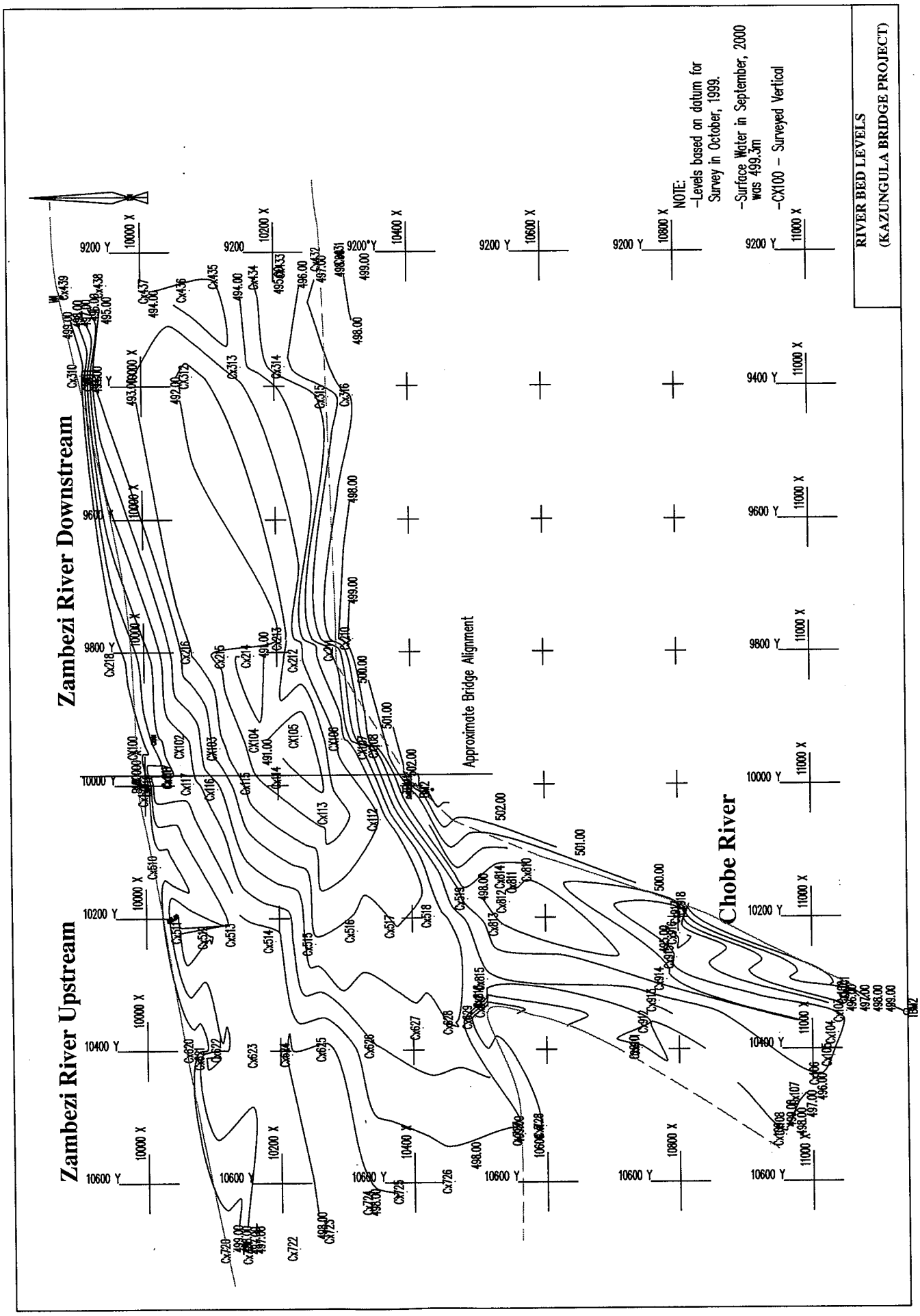
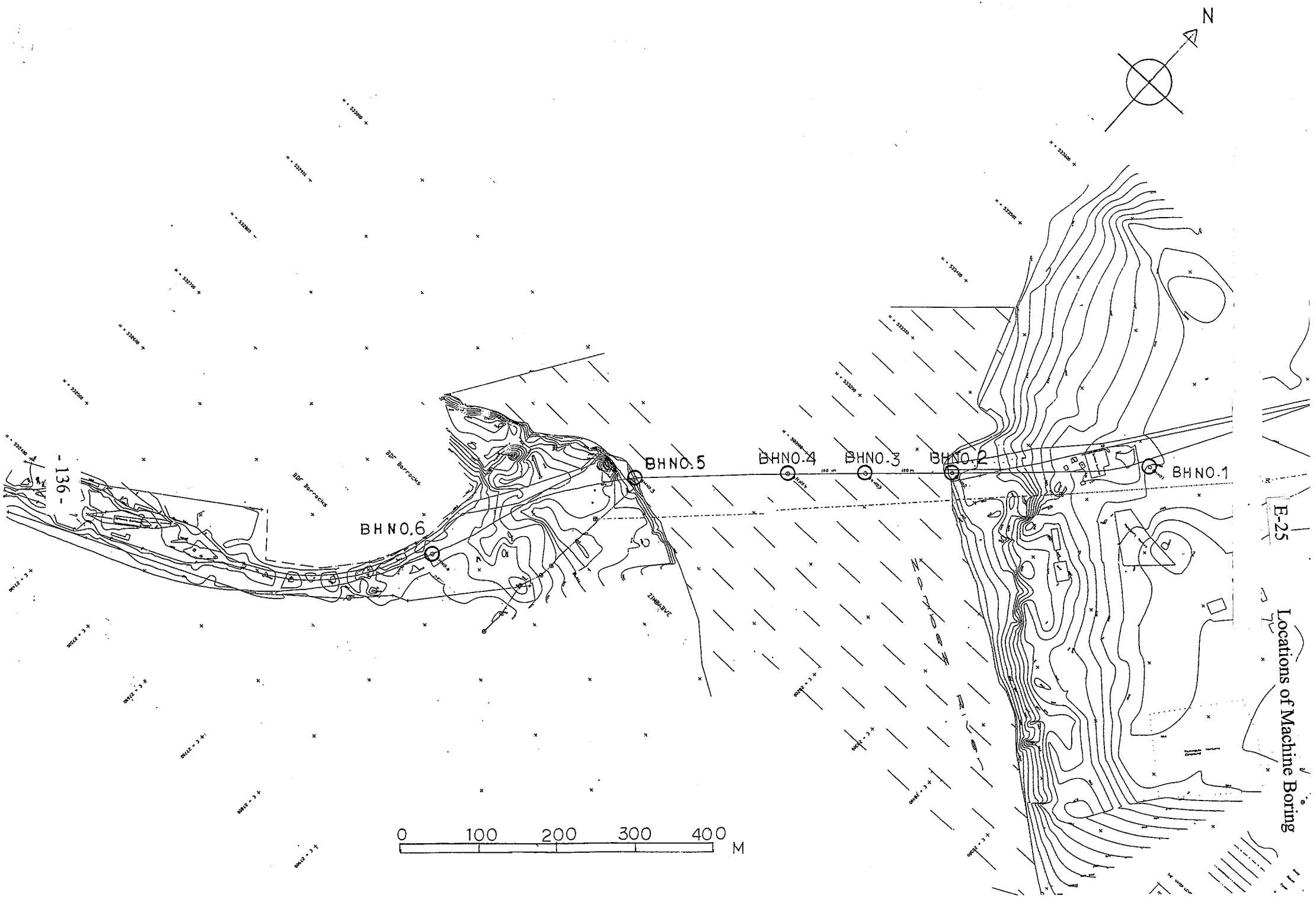
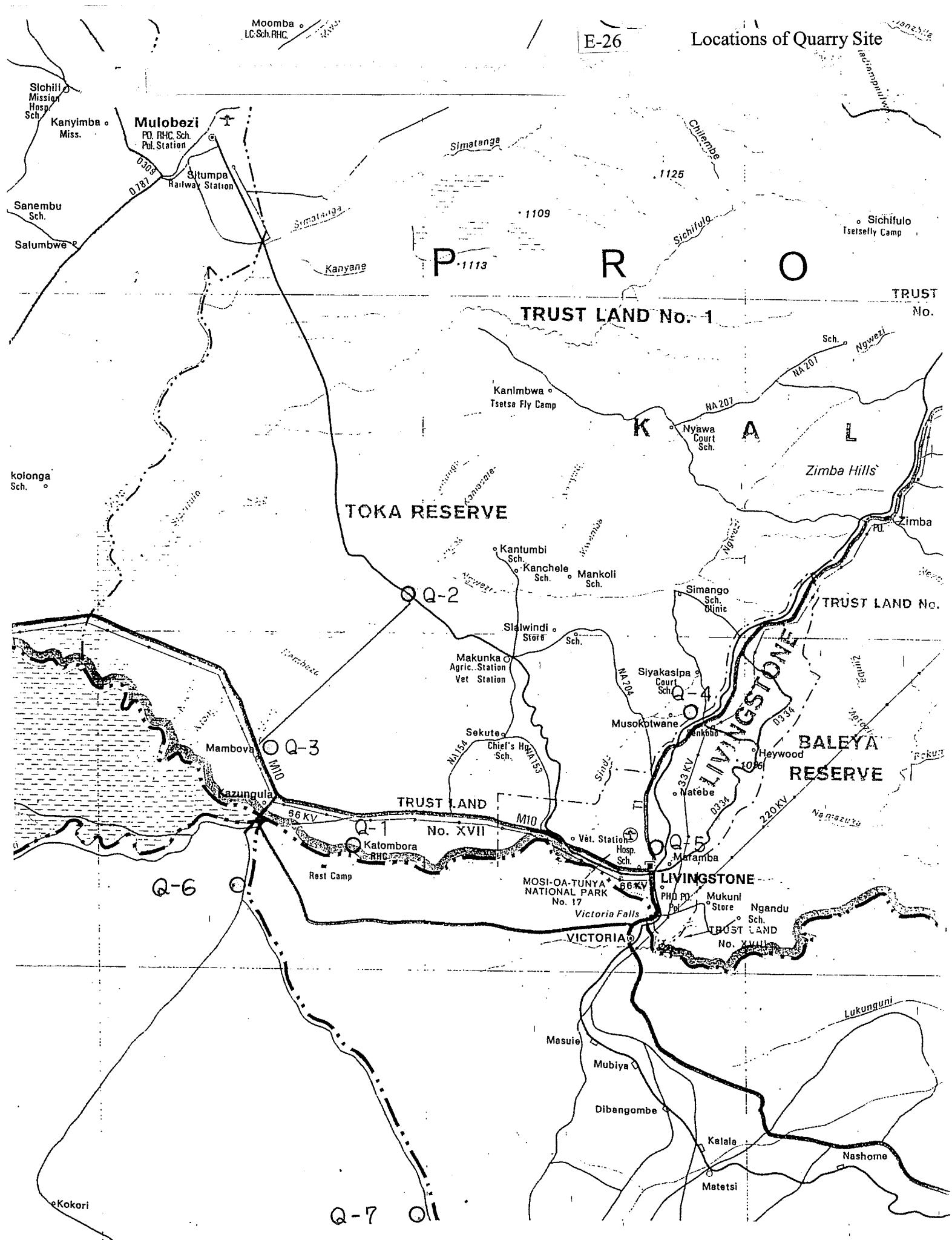

RIVER BED LEVELS
(KAZUNGULA BRIDGE PROJECT)
NOTE:
-Levels based on datum for Survey in October, 1999.
-Surface Water in September, 2000 was 499.3m
-CX100 – Surveyed Vertical
Zambezi River Downstream
Zambezi River Upstream
Chobe River
Approximate Bridge Alignment



Locations of Machine Boring

E-25

Locations of Quarry Site



Scale 1:750,000

Km. 10 0 10 20 30 40 50 60 70 80 90 100 Km.

25° 25°30' 26°

Structural Analysis of Superstructure for Kazungula Bridge

1 General

1.1 Standard and Specifications

Name of Standards, Specification, or Guideline
Design Criteria for Bridge Design for The KAZUNGULA Bridge Construction Project
BS5400 Steel, concrete and composite bridge

1.2 Geometry of Bridge

Type of Bridge

Main Bridge

3-Spans continuous PC Extra-dosed bridge

Span Arrangement 122.5+220+122.5=465 m

Type of Girder: segment PC box girder

Type of Pier: Column pier

Foundation : Cast in Place Concrete pile Dia.1.00m, Dia.3.00m

Pier name	Type of Substructure	Type of Foundation	Bearing condition
P3, P6	Column Pier	Cast in situ Concrete Pile (Dia. 1,000,)	Elastomeric
P4, P5	Column Pier	Cast in situ Concrete Pile (Dia. 3,000)	Elastomeric

Elastomeric Bearing supports the force of vertical and longitudinal horizontal direction to Flexibility.

Approach Viaduct

Botswana side

Bridge Type : 3-spans Continuous PC Box Girder

Span arrangement : 3@42.5m=127.5m

Substructure : reversed -T-type Abutment, column pier

Foundation : Cast in Place Concrete pile Dia.1.000m

Zambia side

Bridge Type : 3spans Continuous PC Box Girder

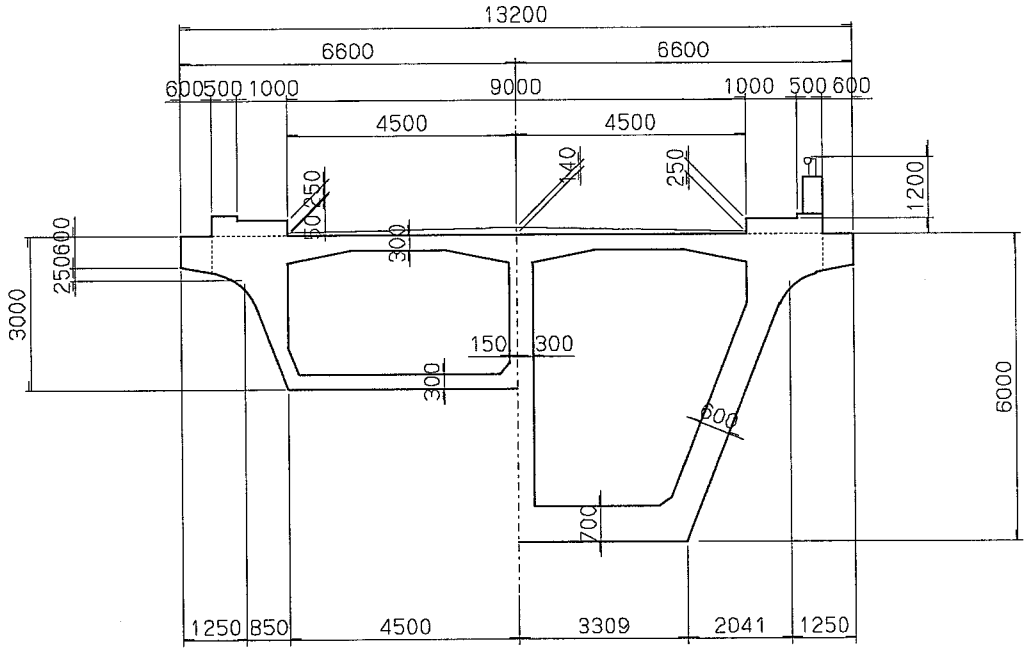
Span arrangement : 3@42.5m=127.5m

Substructure : reversed -T-type Abutment, columns pier

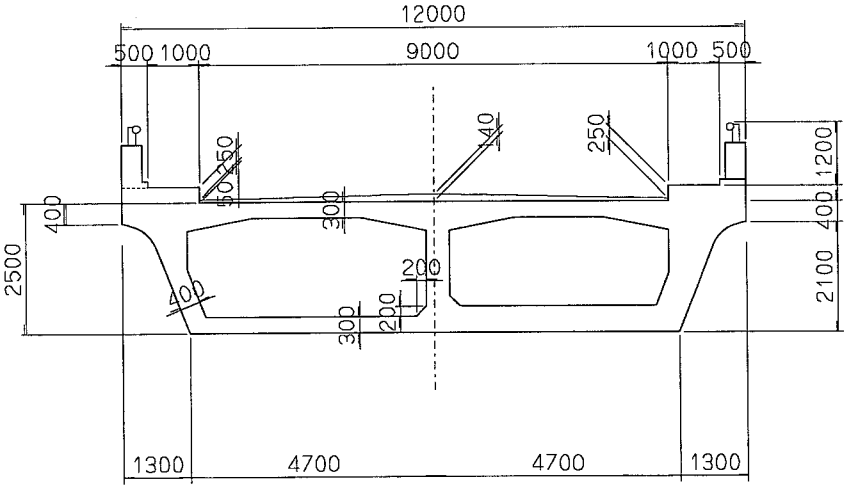
Foundation : Cast in Place Concrete pile Dia.1.000m

1.3 Cross Section

Typical Cross Section of Main Bridge (PC Box Girder)



Typical Cross Section of Approach Viaduct



1.4 Design Loads

1.4.1 Dead Load

Dead loads are calculated using following density of each material

RC;24.5kN/m3

Plain concrete; 22.5kN/m3

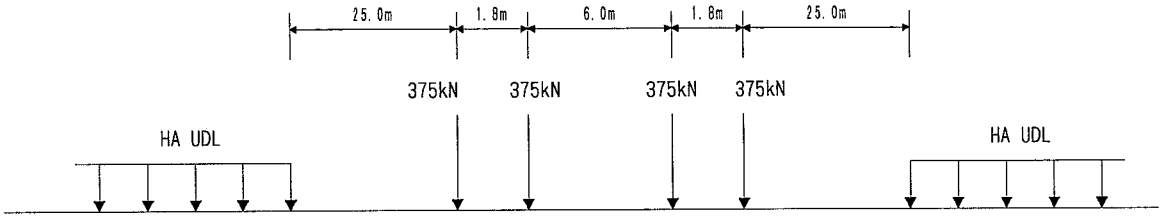
Asphalt; 22.5kN/m3

1.4.2 Live Load

Loading Classification

In conformity with design traffic loads HB-37.5 with HA UDL(according to BS5400).

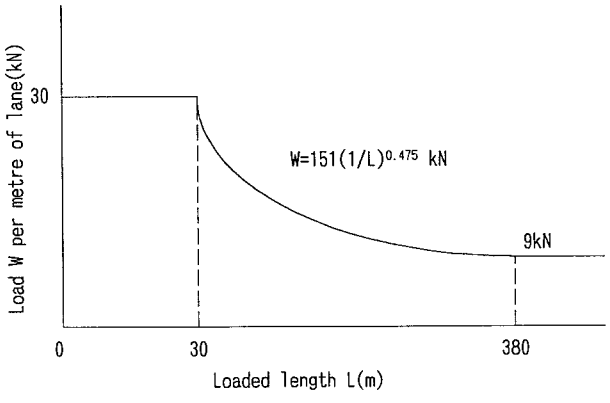
HB-37.5



HA uniform distribute load

HA UDL shall be taken as 30kN per linear metre of nominal lane for loaded lengths up to 30m, and for loaded lengths in excess of 30m it shall be derived from the equation

$W=151(1/L)0.475$ but not less than 9



1.5 Material

1.5.1 Concrete

Class	Fc′	Ec (MPa)	G (MPa)	Ct
A	40MPa	31,000	12,900	12.0/°C x 1.0E-6
B	25MPa	26,000	10,800	

* fc′: Compressive Strength of Concrete at 28 days (BS5400 Part4 4.3.2.1)

Ec: Elasticity Modulus of Concrete (BS5400 Part4 4.3.2.1)

G: Shear Modulus

G = Ec/(2 x (1+Poisson's ratio)) = Ec/2.4

Poisson's ratio = 0.2 (BS5400 Part4 4.3.2.1)

Class	Fc′	Typical use
A	40 MPa	In situ concrete: Pylons, PC Box Girders Pre-cast concrete: PC Box Girders
B	25 MPa	In situ concrete : Pier, Abutment, Pile caps, Foundation

Ct: Coefficient of thermal expansion and contraction (BS5400 Part4 4.3.2.1)

1.5.2 Reinforcement Steel

GRADE : SD345

- Specified Yield Strength:
  Plain Round: 235MPa High Yield deformed: 390MPa
- Modulus of elasticity of reinforcement steel: Es = 200,000 MPa

Available size of reinforcement

Dia. (mm)	Area (mm^2)	Mass (N/m)	Dia. (mm)	Area (mm^2)	Mass (N/m)
10	78.54	6.05	28	615.8	47.37
12	113.1	8.71	30	706.9	54.43
14	153.9	11.87	32	804.2	61.88
16	201.1	15.49	35	956.6	73.65
18	254.5	19.61	38	1140.0	87.76
20	314.2	24.22	41	1340.0	102.97
22	380.1	29.22	51	2002.7	155.93
25	490.9	37.76			

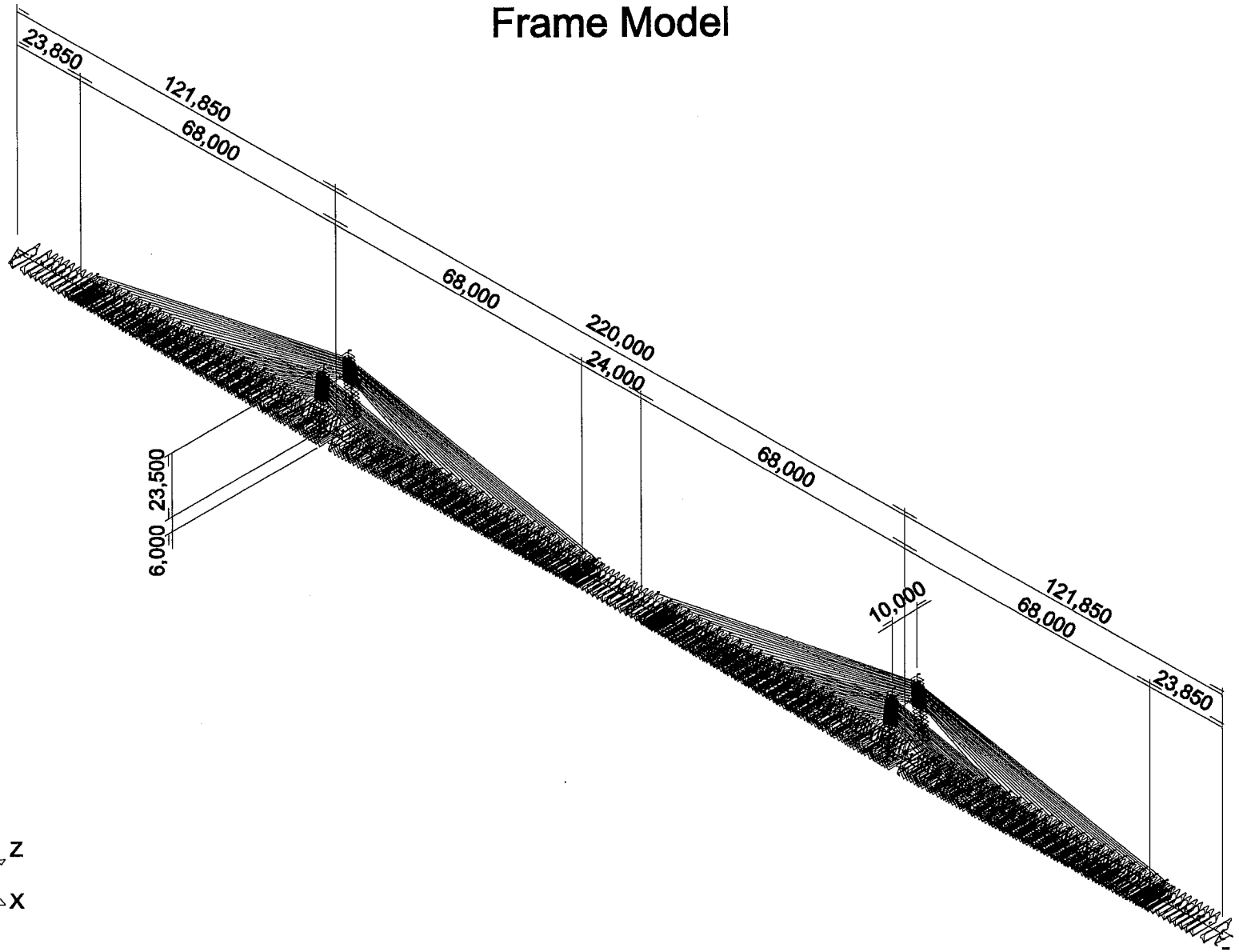
1.5.3 PC Steel

	External (Longitudinal)	Longitudinal PC Bar
Grade	SWPR7BL	SBPR1180
Type of PC Steel	19S15.2	PC bar dia.32mm
Sectional Area (mm^2)	2,635.3	804.2
Nominal Strength (N/mm^2)	1,860	1,180
Yield Strength (N/mm^2)	1,570	930
Young's Modules (MPa)	196,000	197,000
Friction Loss Coefficient (/m)	0.002	0.002
Angle Coefficient (/Deg.)	0.25	0.25
Set Losses (mm)	7	0

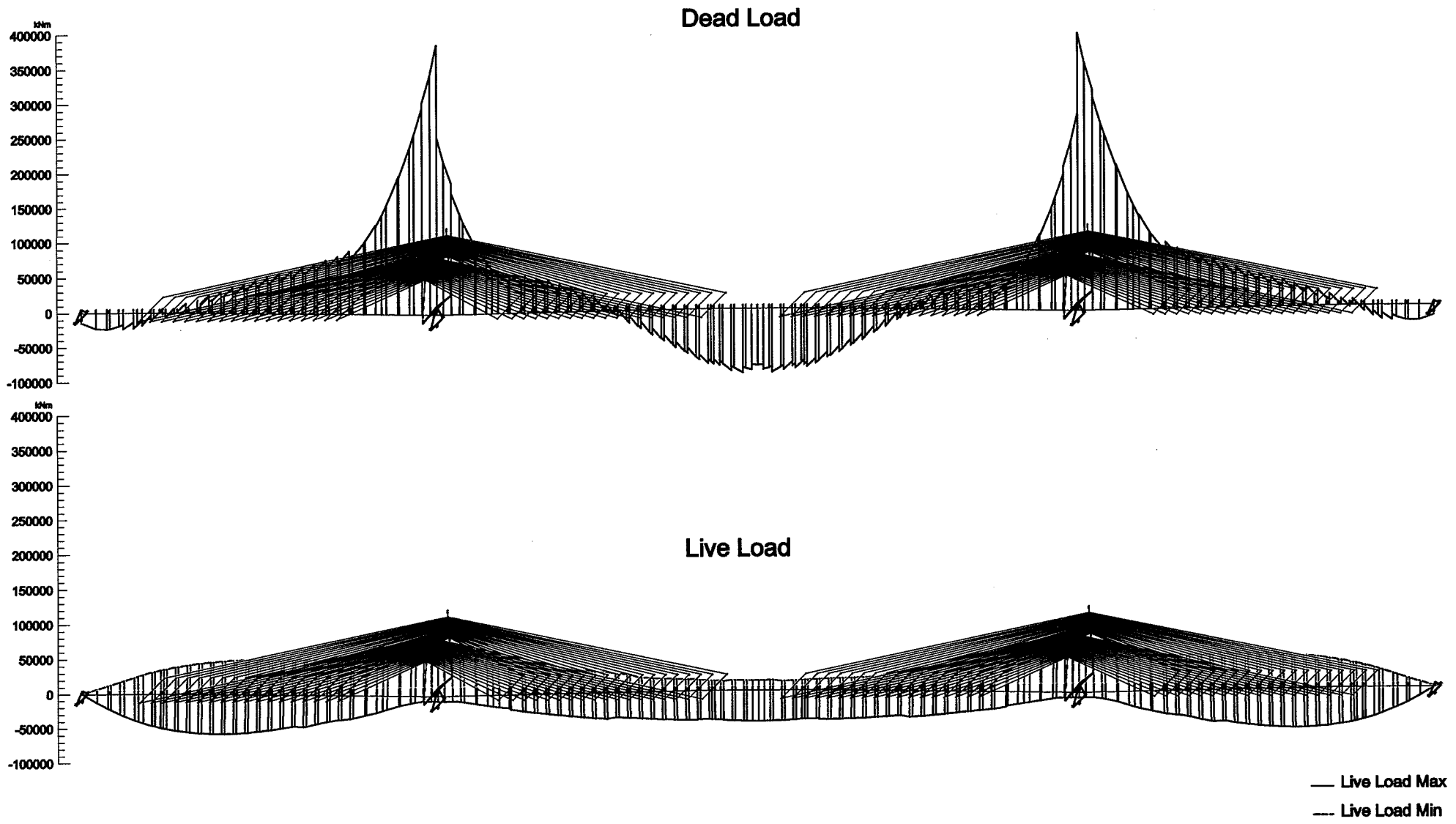
1.5.4 Stay Cable

Material	Nos. of Strand	Nom.ld (mm)	Area (mm^2)	Guaranteed Ultimate Tensile Strength f_p (MPa)	Guaranteed Ultimate Force P_B (kN)	Service Limit Force (kN)
Strand	37	15.2	140	1862	261	117

Frame Model

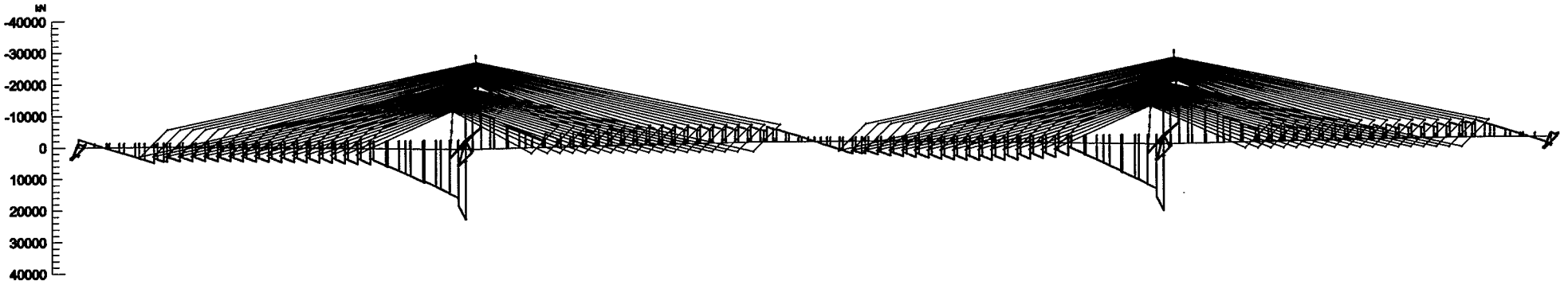

23,850
121,850
68,000
68,000
220,000
24,000
68,000
121,850
68,000
23,850
10,000
23,500
6,000
Y
Z
X

Bending Moment Diagram

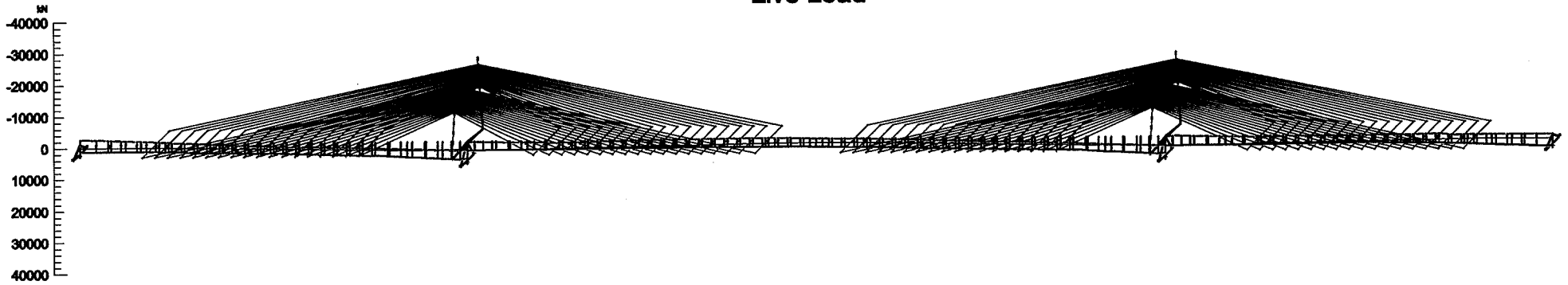


Shear Force Diagram

Dead Load



Live Load

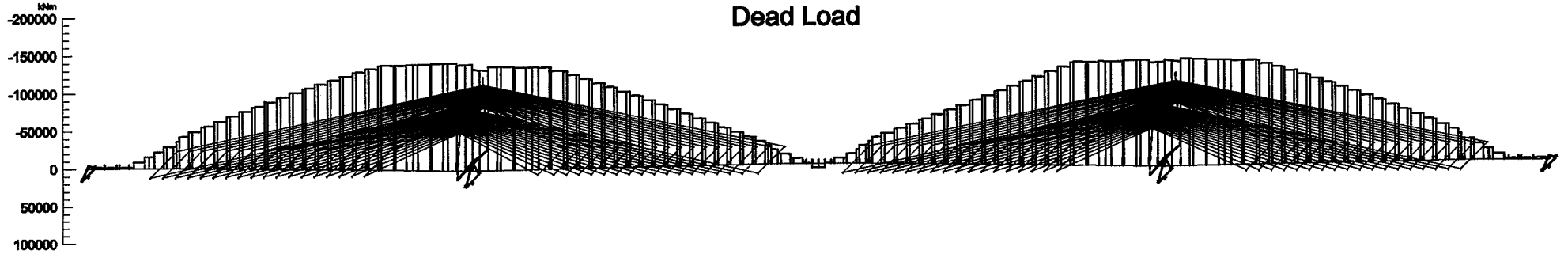


Live Load Max

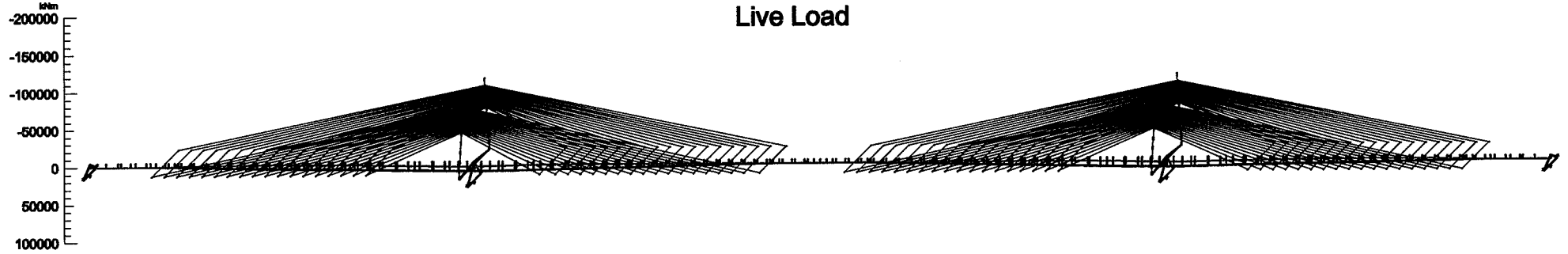
Live Load Min

Axial Force Diagram

Dead Load



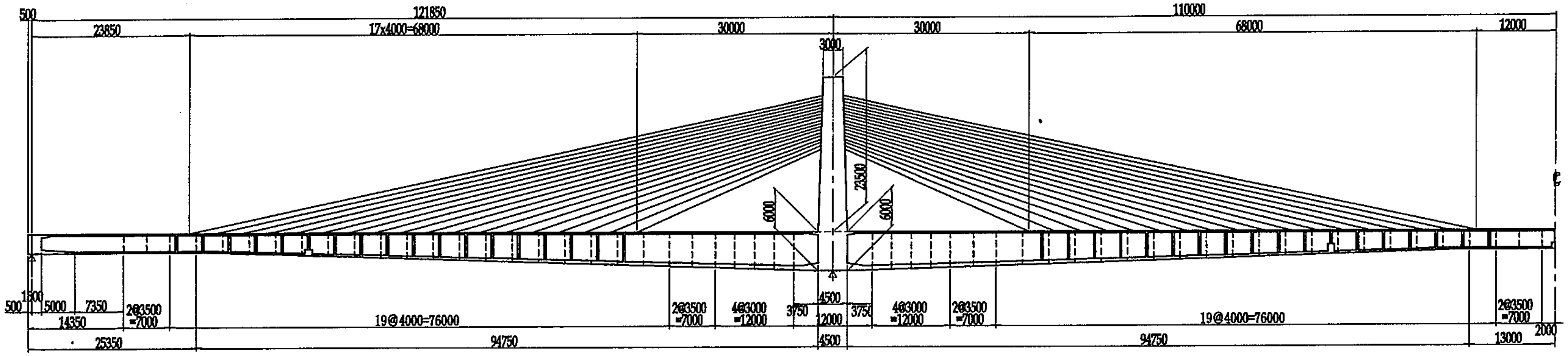
Live Load



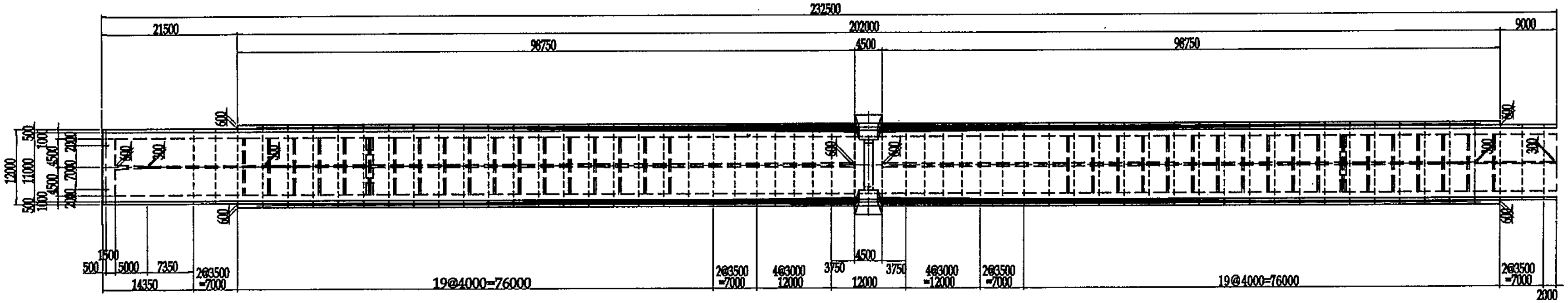
Live Load Max

Live Load Min

ELEVATION SCALE 1:400

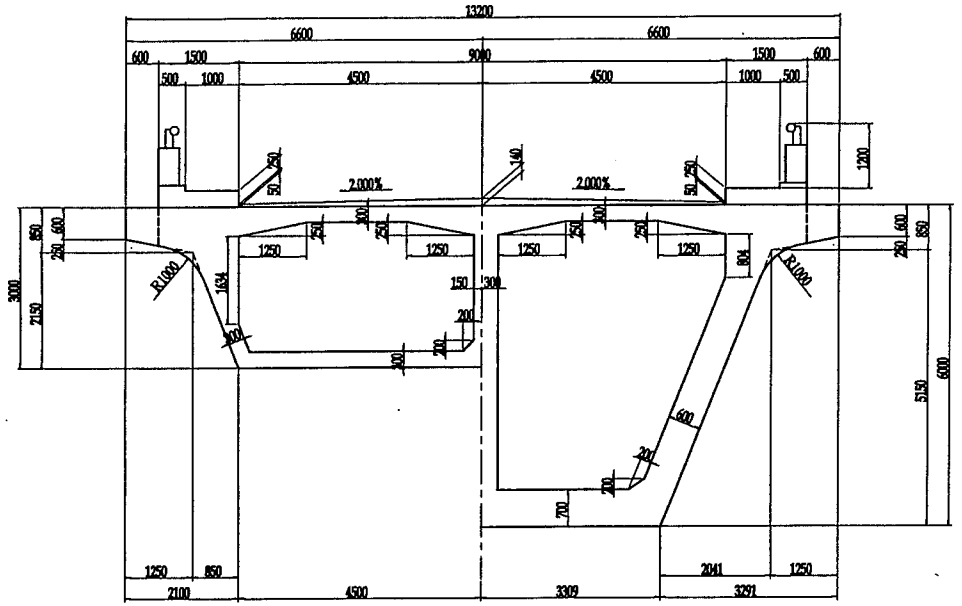


PLAN SCALE 1:400

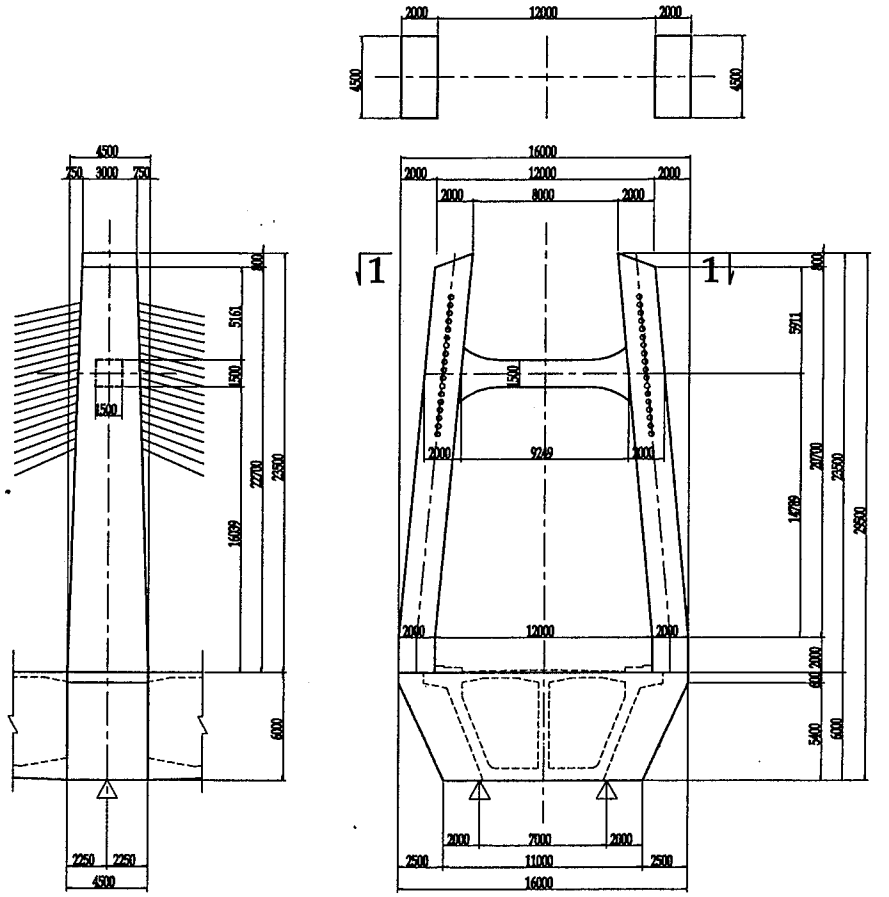


PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM	DRAWING TITLE	DWG NO.
THE FEASIBILITY STUDY ON THE PROPOSED KAZUNGULA BRIDGE OVER THE ZAMBEZI RIVER BETWEEN BOTSWANA AND ZAMBIA	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	MINISTRY OF WORKS, TRANSPORT AND COMMUNICATIONS REPUBLIC OF BOTSWANA MINISTRY OF WORKS AND SUPPLY REPUBLIC OF ZAMBIA	NIPPON KOEI CO.,LTD. ORIENTAL CONSULTANTS CO.,LTD	SUPERSTRUCTURE (1)	

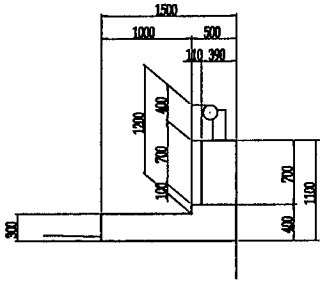
CROSS SECTION SCALE 1:50



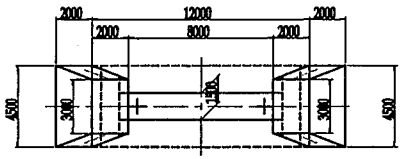
PYLON SCALE 1:150



DETAIL OF CONCRETE BARRIER SCALE 1:30



1-1



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