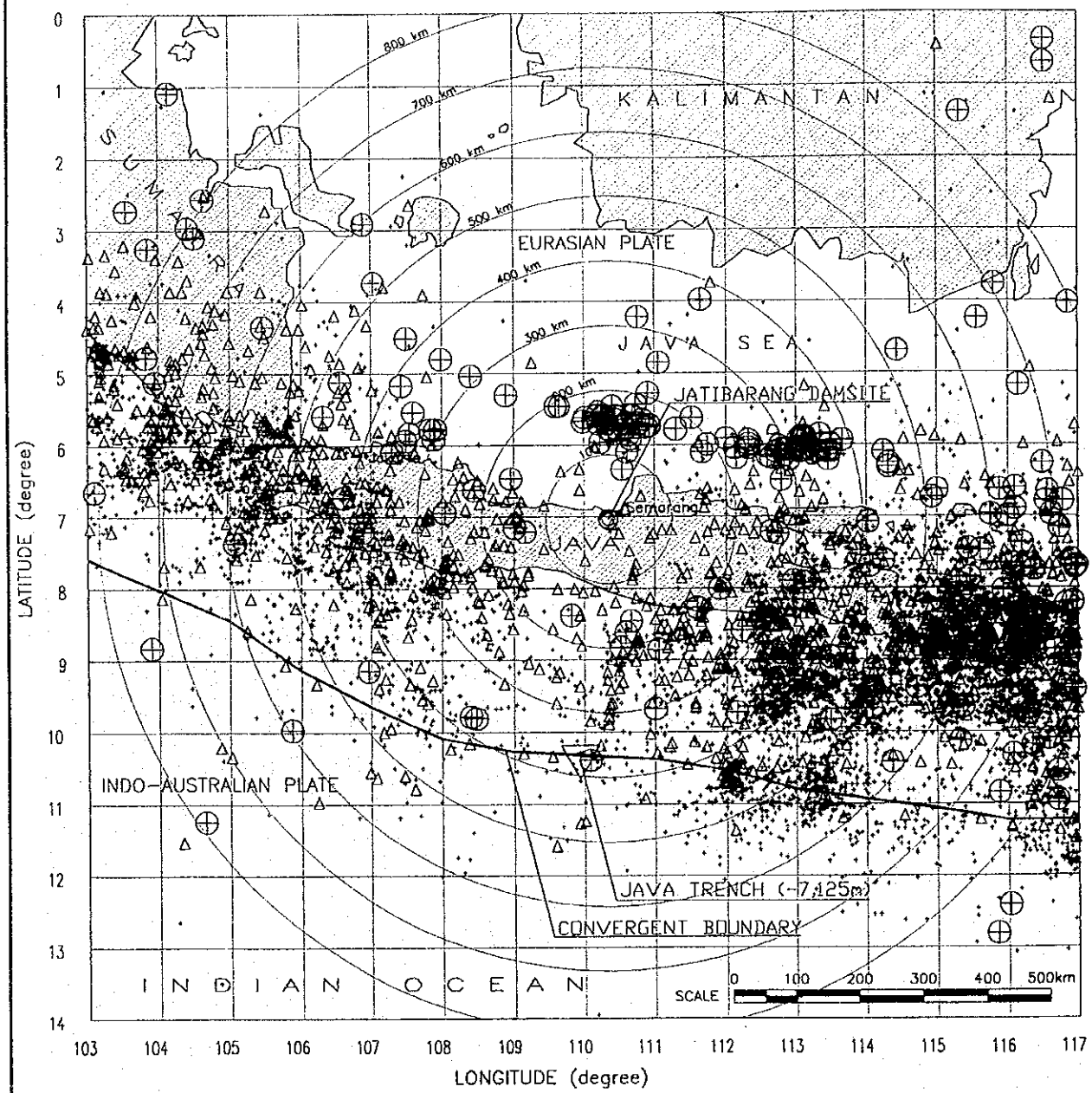
* About 7,200 seismic records from 1900 to 1999, qualified by Meteorological and Geophysical Agency.

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.3.7

HISTORICAL SEISMIC DATA AROUND JAVA ISLAND (BY MAGNITUDE)



LEGEND

DEPTH OF EPICENTER	· 0 – 99 km △ 100 – 299 km ⊕ 300 km –
LOCATION OF JATIBARANG DAMSITE	LATITUDE 7° 2′ 10″ S LONGITUDE 110° 21′ 3″ E

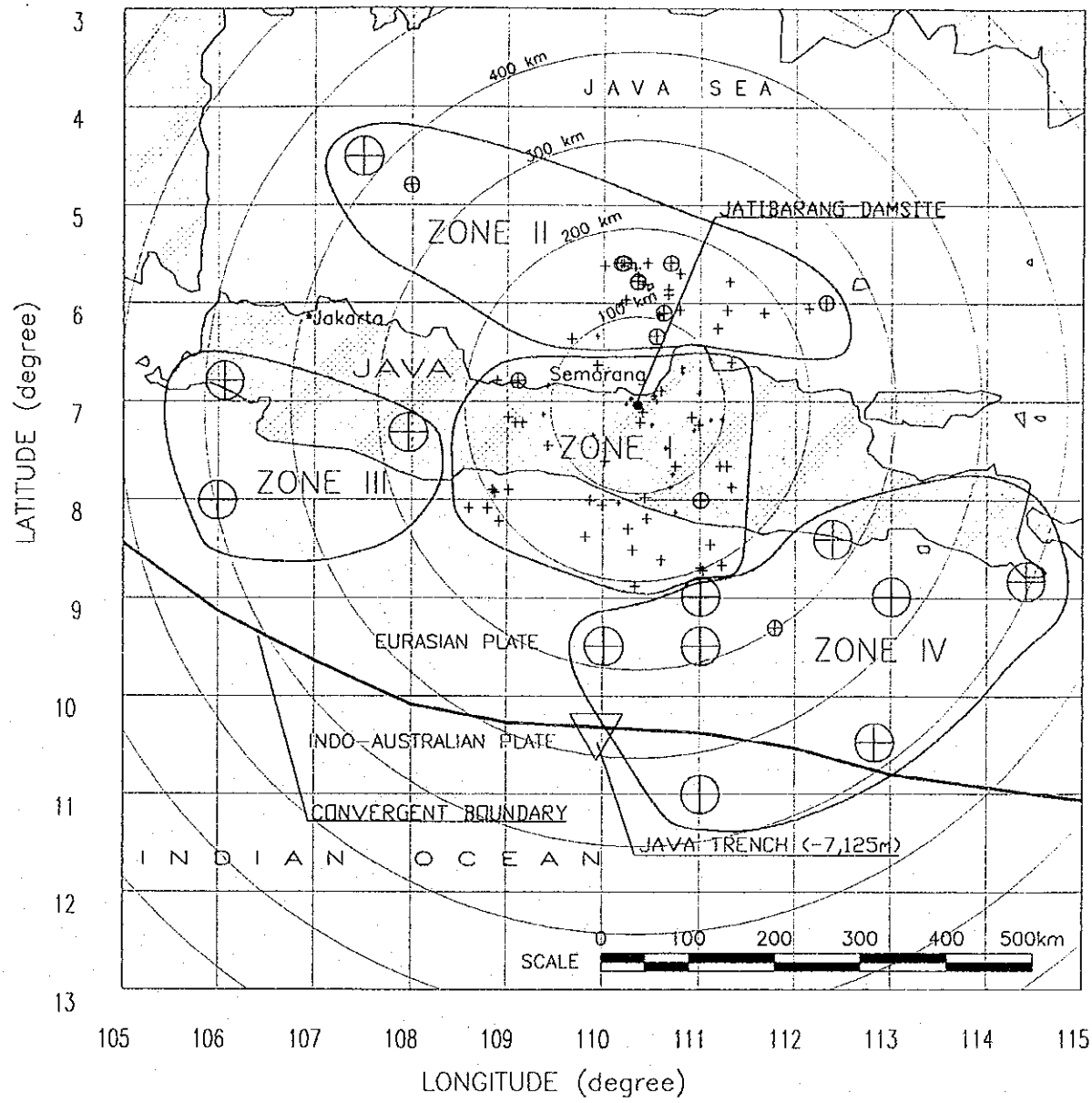
* About 7,200 seismic records from 1900 to 1999, qualified by Meteorological and Geophysical Agency.

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.3.8

HISTORICAL SEISMIC DATA AROUND JAVA ISLAND (BY DEPTH)



LEGEND

MAGNITUDE OF EARTHQUAKE	· 4.0 – 4.9 ⊕ 6.0 – 6.9 + 5.0 – 5.9 ⊕ 7.0 – 7.9
LOCATION OF JATIBARANG DAMSITE	LATITUDE 7° 2′ 10″ S LONGITUDE 110° 21′ 3″ E

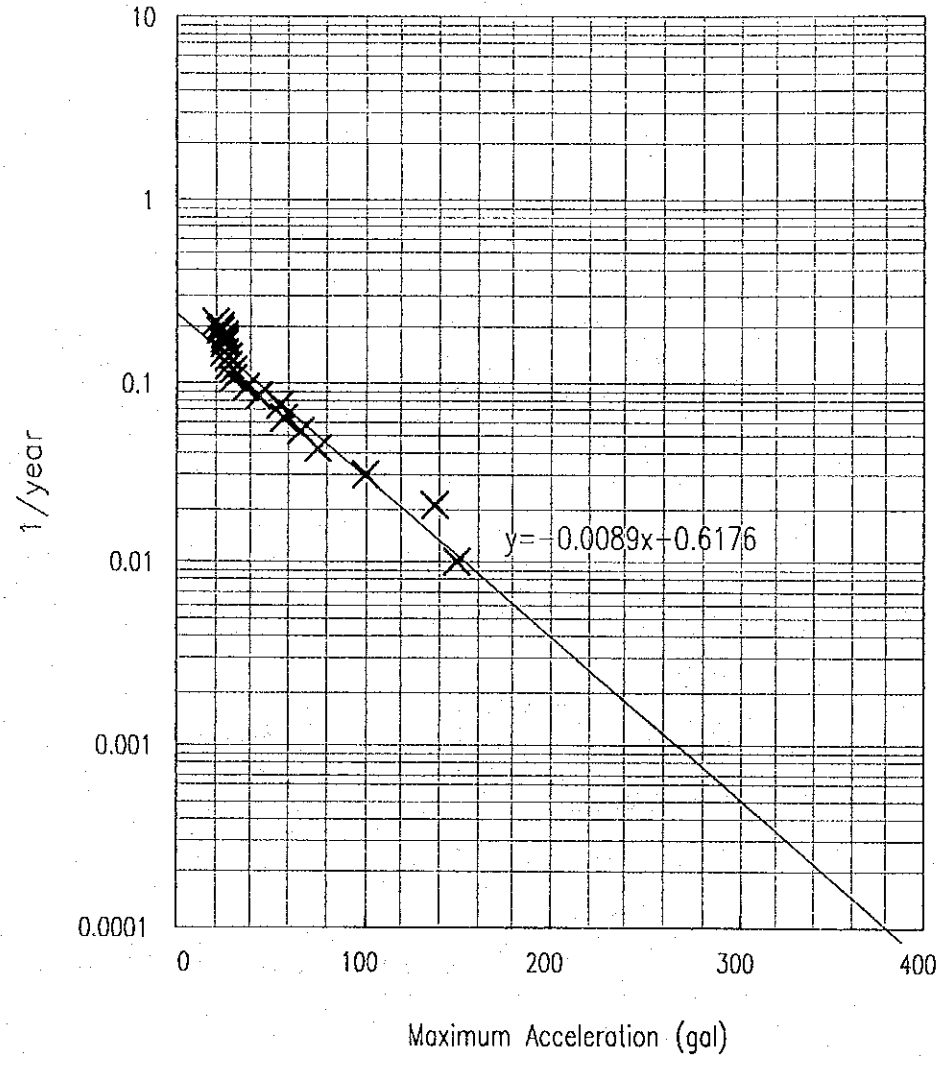
* 100 seismic records from 1900 to 1999, influenced to Jatibarang Damsite.

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 7.3.9

HISTORICAL SEISMIC DATA AROUND JATIBARANG DAMSITE



Return Period (year)	Maximum Acceleration (gal)	Design Earthquake
100	155.3	
200	189.1	Design Basis Earthquake
500	233.9	
1,000	267.7	
5,000	346.2	
10,000	380.0	Maximum Credible Earthquake

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

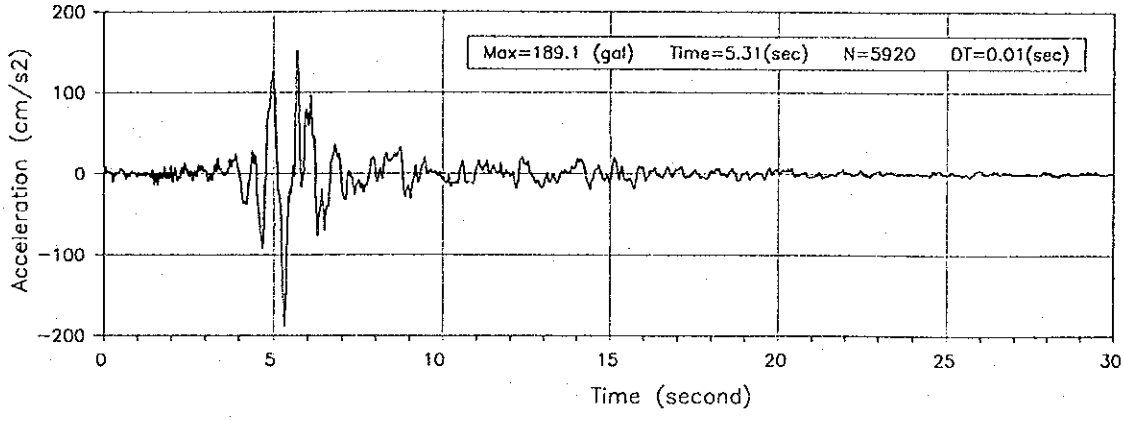
Fig. 7.3.10

PROBABILISTIC RISK ANALYSIS OF EARTHQUAKE AT JATIBARANG DAMSITE

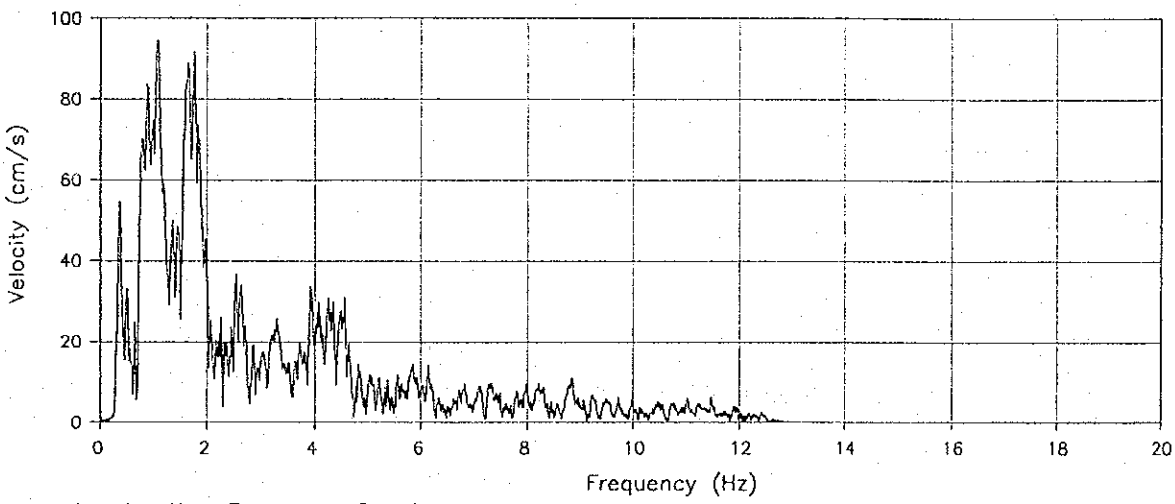
DYNAMIC ANALYSIS FOR DAM

Input Earthquake Motion
Design Basis Earthquake (189.1gal)

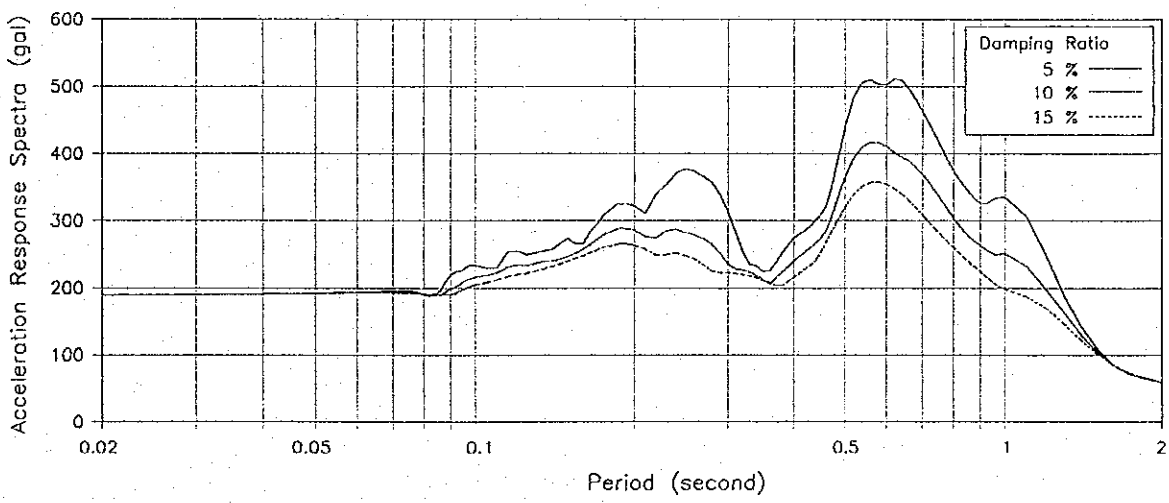
Acceleration



Fourier Spectra



Acceleration Response Spectra



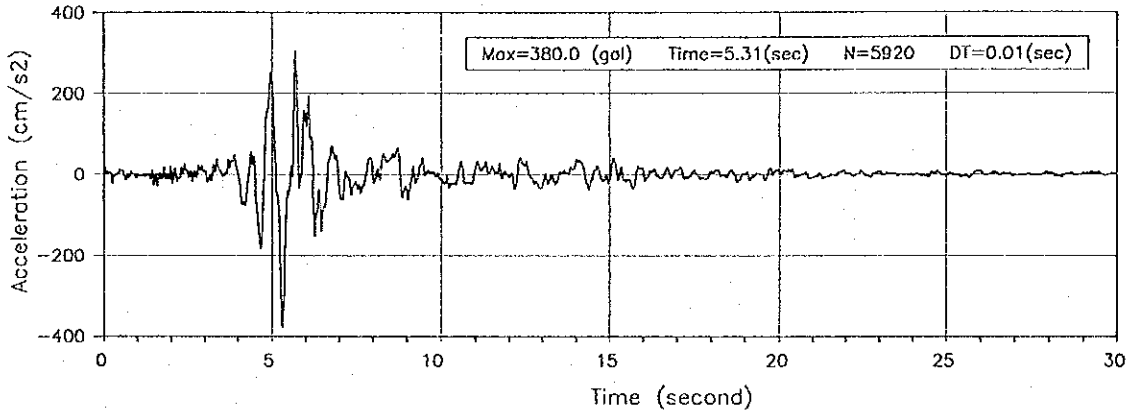
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.11 (1/2) INPUT EARTHQUAKE MOTION OF DBE AND MCE
JAPAN INTERNATIONAL COOPERATION AGENCY	

DYNAMIC ANALYSIS FOR DAM

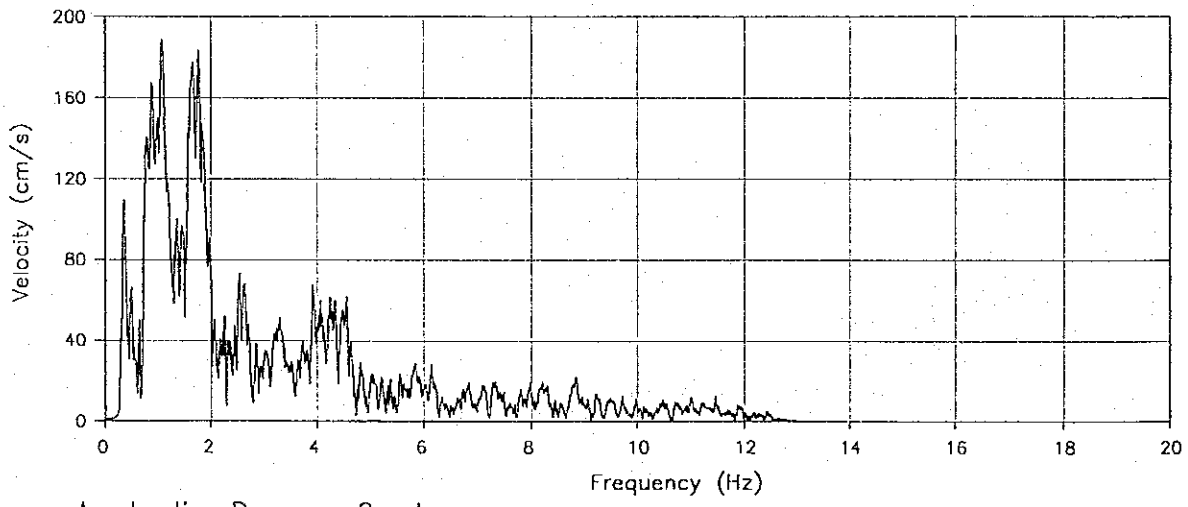
INPUT EARTHQUAKE MOTION

Maximum Credible Earthquake (380.0gal)

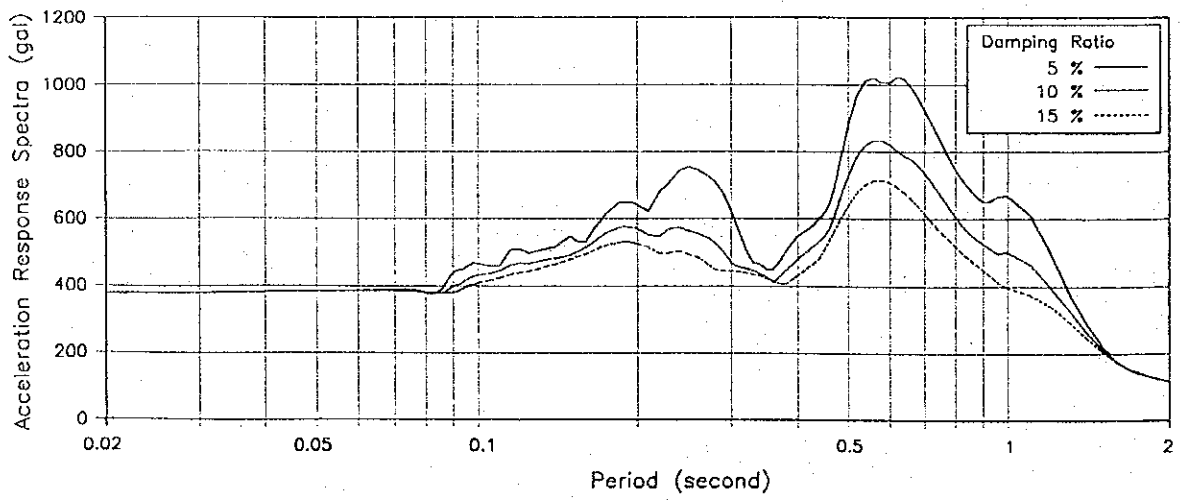
Acceleration



Fourier Spectra



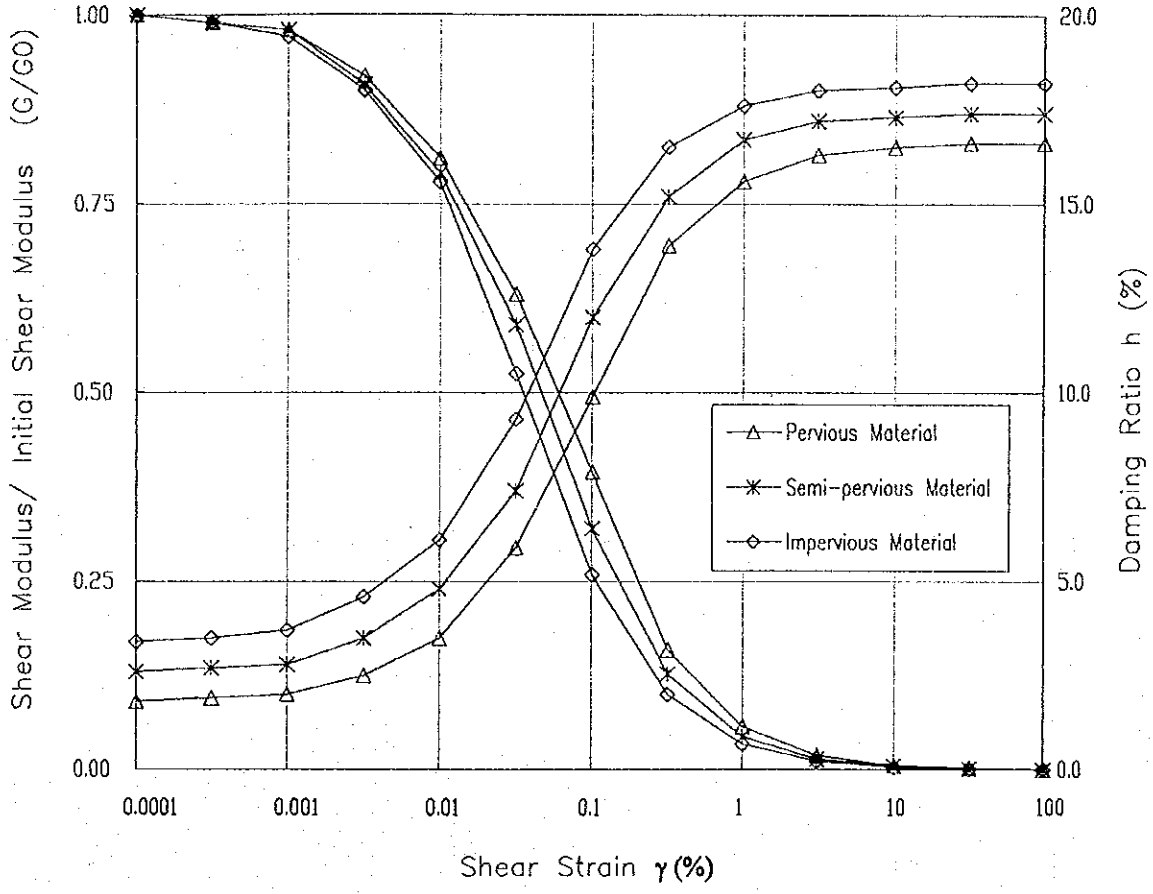
Acceleration Response Spectra



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.11 (2/2) INPUT EARTHQUAKE MOTION OF DBE AND MCE
JAPAN INTERNATIONAL COOPERATION AGENCY	

DYNAMIC ANALYSIS FOR DAM

Shear Strain Dependent Curve



Relationship between G/GO, h and shear Strain

Shear Strain γ (%)	Pervious Material		Semi-pervious Material		Impervious Material	
	G/GO	h (%)	G/GO	h (%)	G/GO	h (%)
10^{-4}	1.000	1.8	1.000	2.6	1.000	3.4
$10^{-3.5}$	0.990	1.9	0.990	2.7	0.990	3.5
10^{-3}	0.980	2.0	0.980	2.8	0.972	3.7
$10^{-2.5}$	0.920	2.5	0.908	3.5	0.900	4.6
10^{-2}	0.810	3.5	0.790	4.8	0.778	6.1
$10^{-1.5}$	0.630	5.9	0.590	7.4	0.525	9.3
10^{-1}	0.395	9.9	0.320	12.0	0.259	13.8
$10^{-0.5}$	0.159	13.9	0.127	15.2	0.100	16.5
10^{0}	0.057	15.6	0.044	16.7	0.034	17.6
$10^{0.5}$	0.019	16.3	0.014	17.2	0.011	18.0
10^{1}	0.006	16.5	0.005	17.3	0.003	18.1
$10^{1.5}$	0.002	16.6	0.001	17.4	0.001	18.2
10^{2}	0.000	16.6	0.000	17.4	0.000	18.2

THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA

JAPAN INTERNATIONAL COOPERATION AGENCY

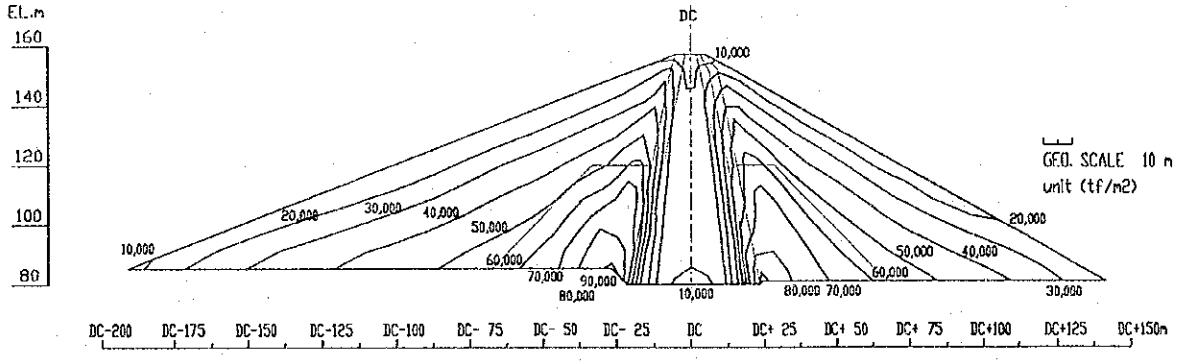
Fig. 7.3.12

STRAIN DEPENDENT SHEAR MODULUS AND DAMPING RATIO

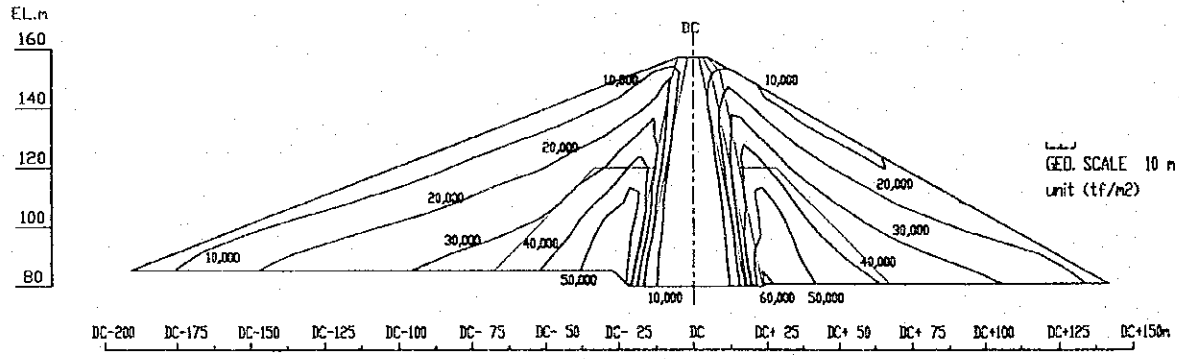
DYNAMIC ANALYSIS FOR DAM

Shear Modulus Contour

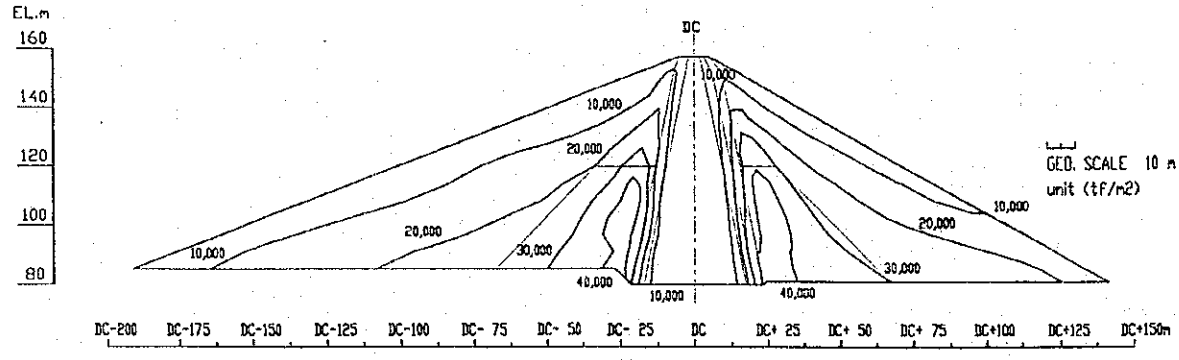
Initial Shear Modulus



Final Shear Modulus after Design Basis Earthquake (189.1 gal)



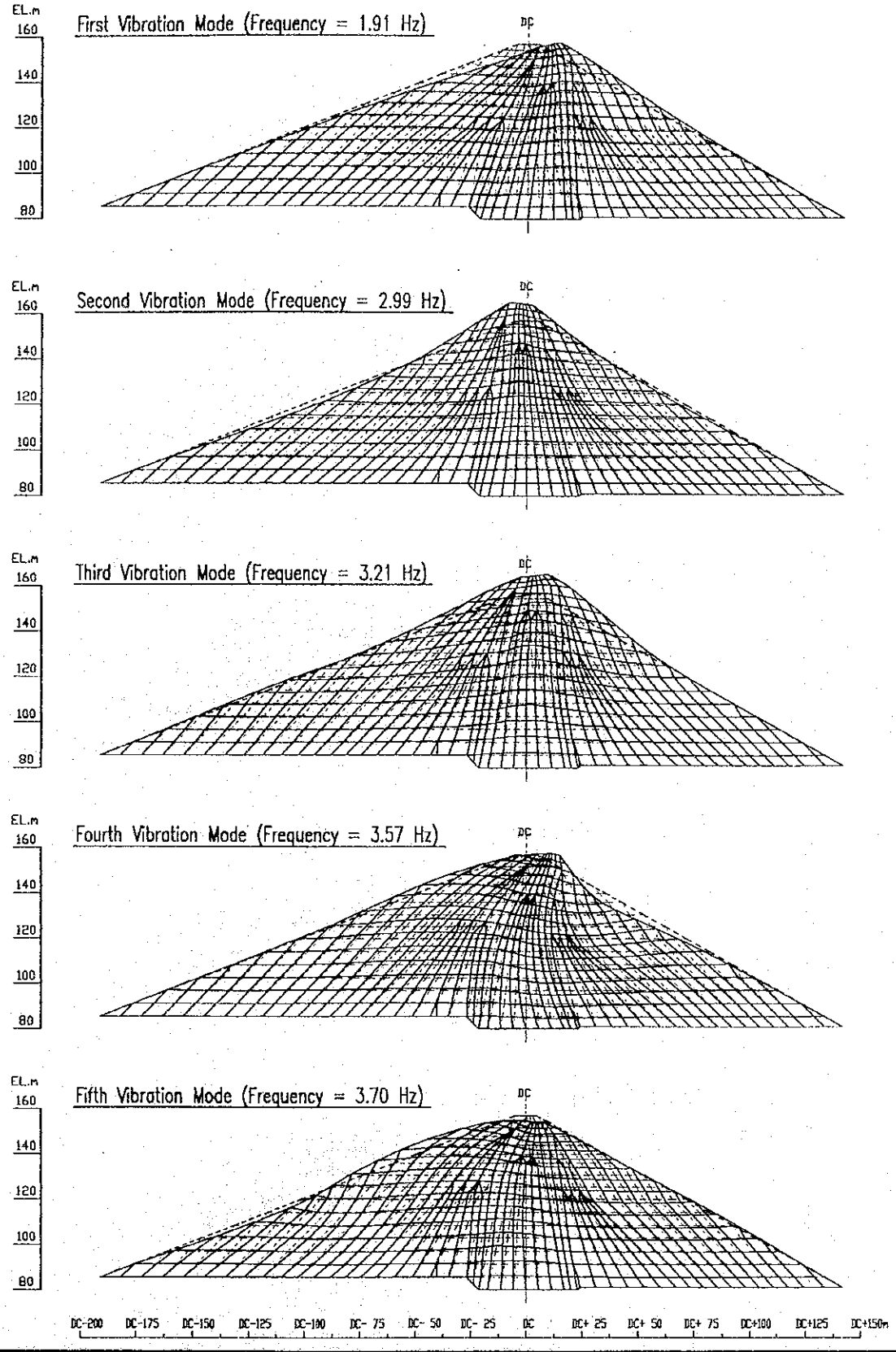
Final Shear Modulus after Maximum Credible Earthquake (380.0 gal)



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.13 **RESULTS OF DYNAMIC ANALYSIS (SHEAR MODULUS CONTOUR)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

DYNAMIC ANALYSIS FOR DAM

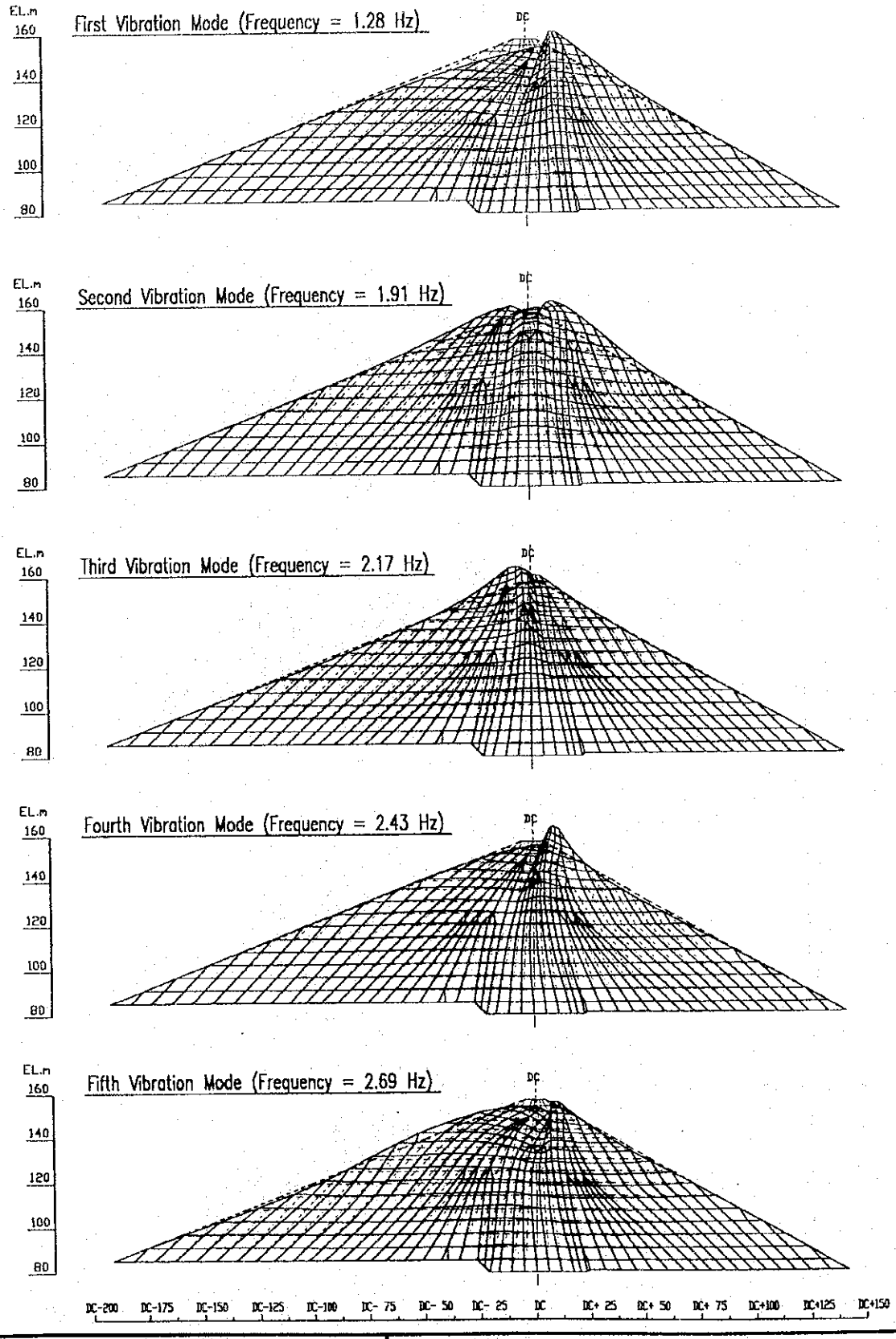
Vibration Mode Shape
subjected to Initial Shear Modulus



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.14 (1/3) **RESULTS OF DYNAMIC ANALYSIS (VIBRATION MODE SHAPE)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

DYNAMIC ANALYSIS FOR DAM

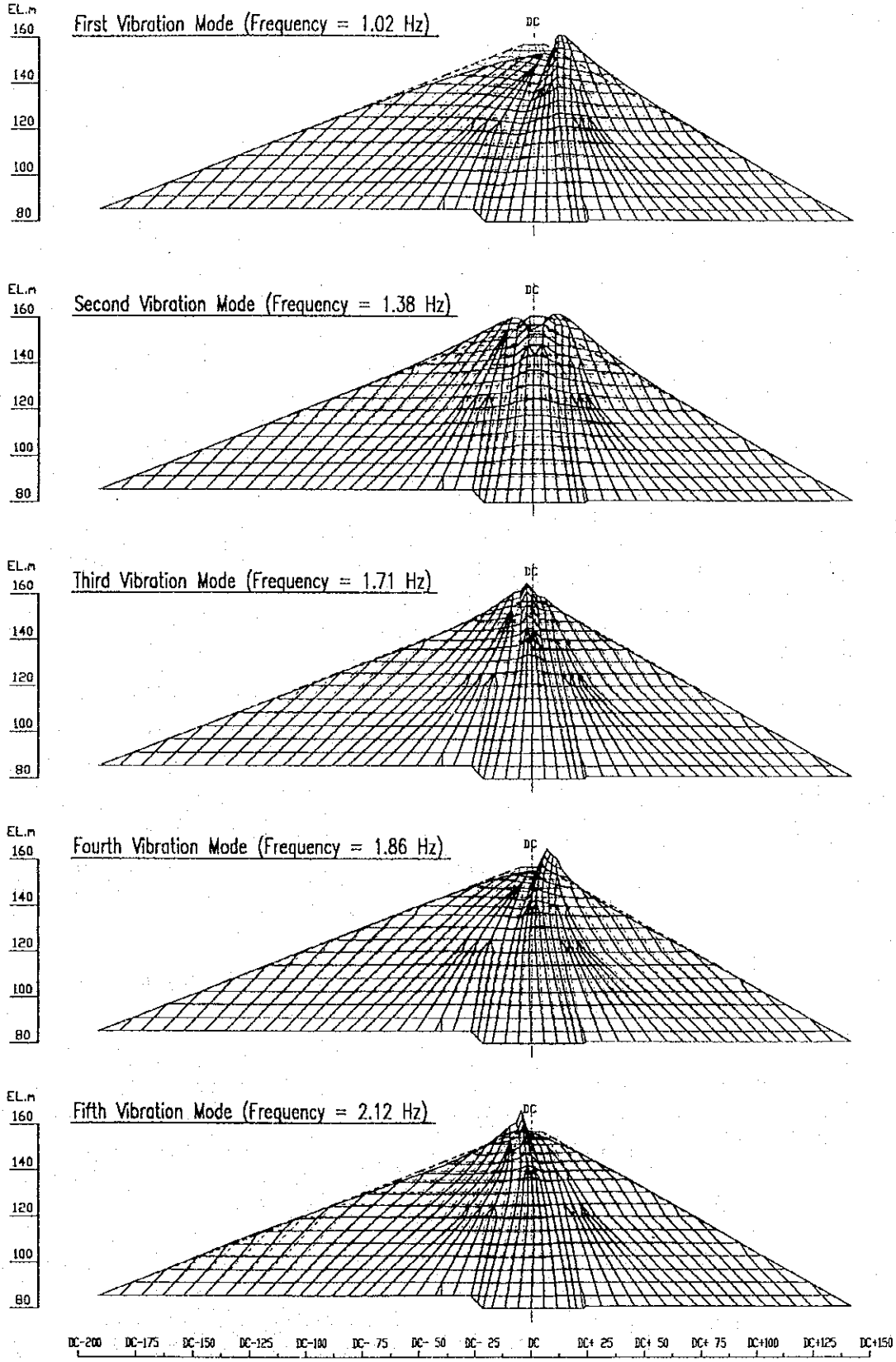
Vibration Mode Shape
after Design Basis Earthquake (189.1gal)



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.14 (2/3) RESULTS OF DYNAMIC ANALYSIS (VIBRATION MODE SHAPE)
JAPAN INTERNATIONAL COOPERATION AGENCY	

DYNAMIC ANALYSIS FOR DAM

Vibration Mode Shape
after Maximum Credible Earthquake (380.0gal)



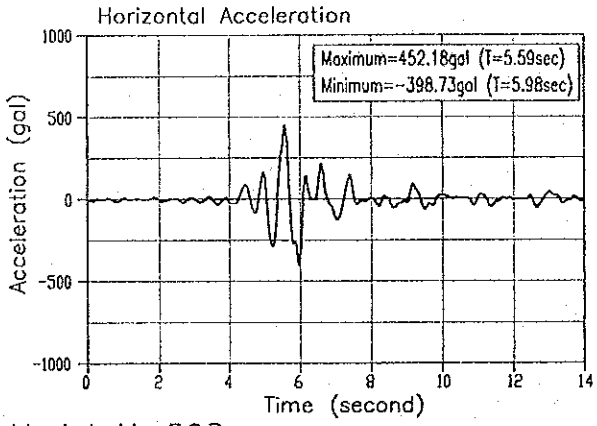
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.14 (3/3) **RESULTS OF DYNAMIC ANALYSIS (VIBRATION MODE SHAPE)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

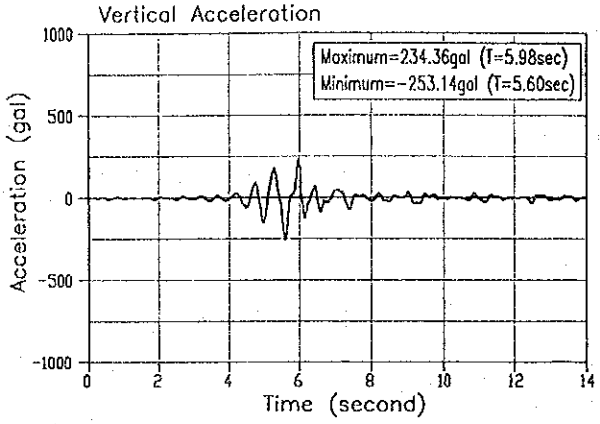
DYNAMIC ANALYSIS FOR DAM

Crest Acceleration

Design Basis Earthquake (189.1gal)

Nodal No.502





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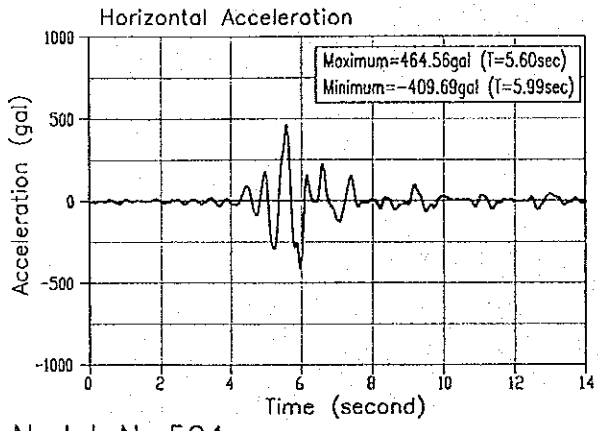

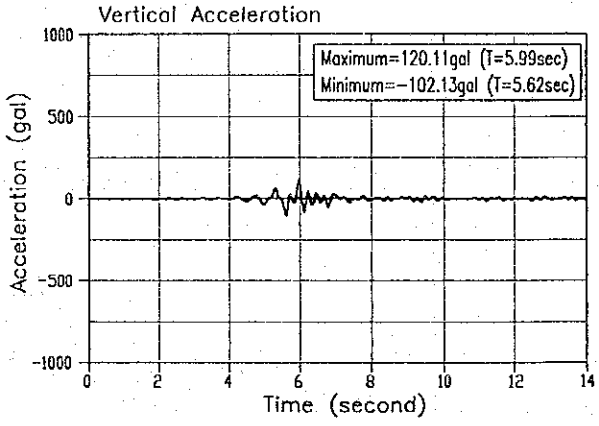

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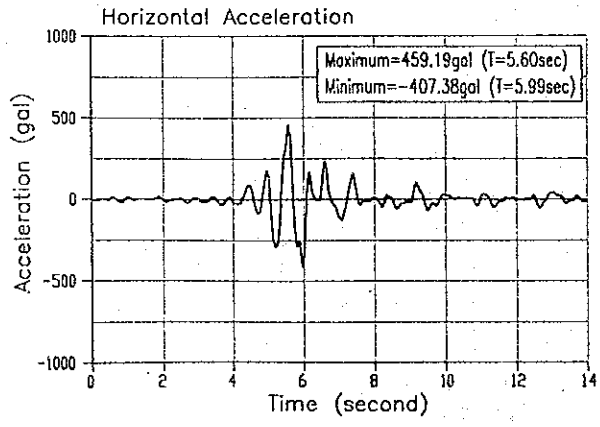
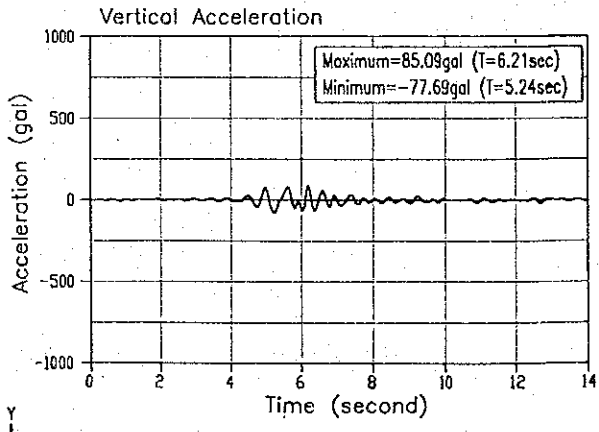
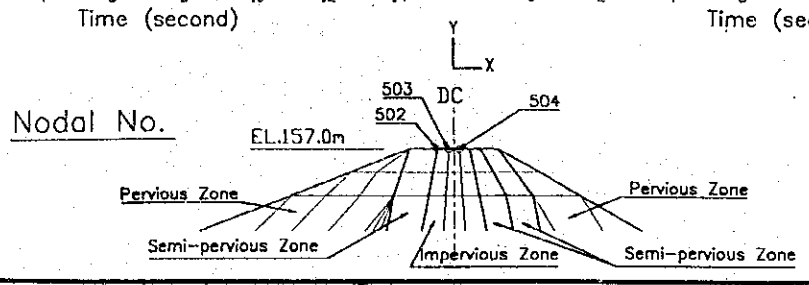






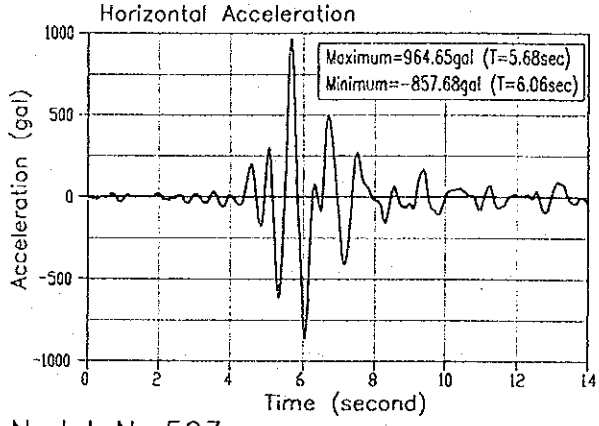
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.15 (1/4) RESULTS OF DYNAMIC ANALYSIS (MAXIMUM ACCELERATION AND DISPLACEMENT AT CREST)
JAPAN INTERNATIONAL COOPERATION AGENCY	

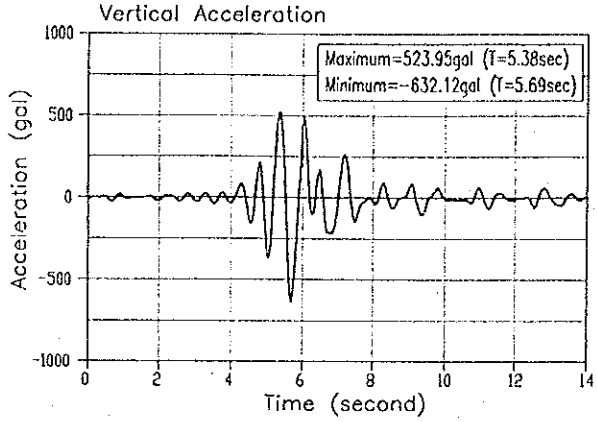
DYNAMIC ANALYSIS FOR DAM

Crest Acceleration

Maximum Credible Earthquake (380.0gal)

Nodal No.502





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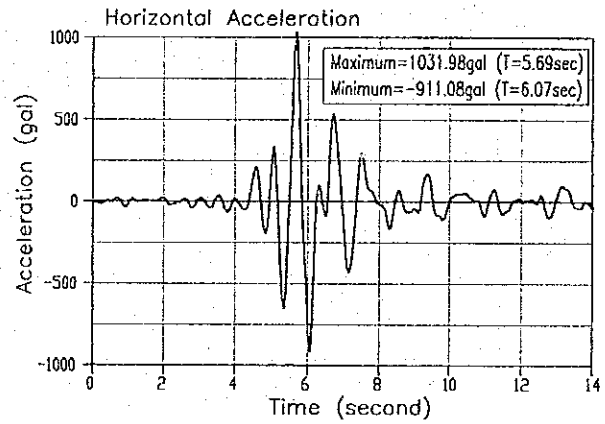

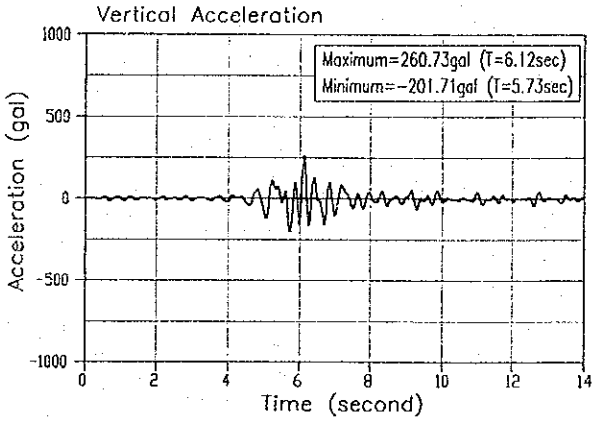

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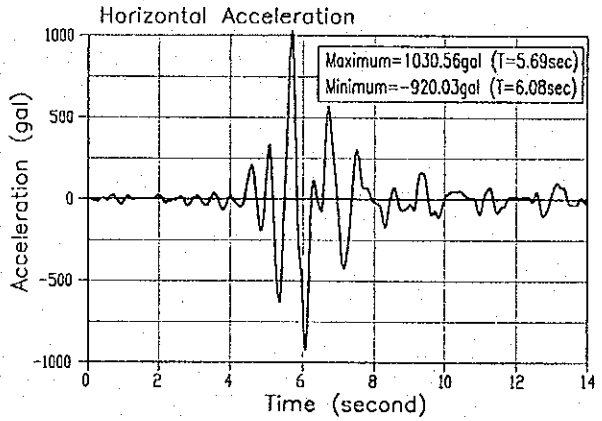
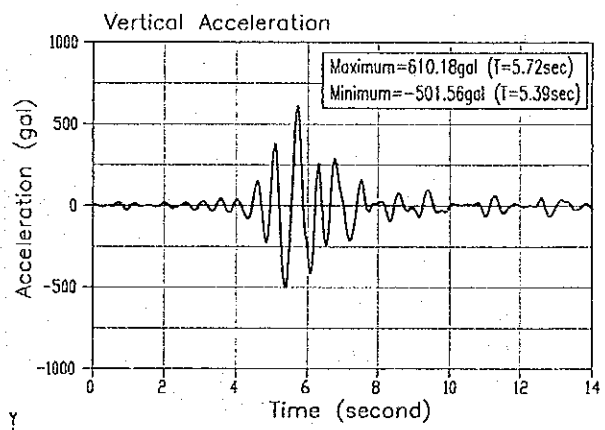
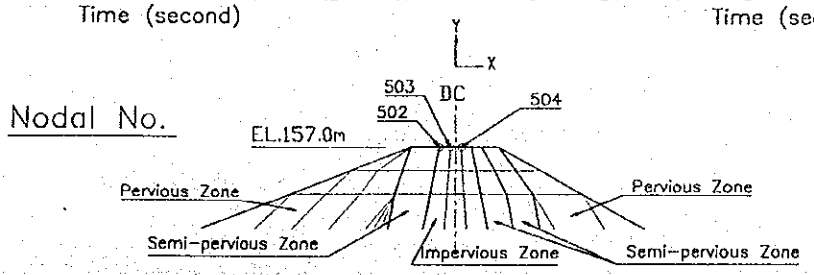






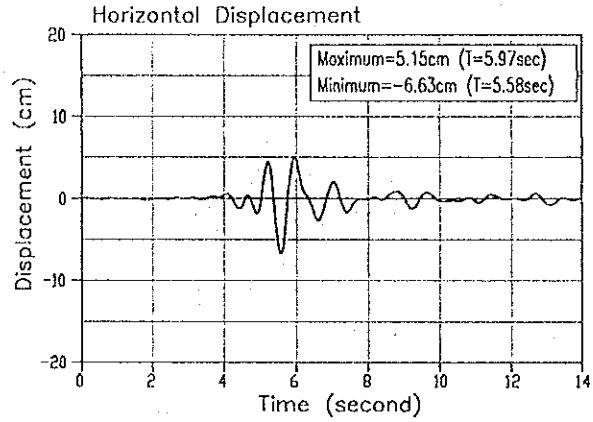
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.15 (2/4) **RESULTS OF DYNAMIC ANALYSIS (MAXIMUM ACCELERATION AND DISPLACEMENT AT CREST)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

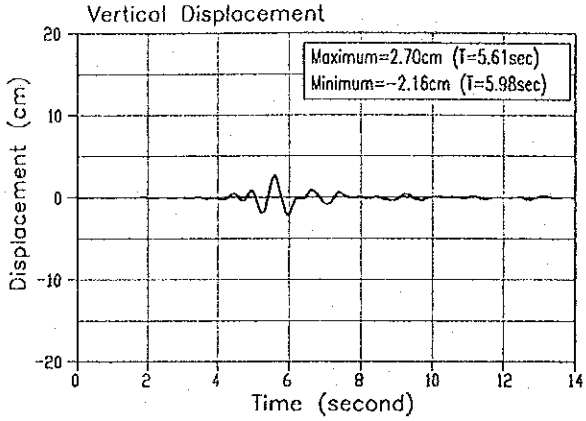
DYNAMIC ANALYSIS FOR DAM

Crest Displacement

Design Basis Earthquake (189.1gal)

Nodal No.502





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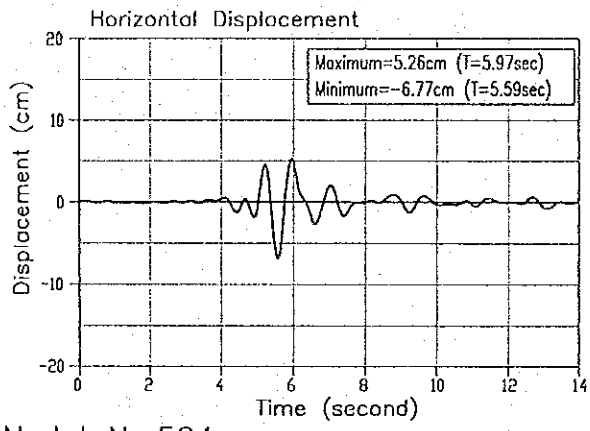

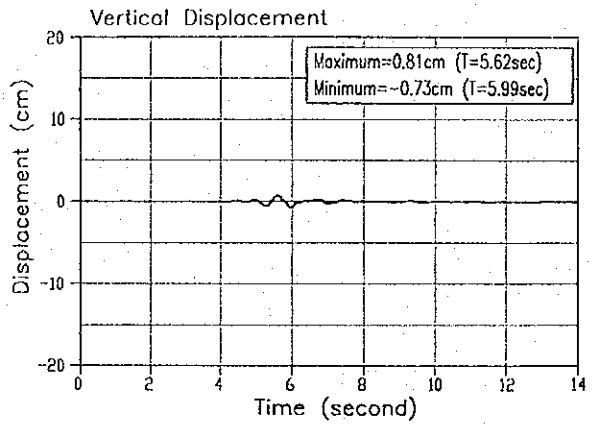

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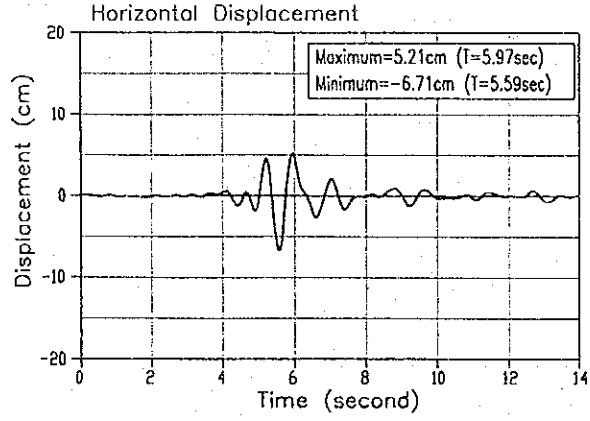
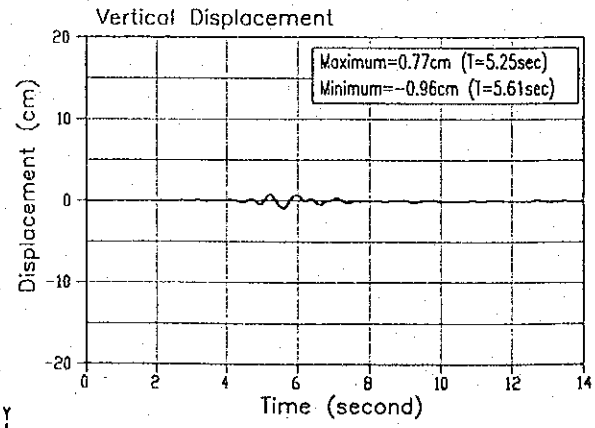
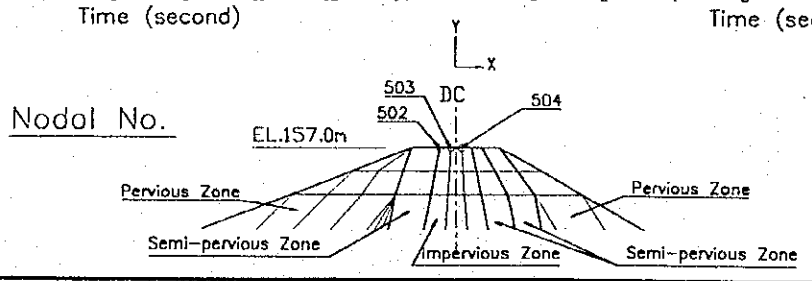






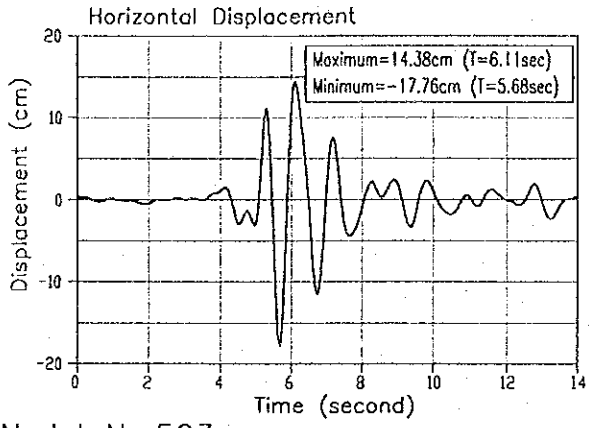
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.15 (3/4) RESULTS OF DYNAMIC ANALYSIS (MAXIMUM ACCELERATION AND DISPLACEMENT AT CREST)
JAPAN INTERNATIONAL COOPERATION AGENCY	

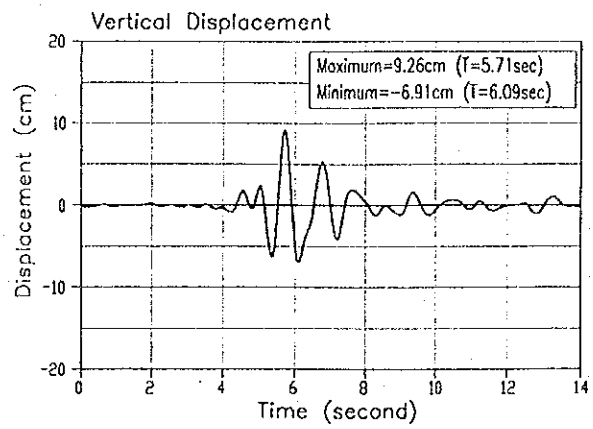
DYNAMIC ANALYSIS FOR DAM

Crest Displacement

Maximum Credible Earthquake (380.0gal)

Nodal No.502





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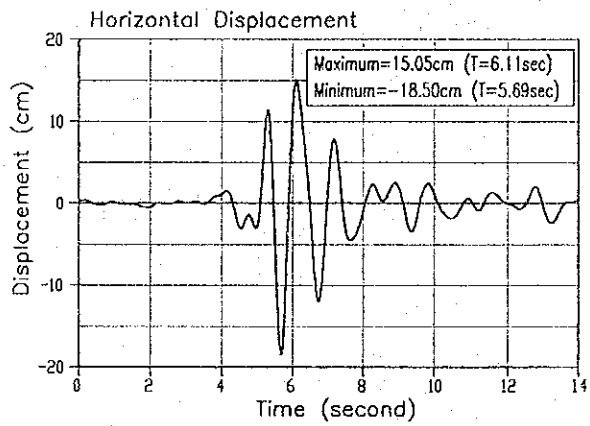

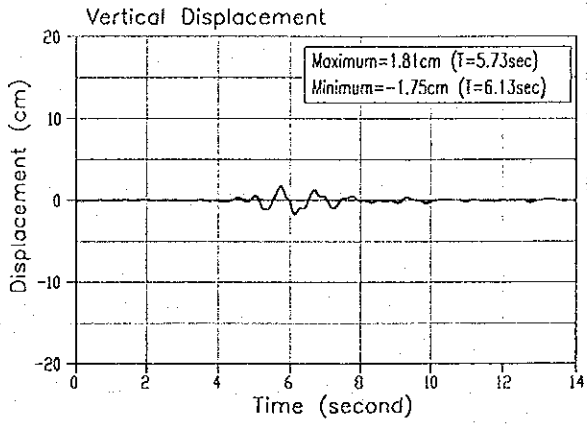

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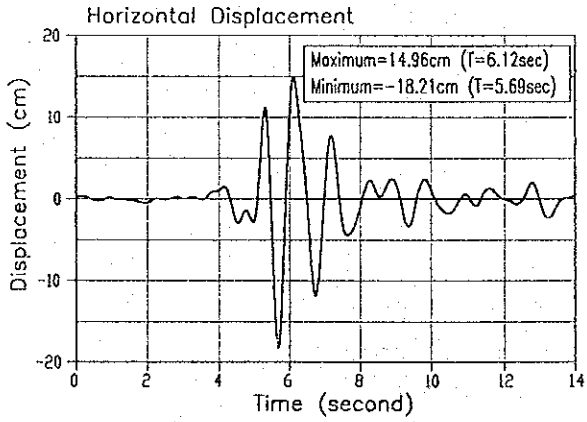
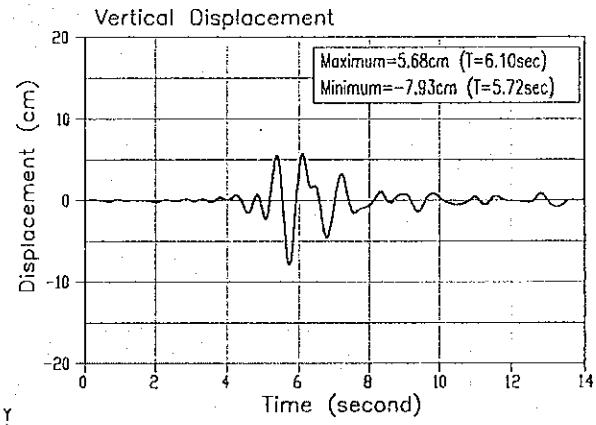
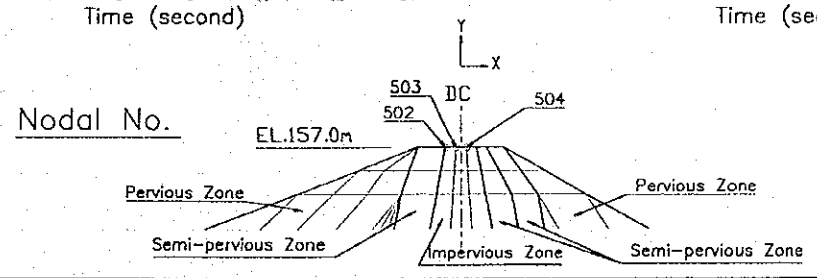




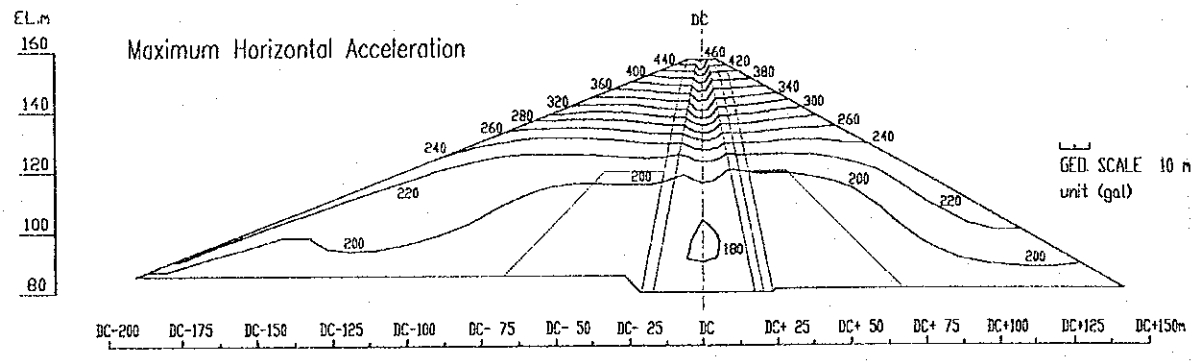


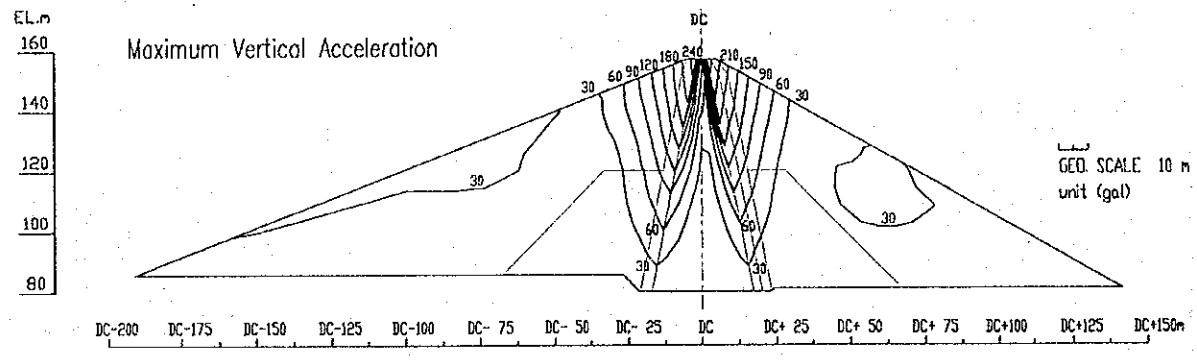
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.15 (4/4) **RESULTS OF DYNAMIC ANALYSIS (MAXIMUM ACCELERATION AND DISPLACEMENT AT CREST)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

DYNAMIC ANALYSIS FOR DAM

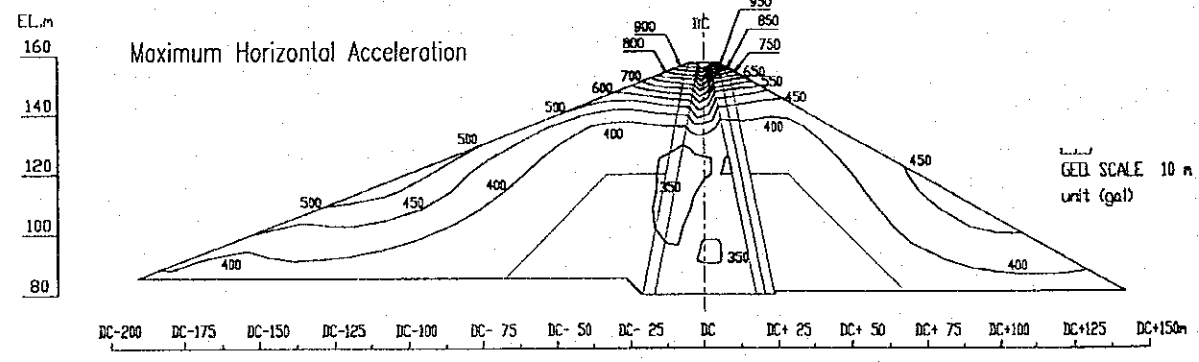
Maximum Acceleration Contour

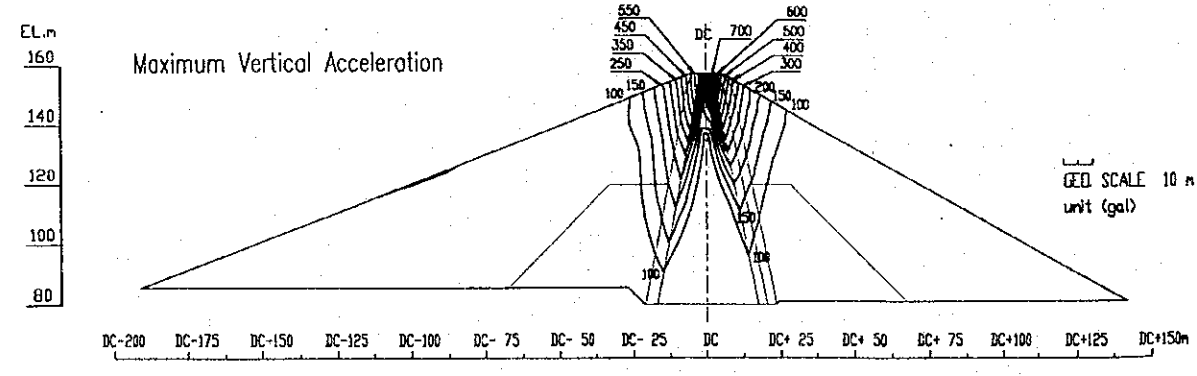
Design Basis Earthquake (189.1 gal)





Maximum Credible Earthquake (380.0 gal)



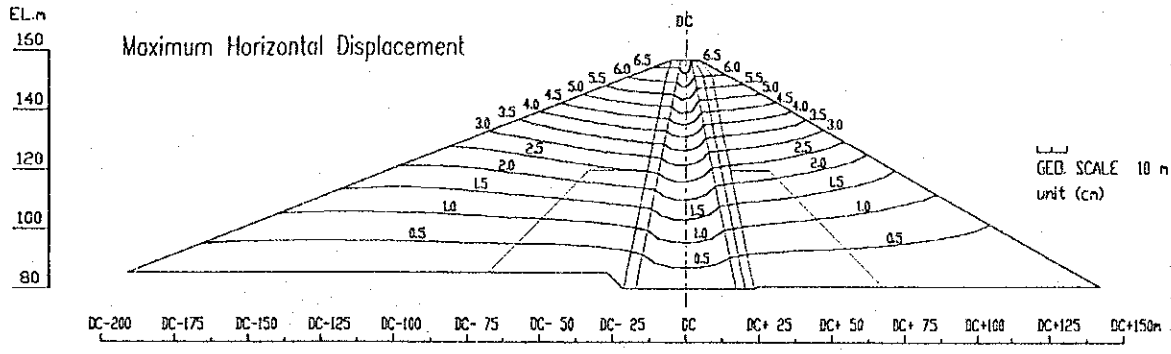


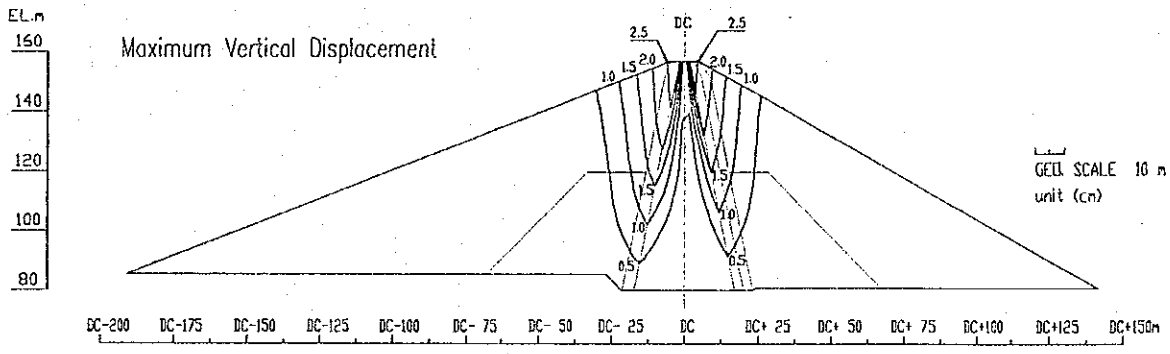
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. **7.3.16 (1/2)** **RESULTS OF DYNAMIC ANALYSIS (MAXIMUM ACCELERATION AND DISPLACEMENT CONTOUR)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

DYNAMIC ANALYSIS FOR DAM

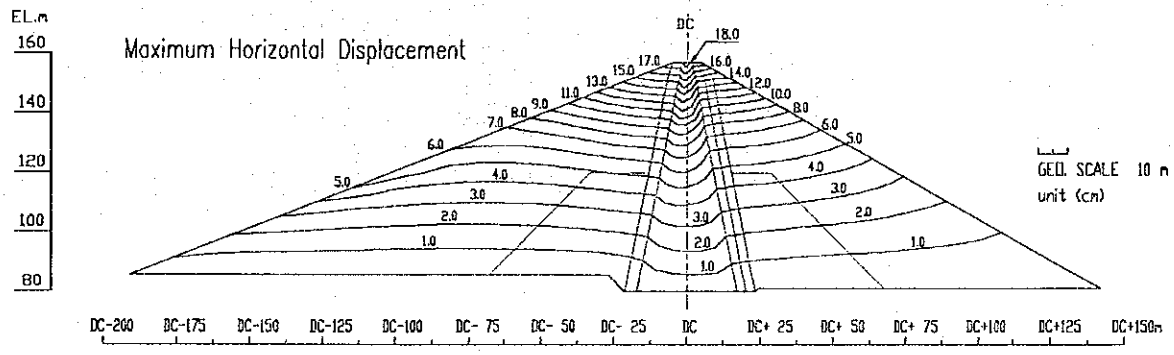
Maximum Displacement Contour

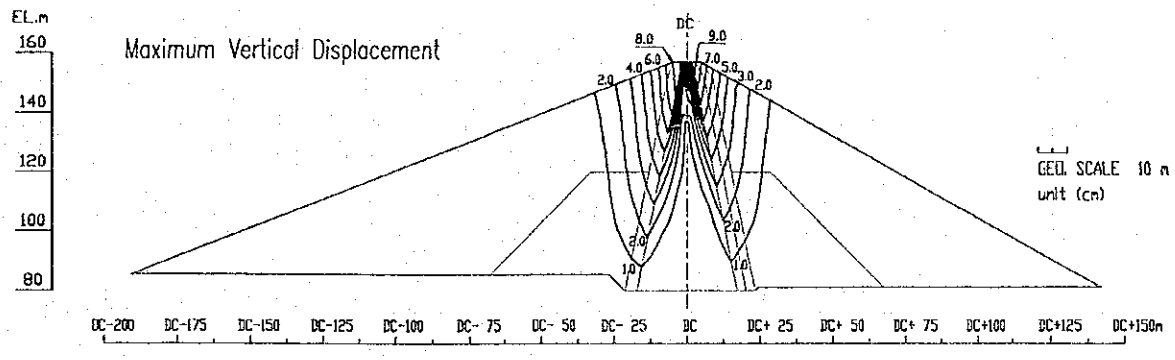
Design Basis Earthquake (189.1 gal)





Maximum Credible Earthquake (380.0 gal)





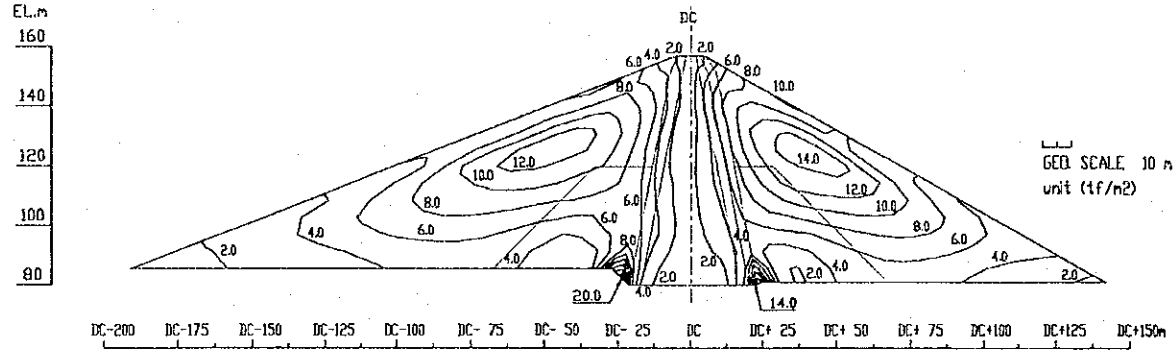
THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.16 (2/2) **RESULTS OF DYNAMIC ANALYSIS (MAXIMUM ACCELERATION AND DISPLACEMENT CONTOUR)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

DYNAMIC ANALYSIS FOR DAM

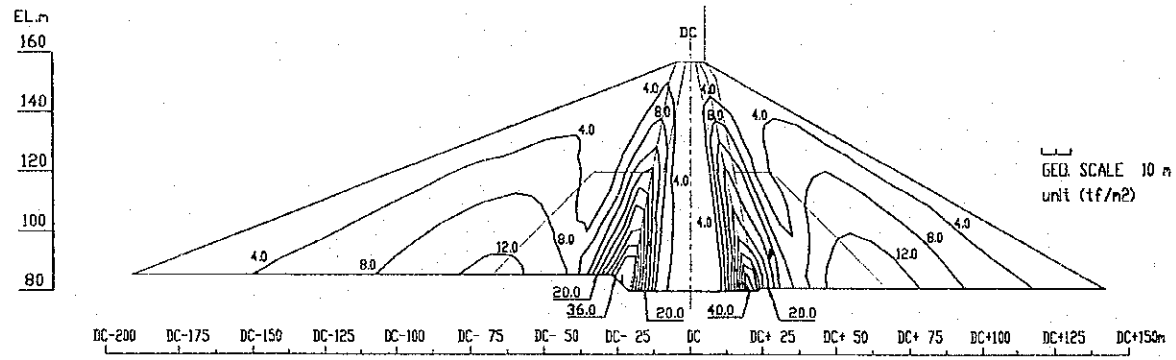
Stress Contour

Design Basis Earthquake (189.1 gal)

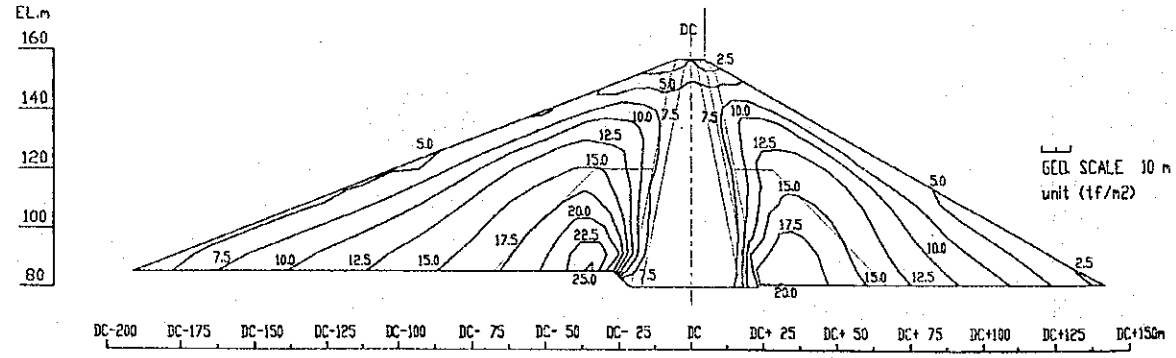
Horizontal Stress



Vertical Stress



Shear Stress



THE DETAILED DESIGN OF FLOOD CONTROL, URBAN DRAINAGE AND WATER RESOURCES DEVELOPMENT IN SEMARANG IN THE REPUBLIC OF INDONESIA	Fig. 7.3.17 (1/2)
JAPAN INTERNATIONAL COOPERATION AGENCY	**RESULTS OF DYNAMIC ANALYSIS (DYNAMIC STRESS CONTOUR)**