Governor's Office of the Capital City

INTEGRATED PROJECT MANAGEMENT OFFICE

CSCEC AECOM Consultants Co., Ltd

FEASIBILITY STUDY & CONCEPT DESIGN

"FIRST RING ROAD" project

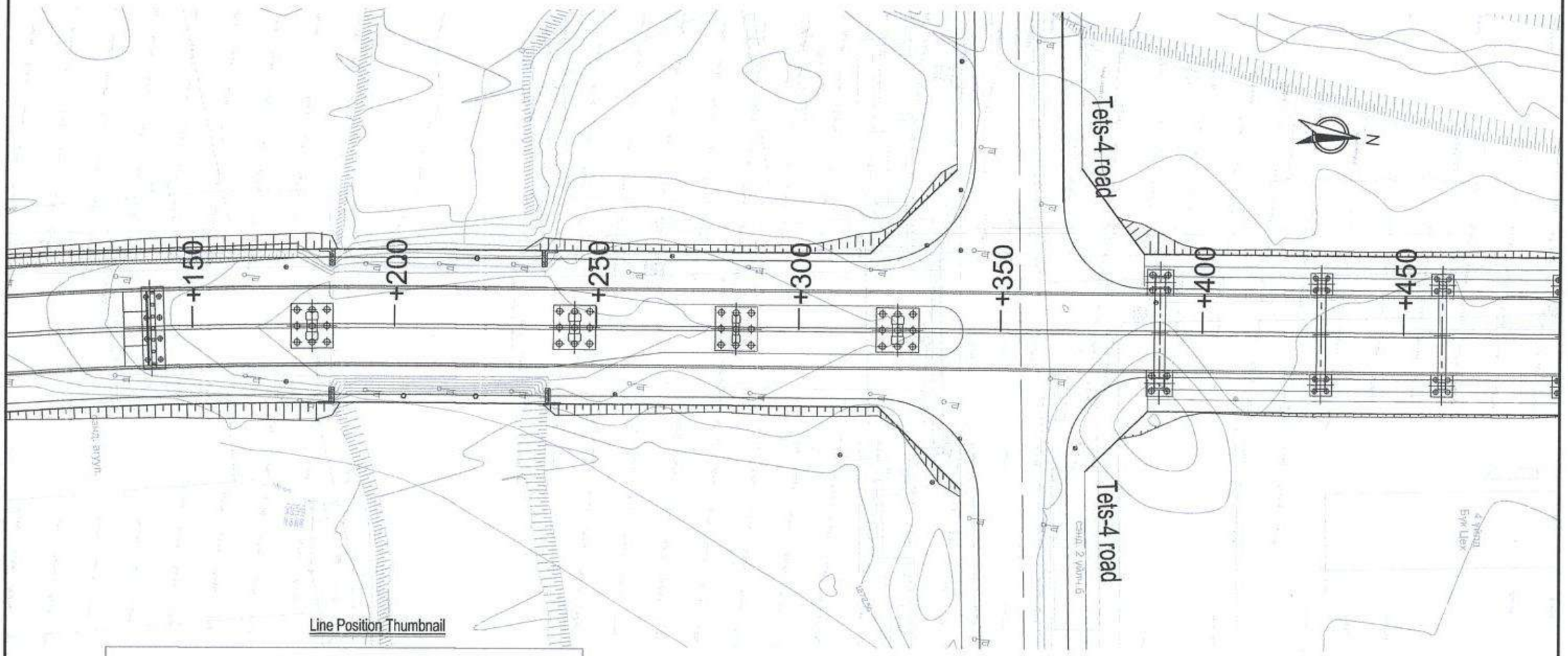
"Bridge & tunnel" Concept design Volume IV-III

Ulaanbaatar
2025

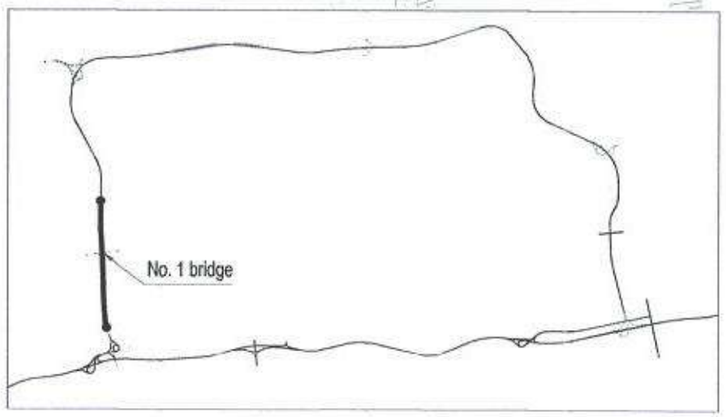
Bridge Location Plan for No. 1 Bridge

1:1000

Pile Nos. at a start point and an end point: K0+139.559~K3+090.559



Line Position Thumbnail



Notes:

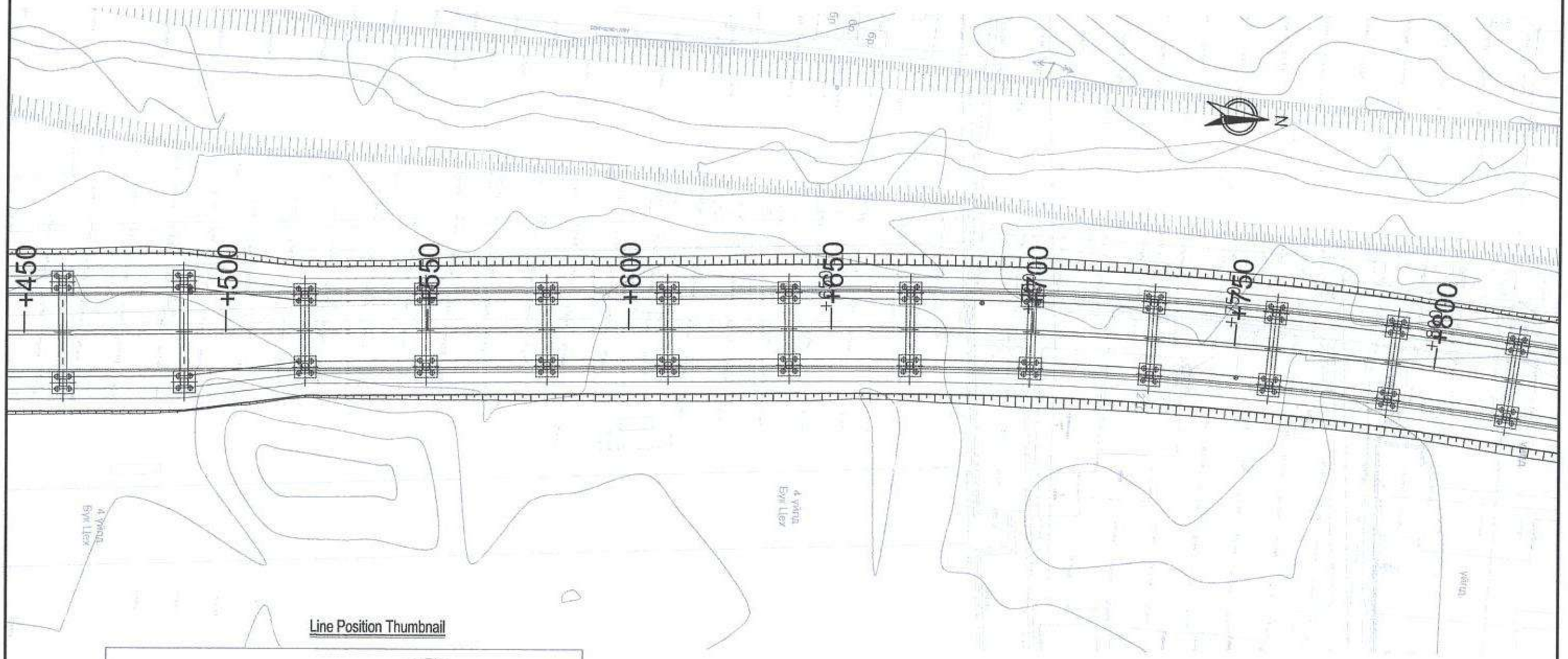
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2.This drawing is applicable to No. 1 Bridge , with a span arrangement of 2×(40+65+40)+5×(3×30)+(40+65+40)+2×(3×30)+(4×30)+(3×27)+(30+45+30)+(30+50+30)+(3×30+31)+(45+70+45)+(4×30)+(2×30+25)+(4×25)+(45+70+45)+2×(4×30)+(3×30+28)+(2×28+2×30)+(4×27.5)+(40+60+40)=2951m, where the upper structure of 25m, 27m, 27.5 m, 28m, 30 m and 31 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the(30+45+30)m、(30+50+30)m、(40+60+40)m、(40+65+40)m、(45+70+45) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-01
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHU						

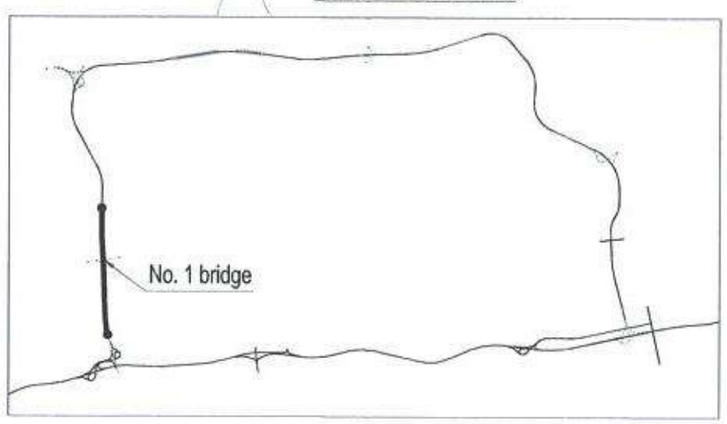
Bridge Location Plan for No. 1 Bridge

1:1000

Pile Nos. at a start point and an end point: K0+139.559~K3+090.559



Line Position Thumbnail



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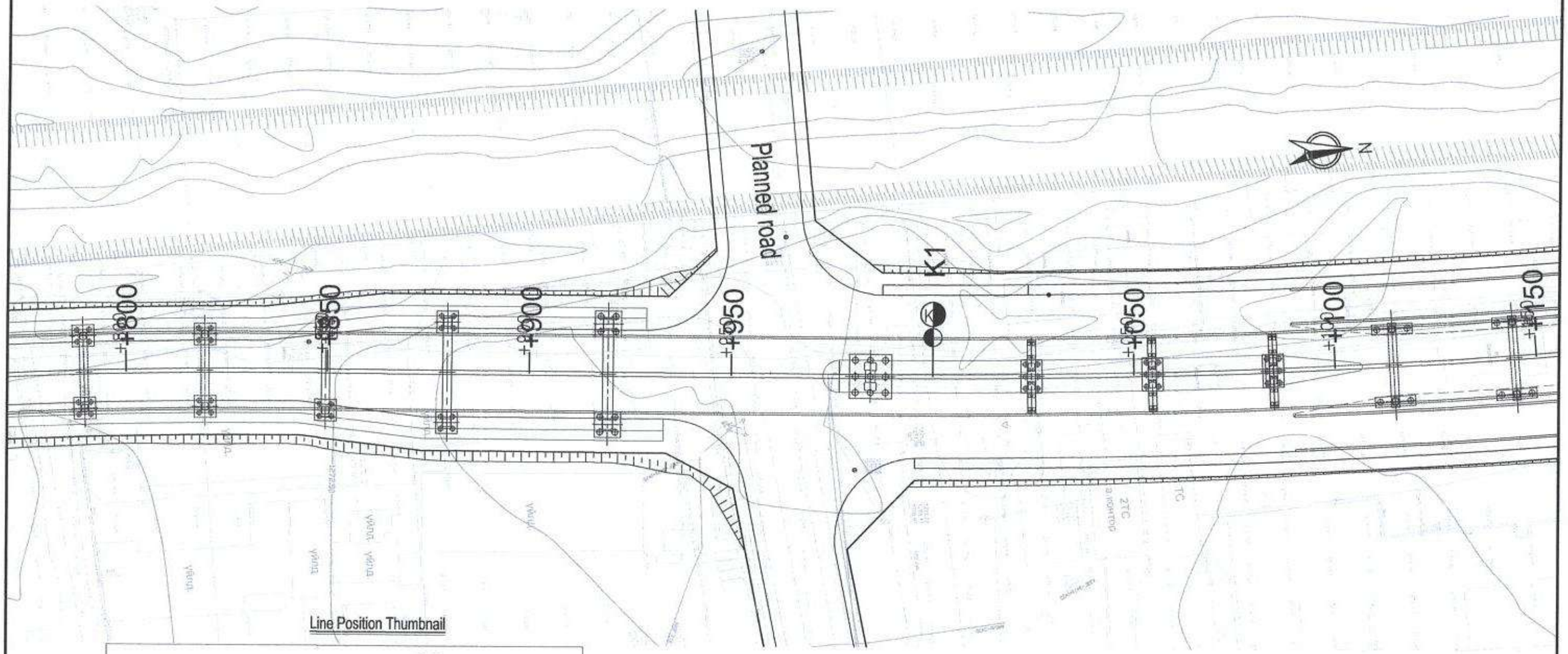
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-01
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHU						

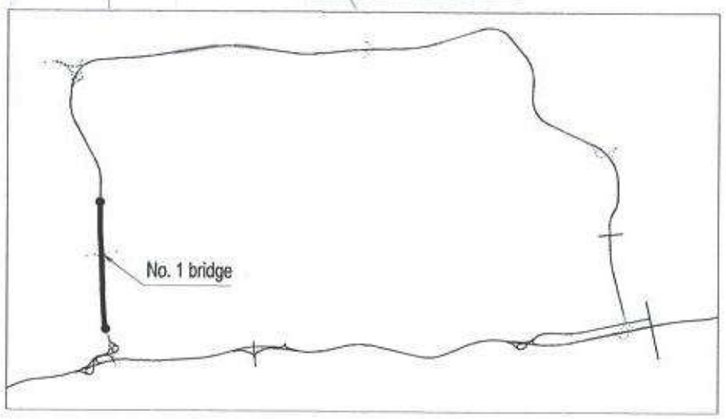
Bridge Location Plan for No. 1 Bridge

1:1000

Pile Nos. at a start point and an end point: K0+139.559~K3+090.559



Line Position Thumbnail



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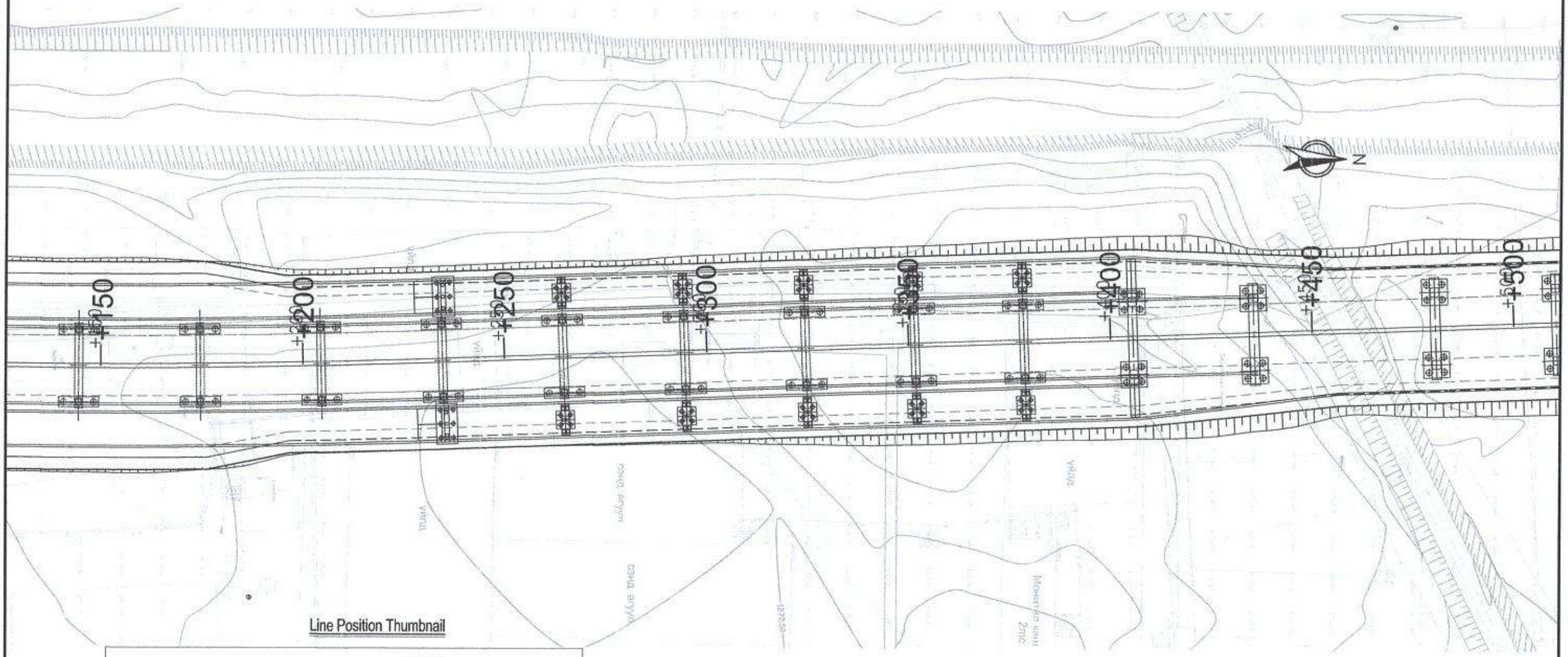
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-01
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHU						

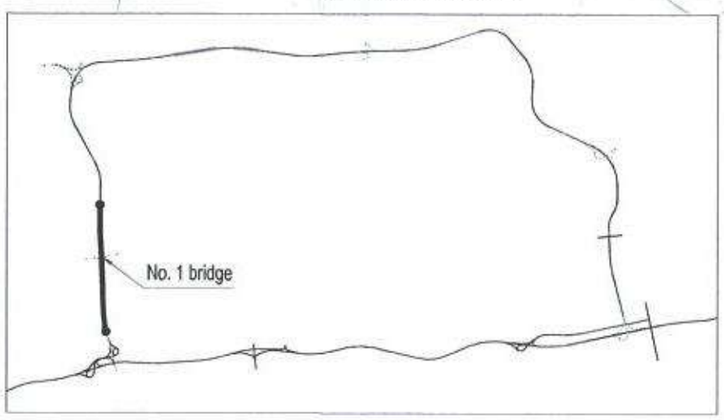
Bridge Location Plan for No. 1 Bridge

1:1000

Pile Nos. at a start point and an end point: K0+139.559~K3+090.559



Line Position Thumbnail



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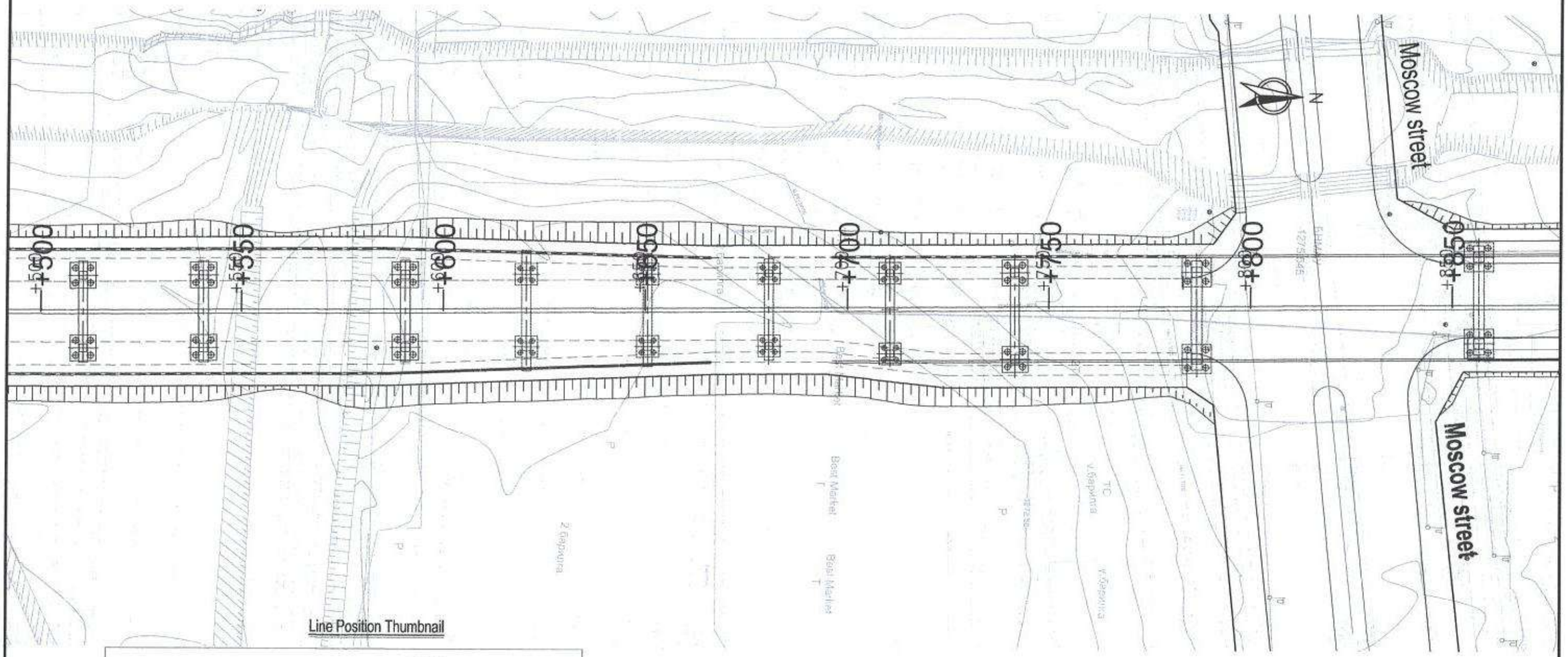
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-01
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	YANG WANHU				

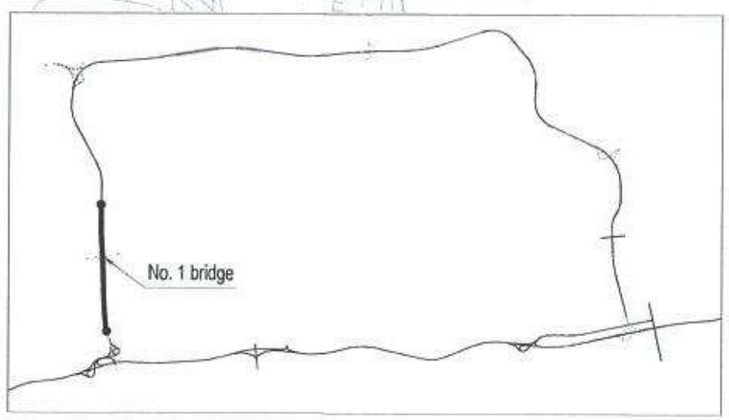
Bridge Location Plan for No. 1 Bridge

1:1000

Pile Nos. at a start point and an end point: K0+139.559~K3+090.559



Line Position Thumbnail



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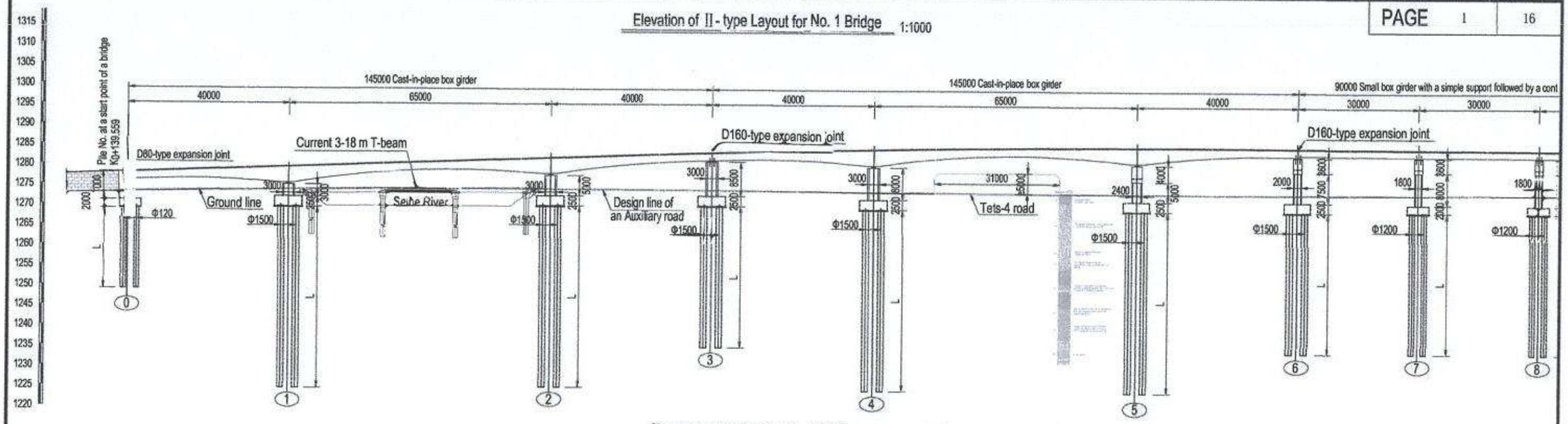
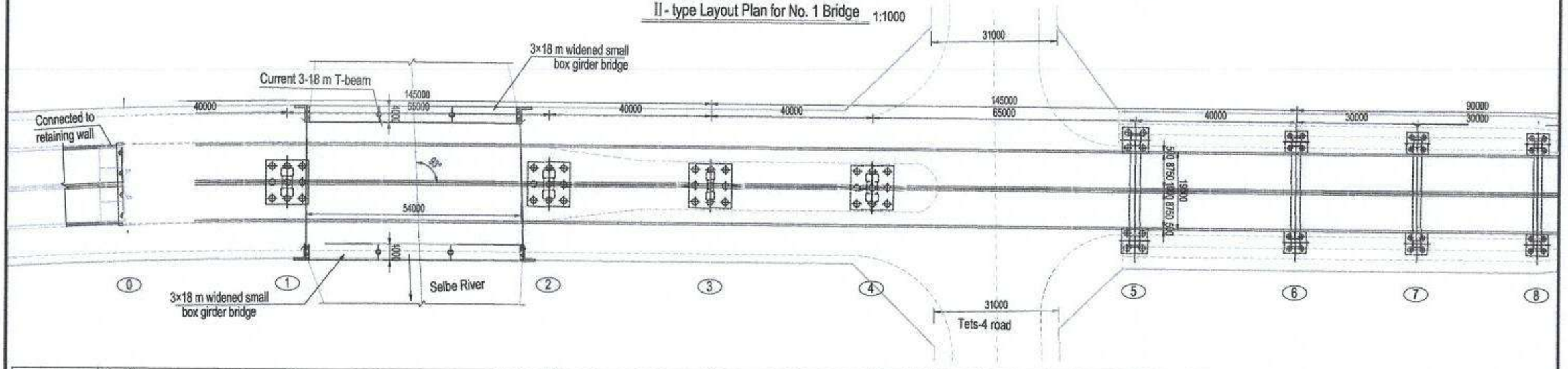
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-01
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHU						

Elevation of II - type Layout for No. 1 Bridge 1:1000



II - type Layout Plan for No. 1 Bridge 1:1000



Design elevation (m)	1278.049	1279.505	1281.872	1283.254	1284.266	1285.059	1285.033	1284.928	1284.823	
Ground elevation (m)	1273.322	1273.866	1274.106	1273.616	1273.449	1273.373	1273.606	1273.694	1273.570	
Slope (%)	3.64									
Slope length (m)	367.34					+340 1285.35				
Mileage pile No.	K0 +139.559	+79.559	+2 . 9 5 5 4 4	+2 . 559 84	+324.559	+389.559	+429.559	+459.559	+489.559	
Straight line and horizontal curve	JD1 I-11°17'58"(Y) R-1200 Ls-80					R-∞				

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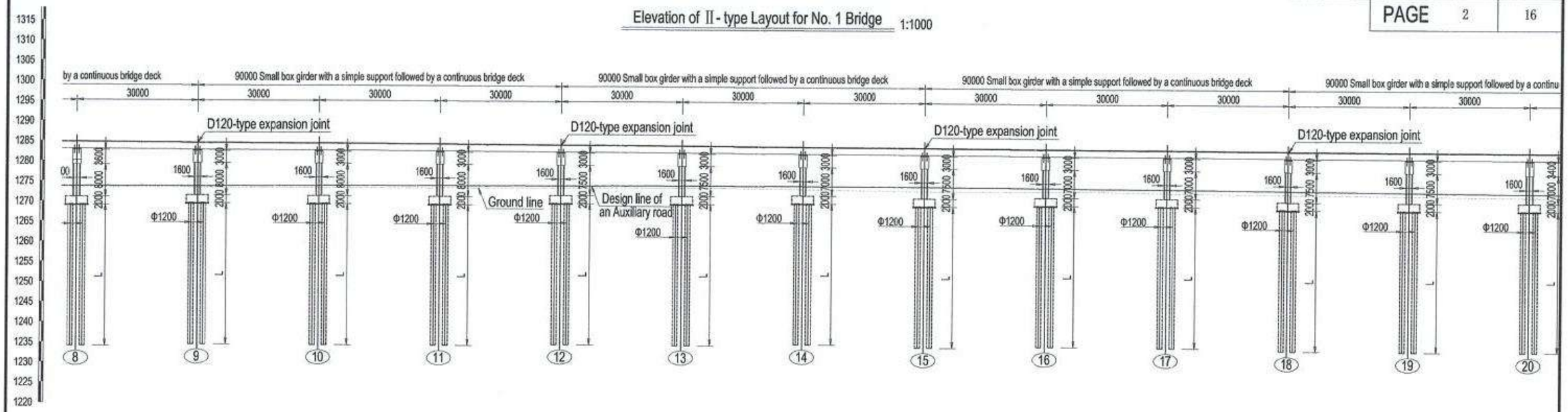
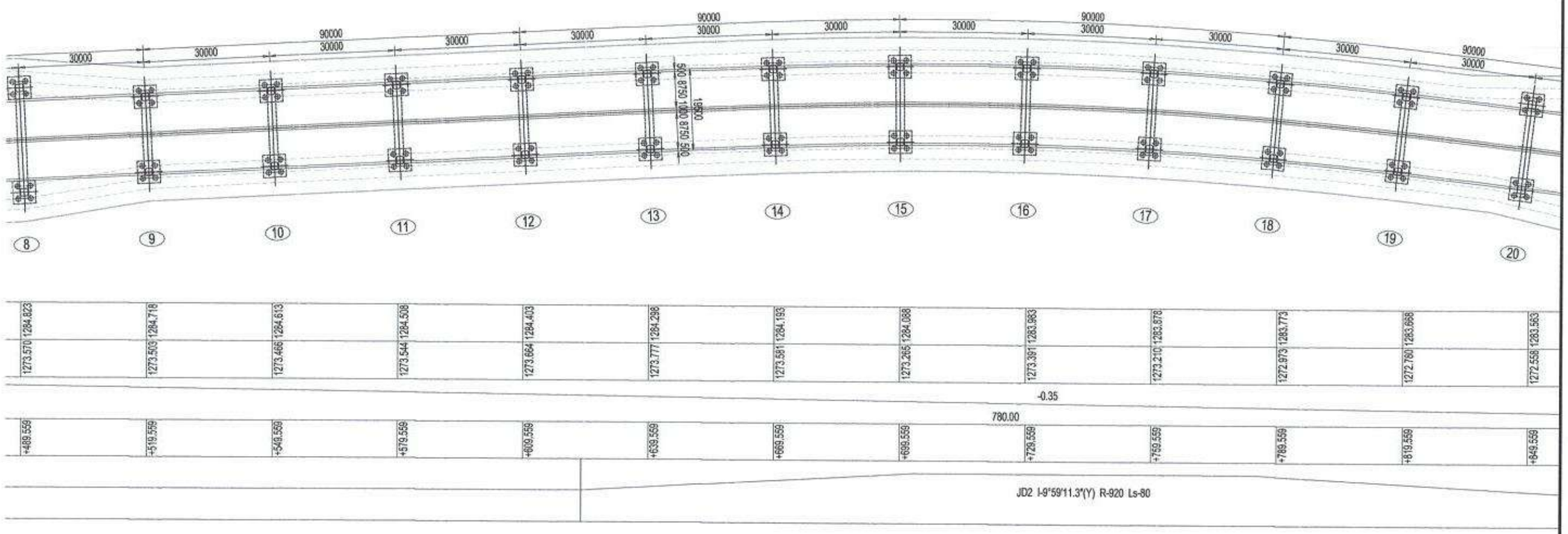
		Bridge - type Layout of a Viaducton a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II - 02
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LIU SHENGHAN						

Elevation of Ⅱ- type Layout for No. 1 Bridge 1:1000



Ⅱ- type Layout Plan for No. 1 Bridge 1:1000



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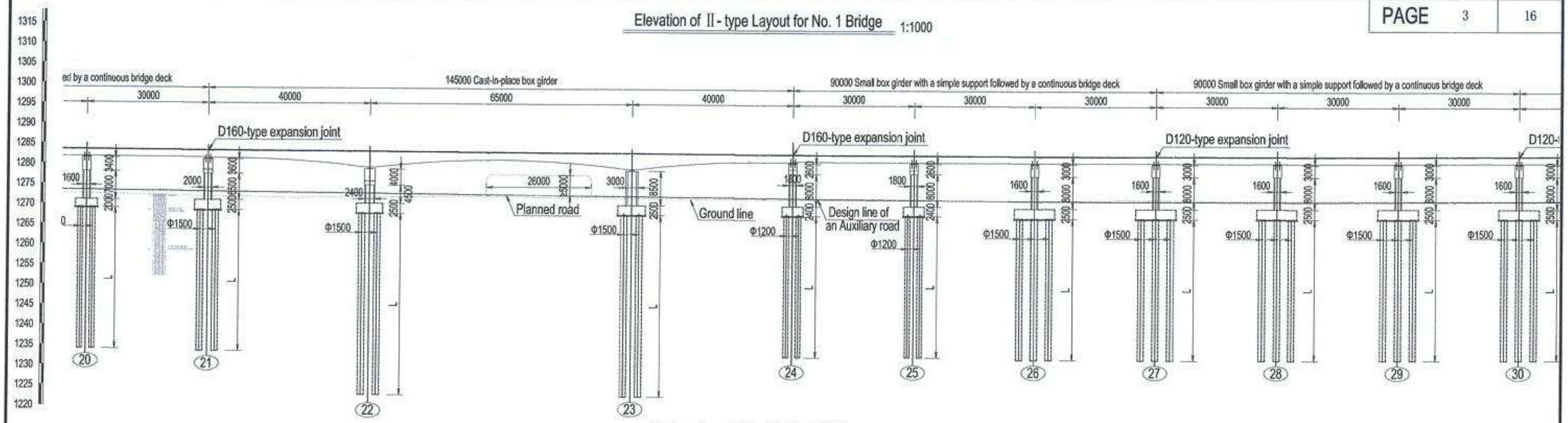
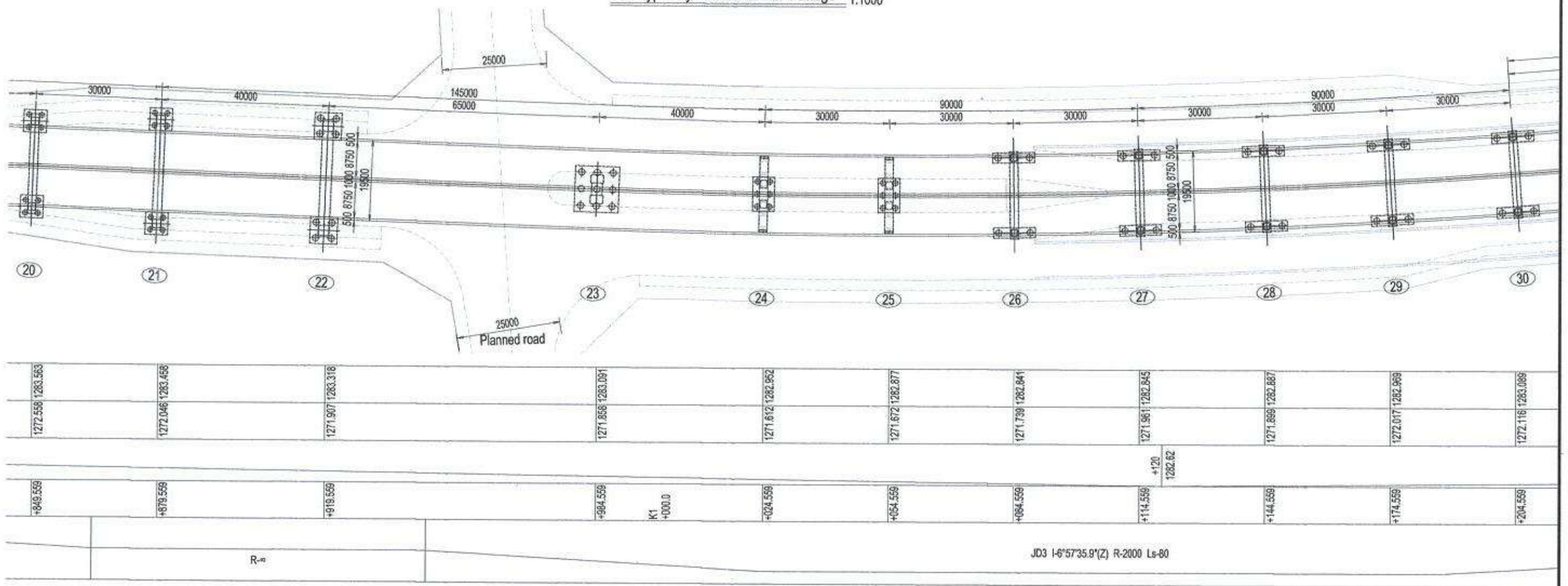
		Bridge - type Layout of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	Ⅱ- 02
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LIU SHENGHAN						

Elevation of Ⅱ- type Layout for No. 1 Bridge 1:1000



Ⅱ- type Layout Plan for No. 1 Bridge 1:1000



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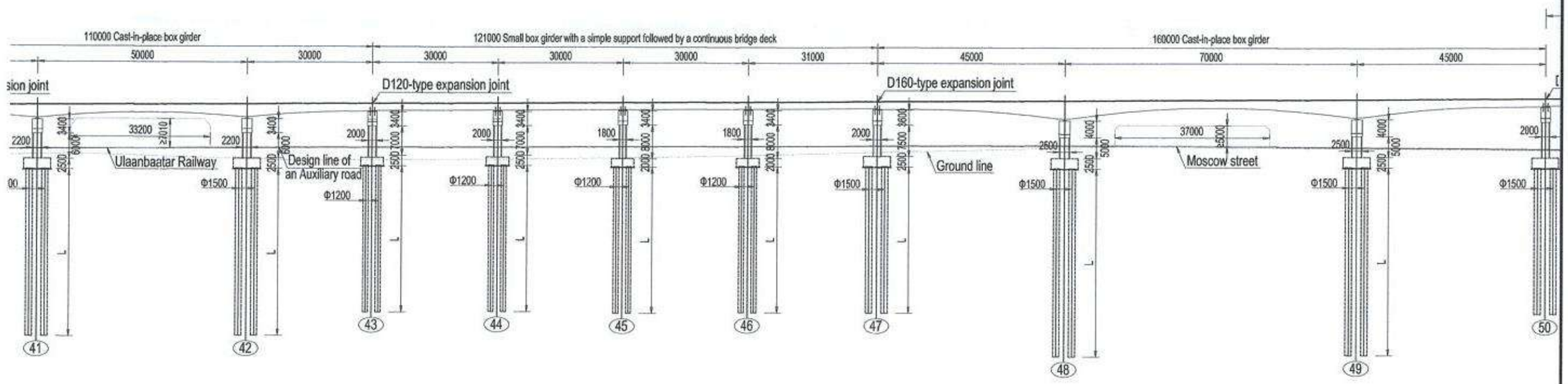
								DESIGNED	LIU SHENGHAN			DATE	2025.07

Elevation of Ⅱ- type Layout for No. 1 Bridge 1:1000



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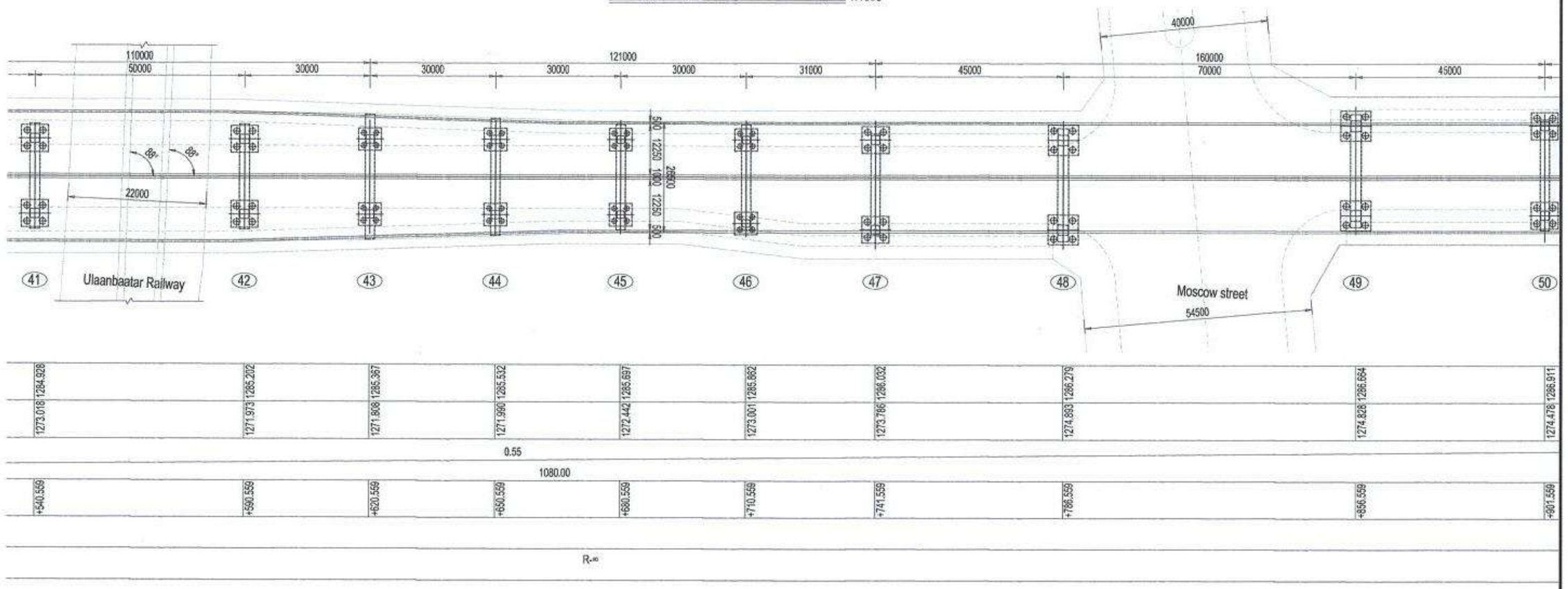

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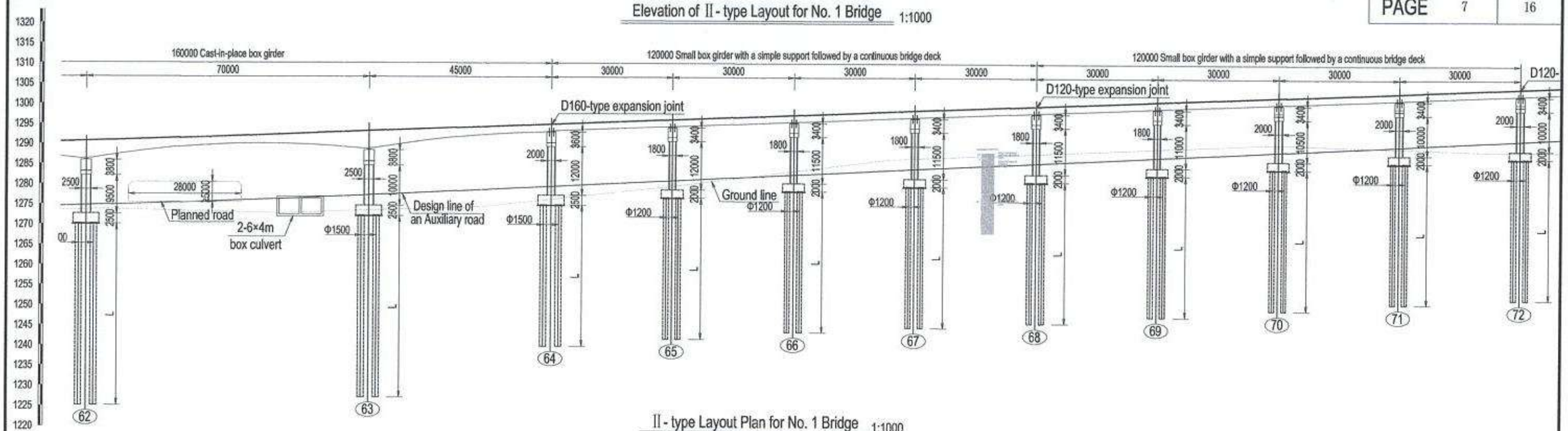
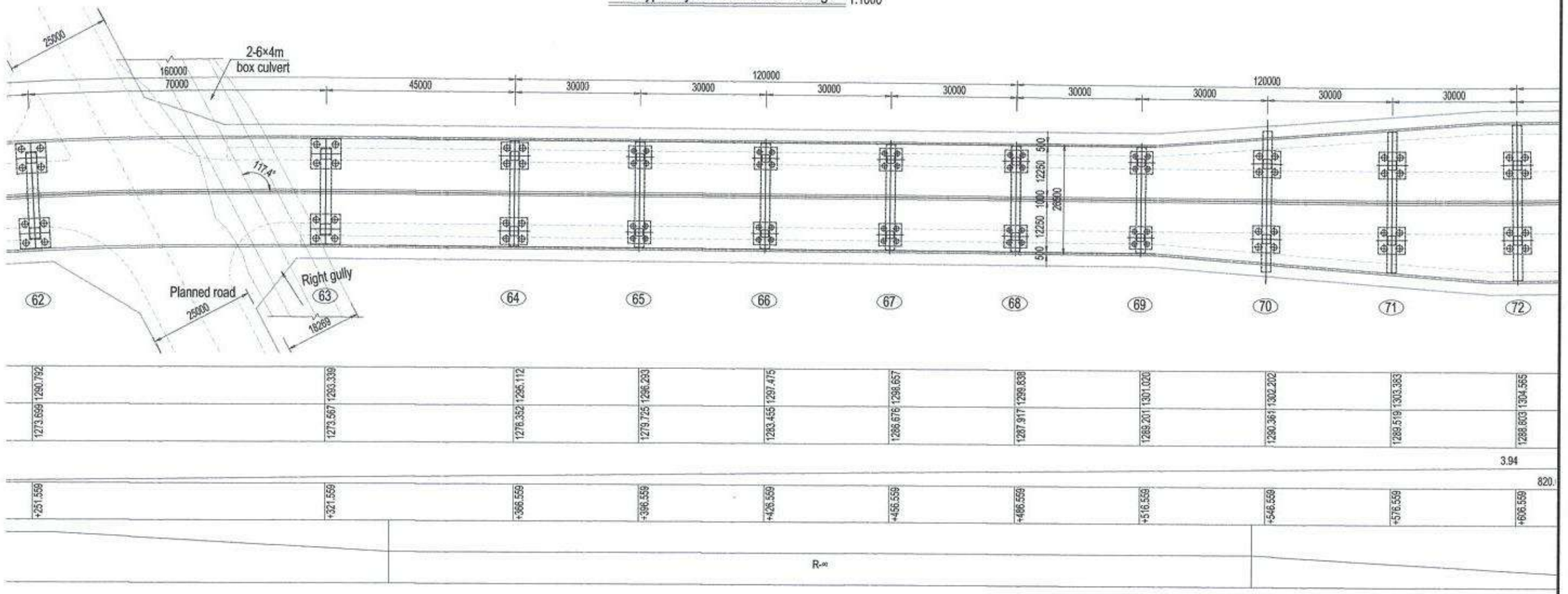
		Bridge - type Layout of a Viaduct on a Main Line (No. 1 Bridge)		MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.: II - 02
				MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE: 2025.07
							DESIGNED	LIU SHENGHAN					

Elevation of Ⅱ - type Layout for No. 1 Bridge 1:1000



Ⅱ - type Layout Plan for No. 1 Bridge 1:1000



62	63	64	65	66	67	68	69	70	71	72	
1273.699	1273.567	1276.352	1279.725	1283.455	1286.676	1297.917	1289.201	1290.361	1289.519	1288.603	
1290.792	1293.339	1296.112	1296.293	1297.475	1298.657	1299.838	1301.020	1302.202	1303.383	1304.565	
										3.94	
+251.559	+321.559	+366.559	+396.559	+426.559	+456.559	+486.559	+516.559	+546.559	+576.559	+606.559	820.

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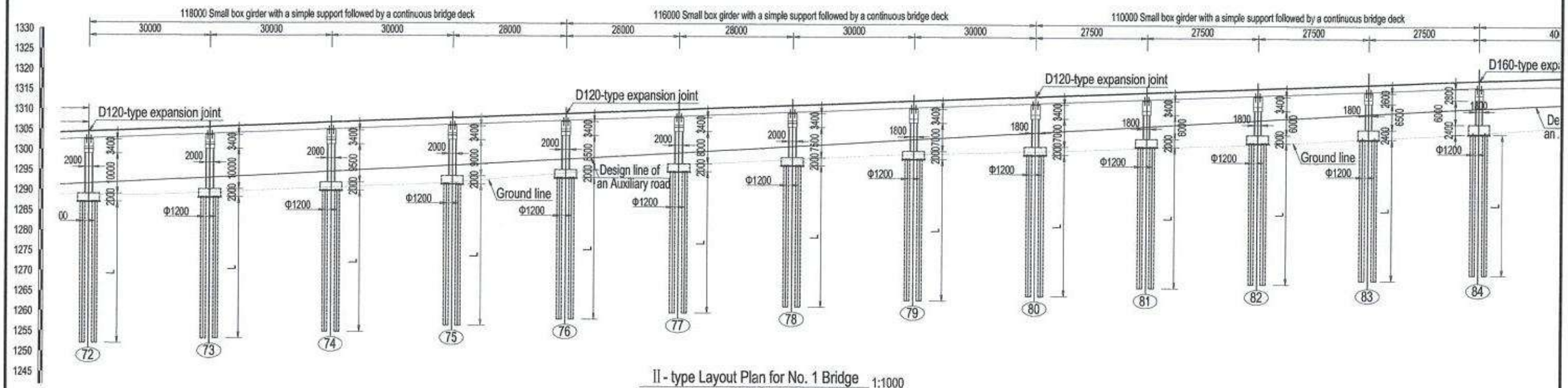
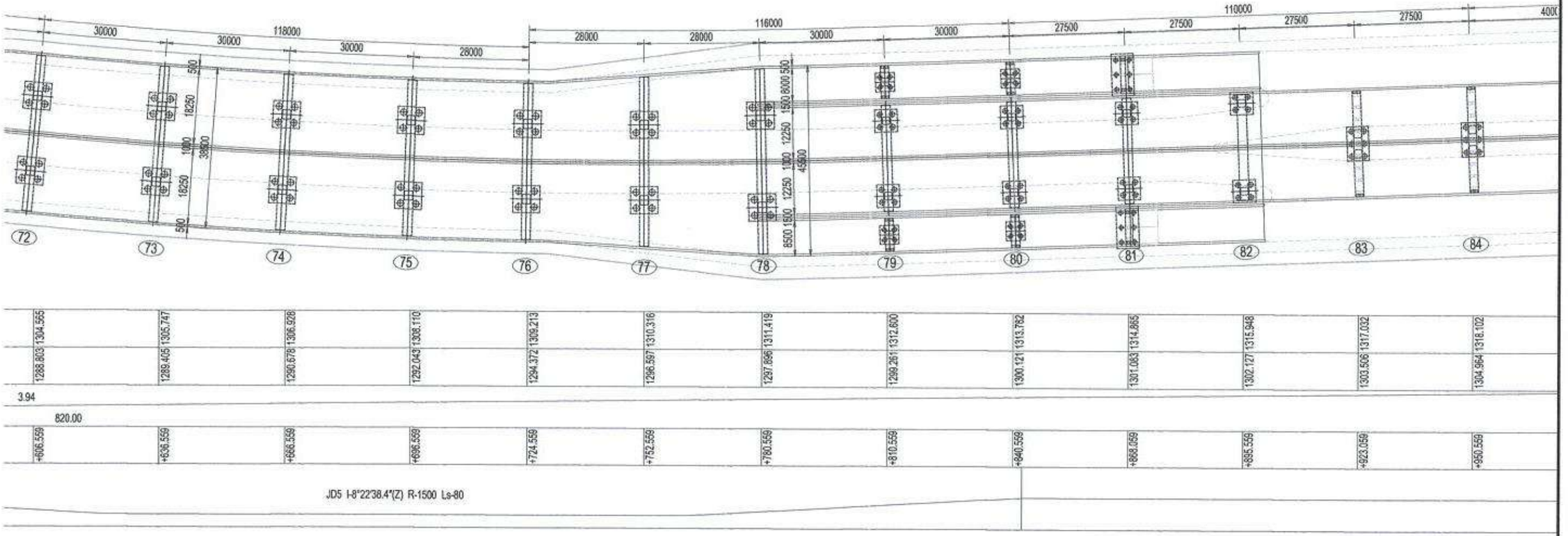
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	LIU SHENGHAN			DATE	2025.07

Elevation of Ⅱ - type Layout for No. 1 Bridge 1:1000

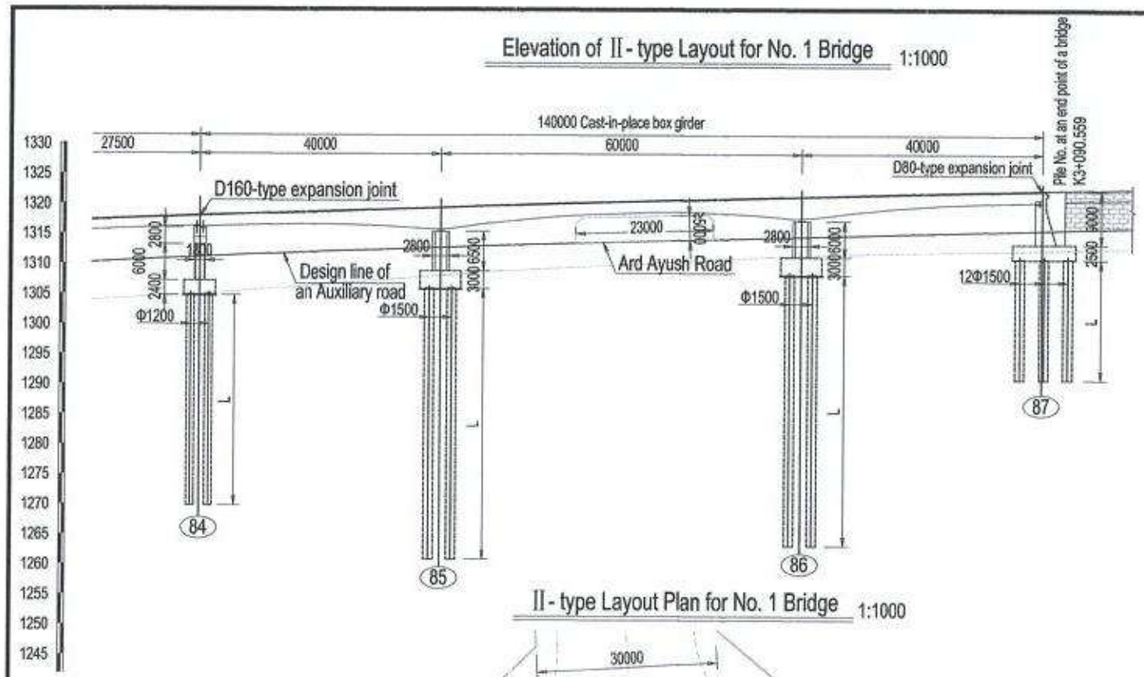


Ⅱ - type Layout Plan for No. 1 Bridge 1:1000

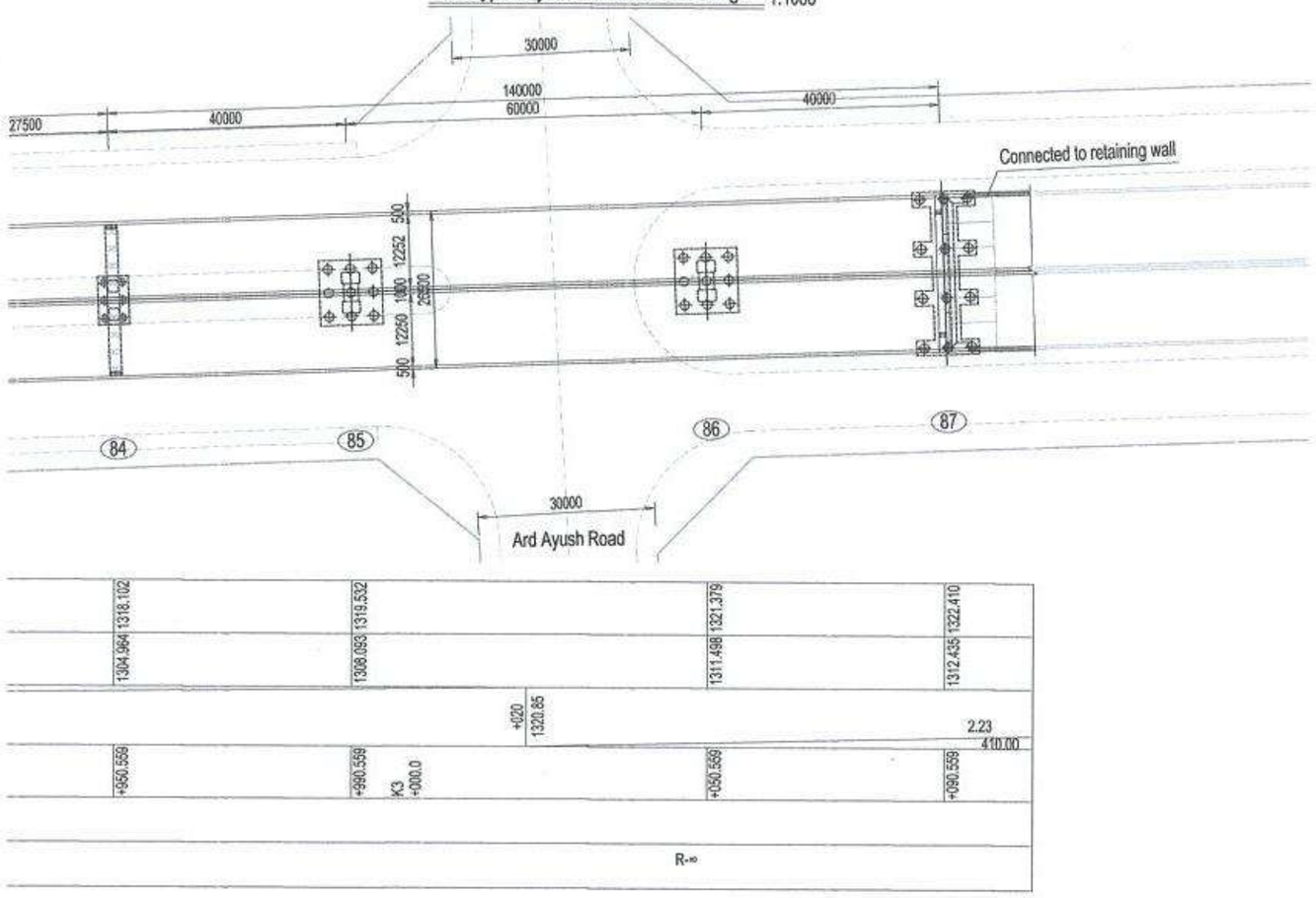


中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:1000
		Bridge - type Layout of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	Ⅱ - 02
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LIU SHENGHAN						

Elevation of Ⅱ- type Layout for No. 1 Bridge 1:1000



Ⅱ- type Layout Plan for No. 1 Bridge 1:1000



Notes:

1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

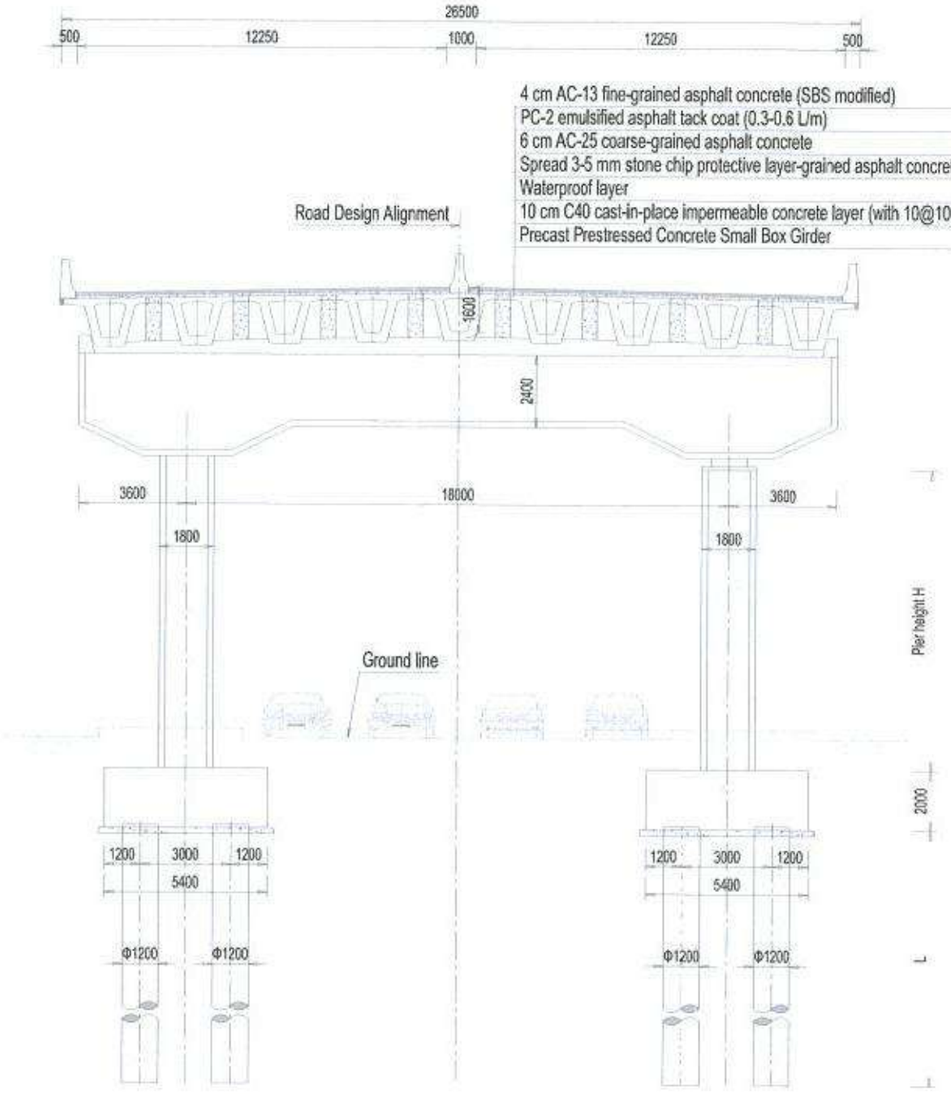
2.This drawing is applicable to No. 2 Bridge , with a span arrangement of 2×(40+65+40)+5×(3×30)+(40+65+40)+2×(3×30)+(4×30)+(3×27)+(30+45+30)+(30+50+30)+(3×30+31)+(45+70+45)+(4×30)+(2×30+25)+(4×25)+(45+70+45)+2×(4×30)+(3×30+28)+(2×28+2×30)+(4×27.5)+(40+60+40)=2951m, where the upper structure of 25m, 27m, 27.5 m, 28m, 30 m and 31 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the(30+45+30)m、(30+50+30)m、(40+60+40)m、(40+65+40)m、(45+70+45) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations.

3.According to the geological conditions, the pile length L of this bridge is 15.0 m-45.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1:1000
		Bridge - type Layout of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II - 02
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	LIU SHENGHAN				

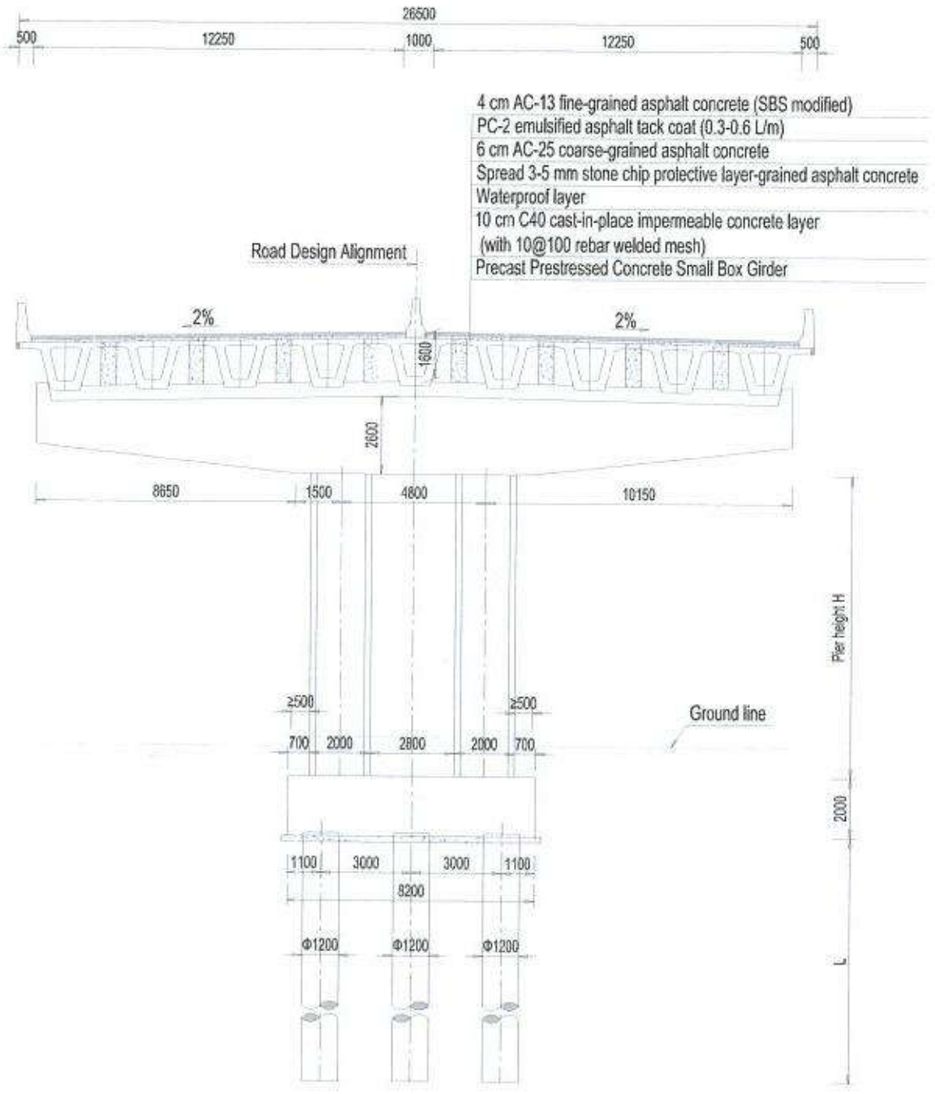
Typical Cross-Section Arrangement of Small Box Girder 1:200

Suitable for 53#~61# and 64#~69# piers



Typical Cross-Section Arrangement of Small Box Girder 1:200

Suitable for 83#~84# piers



Notes:

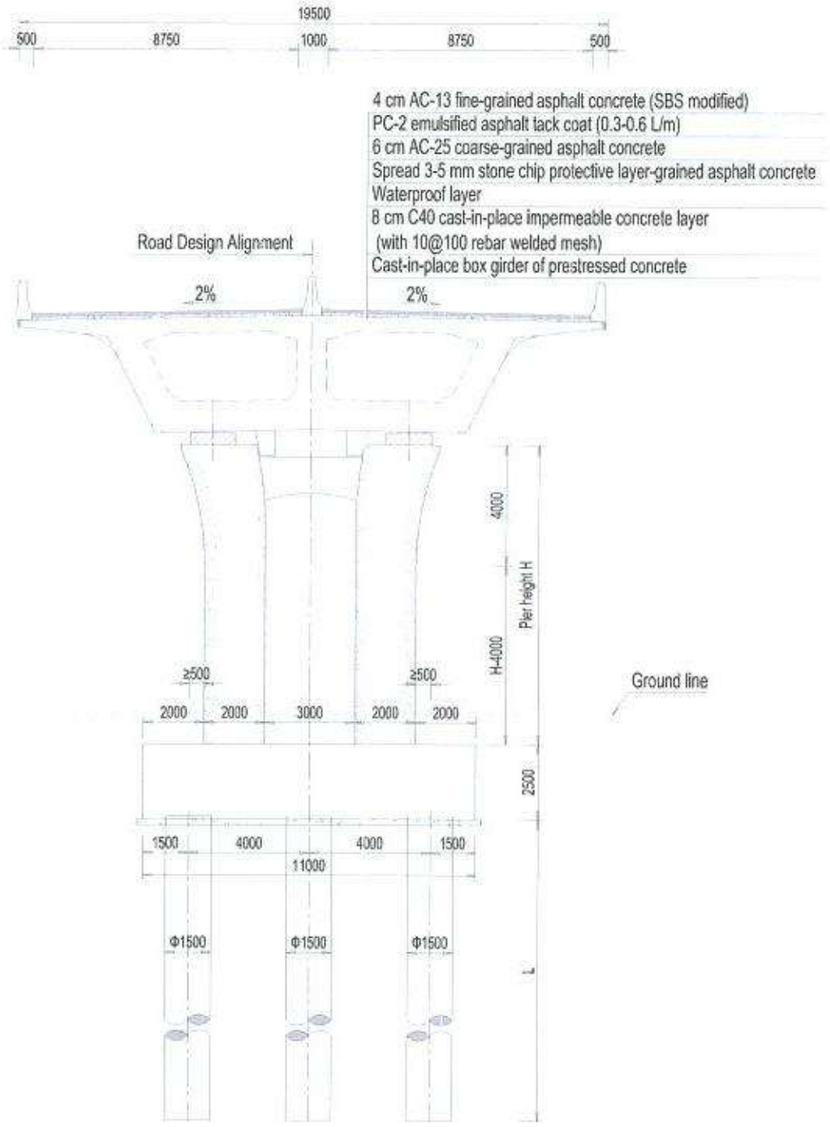
1. All dimensions in this drawing are measured in mm.
2. According to the geological concitions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 200
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-02
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	MA JUN				

Cross Section of a 40+64+40 m Middle Pivot

Suitable for 1#~4# piers

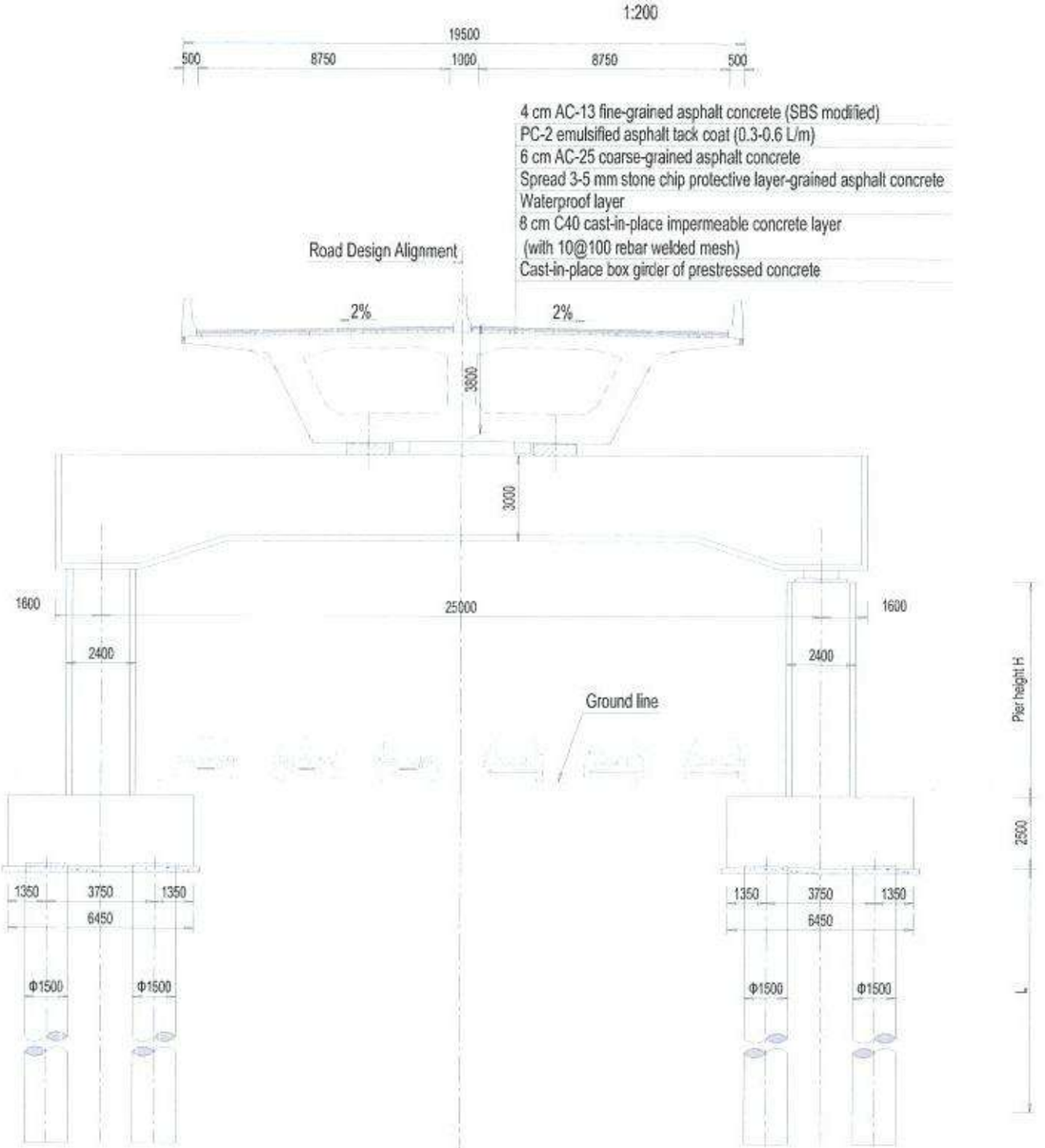
1:200



Cross Section of a 40+64+40 m Middle Pivot

Suitable for 5# pier

1:200



Notes:

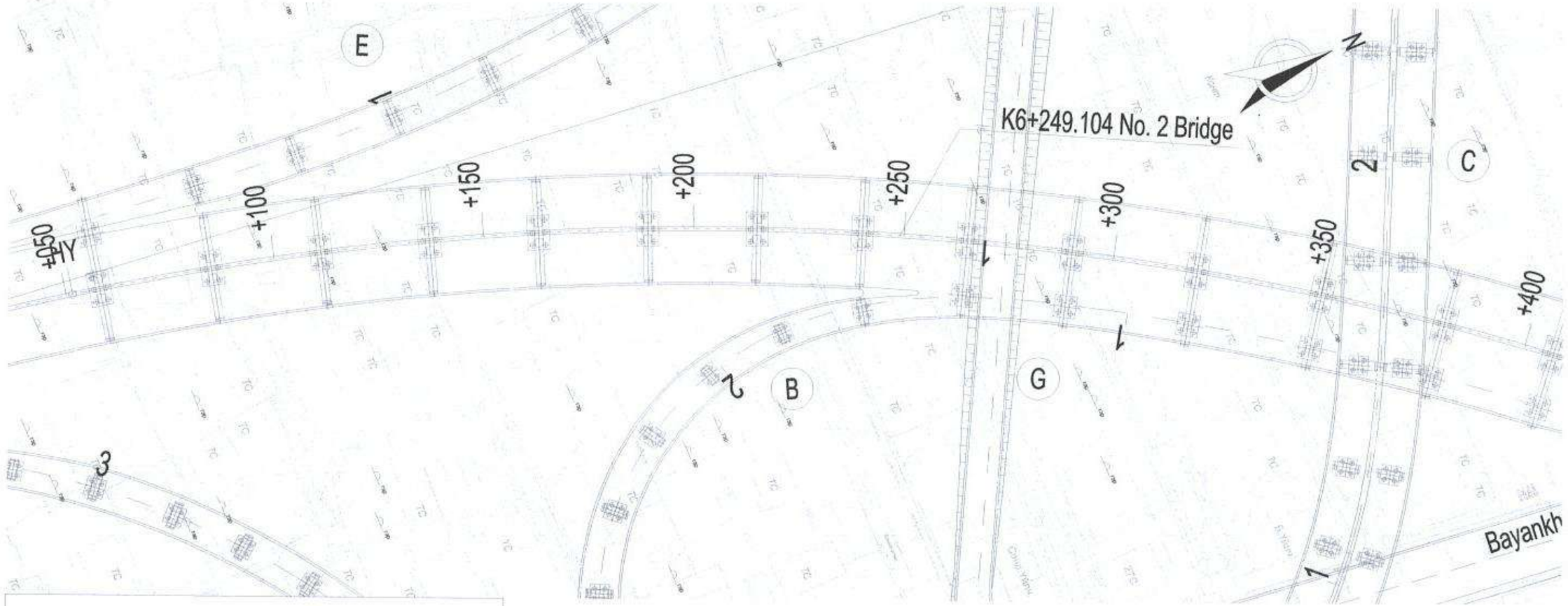
1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 1 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-02
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

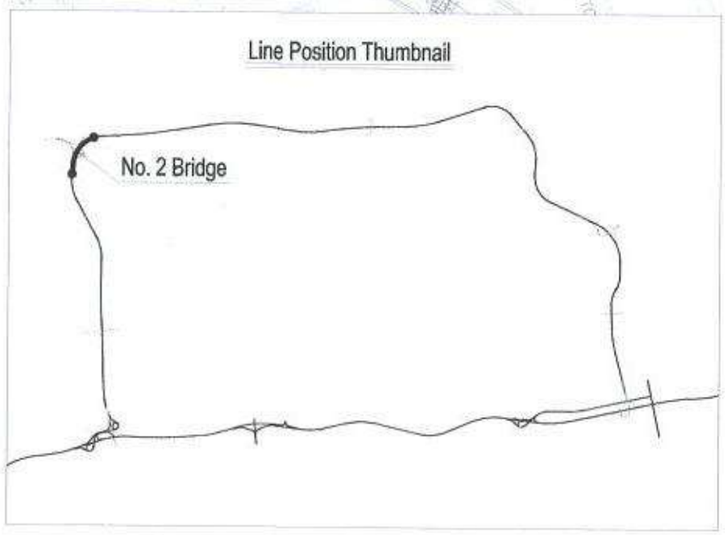
Bridge Location Plan for No. 2 Bridge

1:1000

Pile Nos. at a start point and an end point: K5+710.104~K6+788.104



Line Position Thumbnail



Notes:

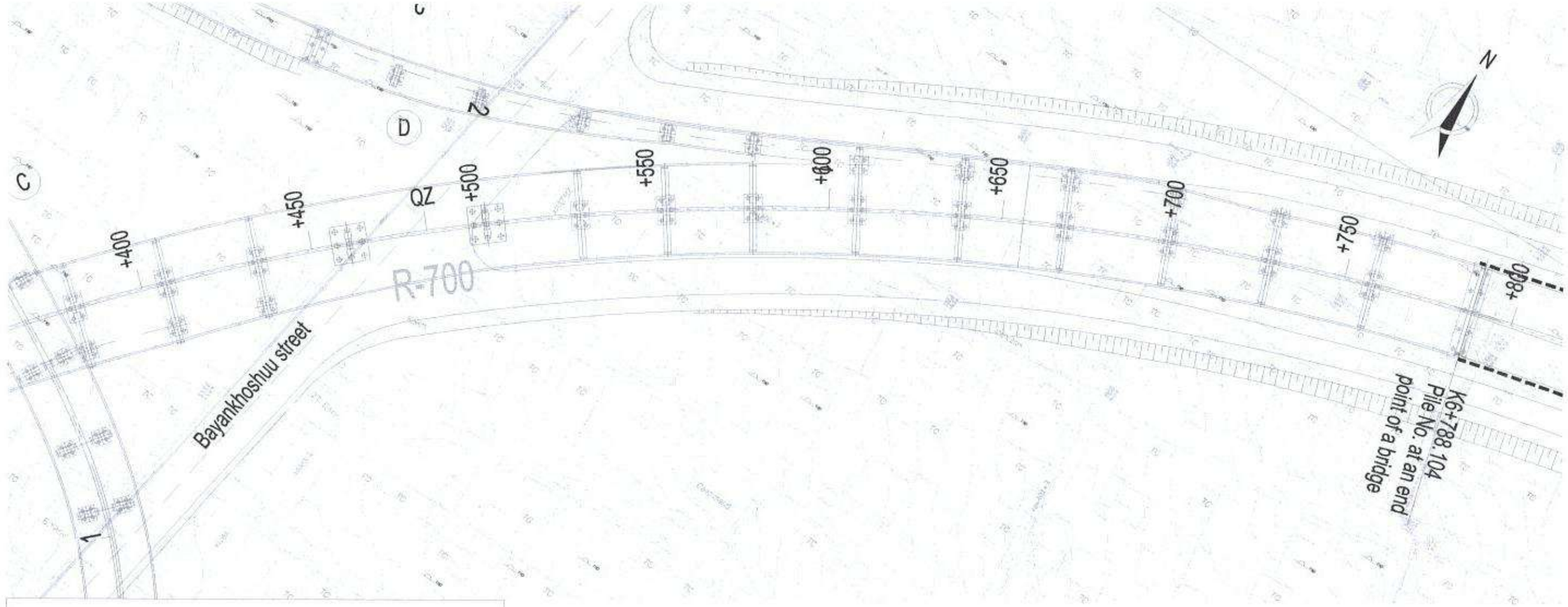
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2. This drawing is applicable to No. 2 Bridge , with a span arrangement of 30+(30+45+30)+(3×25+30)+4×27+(27+3×26)+(2×26+25)+(2×25+2×30)+(30+2×27) +(27+40+27)+(2×25+30)+2×(3×30)=1,078 m, where the upper structure of 25 m, 26 m, 27 m and 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (27+40+27) m and (30+45+30) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations. The bottom of the foundation pile cap is located below the seasonal frozen earth line.
3. A~G are the ramp interchanges between the New Ring Road and the western side of the Second Ring Road.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 1000
		Bridge-type Layout of a Main Viaduct (No. 2 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-03
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	ZHANG BO				

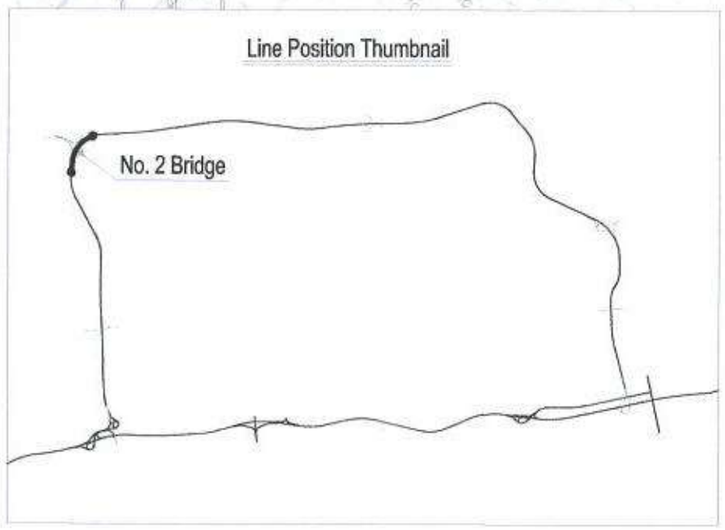
Bridge Location Plan for No. 2 Bridge

1:1000

Pile Nos. at a start point and an end point: K5+710.104~K6+788.104



Line Position Thumbnail

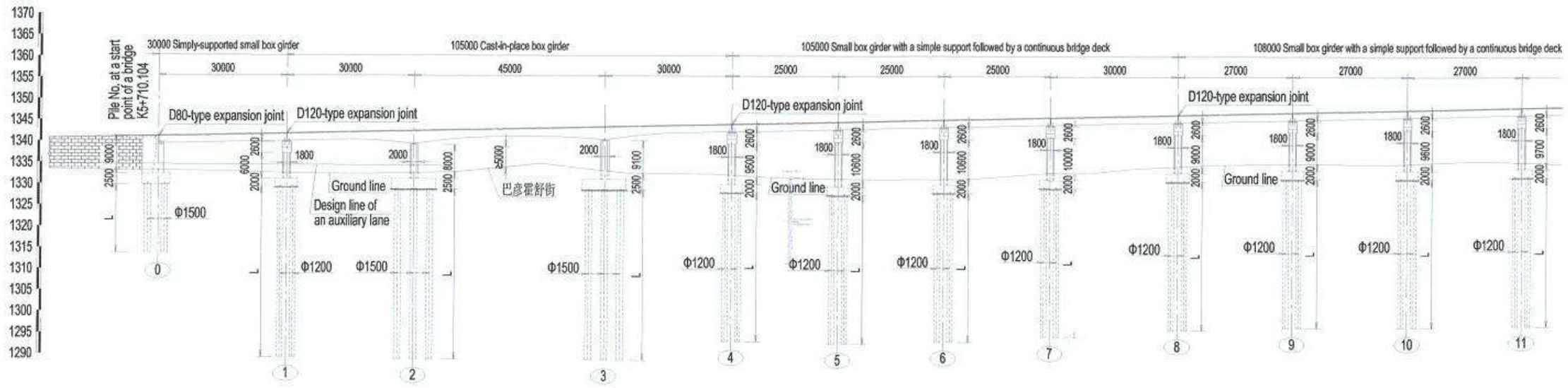


Notes:

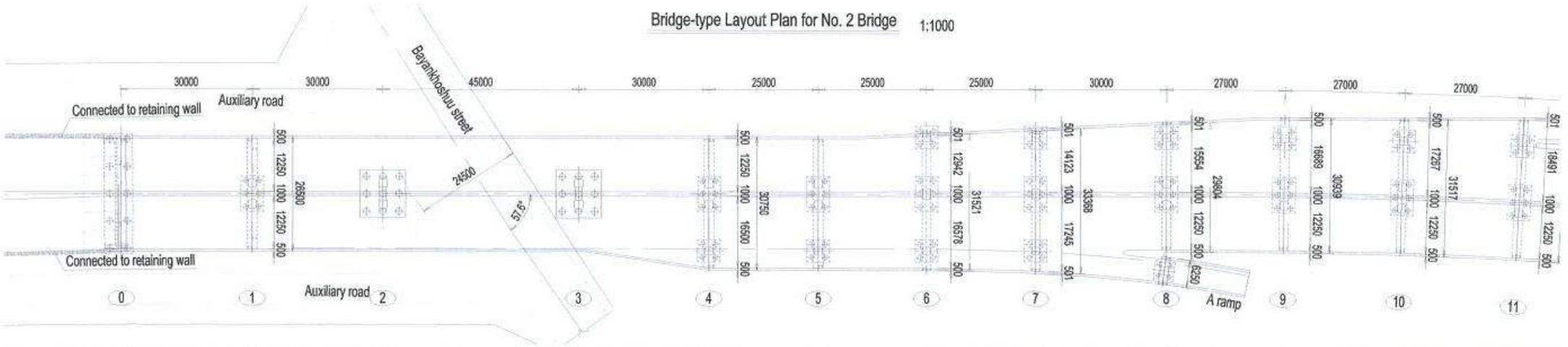
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2. This drawing is applicable to No. 2 Bridge , with a span arrangement of 30+(30+45+30)+(3×25+30)+4×27+(27+3×26)+(2×26+25)+(2×25+2×30)+(30+2×27) +(27+40+27)+(2×25+30)+2×(3×30)=1,078 m, where the upper structure of 25 m, 26 m, 27 m and 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (27+40+27) m and (30+45+30) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations. The bottom of the foundation pile cap is located below the seasonal frozen earth line.
3. A~G are the ramp interchanges between the New Ring Road and the western side of the Second Ring Road.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the "First Ring Road" Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 1000
		Bridge-type Layout of a Main Viaduct (No. 2 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-03
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	ZHANG BO			DATE	2025.07

Elevation of Bridge-type Layout for No. 2 Bridge 1:1000



Bridge-type Layout Plan for No. 2 Bridge 1:1000



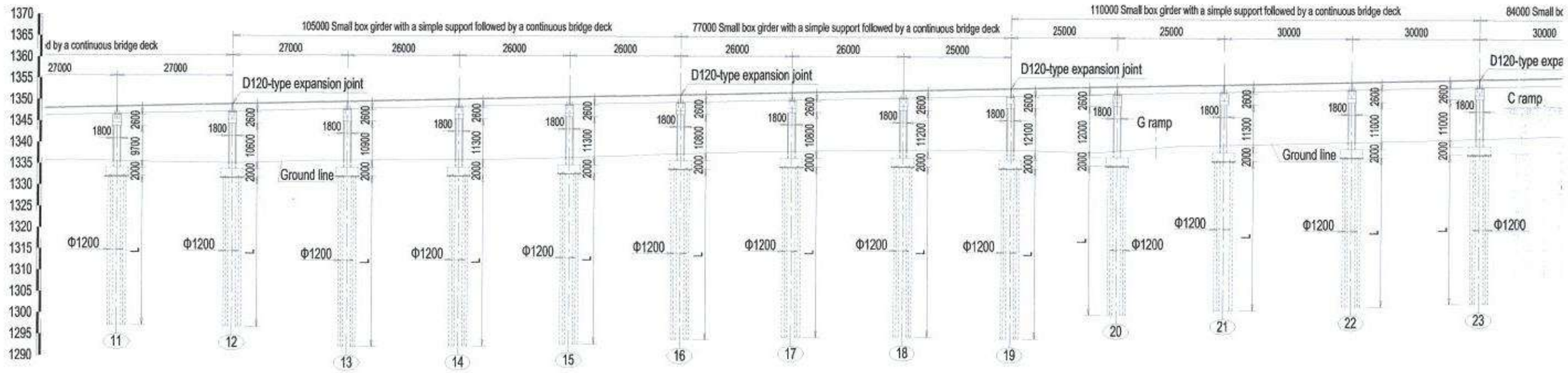
Design elevation (m)	1341.379	1342.042	1342.704	1343.666	1344.361	1344.913	1345.465	1346.017	1346.680	1347.276	1347.872	1348.469
Ground elevation (m)	1333.240	1332.732	1332.778	1333.942	1332.369	1331.488	1331.486	1332.989	1334.518	1335.184	1335.184	1335.583
Slope (%) / Slope length (m)												
Mileage pile No.	K5+710.104	+740.104	+770.104	+815.104	+845.104	+870.104	+895.104	+920.104	+950.104	+977.104	K6+4.104	+31.104
Straight line and horizontal curve	R=∞											

Notes:

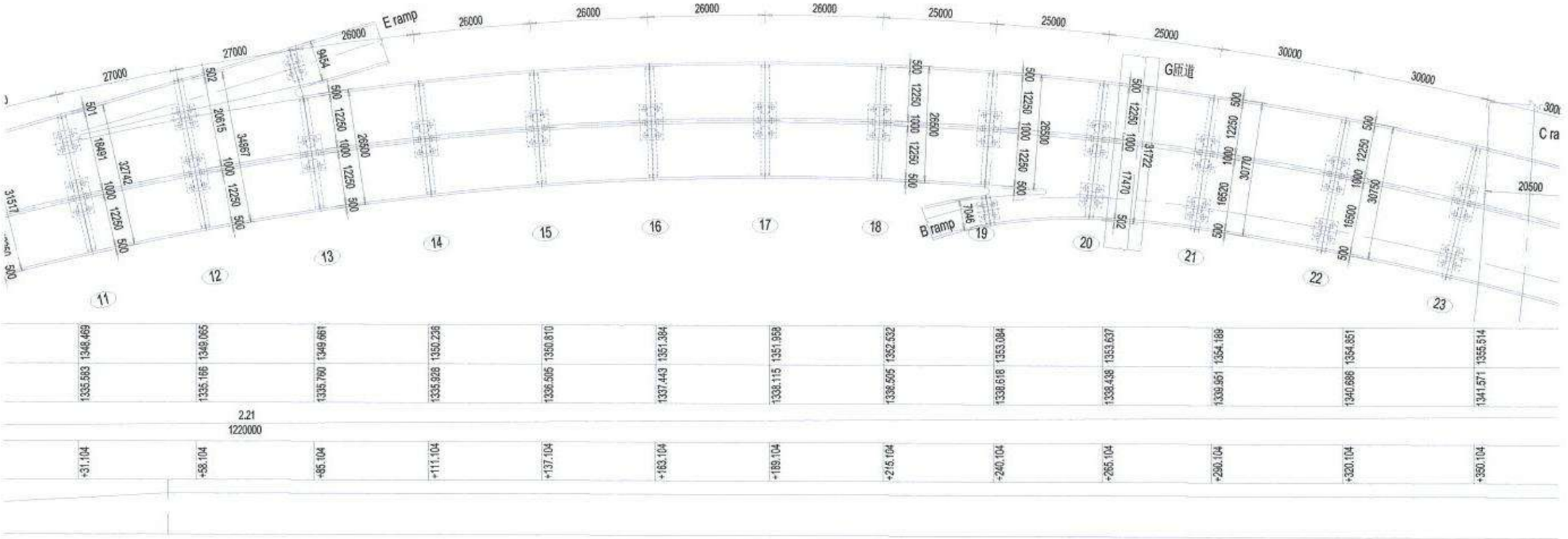
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 1000
		Bridge-type Layout of a Main Viaduct (No. 2 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-04
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	ZHANG BO				

Elevation of Bridge-type Layout for No. 2 Bridge 1:1000



Bridge-type Layout Plan for No. 2 Bridge 1:1000

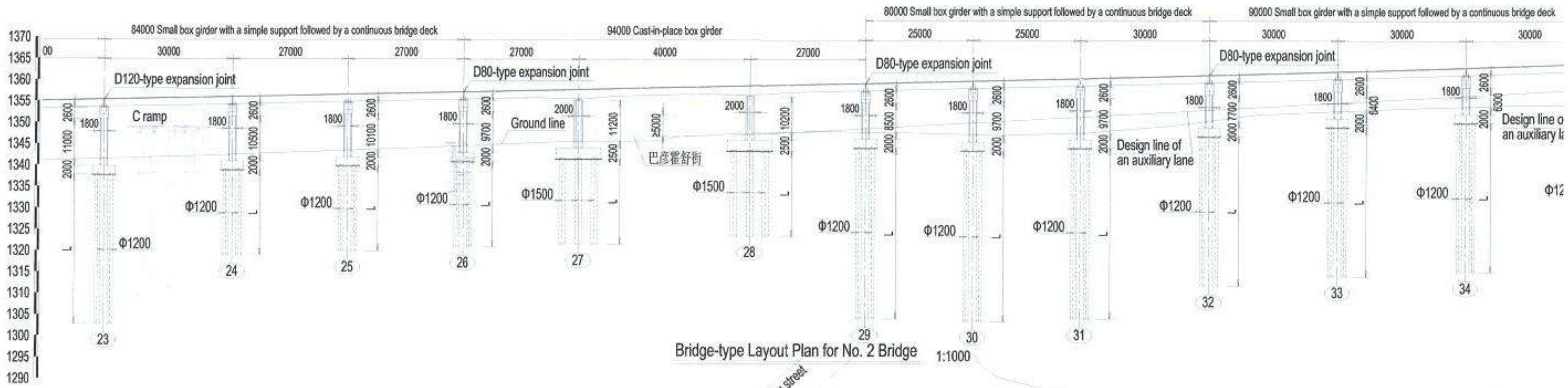


Notes:

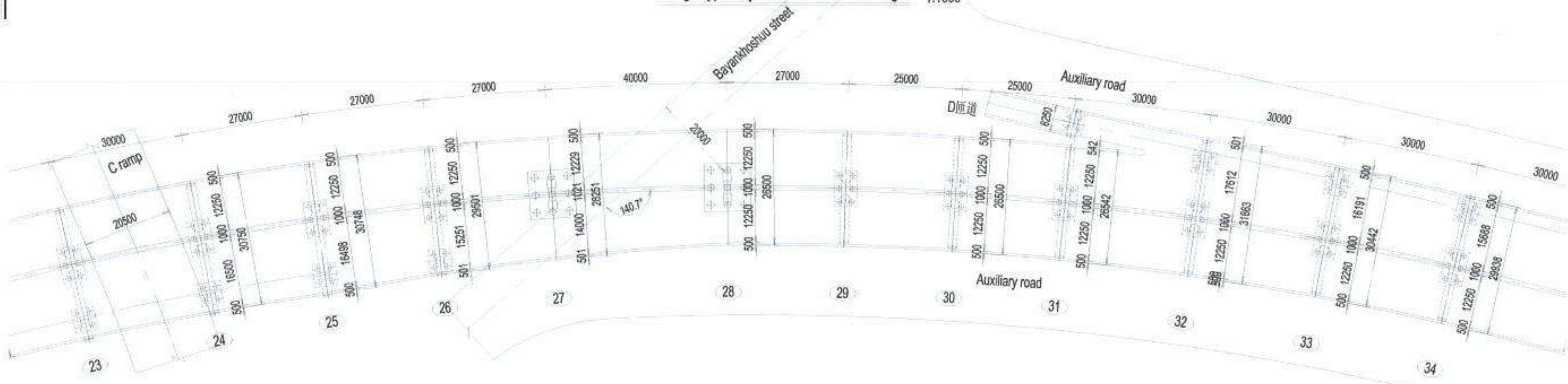
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 1000
		Bridge-type Layout of a Main Viaduct (No. 2 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-04
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	ZHANG BO				

Elevation of Bridge-type Layout for No. 2 Bridge 1:1000



Bridge-type Layout Plan for No. 2 Bridge 1:1000



1355.514	1356.174	1356.773	1357.369	1357.965	1358.849	1359.445	1360.023	1360.641	1361.439	1362.296		1363.214
1341.571	1342.610	1343.574	1344.676	1345.727	1347.666	1347.927	1347.424	1347.777	1350.615	1352.904		1353.982
+350.104	+380.104	+407.104	+434.104	+461.104	+501.104	+528.104	+553.104	+578.104	+608.104	+638.104	+660 1362.36	+668.104

JD7 I-80°33'31.9"(Y) R-700 Ls-120

Notes:

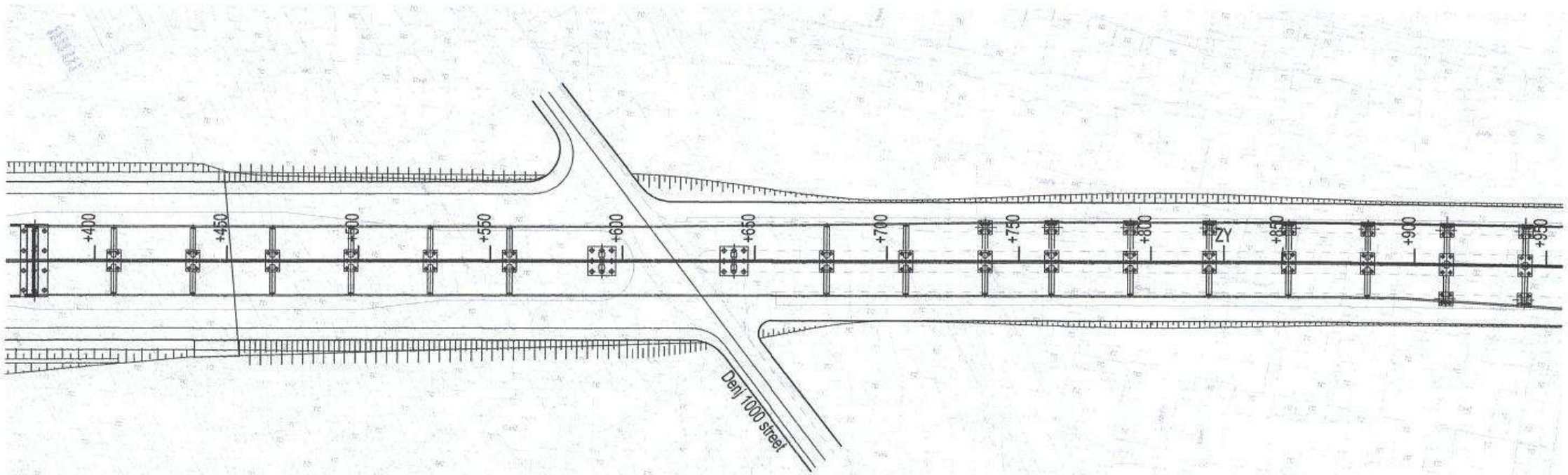
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	[signature]	SUB.MANAGER	GAO JINCHUN	[signature]	CHECKED	GAO JINCHUN	[signature]	SCALE 1: 1000
		Bridge-type Layout of a Main Viaduct (No. 2 Bridge)				MASTER DES.	CAO YONGXIANG	[signature]	SPE.MANAGER	ZHANG BO	[signature]	EXAMINED	PANG WEI	[signature]	DRAWING NO. II-04
						MASTER DES.	PAN HAOGUO	[signature]	SPE.MANAGER	MA JUN	[signature]	APPROVED	ZHU ANJING	[signature]	DATE 2025.07
									DESIGNED	ZHANG BO	[signature]				

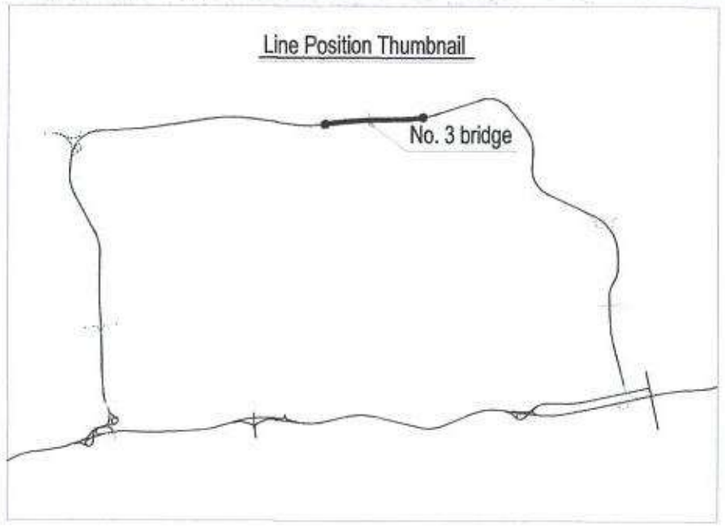
Bridge Location Plan for No. 3 Bridge

1:1000

Pile Nos. at a start point and an end point: K12+377.165~K14+692.165



Line Position Thumbnail



Notes:

1.All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

2、This drawing is applicable to No. 3 Bridge , with a span arrangement of 2×(3×30)+(35+50+35)+(2×30+25+30)+4×30+3×(3×30)+(30+40+30+30)+2×30+3×26+2×26+3×30+2×(4×30)+3×30+(2×33.65+32.7)+5×(4×30)+(20+30+20)=2315m。

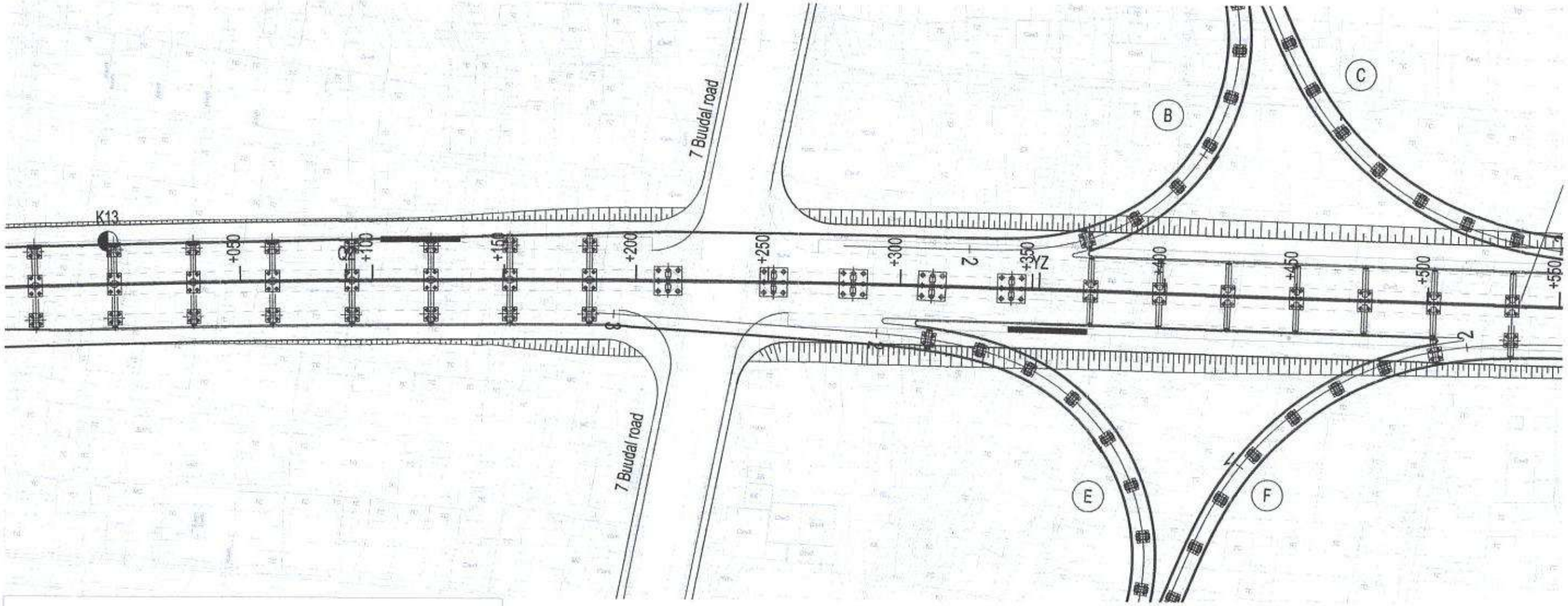
3、B-E are ramps of an interchange between the First Ring Road and the 7 Buudal Road.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 1000
		Plan of a Bridge Location of a Viaduct on a main line (No. 3 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-05
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

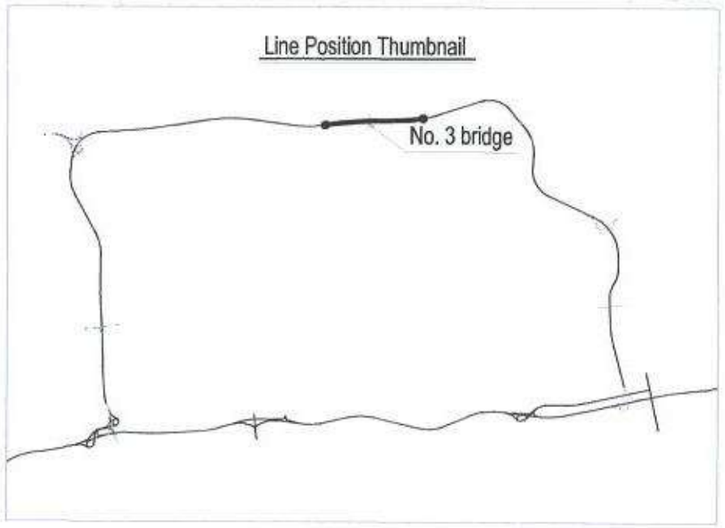
Bridge Location Plan for No. 3 Bridge

1:1000

Pile Nos. at a start point and an end point: K12+377.165~K14+692.165



Line Position Thumbnail



Notes:

1.All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

2、This drawing is applicable to No. 3 Bridge , with a span arrangement of 2×(3×30)+(35+50+35)+(2×30+25+30)+4×30+3×(3×30)+(30+40+30+30)+2×30+3×26+2×26+3×30+2×(4×30)+3×30+(2×33.65+32.7)+5×(4×30)+(20+30+20)=2315m。

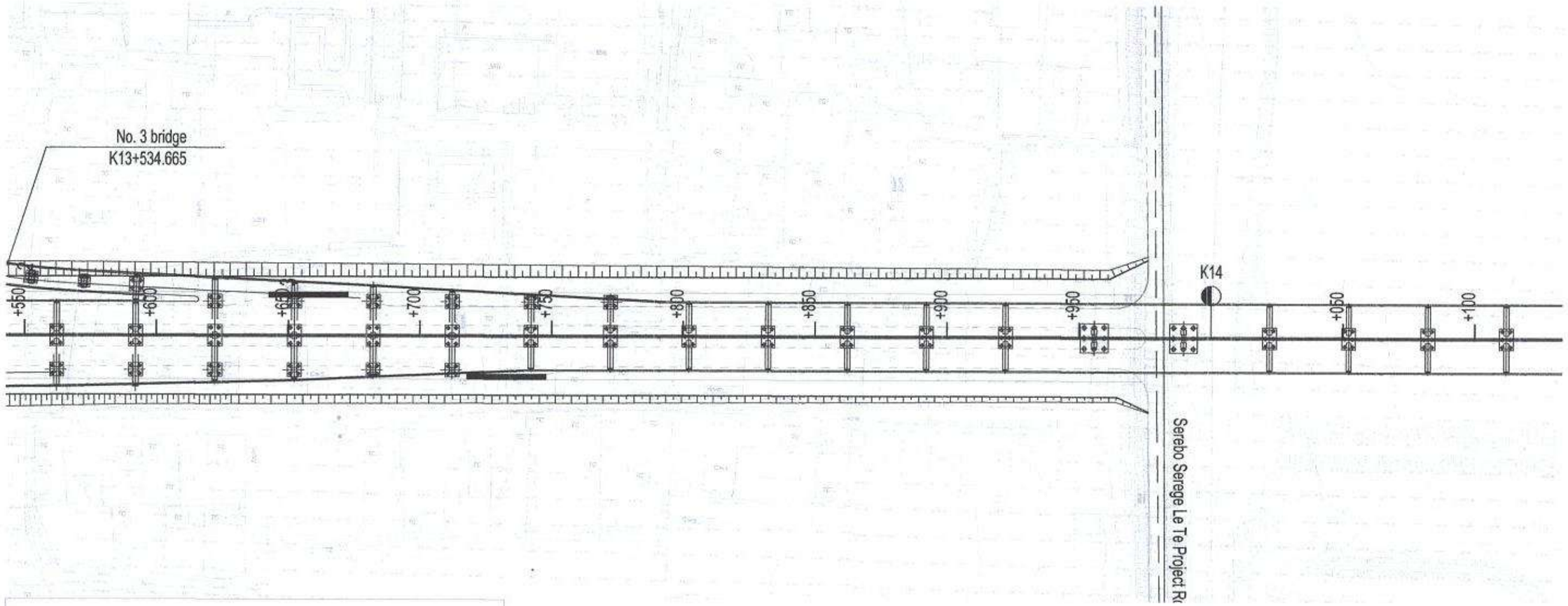
3、B-E are ramps of an interchange between the First Ring Road and the 7 Buudal Road.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 1000
		Plan of a Bridge Location of a Viaduct on a main line (No. 3 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-05
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

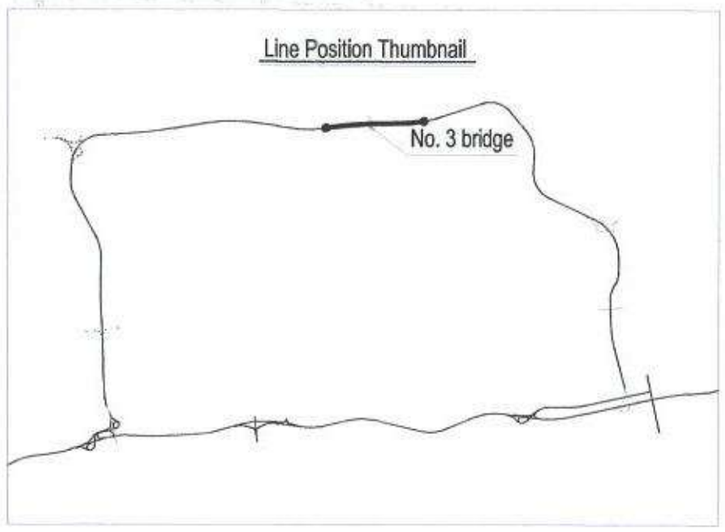
Bridge Location Plan for No. 3 Bridge

1:1000

Pile Nos. at a start point and an end point: K12+377.165~K14+692.165



Line Position Thumbnail



Notes:

1.All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

2、This drawing is applicable to No. 3 Bridge , with a span arrangement of 2×(3×30)+(35+50+35)+(2×30+25+30)+4×30+3×(3×30)+(30+40+30+30)+2×30+3×26+2×26+3×30+2×(4×30)+3×30+(2×33.65+32.7)+5×(4×30)+(20+30+20)=2315m。

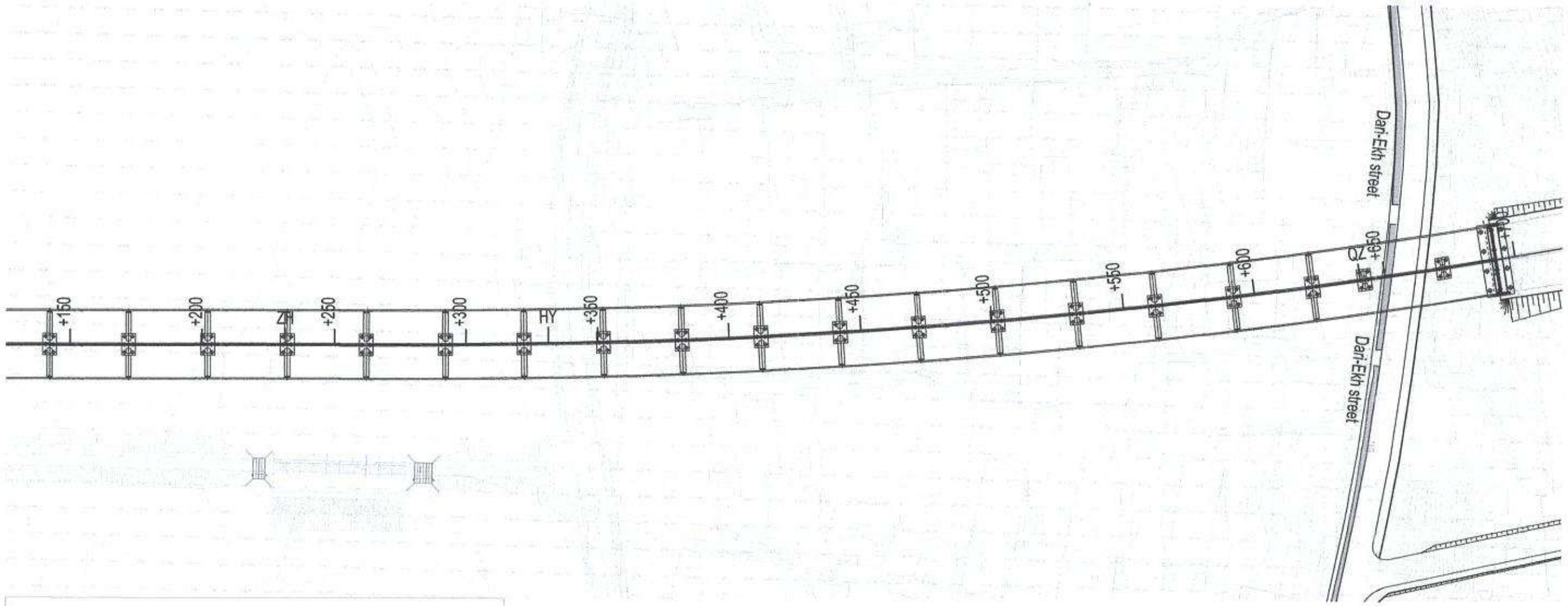
3、B-E are ramps of an interchange between the First Ring Road and the 7 Buudal Road.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES.MANAGER: PANG WEI	SUB.MANAGER: GAO JINCHUN	CHECKED: GAO JINCHUN	SCALE: 1: 1000
		Plan of a Bridge Location of a Viaduct on a main line (No. 3 Bridge)		MASTER DES.: CAO YONGXIANG	SPE.MANAGER: ZHANG BO	EXAMINED: PANG WEI	DRAWING NO.: II-05
				MASTER DES.: PAN HAOGUO	SPE.MANAGER: MA JUN	APPROVED: ZHU ANJING	
					DESIGNED: LI MAOJUN		DATE: 2025.07

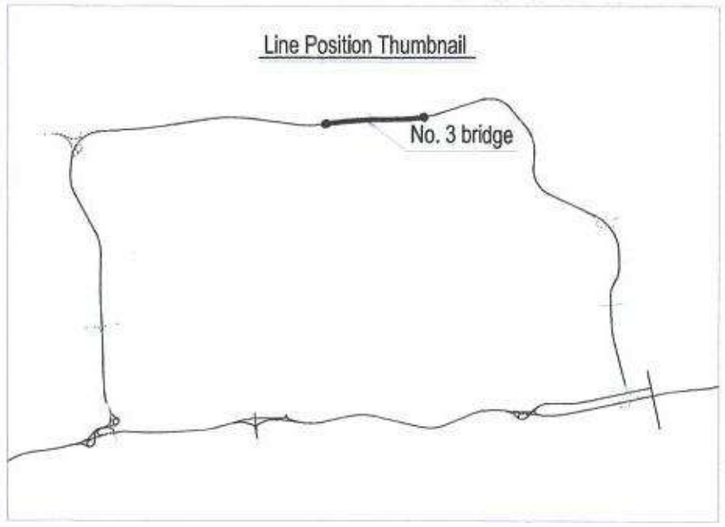
Bridge Location Plan for No. 3 Bridge

1:1000

Pile Nos. at a start point and an end point: K12+377.165~K14+692.165



Line Position Thumbnail



Notes:

1.All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

2、This drawing is applicable to No. 3 Bridge , with a span arrangement of 2×(3×30)+(35+50+35)+(2×30+25+30)+4×30+3×(3×30)+(30+40+30+30)+2×30+3×26+2×26+3×30+2×(4×30)+3×30+(2×33.65+32.7)+5×(4×30)+(20+30+20)=2315m。

3、B-E are ramps of an interchange between the First Ring Road and the 7 Buudal Road.

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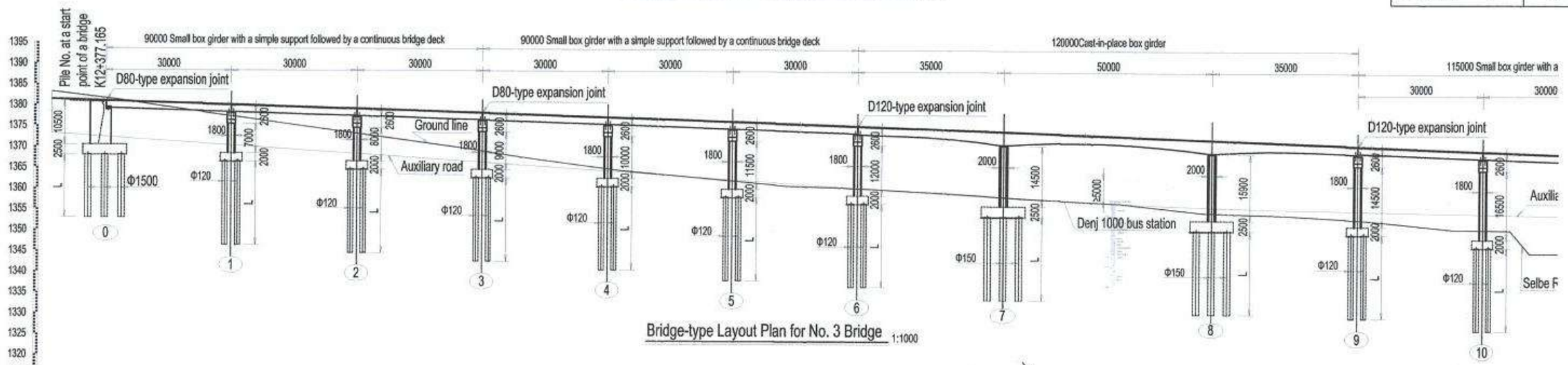
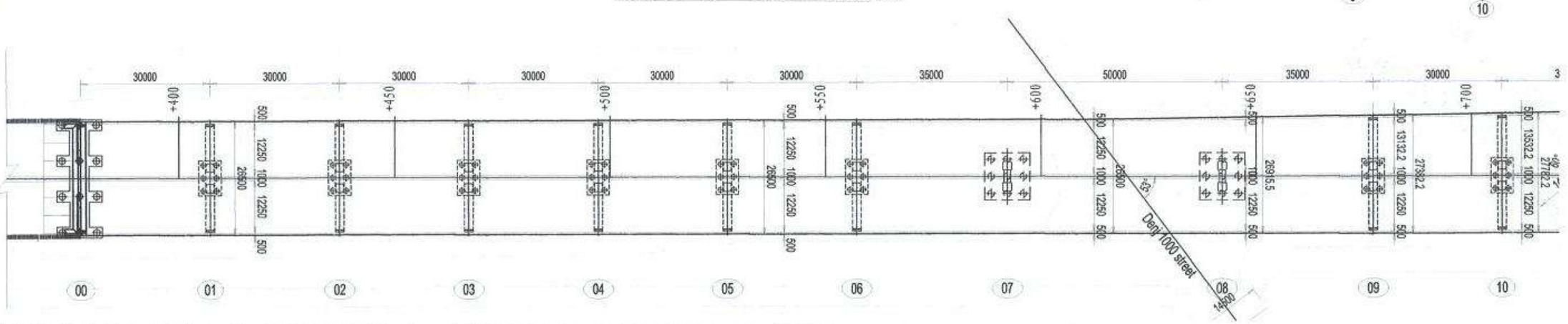
		Plan of a Bridge Location of a Viaduct on a main line (No. 3 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-05
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Elevation of Bridge-type Layout for No. 3 Bridge 1:1000



Bridge-type Layout Plan for No. 3 Bridge 1:1000



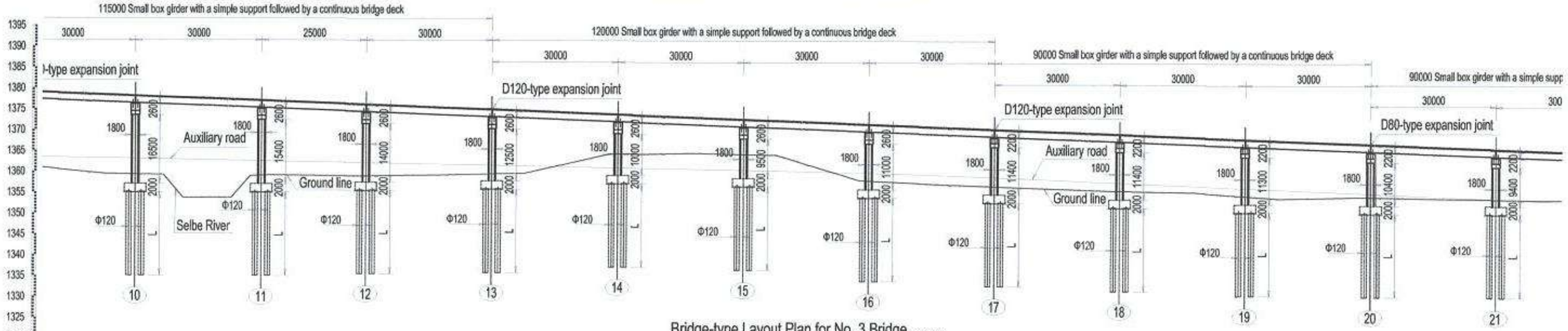
Mileage pile No.(m)	+377.165	K12	K12 +407.165	K12 +437.165	K12 +467.165	K12 +497.165	K12 +527.165	K12 +557.165	K12 +592.165	K12 +642.165	K12 +677.165	K12 +707.165
designed elevation (m)	1384.116		1383.218	1382.299	1381.354	1380.384	1379.387	1378.365	1377.140	1375.330	1374.020	1372.880
Auxiliary road elevation (m)	1375.365		1373.378	1371.392	1367.418	1365.431	1363.445	1361.233	1359.061	1358.264	1357.729	1357.194
Slope (%)/ Slope length (m)			-2.89 / 1390.00				+520 / 1379.99					
Straight line and horizontal curve			R-∞									

Notes:

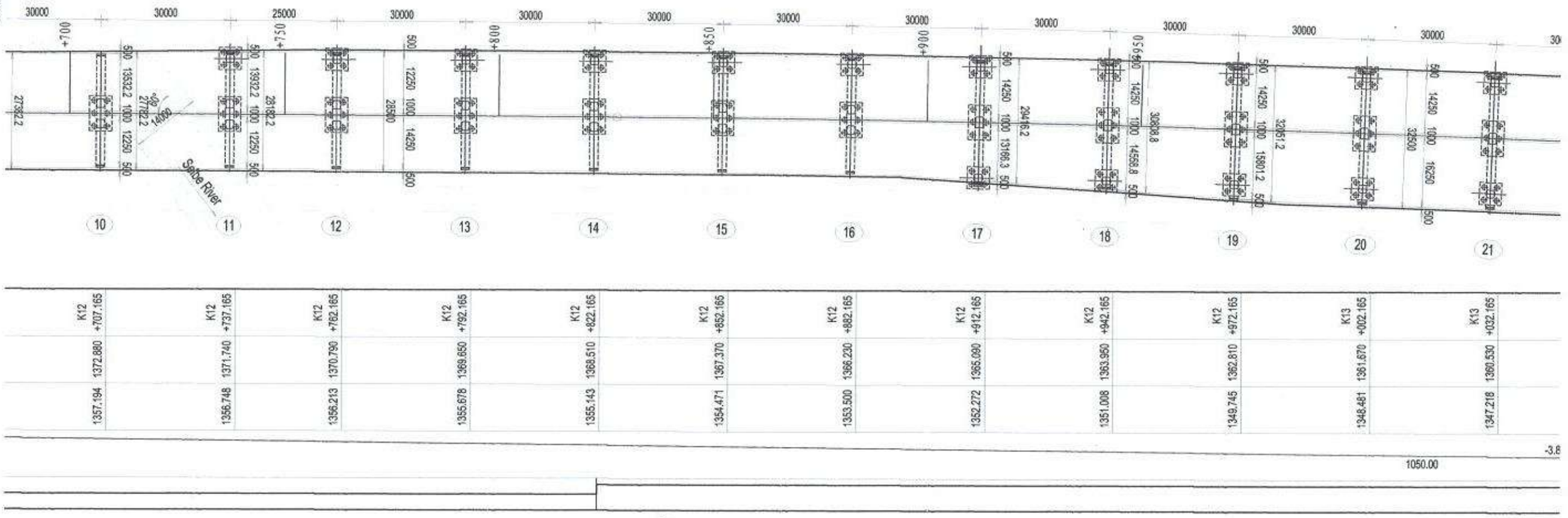
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2. This drawing is applicable to No. 3 Bridge , with a span arrangement of 2×（3×30）+(35+50+35)+(2×30+25+30)+4×30+3×(3×30)+(30+40+30+30)+2×30+3×26+2×26+3×30+2×(4×30)+3×30+(2×33.65+32.7)+5×(4×30)+(20+30+20)=2315m, where the upper structure of 25 m, 26 m, 27 m and 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (27+40+27) m and (30+45+30) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations. The bottom of the foundation pile cap is located below the seasonal frozen earth line.
3. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 1000
		Bridge-type Layout of a Main Viaduct (No. 3 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-06
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Elevation of Bridge-type Layout for No. 3 Bridge 1:1000



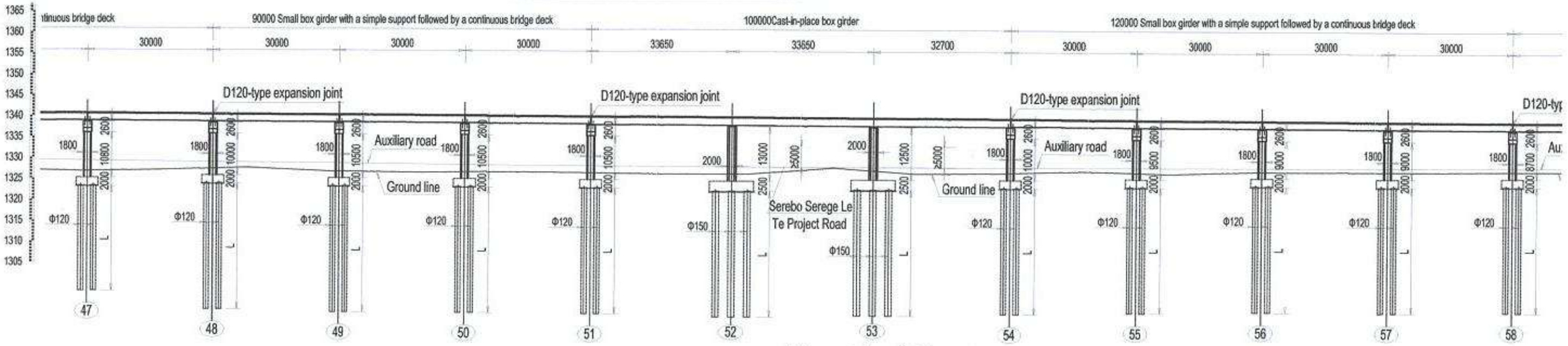
Bridge-type Layout Plan for No. 3 Bridge 1:1000



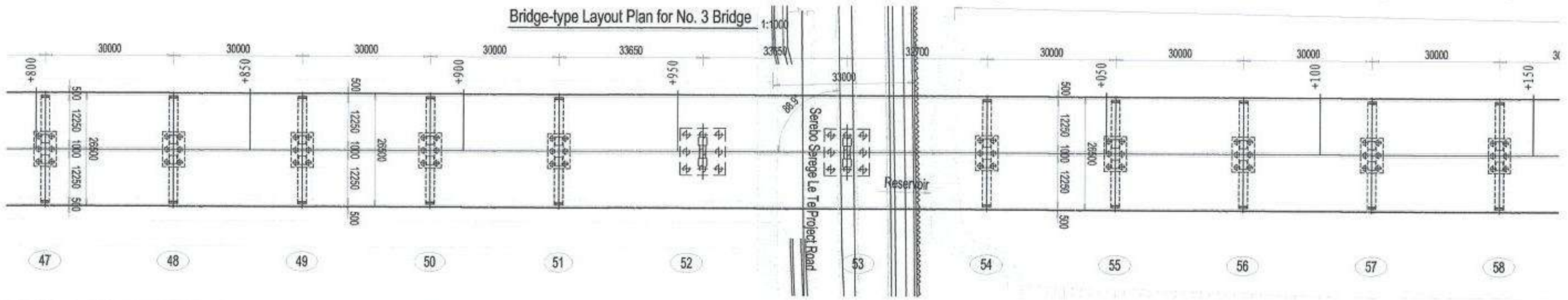
Notes:
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2. This drawing is applicable to No. 3 Bridge , with a span arrangement of 2×（3×30）+(35+50+35)+(2×30+25+30)+4×30+3×(3×30)+(30+40+30+30)+2×30+3×26+2×26+3×30+2×(4×30)+3×30+(2×33.65+32.7)+5×(4×30)+(20+30+20)=2315m, where the upper structure of 25 m, 26 m, 27 m and 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (27+40+27) m and (30+45+30) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations. The bottom of the foundation pile cap is located below the seasonal frozen earth line.
3. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 1000
		Bridge-type Layout of a Main Viaduct (No. 3 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	Ⅱ-06
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Elevation of Bridge-type Layout for No. 3 Bridge 1:1000



Bridge-type Layout Plan for No. 3 Bridge 1:1000



K13 +802.165	K13 +832.165	K13 +862.165	K13 +892.165	K13 +922.165	K13 +952.165	K13 +992.165	K14 +022.165	K14 +052.165	K14 +082.165	K14 +112.165	K14 +142.165
1339.210	1339.096	1338.982	1338.868	1338.754	1338.640	1338.488	1338.374	1338.260	1338.146	1338.032	1337.918
1327.625	1327.369	1327.113	1326.899	1326.759	1326.689	1326.724	1326.811	1326.901	1326.991	1327.081	1327.171

880.00 -0.38

Notes:

1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
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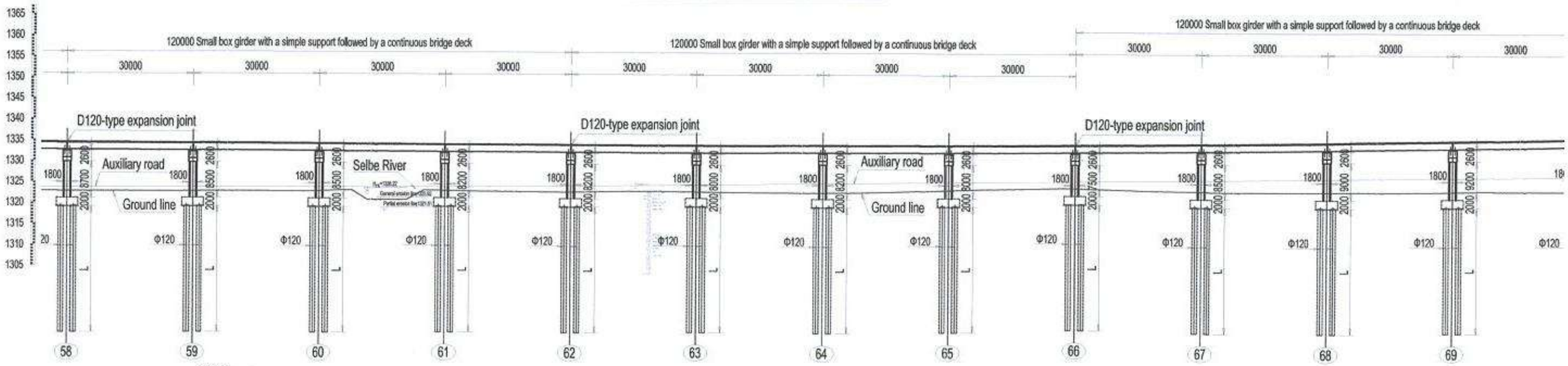
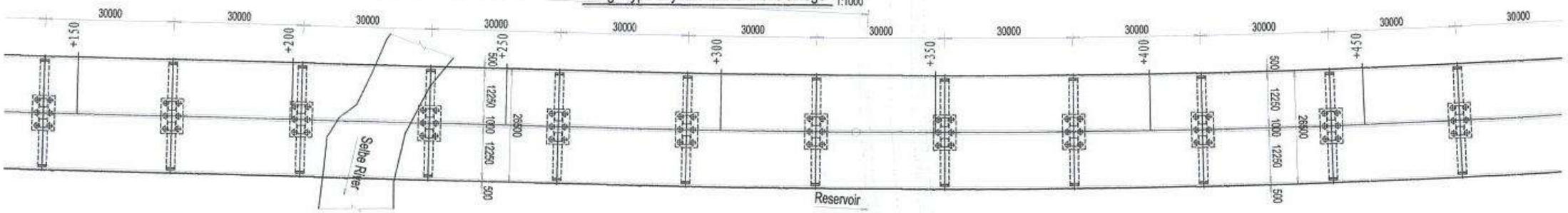
		Bridge-type Layout of a Main Viaduct (No. 3 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	Ⅱ-06
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Elevation of Bridge-type Layout for No. 3 Bridge 1:1000



Bridge-type Layout Plan for No. 3 Bridge 1:1000



K14	+172.165	+202.165	+232.165	+262.165	+292.165	+322.165	+352.165	+382.165	+412.165	+442.165	+472.165	+502.165	K14
	1337.804	1337.690	1337.576	1337.466	1337.422	1337.469	1337.605	1337.831	1338.148	1338.554	1339.050	1339.636	
	1327.261	1327.351	1327.560	1327.942	1328.324	1328.707	1329.089	1329.471	1329.853	1330.236	1330.618	1331.000	

+450 1336.75

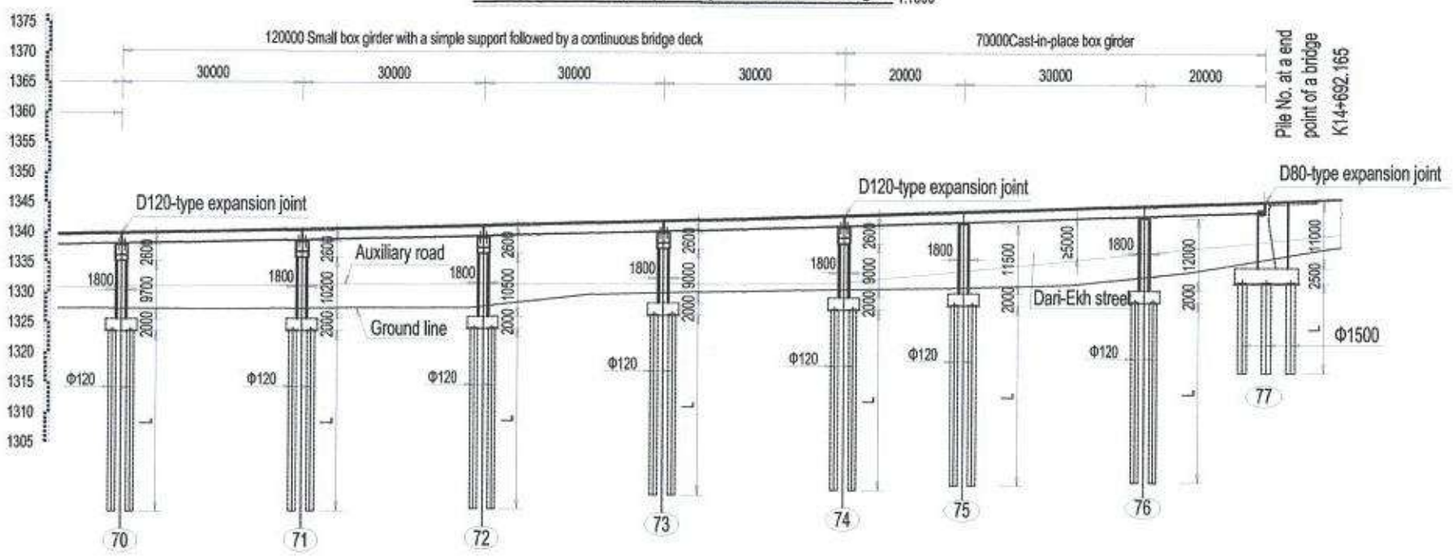
Notes: 1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

2.This drawing is applicable to No. 3 Bridge , with a span arrangement of 2×（3×30）+(35+50+35)+(2×30+25+30)+4×30+3×(3×30)+(30+40+30+30)+2×30+3×26+2×26+3×30+2×(4×30)+3×30+(2×33.65+32.7)+5×(4×30)+(20+30+20)=2315m, where the upper structure of 25 m, 26 m, 27 m and 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (27+40+27) m and (30+45+30) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations. The bottom of the foundation pile cap is located below the seasonal frozen earth line.

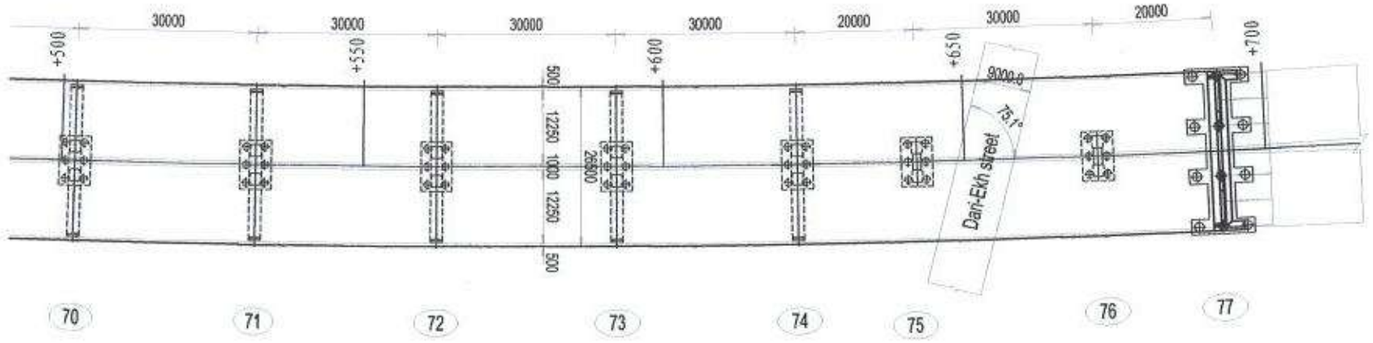
3.According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 1000
		Bridge-type Layout of a Main Viaduct (No. 3 Bridge)				MASTER DES.	CAO YONGJIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-06
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Elevation of Bridge-type Layout for No. 3 Bridge 1:1000



Bridge-type Layout Plan for No. 3 Bridge 1:1000



	K14 +502.165	K14 +532.165	K14 +562.165	K14 +592.165	K14 +622.165	K14 +642.165	K14 +672.165	K14 +692.165
	1339.636	1340.313	1341.079	1341.935	1342.882	1343.663	1344.625	1345.334
	1331.000	1331.213	1331.366	1331.722	1333.694	1336.653	1335.666	1337.865

680.00

3.55

JD12 I-16°27'45.2"(Z) R-2500 Ls-100

Notes:

1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2. This drawing is applicable to No. 3 Bridge , with a span arrangement of 2×（3×30）+(35+50+35)+(2×30+25+30)+4×30+3×(3×30)+(30+40+30+30)+2×30+3×26+2×26+3×30+2×(4×30)+3×30+(2×33.65+32.7)+5×(4×30)+(20+30+20)=2315m, where the upper structure of 25 m, 26 m, 27 m and 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (27+40+27) m and (30+45+30) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations. The bottom of the foundation pile cap is located below the seasonal frozen earth line.
3. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

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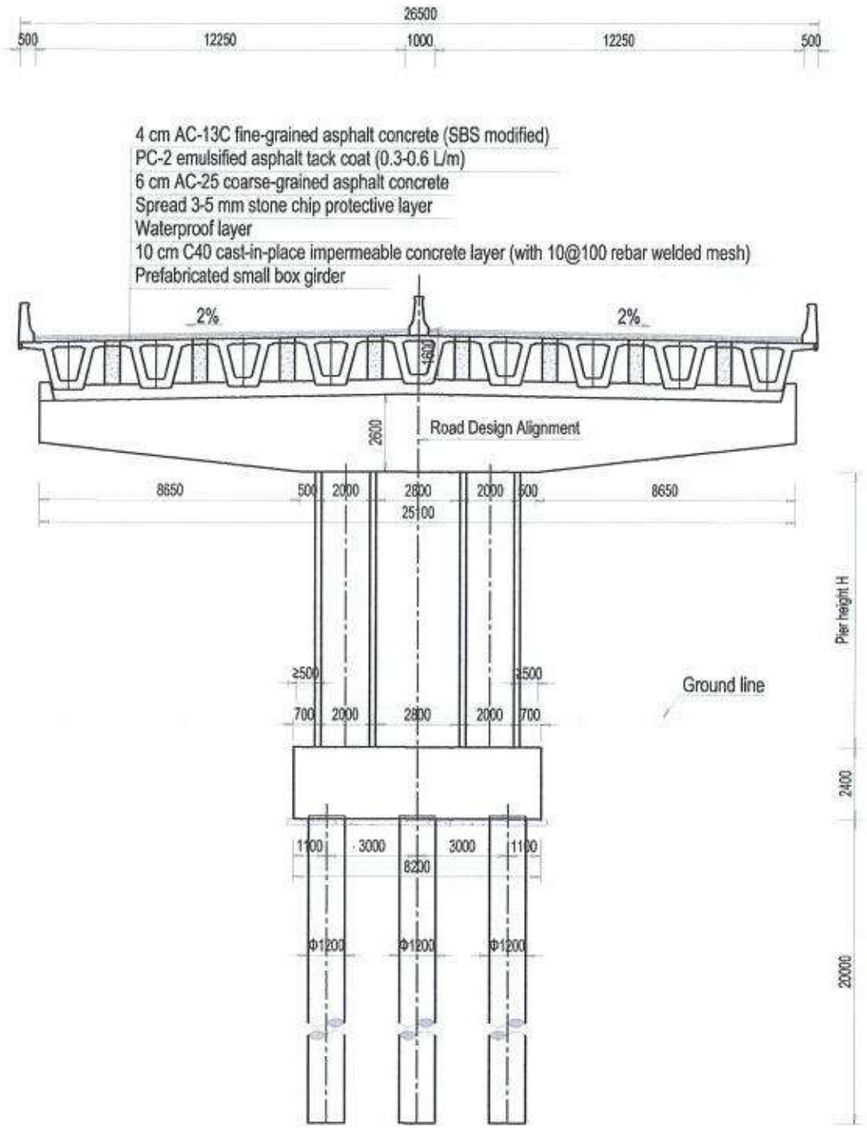
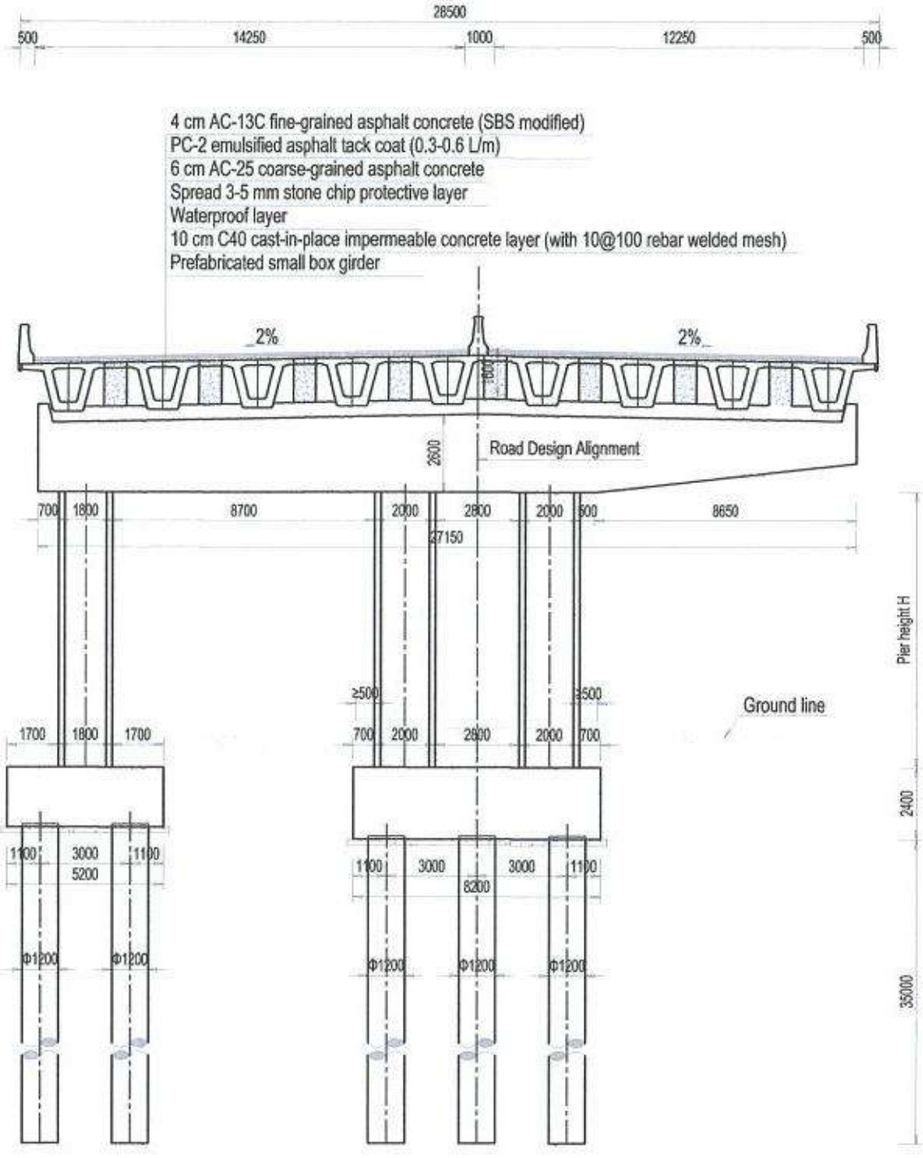
		Bridge-type Layout of a Main Viaduct (No. 3 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-06
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	LI MAOJUN				

Cross Section for a Small Box Girder of a Standard Section 1:200



Cross Section for Widening of One Side of the Road 1:200

Suitable for piers 9#~16#

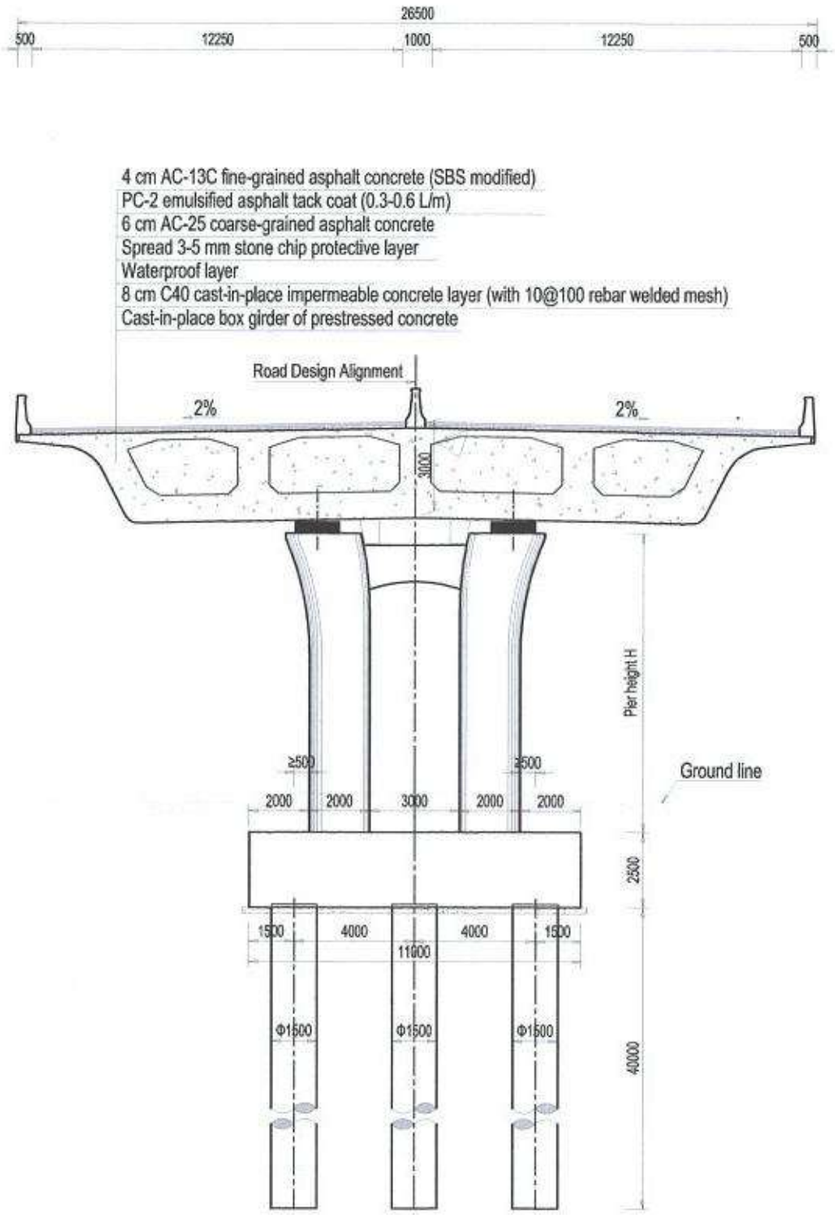


Notes:

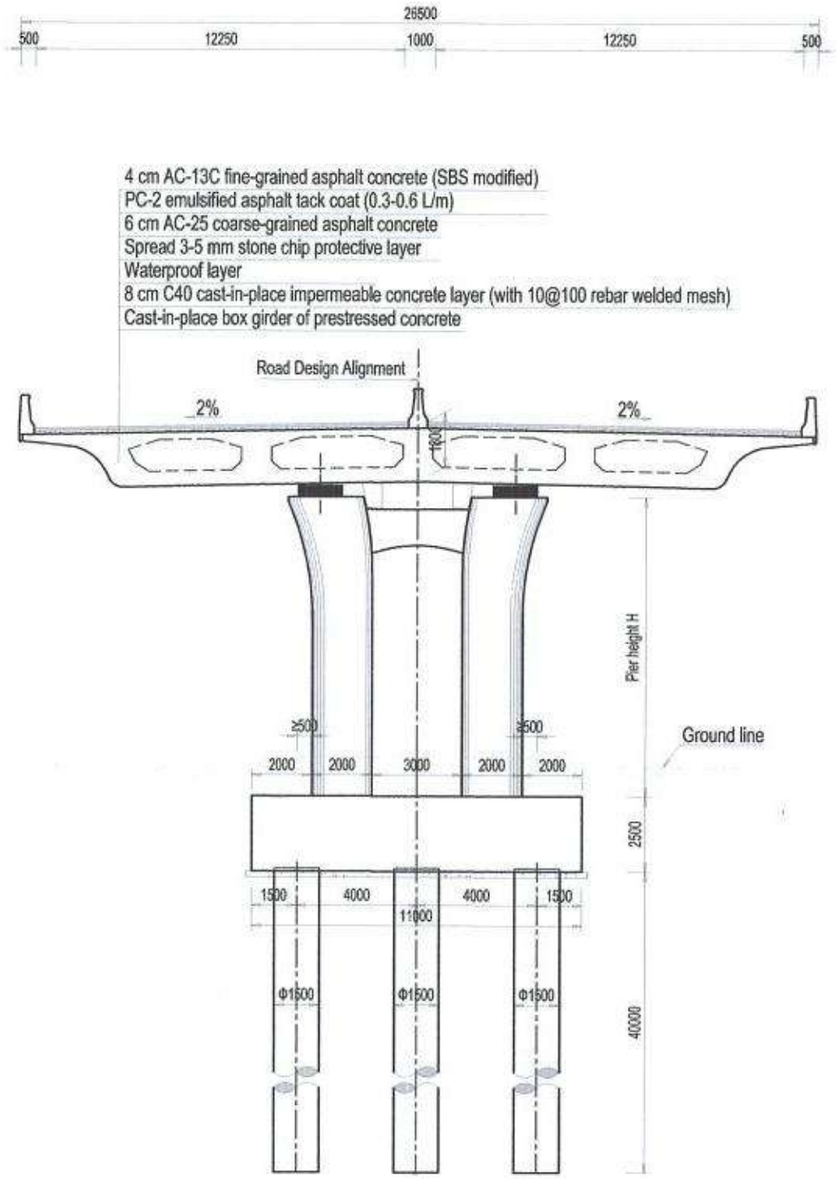
1、All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO. 10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		Bridge-type Layout of a Main Viaduct (No. 3 Bridge)		MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-06
				MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
							DESIGNED	LI MAOJUN						

35+50+35m Cross Section of End Pivot Support 1:200



35+50+35m Cross Section of Middle Pivot Support 1:200

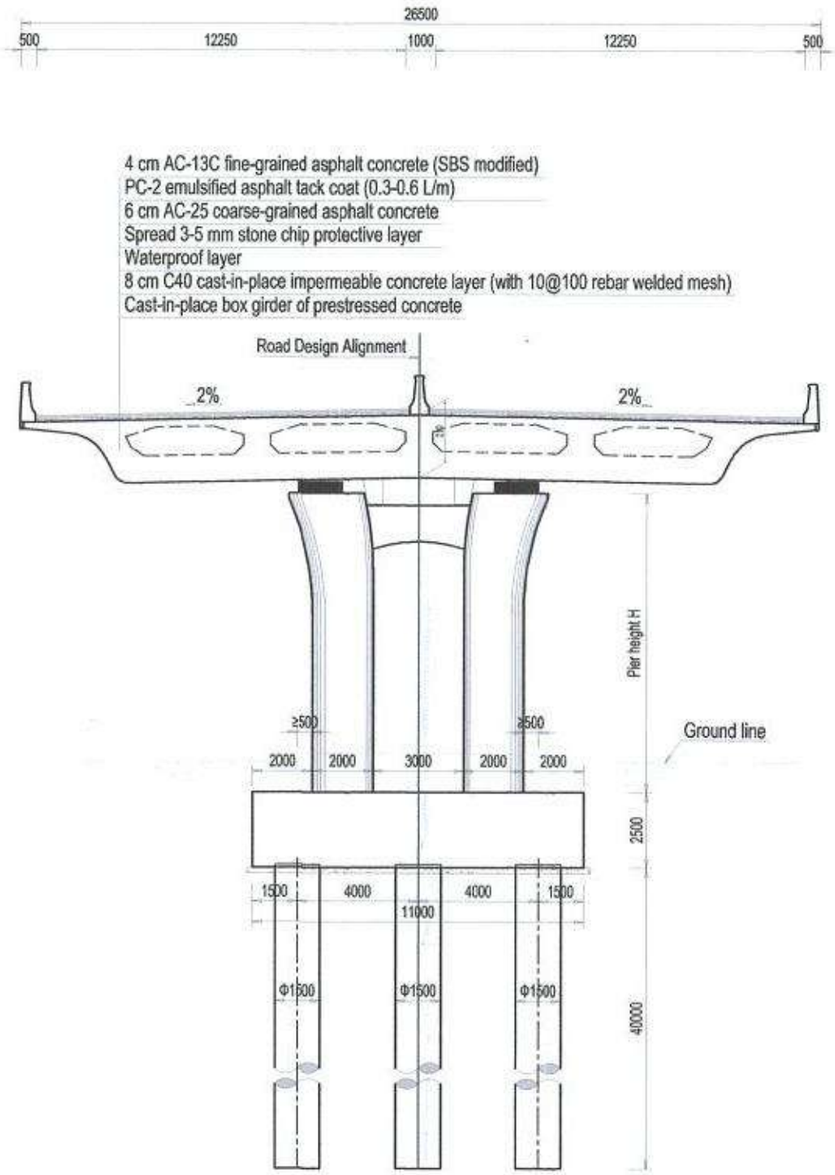


Notes:

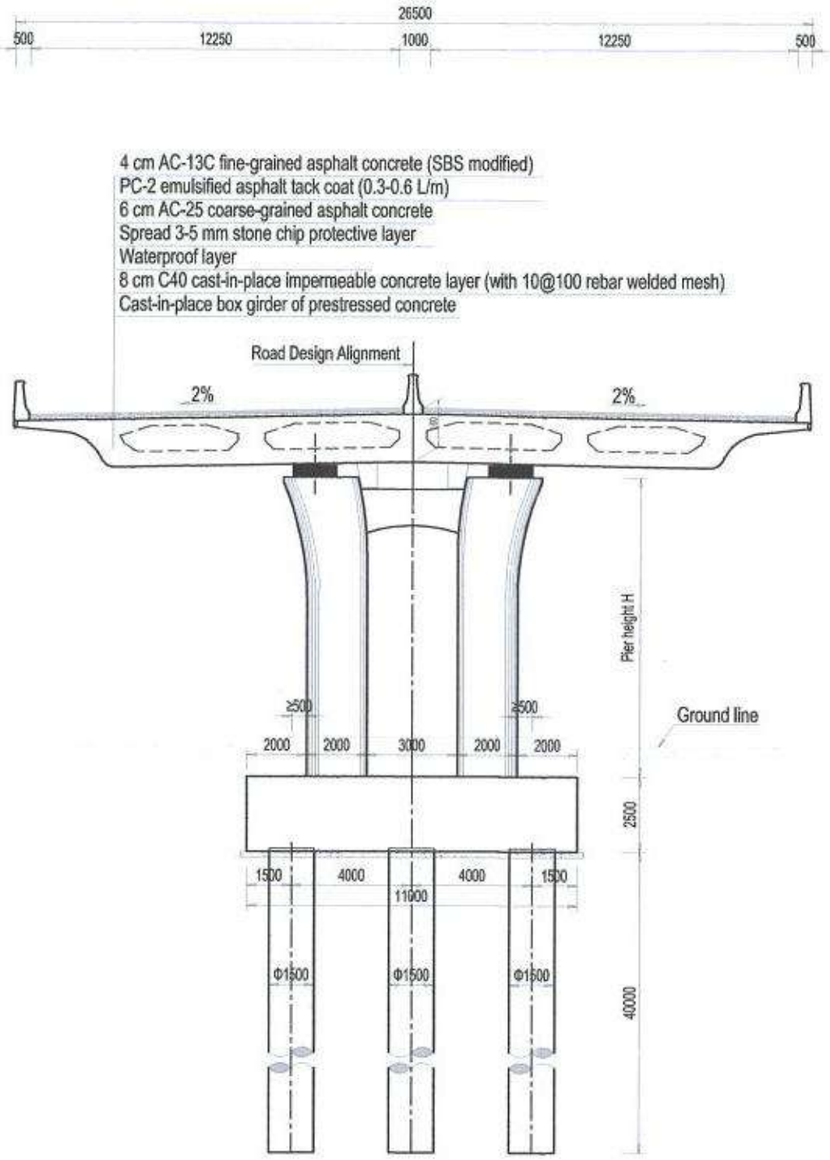
1、All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES.MANAGER: PANG WEI	SUB.MANAGER: GAO JINCHUN	CHECKED: GAO JINCHUN	SCALE: 1: 200
		Bridge-type Layout of a Main Viaduct (No. 3 Bridge)		MASTER DES.: CAO YONGXIANG	SPE.MANAGER: ZHANG BO	EXAMINED: PANG WEI	DRAWING NO.: II-06
				MASTER DES.: PAN HAOGUO	SPE.MANAGER: MA JUN	APPROVED: ZHU ANJING	DATE: 2025.07
					DESIGNED: LI MAOJUN		

30+40+30m Cross Section of End Pivot Support 1:200



30+40+30m Cross Section of Middle Pivot Support 1:200

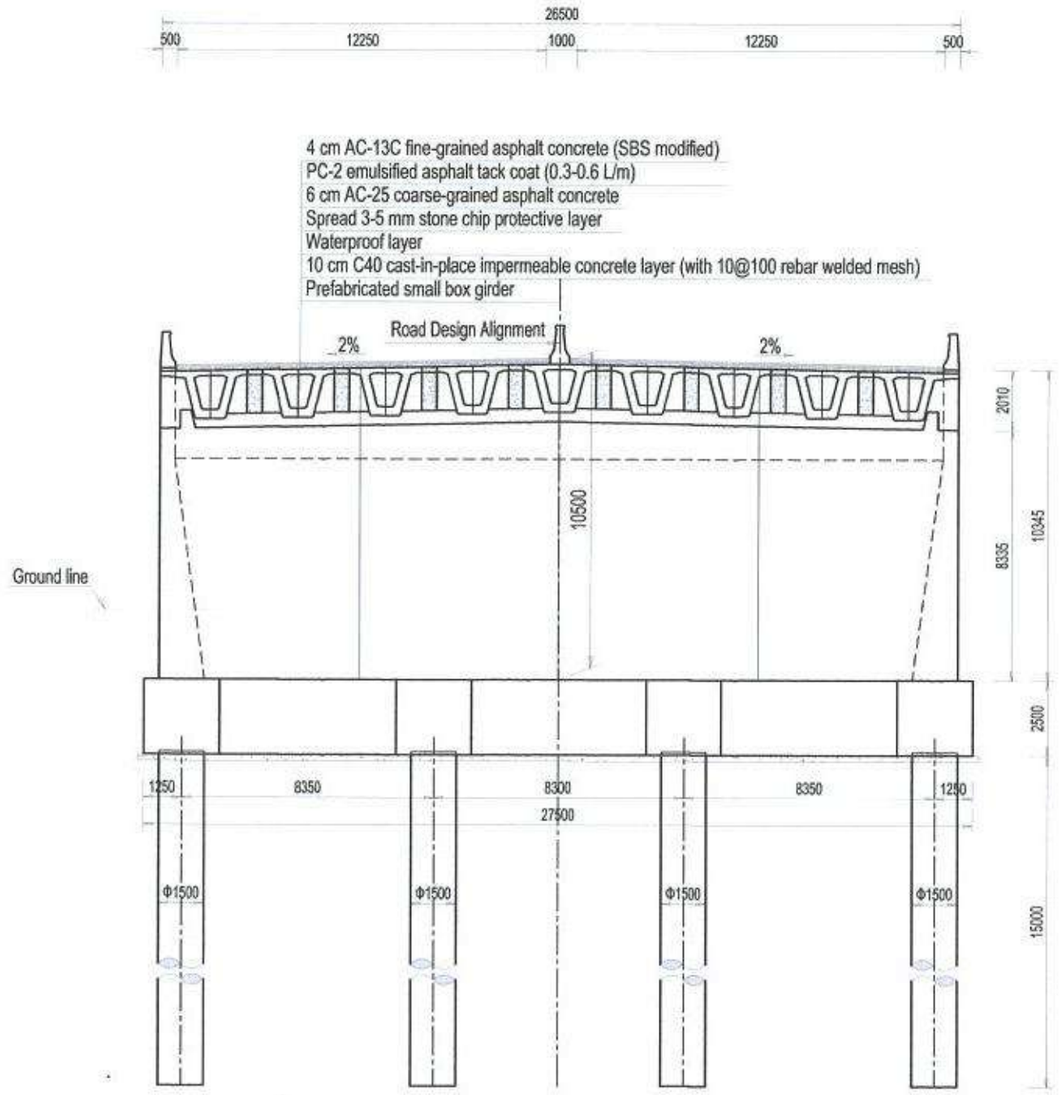


Notes:

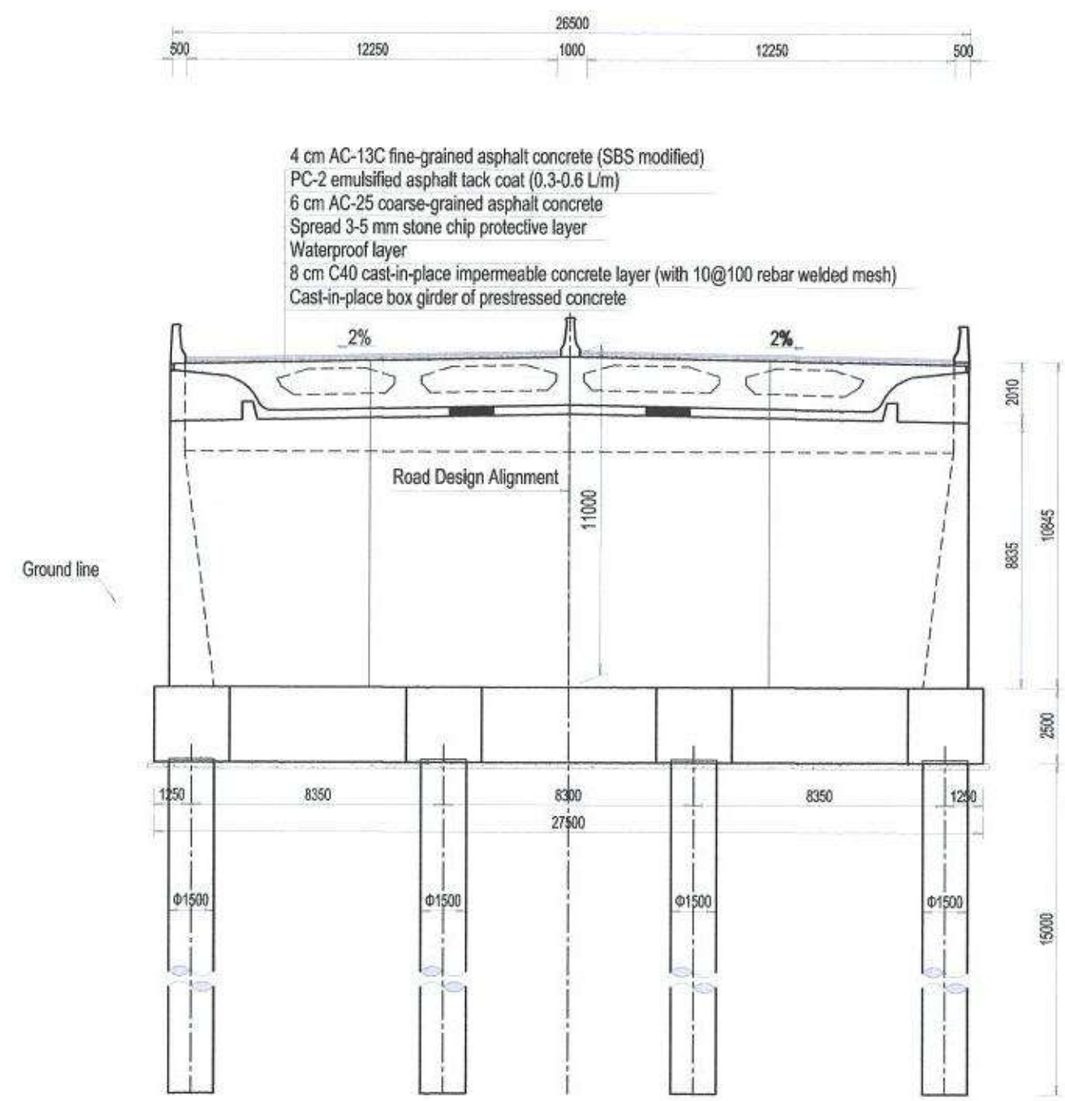
1、All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES.MANAGER: PANG WEI	SUB.MANAGER: GAO JINCHUN	CHECKED: GAO JINCHUN	SCALE: 1: 200
		Bridge-type Layout of a Main Viaduct (No. 2 Bridge)		MASTER DES.: CAO YONGXIANG	SPE.MANAGER: ZHANG BO	EXAMINED: PANG WEI	DRAWING NO.: II-06
				MASTER DES.: PAN HAOGUO	SPE.MANAGER: MA JUN	APPROVED: ZHU ANJING	
					DESIGNED: LI MAOJUN		DATE: 2025.07

Cross Section of 0 # Abutment 1:200



Cross Section of 76 # Abutment 1:200



Notes:

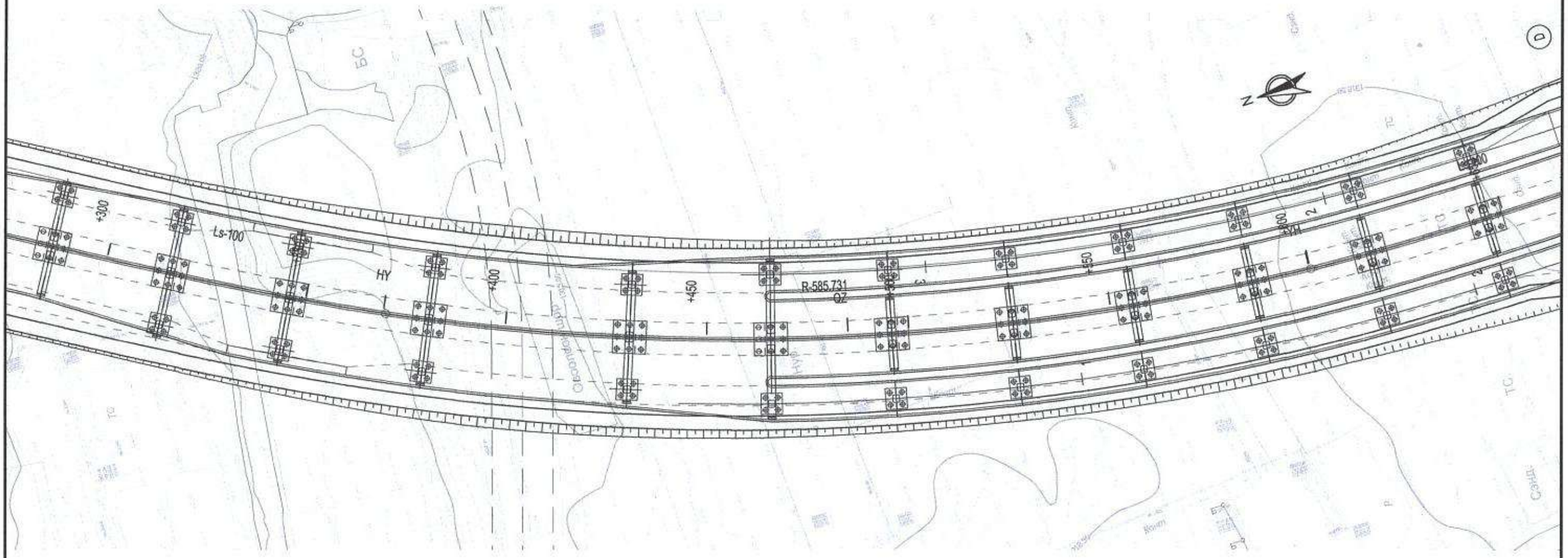
1、All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		Bridge-type Layout of a Main Viaduct (No. 3 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-06
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

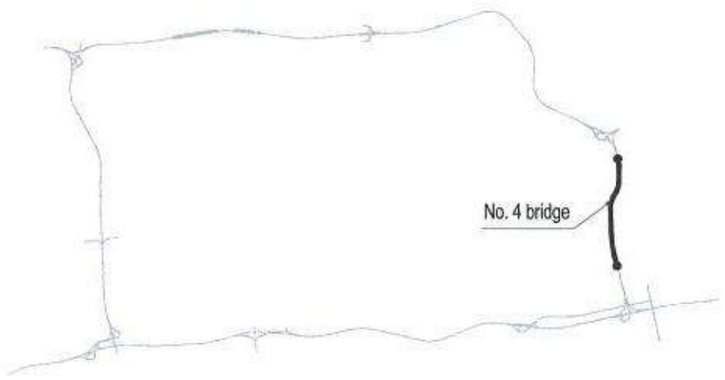
Bridge Location Plan for No. 4 Bridge

1:1000

Pile Nos. at a start point and an end point: K21+355.437~K23+925.437



Line Position Thumbnail



Notes:

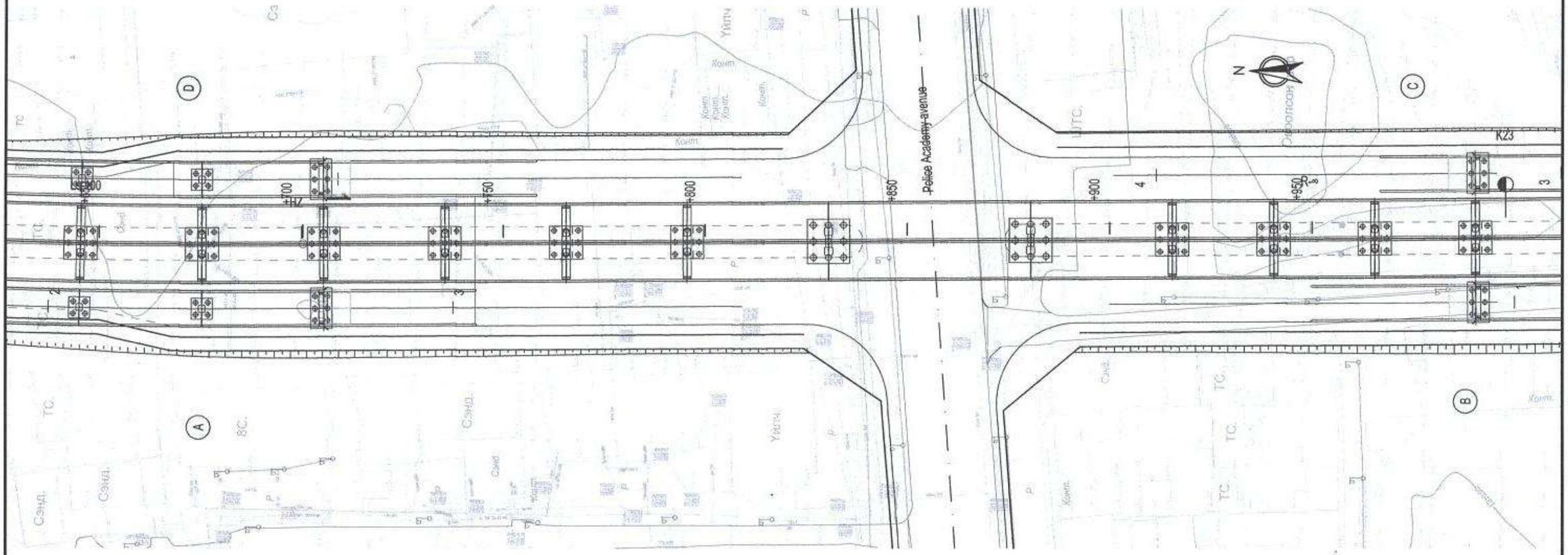
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2. This drawing is applicable to No. 4 Bridge , with a span arrangement of(5x30)+(35+50+35)+6x(4x30)+(35+50+35)+(4x30)+(3x30)+(4x30)+(35+50+35)+(3x25)+(4x30)+(5x30)+(3x30)+2x(4x30)+(5x30)+(1x25)+(30+40+30)+(2x30)=2570m，where the upper structure of 25 m, 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (30+40+30) m and (35+50+35) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 4 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-07
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHU						

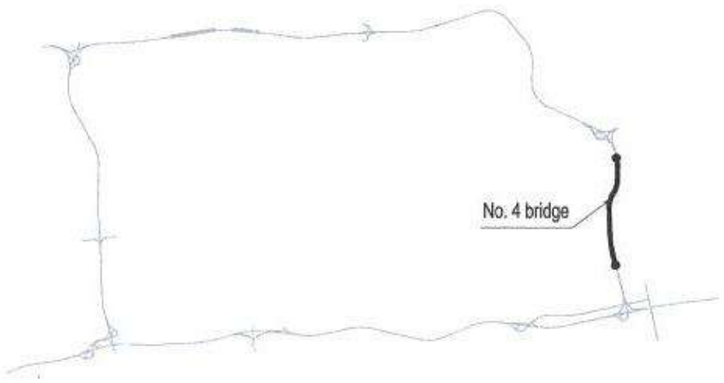
Bridge Location Plan for No. 4 Bridge

1:1000

Pile Nos. at a start point and an end point: K21+355.437~K23+925.437



Line Position Thumbnail



Notes:

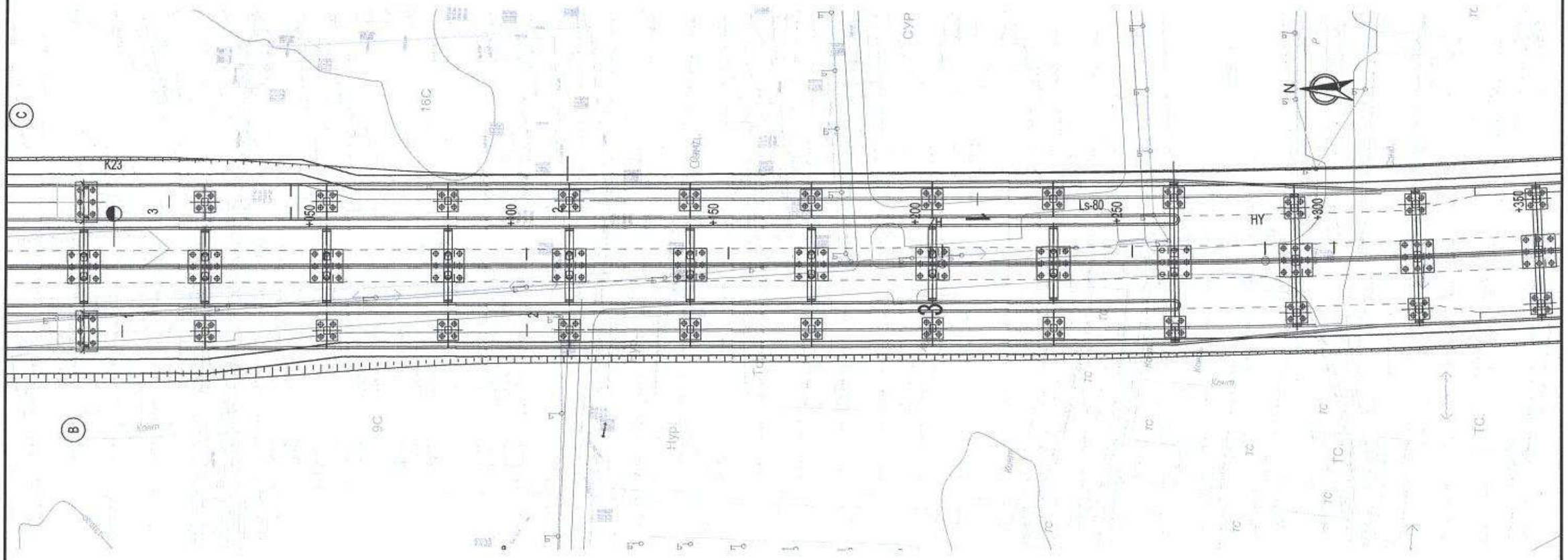
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2. This drawing is applicable to No. 4 Bridge , with a span arrangement of(5x30)+(35+50+35)+6x(4x30)+(35+50+35)+(4x30)+(3x30)+(4x30)+(35+50+35)+(3x25)+(4x30)+(5x30)+(3x30)+2x(4x30)+(5x30)+(1x25)+(30+40+30)+(2x30)=2570m，where the upper structure of 25 m, 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (30+40+30) m and (35+50+35) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 4 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-07
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHU				

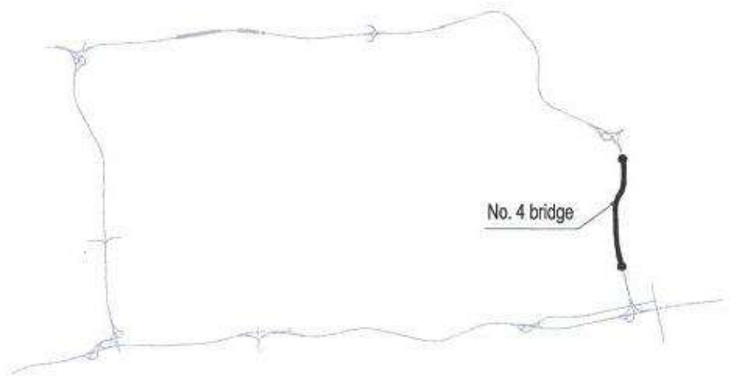
Bridge Location Plan for No. 4 Bridge

1:1000

Pile Nos. at a start point and an end point: K21+355.437~K23+925.437



Line Position Thumbnail

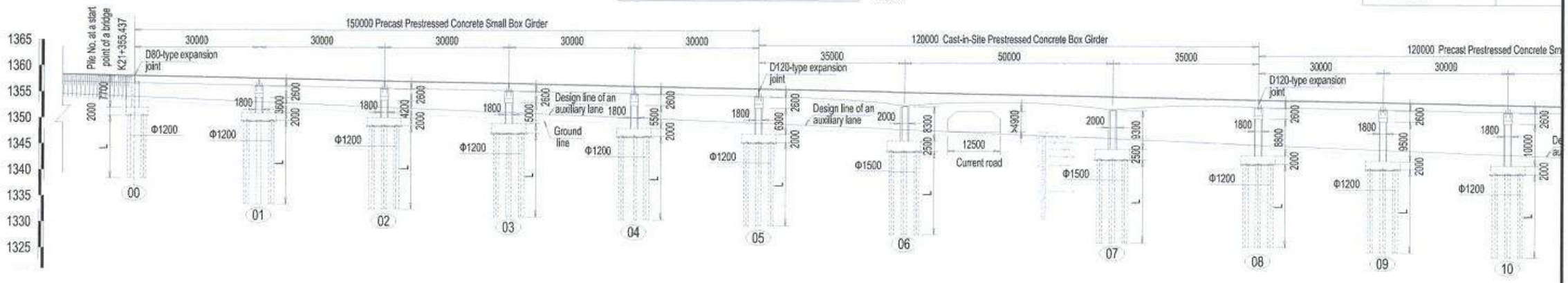


Notes:

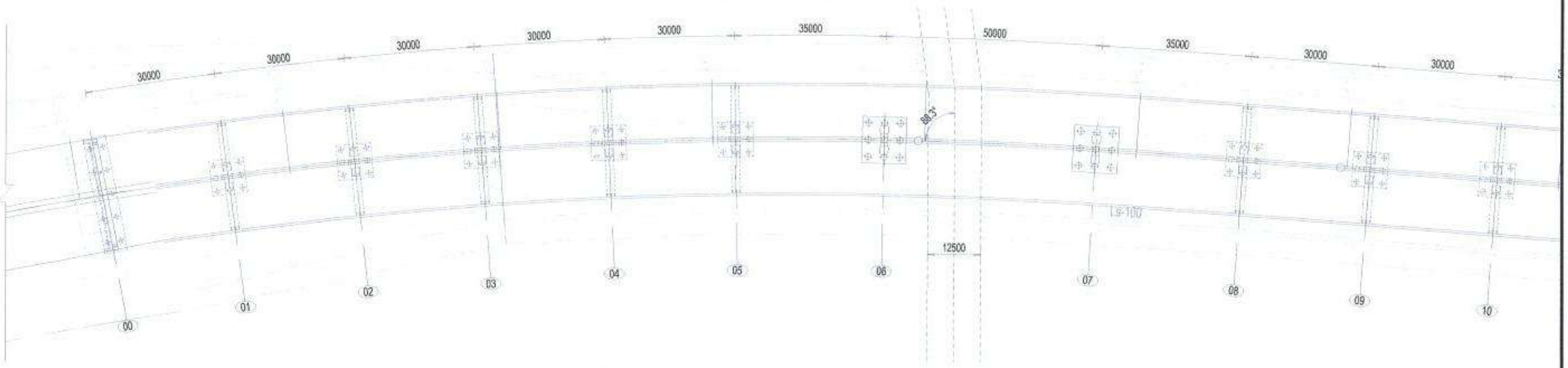
1. All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2. This drawing is applicable to No.4 Bridge , with a span arrangement of(5x30)+(35+50+35)+6x(4x30)+(35+50+35)+(4x30)+(3x30)+(4x30)+(35+50+35)+(3x25)+(4x30)+(5x30)+(3x30)+2x(4x30)+(5x30)+(1x25)+(30+40+30)+(2x30)=2570m，where the upper structure of 25 m, 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (30+40+30) m and (35+50+35) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 4 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II -07
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	YANG WANHU					DATE	2025.07

Elevation Layout Drawing of Bridge No. 4 1:1000



Plan Layout Drawing of Bridge No. 4 1:1000



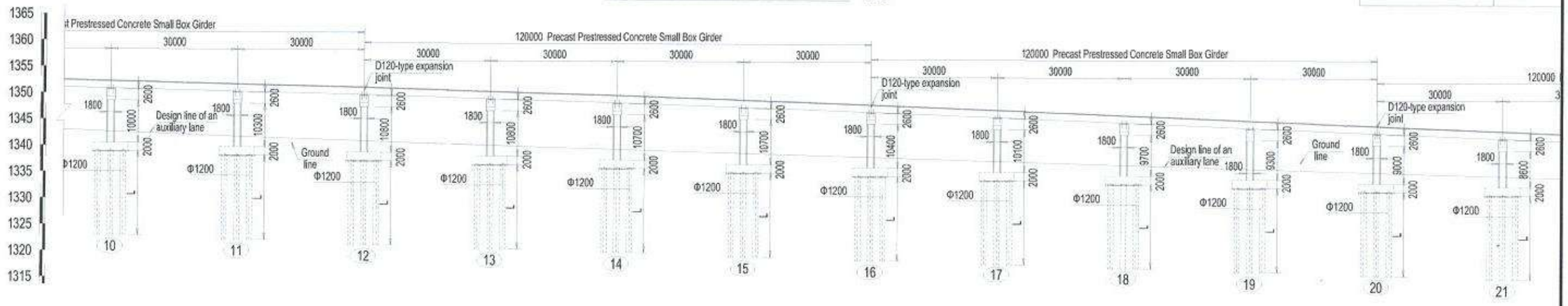
Design elevation (m)	1358.916	1358.320	1357.724	1357.127	1356.531	1355.935	1355.239	1354.246	1353.550	1352.954	1352.358
Ground elevation (m)	1353.985	1352.748	1351.511	1350.274	1349.037	1347.800	1346.357	1344.295	1342.852	1341.618	1340.453
Slope (%)	-1.99										
Slope length (m)	570.00										
Mileage pile No.	+355.437 K21	+385.437 4	+415.437	+445.437	+475.437 5	+505.437	+540.437	+590.437 6	+625.437	+655.437	+685.437
Straight line and horizontal curve	JD16 I-65°35'47"(Y) R-1000 Ls-100 JD1 I-9°37'43.1"(Y) R-700 Ls-80										

Notes:

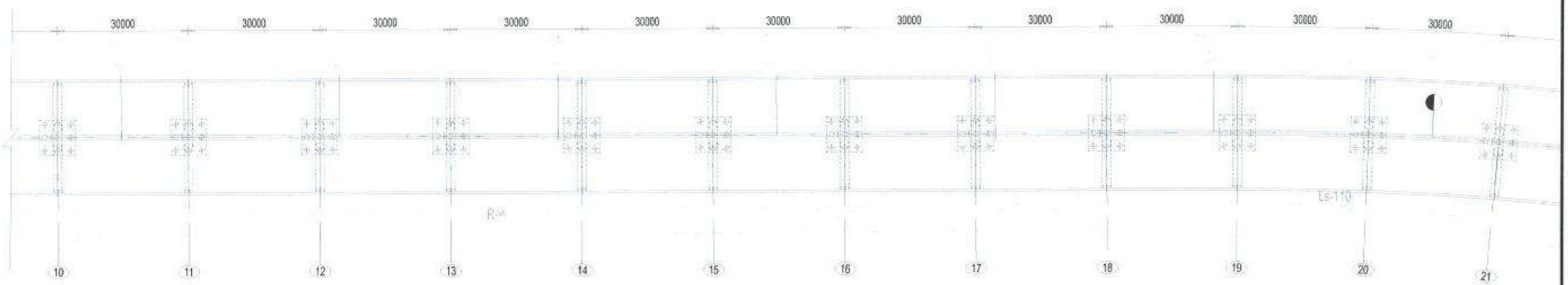
1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 4 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-08
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	MA JUN				

Elevation Layout Drawing of Bridge No. 4 1:1000



Plan Layout Drawing of Bridge No. 4 1:1000



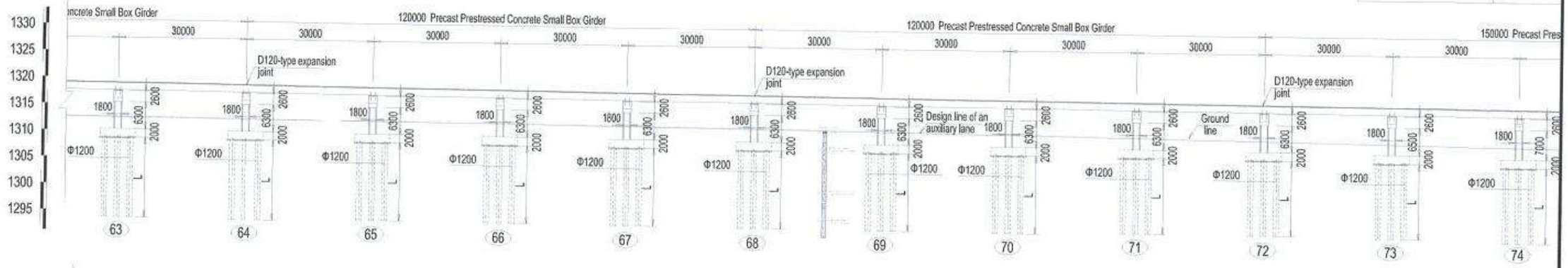
Design elevation (m)	1352.358	1351.761	1351.059	1350.279	1349.410	1348.451	1347.401	1346.262	1345.063	1343.863	1342.663	1341.463
Ground elevation (m)	1340.453	1339.388	1338.423	1337.557	1336.691	1335.900	1335.071	1334.243	1333.414	1332.585	1331.756	1330.928
Slope (%) Slope length (m)	+800	1350.08										
Mileage pile No.	+685.437 7	+715.437	+745.437	+775.437 8	+805.437	+835.437	+865.437	+895.437 9	+925.437	+955.437	+985.437 K22	+15.437
Straight line and horizontal curve	R-∞											

Notes:

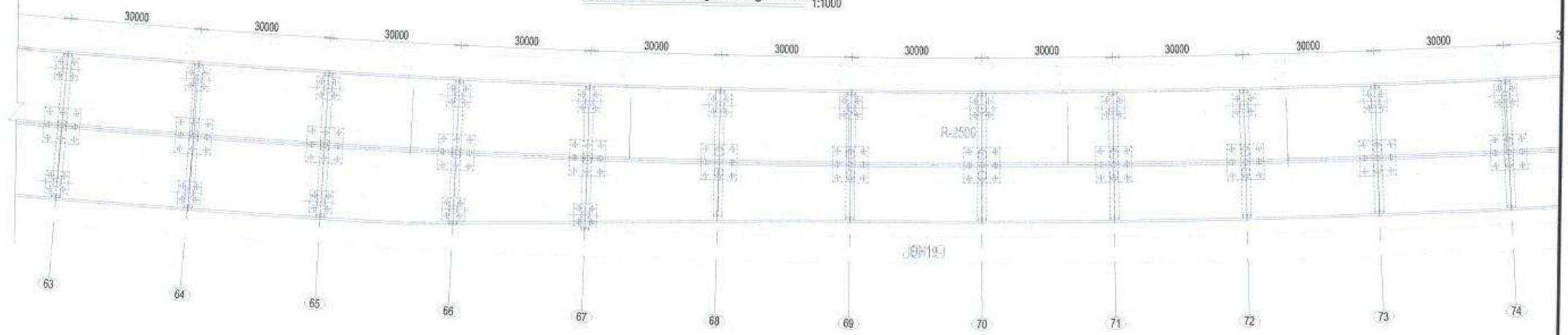
1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 4 Bridge)				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-08
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	MA JUN				

Elevation Layout Drawing of Bridge No. 4 1:1000



Plan Layout Drawing of Bridge No. 4 1:1000



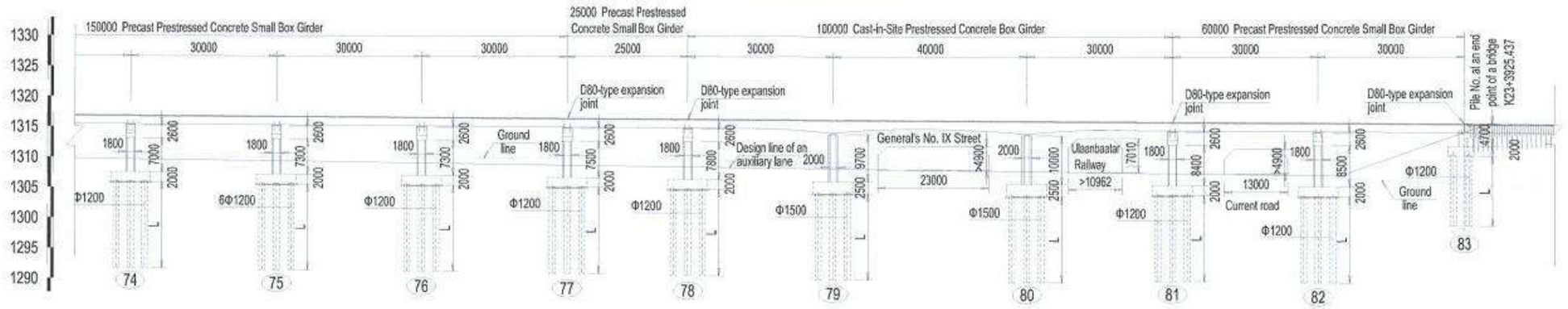
Design elevation (m)	1319.036	1318.874	1318.712	1318.550	1318.388	1318.226	1318.064	1317.902	1317.740	1317.578	1317.416	1317.254
Ground elevation (m)	1311.087	1310.980	1310.873	1310.762	1310.612	1310.418	1310.173	1309.896	1309.567	1309.195	1308.811	1308.427
Slope (%) Slope length (m)												
Mileage pile No.	+320.437	+350.437	+380.437	+410.437	+440.437	+470.437	+500.437	+530.437	+560.437	+590.437	+620.437	+650.437
Straight line and horizontal curve	JD19 I-12°34'32.7"(Z) R-2500 Ls-80											

Notes:

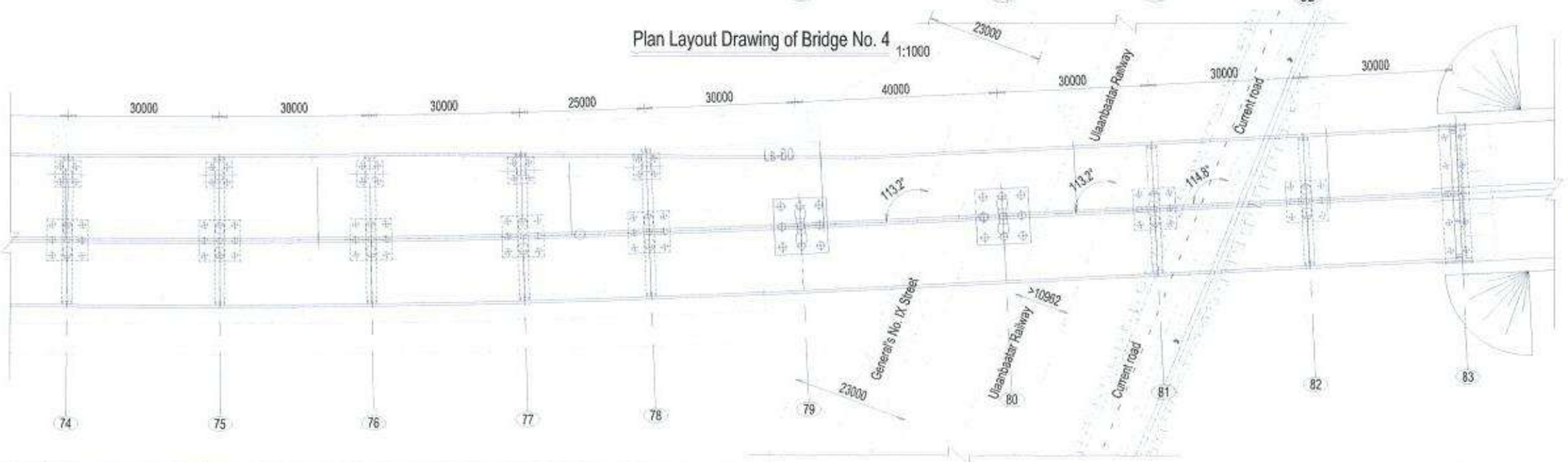
1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 4 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-08
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

Elevation Layout Drawing of Bridge No. 4 1:1000



Plan Layout Drawing of Bridge No. 4 1:1000



Design elevation (m)	1317.254		1317.092		1316.930		1316.768	1316.633	1316.471	1316.255	1316.093	1315.903	1315.669
Ground elevation (m)	1308.427		1308.043		1307.659		1307.275	1306.955	1306.571	1306.059	1305.675	1305.291	1314.146
Slope (%) Slope length (m)													+930 1315.74
Mileage pile No.	+650.437		+680.437	7	+710.437		+740.437	+765.437	+795.437	8	+835.437	+865.437	+895.437	9	+925.437
Straight line and horizontal curve													

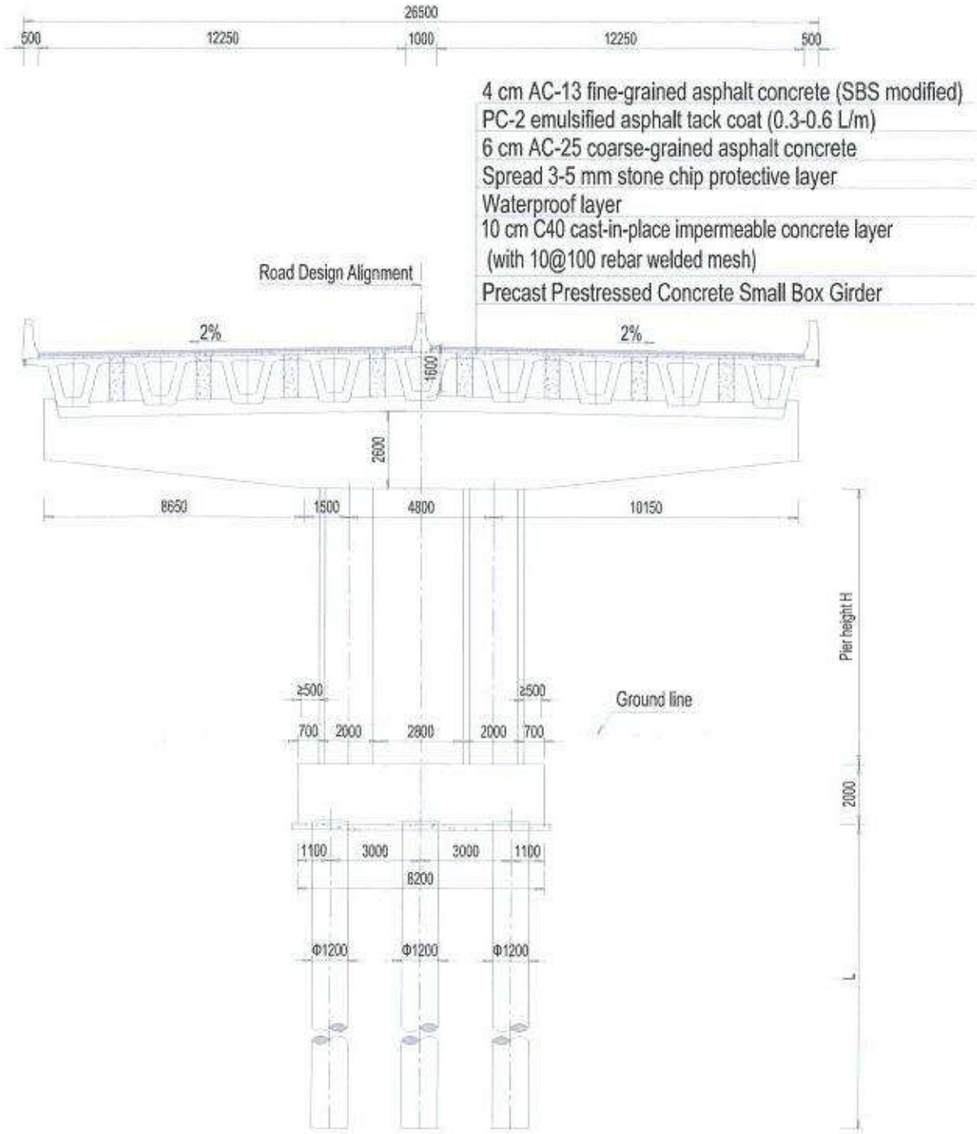
Notes: 1. All dimensions in this drawing are measured in mm.

2. This drawing is applicable to No. 4 Bridge , with a span arrangement of (5*30)+(35+50+35)+6*(4*30)+(35+50+35)+(4*30)+(3*30)+(4*30)+(35+50+35)+(3*25)+(4*30)+(5*30)+(3*30)+2*(4*30)+(5*30)+(1*25)+(30+40+30)+(2*30)=2,570 m, where the upper structure of 25 m and 30 m spans is of a prestressed concrete small box girder structure with a simple support followed by a continuous bridge deck, and the lower structure consists of double-column rectangular pier large cantilever bent cap + a cap pile foundation; the upper structure of the (35+50+35) m and (30+40+30) m span arrangements is continuous girders of cast-in-place prestressed concrete, while the lower structure consists of frame piers and cap pile foundations. The bottom of the foundation pile cap is located below the seasonal frozen earth line.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 4 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-08
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

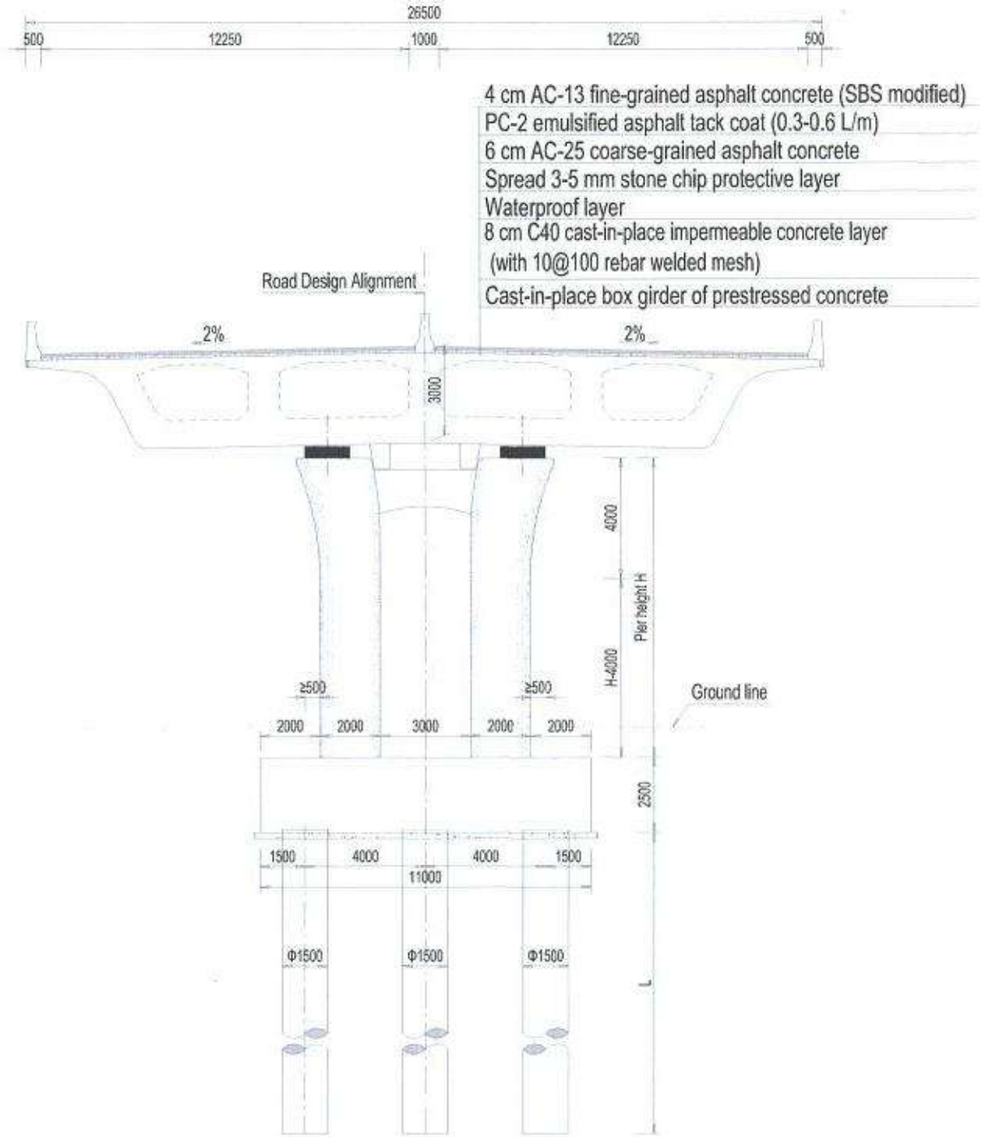
Typical Cross-Section Arrangement of Small Box Girder 1:200

Suitable for 1#~5# , 8#~28# and 81#~82# piers



Cross Section of a 35+50+35 m Pivot 1:200

Suitable for 6#~7# piers



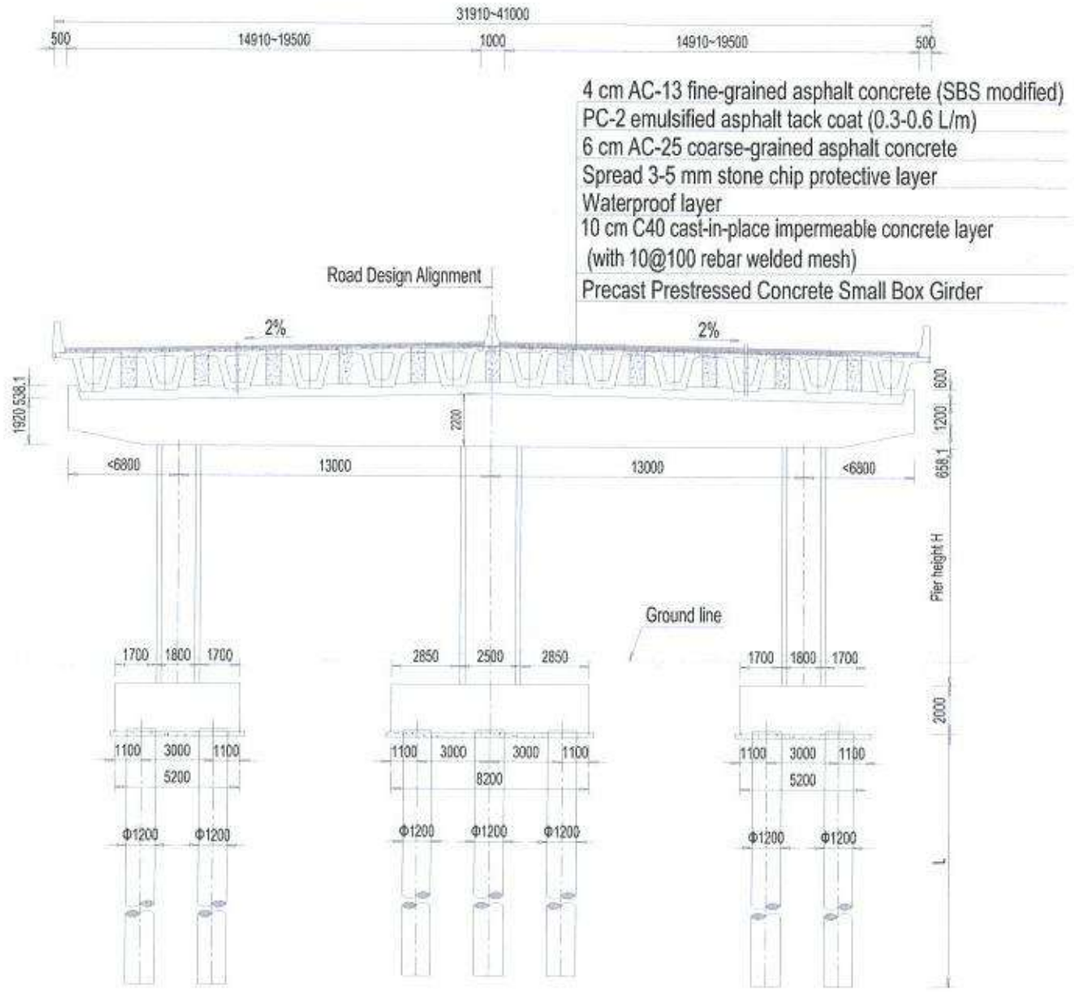
Notes:

1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		主线高架桥型布置图（4号桥）				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-08
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

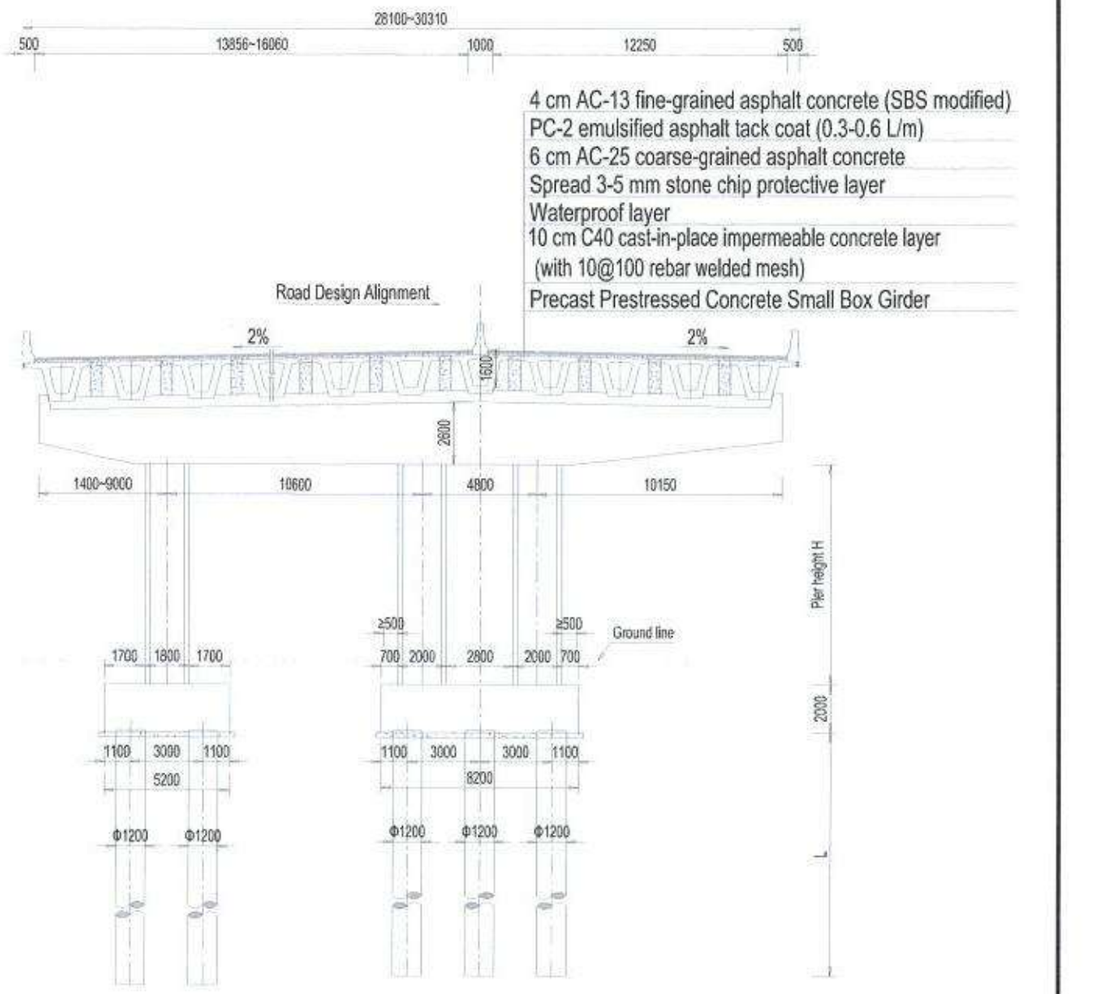
Cross Section for Widening of Both Sides of the Road 1:250

Suitable for 31#~35# and 61#~67# piers



Cross Section for Widening of One Side of the Road 1:250

Suitable for 29#~30# and 68#~79# piers



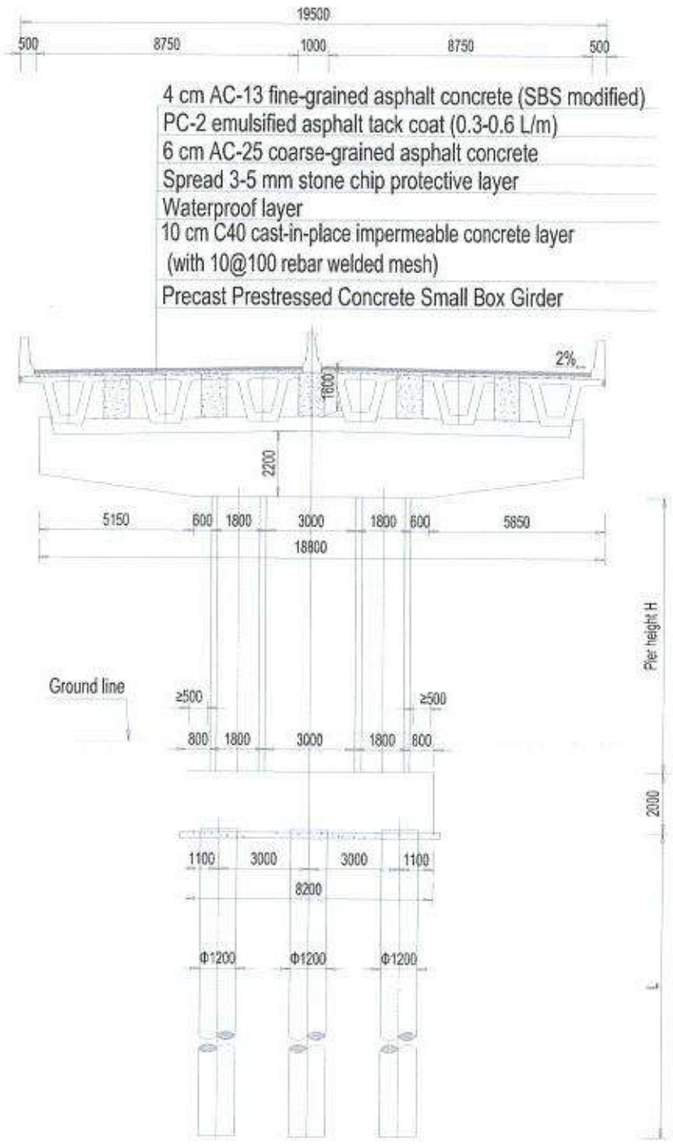
Notes:

1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

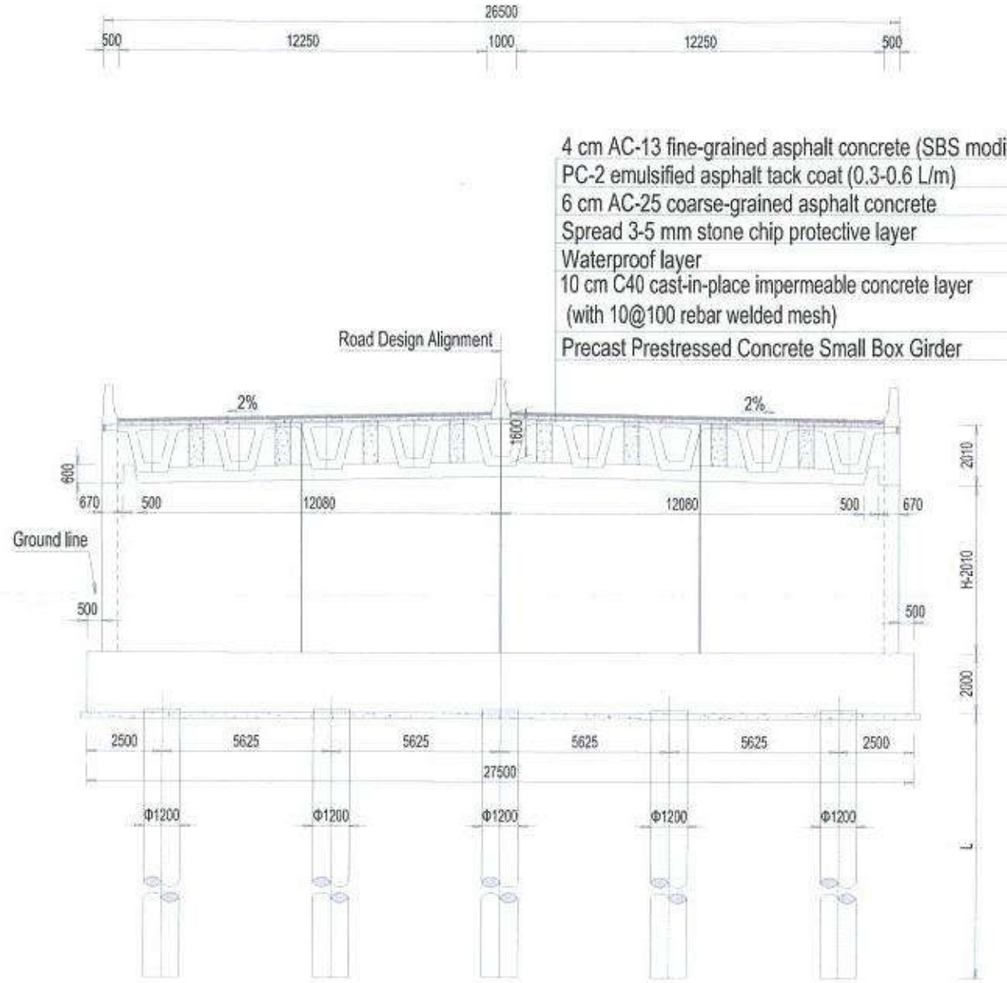
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 250
		主线高架桥型布置图（4号桥）				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-08
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

Typical Cross-Section Arrangement of Small Box Girder 1:200

Suitable for 36#~60# piers



Cross Section of 0 # And 83 # Abutment 1:200



Notes:

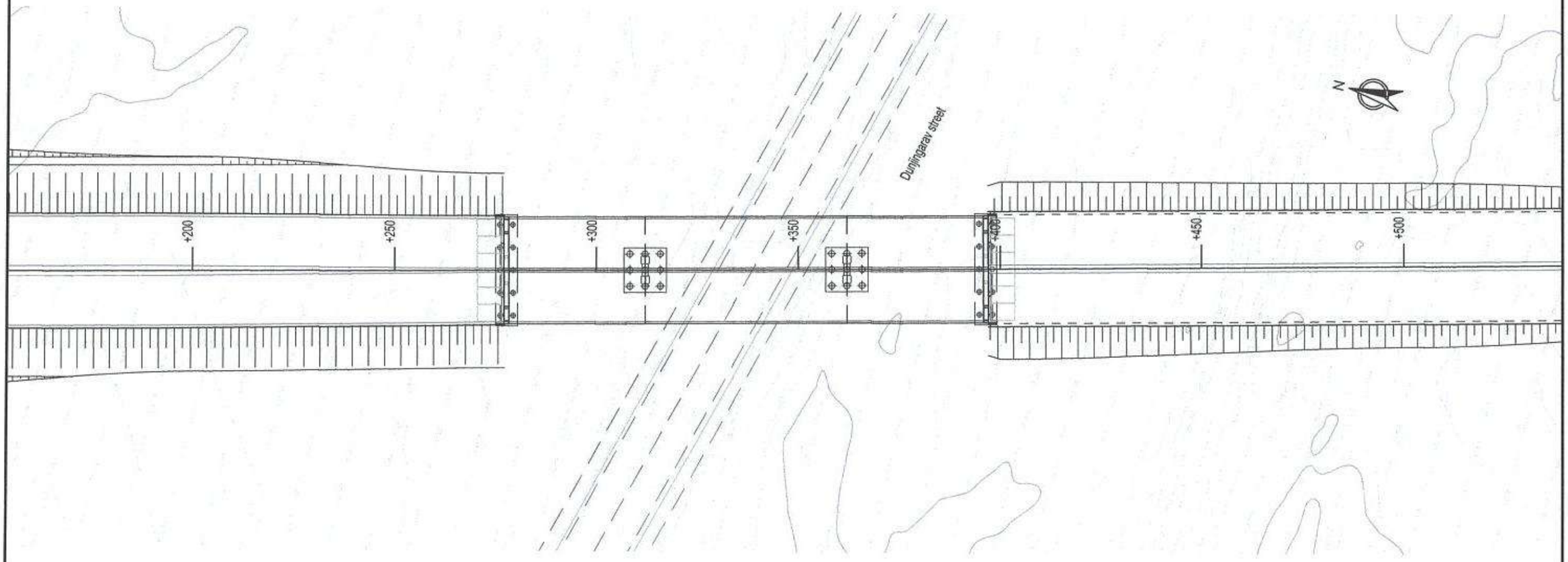
1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1：200
		主线高架桥型布置图（4号桥）				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-08
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	MA JUN			DATE	2025.07

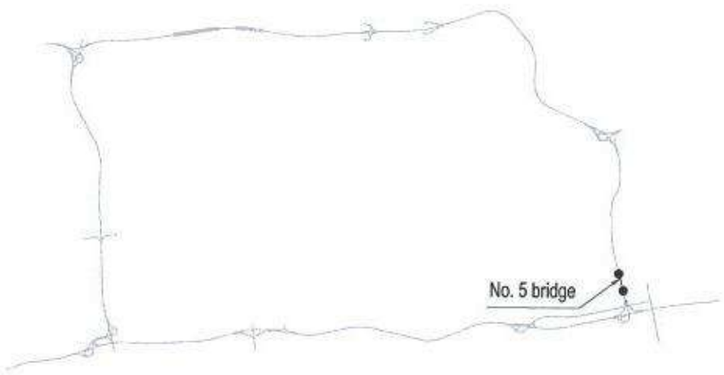
Bridge Location Plan for No. 5 Bridge

1:1000

Pile Nos. at a start point and an end point: K24+277.000~K24+397.000



Line Position Thumbnail



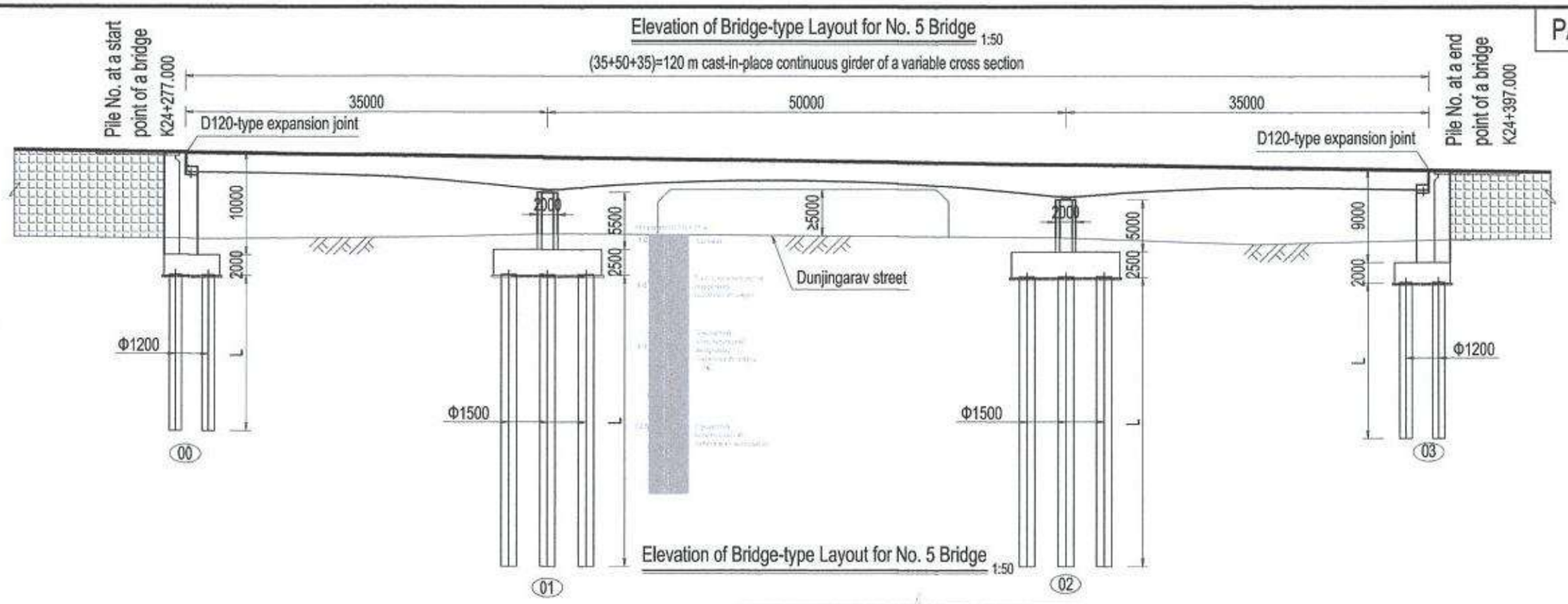
Notes:

1.All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.

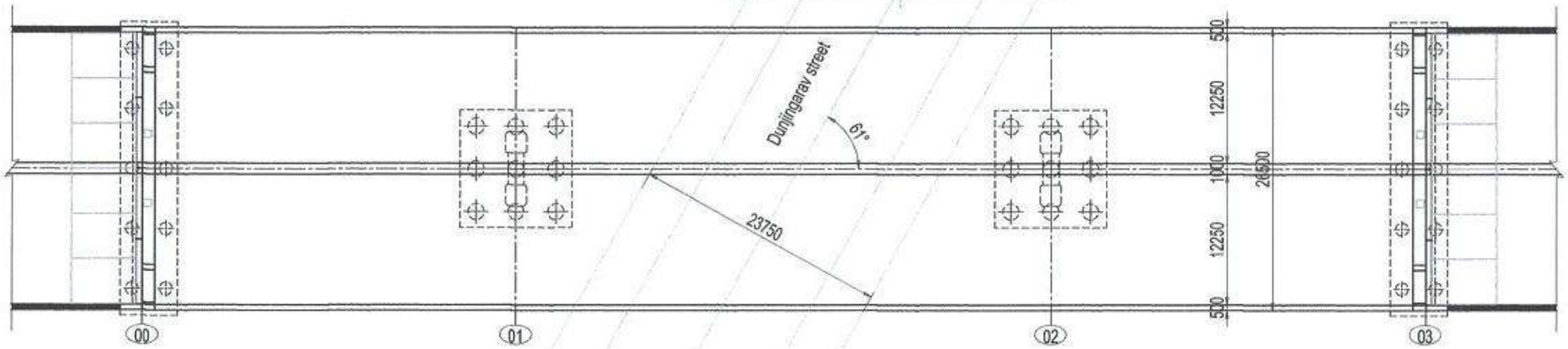
2.This drawing is applicable to No. 5 bridge at the main line, with a span arrangement of (35+50+35)=120 m. The upper structure is a continuous girder of cast-in-place prestressed concrete, and the lower structure is a double-column vase pier + a cap pile foundation.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:1000
		Plan of a Bridge Location of a Viaduct on a Main Line (No. 5 Bridge)				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II -09
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	YANG WANHUI					DATE	2025.07

Elevation of Bridge-type Layout for No. 5 Bridge 1:50



Elevation of Bridge-type Layout for No. 5 Bridge 1:50

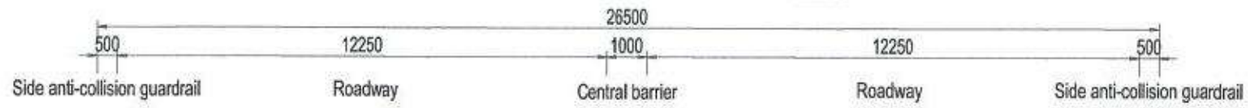


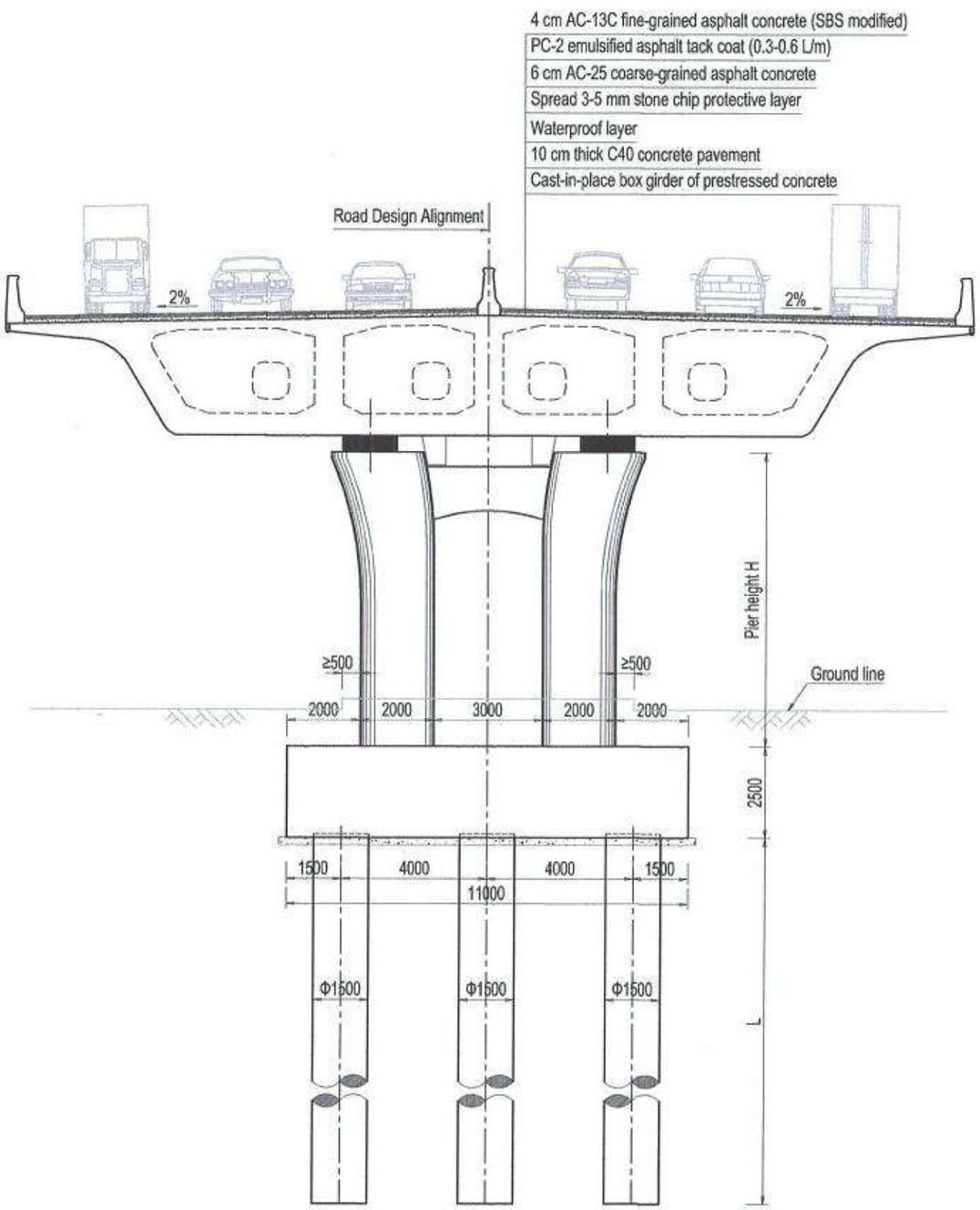
Design elevation (m)	1311.489	1311.022	1310.320	1309.803
Ground elevation (m)	1303.085	1303.511	1303.148	1302.949
Slope(%) / Slope length (m)	-1.22 / 410.00	+340 1310.74	-1.60 / 453.01	
Mileage pile No.	K24 +277.000	+312.000	+362.000	+397.000
Straight line and horizontal curve	R-∞			

Notes:
1.All dimensions in this drawing are measured in mm, except for the mileage and elevation which are measured in m.
2.This drawing is applicable to No. 5 bridge at the main line, with a span arrangement of (35+50+35)=120 m. The upper structure is a continuous girder of cast-in-place prestressed concrete, and the lower structure is a double-column vase pier + a cap pile foundation.
3.According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:50
		Bridge-type Layout of a Viaduct on a Main Line (No. 5 Bridge)				MASTER DES.	GAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-10
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHUI						

Layout for a Standard Cross Section of No. 5 Bridge 1:15





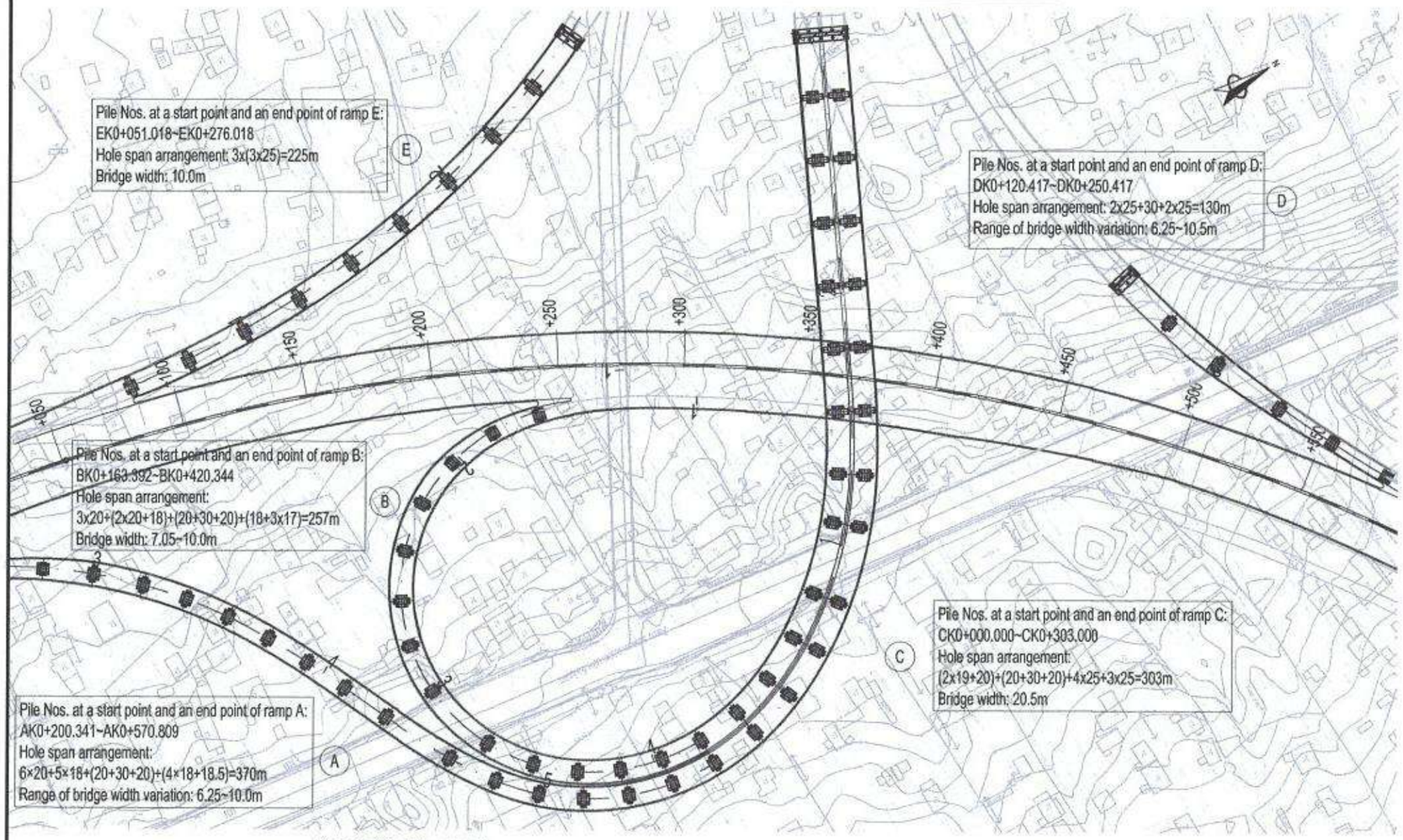
Notes:

1.All dimensions in this drawing are measured in mm.
2.According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

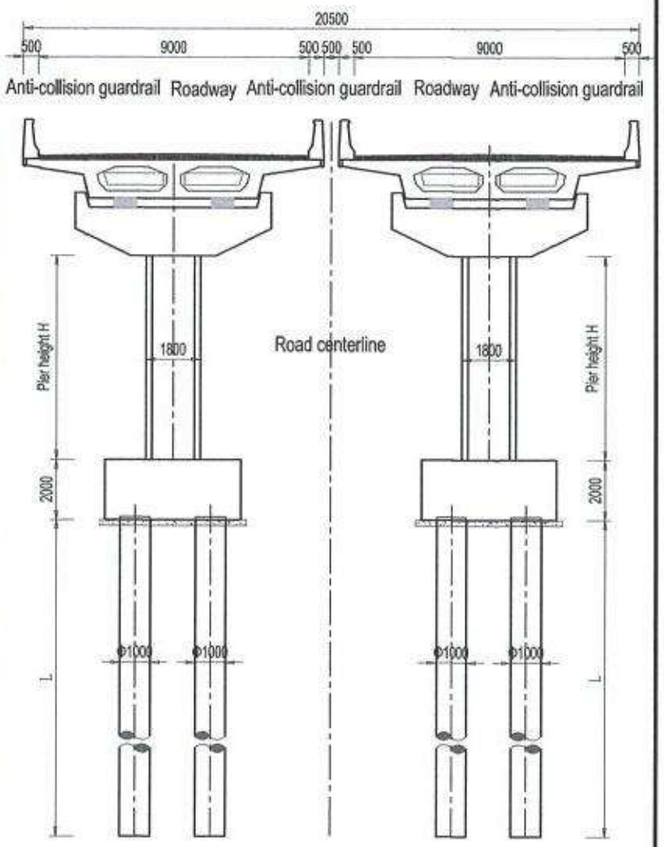
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:15
		Bridge-type Layout of a Viaduct on a Main Line (No. 5 Bridge)				MASTER DES.	GAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-10
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHUI						

PAGE

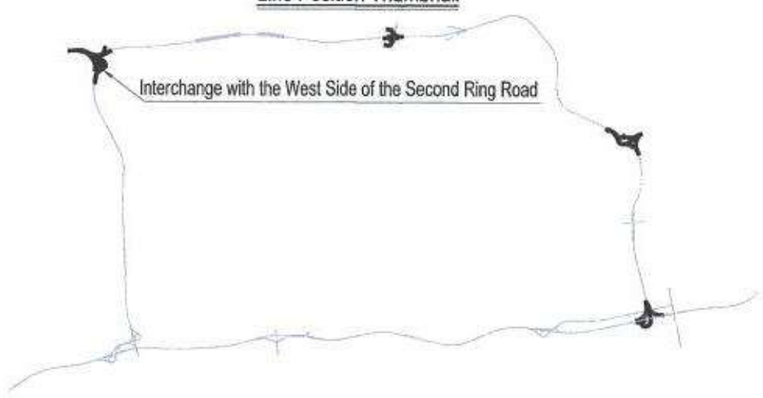
General Layout of an Interchange with the West Side of the Second Ring Road 1:2000



Standard Cross Section Layout of a C Ramp Cast-in-place Section 1:2000



Line Position Thumbnail



Notes:

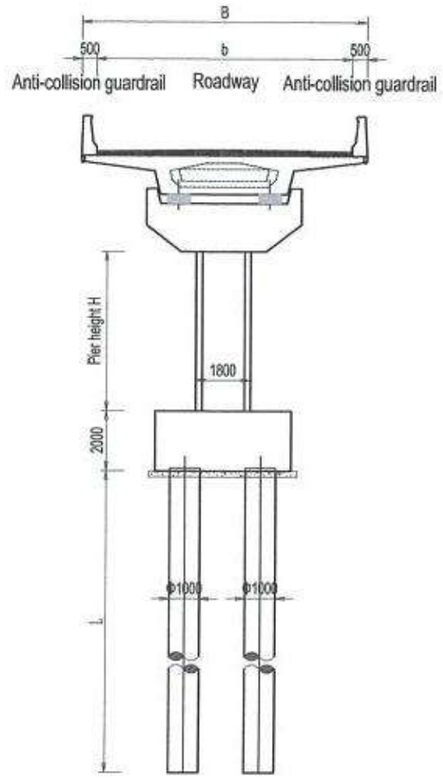
1.All dimensions in this drawing are measured in mm.

2.This drawing is applicable to the layout of hole spans on the A, B, C, D and E ramp bridge location planes of an Interchange between the New Ring Road and the west side of the Second Ring Road. The span arrangement of ramp A is 6×20+5×18+(20+30+20)+(4×18+18.5)=370 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp B is 3x20+(2x20+18)+(20+30+20)+(18+3x17)=257 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp C is (2x19+20)+(20+30+20)+4x25+3x25=303 m, the upper structure consists of a concrete cast-in-place box girder and a prefabricated small box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp D is 2x25+30+2x25=130 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of the ramp E is 3x(3x25)=225 m, the upper structure is a prefabricated small box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation.

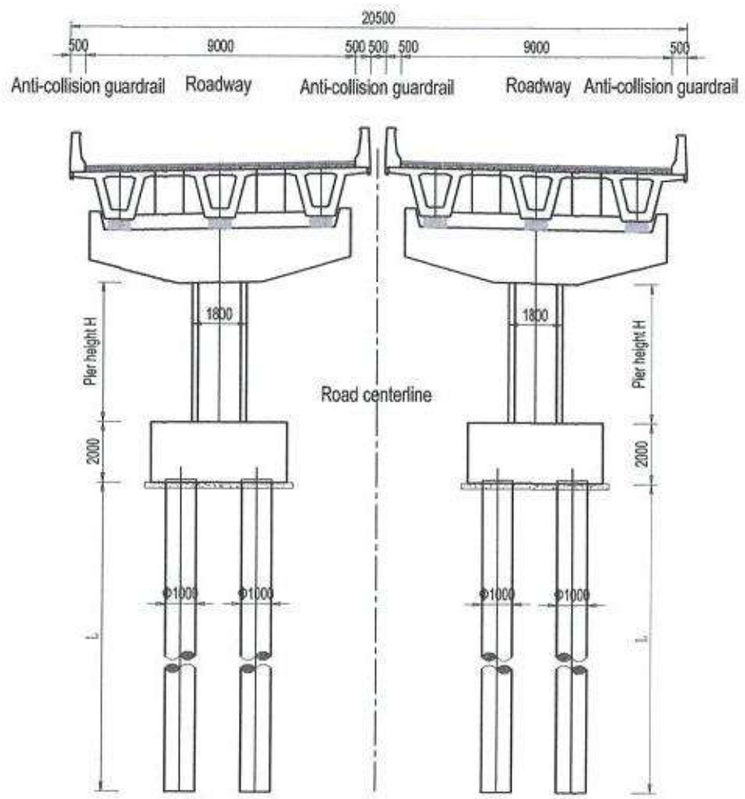
3.According to the geological conditions, the pile length L of this bridge is 15.0 m-30.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:2000
		General Layout of an Interchange with the West Side of the Second Ring Road				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-11
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	YANG WANHUI					DATE	2025.07

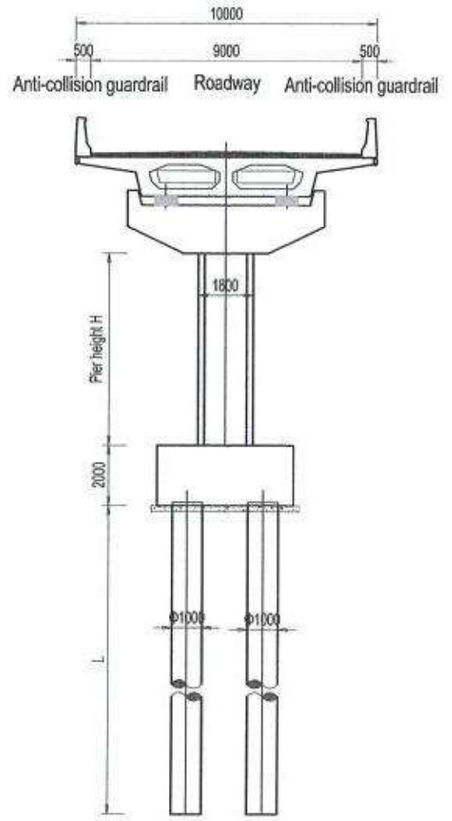
Standard Cross Section Layout for A, B and D Ramps 1:2000



Standard Cross Section Layout of a C Ramp Prefabricated Section 1:2000



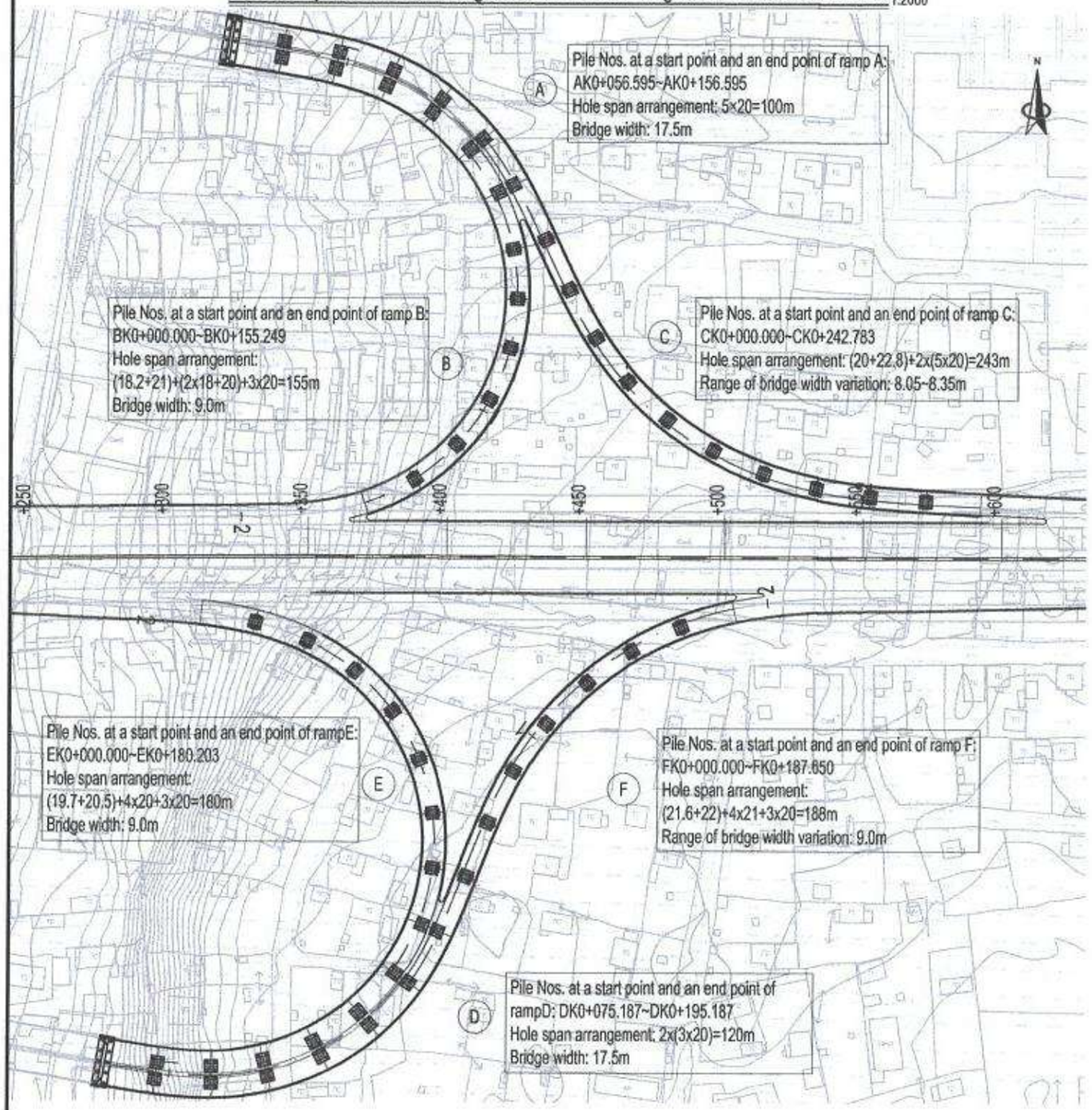
Standard Cross Section Layout of a E Ramp Prefabricated Section 1:2000



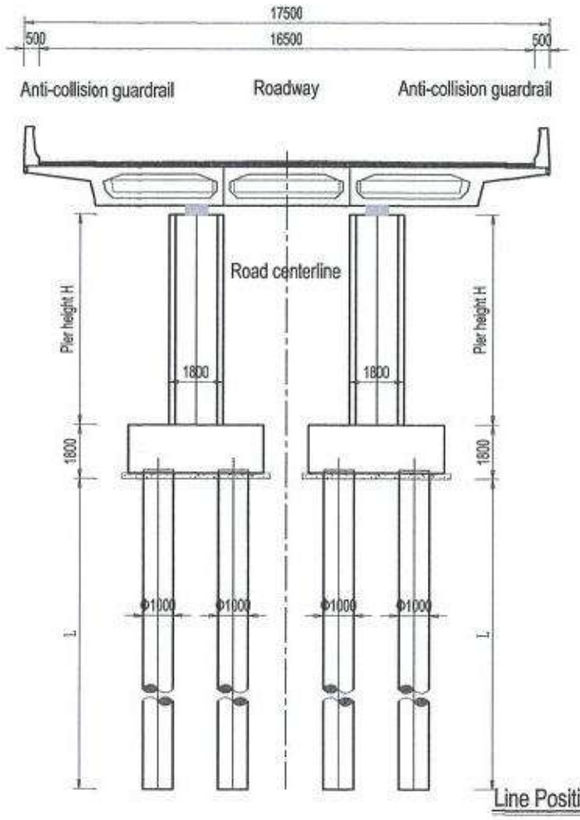
Notes:
1.All dimensions in this drawing are measured in mm.
2.This drawing is applicable to the layout of hole spans on the A, B, C, D and E ramp bridge location planes of an Interchange between the New Ring Road and the west side of the Second Ring Road. The span arrangement of ramp A is 6×20+5×18+(20+30+20)+(4×18+18.5)=370 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp B is 3x20+(2x20+18)+(20+30+20)+(18+3x17)=257 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp C is (2x19+20)+(20+30+20)+4x25+3x25=303 m, the upper structure consists of a concrete cast-in-place box girder and a prefabricated small box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp D is 2x25+30+2x25=130 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of the ramp E is 3x(3x25)=225 m, the upper structure is a prefabricated small box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation.
3.According to the geological conditions, the pile length L of this bridge is 15.0 m-30.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1:2000
		General Layout of an Interchange with the West Side of the Second Ring Road				MASTER DES.	CAO YONGJIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-11
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	YANG WANHU				

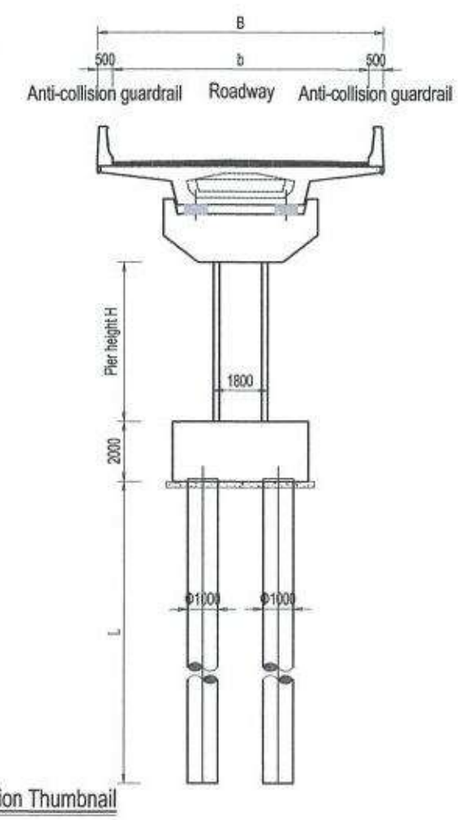
General Layout for an Interchange between the New Ring Road and the No. VII Road 1:2000



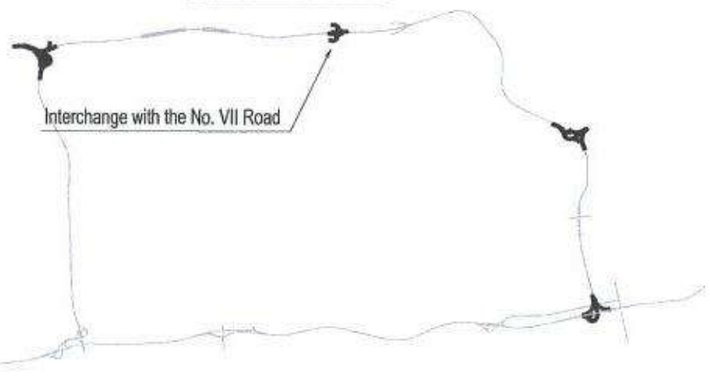
Standard Cross Section Layout for A, D Ramps 1:2000



Standard Cross Section Layout for B, C, E and F Ramps 1:2000



Line Position Thumbnail



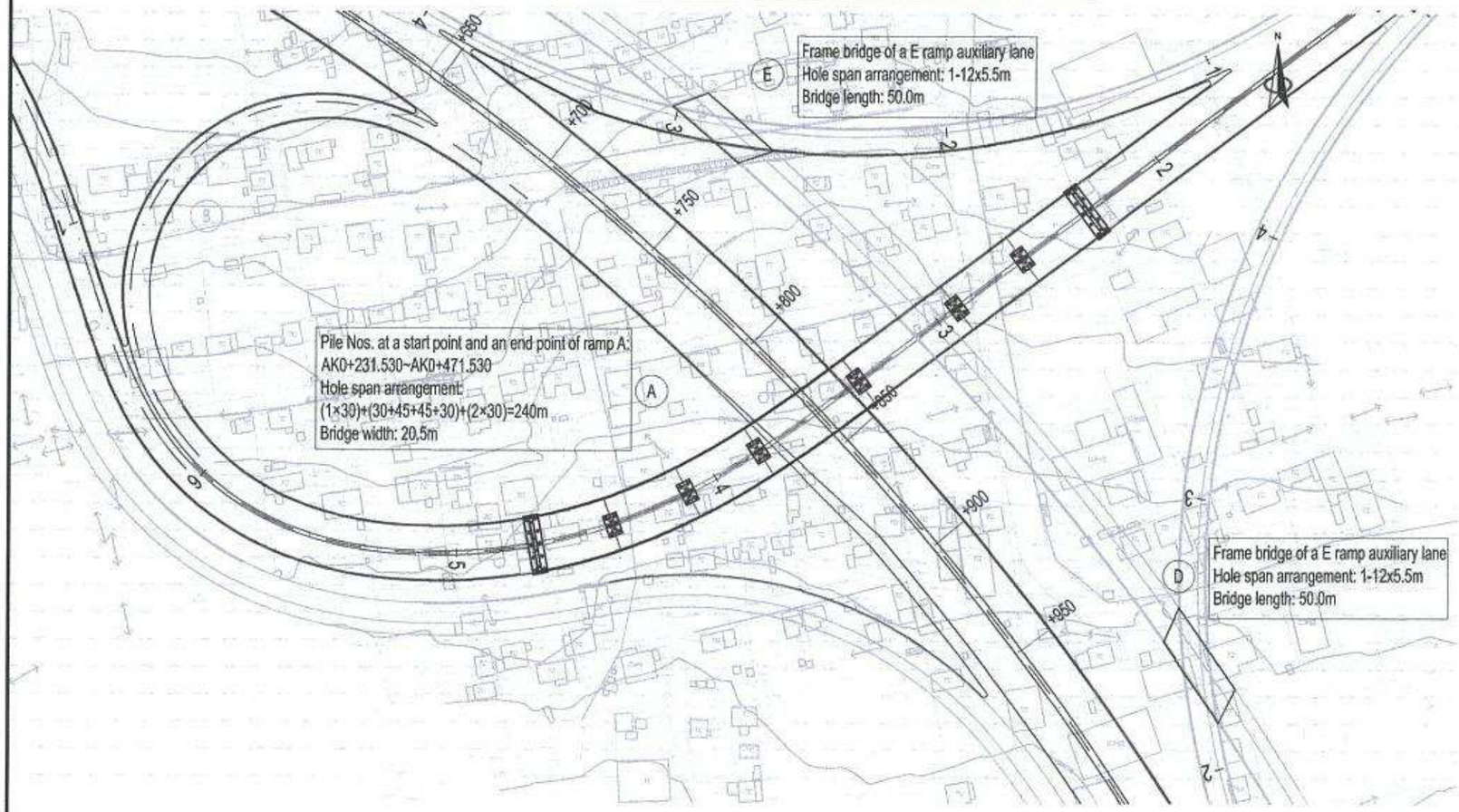
Notes: 1.All dimensions in this drawing are measured in mm.

2.This drawing is applicable to the layout of hole spans one the bridge A, B, C, D, E and F ramp bridge location planes of an Interchange between the New Ring Road and the No. VII Road. The span arrangement of ramp A is 5×20=100 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp B is (18.2+21)+(2x18+20)+3x20=155 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp C is (20+22.8)+2x(5x20)=243 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp D is 2x(3x20)=120 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of the ramp E is (19.7+20.5)+4x20+3x20=180 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of the ramp F is (21.6+22)+4x21+3x20=188 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation.

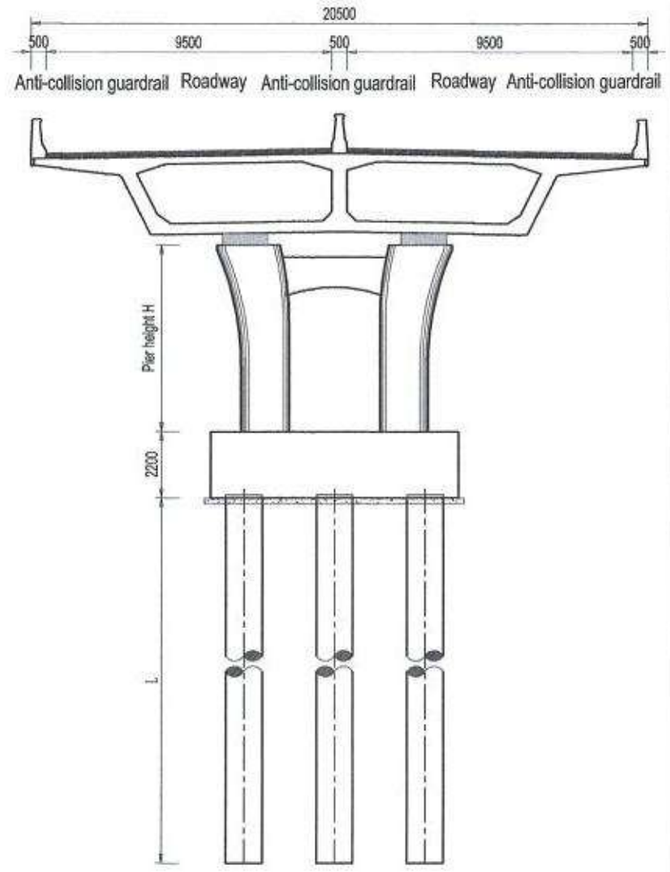
3.According to the geological conditions, the pile length L of this bridge is 15.0 m-30.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:2000
		General Layout of an Interchange with the No. 7 Road				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-12
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHU						

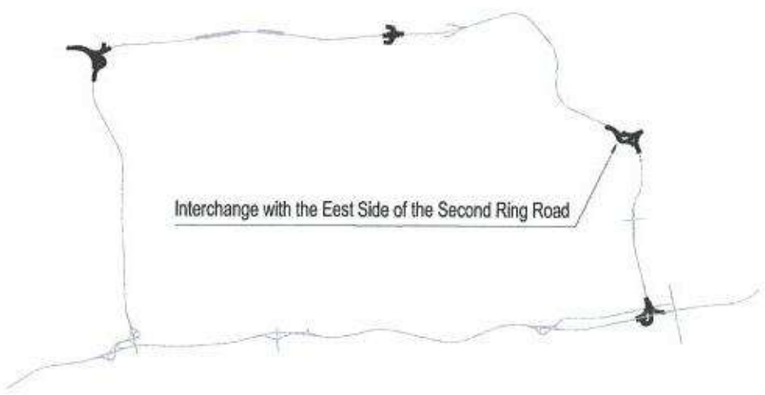
General Layout for an Interchange between the New Ring Road and the East Side of the Second Ring Road 1:2000



Standard Cross Section Layout for A Ramps 1:2000



Line Position Thumbnail

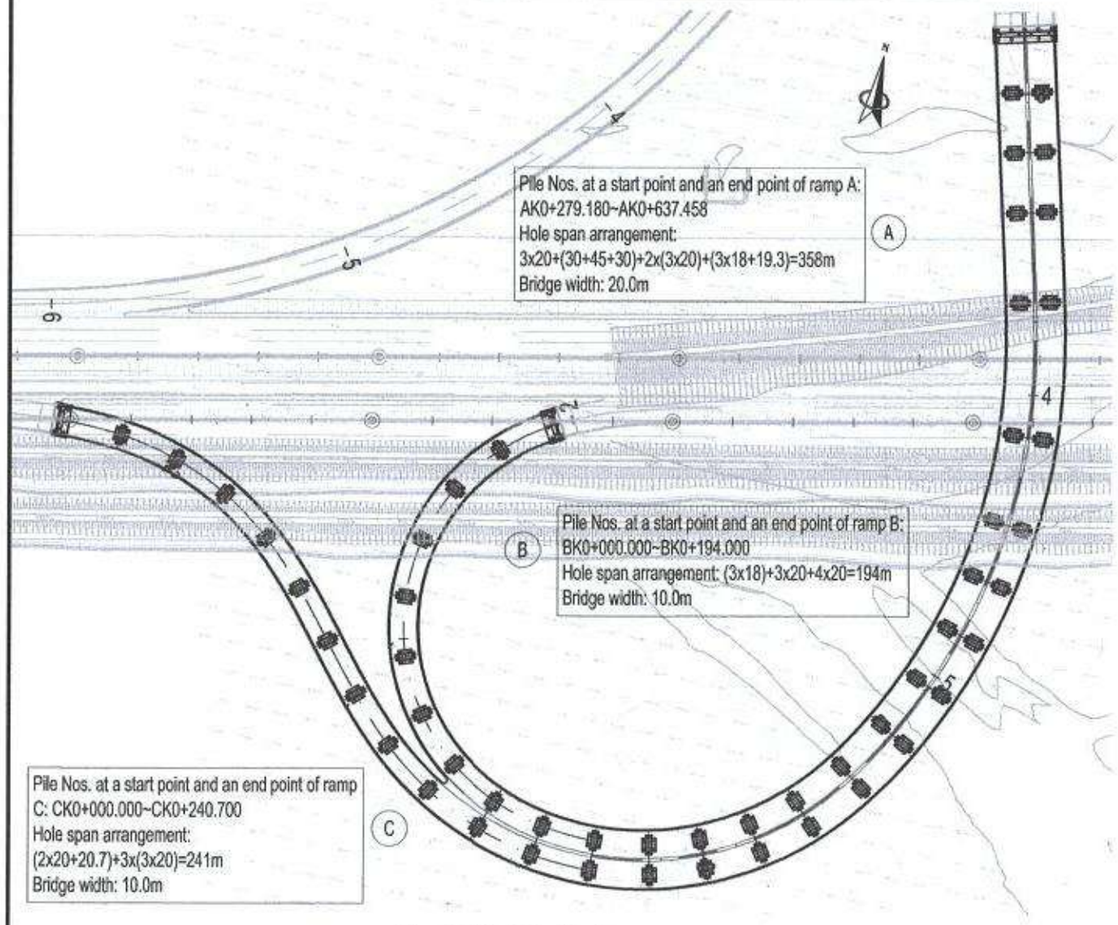


Notes:

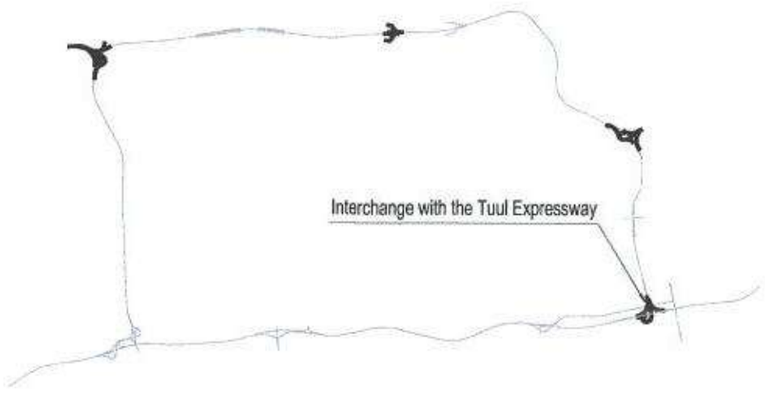
1.All dimensions in this drawing are measured in mm.
2.This drawing is applicable to the layout of hole spans on the A, B and C ramp bridge location planes of an Interchange between the New Ring Road and the Tuul Expressway. The span arrangement of ramp A is 3x20+(30+45+30)+2x (3x20)+(3x18+19.3)=358 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp B is (3x18)+3x20+4x20=194 m, the upper structure is concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp C is (2x20+20.7)+3x20=241 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation.
3.According to the geological conditions, the pile length L of this bridge is 15.0 m-30.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:2000
		General Layout of an Interchange with the East Side of the Second Ring Road				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-13
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHUI						

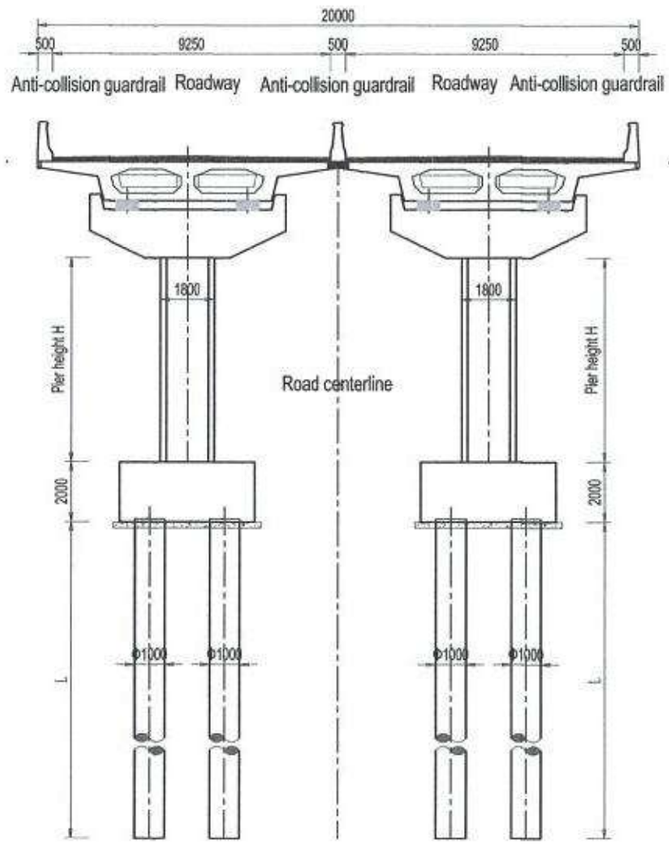
General Layout for an Interchange between the New Ring Road and the Tuul Expressway 1:2000



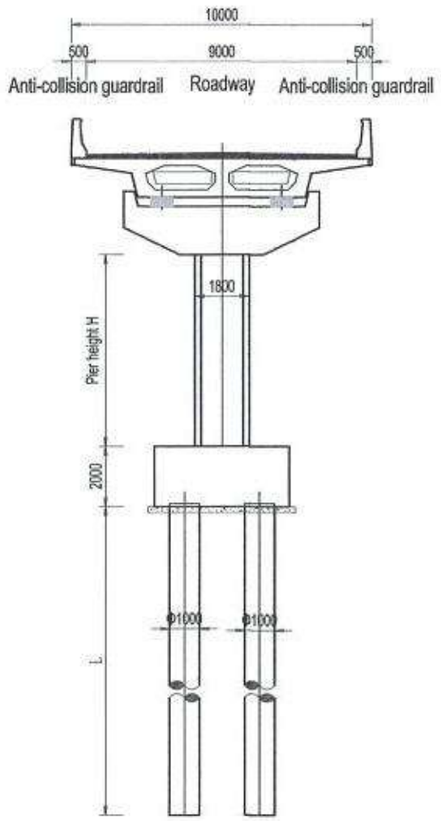
Line Position Thumbnail



Standard Cross Section Layout for A Ramps 1:2000



Standard Cross Section Layout for B,CRamps 1:2000



Notes:

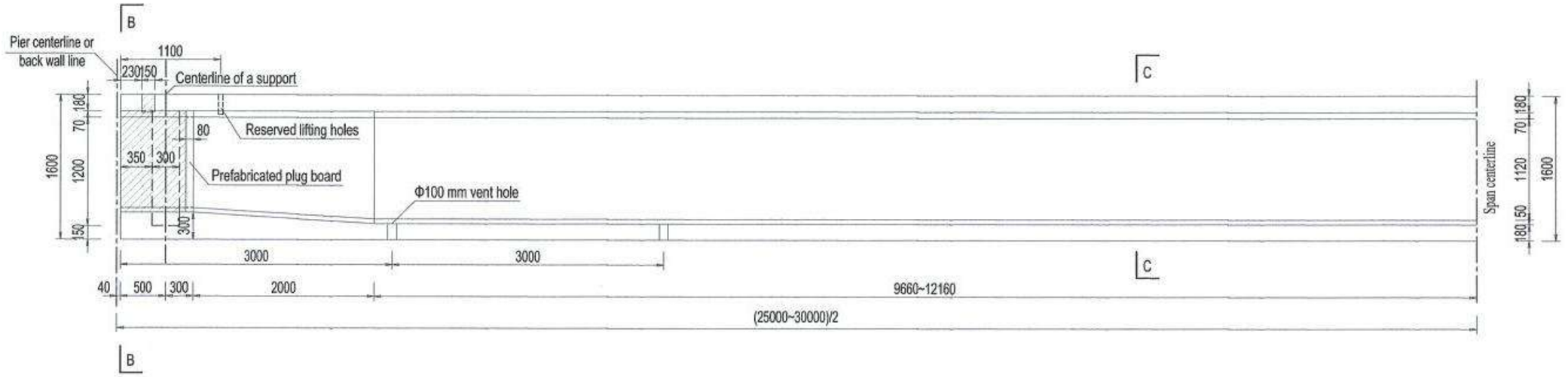
1.All dimensions in this drawing are measured in mm.

2.This drawing is applicable to the layout of hole spans on the A, B and C ramp bridge location planes of an Interchange between the New Ring Road and the Tuul Expressway. The span arrangement of ramp A is 3x20+(30+45+30)+2x (3x20)+(3x18+19.3)=358 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp B is (3x18)+3x20+4x20=194 m, the upper structure is concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation. The span arrangement of ramp C is (2x20+20.7)+3x20=241 m, the upper structure is a concrete cast-in-place box girder, and the lower structure consists of a rectangular pier cantilever bent cap + a cap pile foundation.

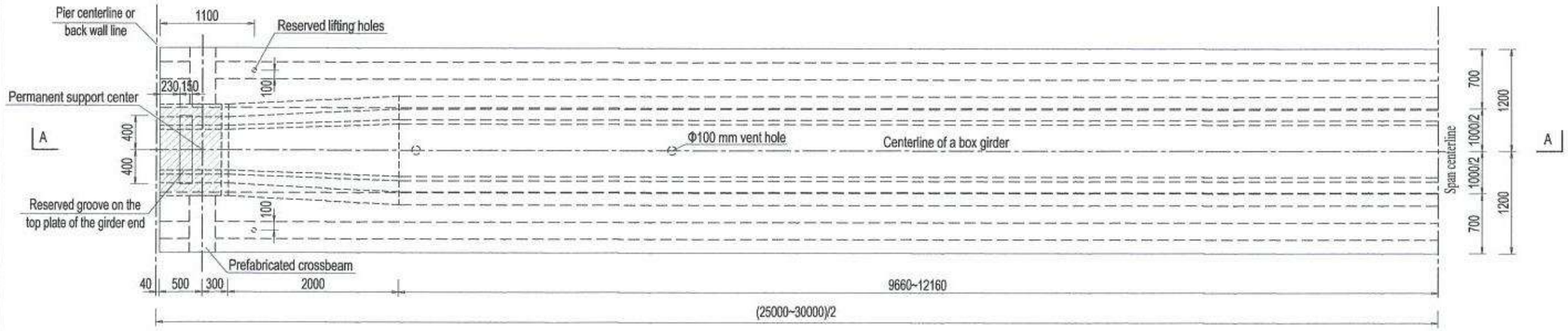
3.According to the geological conditions, the pile length L of this bridge is 15.0 m-30.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:2000
		General Layout of an Interchange with the Tuul Expressway				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-14
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	YANG WANHU						

A-A(middle girder) 1:50



Plane (middle girder) 1:50

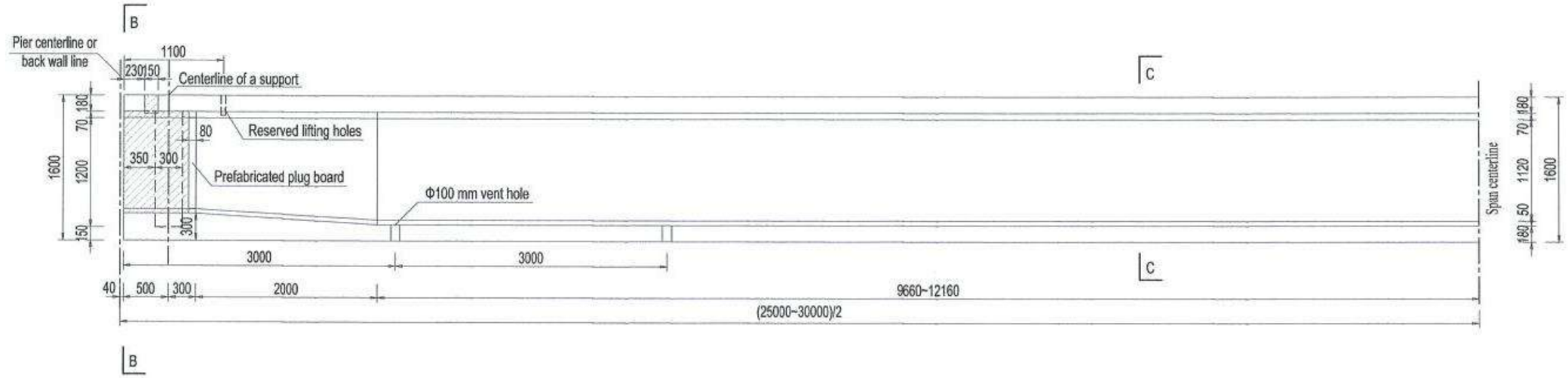


Notes:

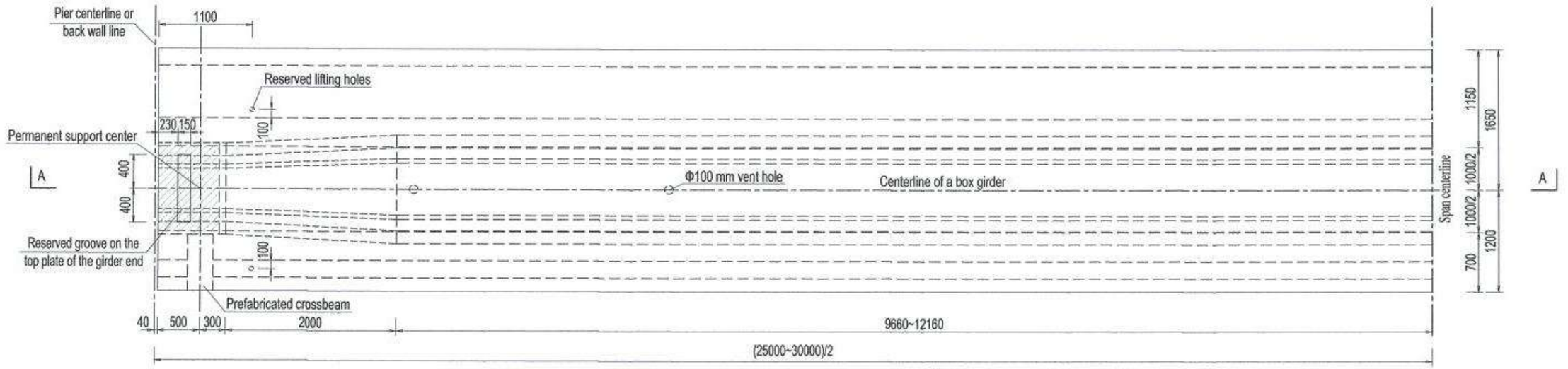
1.All dimensions in this drawing are measured in mm.
2.This drawing only shows the half-span middle girder structure.
3.The dashed part at the girder end in the drawing will be poured simultaneously with anchor sealing after prestressed tensioning.
4.After the removal of the internal formwork of the box girder, concrete will be poured into the interior of the girder end through the reserved groove on the top plate of the girder end.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:50
		General Construction Drawing of a Small Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II - 15
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LIU SHENGHAN						

A-A(side girder) 1:50



Plane (side girder) 1:50

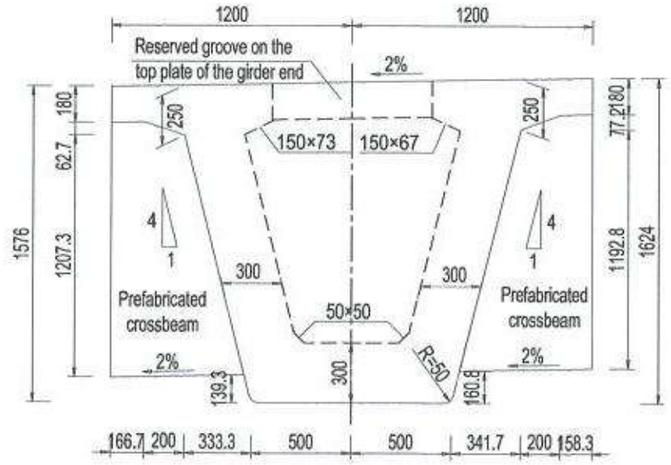


Notes:

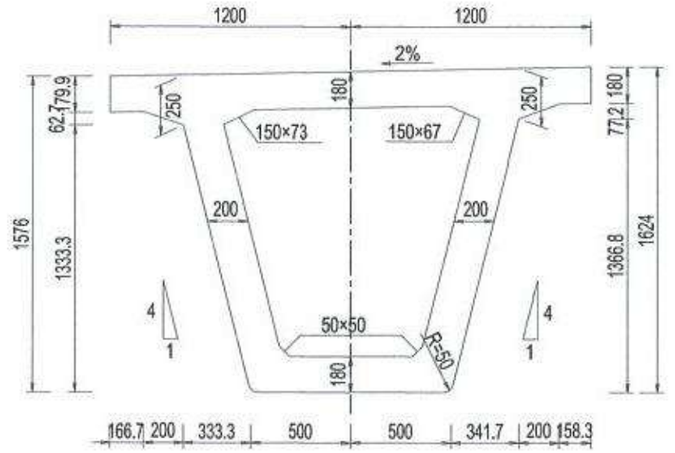
1. All dimensions in this drawing are measured in mm.
2. This drawing only shows the half-span side girder structure.
3. The dashed part at the girder end in the drawing will be poured simultaneously with anchor sealing after prestressed tensioning.
4. After the removal of the internal formwork of the box girder, concrete will be poured into the interior of the girder end through the reserved groove on the top plate of the girder end.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES.MANAGER: PANG WEI	SUB.MANAGER: GAO JINCHUN	CHECKED: GAO JINCHUN	SCALE: 1:50
		General Construction Drawing of a Small Box Girder		MASTER DES.: CAO YONGXIANG	SPE.MANAGER: ZHANG BO	EXAMINED: PANG WEI	DRAWING NO.: II - 15
				MASTER DES.: PAN HAOGUO	SPE.MANAGER: MA JUN	APPROVED: ZHU ANJING	DATE: 2025.07
					DESIGNED: LIU SHENGHAN		

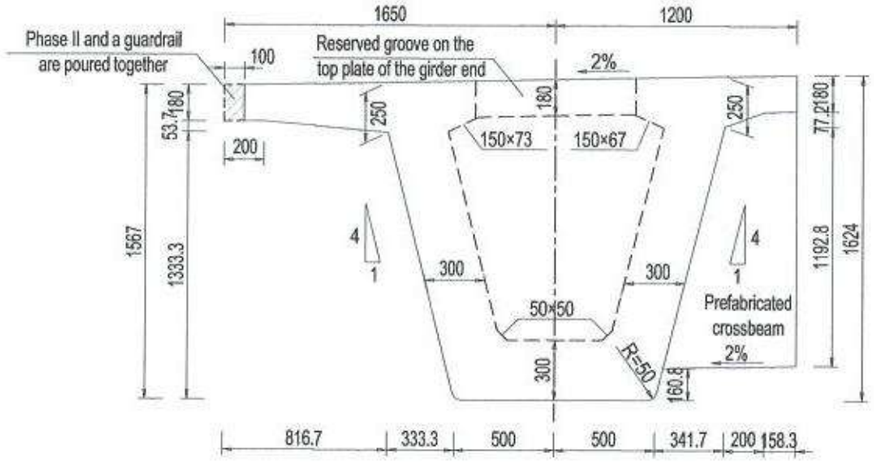
B-B(middle girder) 1:30



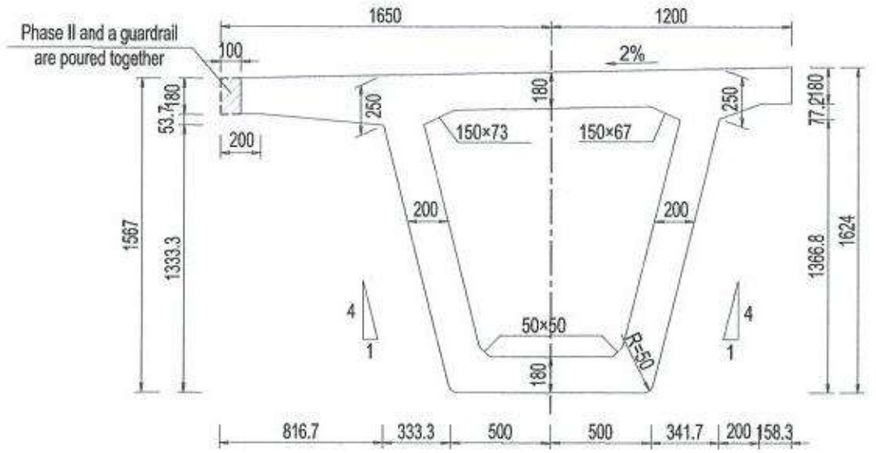
C-C(middle girder) 1:30



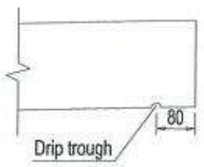
B-B(side girder) 1:30



C-C(side girder) 1:30



Detailed Drawing of a Drip Trough 1:12.5

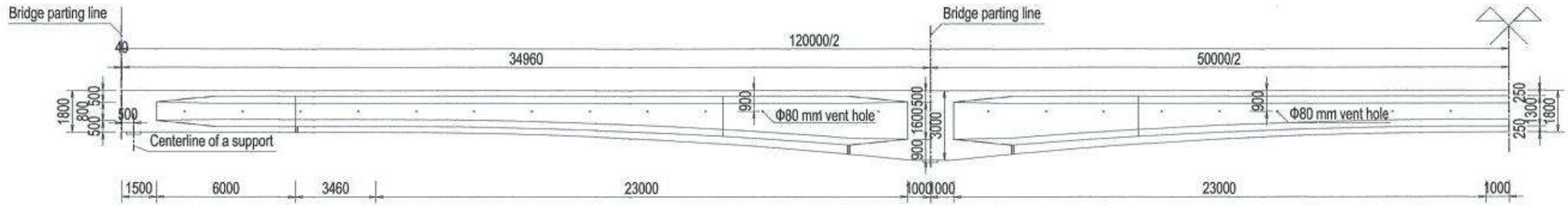


Notes:

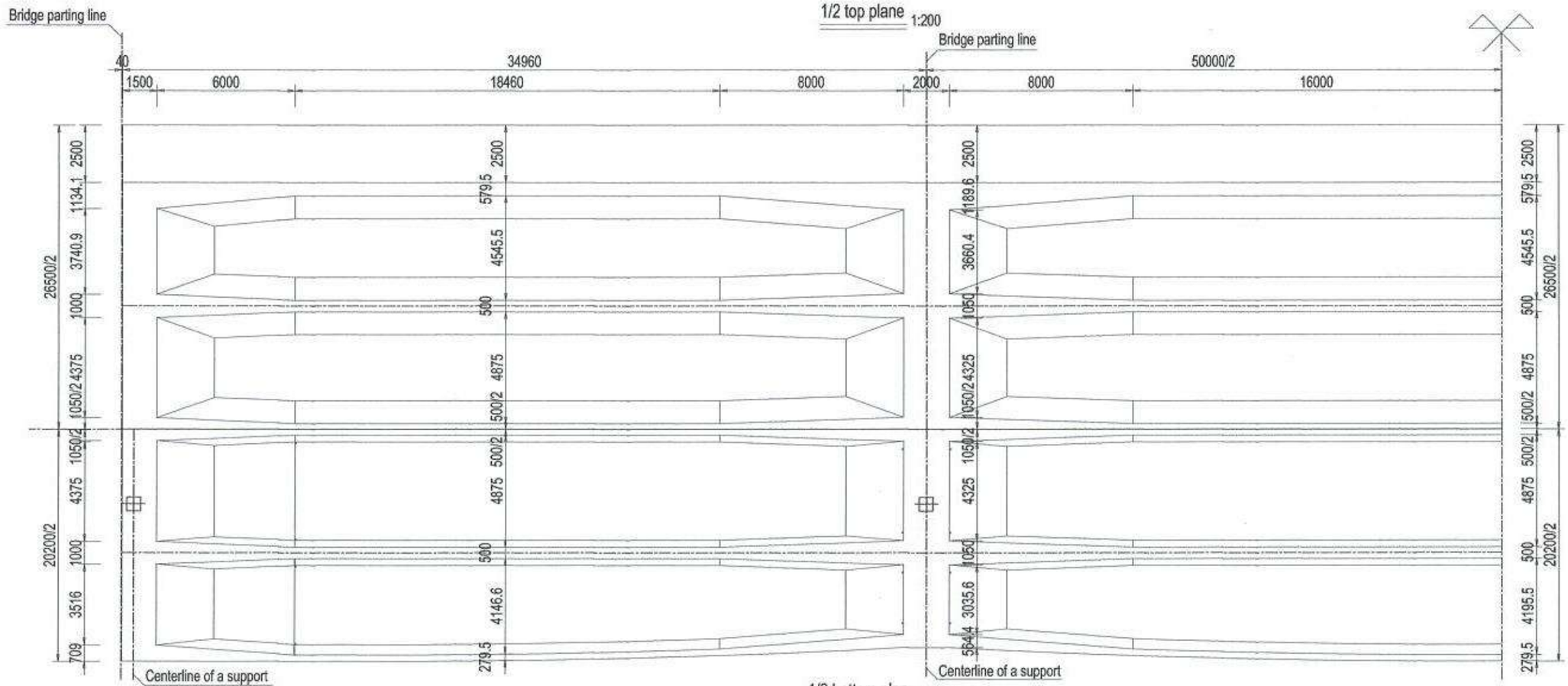
1. All dimensions in this drawing are measured in mm.
2. The dashed part at the wing edge end in the drawing is poured together with the guardrail.
3. The drip trough can be formed using wooden strips with a depth of 10 mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:50
		General Construction Drawing of a Small Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II - 15
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LIU SHENGHAN						

Elevation 1:200



1/2 top plane 1:200



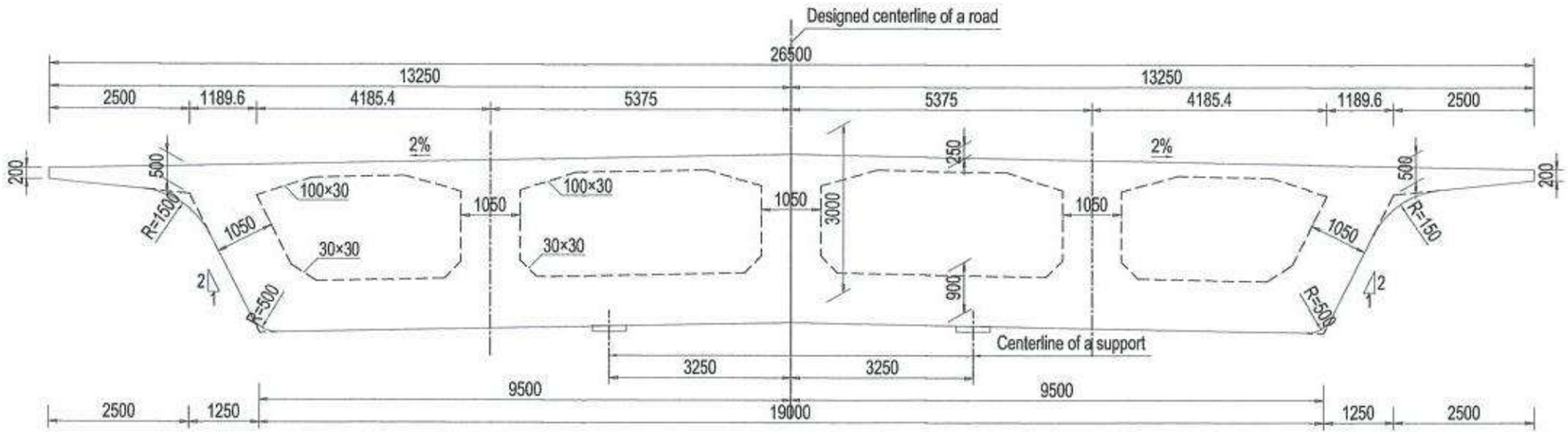
1/2 bottom plane 1:200

Notes:

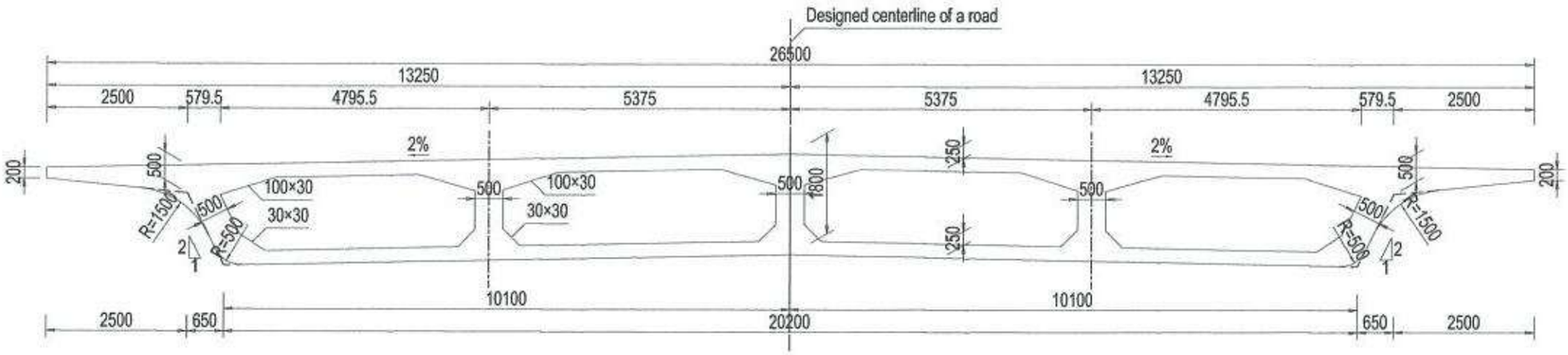
1. All dimensions in this drawing are measured in mm.
2. The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.
3. This cast-in-place box girder is constructed with the method of casting in place with few supports.
4. There are 2 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1:200
		General Construction Drawing of a (35+50+35) m Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II - 16
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	LIU SHENGHAN			DATE	2025.07

Cross Section of Pivot Support 1:100



Mid-Span Cross Section 1:100



Notes:

1.All dimensions in this drawing are measured in mm.

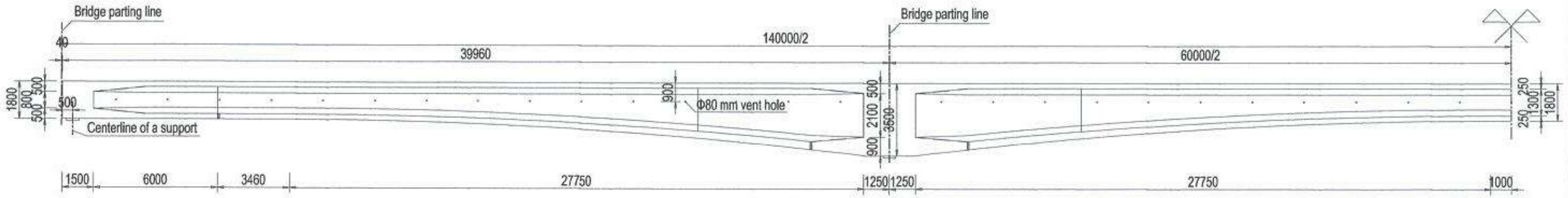
2.The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.

3.This cast-in-place box girder is constructed with the method of casting in place with few supports.

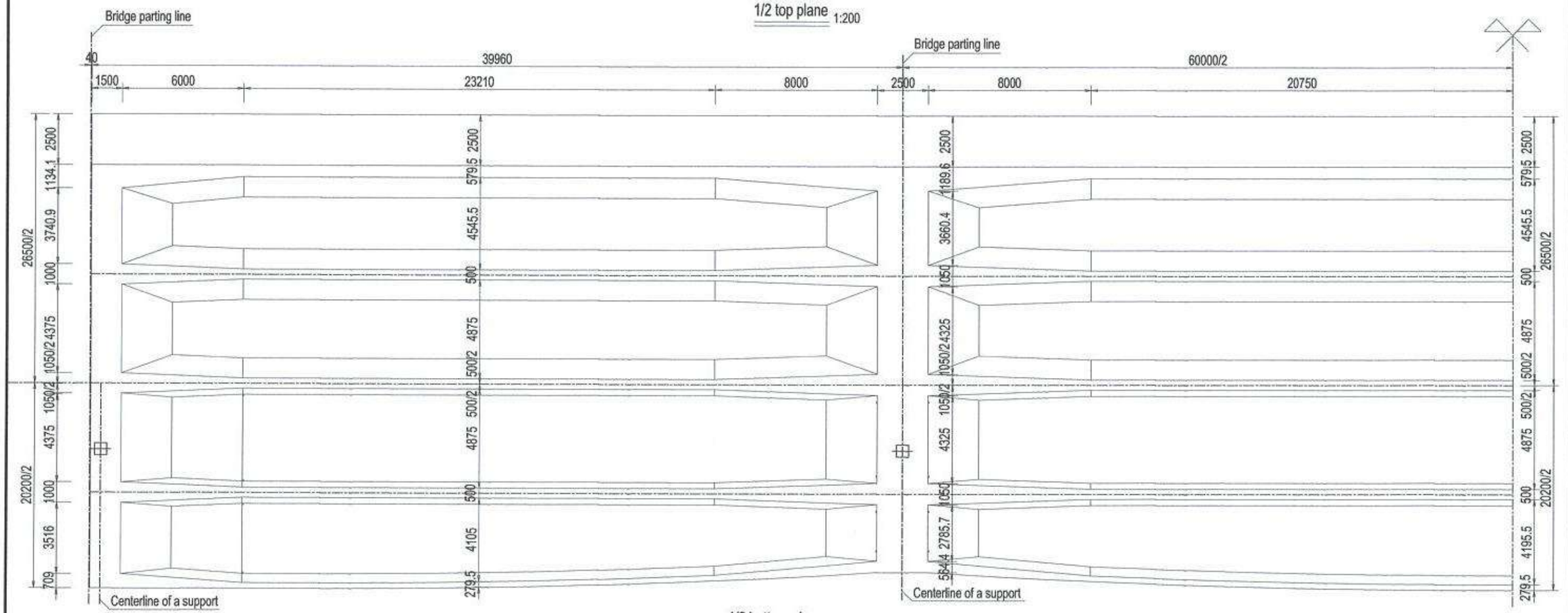
4.There are 2 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES.MANAGER: PANG WEI	SUB.MANAGER: GAO JINCHUN	CHECKED: GAO JINCHUN	SCALE: 1:100					
		General Construction Drawing of a (35+50+35) m Cast-in-place Box Girder		MASTER DES.: CAO YONGXIANG	SPE.MANAGER: ZHANG BO	EXAMINED: PANG WEI	DRAWING NO.: II - 16					
				MASTER DES.: PAN HAOGUO	SPE.MANAGER: MA JUN	APPROVED: ZHU ANJING						
					DESIGNED: LIU SHENGHAN		DATE: 2025.07					

Elevation 1:200



1/2 top plane 1:200



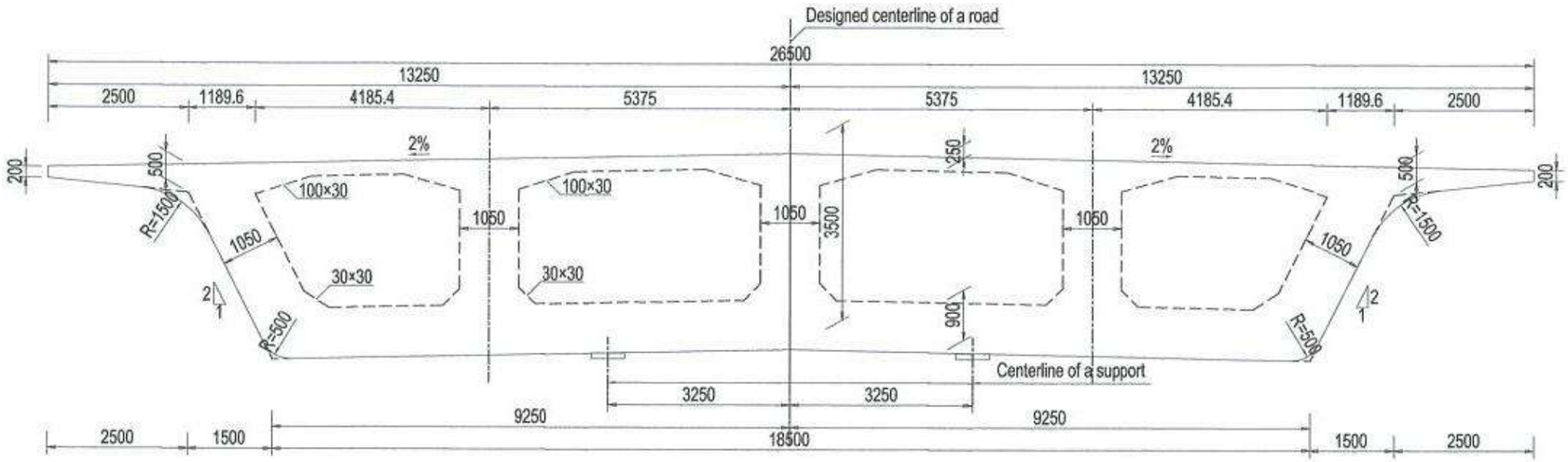
1/2 bottom plane 1:200

Notes:

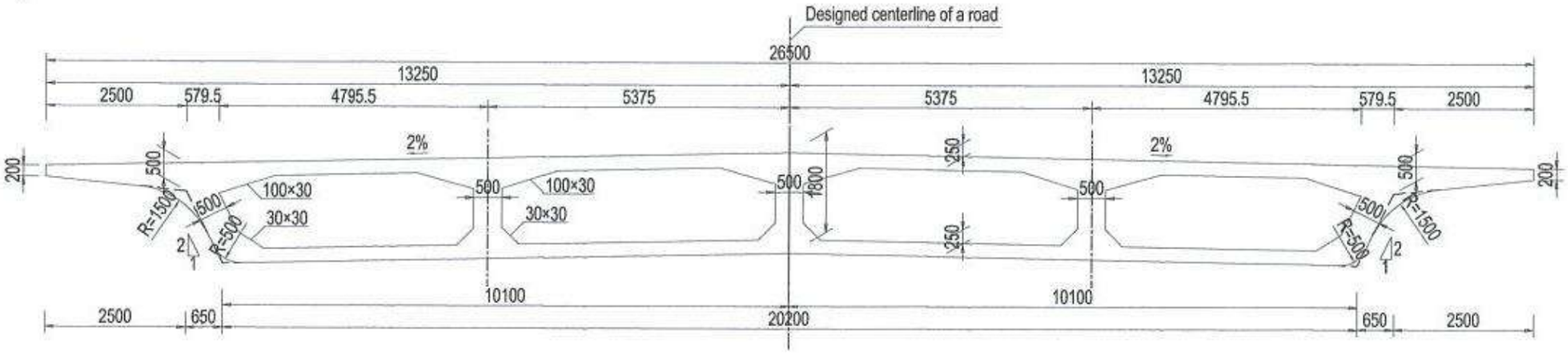
1. All dimensions in this drawing are measured in mm.
2. The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.
3. This cast-in-place box girder is constructed with the method of casting in place with few supports.
4. There are 2 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1:200
		General Construction Drawing of a (40+60+40) m Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II - 17
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	LIU SHENGHAN			DATE	2025.07

Cross Section of Pivot Support 1:100



Mid-Span Cross Section 1:100

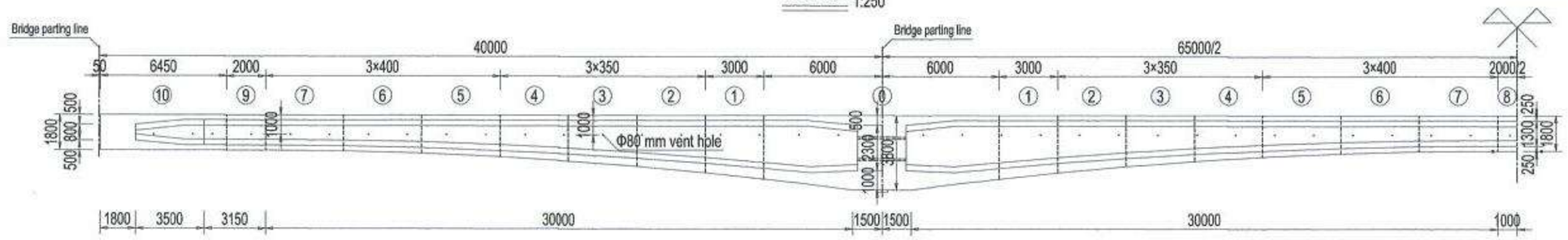


Notes:

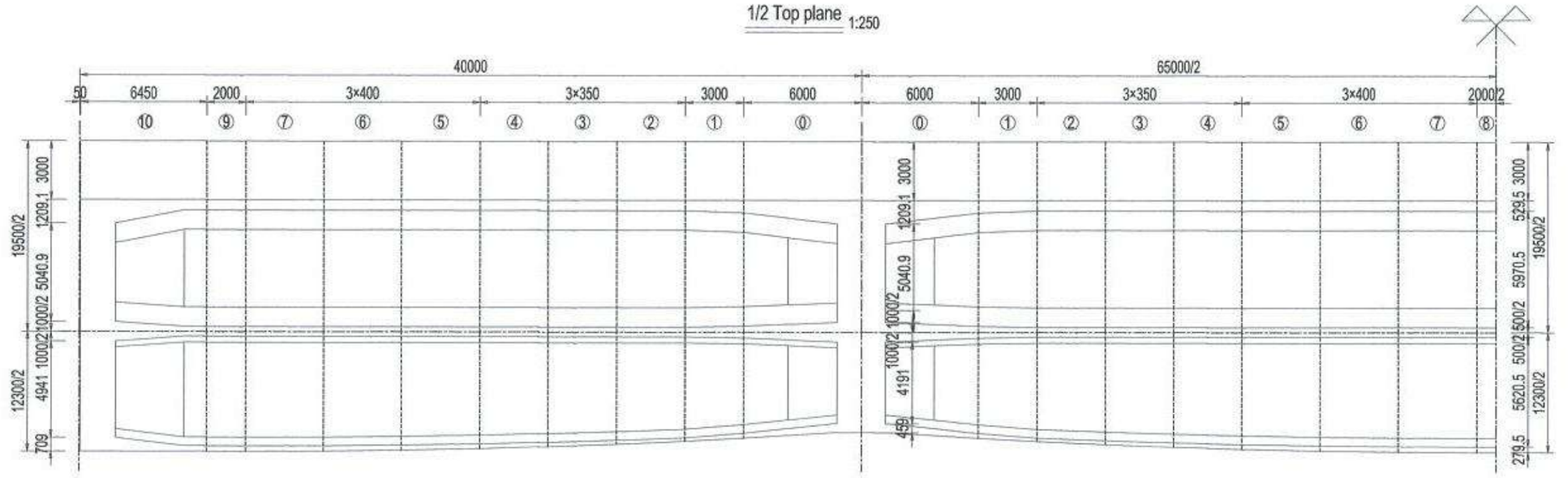
1. All dimensions in this drawing are measured in mm.
2. The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.
3. This cast-in-place box girder is constructed with the method of casting in place with few supports.
4. There are 2 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:100
		General Construction Drawing of a (40+60+40) m Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II - 17
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LIU SHENGHAN						

Elevation 1:250



1/2 Top plane 1:250



1/2 Bottom plane 1:250

Section No.	10	9	7	6	5	4	3	2	1	0	1	2	3	4	5	6	7	8
Girder height(cm)	180	180	180	183.6	194.2	212	233.4	260.2	292.5	324.5	324.5	292.5	260.2	233.4	212	194.2	183.6	180
Bottom slab thickness(mm)	50	25	25	25.7	27.8	31.4	35.8	41.3	47.9	54.5	54.5	47.9	41.3	35.8	31.4	27.8	25.7	25
Middle web thickness(mm)	100	50	50	50	50	50	50	50	50	60.4	60.4	50	50	50	50	50	50	50
Side web thickness(mm)	100	50	50	50	50	50	50	50	50	60.4	60.4	50	50	50	50	50	50	50
Section length(mm)	1150	200	400	400	400	350	350	350	300	1200	300	350	350	350	400	400	400	200
Section volume(m3)	194.99	23.48	47.19	48.18	50.18	46.28	49.15	52.56	49.37	314.98	49.37	52.56	49.15	46.28	50.18	48.18	47.19	23.48
Section weight(t)	517.3	62.3	125.2	127.8	133.1	122.8	130.4	139.5	131.0	835.7	131.0	139.5	130.4	122.8	133.1	127.8	125.2	62.3

Notes:

1.All dimensions in this drawing are measured in mm.

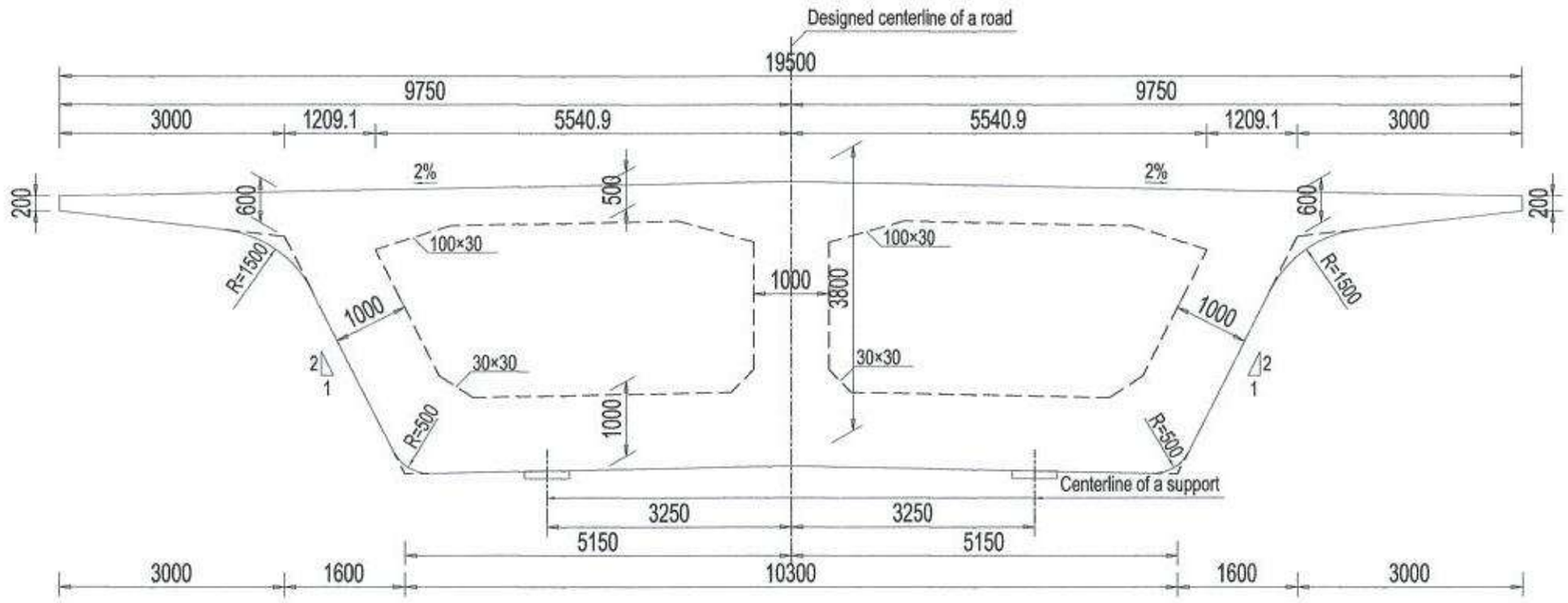
2.The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.

3.This cast-in-place box girder is constructed with the method of cantilever pouring.

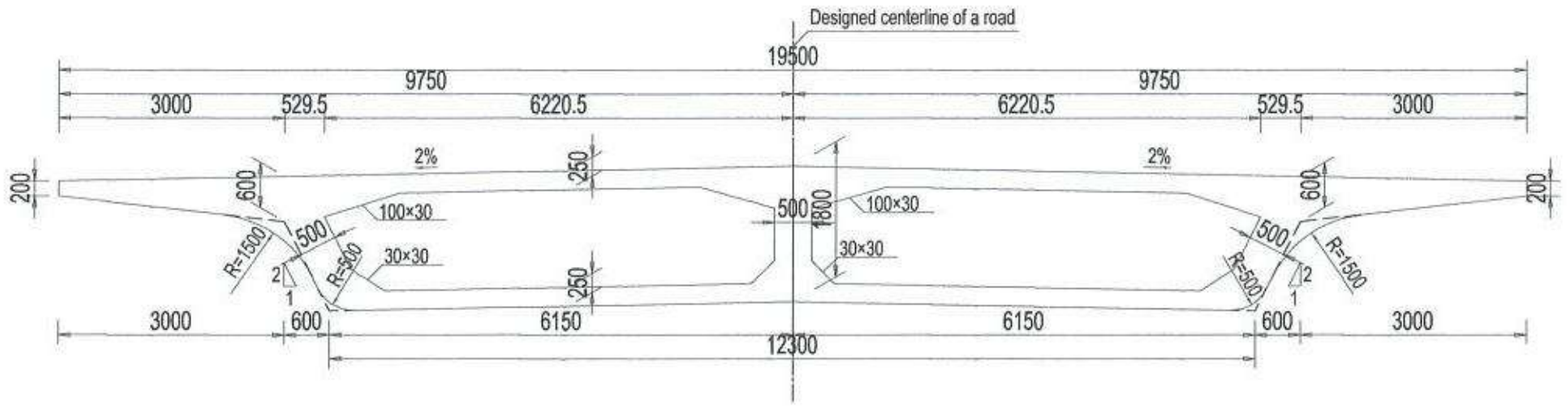
4.There are 3 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:250
		General Construction Drawing of a (40+65+40) m Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II - 18
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	LIU SHENGHAN					DATE	2025.07

Cross Section of Pivot Support 1:80



Mid-Span Cross Section 1:80

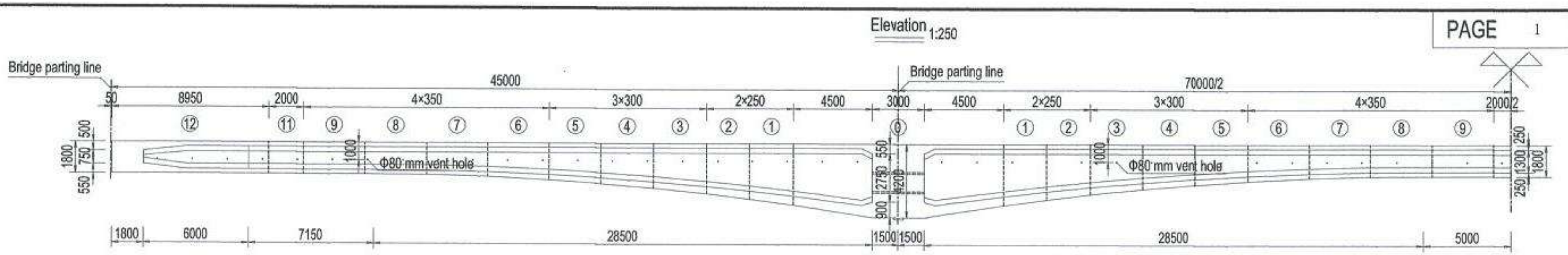


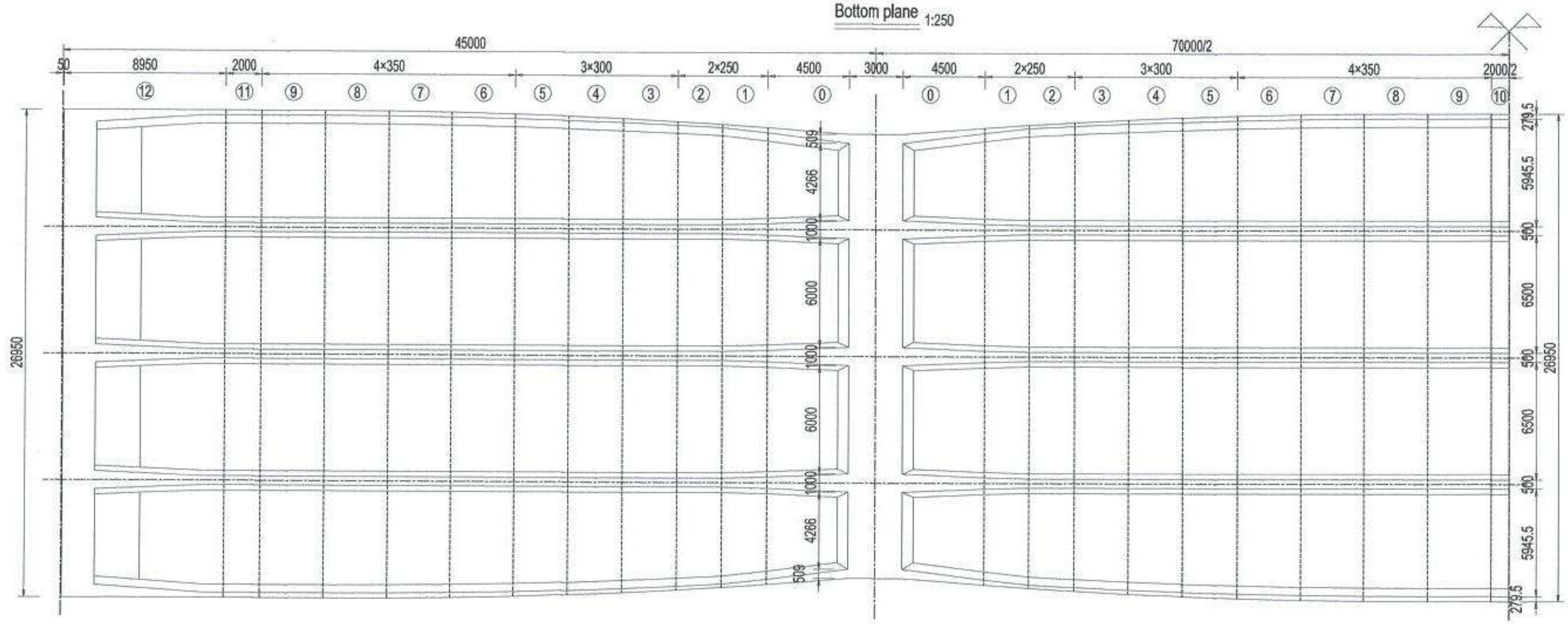
Notes:

1. All dimensions in this drawing are measured in mm.
2. The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.
3. This cast-in-place box girder is constructed with the method of cantilever pouring.
4. There are 3 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES.MANAGER: PANG WEI	SUB.MANAGER: GAO JINCHUN	CHECKED: GAO JINCHUN	SCALE: 1:80
		General Construction Drawing of a (40+65+40) m Cast-in-place Box Girder		MASTER DES.: CAO YONGXIANG	SPE.MANAGER: ZHANG BO	EXAMINED: PANG WEI	DRAWING NO.: II - 18
				MASTER DES.: PAN HAOGUO	SPE.MANAGER: MA JUN	APPROVED: ZHU ANJING	
					DESIGNED: LIU SHENGHAN		DATE: 2025.07

PAGE 1 3





Section No.	12	11	9	8	7	6	5	4	3	2	1		0	1	2	3	4	5	6	7	8	9	10
Girder height(cm)	180	180	180	180	182.7	192.5	209.5	229.9	255.6	286.7	316.6	350.2		350.2	316.6	286.7	255.6	229.9	209.5	192.5	182.7	180	180
Bottom slab thickness(mm)	55	25	25	25	25.4	26.9	29.5	32.6	36.5	41.2	45.8	50.9		50.9	45.8	41.2	36.5	32.6	29.5	26.9	25.4	25	25
Middle web thickness(mm)	100	50	50	50	50	50	50	50	50	50	50	62.5		62.5	50	50	50	50	50	50	50	50	50
Side web thickness(mm)	100	50	50	50	50	50	50	50	50	50	50	62.5		62.5	50	50	50	50	50	50	50	50	50
Section length(mm)	900	200	350	350	350	350	300	300	300	250	250	1200		250	250	300	300	300	350	350	350	350	200
Section volume(m3)	299.27	43.29	75.75	76.02	77.28	79.99	71.77	75.67	80.42	71.21	77.74		638.51	77.74	71.21	80.42	75.67	71.77	79.99	77.28	76.02	75.75	43.29
Section weight(t)	794.0	114.8	201.0	201.7	205.0	212.2	190.4	200.8	213.4	188.9	206.2		1694.0	206.2	188.9	213.4	200.8	190.4	212.2	205.0	201.7	201.0	114.8

Notes:

1.All dimensions in this drawing are measured in mm.

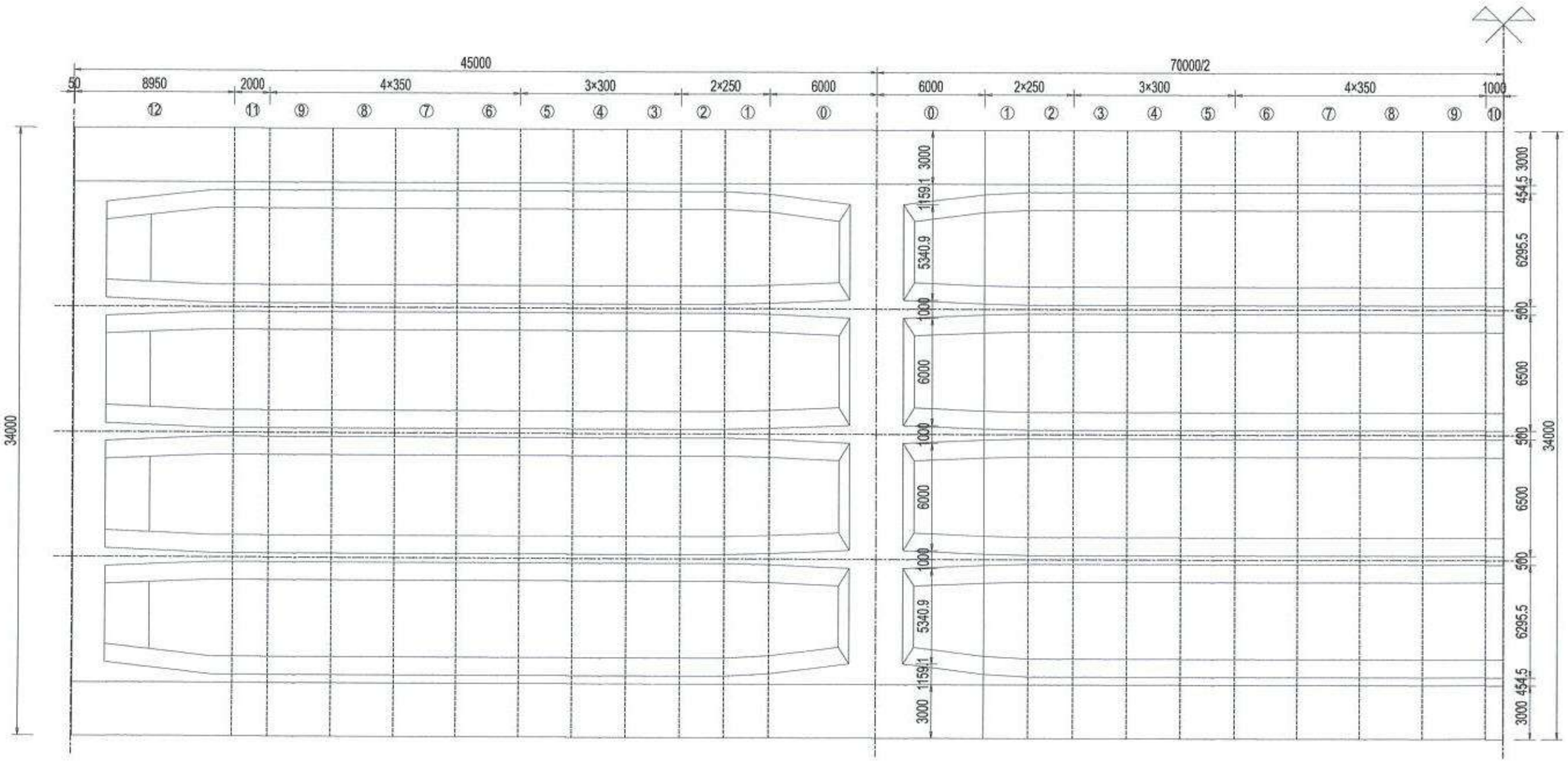
2.The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.

3.This cast-in-place box girder is constructed with the method of cantilever pouring.

4.There are 3 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE 1:250
		General Construction Drawing of a (45+70+45) m Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO. II - 19
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE 2025.07
								DESIGNED	LIU SHENGHAN			

Top plane 1:250



Notes:

1.All dimensions in this drawing are measured in mm.

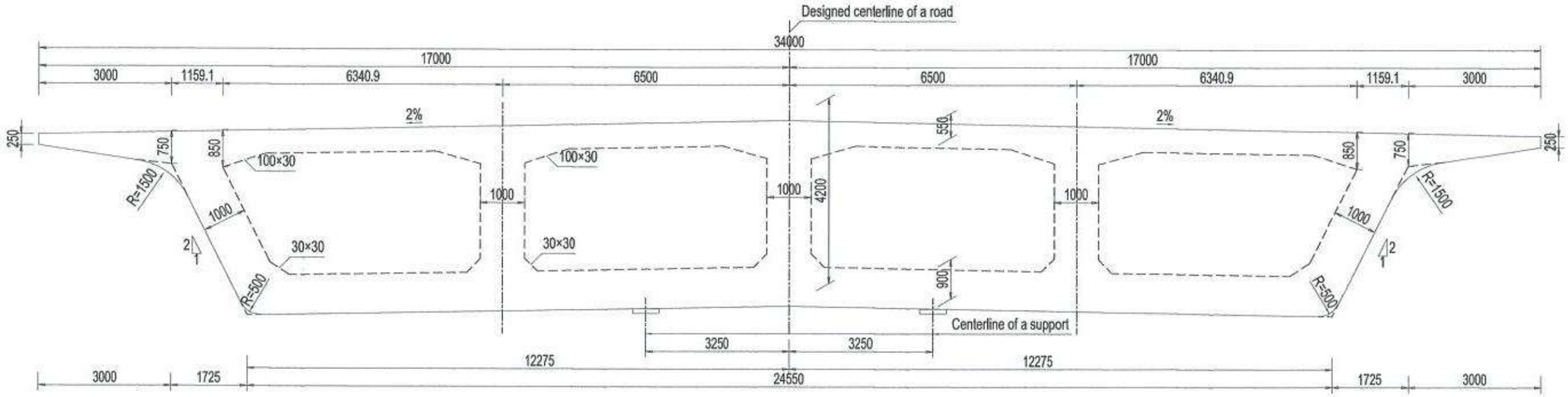
2.The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.

3.This cast-in-place box girder is constructed with the method of cantilever pouring.

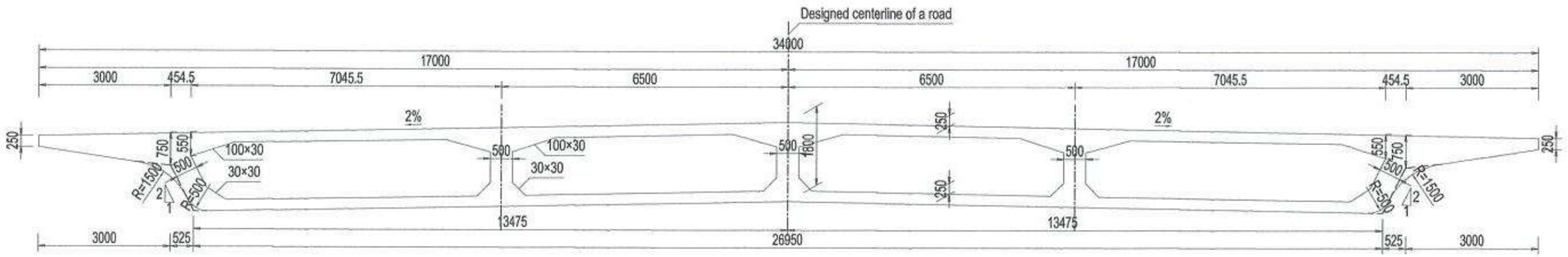
4.There are 3 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:250
		General Construction Drawing of a (45+70+45) m Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II - 19
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LIU SHENGHAN						

Cross Section of Pivot Support 1:100



Mid-Span Cross Section 1:100



Notes:

1.All dimensions in this drawing are measured in mm.

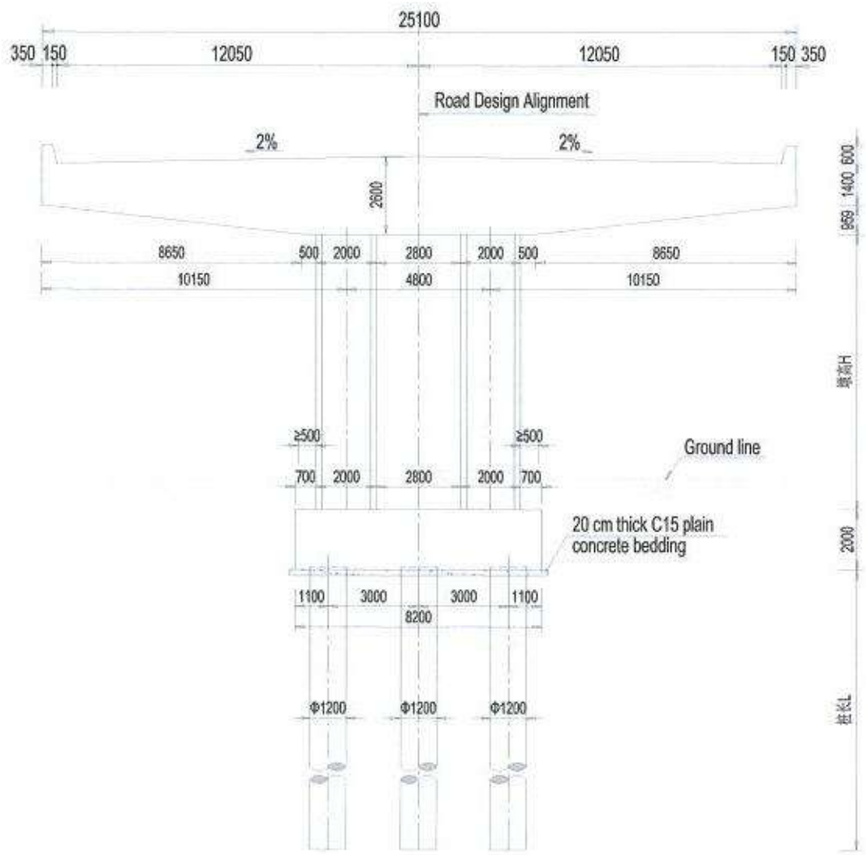
2.The box girder has three spans, but only half of which are shown in the drawing. The other half is symmetrical about center of the middle span.

3.This cast-in-place box girder is constructed with the method of cantilever pouring.

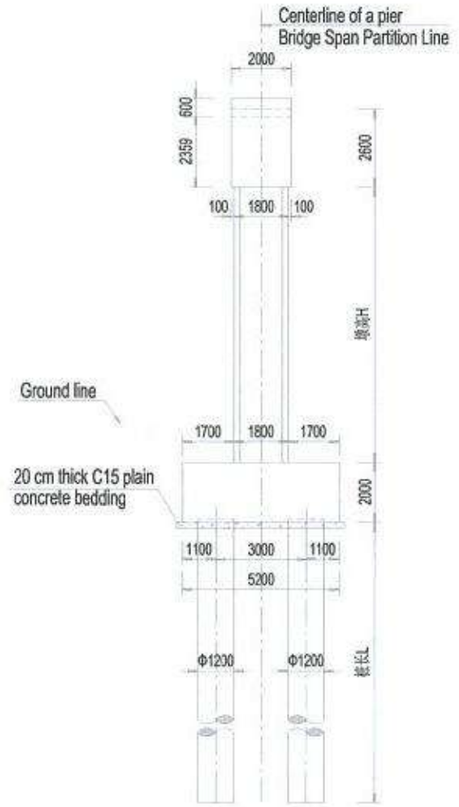
4.There are 3 drawings in total. Please use them together.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES.MANAGER: PANG WEI	SUB.MANAGER: GAO JINCHUN	CHECKED: GAO JINCHUN	SCALE: 1:100
		General Construction Drawing of a (45+70+45) m Cast-in-place Box Girder		MASTER DES.: CAO YONGXIANG	SPE.MANAGER: ZHANG BO	EXAMINED: PANG WEI	DRAWING NO.: II - 19
				MASTER DES.: PAN HAOGUO	SPE.MANAGER: MA JUN	APPROVED: ZHU ANJING	DATE: 2025.07
					DESIGNED: LIU SHENGHAN		

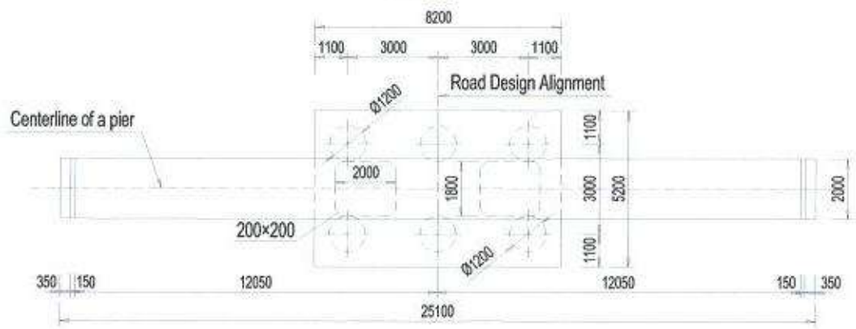
Elevation 1:200



Side view 1:200



Plan 1:200

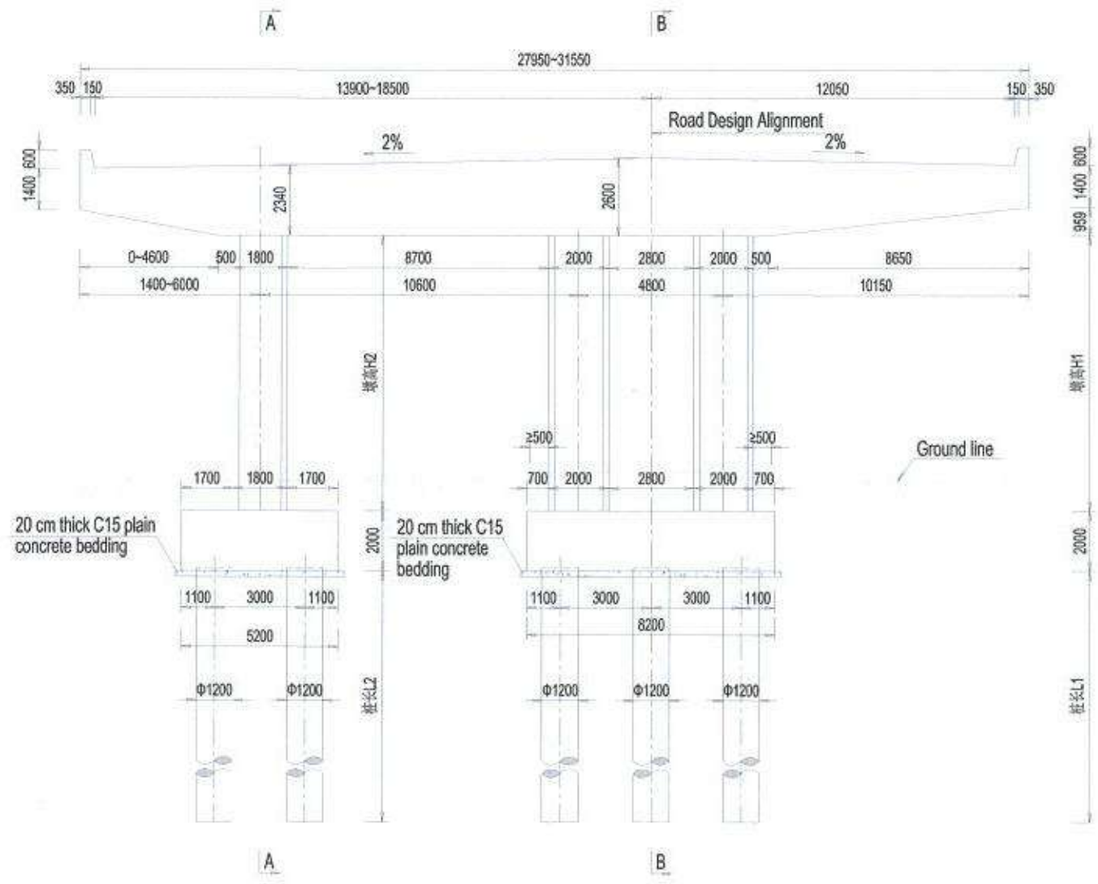


Notes:

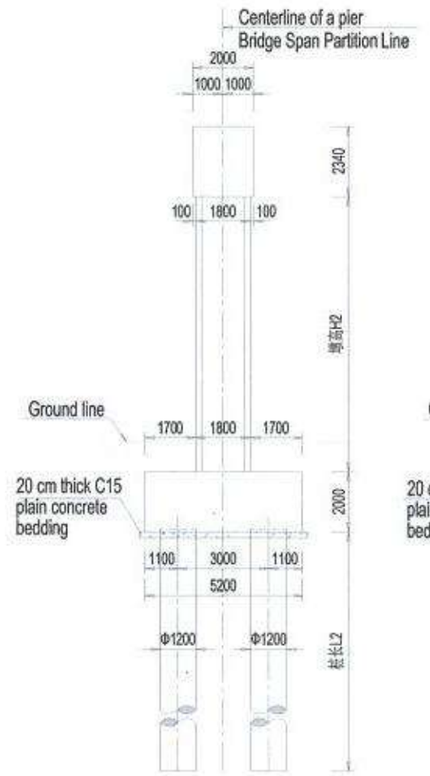
1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to the main bridge with a width of 26.5 m, and the upper structure is a prefabricated small box girder structure.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		General Construction Drawing for a Double-column Pier on a Large Cantilever Bent Cap of a Standard Section				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-20
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

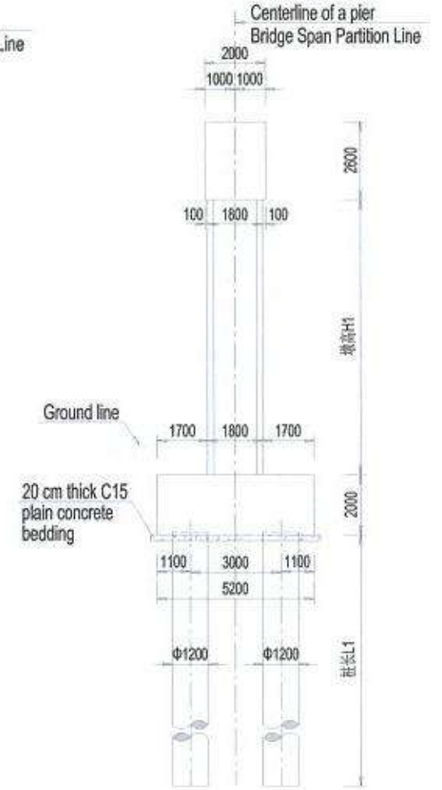
Elevation 1:200



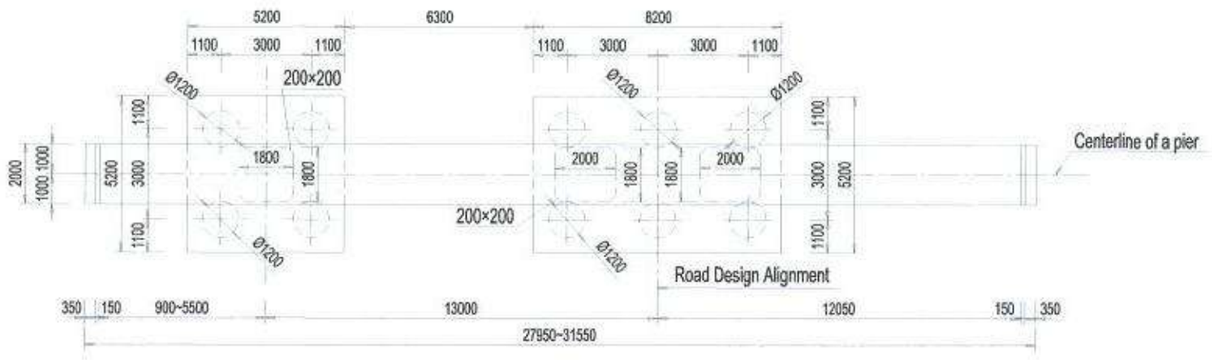
A--A 1:200



B--B 1:200



Plan 1:200

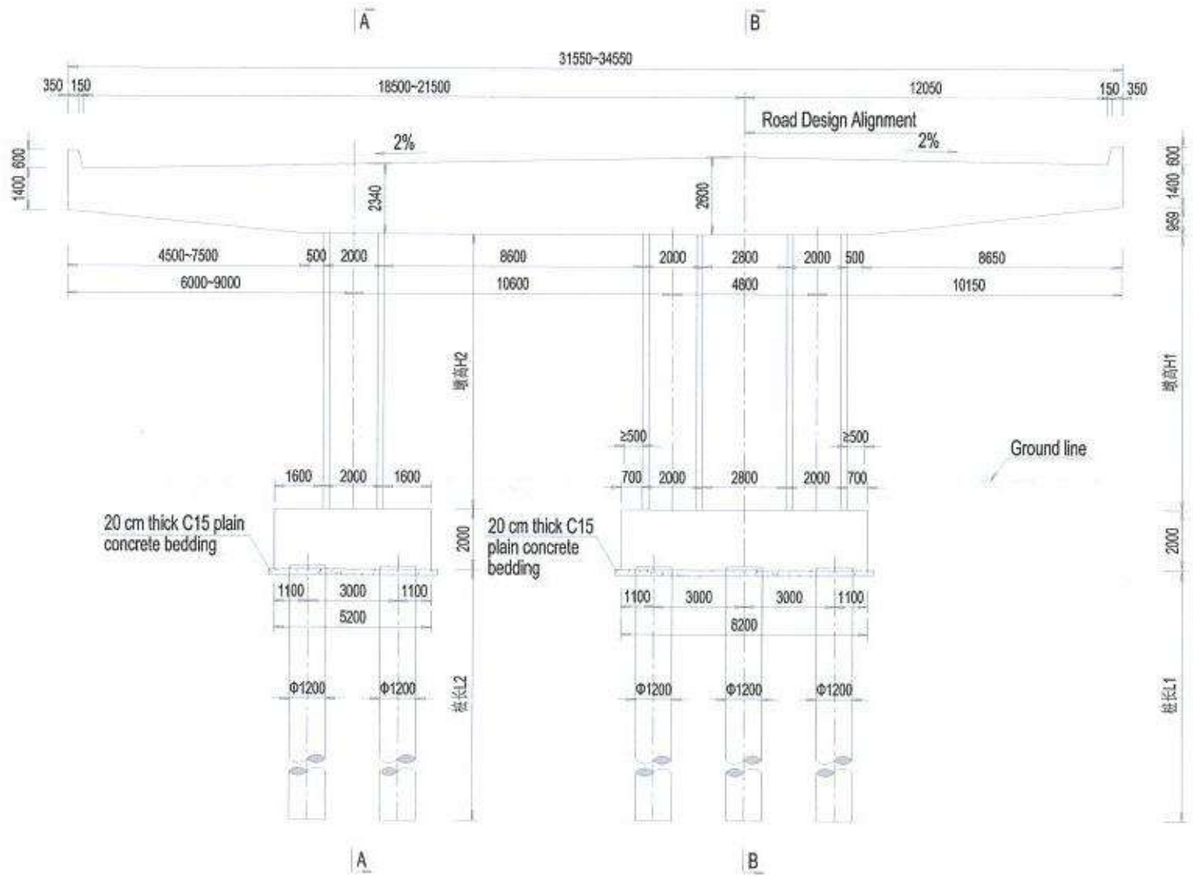


Notes:

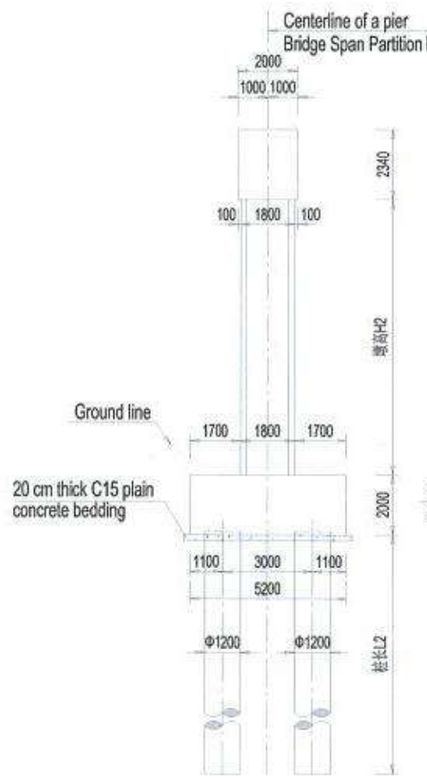
1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to the main bridge with a single-sided widened prefabricated small box girder structure. The applicable range of a bridge width is 26.50-32.85 m. When the widened side cantilever is greater than 2.5 m, chamfering treatment is carried out, and the length of the straight section is 500 mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		General Construction Drawing for Unilateral-widened Three Column Piers				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-21
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	ZHANG BO					DATE	2025.07

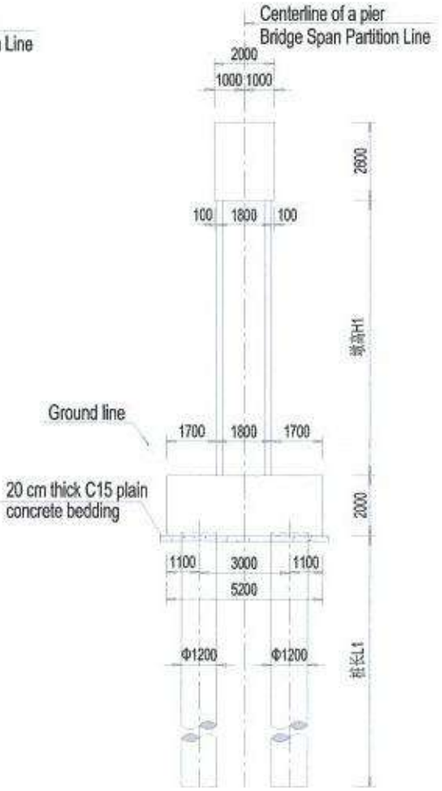
Elevation 1:200



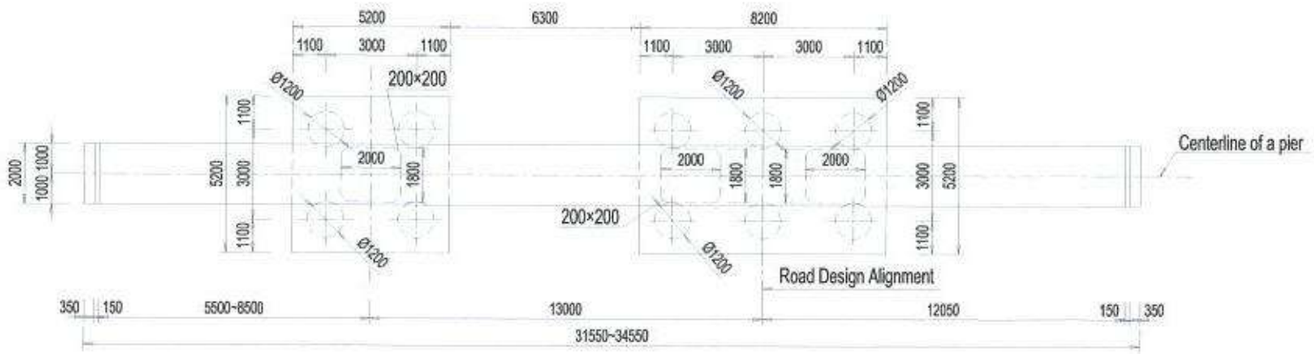
A–A 1:200



B–B 1:200



Plan 1:200

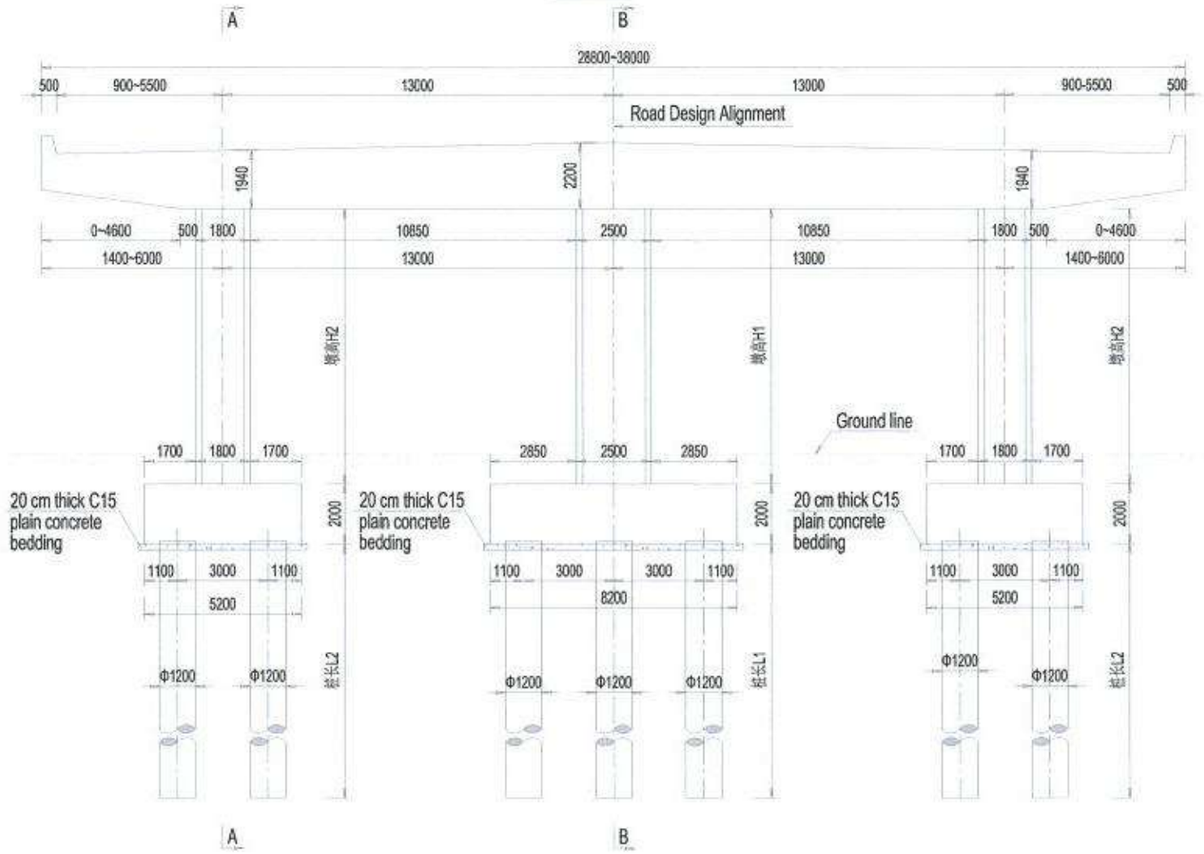


Notes:

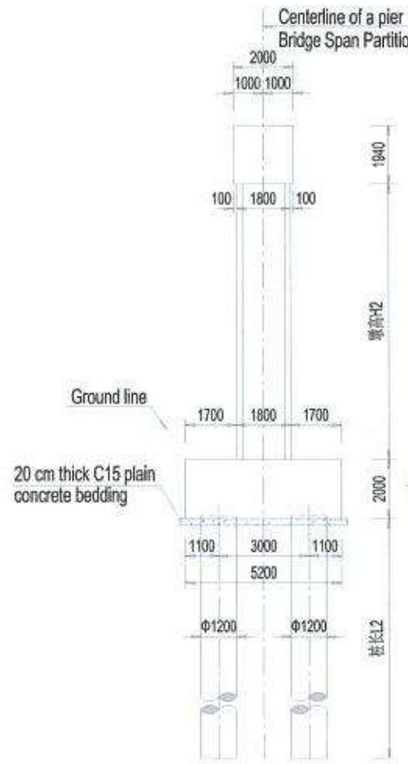
1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to a main bridge with a single-sided widened prefabricated small box girder structure. The applicable range of a bridge width is 32.85-35.85 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 200
		General Construction Drawing for Unilateral-widened Three Column Piers				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-21
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	ZHANG BO			DATE	2025.07

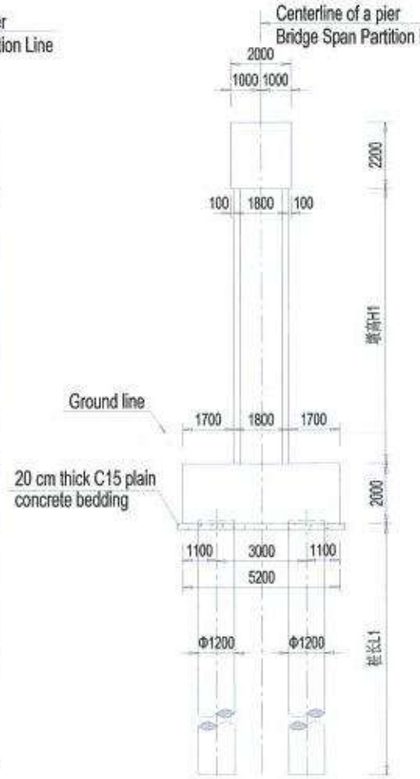
Elevation 1:200



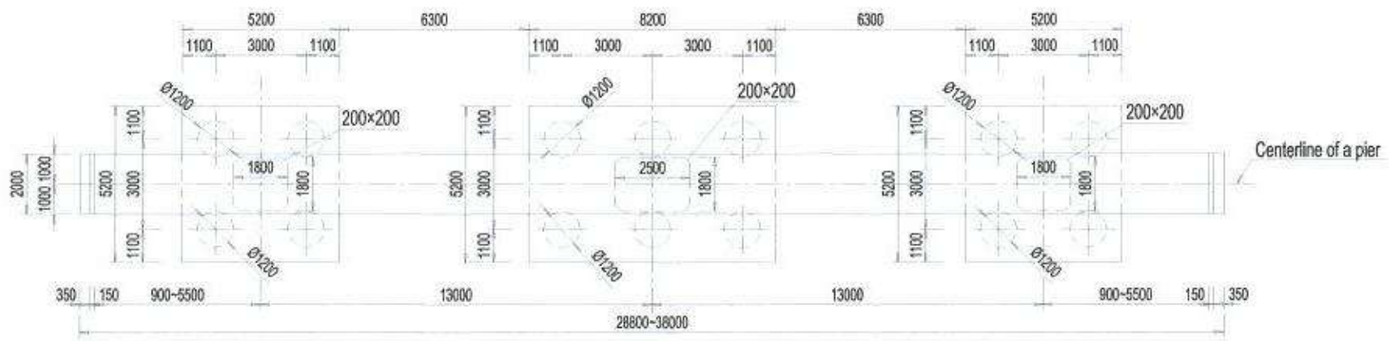
A--A 1:200



B--B 1:200



Plan 1:200

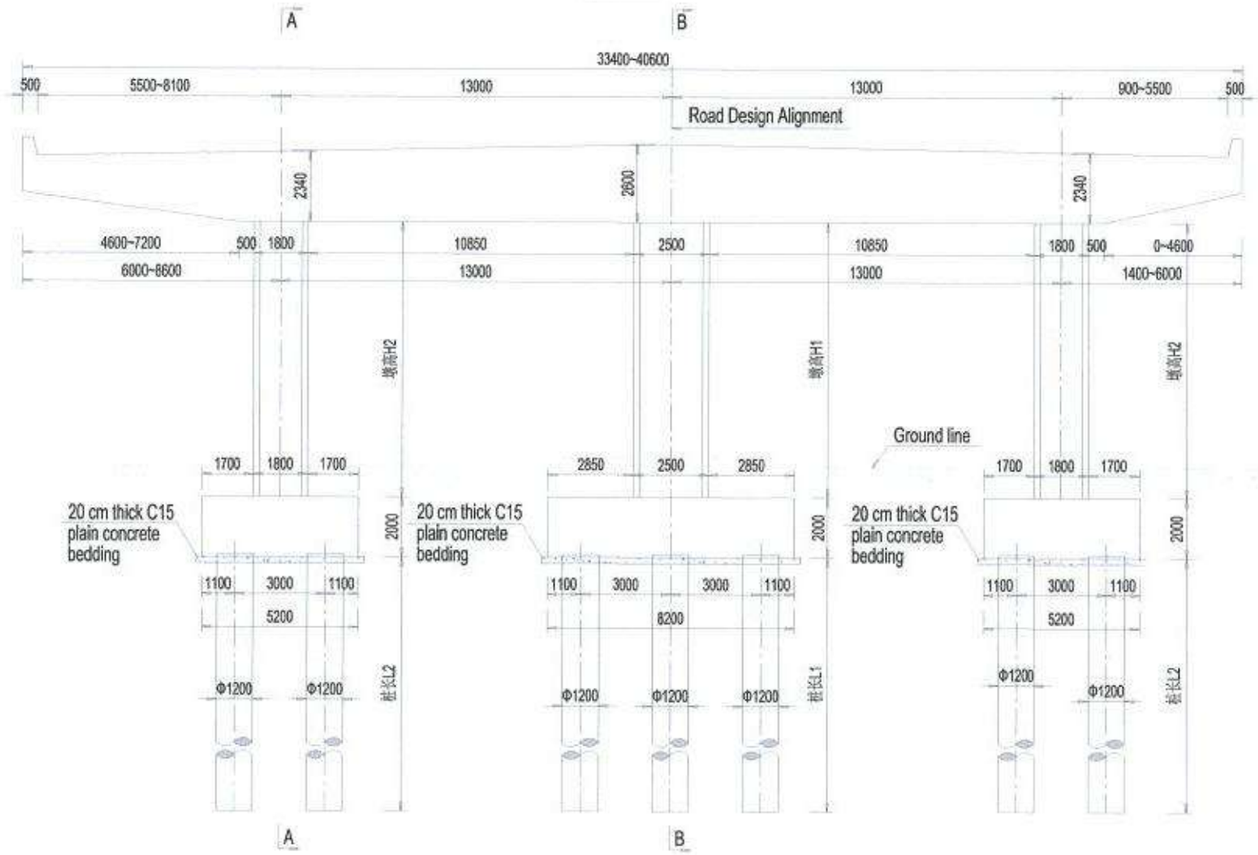


Notes:

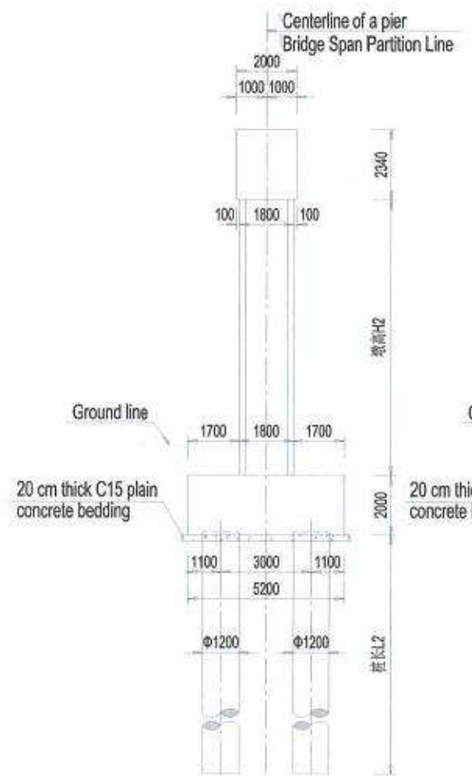
1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to a main bridge with a double-sided widened prefabricated small box girder structure. The applicable range of a bridge width is 30.1-39.3 m. When the widened side cantilever is greater than 2.5 m, chamfering treatment is carried out, and the length of the straight section is 500 mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		General Construction Drawing for Bilateral-widened Three Column Piers				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-22
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	ZHANG BO					DATE	2025.07

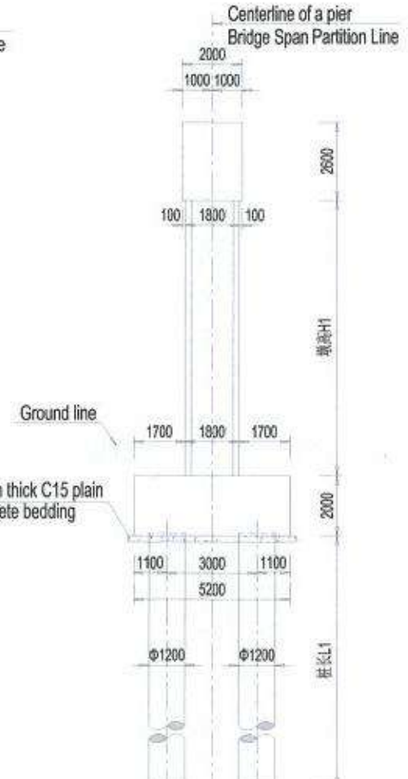
Elevation 1:200



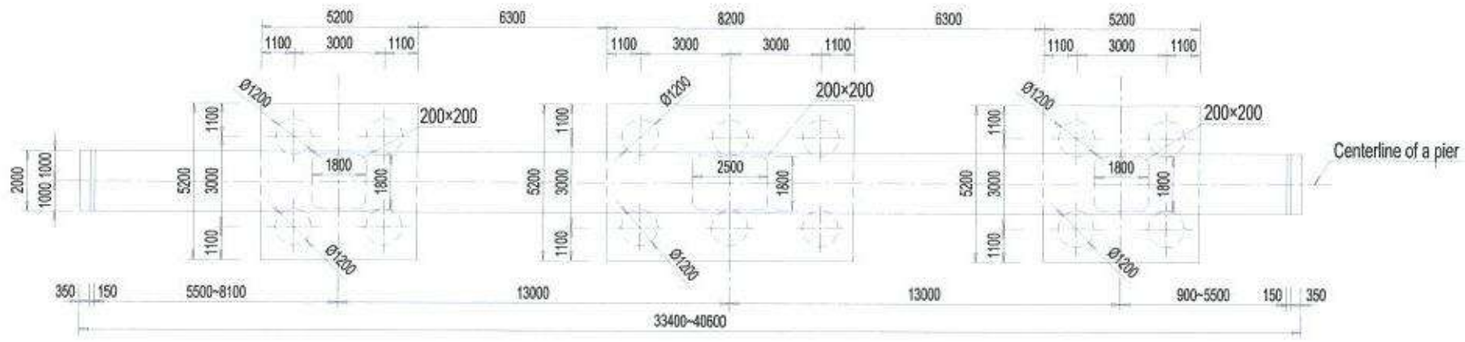
A–A 1:200



B–B 1:200



Plan 1:200

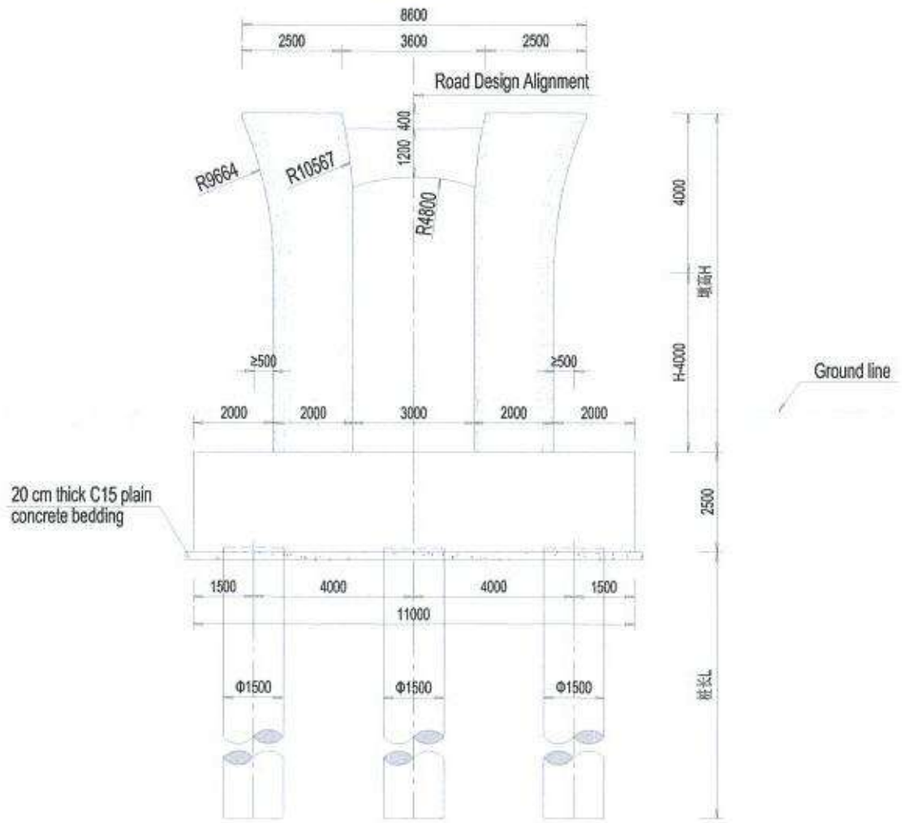


Notes:

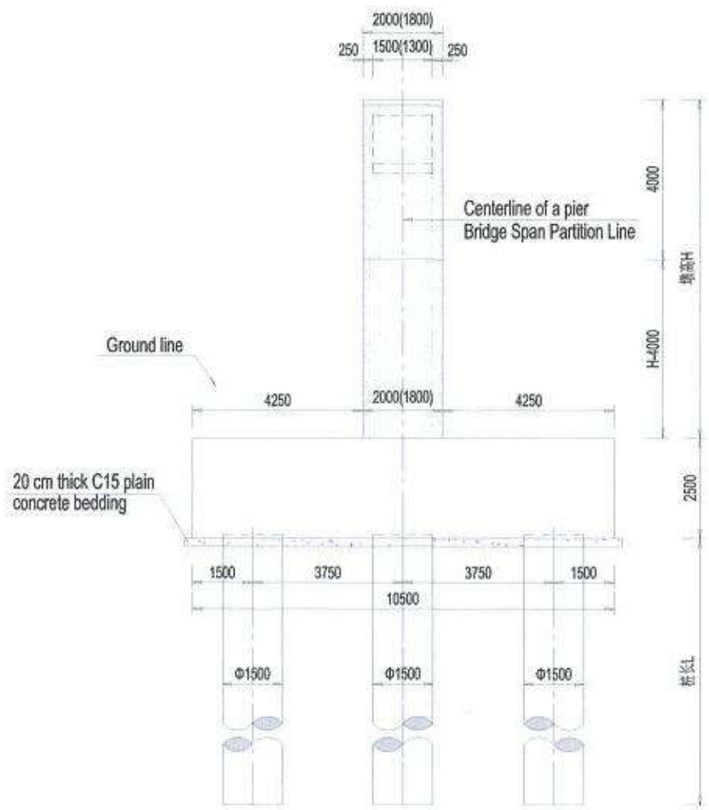
1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to a main bridge with a double-sided widened prefabricated small box girder structure. The applicable range of a bridge width is 34.7-41.9 m. When the widened side cantilever is greater than 2.5 m, chamfering treatment is carried out, and the length of the straight section is 500 mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the "First Ring Road" Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		General Construction Drawing for Bilateral-widened Three Column Piers				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-22
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

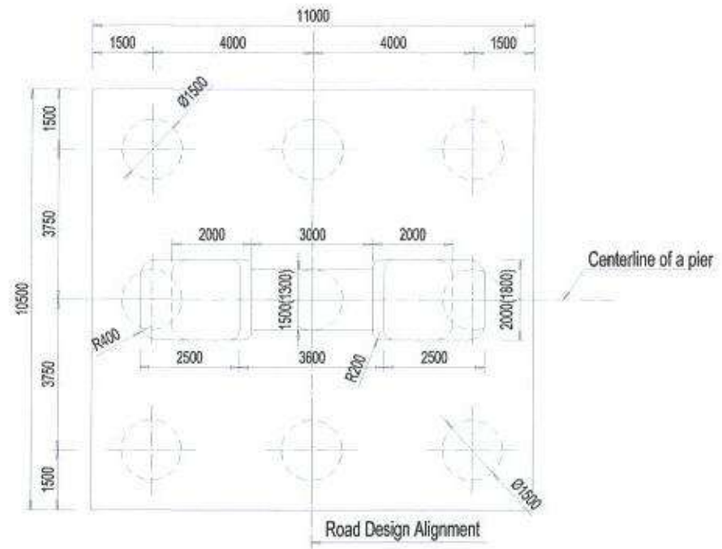
Elevation 1:150



Side view 1:150



Plan 1:150

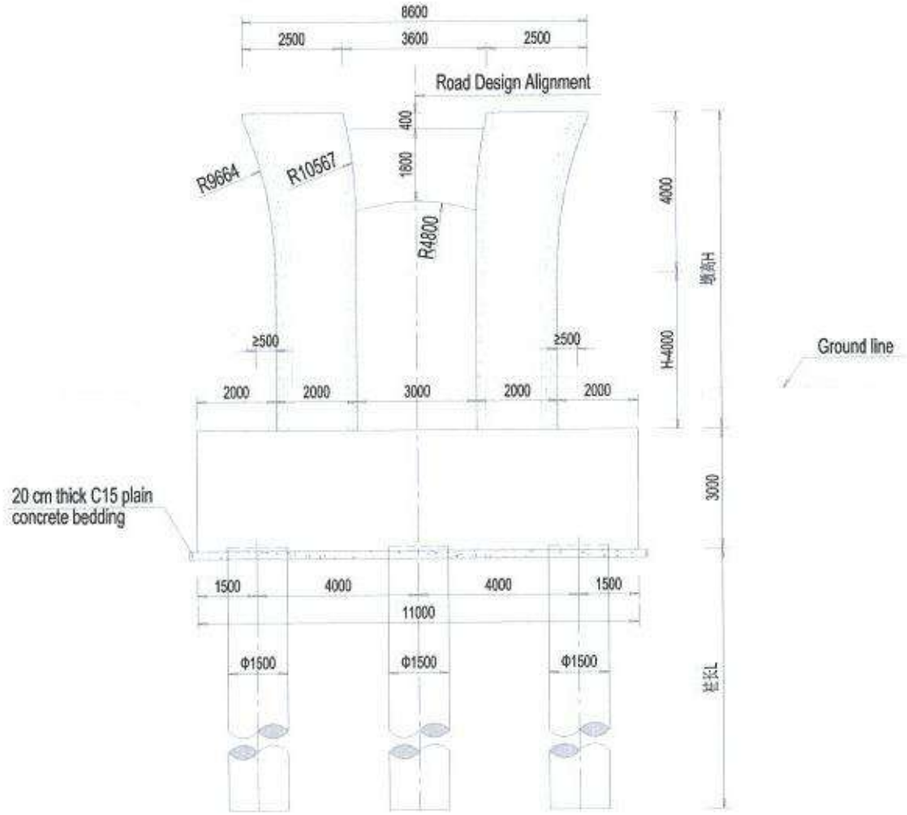


Notes:

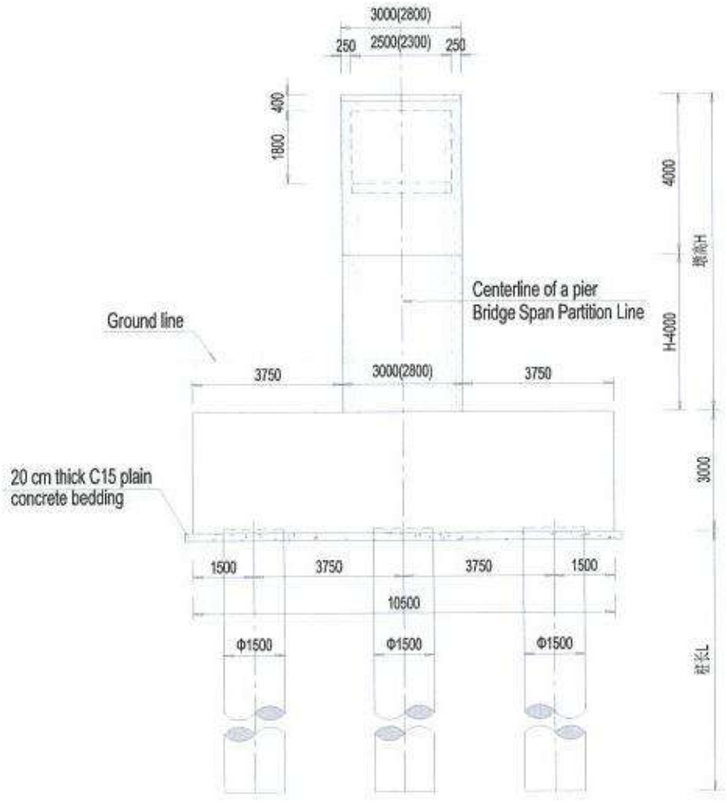
1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to a main bridge. The values outside the brackets are applicable to the cast-in-place structure with an upper widen main span of 40 m and a span of 50 m. The data inside the brackets are applicable to the standard section with a span of 40 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1：150
		General Construction Drawing of a Frame Pier				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-23
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

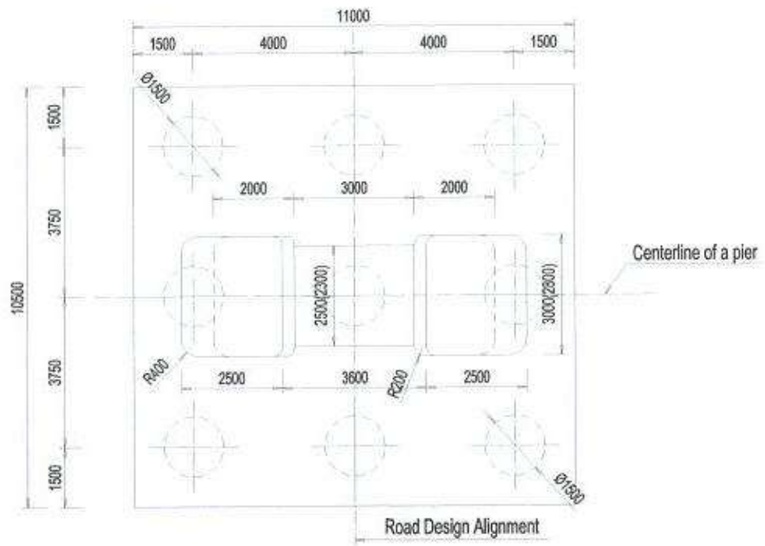
Elevation 1:150



Side view 1:150



Plan 1:150

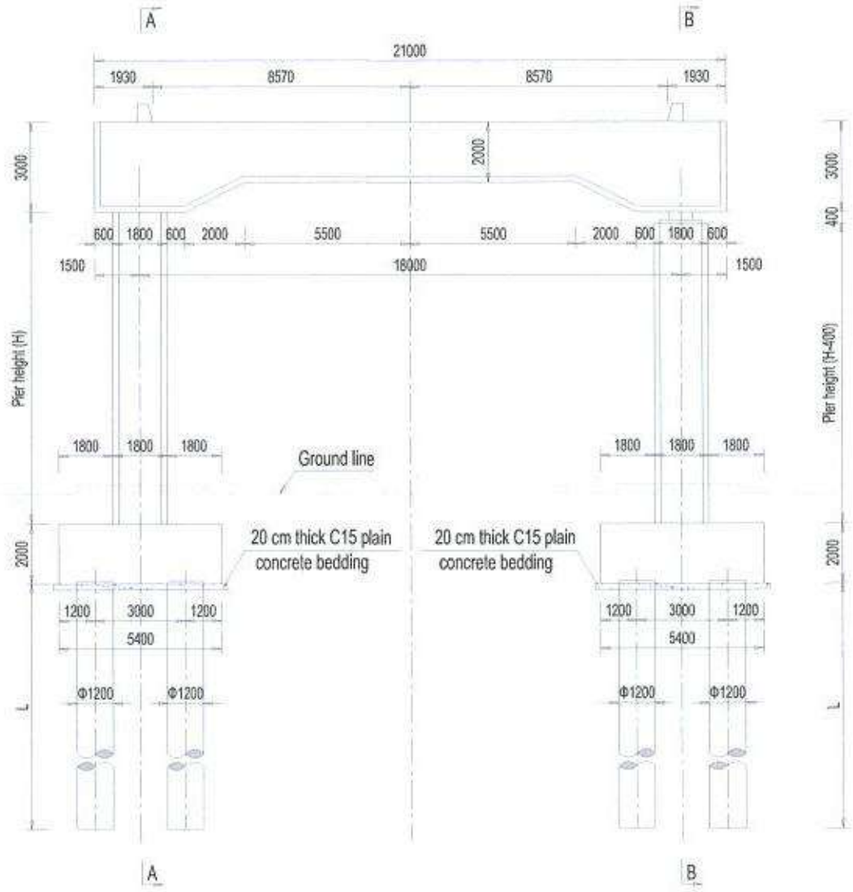


Notes:

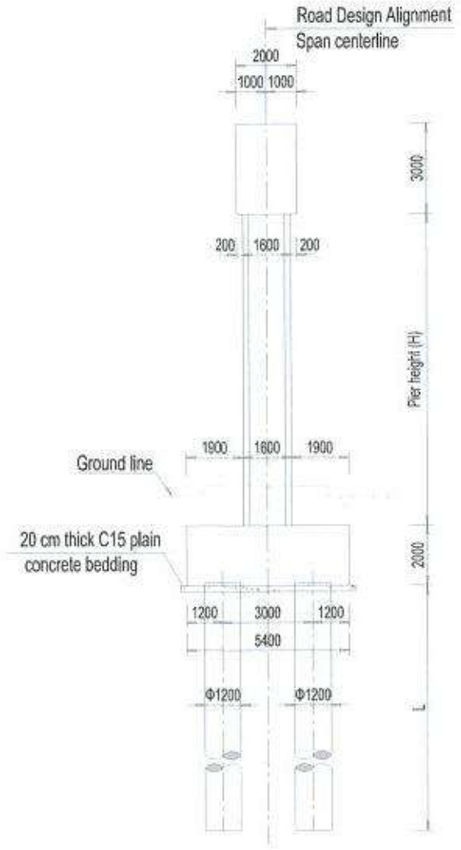
1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to a main bridge. The values outside the brackets are applicable to cast-in-place structures with an upper main span of 65m and a span of 70 m. The data inside the brackets are applicable to standard sections with a span of 60 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 150
		General Construction Drawing of a Frame Pier				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-23
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

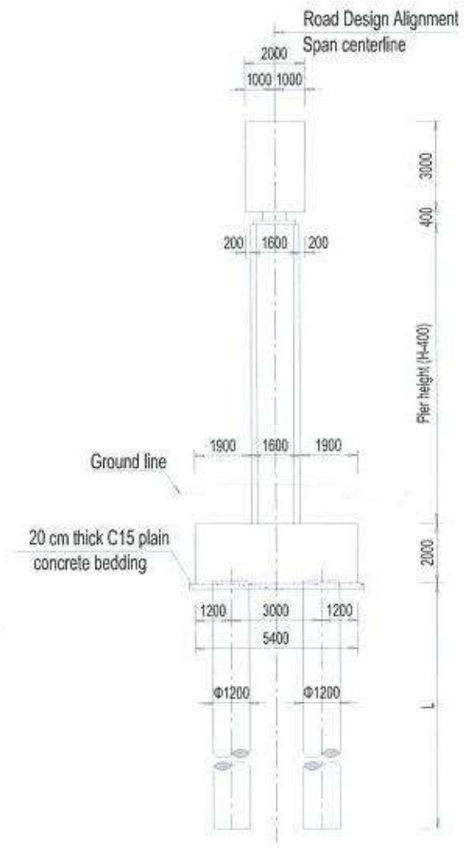
Elevation 1:200



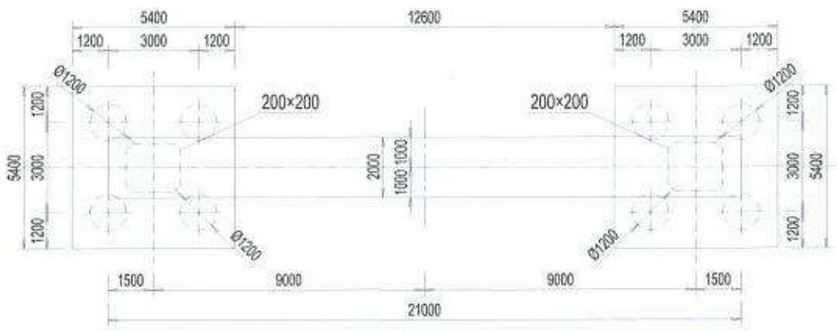
A--A 1:200



B--B 1:200



Plan View 1:200

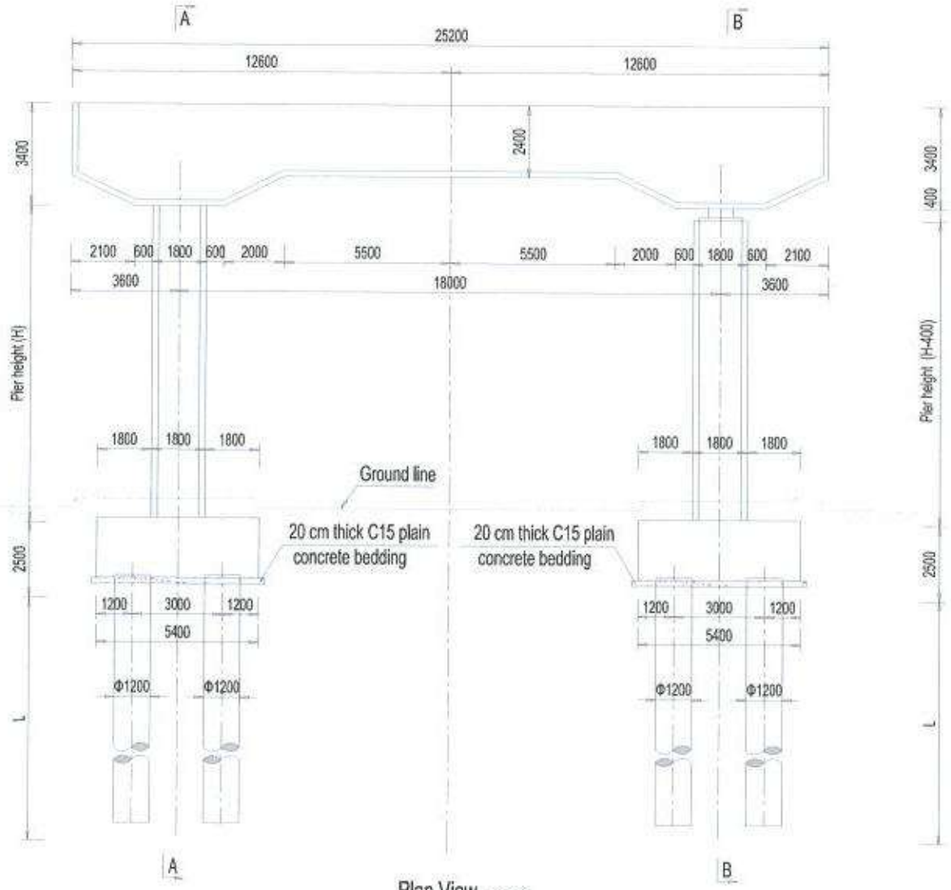


Notes:

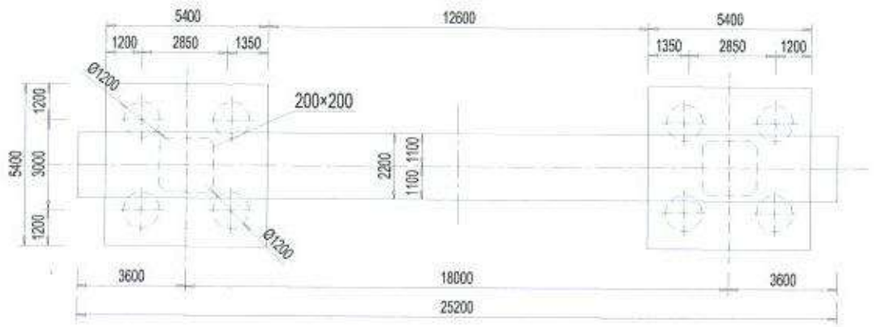
1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		General Construction Drawing of a Portal Pier				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-24
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

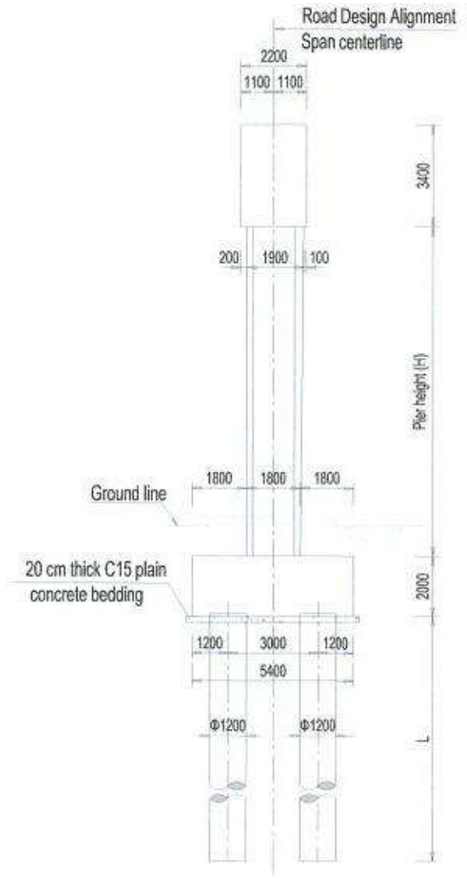
Elevation 1:200



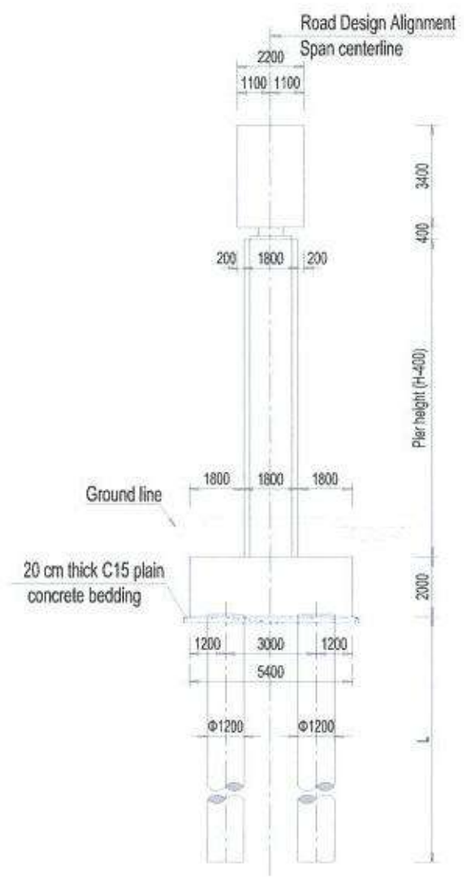
Plan View 1:200



A--A 1:200



B--B 1:200

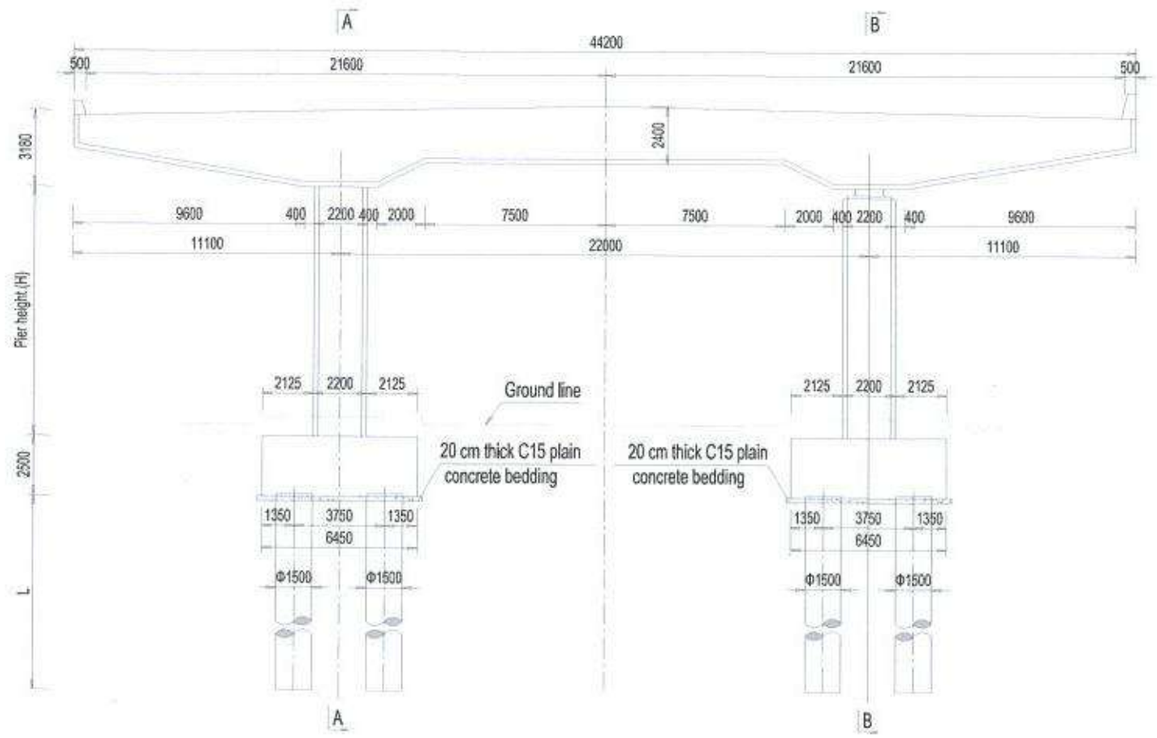


Notes:

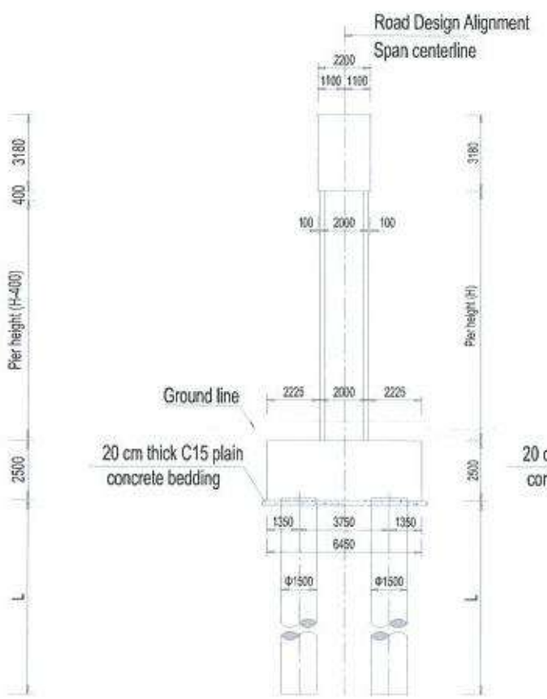
1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		General Construction Drawing of a Portal Pier				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-24
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

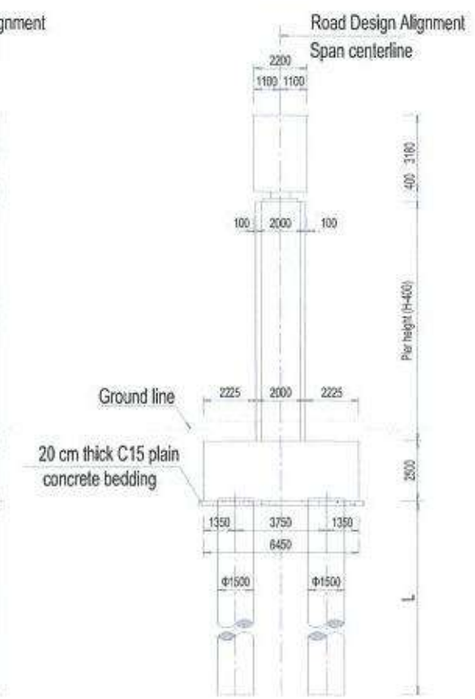
Elevation 1:250



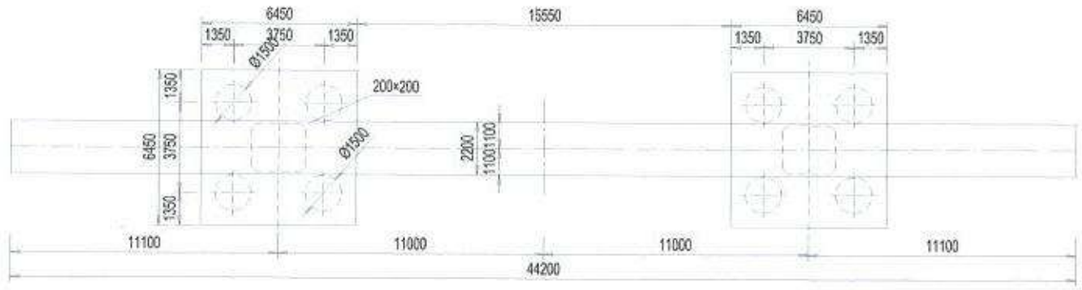
A–A 1:250



B–B 1:250



Plan View 1:250

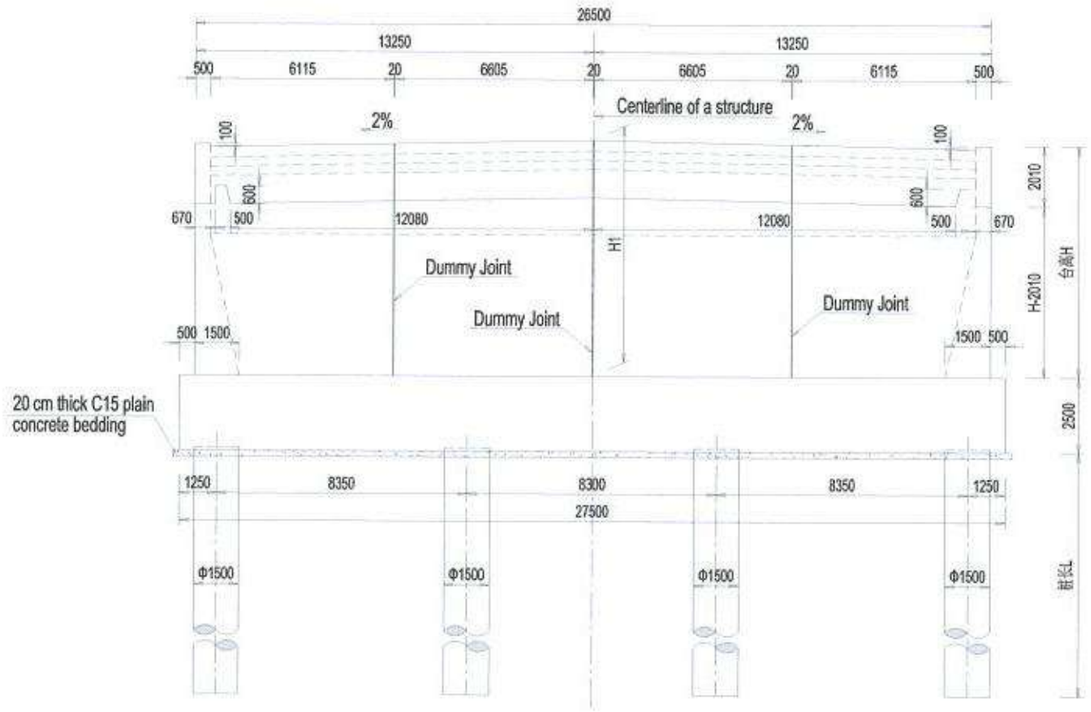


Notes:

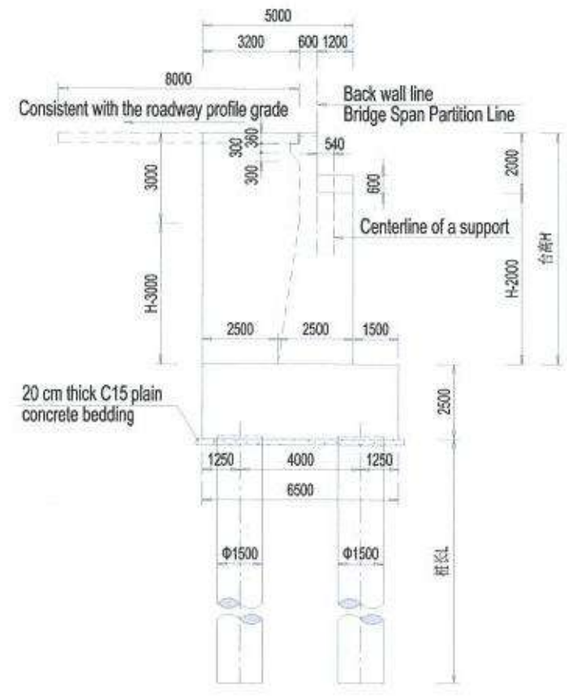
1. All dimensions in this drawing are measured in mm.
2. According to the geological conditions, the pile length L of this bridge is 15.0 m-40.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 250
		General Construction Drawing of a Portal Pier				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-24
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

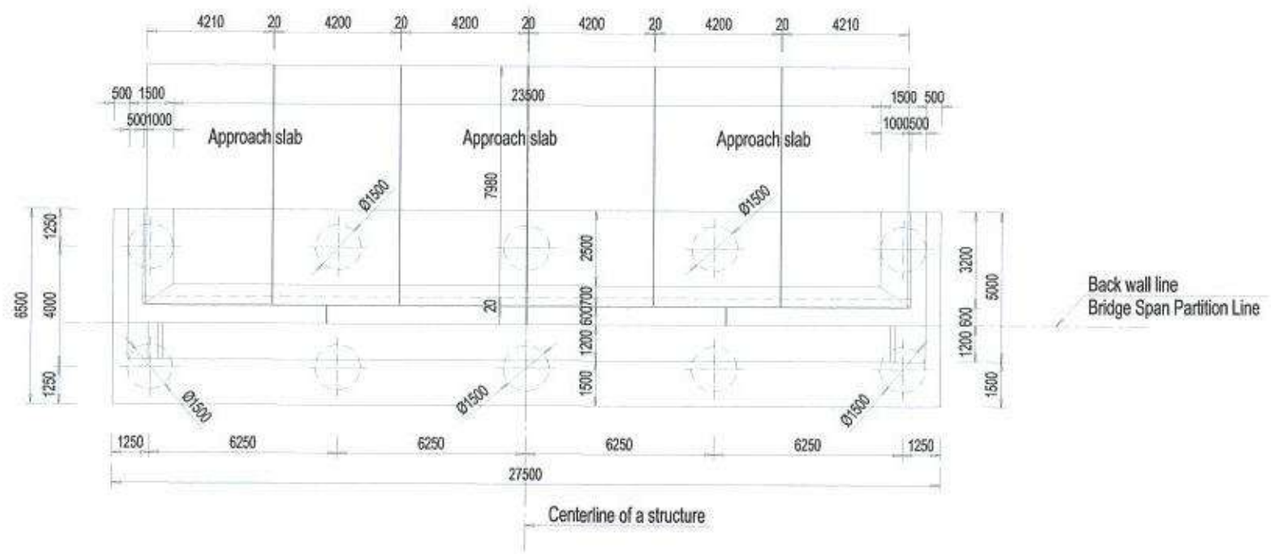
Elevation 1:200



Side view 1:200



Plan 1:200

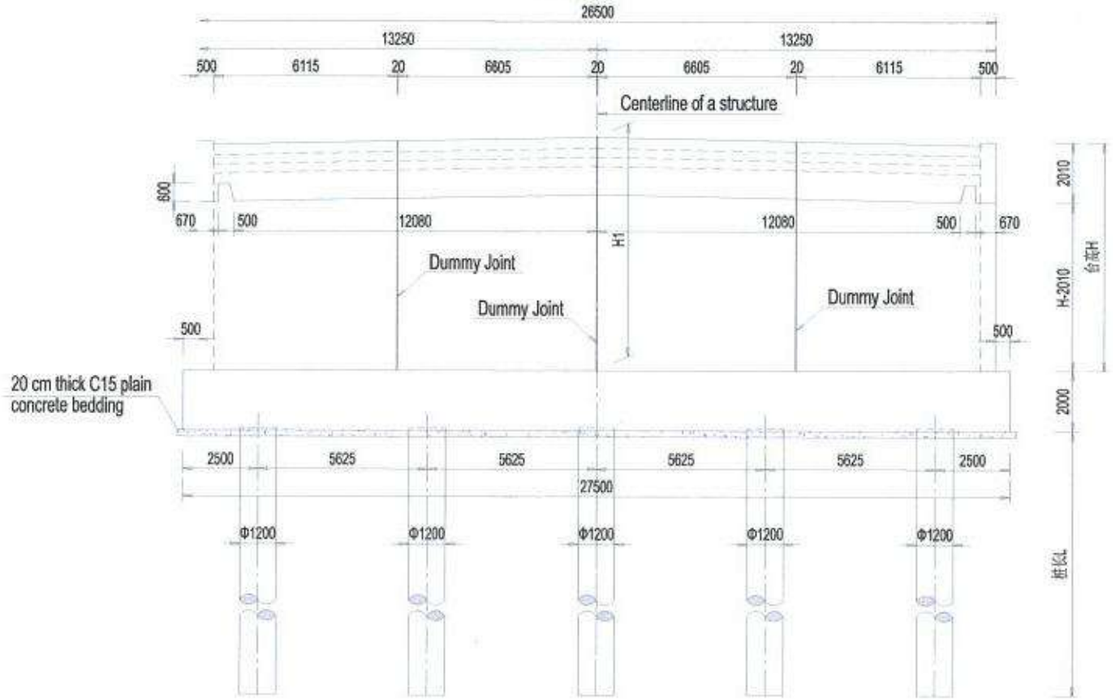


Notes:

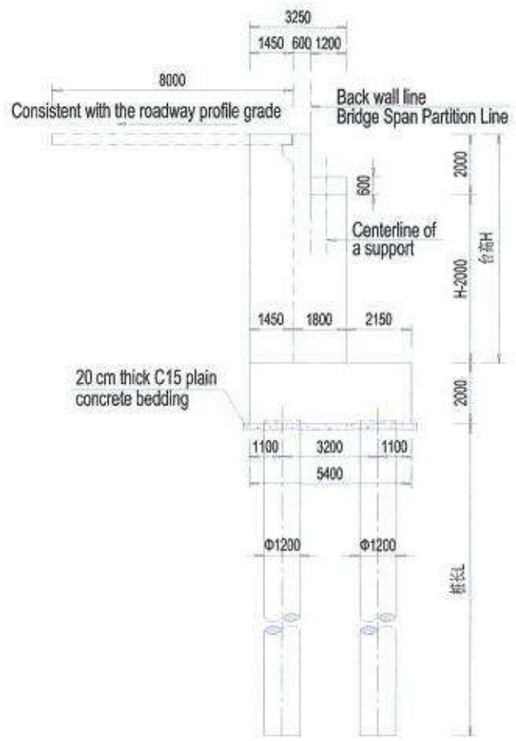
1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to the viaduct on the main line with a bridge width of 26.5 m, the upper structure is a prefabricated small box girder, and the fill height is equal to or greater than 6.0 m.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		General Construction Drawing of an Abutment				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-25
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

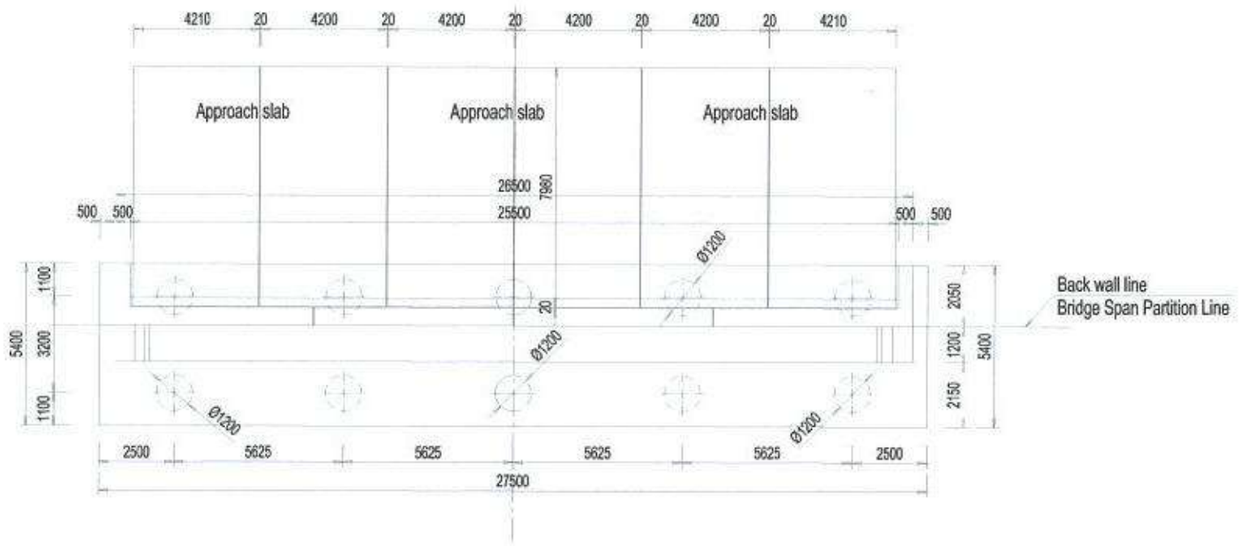
Elevation 1:200



Side view 1:200



Plan 1:200



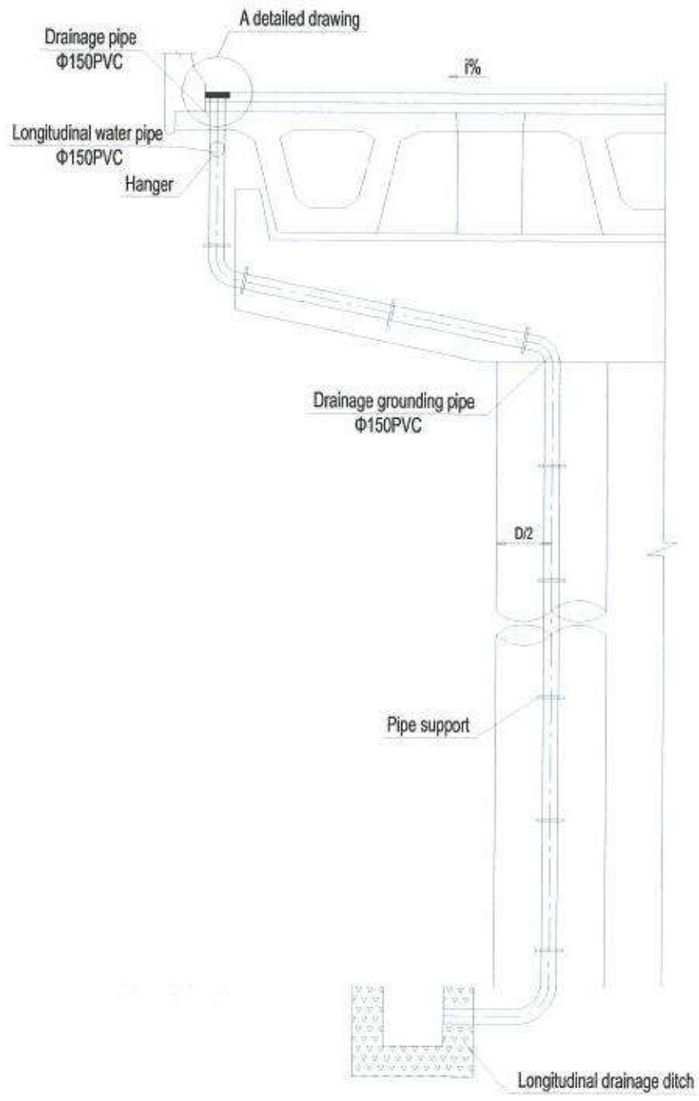
Notes:

1. All dimensions in this drawing are measured in mm.
2. This drawing is applicable to the viaduct on the main line with a bridge width of 26.5 m, and the upper structure is a prefabricated small box girder, and the fill height is less than 6.0 m.

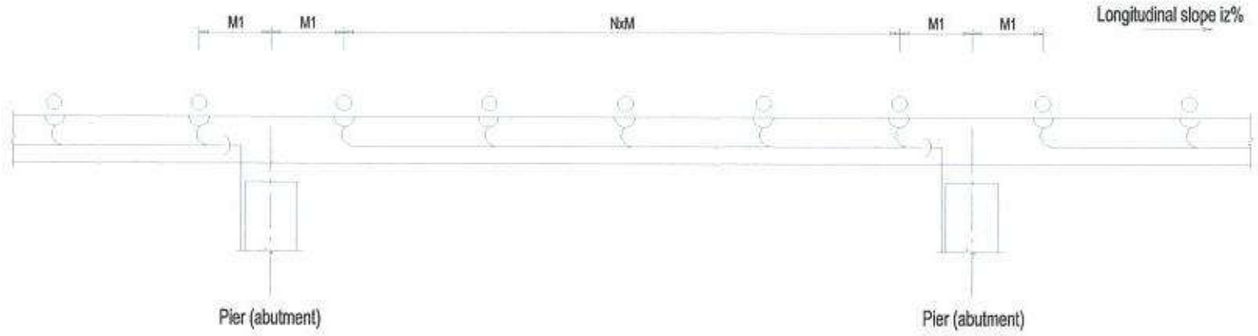
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1：200
		General Construction Drawing of an Abutment				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-25
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	ZHANG BO				

Schematic Horizontal Installation Diagram 1:60

(Drainage through pipes, suitable for prefabricated and cast-in-place box girders)

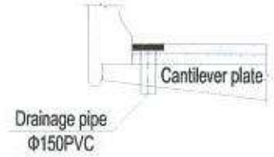


Schematic Installation Diagram of Longitudinal Pipes 1:60



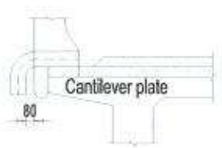
Drawing 1 1:60

(Direct drainage, suitable for cantilever plates with a sufficient drainage space)

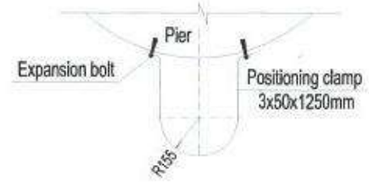


Drawing 2 1:60

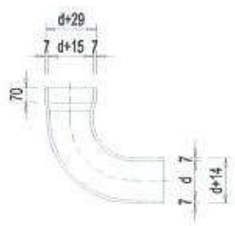
(Direct drainage, suitable for cantilever plates without a sufficient drainage space)



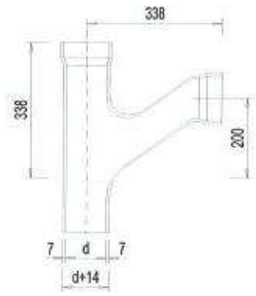
Schematic Installation Plan of a Pipeline Support



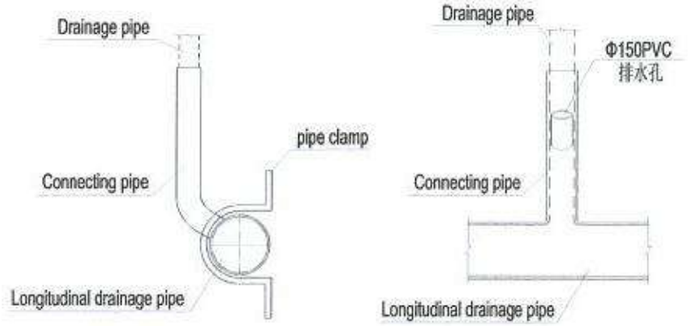
Schematic Bypass Diagram 1:15



Schematic Tee Diagram 1:15



Schematic Diagram of Drain Pipe Connection

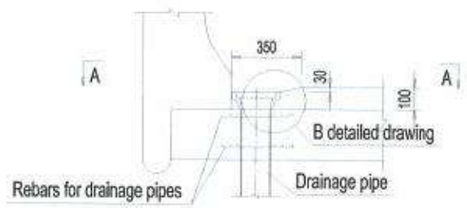


Notes:

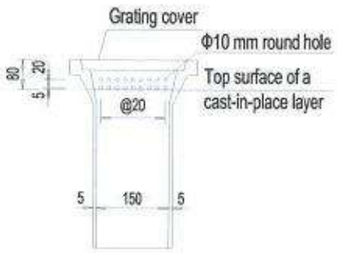
1. All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 60
		Construction Drawing of Bridge Deck Drainage				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II -27
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	ZHANG BO			DATE	2025.07

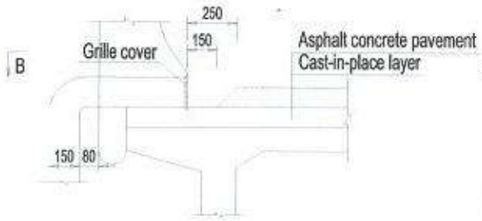
A detailed drawing



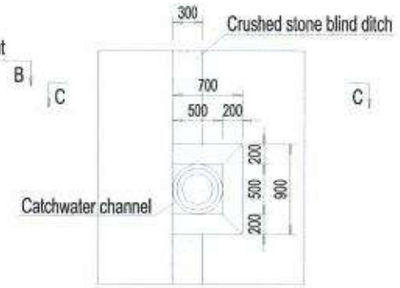
B detailed drawing



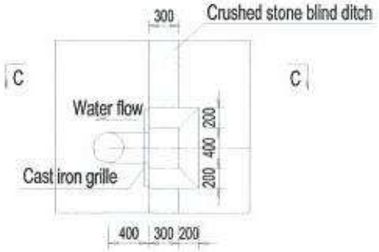
C detailed drawing



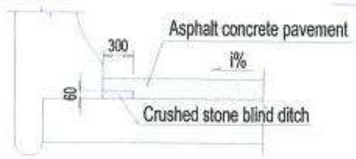
A--A



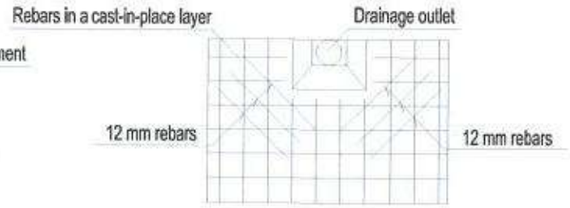
B--B



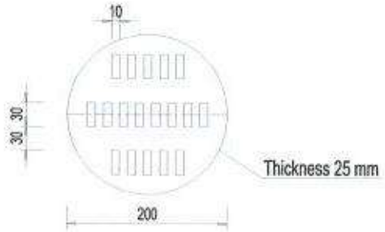
C–C



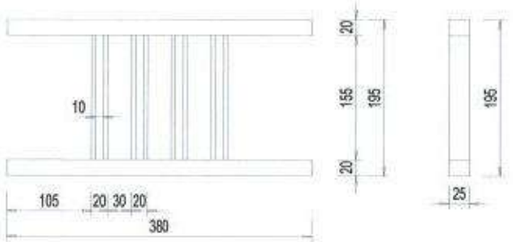
Reinforceed mesh for a drainage pipe



Detailed drawing of a grating cover at a water inlet



Detailed drawing of a cast iron grille at a water inlet



Notes:

1. All dimensions in this drawing are measured in mm.
2. All drainage pipes on this bridge deck are PVC pipes. The drainage pipe is preferred to be made of PVC material (white), and the polyvinyl chloride content is not to be less than 80%.
3. The structural rebars of the main girder where the drainage pipe is located are allowed to be cut off, but rebars for the drainage pipe is to be equipped.
4. The upstream side of the drainage pipe is to equipped with a Φ10 mm round hole to facilitate flowing of stormwater seeping into the pavement layer into the drainage pipe. The layout principles of drainage pipes include the following:
(1) The drainage pipe is only located on the side with a lower elevation in the transverse direction of the bridge; (2) On general road sections, one drainage pipe is arranged every 4-5 m along the longitudinal bridge direction, and it is recommended to increase the density to one drainage pipe every 3 m on super-high road sections; (3) One drainage pipe is arranged at the lowest point of the concave vertical curve and 3 m in front and behind it.
5. The drainage through the longitudinal drainage pipe uses the same direction and slope as the longitudinal slope of the bridge deck. The vertical drainage pipe is to be installed longitudinally on the upstream side of the pier. The bypass and tee of the drainage pipe are allowed to be adjusted appropriately according to the actual field situations and under the guidance of the manufaclurer.
6. The bottom pad for the catchwater channel is 20 mm thick, and made of 350 mm×400 mm asphalt felt; near the outlet of the catchwater channel, the net protective layer of the reinforced mesh for the bridge deck protective layer is at least 40 mm.
7. Corresponding hangers (positioning clamps) are selected for pipes of different diameters. The material of the positioning clamp is Q235 (3 mm) thin steel plate, and the length is allowed to be adjusted appropriately according to the field conditions. Anti-corrosion measures are to be taken.
8. The positioning clamp is fixed with M10 expansion bolts, and the spacing is allowed to be controlled at 2 m. The position of the bolt is allowed to be adjusted appropriately, and precautions are required to avoid touching prestressed members such as anchor heads and corrugated pipes during drilling. Bolts are to be treated with anti-corrosion measures.
9. Before construction, the laying route, elevation and drainage direction of the pipeline are to be reviewed and confirmed. During laying, no slope or reverse slope phenomenon is not allowed.
10. During construction of the main girder and it is to be guaranteed that anti-collision guardrail, drainage pipe holes are reserved. The drainage facilities can only be installed after the anti-collision guardrail is poured.

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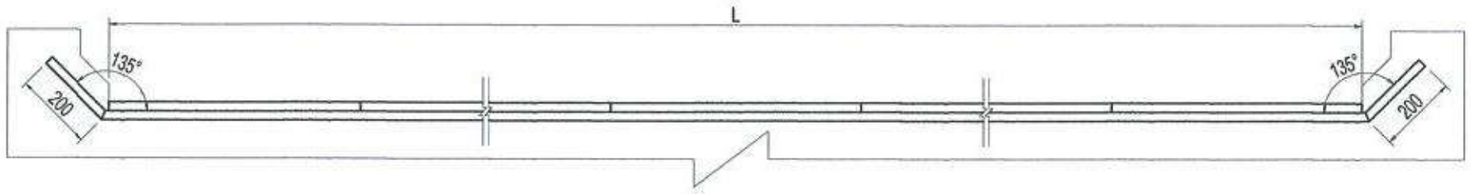
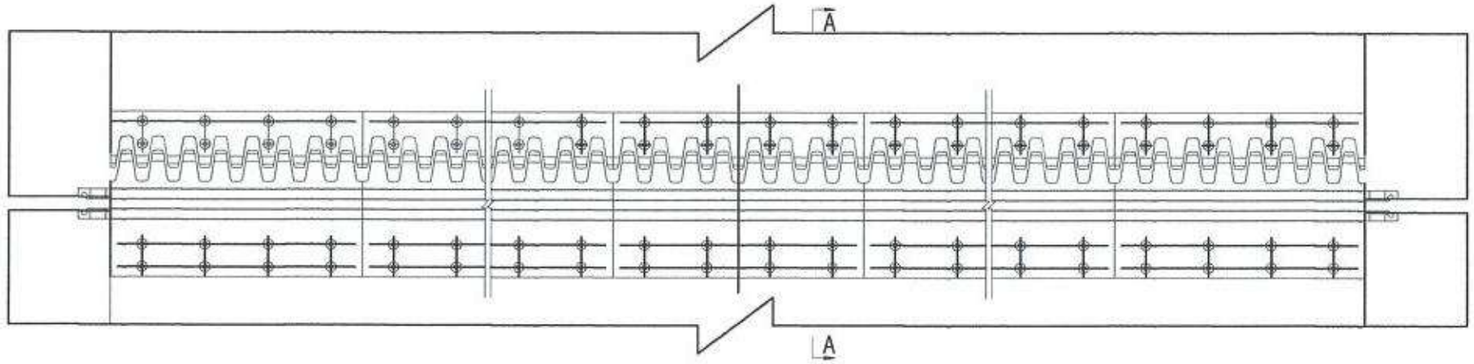
		Construction Drawing of Bridge Deck Drainage				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-27
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	ZHANG BO					DATE	2025.07

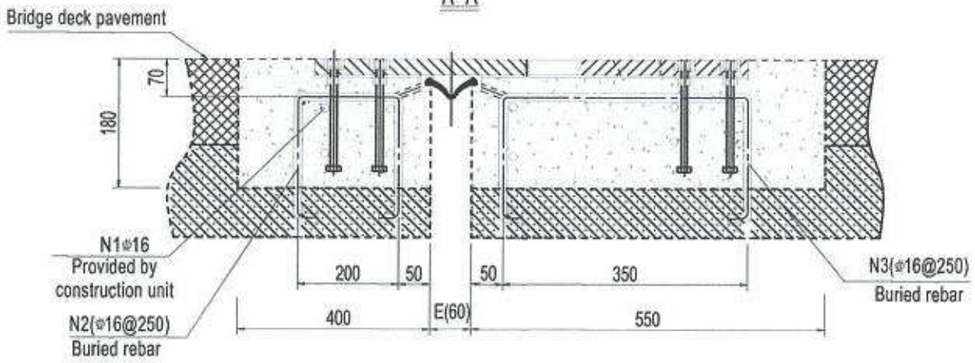
Expansion Joint Elevation

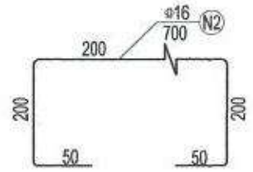


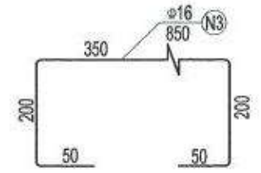
Expansion Joint Plan



A--A







List of material usage per linear meter expansion joint

Material name	Expansion device	Crossing rebar N1	Buried rebar N2	Buried rebar N2	Steel fiber concrete	
Specification	80	⌀16(12pieces)	⌀16(4pieces)	⌀16(4pieces)	C50	Steel fiber
Quantity per meter	1.0m	22.08kg	4.42kg	5.36kg	0.19m³	9.5kg

Notes:
1.The dimensions in this drawing are in millimeters. The product shall comply with the requirements of the Ministry of Transport Industry Standard (JT/T 327-2016) "General Technical Conditions for Highway Bridge Expansion Joints," with an expansion capacity of 0-80mm.
2.The waterproof sealing strips and their corresponding components of the expansion joint shall be provided by the manufacturer.
3.The model of this expansion joint is 80-type.The dimension "E" at the beam end gap shall be set according to the installation temperature. The gap dimension is set at 60mm atthe design mid-temperature of 20°C, with an allowable error of ±10mm.

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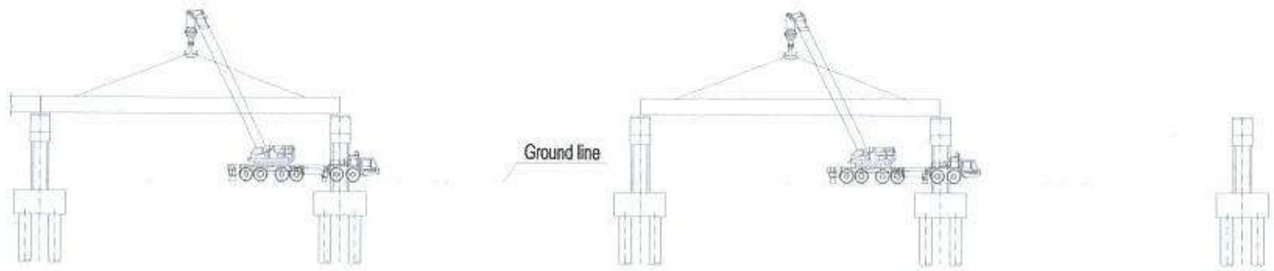
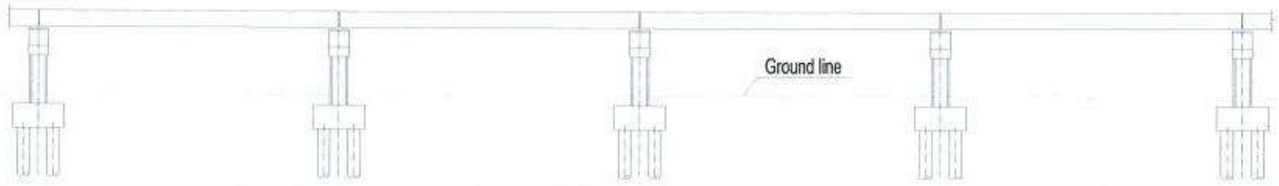
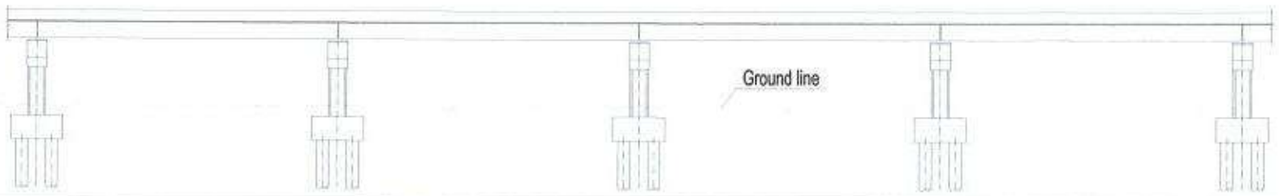
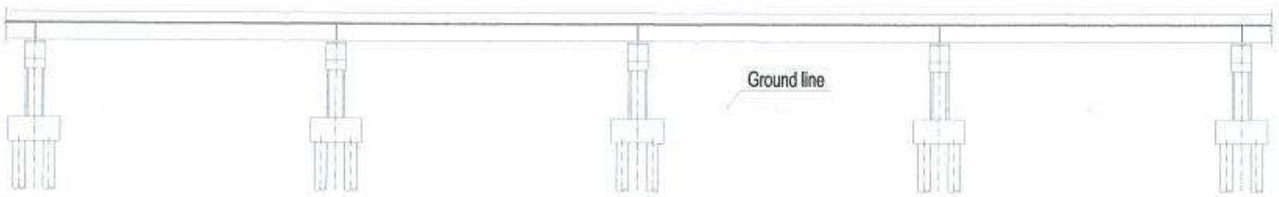
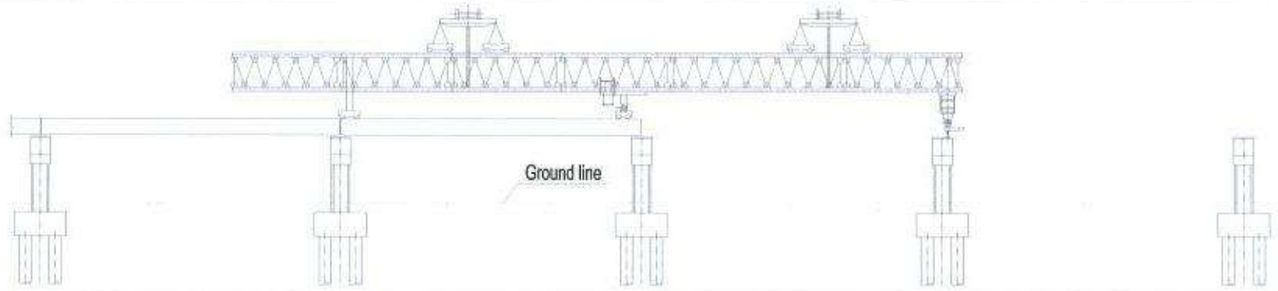
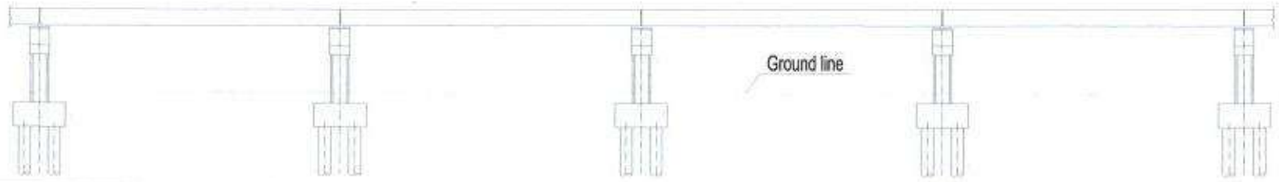
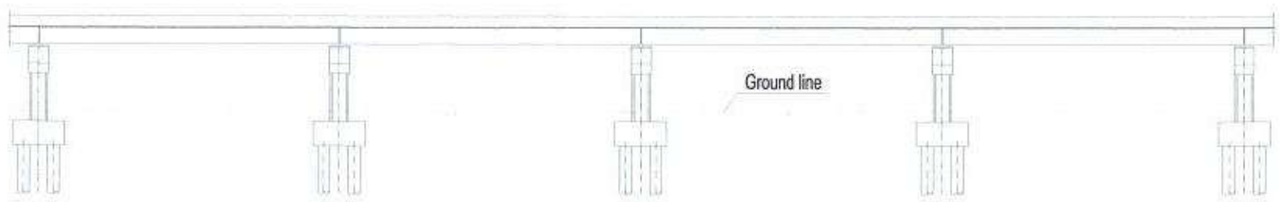
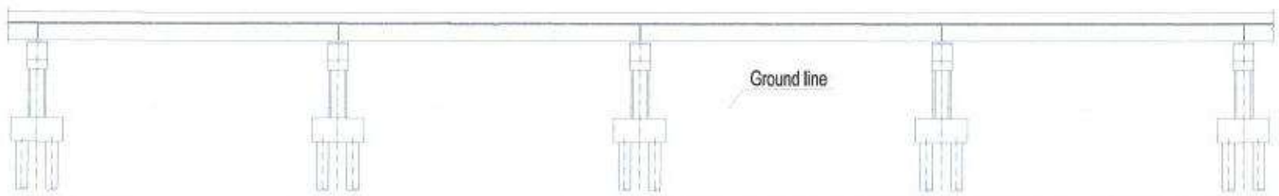
		Construction Drawing of a D80-type Expansion Joint				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II - 28
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LIU SHENGHAN						

Contents in a construction stage	Schematic Diagram of a Construction Procedure (only for four spans in one tie)
Phase 1: (1) Main girders are prefabricated in the beam yard, bored cast-in-place piles are constructed, piers, bent caps and support cushion stones are poured, and rebars, steel plates and other buried parts are buried, and bridge building machinery and equipment are assembled. (2) A pier top support is installed, and the main girder is erected according to the principles of symmetry and balance.	
Phase 2: (1) The transverse wet joint rebars are connected between the transverse partition and the wing plate, and the transverse connecting concrete is poured for the wet joint of the transverse partition and the wing plate. (2) The subsequent construction can only be carried out when the strength of the transverse connecting concrete reaches 80% of the designed strength.	
Phase 3: (1) The integrated layer reinforced mesh and reinforced mesh at the top of the pier are installed, and the anti-collision guardrail and cast-in-place concrete on the bridge deck are poured to form a continuous bridge deck.	
Phase 4: (1) Asphalt concrete is paved, expansion joints are installed, and other ancillary facilities are constructed.	

Notes:

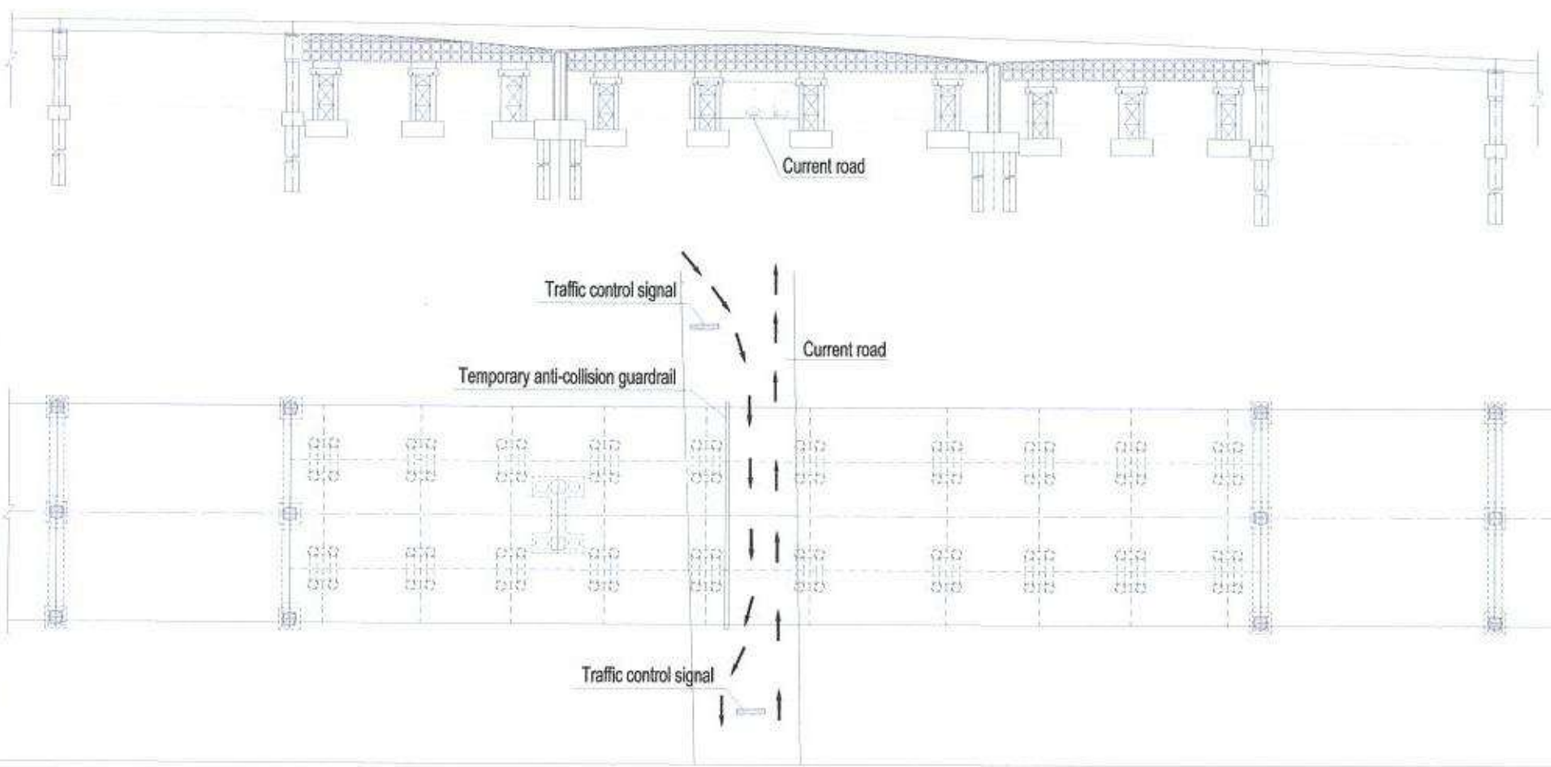
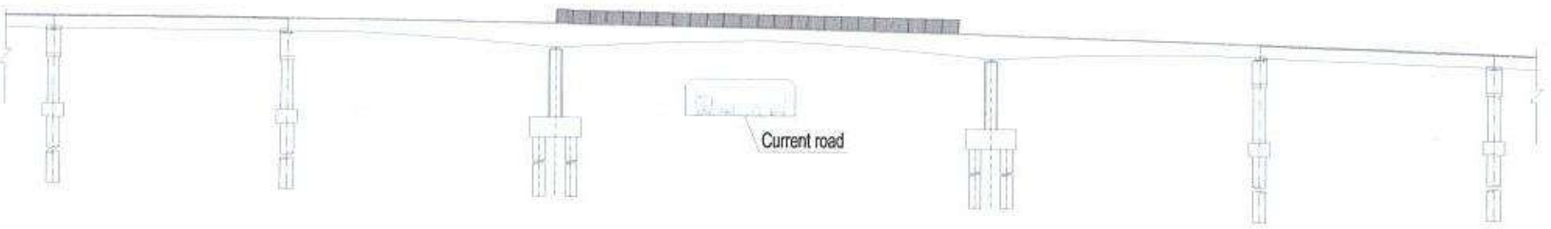
1. This drawing only takes four spans in one tie as an example. Please refer to this drawing for the construction sequence of other ties.
2. This drawing is applicable to the scheme of prefabricated girders lifted by automobiles.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1：600
		Guiding Construction Step drawing for a Prefabricated Small Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-30
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	ZHANG BO				

Contents in a construction stage	Schematic Diagram of a Construction Procedure (only for four spans in one tie)
Phase 1: (1) Main girders are prefabricated in the beam yard, bored cast-in-place piles are constructed, piers, bent caps and support cushion stones are poured, and rebars, steel plates and other buried parts are buried, and bridge building machinery and equipment are assembled. (2) A pier top support is installed, and the main girder is erected according to the principles of symmetry and balance.	
Phase 2: (1) The transverse wet joint rebars are connected between the transverse partition and the wing plate, and the transverse connecting concrete is poured for the wet joint of the transverse partition and the wing plate. (2) The subsequent construction can only be carried out when the strength of the transverse connecting concrete reaches 80% of the designed strength.	
Phase 3: (1) The integrated layer reinforced mesh and reinforced mesh at the top of the pier are installed, and the anti-collision guardrail and cast-in-place concrete on the bridge deck are poured to form a continuous bridge deck.	
Phase 4: (1) Asphalt concrete is paved, expansion joints are installed, and other ancillary facilities are constructed.	

Notes:

1. This drawing only takes four spans in one tie as an example. Please refer to this drawing for the construction sequence of other ties.
2. This drawing is applicable to the scheme of prefabricated girders erected by a bridge erection machine.

Contents in a construction stage	Schematic Diagram of a Construction Procedure (only for a cast-in-place girder with three spans in one tie)
1. Three connections and one leveling of the site are prepared well before construction. 2. Drilled piles, pile caps and piers are constructed.	
1. Construction protective frames are set up within the projection of the bridge plane, and relevant traffic warnings and speed limit signs are arranged to ensure expressway traffic safety. 2. Effective diversion facilities are arranged, the single lane of the intersecting road is changed to two-way traffic, and traffic on half of the road is partially closed off. 3. Temporary piers are set up, Bailey beam supports are installed, and preloading is performed. 4. A formwork is set up, rebars are tied, concrete is poured, and prestressed tensioning (first longitudinal prestress is tensioned, and then transverse prestress is tensioned) is performed when the concrete strength and elastic modulus reach 85% of the designed strength.	
1. Temporary facilities such as support piers and brackets are dismantled. 2. Ancillary works for the entire bridge are constructed. 3. A bridge is completed. 4. Temporary anti-collision guardrails, and relevant traffic warnings and speed limit signs are removed and ground traffic is restored.	

Notes:

1. This drawing only takes three spans in one tie as an example. Please refer to this drawing for the construction sequence of other ties.
2. This drawing is applicable to the construction for a full space support of a cast-in-place box girder.

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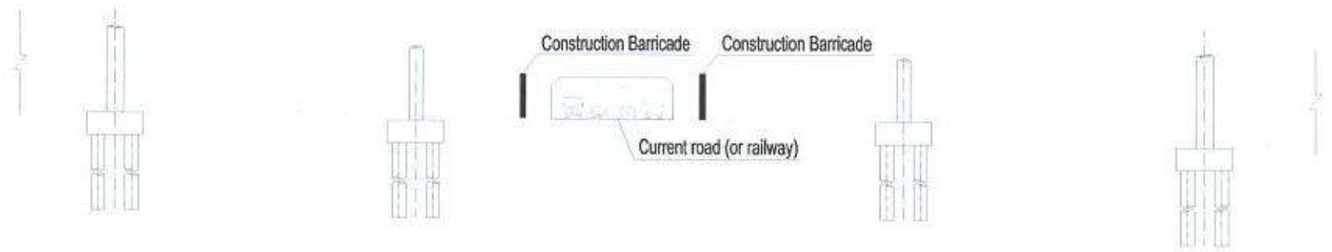
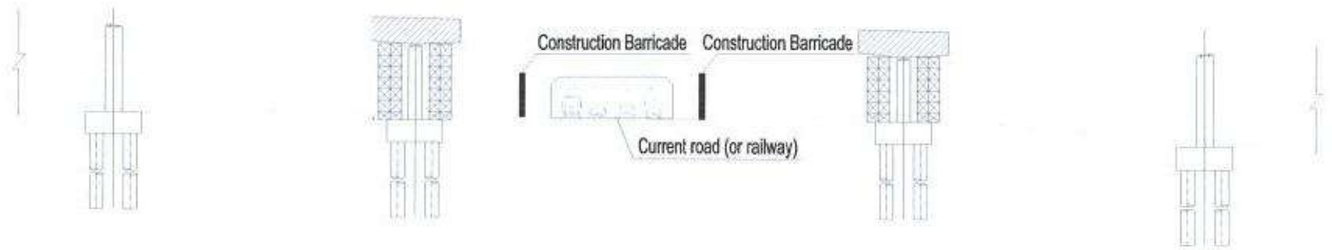
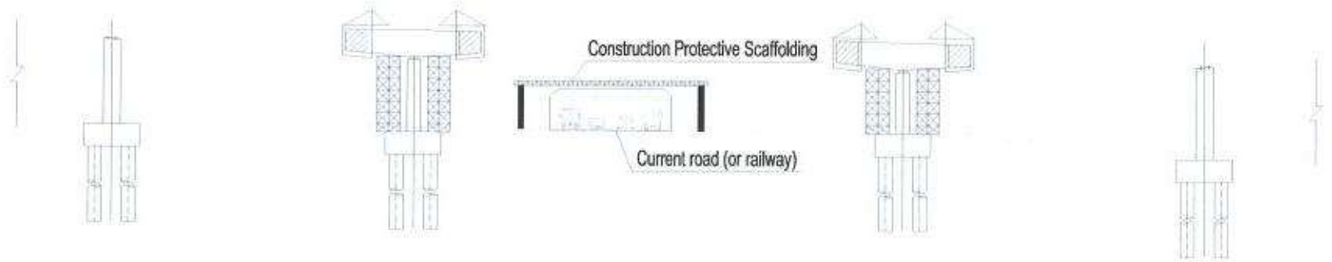
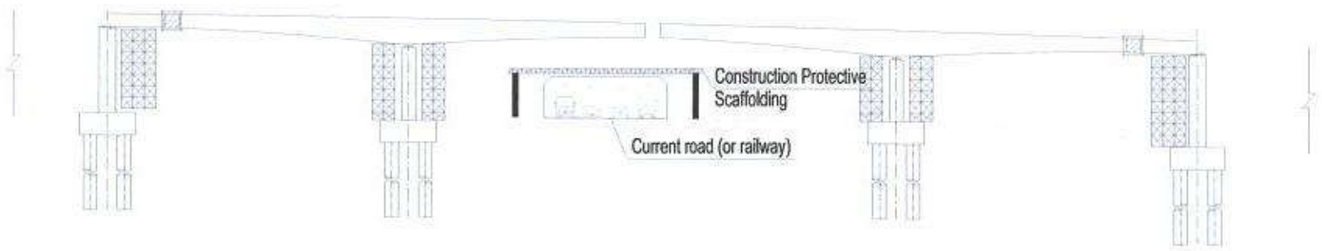
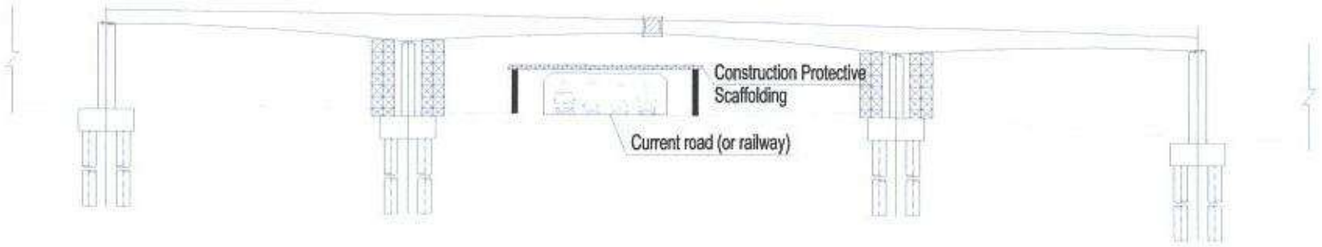
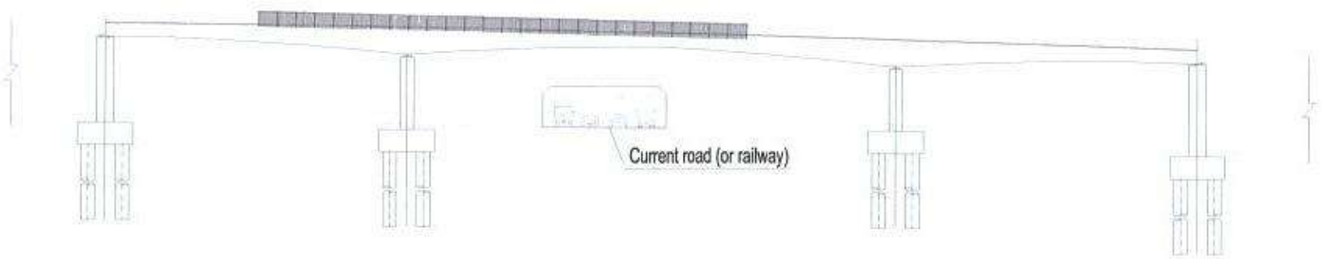
		Guiding Construction Step Drawing for a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-31
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	ZHANG BO					DATE	2025.07

Contents in a construction stage	Schematic Diagram of a Construction Procedure (only for a cast-in-place girder with three spans in one tie)
1. Three connections and one leveling are prepared. 2. Construction fence boards along the outside of current roads (or railways) are erected to ensure safe traffic within the fence. 3. Drilled piles, pile caps and piers are constructed.	
1. Construction protective frames are set up within the projection of the bridge plane of existing roads (or railways), and relevant traffic warnings and speed limit signs are arranged to ensure expressway traffic safety. 2. Temporary supports are installed next to the central pier and preloading is performed. 3. The construction template for section 0 is installed, the rebars are tied, and concrete is poured. 4. After the concrete strength and elastic modulus meet the requirements, tension the longitudinal and transverse prestressed tendons and vertical prestressed rebars of section 0.	
1. The construction basket for cantilever pouring is installed and the formwork elevation is adjusted according to monitoring instructions. 2. The construction template for section 1 is installed, the rebars are tied, and concrete is poured. 3. After the concrete strength and elastic modulus meet the requirements, the longitudinal and transverse prestressed tendons and vertical prestressed rebars of section 1 are tensioned.	

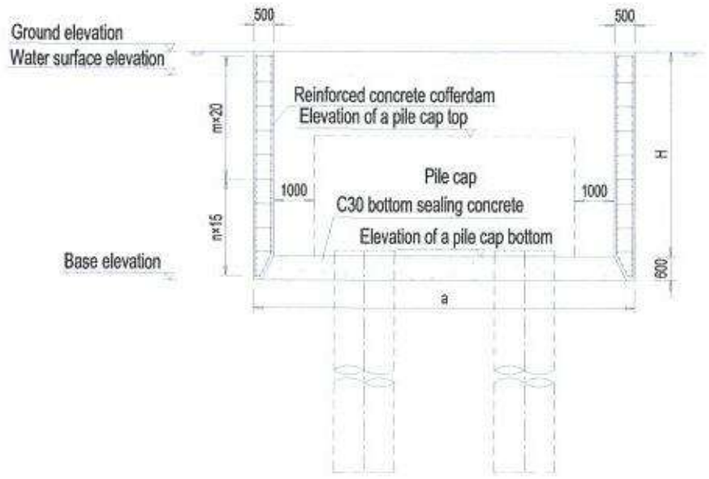
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1：800
		Guiding Construction Step Drawing for a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	Ⅱ-31
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

Contents in a construction stage	Schematic Diagram of a Construction Procedure (only for a cast-in-place girder with three spans in one tie)
1. The cantilever casting construction basket is symmetrically moved, the lower section construction formwork is symmetrically installed, the rebars are tied, concrete is poured, the longitudinal and transverse prestressed steel bundles and vertical prestressed rebars of each section are tensioned. 2. The construction bracket for the edge span cast-in-place section is installed timely, the bracket is preloaded, the construction template for the edge span cast-in-place section is installed, the rebars are tied, concrete is poured, and the transverse prestressed steel stranded wires and vertical prestressed rebars of the edge span cast-in-place section are tensioned. 3. The construction basket for cantilever pouring is dismantled. The side span closure hanger and closure section support are installed, and the temporary tendon is tensioned. 4. The construction formwork for the side span closure section is installed, the rebars are tied, concrete is poured, and the longitudinal prestressed closure tendons, transverse prestressed tendons, and vertical prestressed rebars of the side span are tensioned. 5. The hanger of the side span closure section is dismantled.	
1. The construction bracket of the side span cast-in-place section is dismantled. 2. Temporary supports next to the central pier is dismantled. 3. Middle span closure hangers and supports at the closure section are installed, temporary tendons are tensioned, construction templates are installed, rebars are tied, middle span closure section concrete is poured, and longitudinal prestressed closure tendons, transverse prestressed tendons, and vertical prestressed rebars in the middle span are tensioned.	
1. The middle span closure hanger is dismantled. 2. The temporary consolidation measures for the main pier support is removed and the conversion of the entire bridge system is completed. 3. Pavement of bridge deck and related ancillary works are carried out. 4. A bridge is completed. 5. Construction protective frames, relevant traffic warnings and speed limit signs are removed, and ground traffic is dismantled.	

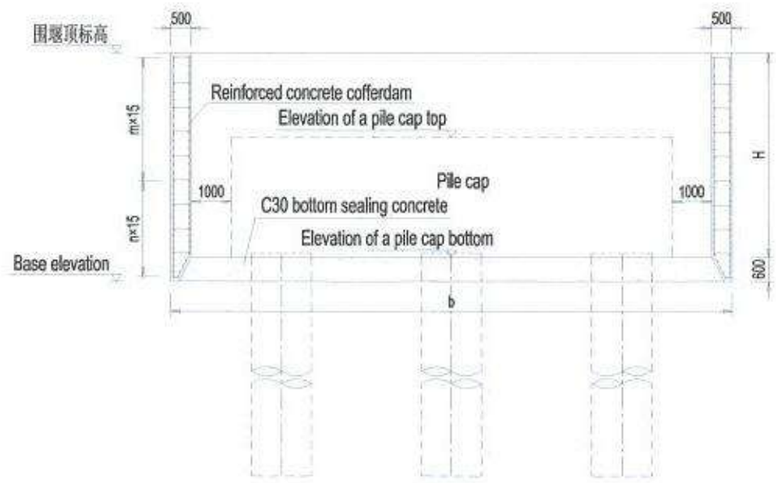
Notes:

1. This drawing only takes three spans in one tie as an example. Please refer to this drawing for the construction sequence of other ties.
2. This drawing is applicable to the construction for cantilever pouring of a cast-in-place box girder.

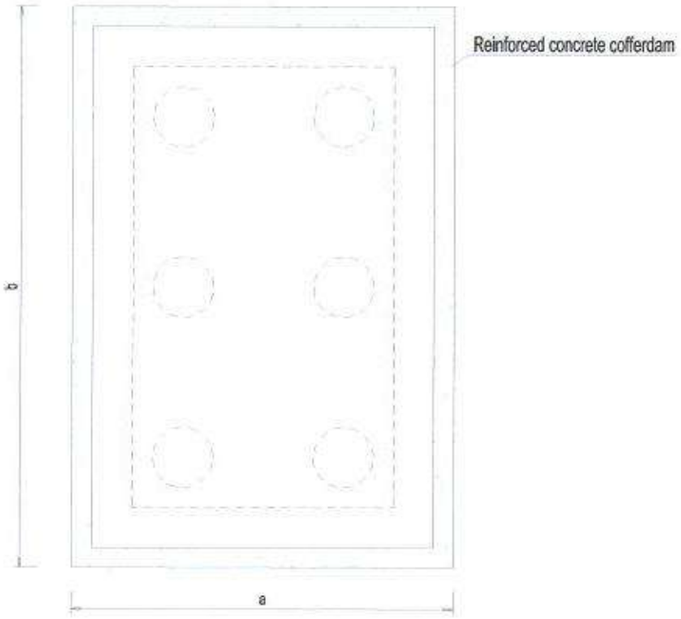
Reinforced concrete cofferdam facade 1:150



Reinforced concrete cofferdam side 1:150



Reinforced concrete cofferdam plan 1:150



Notes:

1. All dimensions in this drawing are measured in mm, except for the elevation which is measured in m.
2. This drawing is applicable for construction in areas where the bridge location is in deep water and there is abundant groundwater. The pile cap is constructed with the method of sinking a reinforced concrete cofferdam.
3. The plane size inside the cofferdam is 100 cm larger than the plane size of the pile cap; the elevation of the cofferdam top is controlled to be 0.3 m higher than the water surface; the elevation of the cofferdam bottom is 0.6 m lower than the pile cap bottom, and the cofferdam thickness is 0.5 m.
4. The cofferdam is constructed while excavating the foundation pit for sinking. The cofferdam is constructed in sections, with the first pouring of 2.0 m and the second pouring determined according to the actual situations on site.
5. Construction sequence: Island construction → site leveling → rebar binding, formwork installation, and concrete pouring for the first section of cofferdam → excavation of a foundation pit → first section of cofferdam sinking → rebar binding, formwork installation, and concrete pouring for the next section of cofferdam → excavation of a foundation pit → cofferdam sinking → pumping → pouring of sealing concrete → construction of a pile cap.

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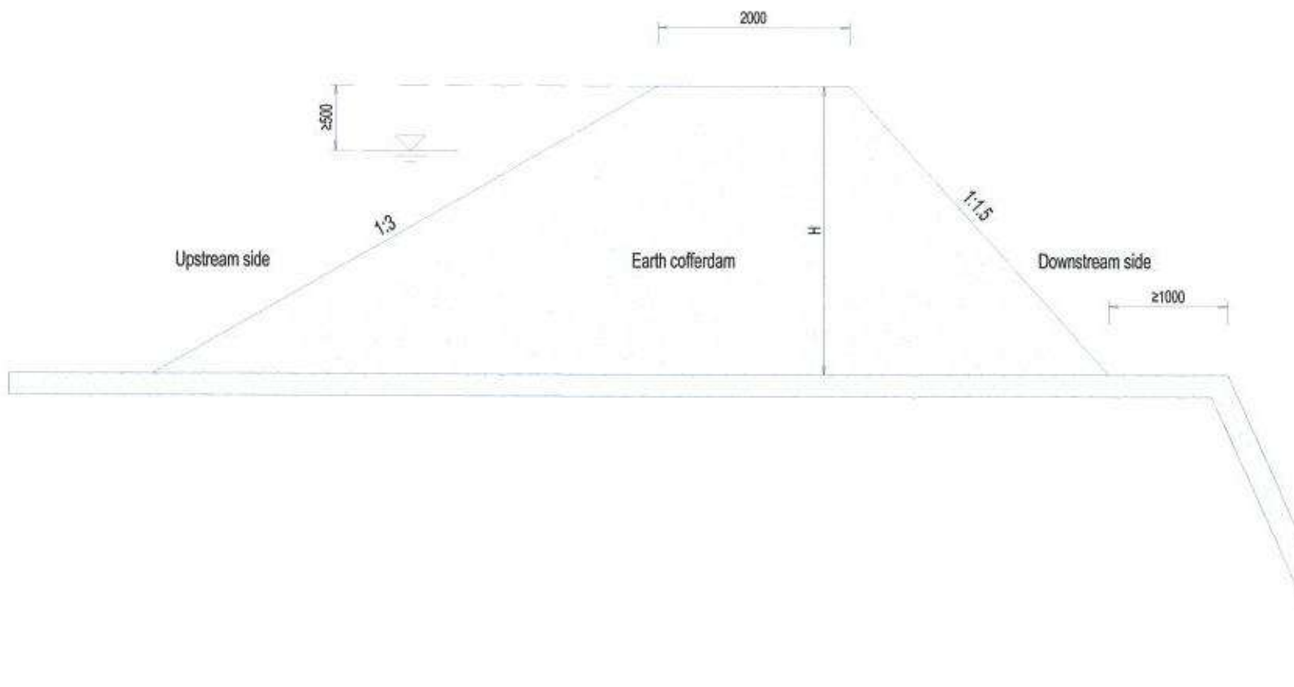
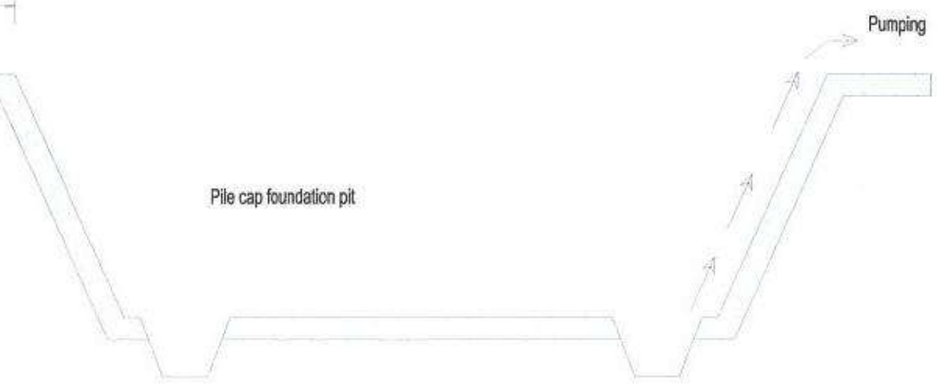
		Schematic Diagram of Underwater Foundation Construction				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	Ⅱ-32
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

Schematic Section Diagram of a Earth Cofferdam 1:50





Notes:

1. All dimensions in this drawing are measured in mm, except for the elevation which is measured in m.
2. This drawing is applicable for construction in areas where the bridge location is in shallow water and there is little groundwater. The pile cap is enclosed by an earth-rock cofferdam, and the construction method is open-cut pumping.
3. The materials for building the cofferdam are preferred to be cohesive earth, silty clay or sand mixed with clay. Tamping is to be carried out after it is filled higher than the water surface. Earth is to be filled from upstream to downstream for closure.
4. Before construction of the cofferdam, all debris, stones, and tree roots from the riverbed below the cofferdam is to be removed. The cofferdam is required to be waterproof and tight to reduce leakage.
5. When there is a risk of erosion on the outer slope of the cofferdam body, anti-erosion facilities are to be installed on the outer slope.
6. Construction process of the cofferdam: Earth cofferdam layout → island construction → slope protection of an upstream cofferdam → filling the cofferdam to the designed elevation → foundation construction inside the cofferdam.

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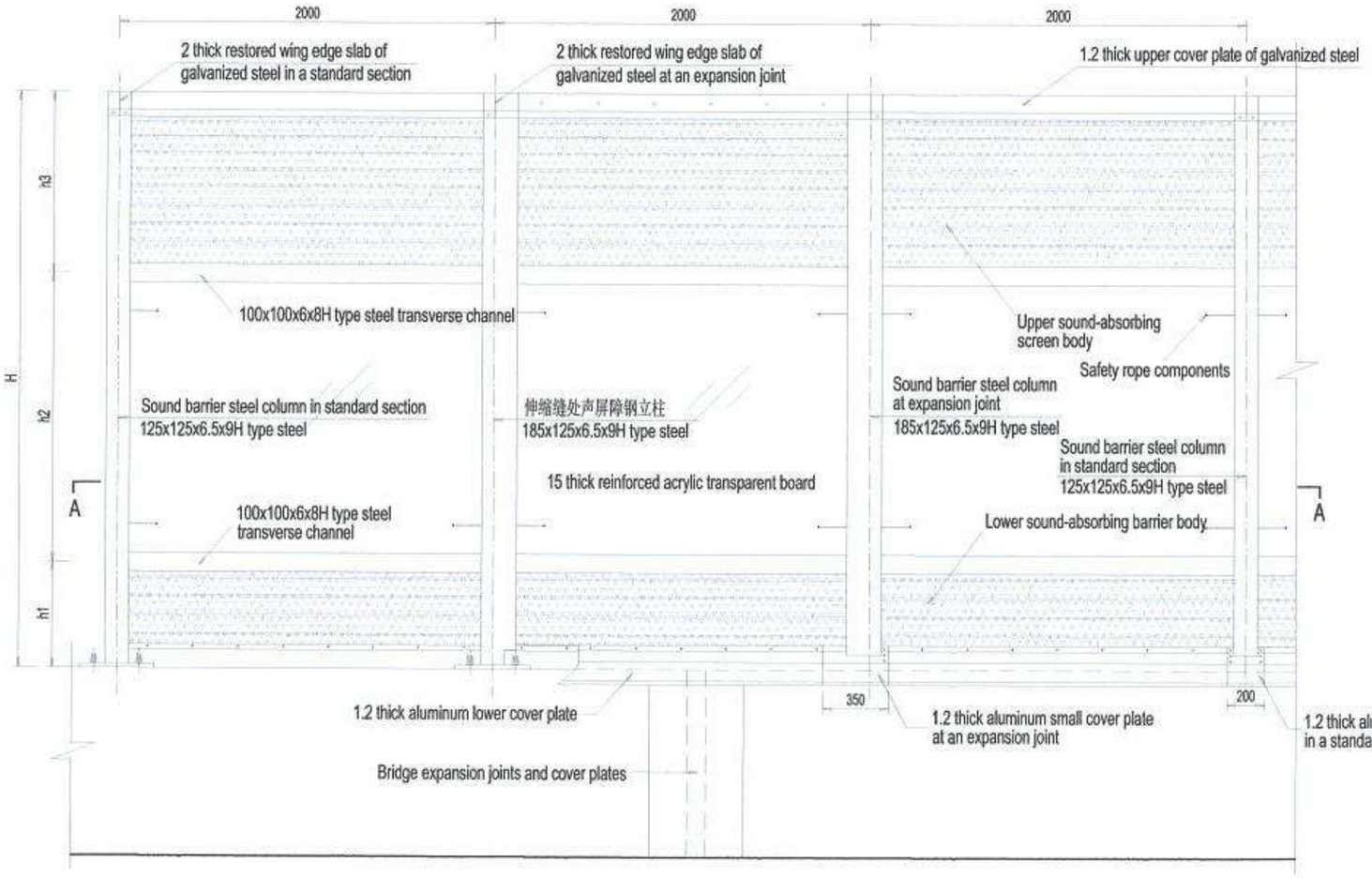
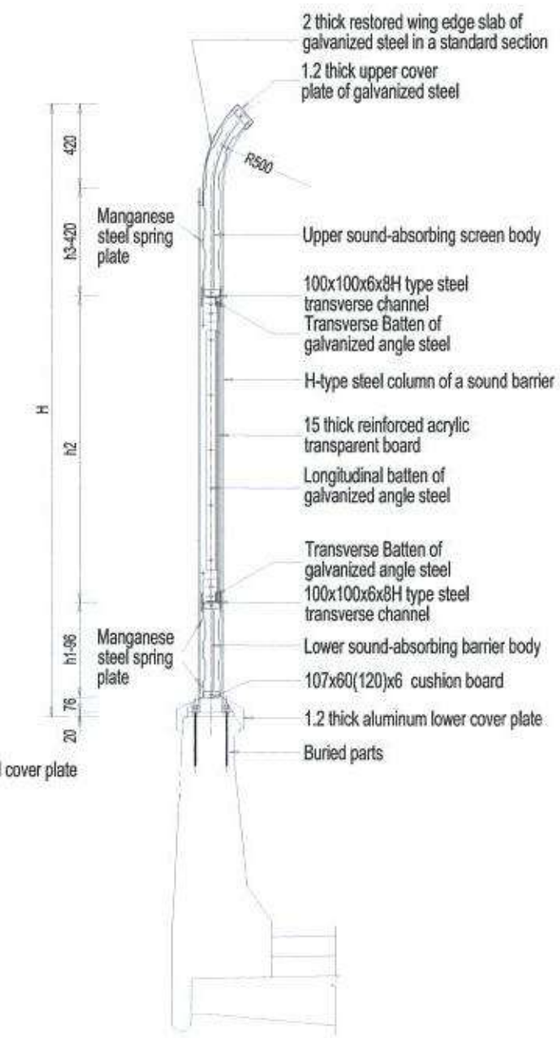
		Schematic Diagram of Underwater Foundation Construction				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-32
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

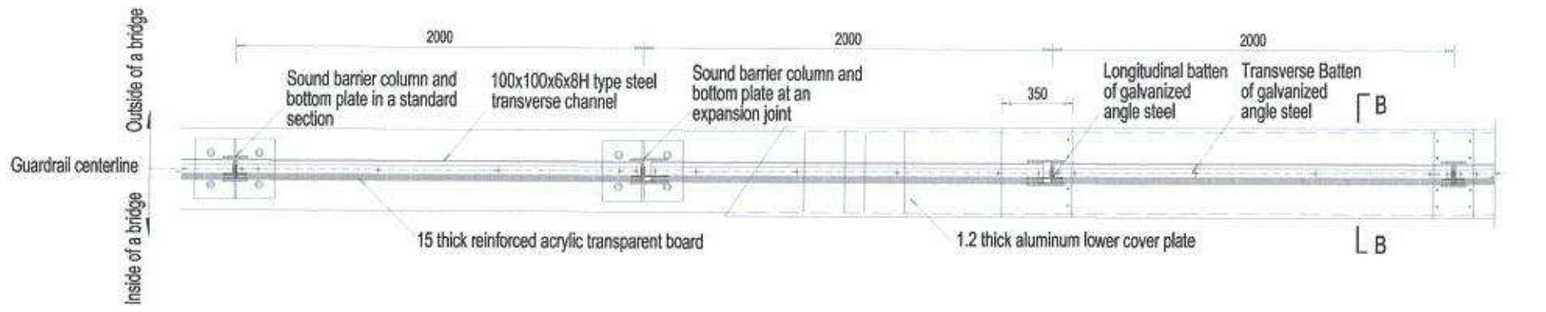
Elevation of a Sound Barrier 1:300



Section B-B 1:300



Section A-A 1:300



Notes:

1. All dimensions in this drawing are measured in mm unless otherwise indicated.
2. The foundation of the concrete box girder sound barrier column consists of buried bolts.
3. The distance between the safety rope hole of a reinforced acrylic transparent board and the edge of the board is not to be less than 0.15 m.

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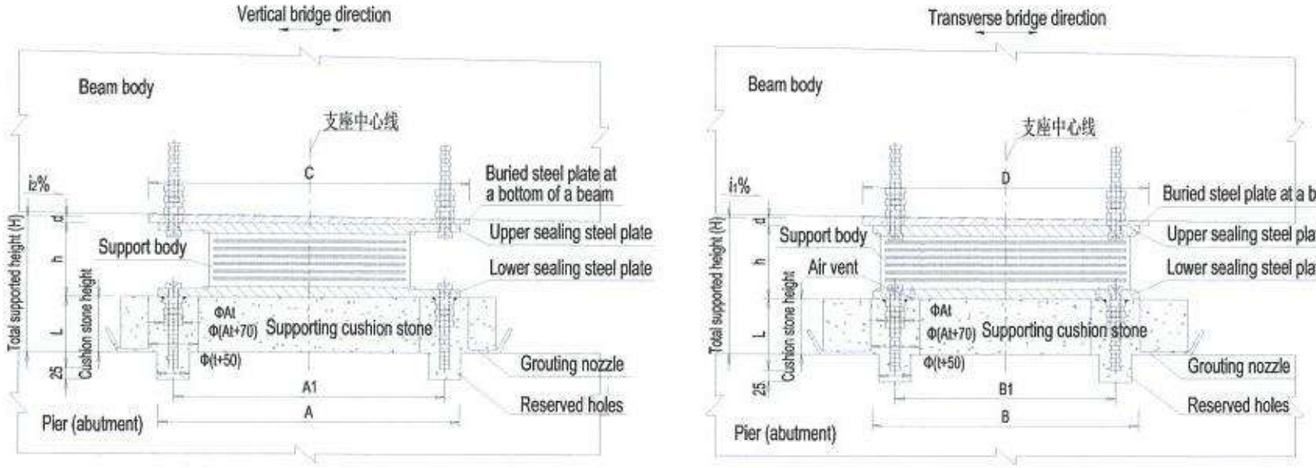
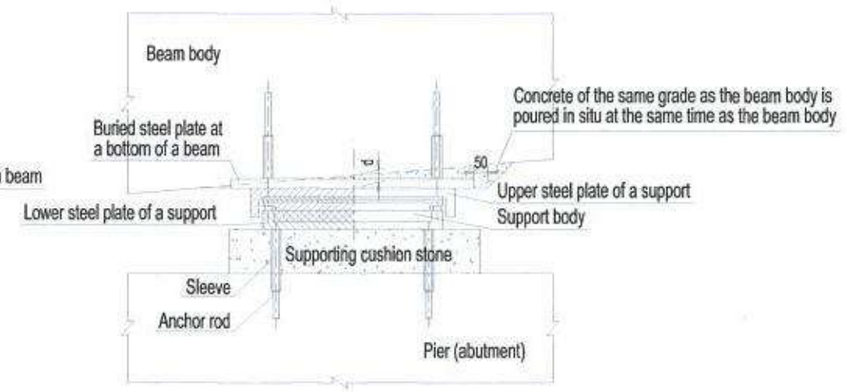
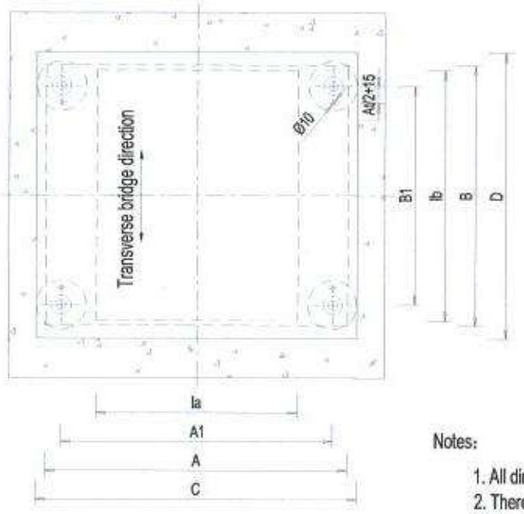
		General Construction Drawing of a Sound Barrier				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-33
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

Schematic Diagram of a Rectangular Fixed Rubber Support with a Dispersed Horizontal Force

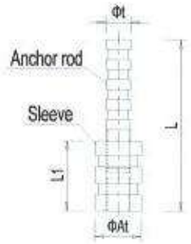


Schematic Diagram of a Shock-absorbing Basin-type Support



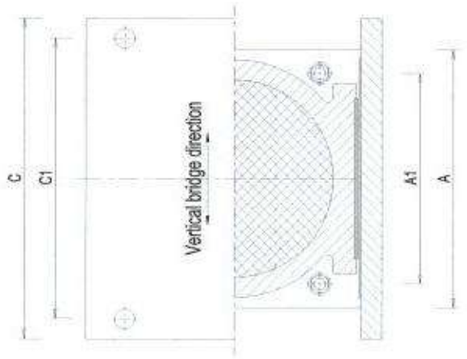


Upper and lower sleeves and anchor rods

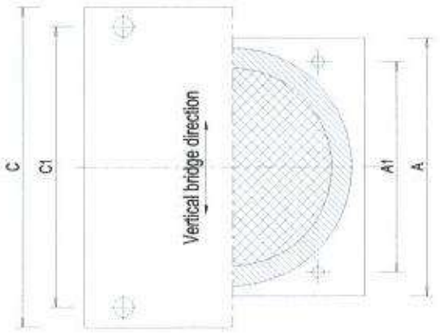


Anchorage bolts

DX (GD)-Schematic Diagram of a Shock-absorbing Basin-type Support



SX-Schematic Diagram of a Basin-type Support



Notes:

1. All dimensions in this drawing are measured in mm.
2. There is no slope for the top surface of the support, and the longitudinal and transverse slopes are adjusted by the upper pad on the bottom of the beam.
3. The total supported height includes the height of the cushion stone, the total height of the support and the thickness of the upper pad. The height of the cushion stone = the total supported height of the support H - the height of the support body - the thickness of the upper pad.
4. The support steel plate and corresponding buried parts are to be treated with anti-corrosion measures, such as galvanizing, and butter being applied before installation in the screw holes.
5. The installation process of the support is as follows:

1) Assembly is carried out in a factory, and leveling is done carefully;2) Reserved holes are pre-set on the support cushion stone on the basis of the drawing, debris is removed from the reserved holes, and it is to be guaranteed that the top surface of the support cushion stone is flat and smooth, with a height difference is no more than 2 mm at four corners;3) The surface flatness of the upper buried steel plate dose not exceed one thousandth of the maximum size, and it is to be guaranteed that the bottom surface of the upper buried steel plate is horizontal during installation;4) A layer of epoxy resin mortar is applied on the top surface of the cushion stone, the support is connected to the upper buried component, and they are installed on the top surface of the cushion stone;5)After the position, direction and elevation of the support are carefully checked, non shrink high-strength epoxy resin mortar (or other anchoring materials) is used for grouting. The mortar is filled up and overflows from the top surface to ensure that the grouting is dense, and verification is carried out through experiments;6) After the epoxy resin mortar reaches the designed strength, the anchoring bolts are tightened to complete the installation of the support body;7) The leveling steel plate at the bottom of the beam and the upper steel plate of the support are bonded with epoxy resin.

6. This drawing is applicable to a rectangular fixed rubber support with a dispersed horizontal force and a shock-absorbing basin-type support.

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		Schematic Diagram of a Support Structure				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-34
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

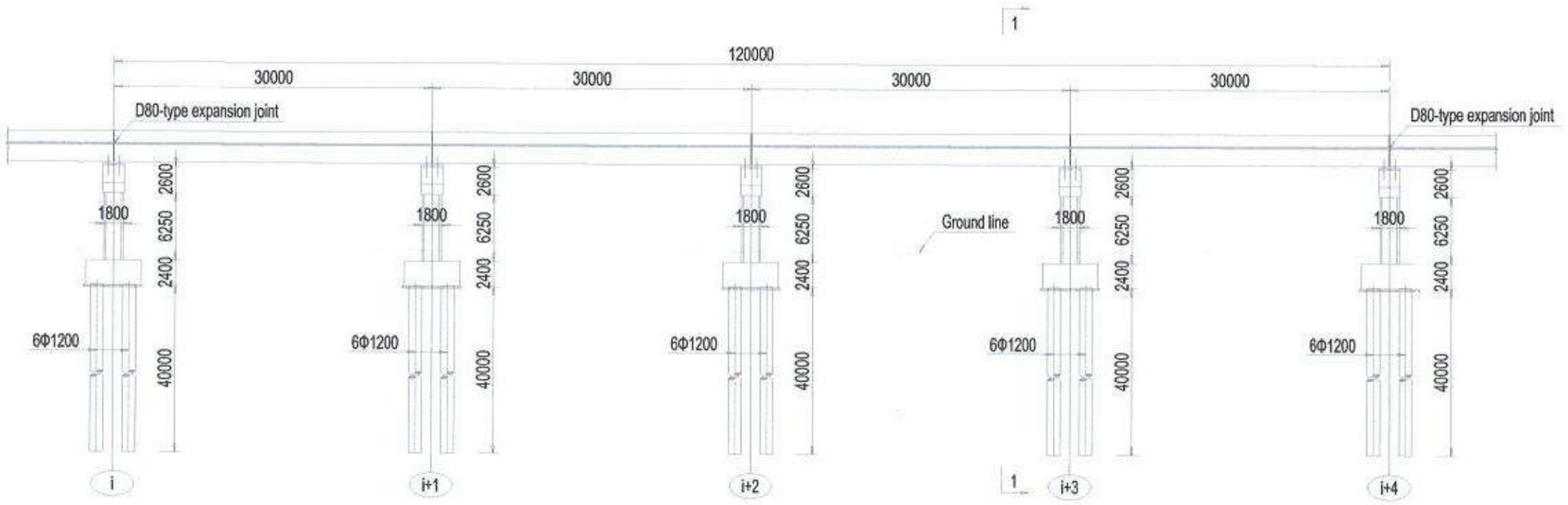
Material Quantity Table for 4×30 m Small Box Girder Engineering of a Standard Section

Material \ Item		Unit	Upper structure		Lower structure				Ancillary structure					Total
			Prefabricated part	Cast-in-place part	Bent cap	Pier column	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Acoustic pipe	
C50 concrete		m^3	1383.7	185.6	435.2						1.4			2005.9
C50 steel fiber concrete		m^3										5.8		5.8
C40 concrete		m^3				181.4			298.6					480.0
C35 concrete		m^3					409.3			182.4				591.7
C30 concrete		m^3						1085.7						1085.7
C15 concrete		m^3					38.5							38.5
Asphalt concrete		m^3							298.6					298.6
Polyurethane waterproof coating for roads and bridges		m^2							2985.6					2985.6
Φ^s15.2 steel stranded wire		kg	70694.4		27833.1									98527.5
Steel	Q235C	kg			1337.6									1337.6
Ordinary rebar	HRB400	kg	277573.0	31634.8	94786.6	36923.0	34794.2	81430.1	36842.3	35712.0	720.0	1864.4		623663.4
	HPB300	kg					4093.4	16286.0						20379.5
Anchorage Device	YM15-5	Set	368.0											368.0
	YM15-6		352.0											352.0
	YJM15-17				48.0									48.0
	YJM15-19				48.0									48.0
Metal corrugated pipe	D_{Within}=55mm	m	5464.0											5464.0
	D_{Within}=70mm		5228.0											5228.0
	D_{Within}=90mm				593.6									593.6
	D_{Within}=102mm				593.2									593.2
Acoustic pipe	SCG57×2.0QY	kg											6146.3	6146.3
Support	LNR-370×470×147	pcs									72.0			72.0
Expansion joint	D80-type expansion joint	m										38.5		38.5

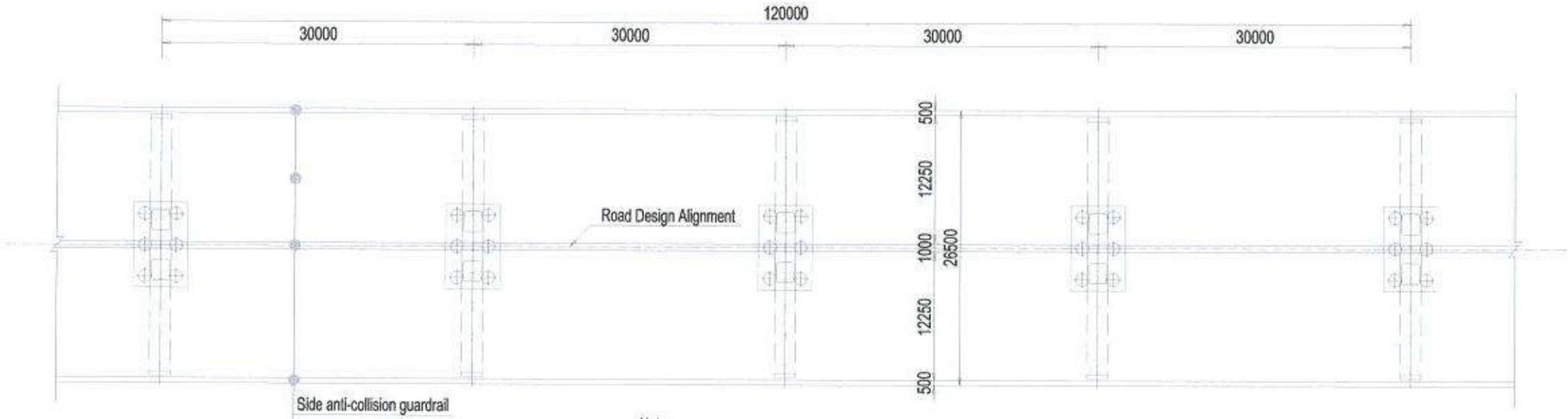
Notes:

1、This drawing shows a bill of quantities for main engineering for a 120 m bridge length, with prefabricated small box girders for the upper structure and double-column rectangular piers with large cantilever bent caps + cap pile foundations for the lower structure.

Elevation for Bridge-type Layout of a 4×30 m Small Box Girder 1:500



Bridge-type Layout Plan of a 4×30 m Small Box Girder 1:500



Notes:

1、All dimensions in this drawing are measured in mm.

2、This drawing is used for scheme comparison and selection. A single bridge length is selected as the benchmark, and the span is arranged as 4×30 m. The upper structural form is of a prestressed concrete small box girder with simple support followed by a continuous bridge deck, and the lower structural form is of a double-column rectangular pier large cantilever bent cap + a cap pile foundation.

3、For the convenience of parameter comparison and selection, the initial fill height is proposed to be 10 m, and the pile length is proposed to be 40 m.

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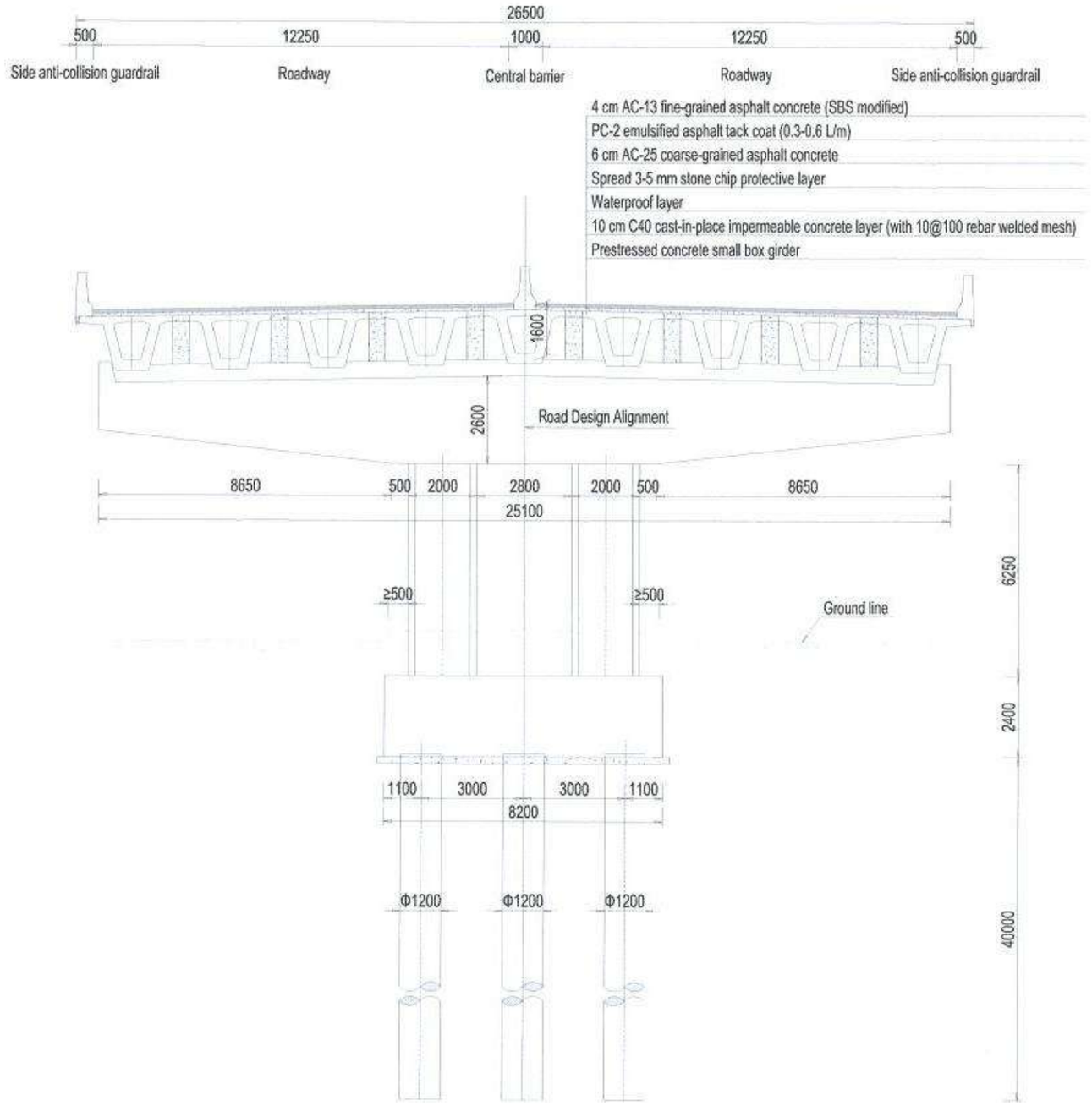
		Scheme I: Bridge-type Layout for a 4×30 m Small Box Girder of a Standard Section				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-36
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	ZHANG BO					DATE	2025.07

Cross Section of 1–1 1:150



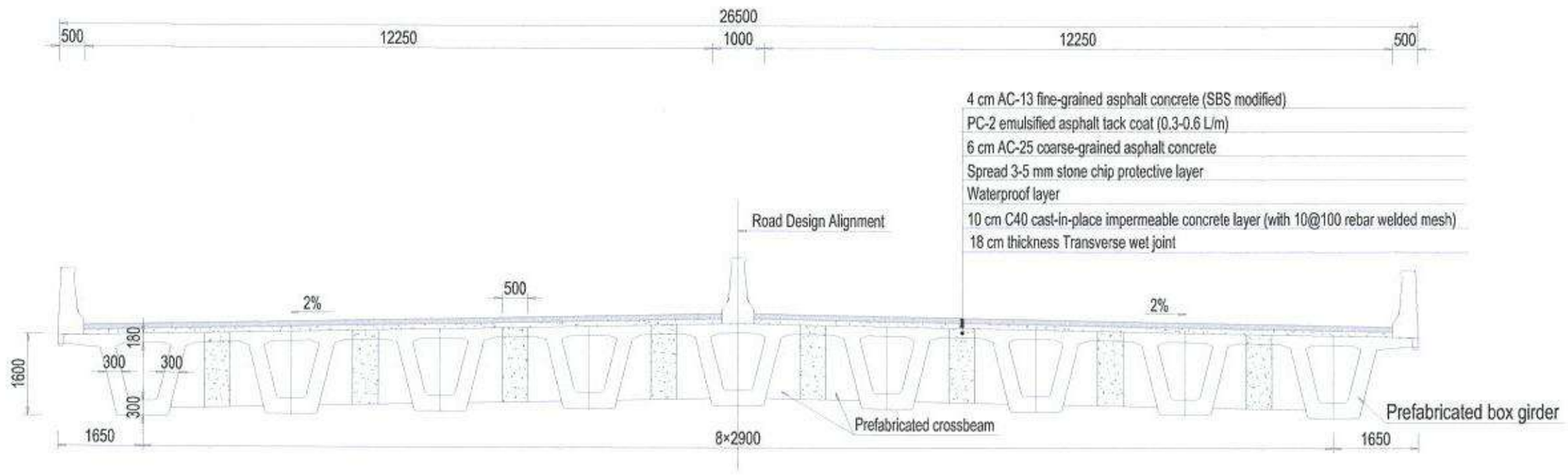
Notes:

1、All dimensions in this drawing are measured in mm.

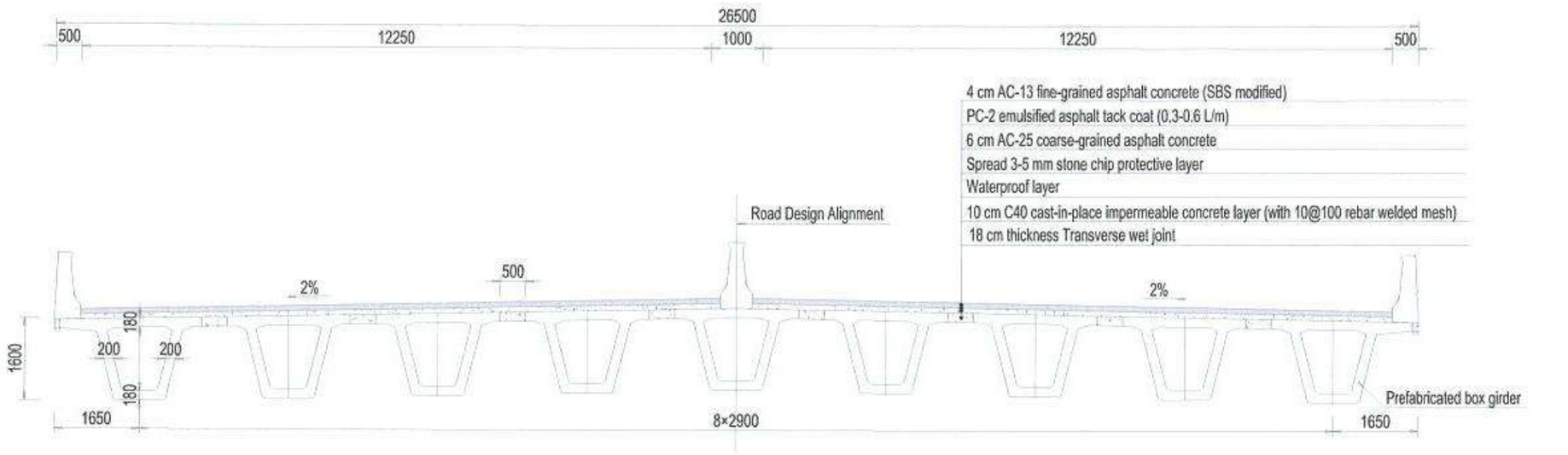
2、This drawing is used for scheme comparison and selection. The upper structural form is of a prestressed concrete small box girder with simple support followed by a continuous bridge deck, and the lower structural form is of a double-column rectangular pier large cantilever bent cap + a cap pile foundation.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 150
		Scheme I: Bridge-type Layout for a 4×30 m Small Box Girder of a Standard Section				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-36
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	ZHANG BO				

Cross Section of Pivot Support 1:100



Mid-Span Cross Section 1:100



Notes:

1、All dimensions in this drawing are measured in mm.

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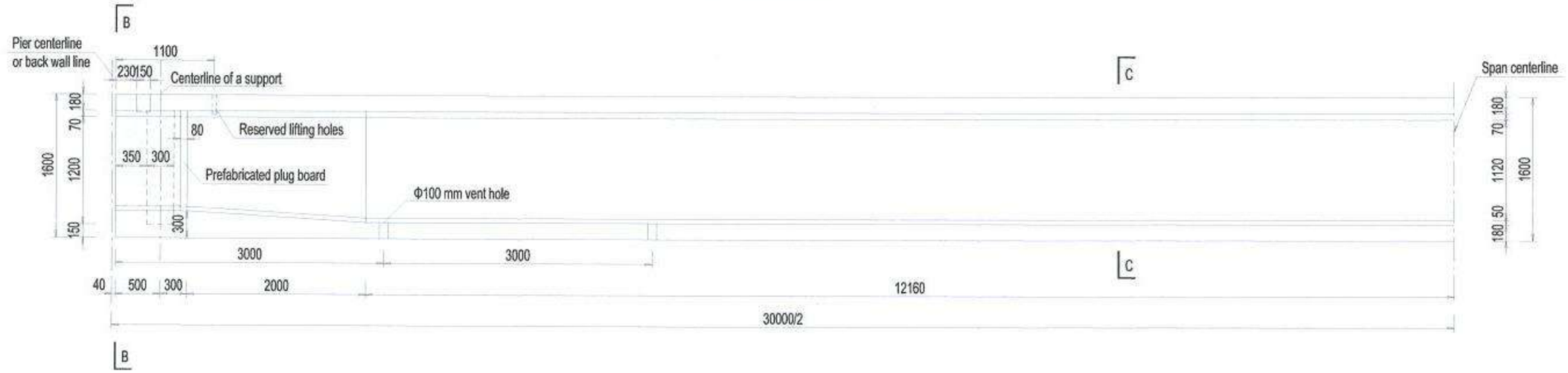
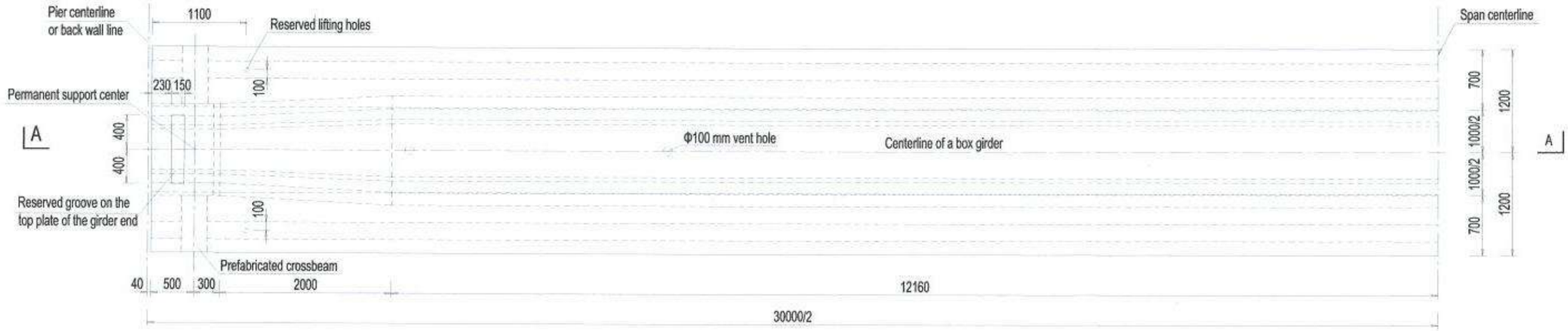
		Scheme I: Cross Section Layout of a 4×30 m Small Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-37
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

A-A (middle girder) 1:50



Plane (middle girder) 1:50



Notes:

1. All dimensions in this drawing are measured in mm.
2. This drawing only shows the half-span middle girder structure.
3. The dashed part at the girder end in the drawing will be poured simultaneously with anchor sealing after prestressed tensioning.
4. After the removal of the internal formwork of the box girder, concrete will be poured into the interior of the girder end through the reserved groove on the top plate of the girder end.

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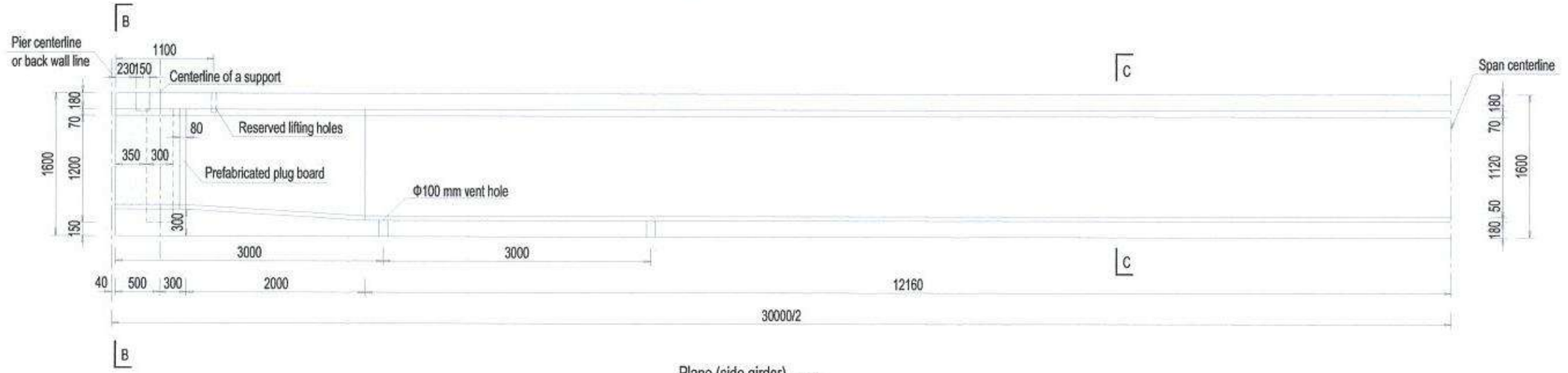
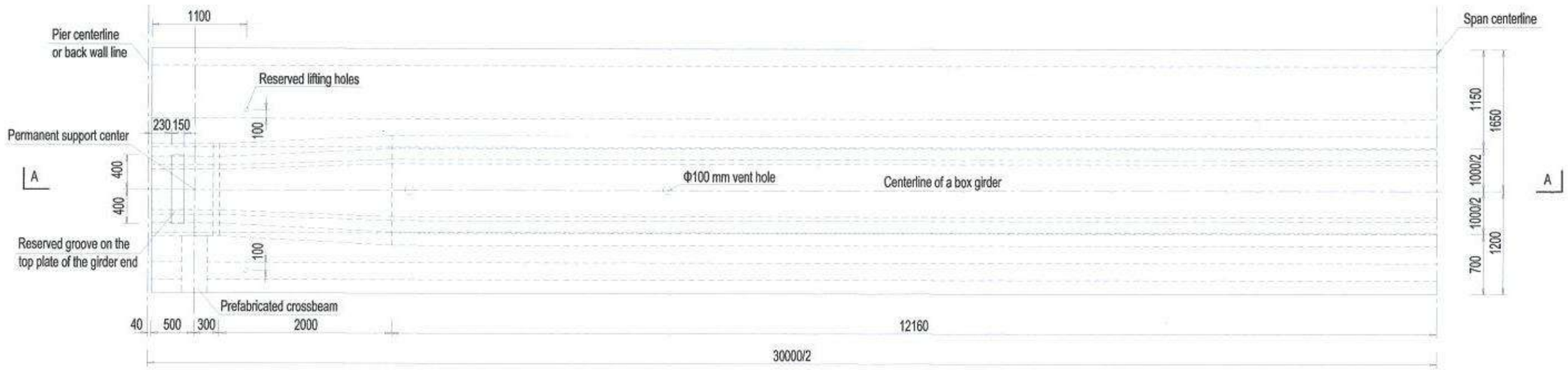
		Scheme I: General Construction Drawing of a Small Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-38
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

A-A (side girder) 1:50



Plane (side girder) 1:50

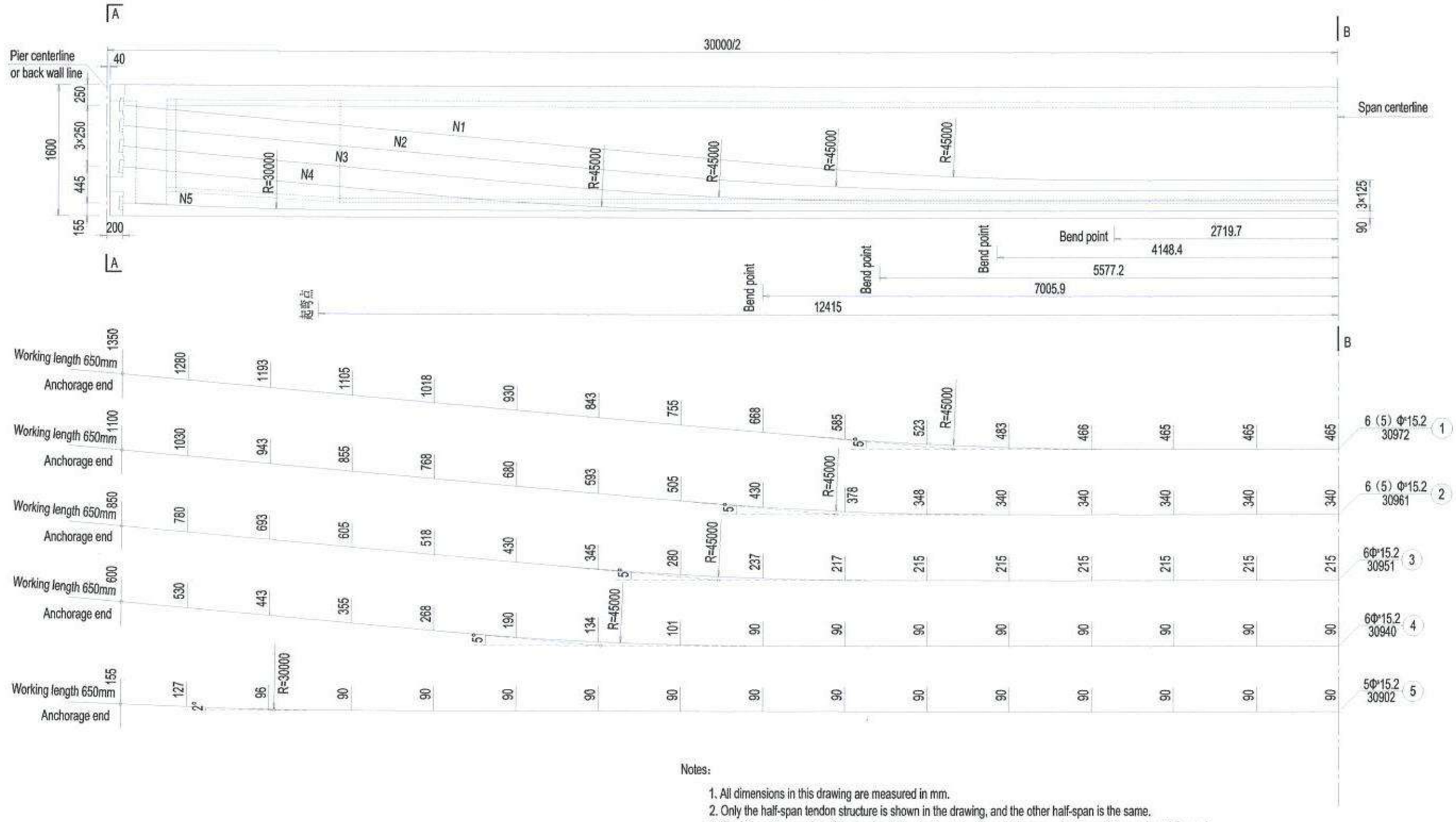


Notes:

1. All dimensions in this drawing are measured in mm.
2. This drawing only shows the half-span side girder structure.
3. The dashed part at the girder end in the drawing will be poured simultaneously with anchor sealing after prestressed tensioning.
4. After the removal of the internal formwork of the box girder, concrete will be poured into the interior of the girder end through the reserved groove on the top plate of the girder end.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 50
		Scheme I: General Construction Drawing of a Small Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-38
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

Tendon structure (half-span) 1:50



Notes:

1. All dimensions in this drawing are measured in mm.
2. Only the half-span tendon structure is shown in the drawing, and the other half-span is the same.
3. The X-coordinate value of the tendon in the drawing takes the middle span of the box girder as the origin, and the vertical Y coordinate is the distance from the center of the tendon to the bottom of the girder. The value in the detailed drawing is the Y-coordinate value of the tendon corresponding to every 1 m of the X coordinate, until the anchorage surface of the tendon.

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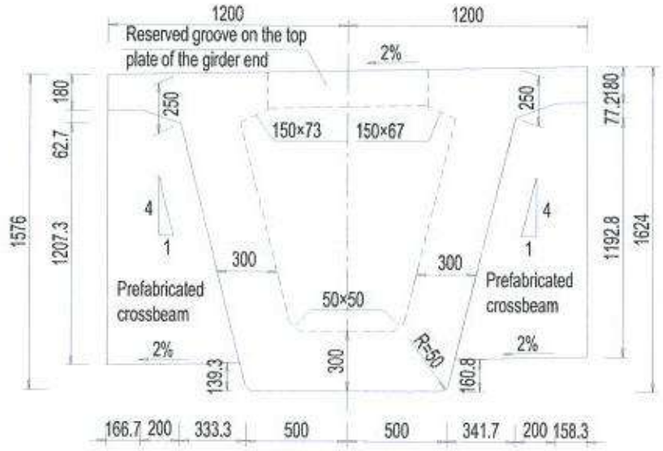
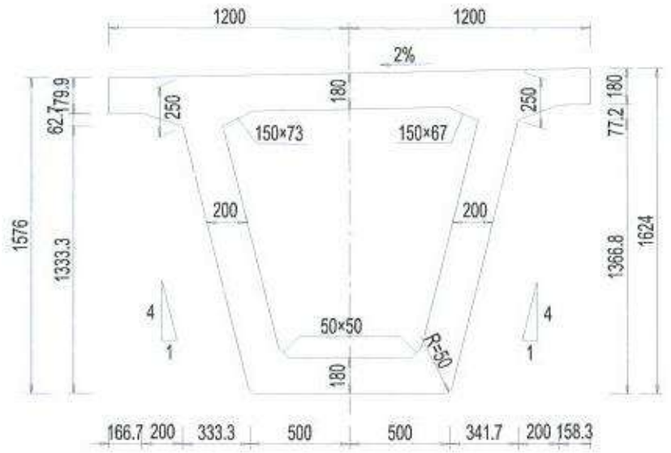
		Scheme I: Construction Drawing of a Prestressed Tendon for a Small Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-39
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	ZHANG BO			DATE	2025.07

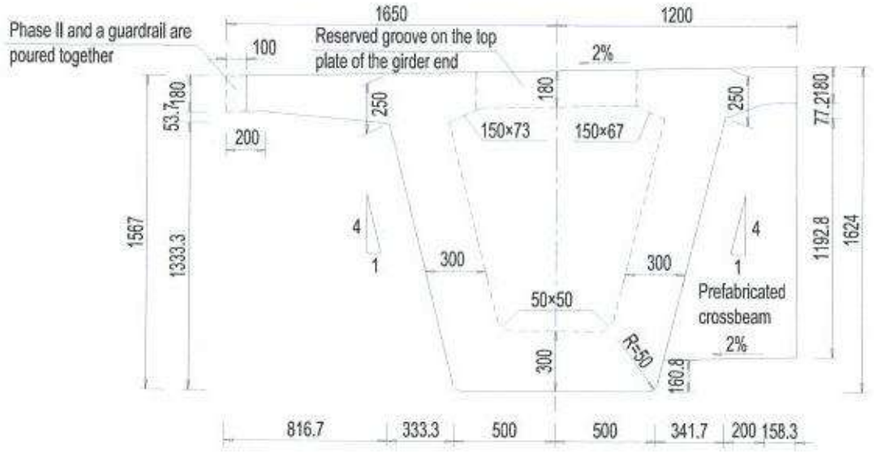
B-B (middle girder) 1:30



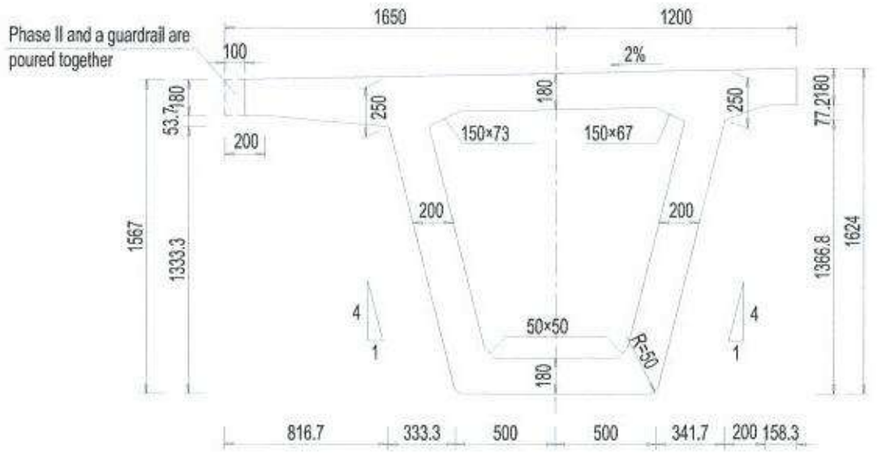
C-C (middle girder) 1:30



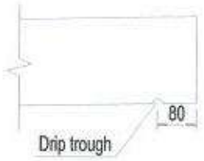
B-B (side girder) 1:30



C-C (side girder) 1:30



Detailed Drawing of a Drip Trough 1:12.5



Notes:

1. All dimensions in this drawing are measured in mm.
2. The dashed part at the wing edge end in the drawing is poured together with the guardrail.
3. The drip trough can be formed using wooden strips with a depth of 10 mm.

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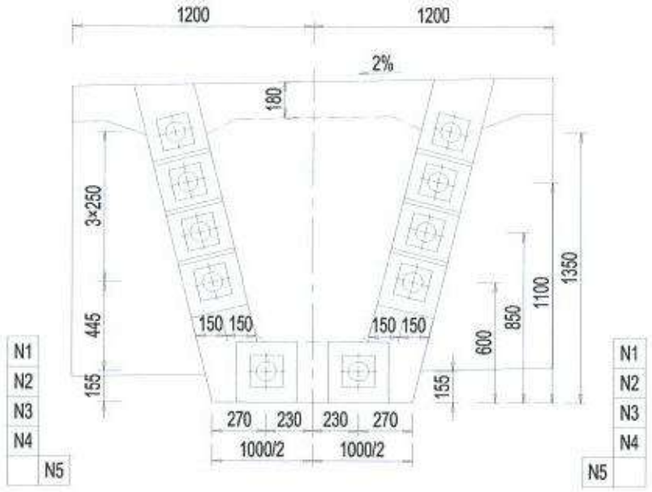
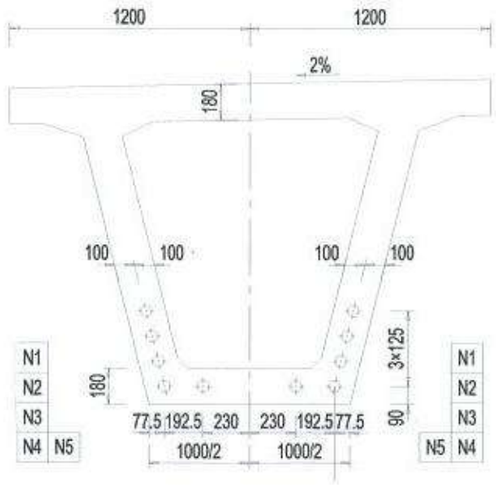
		Scheme I: General Construction Drawing of a Small Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-38
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

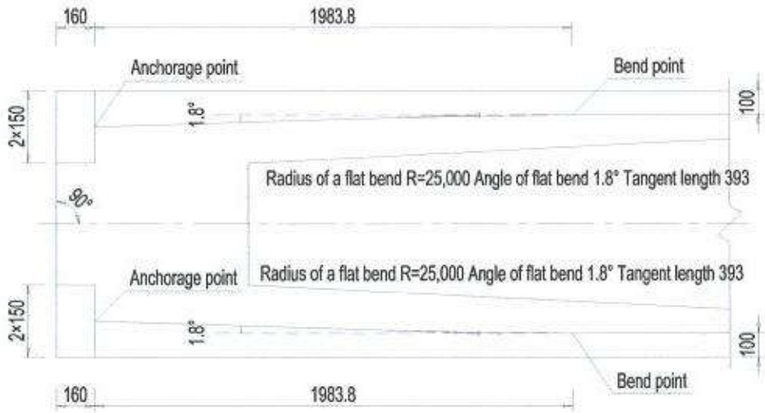
A-A (middle girder) 1:30



B-B (middle girder) 1:30



Detailed Drawing for N1, N2, N3 and N4 Flat Dends 1:25



Quantity Table of Steel Stranded Wires for a Prefabricated Box Girder

No.	Specification (mm)	Length (mm)	Number of tendons	Total length (m)	Total weight (kg)	Total (kg)	Anchorage Device (Set)	Metal corrugated pipe (m)	Extension amount (at both ends) (mm)
N1	Φ^{s}15.2-6 (5)	30972	2	61.9	408.9 (341.0)	1976 (1840)	YM15-5: 4 (12) YM15-6: 16 (8)	Φ_{Within}=55mm: 60 (178) Φ_{Within}=70mm: 237 (119)	208
N2	Φ^{s}15.2-6 (5)	30961	2	61.9	408.9 (340.9)				208
N3	Φ^{s}15.2-6	30951	2	61.9	408.9				208
N4	Φ^{s}15.2-6	30940	2	61.9	408.8				206
N5	Φ^{s}15.2-5	30902	2	61.8	340.2				208

Notes:

1. All dimensions in this drawing are measured in mm.
2. The prestressed tendon can only be tensioned when the concrete strength and elastic modulus reach 85% of the design values, and the concrete age is not less than 7d.
3. The tendon is tensioned symmetrically at both ends in the order of N1, N3, N2, N5, and N4.
4. The tendon tensioning is of dual-control. The controlled stress under the anchor is 0.75 fpk. For the controlled stress of prestressed tensioning outside the anchor, the friction loss between the tendon and the anchor ring mouth also needs to be considered.
5. Only the half-span tendon structure is shown in the drawing, and the other half-span is the same.
6. During installation of anchor pads, it is to be guaranteed that their anchoring surfaces are perpendicular to the tendon.
7. Values enclosed in parentheses in the drawing and the outside values are used for the middle girder and edge girder respectively, and the rest are shared.

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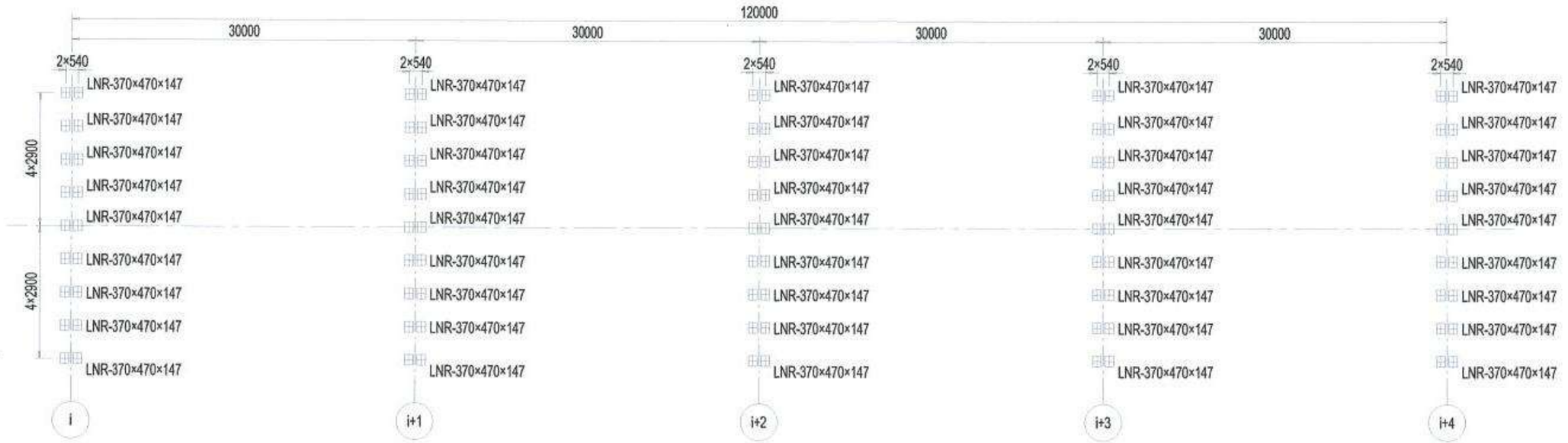
		Scheme I: Construction Drawing of a Prestressed Tendon for a Small Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-39
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

Schematic Layout diagram for a 4×30 m Small Box Girder of a Standard Section 1:400



Main parameters of a rectangular fixed rubber support with a dispersed horizontal force

Specification/model	Support body（mm）			Vertical bearing capacity P	Designed displacement	Designed horizontal force Q	Equivalent stiffness	Vertical designed stiffness Kv	Quantity per span unit
	la	lb	h	（kN）	（mm）	（kN）	（kN/mm）	（kN/mm）	
LNR-370×470×147	370	470	147	1814	80	235	1.96	794	72

Notes:

1、All dimensions in this drawing are measured in mm.
2、A prefabricated small box girder uses a rectangular fixed rubber support with a dispersed horizontal force (LNR-AB).
3、This drawing only shows the layout of a 4×30 m small box girder support.

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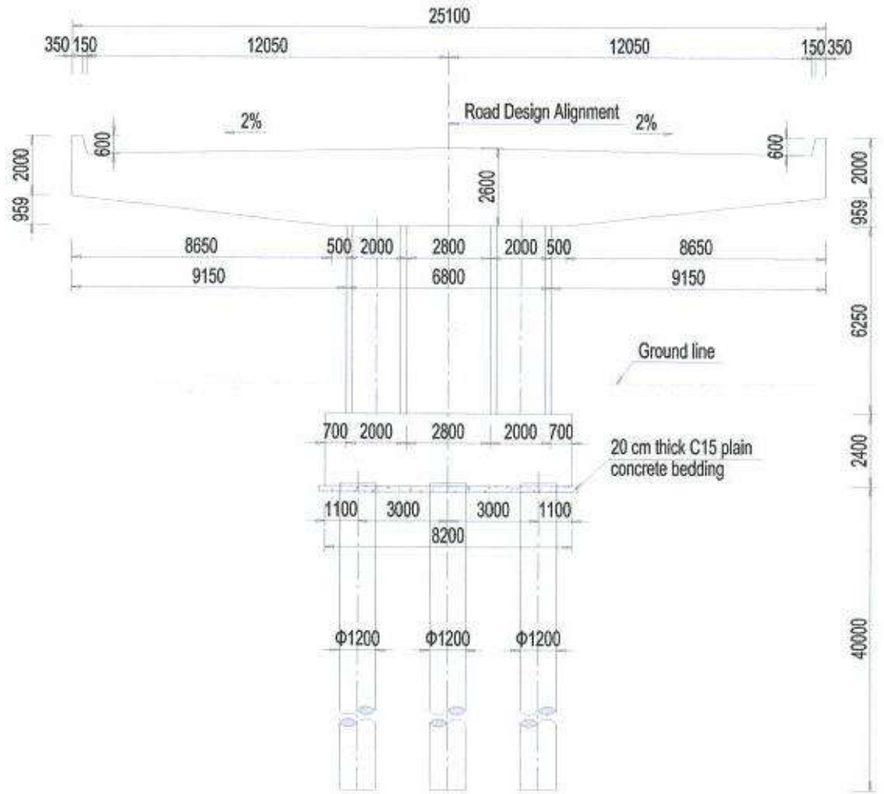
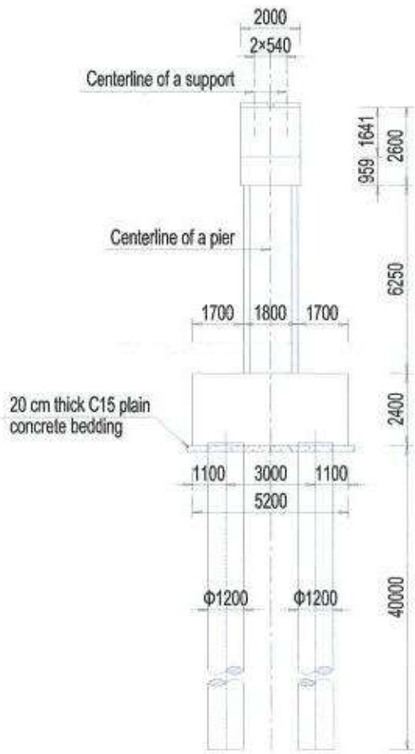
		Scheme I: Layout of a Small Box Girder Support				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-40
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

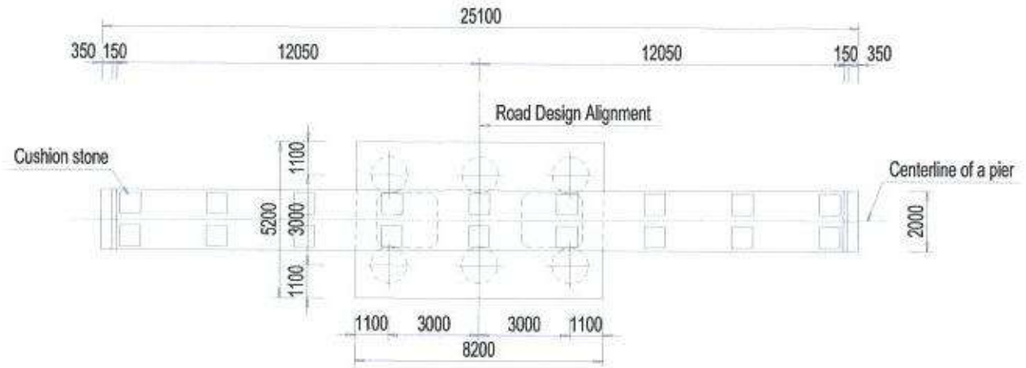
Facade 1:200
(a transverse bridge direction)



Facade 1:200
(a longitudinal bridge direction)



Plane 1:200

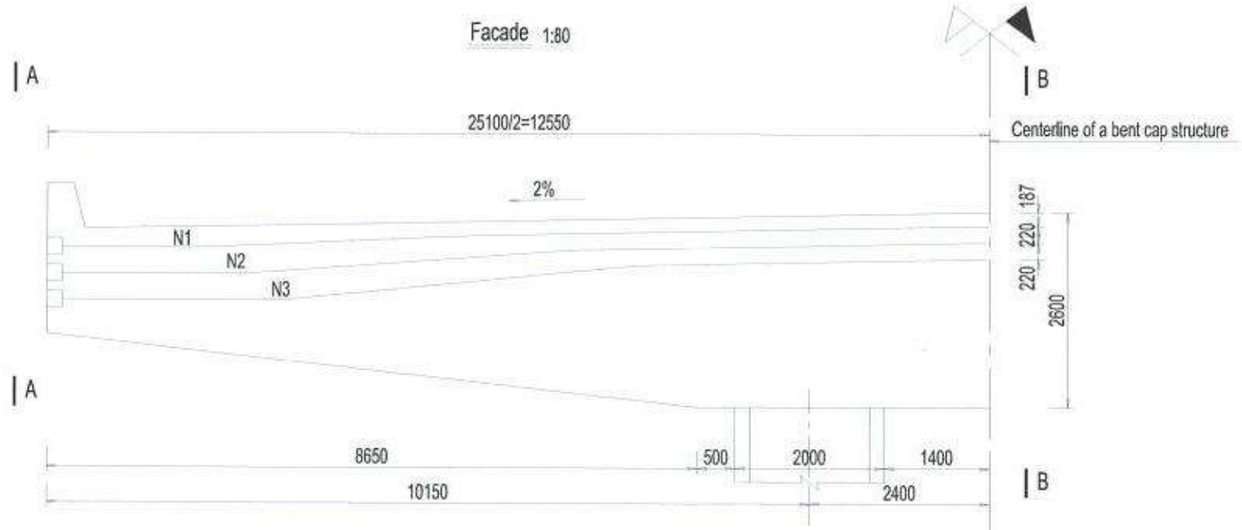


Notes:

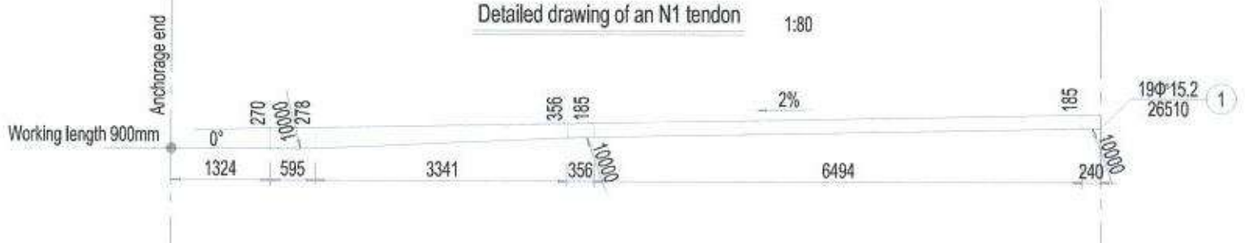
1. All dimensions in this drawing are measured in mm.
2. The pile length and pier height are both proposed values, which are convenient for scheme comparison and selection.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		Scheme I: General Construction Drawing for a Lower structure of a Small Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-41
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

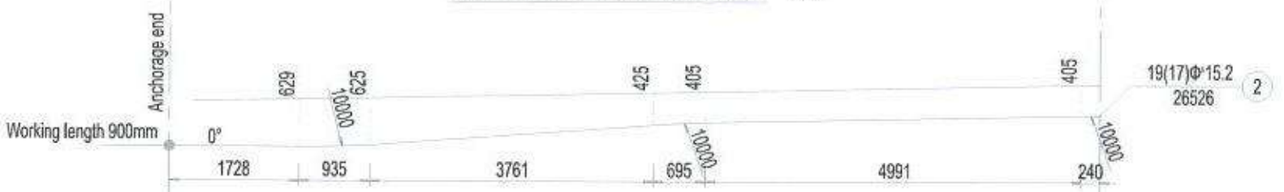
Facade 1:80



Detailed drawing of an N1 tendon 1:80

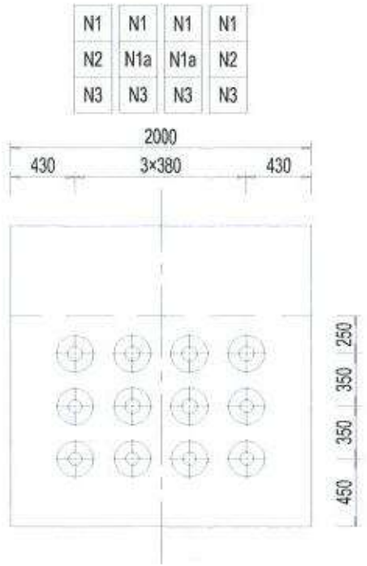


Detailed drawing of an N2 (N1a) tendon 1:80

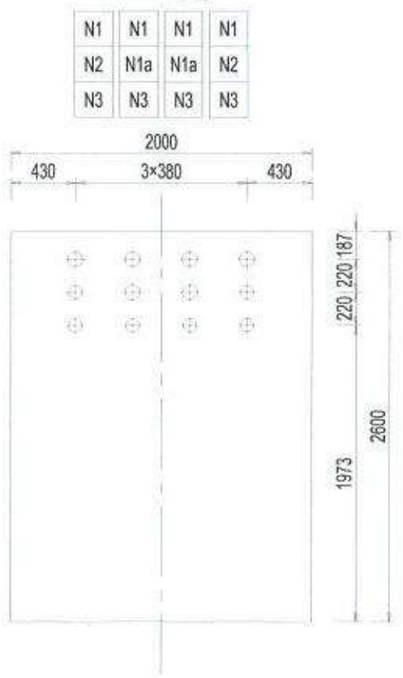


Detailed drawing of an N3 tendon 1:80

A--A 1:40



B--B 1:40



Notes:

1. All dimensions in this drawing are measured in mm.

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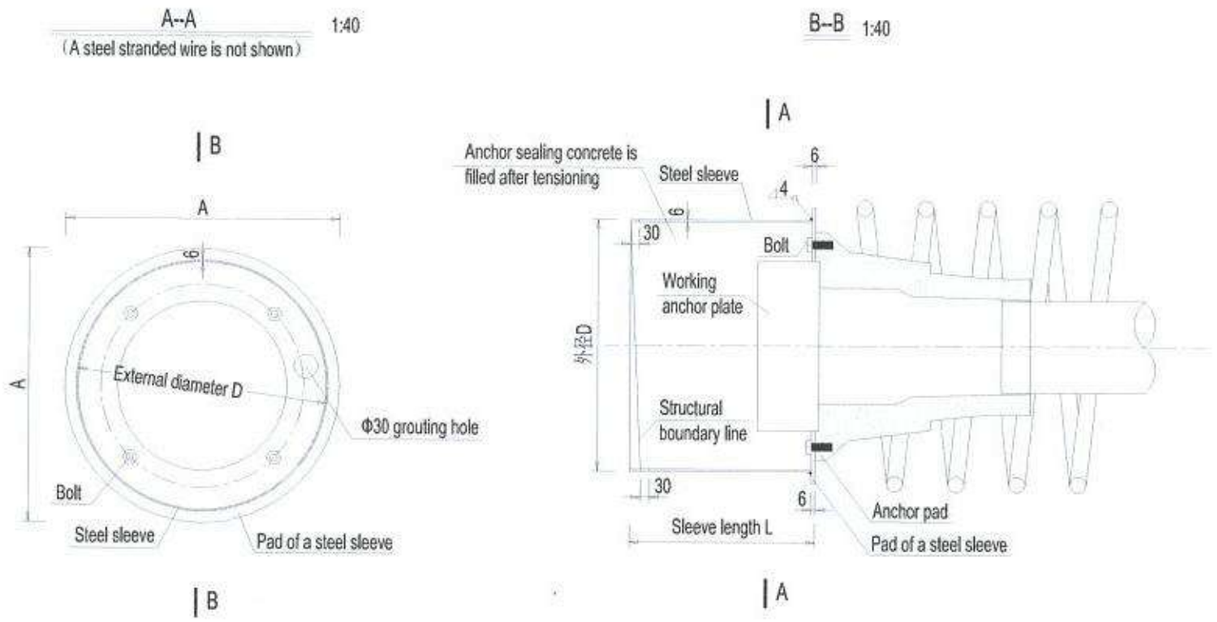
		Scheme I: General Construction Drawing of a Prestressed Rebars of a Bent Cap				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-42
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	ZHANG BO						

Construction of deep buried anchorages, sleeves and sleeve pads



Notes:

1. All dimensions in this drawing are measured in mm.
2. The prestressed steel stranded wire is of the prestressed 1×7 standard type-15.20-1860-GB/T 5224-2023, and the anchorage should be matched with it. Its technical conditions are to comply with standard regulations.
3. During prestressed tensioning, the concrete strength is less than 80% of the design strength, and the elastic modulus is less than 80% of the elastic modulus of the concrete after 28 d; a tensioning procedure: 0 → initial stress (0.1 σcon) → controlled stress (σcon) → holding load for 5 minutes → anchoring, where σcon is the tensioning controlled stress of the prestressed steel stranded wire under anchor; the tensioning is to be carried out symmetrically with dual controls, with stress control as the main focus and the extension amount as a reference.
4. The position and size of the anchor pad is required to be accurate, and the anchor pad is to be perpendicular to the prestressed pipe; after a prestressed tendon is tensioned, it is to be cut 3 cm away from the anchor head, and arc cutting is strictly prohibited.
5. The prestressed pipe is a metal corrugated pipe (parameters μ=0.20, k=0.0015). During arrangement of the prestressed pipe, the positioning rebars are to be arranged with a spacing of 0.8 m for straight sections and 0.5 m for curved sections.
6. The steel stranded wires for the bent cap shall be tensioned in two batches. After the bent cap is poured, 2 N1a, N2, and 4 N3 steel stranded wires are tensioned first. After the beam body is erected, the wet joint construction is completed, and before the bridge deck is paved and the railing is constructed, the second batch of 4 N1 steel stranded wires shall be tensioned. Tendons with the same number are tensioned simultaneously and symmetrically from the center to both sides.
7. The rebars of the bent cap cut due to sleeving are to be bent and then welded to the sleeve, with a single-sided welding of 10 d and a double-sided welding of 5 d (where d is the diameter of the rebar).

Parameter Table of Deep Buried Anchor Sleeves and Sleeve Pads

Tendon No.	Type of an anchorage	Parameter (mm)			Quantity (pcs)	Single piece weight (kg)	Total weight (kg)
		L	A	D			
N1	YJM15-19	200	310	247	8	14.39	115.1
N1a	YJM15-19	200	310	247	4	14.39	57.6
N2	YJM15-17	200	300	242	4	13.48	53.9
N3	YJM15-17	200	300	242	8	13.48	107.8
Total		Q235C: 334.44kg		M10×35 Bolt: 96 pcs			

Summary Table of Tendon Materials

No.	Specification	Length (mm)	Number of tendons	Total length (m)	Total weight (kg)	Extension amount at a tensioning end (mm)		Metal corrugated pipe (m)		Tensioning control force Mpa	Remarks
						Left end	Right end	Φ_{mm}=90mm	Φ_{mm}=102mm		
N1	Φ^{s}15.2-19	26510	4	106.04	2224.3	82	82		98.8	1302	Tensioning at both ends
N1a	Φ^{s}15.2-19	26526	2	53.052	1112.8	83	83		49.5	1302	Tensioning at both ends
N2	Φ^{s}15.2-17	26526	2	53.052	995.7	84	84	49.5		1302	Tensioning at both ends
N3	Φ^{s}15.2-17	26546	4	106.184	1992.9	84	84	99.0		1302	Tensioning at both ends
Total				318.3	6325.7			148.4	148.3		

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	Scheme I: General Construction Drawing of a Prestressed Rebars of a Bent Cap					MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-42
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	ZHANG BO			DATE	2025.07

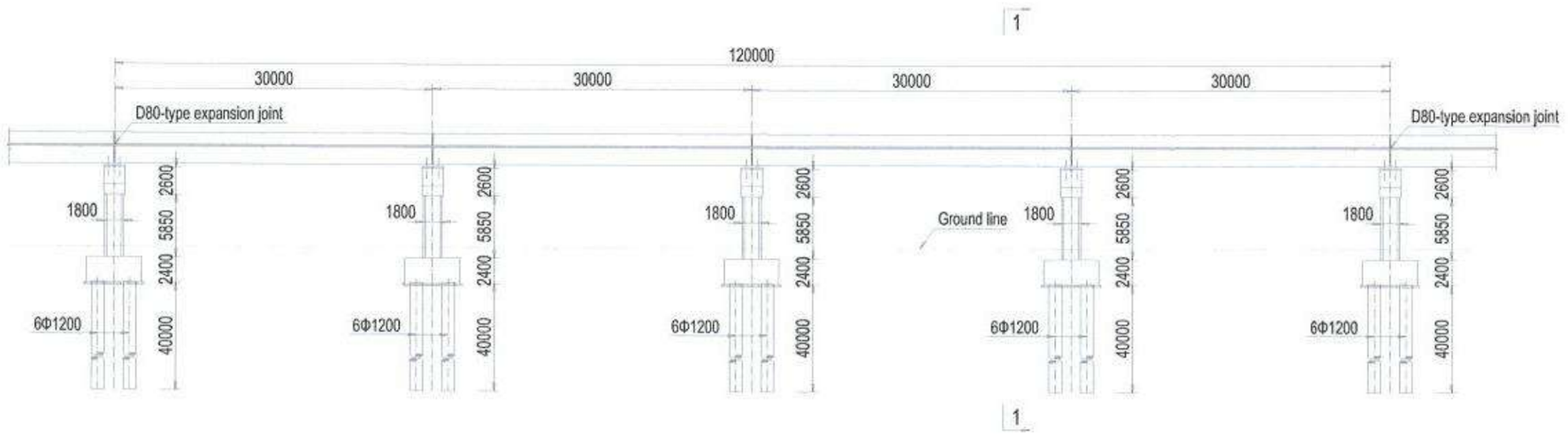
Material Quantity Table for 4×30 m T-girder Engineering of a Standard Section

Item / Material		Unit	Upper structure		Lower structure				Ancillary structure					Total
			Prefabricated part	Cast-in-place part	Bent cap	Pier column	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Acoustic pipe	
C50 concrete		m3	1424.2	205.9	503.4						0.3			2133.8
C50 steel fiber concrete		m3										5.8		5.8
C40 concrete		m3				187.2			298.6					485.8
C35 concrete		m3					409.3			182.4				591.7
C30 concrete		m3						1085.7						1085.7
C15 concrete		m3					38.5							38.5
Asphalt concrete		m3							298.6					298.6
Polyurethane waterproof coating for roads and bridges		m2							2985.6					2985.6
Φ15.2 steel stranded wire		kg	50542.8		36938.4									87481.2
Steel	Q235C	kg			1690.4									1690.4
Ordinary rebar	HRB400	kg	305890.4	44218.4	115736.2	38095.2	34794.2	81430.1	36842.3	35712.0	160.0	1864.4		694743.2
	HPB300	kg					4093.4	16286.0						20379.5
Anchorage Device	YM15-6	Set	248.0											248.0
	YM15-7		72.0											72.0
	YM15-8		104.0											104.0
	YM15-9		16.0											16.0
	YJM15-17				40.0									40.0
	YJM15-19				80.0									80.0
Metal corrugated pipe	D_{within} =70mm	m	4713.3											4713.3
	D_{within} =80mm		1767.9											1767.9
	D_{within} =90mm				514.8									514.8
	D_{within} =102mm				1028.8									1028.8
Acoustic pipe	SCG57×2.0QY	kg											6146.3	6146.3
Support	LNR-320×420×129	Pcs									72.0			72.0
	LNR-370×370×147	Pcs									16.0			16.0
Expansion joint	D80-type expansion joint	m										38.5		38.5

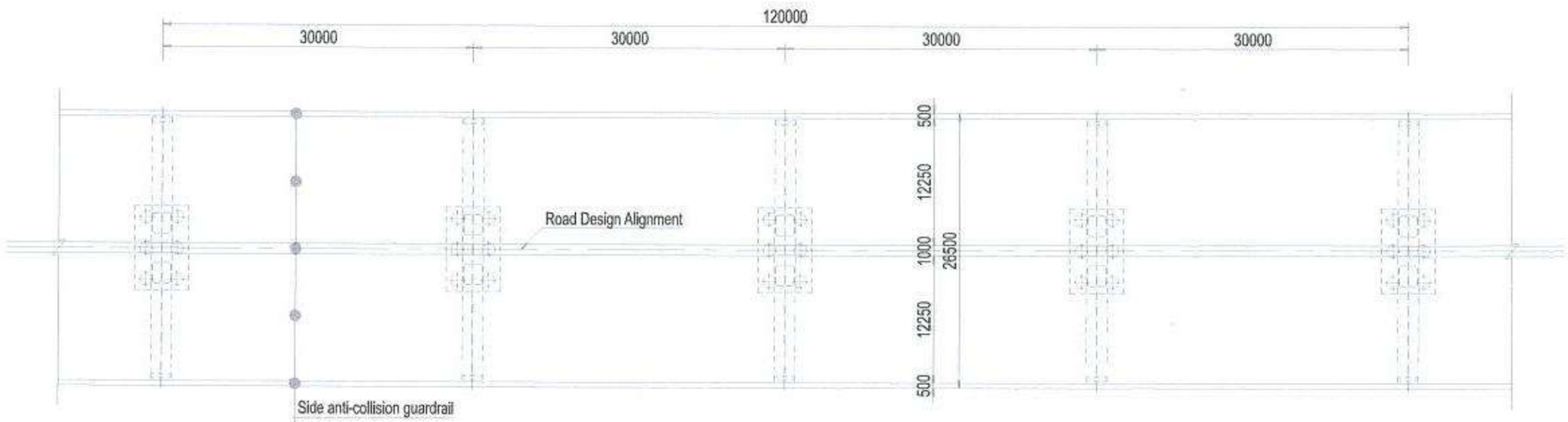
Notes

1. This drawing shows a bill of quantities for main engineering for a 120 m bridge length, with prefabricated T-girders for the upper structure and double-column rectangular piers with large cantilever bent caps + cap pile foundations for the lower structure.

Elevation for Bridge-type Layout of a 4×30 m T-girder 1:500



Bridge-type Layout Plan of a 4×30 m T-girder 1:500



Notes:

1. All dimensions in this drawing are measured in cm.
2. his drawing is used for scheme comparison and selection. A single bridge length is selected as the benchmark, and the span is arranged as 4×30 m. The upper structural form is a prestressed concrete T-girder with simple support followed by a continuous bridge deck, and the lower structural form is of a double-column rectangular pier large cantilever bent cap + a cap pile foundation.
3. For the convenience of parameter comparison and selection, the initial fill height is proposed to be 10 m, and the pile length is proposed to be 30 m.

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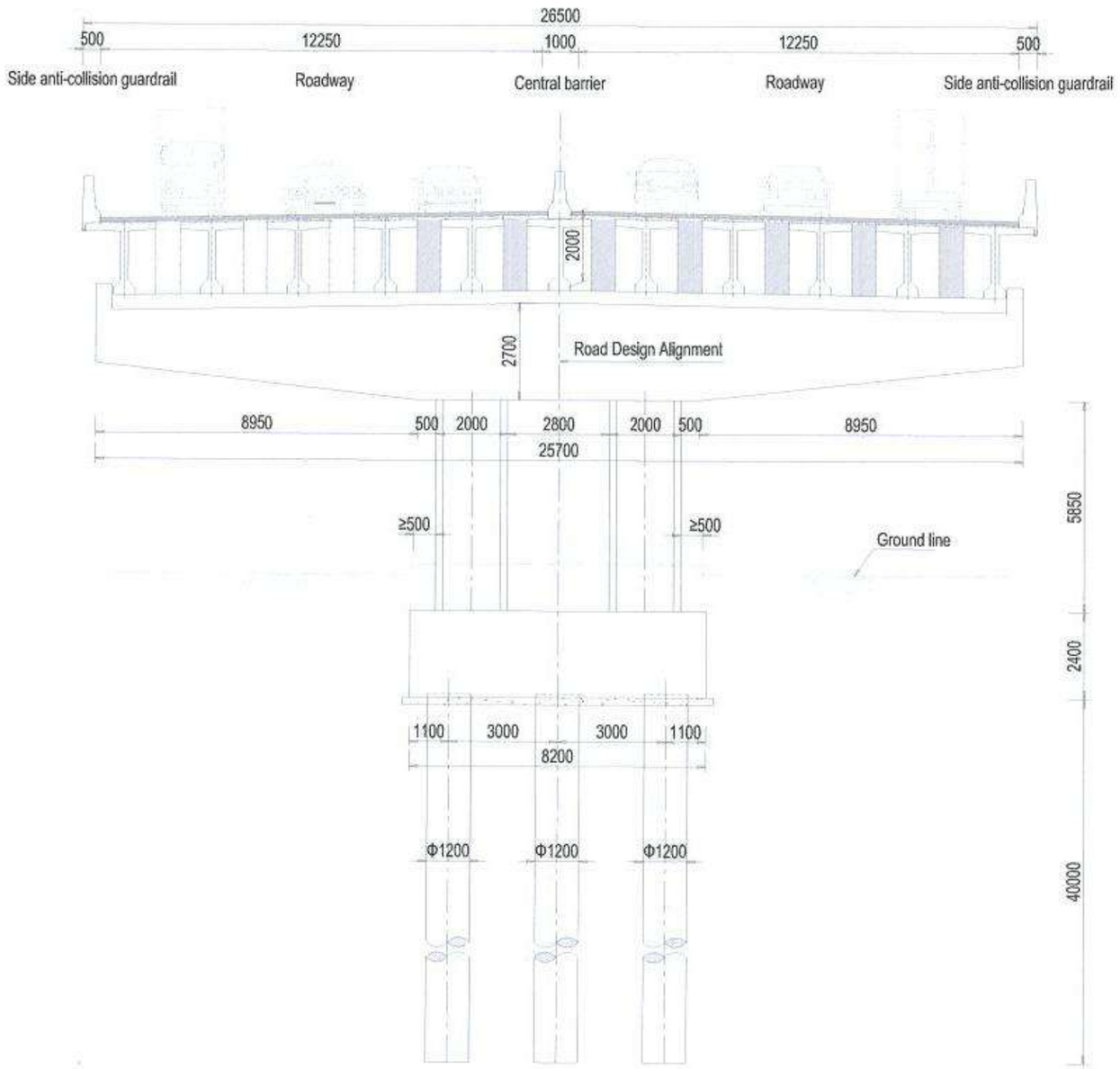
		Scheme II: Bridge-type Layout for a 4×30 m T-girder of a Standard Section				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-44
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	MA JUN			DATE	2025.07

1--1 section 1:150

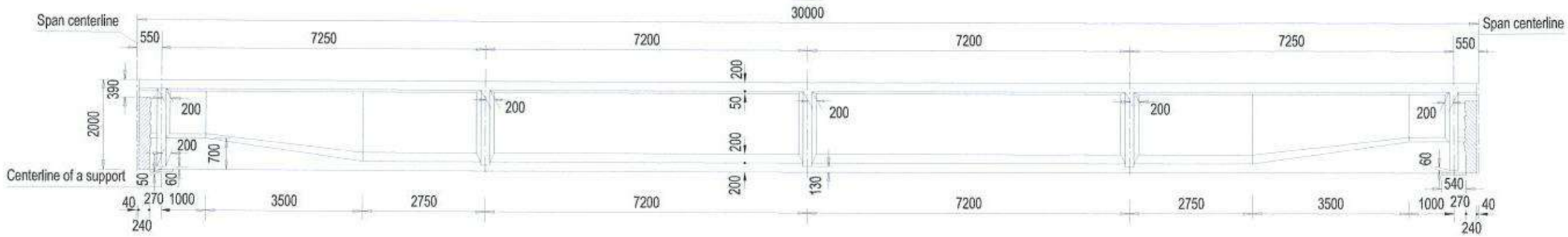


Notes:

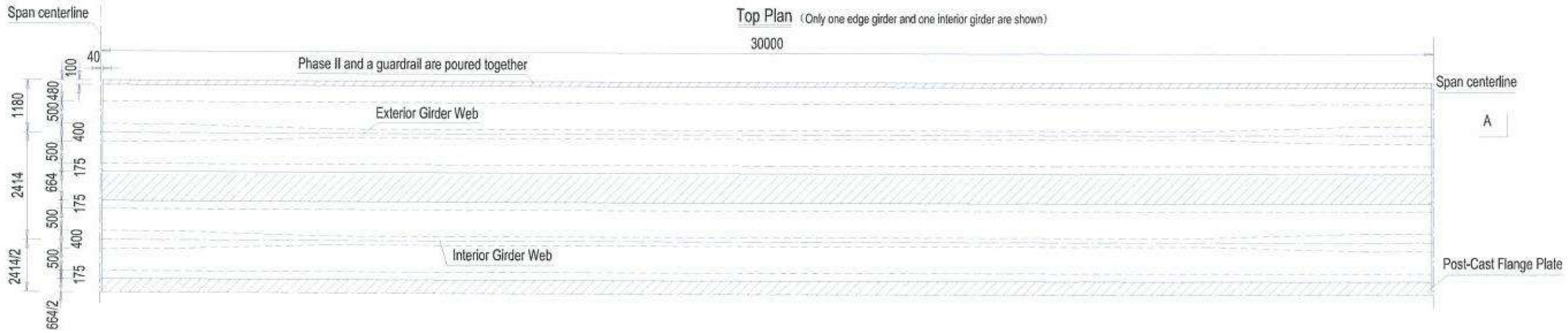
1. All dimensions in this drawing are measured in cm.
2. his drawing is used for scheme comparison and selection. The upper structural form is a prestressed concrete T-girder with simple support followed by a continuous bridge deck, and the lower structural form is of a double-column rectangular pier large cantilever bent cap + a cap pile foundation.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 150
		Scheme II: Cross Section Layout of a 4×30 m T-girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-45
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

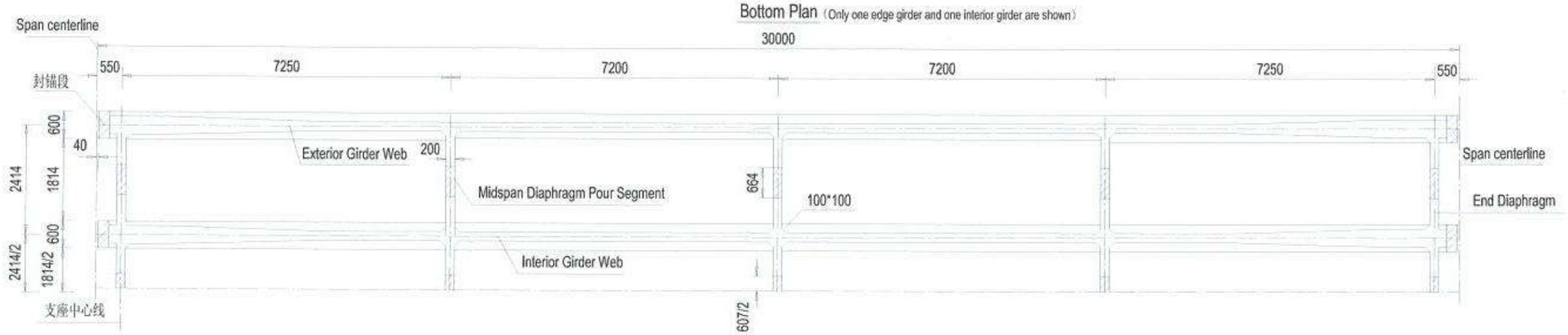
A-A



Top Plan (Only one edge girder and one interior girder are shown)



Bottom Plan (Only one edge girder and one interior girder are shown)

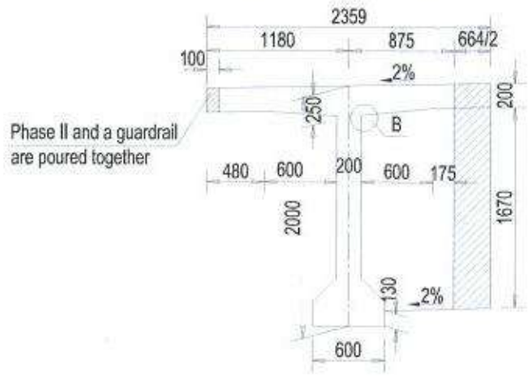


Notes:

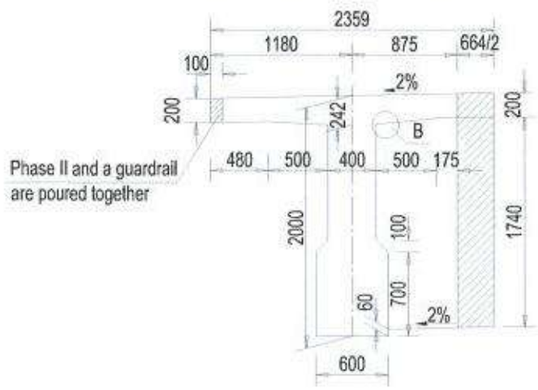
1. All dimensions in this drawing are measured in mm.
2. The dashed part at the girder end in the drawing will be poured simultaneously with anchor sealing after prestressed tensioning.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 1
		Scheme II: General Construction Drawing of a T-girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-46
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

Midspan of Edge Girder

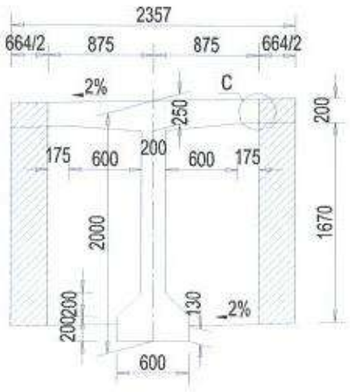


Continuous Deck End of Edge Girder

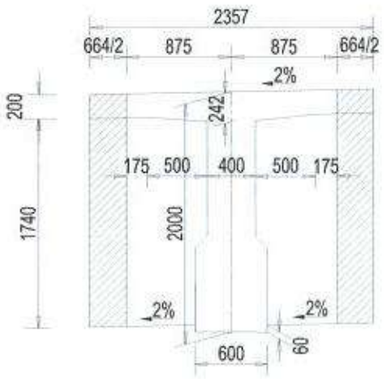


Detail Drawing B

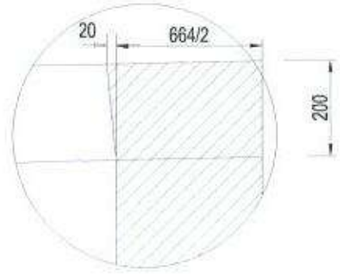
Midspan of Interior Girder



Continuous Deck End of Interior Girder



Detail Drawing C



Notes:

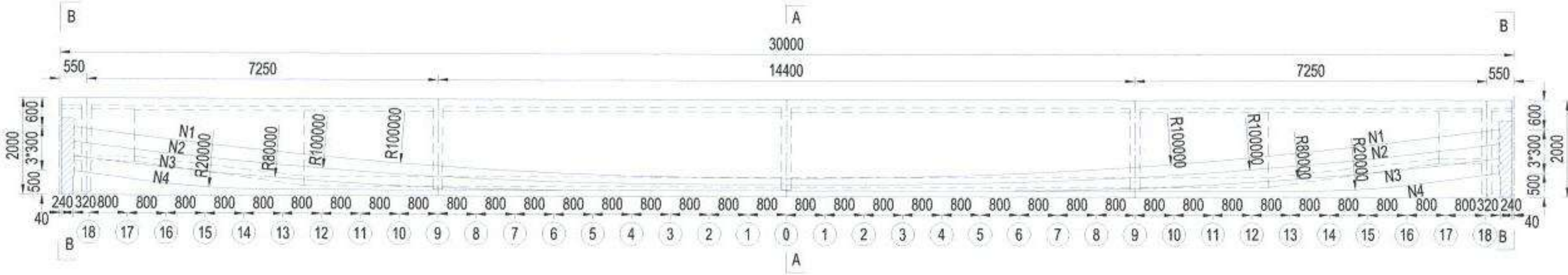
1. All dimensions in this drawing are measured in mm.
2. The dashed part at the girder end in the drawing will be poured simultaneously with anchor sealing after prestressed tensioning.

Concrete Quantity Schedule for One Main Girder (C50)

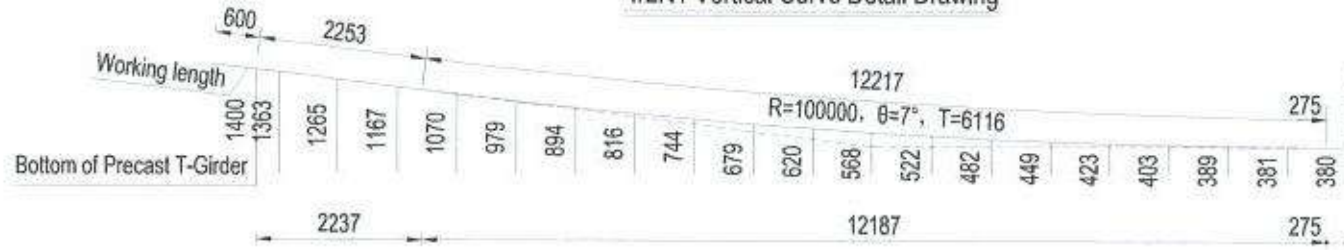
Item	Prefabricated part(m^3)	Cast-in-place part(m^3)
	Prefabricated T-girder	Diaphragm. Flange
Edge Girder	31.31	2.56
Interior Girder	30.72	5.15

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES.MANAGER: PANG WEI	SUB.MANAGER: GAO JINCHUN	CHECKED: GAO JINCHUN	SCALE: 1: 1
		Scheme II: General Construction Drawing of a T-girder		MASTER DES.: CAO YONGXIANG	SPE.MANAGER: ZHANG BO	EXAMINED: PANG WEI	DRAWING NO.: II-46
				MASTER DES.: PAN HAOGUO	SPE.MANAGER: MA JUN	APPROVED: ZHU ANJING	DATE: 2025.07
					DESIGNED: MA JUN		

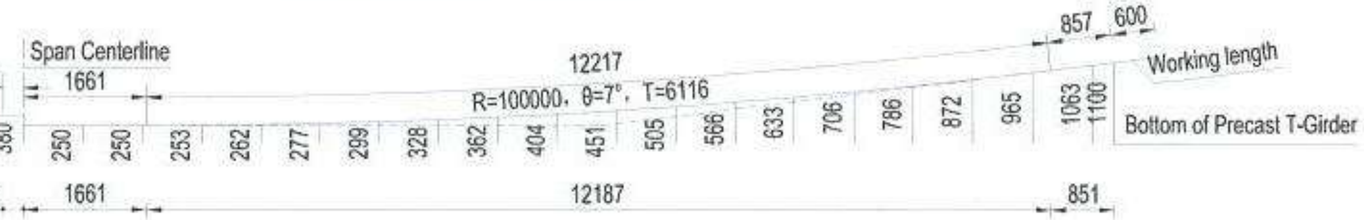
Elevation



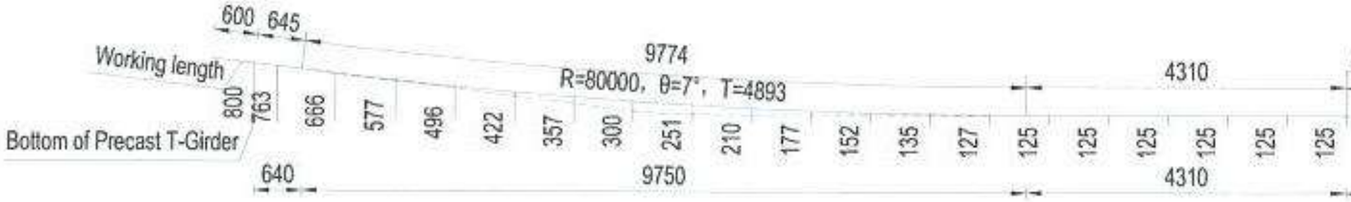
1/2N1 Vertical Curve Detail Drawing



1/2N2 Vertical Curve Detail Drawing



1/2N3 Vertical Curve Detail Drawing



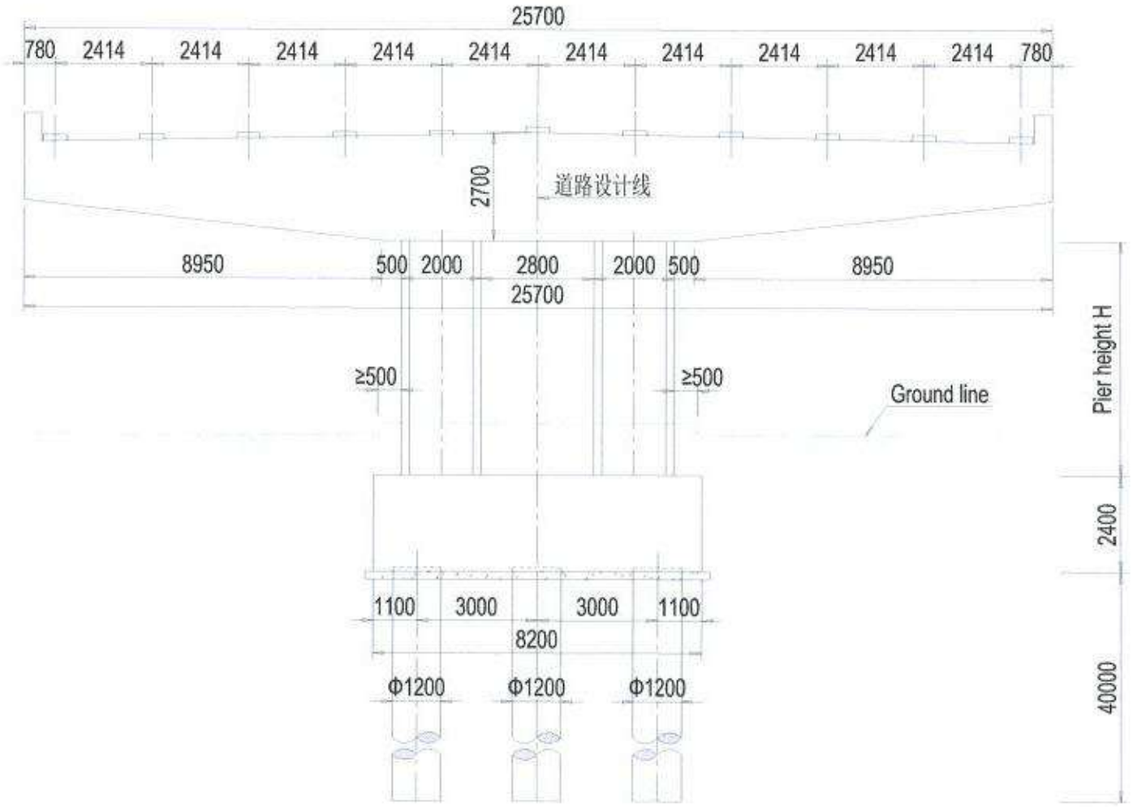
1/2N4 Vertical Curve Detail Drawing

Note:

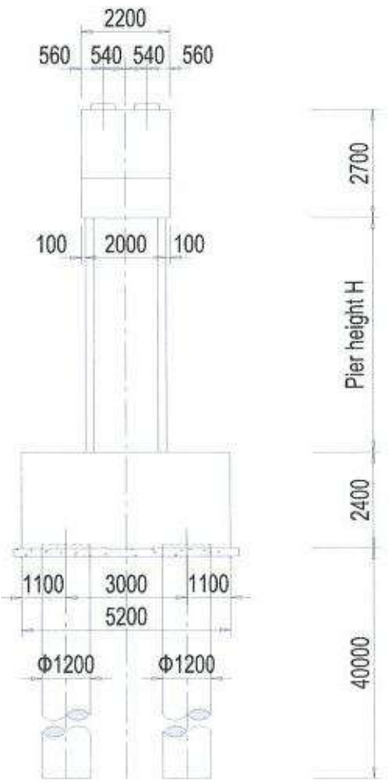
1. All dimensions in this drawing are measured in mm.
2. The prestressed steel stranded wire is of the prestressed 1×7 standard type-15.20-1860-GB/T 5224-2023, and the anchorage should be matched with it. Its technical conditions are to comply with standard egulations.
3. During prestressed tensioning, the concrete strength is less than 85% of the design strength, a tensioning procedure: N2→N3→N4→N1.
4. The position and size of the anchor pad is required to be accurate, and the anchor pad is to be perpendicular to the prestressed pipe; after a prestressed tendon is tensioned, it is to be cut 3 cm away from the anchor head, and arc cutting is strictly prohibited.
5. The prestressed pipe is a metal corrugated pipe (parameters μ=0.20, k=0.0015). During arrangement of the prestressed pipe, the positioning rebars are to be arranged with a spacing of 0.8 m for straight sections and 0.5 m for curved sections.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE 1: 1
		方案二：T梁预应力钢束构造图				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO. Ⅱ-47
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE 2025.07
								DESIGNED	MA JUN			

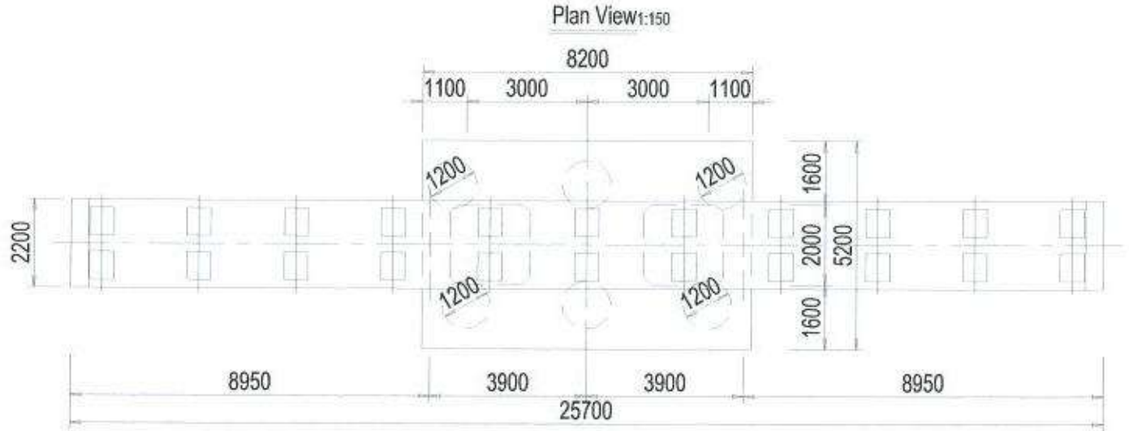
Elevation 1:150



Side View 1:150



Plan View 1:150

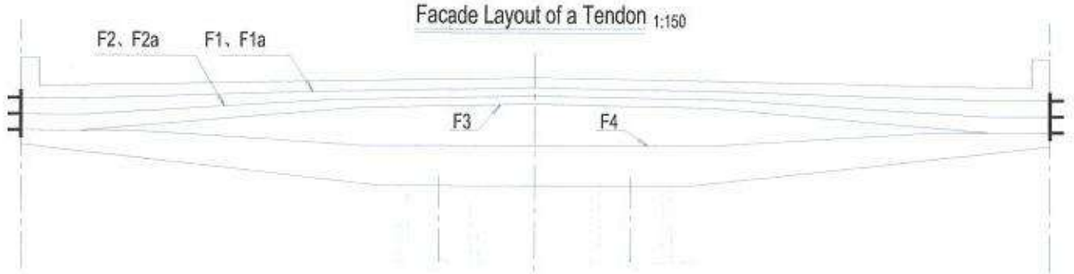


Notes:

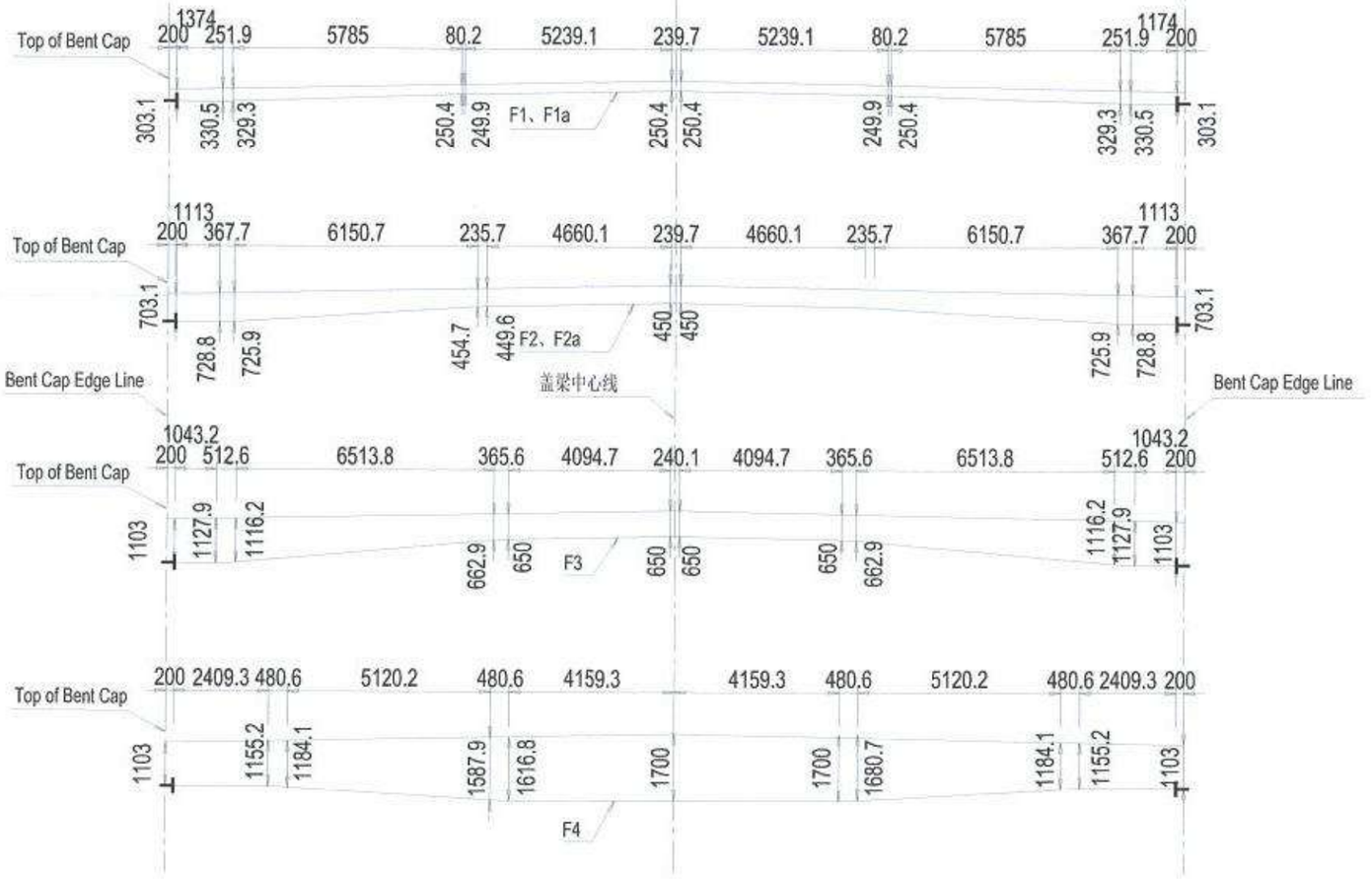
1. All dimensions in this drawing are measured in mm.
2. This drawing is used for scheme comparison and selection. A single bridge length is selected as the benchmark, and the span is arranged as 4×30 m. The upper structural form is a prestressed concrete T-girder with simple support followed by a continuous bridge deck, and the lower structural form is of a double-column rectangular pier large cantilever bent cap + a cap pile foundation.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 150
		Scheme II:General Construction Drawing of a Prestressed Rebars of a Bent Cap				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-49
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

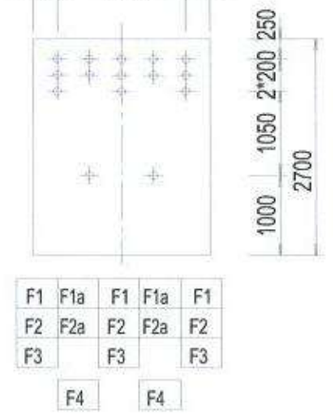
Facade Layout of a Tendon 1:150



Detailed drawing of a Tendon 1:150

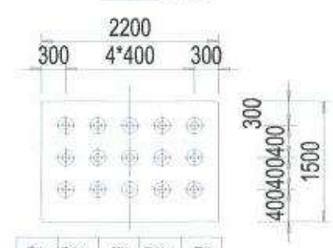


A--A 1:180



F1	F1a	F1	F1a	F1
F2	F2a	F2	F2a	F2
F3		F3		F3
	F4		F4	

B--B 1:180



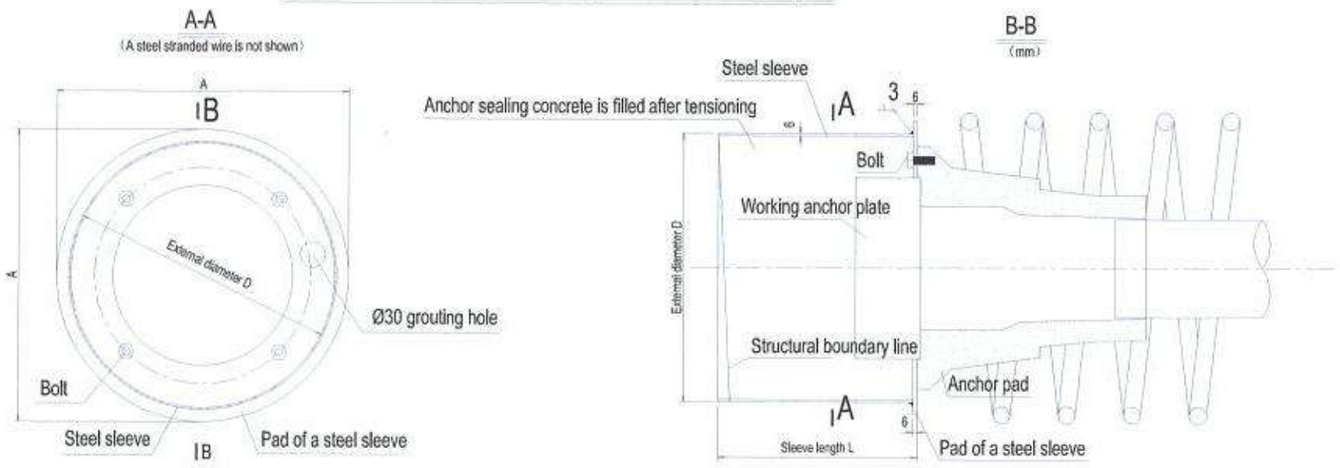
F1	F1a	F1	F1a	F1
F2	F2a	F2	F2a	F2
F3	F4	F3	F4	F3

Notes:

1. All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	Diagram
		Scheme II:General Construction Drawing of a Prestressed Rebars of a Bent Cap				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-50
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	MA JUN						

Construction of deep buried anchorages, sleeves and sleeve pads



Parameter Table of Deep Buried Anchor Sleeves and Sleeve Pads

Tendon No.	Type of an anchorage	Parameter (mm)			Quantity (pcs)	Single piece weight (kg)	Total weight (kg)
		L	A	D			
F1	YJM15-19	200	300	247	6	14.39	86.3
F1a	YJM15-19	200	300	247	4	14.39	57.6
F2	YJM15-19	200	300	247	6	14.39	86.3
F2a	YJM15-19	200	300	247	4	14.39	57.6
F3	YJM15-17	200	300	247	6	13.48	80.9
F4	YJM15-17	200	300	247	4	13.48	53.9
Total	Q235C:422.6kg M10x35 Bolt: 114 (pcs)						

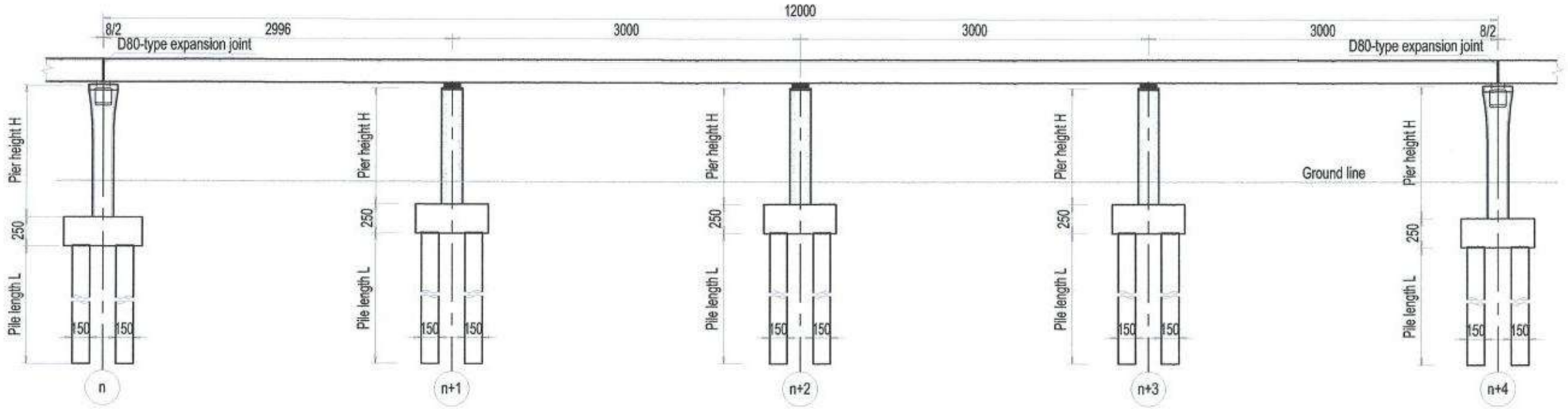
Summary Table of Tendon Materials

Tendon No.	Type of an anchorage	Number of tendons	Cutting Length per Tendon (cm)	Total Cutting Length (cm)	Total Tendon Weight (kg)	Corrugated Duct Inner Diameter (mm)	Total Length of Corrugated Pipe (m)	Jacking Stress (MPa)	Extension amount at a tensioning end (mm)		Tensioning Batch
									Left end	Right end	
F1	19-Φs15.2	3	2771.0	8313.0	1739.0	100	77.2	1339.2	68.8	68.8	1st
F1a	19-Φs15.2	2	2771.0	5542.0	1159.3	100	51.4	1339.2	68.7	68.7	2nd
F2	19-Φs15.2	3	2773.1	8319.3	1740.4	100	77.2	1339.2	68.2	68.2	1st
F2a	19-Φs15.2	2	2773.1	5542.6	1159.5	100	51.4	1339.2	68.7	68.7	2nd
F3	17-Φs15.2	3	2775.9	8327.7	1558.7	100	77.3	1339.2	68.2	68.2	1st
F4	17-Φs15.2	2	2773.5	5547.0	1038.2	100	51.4	1339.2	68.2	68.2	1st
Total Quantity per Bent Cap: Total Length of Corrugated Pipe: 385.9m 15-19 Anchorage Device:20(pcs) 15-17 Anchorage Device:10(pcs) Total Tendon Weight: 8395.1(kg)											

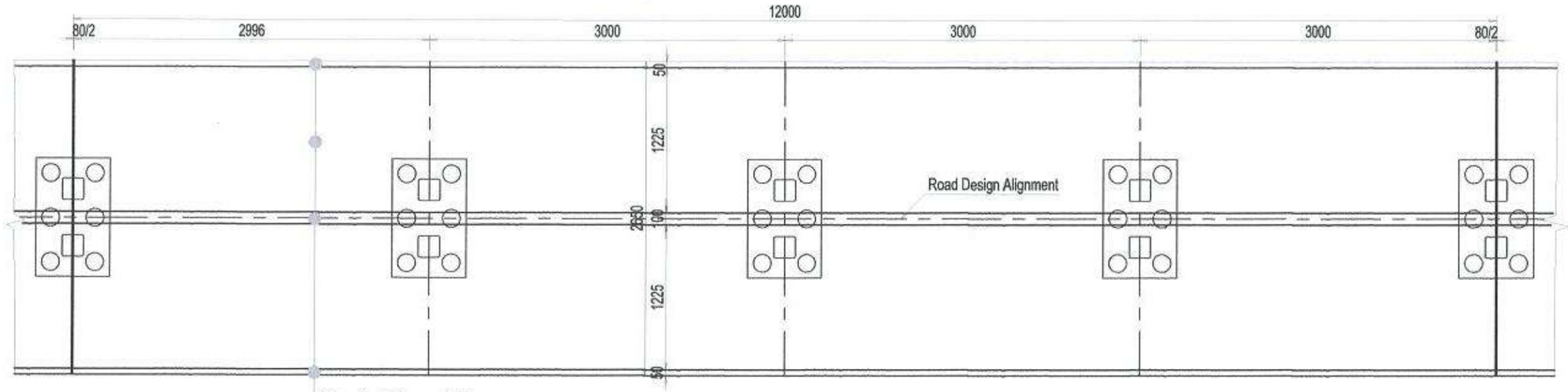
Note:

1. All dimensions in this drawing are measured in mm.
2. The prestressed steel stranded wire is of the prestressed 1×7 standard type-15.20-1860-GB/T 5224-2023, and the anchorage should be matched with it. Its technical conditions are to comply with standard egulations.
3. During prestressed tensioning, the concrete strength is less than 80% of the design strength, and the elastic modulus is less than 80% of the elastic modulus of the concrete after 28 d; a tensioning procedure: 0 → initial stress (0.1 σcon) → controlled stress (σcon) → holding load for 5 minutes → anchoring, where σcon is the tensioning controlled stress of the prestressed steel stranded wire under anchor; the tensioning is to be carried out symmetrically with dual controls, with stress control as the main focus and the extension amount as a reference.4. The position and size of the anchor pad is required to be accurate, and the anchor pad is to be perpendicular to the prestressed pipe; after a prestressed tendon is tensioned, it is to be cut 3 cm away from the anchor head, and arc cutting is strictly prohibited.
4. The steel stranded wires for the bent cap shall be tensioned in two batches. After the bent cap is poured, F1, F2, F3, and F4 steel stranded wires are tensioned first. After the beam body is erected, the wet joint construction is completed, and before the bridge deck is paved and the railing is constructed, the second batch of F1a and F2a steel stranded wires shall be tensioned. Tendons with the same number are tensioned simultaneously and symmetrically from the center to both sides.
5. The prestressed pipe is a metal corrugated pipe (parameters μ=0.20, k=0.0015). During arrangement of the prestressed pipe, the positioning rebars are to be arranged with a spacing of 0.8 m for straight sections and 0.5 m for curved sections.
6. The rebars of the bent cap cut due to sleeving are to be bent and then welded to the sleeve, with a single-sided welding of 10 d and a double-sided welding of 5 d (where d is the diameter of the rebar).

Elevation for Bridge-type Layout of a 4×30 m Box Girder 1:40



Bridge-type Layout Plan of a 4×30 m Box Girder 1:40



Notes:

1.All dimensions in this drawing are measured in cm.

2.This drawing is used for scheme comparison and selection. A single bridge length is selected as the benchmark, and the span is arranged as 4×30 m. The upper structure is a prestressed concrete cast-in-place continuous girder, and the lower structure consists of a frame pier + a cap pile foundation.

3.For the convenience of parameter comparison and selection, the initial fill height is proposed to be 10 m, and the pile length is proposed to be 40 m.

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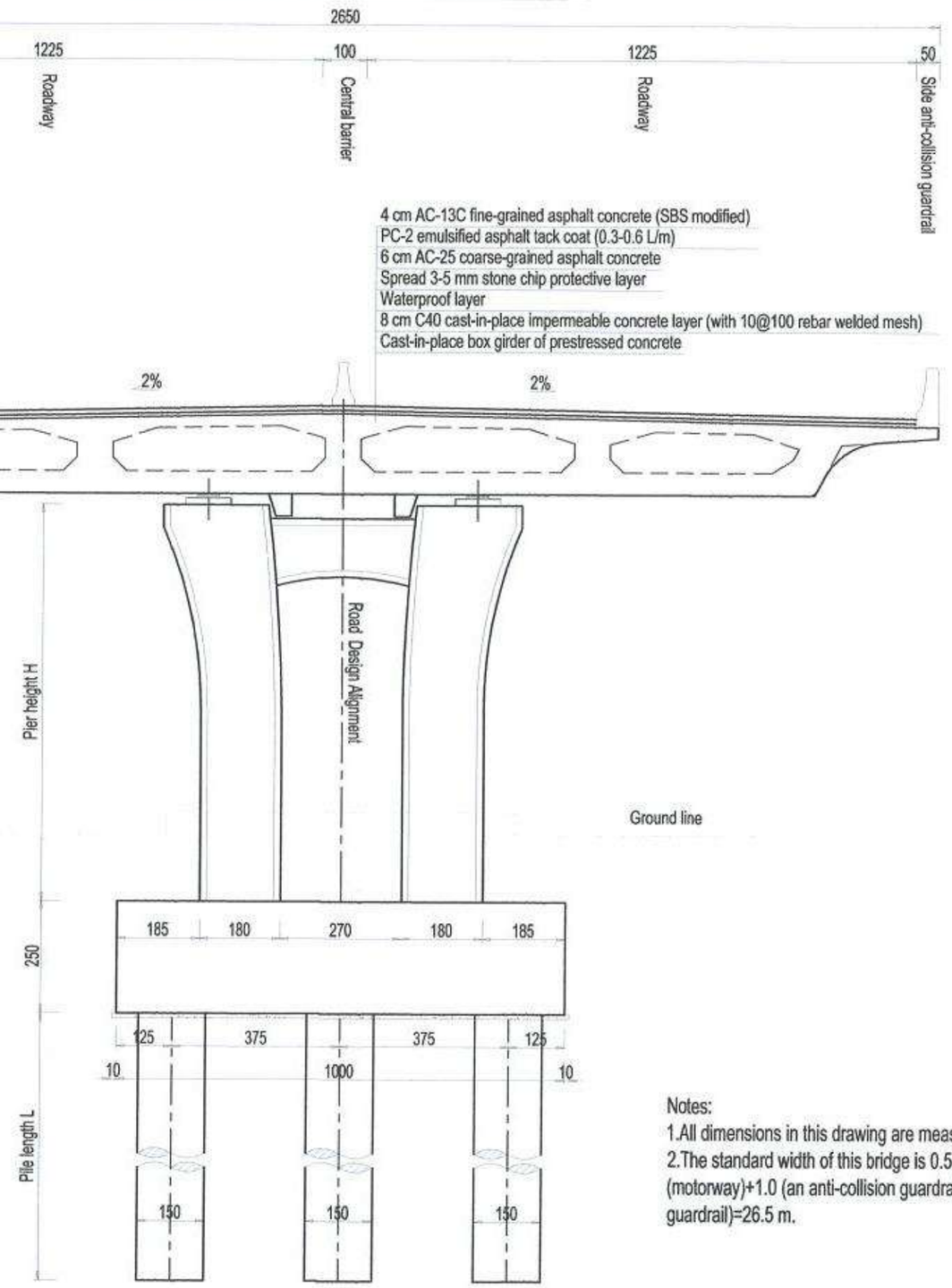
		Scheme III: Bridge-type Layout for a 4×30 m Cast-in-place Box Girder of a Standard Section				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-52
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Cross Section Layout of a 4×30 m Cast-in-place Box Girder

1:120



Notes:

1.All dimensions in this drawing are measured in cm.

2.The standard width of this bridge is 0.5 (an anti-collision guardrail)+12.25 (motorway)+1.0 (an anti-collision guardrail)+12.25 (motorway)+0.5 (an anti-collision guardrail)=26.5 m.

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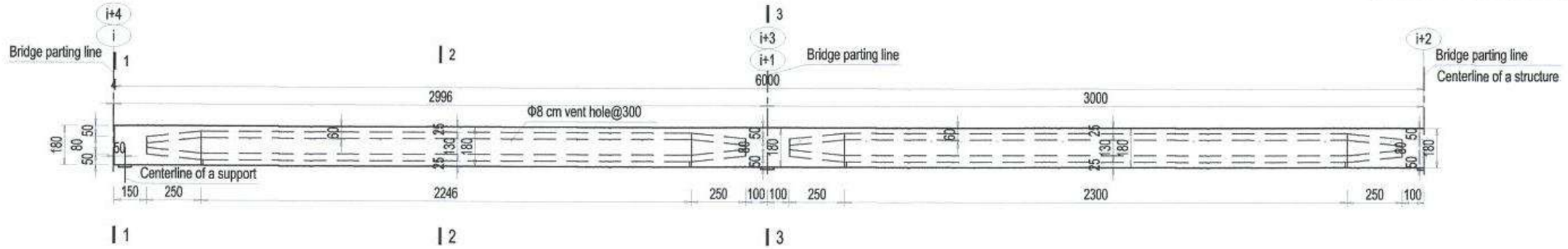
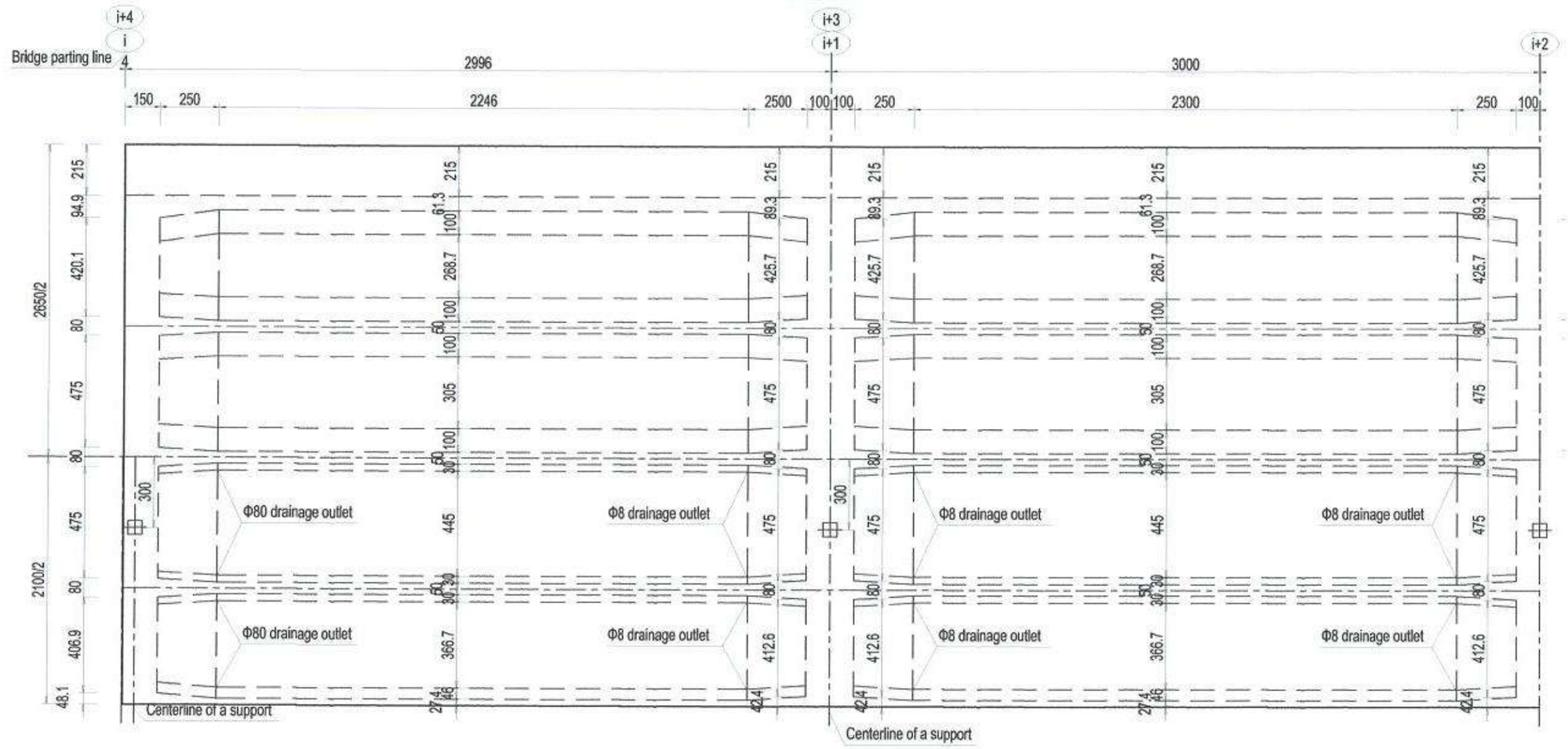
		Scheme III: Cross Section Layout of a 4×30 m Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-53
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Elevation 1:200



1/2 Top plane 1:200

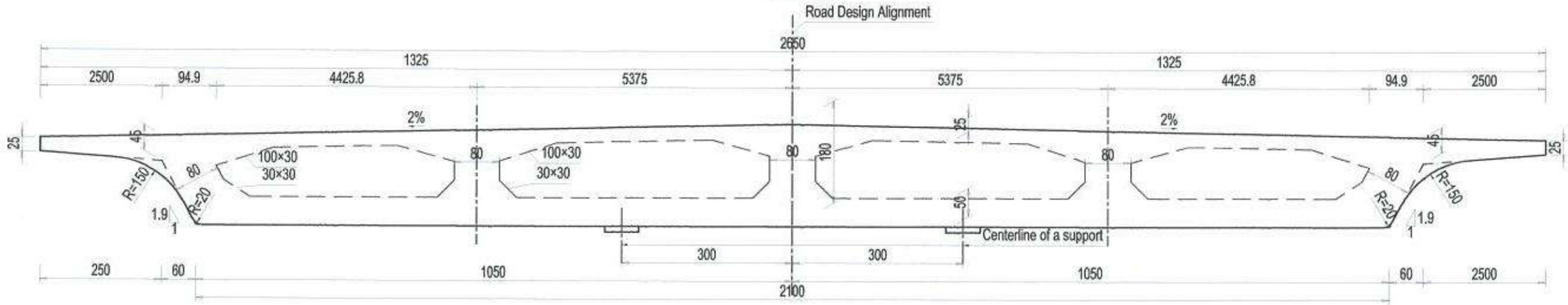


1/2 Bottom plane 1:200

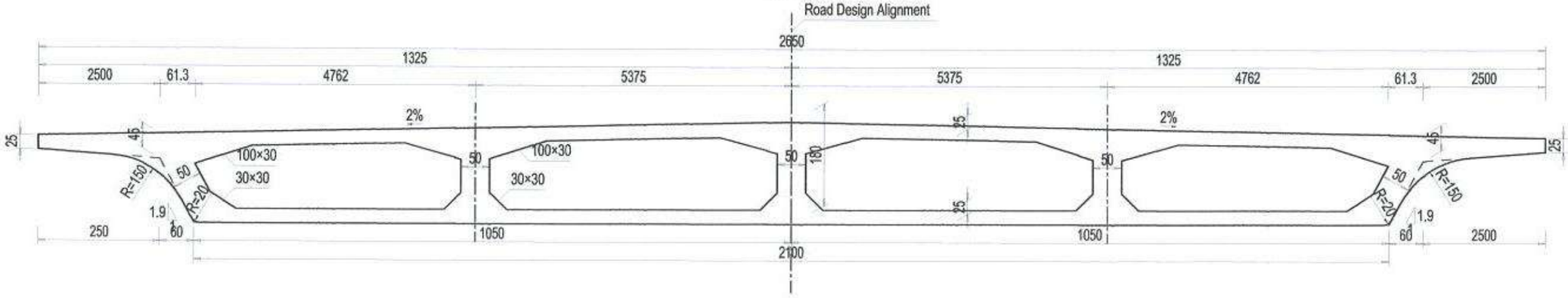
Notes:
1.All dimensions in this drawing are measured in cm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 200
		Scheme III: General Construction Drawing of a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-54
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	LI MAOJUN				

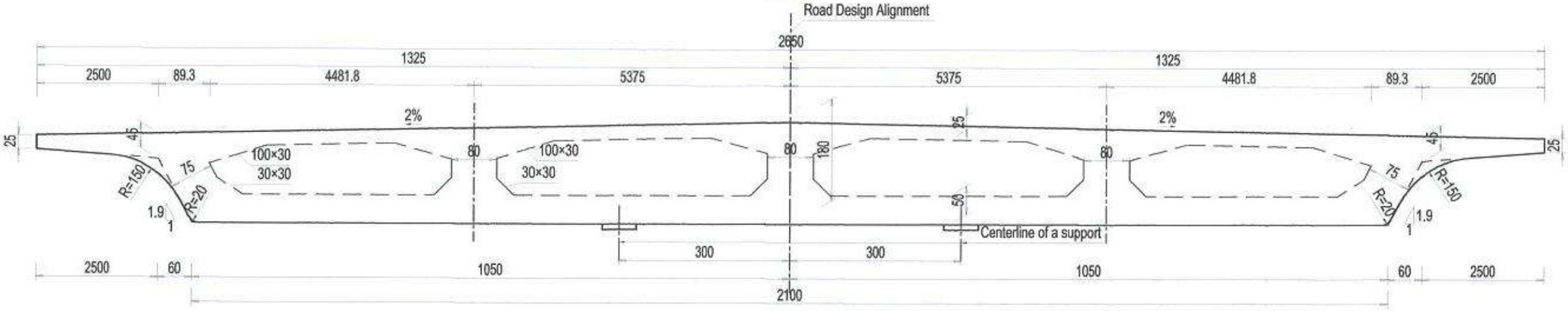
1 - 1 1:80



2 - 2 1:80



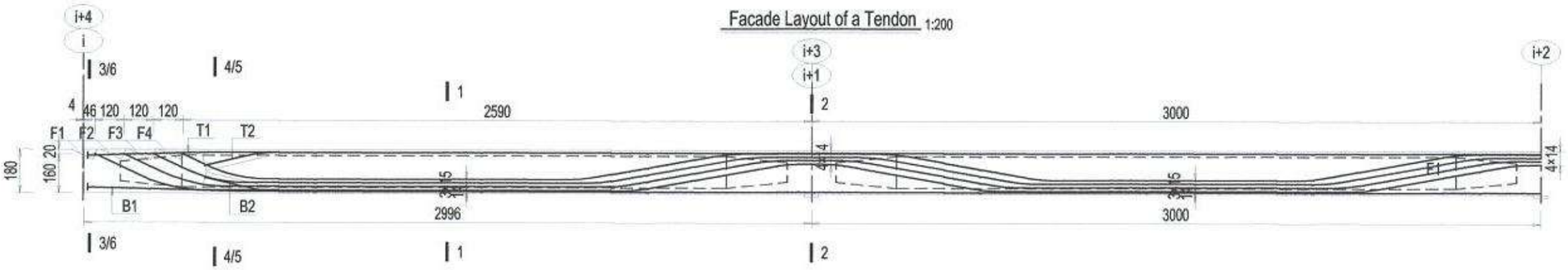
3 - 3 1:80



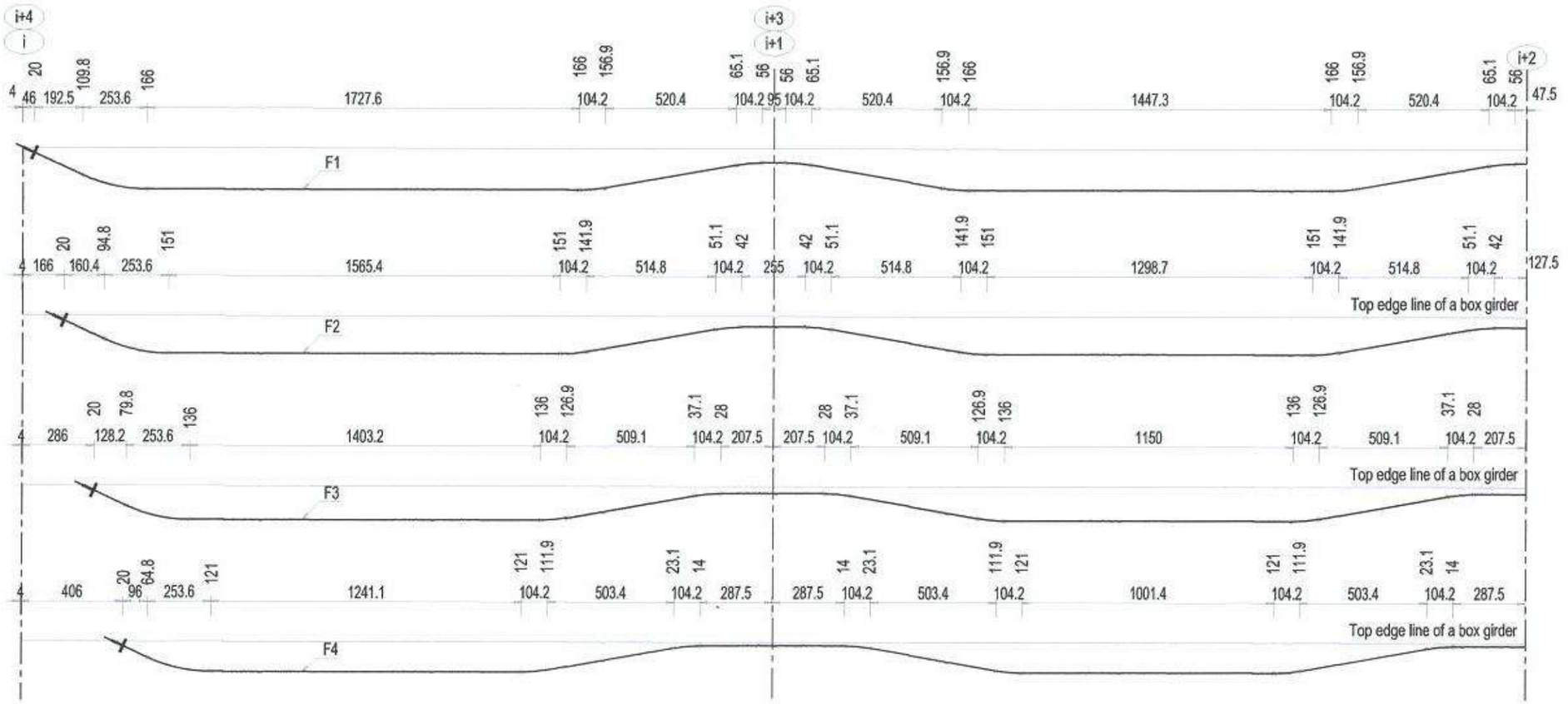
Notes:
1.All dimensions in this drawing are measured in cm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 80
		Scheme III: General Construction Drawing of a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-54
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Facade Layout of a Tendon 1:200

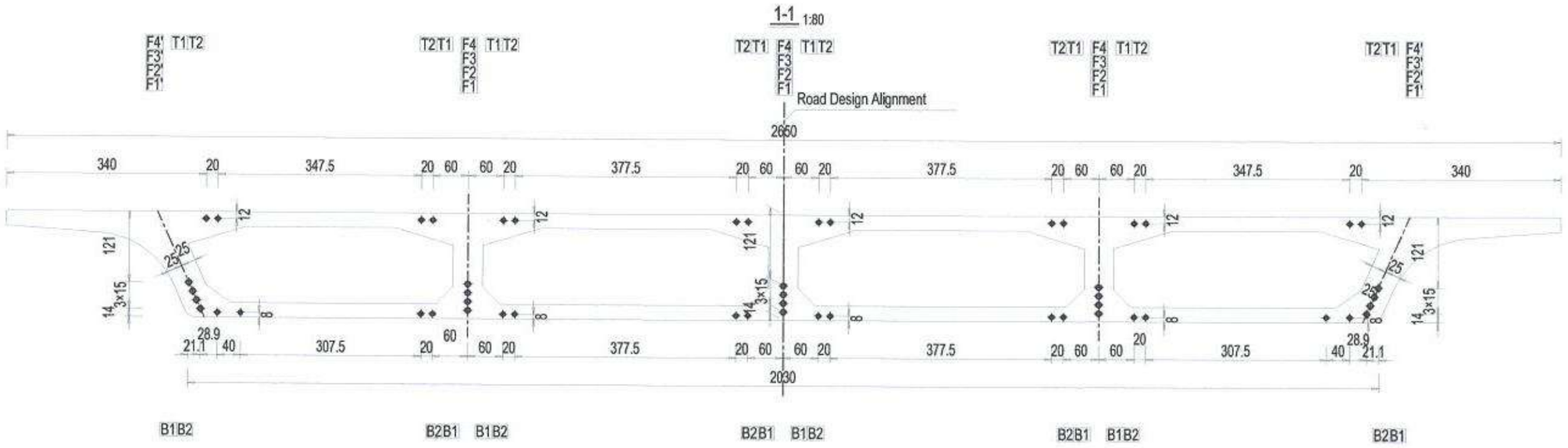


Detailed drawing of a Tendon 1:200



Notes:
1.All dimensions in this drawing are measured in cm.
2.In this drawing, "⊢" represents the tensioning end, and " | " represents the fixed end.
3.The vertical bending radius of the tendon is 6000 mm.

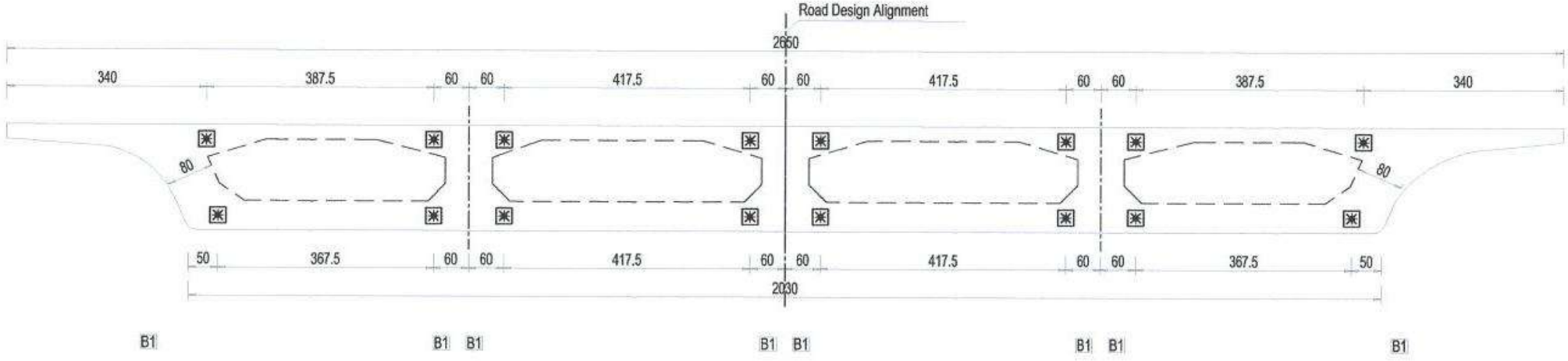
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 200
		Scheme III: Construction Drawing of a Prestressed Tendon for a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-55
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	LI MAOJUN				



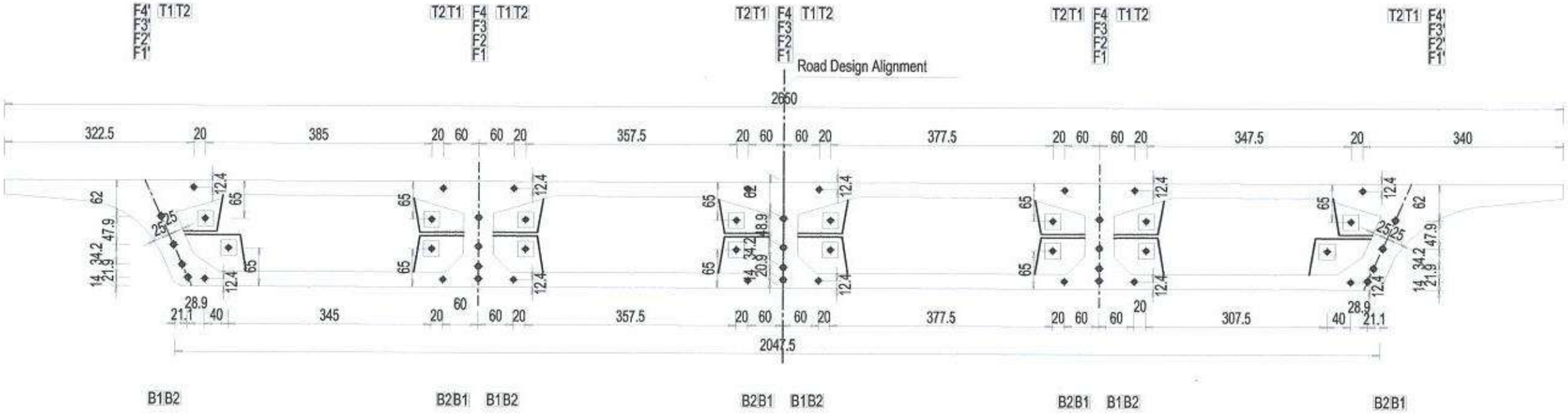
Notes:
1.All dimensions in this drawing are measured in cm.
2.In this drawing, " ⌖" represents passing the tendon, " ⊠" represents the tensioning end, and " ⊕" represents the fixed end.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 80
		Scheme III: Construction Drawing of a Prestressed Tendon for a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-55
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	LI MAOJUN				

3-3 1:80



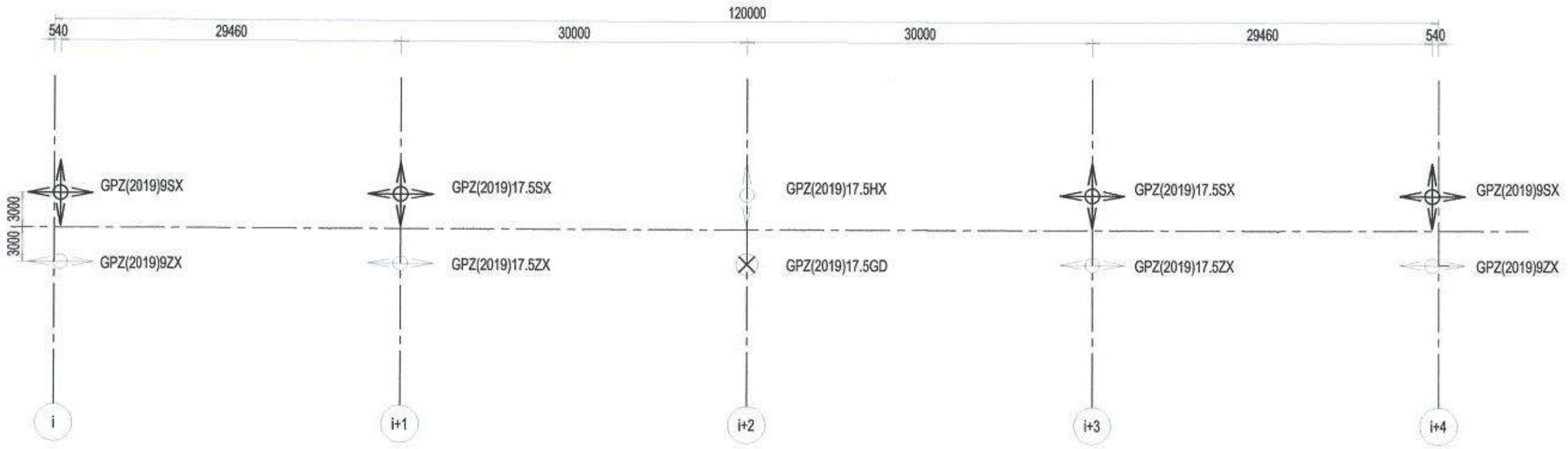
4-4 1:80



Notes:
1.All dimensions in this drawing are measured in cm.
2.In this drawing, " ✦" represents passing the tendon, " ⊠" represents the tensioning end, and " ⊞ " represents the fixed end.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the "First Ring Road" Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 80
		Scheme III: Construction Drawing of a Prestressed Tendon for a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-55
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Schematic Layout Diagram for a 4×30 m Cast-in-place Girder Support of a Standard Section 1:400



Main parameters of a Basin-type Rubber Support

Specification/model	Support body（mm）			Vertical bearing capacity P	Main designed displacement	Quantity per span unit
	la	lb	h	（MN）	（mm）	
GPZ(2019)17.5GD	1050	895	190	17.5		1
GPZ(2019)17.5ZX	1295	1160	220	17.5	±100	2
GPZ(2019)17.5HX	1195	1060	220	17.5	±50	1
GPZ(2019)17.5SX	1105	1000	190	17.5	±100	2
GPZ(2019)9SX	820	745	145	9.0	±100	1
GPZ(2019)9ZX	985	885	175	9.0	±100	1

Notes:
1.All dimensions in this drawing are measured in cm.
2.In the drawing, " × " represents a fixed support; " — "represents a unidirectional movable support; " + "represents a bidirectional movable support.

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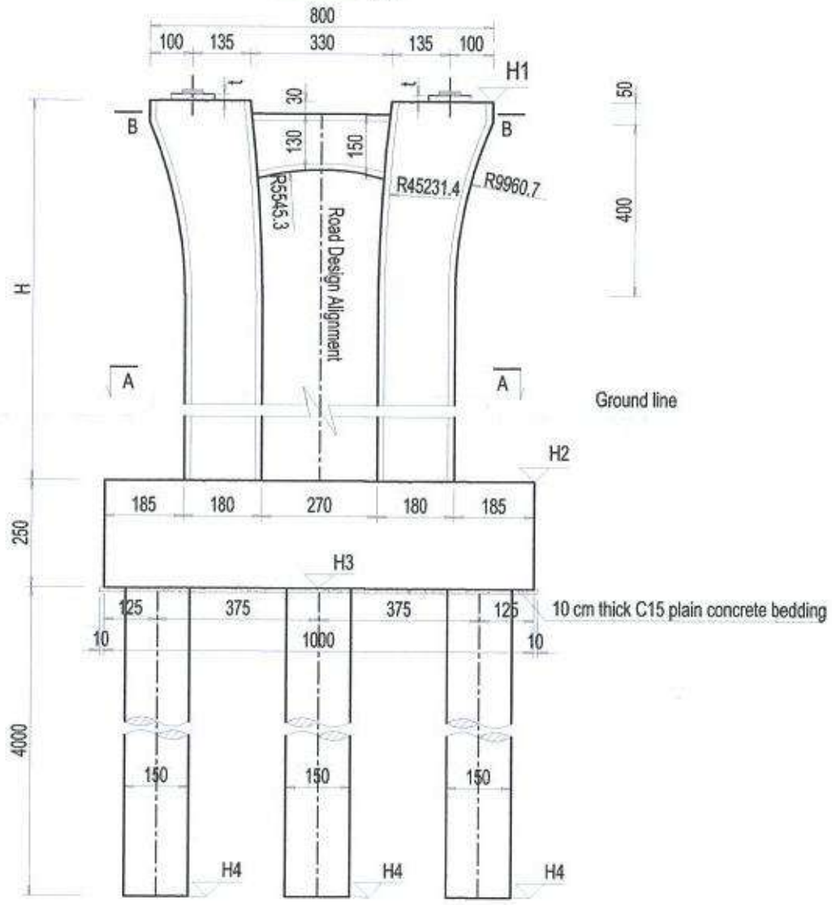
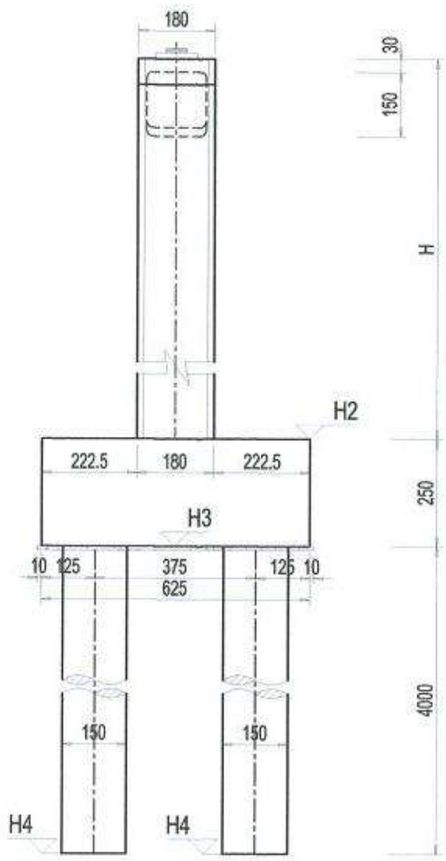
		Scheme III: Layout of a Cast-in-place Girder Support				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-56
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

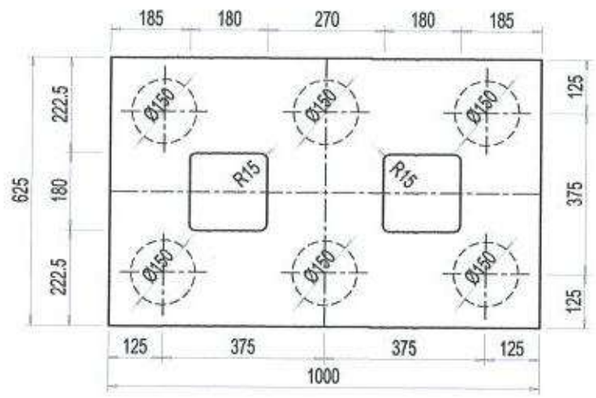
Elevation 1:140



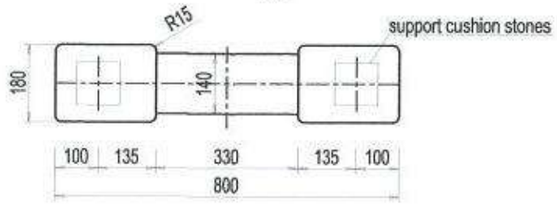
Side view 1:140



A-A 1:140



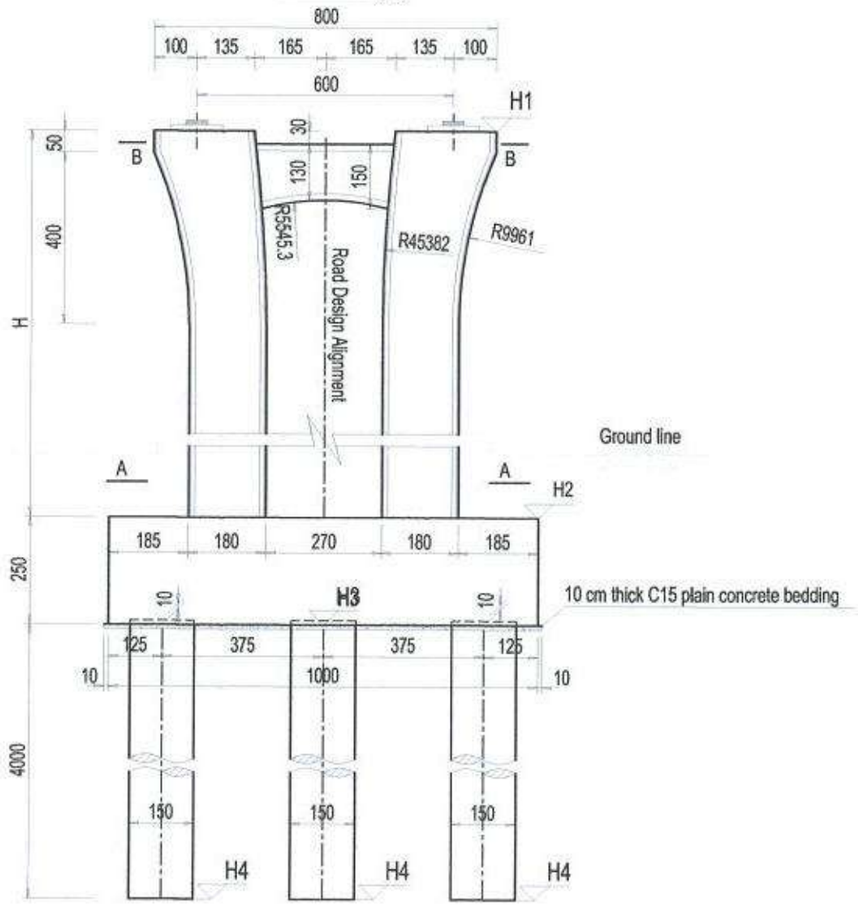
B--B 1:140



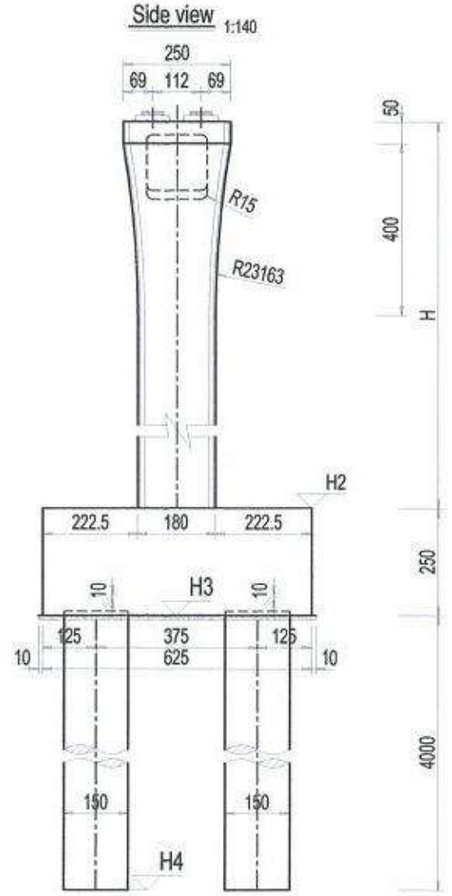
Notes:
1.All dimensions in this drawing are measured in mm, except for the elevation which is measured in m.
2.This drawing is applicable to the piers of the viaduct on the main line.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 140
		Scheme III: General Construction Drawing for a Lower Structure of a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-57
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	LI MAOJUN				

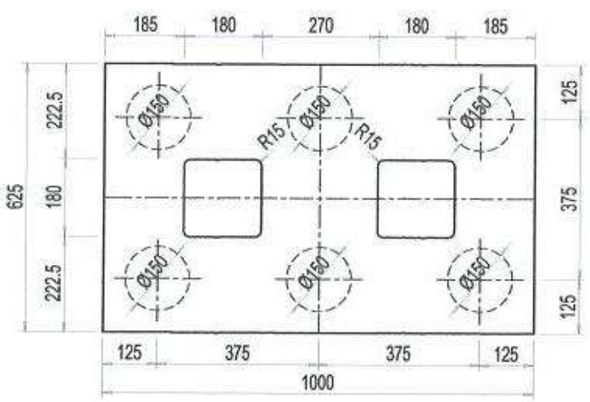
Elevation 1:140



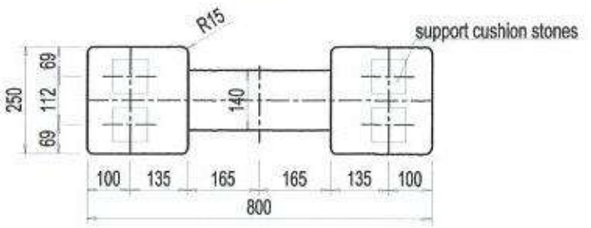
Side view 1:140



A-A 1:140



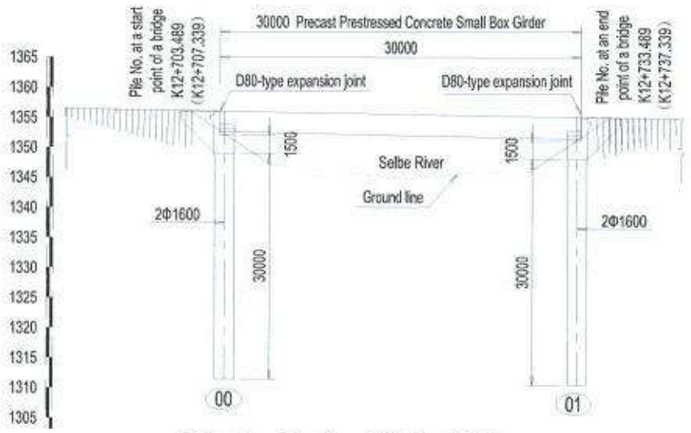
B–B 1:140



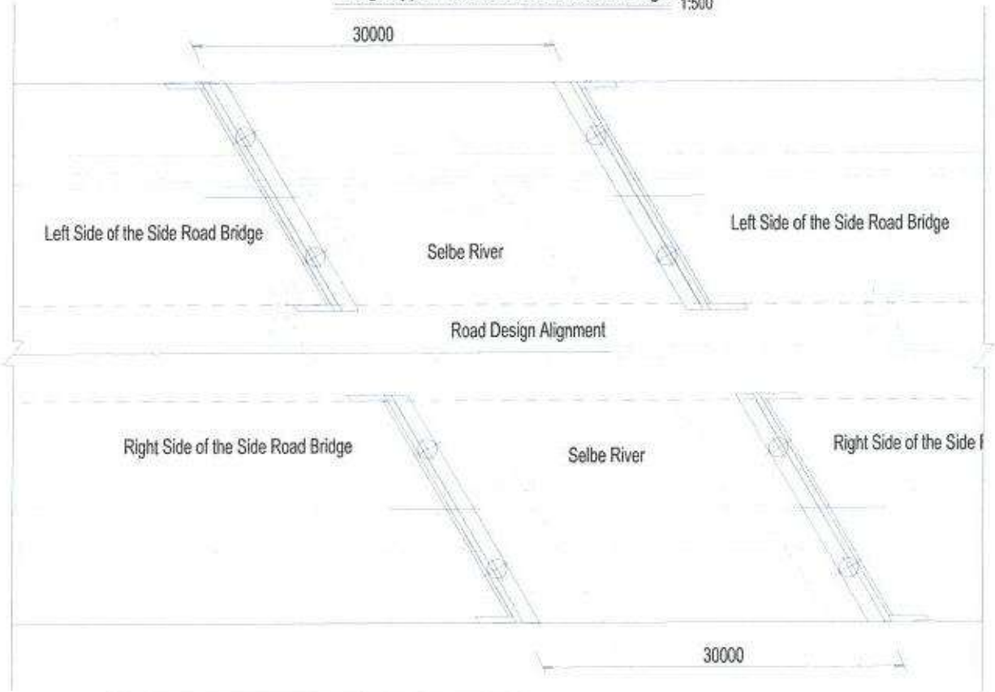
Notes:
1.All dimensions in this drawing are measured in mm, except for the elevation which is measured in m.
2.This drawing is applicable to the main elevated transition piers.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1：140
		Scheme III: General Construction Drawing for a Lower Structure of a Cast-in-place Box Girder				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-57
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	LI MAOJUN				

Bridge-type Elevation for a Side Road Bridge 1:500

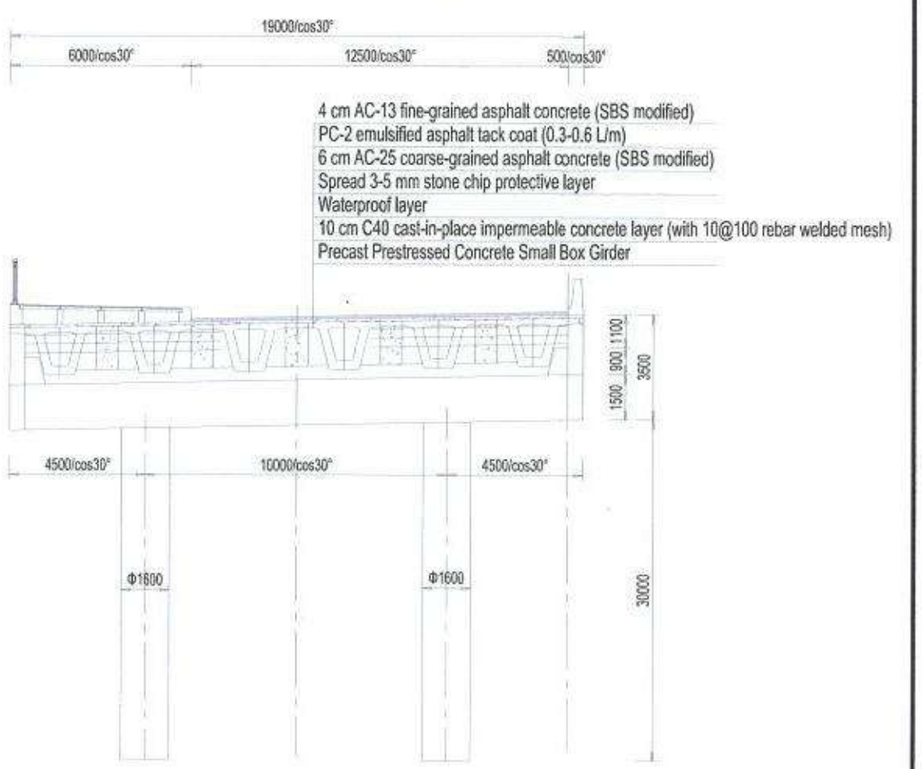


Bridge-type Plan for a Side Road Bridge 1:500



Design elevation (m)	1357.750	1357.649		1357.129
Ground elevation (m)	1354.090	1353.527		1353.364
Slope (%) Slope length (m)		-1.78 / 270.00		
Mileage pile No.	K12+05.414			+35.414
Straight line and horizontal curve	R-∞			

Cross Section of 0 # And 1 # Abutment 1:500



Note:

1. All dimensions in this drawing are measured in mm, except for the elevation which is measured in m.
2. The values outside the brackets are applicable to the Left Side of the Side Road Bridge. The data inside the brackets are applicable to the Right Side of the Side Road Bridge

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中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 500
		Bridge-type Layout for a Side Road Bridge				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-58
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING	DATE	2025.07
								DESIGNED	MA JUN				

Bill of Quantities for Main Engineering of No. 1 Bridge in Section I

Material	Item	Unit	Small box girder		Cast-in-place box girder	Pier and foundation				Abutment and foundation			Ancillary structure						Total
			Prefabricated part	Cast-in-place part		Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Anti-throwing net	Drainage pipe	Sound barrier	
C50 concrete		m^3	20306.5	2738.3	21135.3	7977.7													52168.0
C40 concrete		m^3					9904.2						7348.3						17252.5
C35 concrete		m^3						11979.3		695.8	921.1			4485.5					18081.7
C30 underwater concrete		m^3							32887.3			605.1							33492.4
C15 concrete		m^3						1590.4			82.5								1672.9
Asphalt concrete		m^2											7348.3						7348.3
Polyurethane waterproof coating for roads and bridges		m^2											73483.3						73483.3
Φ^s15.2 steel stranded wire		kg	864653.3		1056762.5	438775.7													2360191.5
Number of small box girders	Span 30 m	Pcs	399.0																399.0
	Span 29 m	Pcs	35.0																35.0
	Span 28 m	Pcs	21.0																21.0
	Span 25 m	Pcs	90.0																90.0
Number of pile foundations	Φ1200mm	Pcs							532.0			8.0							540.0
	Φ1500mm								126.0			12.0							138.0
Ordinary rebar	HRB400	kg	3966956.1	701251.2	4227050.0	1435993.2	1809523.6	1437516.0	3288729.1	111326.4	110536.2	63532.4	906783.3	447961.8					18507159.4
Support	GPZ30.0-JZGD-F	Pcs													6.0				6.0
	GPZ30.0-JZZX-±100-F														8.0				8.0
	GPZ30.0-JZHX±50-F														6.0				6.0
	GPZ30.0-SX±100-F														8.0				8.0
	GPZ10.0-JZZX±100-F														12.0				12.0
	GPZ10.0-SX±100-F														12.0				12.0
	LNR-370×470×147														1090.0				1090.0
Expansion joint	D80-type expansion joint	m														63.9			63.9
	D120-type expansion joint	m														356.5			356.5
	D160-type expansion joint	m														200.6			200.6
	D320-type expansion joint	m														39.0			39.0
2.0 m high anti-throwing net	Low-carbon steel wire mesh	m															440.0		440.0
2.0 m high sound barrier		m																1800	1800
Drainage	PVC pipe with a diameter of 150 mm	m																7530.6	7530.6
Excavation volume		m^3						65886.2			5066.2								70952.4
Filling volume		m^3						53906.9			4145.1								58052.0

Bill of Quantities for Main Engineering of No. 2 Bridge in Section I

Material	Item	Unit	Small box girder		Cast-in-place box girder	Pier and foundation				Abutment and foundation			Ancillary structure					Total
			Prefabricated part	Cast-in-place part		Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
C50 concrete		m^3	11340.6	1505.9	4877.3	4182.2												21906.0
C40 concrete		m^3					3329.7						2991.9					6321.6
C35 concrete		m^3						5422.3		988.7	688.2			1647.5				8746.7
C30 underwater concrete		m^3							13390.8			373.2						13764.0
4 cm AC-13C fine-grained asphalt concrete (SBS modified)		m^2											1196.8					1196.8
6 cm AC-25 coarse-grained asphalt concrete		m^2											1795.1					1795.1
Polyurethane waterproof coating for roads and bridges		m^2											29919.0					29919.0
Φ^{s}15.2 steel stranded wire		kg	552248.0		219478.5	225071.8												996797.5
Ordinary rebar	HRB400	kg	2209652.0	240907.9	975460.0	758196.0	878185.0	650676.0	1325696.2	158192.0	82584.0	37320.0	369200.5	330574.3				8016643.9
Number of small box girders	Span 30m	Pcs	139.0															139.0
	Span 25m to 30m		118.0															118.0
	Span 25m		48.0															48.0
Number of pile foundations	Φ1000mm	Pcs							16.0									16.0
	Φ1200mm								284.0			22.0						306.0
	Φ1500mm								36.0									36.0
Support	GPZ30.0-JZGD-F	Pcs													2.0			2.0
	GPZ30.0-JZZX-±100-F														2.0			2.0
	GPZ30.0-JZHX-±50-F														2.0			2.0
	GPZ30.0-SX±100-F														2.0			2.0
	GPZ10.0-JZZX-±100-F														4.0			4.0
	GPZ10.0-SX±100-F														4.0			4.0
	LNR-370×470×147														610.0			610.0
Expansion joint	D80-type expansion joint	m														223.9		223.9
	D120-type expansion joint	m														165.7		165.7
Drainage	PVC pipe with a diameter of 150 mm	m															3660.0	3660.0
Excavation volume		m^3						29630.0										29630.0
Filling volume		m^3						24407.7										24407.7

Bill of Quantities for Main Engineering of the Upper and Lower Bridge Ramps at K1+090 in Section I

Material	Item	Unit	Small box girder		Pier and foundation				Abutment and foundation			Ancillary structure					Total
			Prefabricated part	Cast-in-place part	Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
C50 concrete		m^3	2057.2	184.7	381.8												2623.7
C40 concrete		m^3				445.8						468.0					913.8
C35 concrete		m^3					648.0		99.7	162.0			520.0				1429.7
C30 underwater concrete		m^3						1508.0			141.4						1649.3
C15 concrete		m^3					70.7			22.8							93.5
Asphalt concrete		m^3										468.0					468.0
Polyurethane waterproof coating for roads and bridges		m^2										4680.0					4680.0
Φ^s15.2 steel stranded wire		kg	81060.0		20996.8												102056.8
Number of small box girders	Span 30m	Pcs	42.0														42.0
	Span 25m		12.0														12.0
Number of pile foundations	Φ1000mm	Pcs						64.0			12						76.0
Ordinary rebar	HRB400	kg	328647.2	38685.7	68716.8	111456.0	77760.0	150796.4	15945.6	19440.0	14844.0	57751.2	78936.0				952979.0
Support	LNR-370×470×147	Pcs												108.0			108.0
Expansion joint	D80-type expansion joint	m													54.0		54.0
Drainage	PVC pipe with a diameter of 150 mm	m														1523.2	1523.2
Excavation volume		m^3					3564.0			891.0							4455.0
Filling volume		m^3					2916.0			729.0							3645.0

Bill of Quantities for Main Engineering of an Interchange Ramp between the New Ring Road and the Ard Ayush Road in Section I

Material	Item	Unit	Small box girder		Pier and foundation				Abutment and foundation			Ancillary structure					Total
			Prefabricated part	Cast-in-place part	Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
C50 concrete		m^3	951.5	91.1	179.6												1222.2
C40 concrete		m^3				251.7						222.3					474.0
C35 concrete		m^3					283.5		104.5	170.1			270.0				828.1
C30 underwater concrete		m^3						659.7			141.4						801.1
C15 concrete		m^3					30.9			24.0							54.9
Asphalt concrete		m^3										222.3					222.3
Polyurethane waterproof coating for roads and bridges		m^2										2223.0					2223.0
Φ^s15.2 steel stranded wire		kg	46590.0		9879.1												56469.1
Number of small box girders	Span 30m	Pcs	24.0														24.0
Number of pile foundations	Φ1000mm	Pcs						28.0			12						40.0
Ordinary rebar	HRB400	kg	189430.8	20695.8	32331.6	62937.0	34020.0	65973.4	16723.2	20412.0	14844.0	27431.6	40986.0				525985.7
Support	LNR-370×470×147	Pcs												48.0			48.0
Expansion joint	D80-type expansion joint	m													18.0		18.0
Drainage	PVC pipe with a diameter of 150 mm	m														786.4	786.4
Excavation volume		m^3					1559.3			935.6							2494.8
Filling volume		m^3					1275.8			765.5							2041.2

Bill of Quantities for Main Engineering of an Interchange Ramp between the New Ring Road and the West Side of the Second Ring Road in Section I

Material	Item	Unit	Small box girder		Cast-in-place box girder	Pier and foundation				Abutment and foundation			Ancillary structure					Total
			Prefabricated part	Cast-in-place part		Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
C50 concrete		m^3	2454.3	355.8	7257.1	1451.4												11518.6
C40 concrete		m^3					1927.7						1435.7					3363.4
C35 concrete		m^3						2754.0		899.5	356.5			1828.0				5838.0
C30 underwater concrete		m^3							6409.0			259.2						6668.2
C15 concrete		m^3																0.0
4 cm AC-13C fine-grained asphalt concrete (SBS modified)		m^3											574.3					574.3
6 cm AC-25 coarse-grained asphalt concrete		m^3											861.4					861.4
Polyurethane waterproof coating for roads and bridges		m^2											14357.0					14357.0
Φ^s15.2 steel stranded wire		kg	119894.9		131197.5													251092.4
Ordinary rebar	HRB400	kg	483494.5	57515.4	2232908.0	348336.0	481925.0	330480.0	672945.0	143920.0	42780.0	27216.0	177165.4	347320.0				5346605.3
Number of small box girders	Span 25m	Pcs	69.0															69.0
Number of pile foundations	Φ1000mm	Pcs							272.0			22.0						294.0
Support	LNR-370×470×147	Pcs													138.0			138.0
	LNR-470×570×167														98.0			98.0
Expansion joint	D80-type expansion joint	m														125.0		125.0
	D120-type expansion joint	m														95.0		95.0
Drainage	PVC pipe with a diameter of 150 mm	m															2675.0	2675.0
Excavation volume		m^3						15147.0			1960.8							17107.8
Filling volume		m^3						12393.0			1604.3							13997.3

Bill of Quantities for Main Engineering of a Flyover in Section I

Material	Item	Unit	Small box girder		Pier and foundation				Abutment and foundation		Ancillary structure					Total
			Prefabricated part	Cast-in-place part	Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
C50 concrete		m^3	699.4	67.9	110.4											877.7
C40 concrete		m^3				118.8					135.0					253.8
C35 concrete		m^3					162.3		134.2			100.0				396.5
C30 underwater concrete		m^3						407.2		160.8						568.0
C15 concrete		m^3														0.0
4 cm AC-13C fine-grained asphalt concrete (SBS modified)		m^3									54.0					54.0
6 cm AC-25 coarse-grained asphalt concrete		m^3									81.0					81.0
Polyurethane waterproof coating for roads and bridges		m^2									1350.0					1350.0
Φ^s15.2 steel stranded wire		kg	34099.2		4968.0											39067.2
Ordinary rebar	HRB400	kg	150693.8	9247.5	19872.0	29700.0	19476.0	40720.0	21476.6	14793.6	16659.0	19000.0				341638.3
Number of small box girders	Span 25m	Pcs	20.0													20.0
Number of pile foundations	Φ1200mm	Pcs						12.0								12.0
	Φ1600mm									4.0						4.0
Support	LNR-370×470×147	Pcs											40.0			40.0
Expansion joint	D120-type expansion joint	m												30.0		30.0
Drainage	PVC pipe with a diameter of 150 mm	m													308.0	308.0
Excavation volume		m^3					892.7									892.7
Filling volume		m^3					730.4									730.4

Bill of Quantities for Main Engineering of a Footbridge in Section I

Material	Item	Unit	Small box girder	Stairway	Pier and foundation					Ancillary structure					Total
			Prefabricated part	Cast-in-place part	Bent cap	Pier column	Pile cap	Pile foundation	Stair Base	M15 mortar	10 mm thick anti-slip tile	Footbridge railing	Support	Drainage pipe	
C50 concrete		m^3	224.0	737.2	26.6										987.8
C40 concrete		m^3				271.0									271.0
C35 concrete		m^3					156.0		218.4						374.4
C30 underwater concrete		m^3						1146.0							1146.0
M15 mortar		m^3								45.9					45.9
10 mm thick anti-slip tile		m^2									1530.0				1530.0
Φ^j15.2 steel stranded wire		kg	7840.0												7840.0
Ordinary rebar	HRB400	kg	44800.0	176947.2	5852.0	67750.0	18720.0	119312.0	18578.0			2089.9			454049.1
Q235C steels		kg										114547.5			114547.5
Number of small box girders	Span 32m	Pcs	4.0												4.0
Number of pile foundations	Φ1000mm	Pcs						80.0							80.0
	Φ1200mm							12.0							12.0
Support	GYZ d400×69(NR)	Pcs											16.0		16.0
Drainage	PVC pipe with a diameter of 150 mm	m												388.0	388.0
Excavation volume		m^3					858.0		655.2						1513.2
Filling volume		m^3					702.0		436.8						1138.8

Bill of Quantities for Main Engineering of a Box Culvert in Section I

Material	Item	Unit	Culvert body	Foundation	Bedding	Wing-type wall		Pavement of the entrance	Waterproof wall	Total
						Wall body	Foundation			
C35 concrete		m^3	552.0							552.0
C20 concrete		m^3		384.0		40.0	26.0			450.0
C20 rubble concrete		m^3						40.0	8.0	48.0
Gravel bedding		m^3			1908.0					1908.0
Ordinary rebar	HRB400	kg	87480.0							87480.0

Bill of Quantities for Main Engineering of No. 3 Bridge in Section II

Item / Material		Unit	Small box girder		Cast-in-place box girder	Pier and foundation				Abutment and foundation			Ancillary structure						Total
			Prefabricated part	Cast-in-place part		Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Anti-throwing net	Drainage pipe	
C50 concrete		m^3	22077.2	3167.9	12983.9	7788.7													46017.8
C40 concrete		m^3					6823.5						6444.7						13268.2
C35 concrete		m^3						10970.9		1199.1	1443.8			3518.8					17132.6
C30 concrete		m^3							25385.0			636.2							26021.2
C15 concrete		m^3						1316.4			118.6								1435.0
Asphalt concrete		m^3											6750.3						6750.3
Polyurethane waterproof coating for roads and bridges		m^2											67502.5						67502.5
Φ^S15.2 steel stranded wire		kg	1077095.0		584276.4	428378.5													2089749.9
Ordinary rebar	HRB400	kg	4296200.4	169976.3	2596784.0	1401966.0	1885444.0	1316508.0	2002920.0	191856.0	173250.0	58527.9	832980.9	351417.0					15277830.4
Number of small box girders	Span 30 m	Pcs	536.0																536.0
	Span 26 m	Pcs	45.0																45.0
Number of pile foundations	Φ1200mm								560.0										560.0
	Φ1500mm								99.0			24.0							123.0
Support	GPZ30.0-JZGD-F	Pcs													5.0				5.0
	GPZ30.0-JZZX-±100-F														4.0				4.0
	GPZ30.0-JZHX±50-F														5.0				5.0
	GPZ30.0-SX±100-F														4.0				4.0
	GPZ10.0-JZZX±100-F														10.0				10.0
	GPZ10.0-SX±100-F														12.0				12.0
	LNR-370×470×147														1162.0				1162.0
Expansion joint	D80-type expansion joint	m														300.0			300.0
	D120-type expansion joint	m														430.0			430.0
2.0 m high anti-throwing net	Low-carbon steel wire mesh	m															160.0		160.0
Drainage	PVC pipe with a diameter of 150 mm	m																7654.0	7654.0
Excavation volume		m^3						60340.0			7950.0								68290.0
Filling volume		m^3						49370.0			6500.0								55870.0

Bill of Quantities for Main Engineering of a Box Culvert in Section II

Item / Material		Unit	Culvert body	Foundation	Bedding	Wing-type wall		Pavement of the entrance	Waterproof wall	Total
						Wing-type wall	Foundation			
C35 concrete		m^3	3381.2							3381.2
C20 concrete		m^3		1797.6		93.6	45.6			1936.8
C20 rubble concrete		m^3						140.0	20.0	160.0
Gravel bedding		m^3			8945.2					8945.2
Ordinary rebar	HRB400	kg	633975.0							633975.0

Bill of Quantities for Main Engineering of an Interchange Ramp between the New Ring Road and No. 7 Road in Section II

Item / Material		Unit	Upper structure	Pier and foundation				Abutment and foundation					Ancillary structure					Total
			Cast-in-place box girder	Pier column	Bent cap	Pile cap	Pile foundation	Back wall	Side wall	Abutment body	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
Pavement	4 cm AC-13C fine-grained asphalt concrete (SBS modified)	m^3											418.2					418.2
	6 cm AC-25 coarse-grained asphalt concrete	m^3											627.2					627.2
	Polyurethane waterproof coating for roads and bridges	m^2											10453.8					10453.8
C50 concrete		m^3	10453.8															10453.8
C40 concrete		m^3		2560.3	516.8								1045.4					4122.4
C35 concrete		m^3				1579.5		42.0	42.7	820.9	348.3			985.9				3819.3
C30 underwater concrete		m^3					4992.0					240.0						5232.0
C15 concrete		m^3				114.9					24.3							139.2
Number of pile foundations	Φ1000mm	Pcs					208.0				20.0							228.0
Ordinary rebar	HRB400	kg	3972444.4	972899.9	196384.0	189540.0	524160.0	11760.0	4271.6	41043.7	41796.0	25200.0	128999.9	108447.4				6216946.9
Support	LNR-470×570×167	Pcs													90.0			90.0
Expansion joint	D80-type expansion joint	m														226.1		226.1
Drainage	PVC pipe with a diameter of 150 mm	m															3674.9	3674.9
Excavation volume		m^3				8687.3					1915.7							10602.9
Filling volume		m^3				7107.8					1567.4							8675.1

Bill of Quantities for Main Engineering of an Frontage Road Bridge in Section II

Item / Material		Unit	Small box girder		Abutment and foundation		Ancillary structure					Total
			Prefabricated part	Cast-in-place part	Abutment body and ear-back wall	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
C50 concrete		m^3	464.1	58.6								522.7
C40 concrete		m^3					105.0					105.0
C35 concrete		m^3			335.7			60.0				395.7
C30 underwater concrete		m^3				482.6						482.6
C15 concrete		m^3										0.0
4 cm AC-13C fine-grained asphalt concrete (SBS modified)		m^3					42.0					42.0
6 cm AC-25 coarse-grained asphalt concrete		m^3					63.0					63.0
Polyurethane waterproof coating for roads and bridges		m^2					1050.0					1050.0
Φ^S15.2 steel stranded wire		kg	22624.0									22624.0
Ordinary rebar	HRB400	kg	89763.2	9347.2	53705.3	44399.2	12957.0	11400.0				221571.9
Number of small box girders	Span 30 m	Pcs	12.0									12.0
Number of pile foundations	Φ1600mm	Pcs				8.0						8.0
Support	LNR-370×470×147	Pcs							24.0			24.0
Expansion	D80-type expansion joint	m								88.0		88.0
Drainage	PVC pipe with a diameter of 150 mm	m									35.0	35.0

Bill of Quantities for Main Engineering of No. 4 Bridge in Section III

Item / Material		Dimensions	Small Box Girder		Cast-in-place	Pier and foundation				Abutment and foundation			Ancillary structure							Total
			Prefabricated part	Cast-in-place part	Box Girder	Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Sound Barrier	Anti-throwing net	Drainage pipe	
C50 concrete		m3	23659.1	3234.7	9854.1	8985.6														45733.5
C40 concrete		m3					6078.3						6678.3							12756.6
C35 concrete		m3						10446.6		312.3	445.5			3906.4						15110.8
C30 concrete		m3							38204.3			235.6								38439.9
C15 concrete		m3						1241.4			60.9									1302.3
4 cm AC-13C fine-grained asphalt concrete (SBS modified)		m3											6678.3							6678.3
6 cm AC-25 coarse-grained asphalt concrete (SBS modified)		m3											2671.3							2671.3
Polyurethane waterproof coating for roads and bridges		m2											4007.0							4007.0
Φs15.2 steel stranded wire		kg	1154450.0		443432.3	494208.7														2092090.9
Ordinary rebar	HRB400	kg	4608154.0	138067.9	1970810.0	1617410.2	1541197.5	1253591.0	3820428.0	49966.4	53460.0	24740.0	824096.1	390126.0						16292047.1
Number of small box girders	The span 25000mm	pcs	31.0																	31.0
	The span 30000mm		586.0																	586.0
Number of pile foundations	φ1000m	pcs										20.0								20.0
	φ1200m								732.0											732.0
	φ1500mm								72.0											72.0
Support	GPZ30.0-JZGD-F	pcs													4.0					4.0
	GPZ30.0-JZZX-±100-F														4.0					4.0
	GPZ30.0-JZHX±50-F														4.0					4.0
	GPZ30.0-SX±100-F														4.0					4.0
	GPZ10.0-JZZX±100-F														8.0					8.0
	GPZ10.0-SX±100-F														8.0					8.0
	LNR-370×470×147														1234.0					1234.0
Expansion joint	D80-type expansion joint	m														137.7				137.7
	D100-type expansion joint	m														510.7				510.7
2.0 m high sound barrier		m															2056.0			2056.0
2.0 m high anti-throwing net		m																400.0		400.0
PVC pipe with a diameter of 150 mm		m																	13364.0	13364.0
Excavation volume		m3						57456.3			2450.3									59906.5
Filling volume		m3						47009.7			2004.8									49014.4

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1:1
		Bill of Quantities for Main Engineering of Bridge and Culvert Structures				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	Ⅱ-60
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	YANG WANHU					DATE	2025.07

Bill of Quantities for Main Engineering of No. 5 Bridge in Section III

Item / Material		Dimensions	Upper structure: Cast-in-place box girder	Pier and foundation: Pier	Pile cap	Pile foundation	Abutment and foundation: Back wall	Abutment body	Pile cap	Pile foundation	Ancillary structure: Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	Total
4 cm AC-13C fine-grained asphalt concrete (SBS modified)		m3									127.2					127.2
6 cm AC-25 coarse-grained asphalt concrete (SBS modified)											190.8					190.8
Polyurethane waterproof coating for roads and bridges		m2									3180.0					3180.0
C50 concrete		m3	2703.0													2703.0
C40 concrete				108.0							318.0					426.0
C35 concrete					371.3		107.1	686.9	445.5			182.4				1793.1
C30 underwater concrete						635.9				339.1						975.0
C15 concrete					15.6				31.0							46.6
Φs15.2 steel stranded wire		kg	121635.0													121635.0
Number of pile foundations	Φ1200mm	pcs								20.0						20.0
	Φ1500mm					18.0										18.0
Ordinary rebar	HRB400	kg	540600.0	41040.0	44550.0	58498.2	29974.0	34344.0	53460.0	35607.6	39241.2	20064.0				897379.0
Support	GPZ30.0-JZGD-F	pcs											1.0			1.0
	GPZ30.0-JZZX-±100-F												1.0			1.0
	GPZ30.0-JZHX±50-F												1.0			1.0
	GPZ30.0-SX±100-F												1.0			1.0
	GPZ10.0-JZZX±100-F												2.0			2.0
	GPZ10.0-SX±100-F												2.0			2.0
Expansion joint	D120-type expansion joint	m												53.0		53.0
Drainage	PVC pipe with a diameter of 150														352.0	352.0
Excavation volume		m3			2041.9				2450.3							4492.2
Filling volume					1670.6				2004.8							3675.4

Bill of Quantities for Main Engineering of Interchange Ramp between the New Ring Road and the East Side of the Second Ring Road in Section III

Item / Material		Dimensions	Cast-in-place box girder	Framework tunnel	Pier and foundation				Abutment and foundation			Ancillary structure					Total
					Pile cap	Pier	Pile cap	Pile foundation	Abutment body	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
C50 concrete		m3	4034.4		220.1												4254.5
C40 concrete		m3		3557.5		330.5						432.0					4320.0
C35 concrete		m3					486.0		408.8	348.4			480.0				1723.2
C30 underwater concrete		m3						1131.0			235.6						1366.6
4 cm AC-13C fine-grained asphalt concrete (SBS modified)		m3										172.8					172.8
6 cm AC-25 coarse-grained asphalt concrete (SBS modified)		m3										259.2					259.2
Polyurethane waterproof coating for roads and bridges		m2										4320.0					4320.0
Φs15.2 steel stranded wire		kg	181548.0														181548.0
Ordinary rebar	HRB400	kg	806880.0	782650.0	52824.0	82625.0	58320.0	118755.0	65408.0	41808.0	24738.0	53308.8	91200.0				2178516.8
Number of small box girders	Φ1000mm	pcs						48.0			20.0						68.0
Support	LNR-470×570×167	pcs												24.0			24.0
	LNR-720×720×226													12.0			12.0
Expansion joint	D80-type expansion joint	m													42.0		42.0
	D120-type expansion joint	m													42.0		42.0
Drainage	PVC pipe with a diameter of 150 mm	m														692.0	692.0
Excavation volume		m3		3750			2673.0			1916.2							8339.2
Filling volume		m3					2187.0			1567.8							3754.8

Bill of Quantities for Main Engineering of an Interchange Ramp between New Ring Road and Police Academy Avenue in Section III

Item / Material	Dimensions	Upper structure		Pier and foundation				Abutment and foundation					Ancillary structure					Total
		Prefabricated part	Cast-in-place part	Bent cap	Pier column	Pile cap	Pile foundation	Back wall	Side wall	Abutment body	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
4 cm AC-13C fine-grained asphalt concrete (SBS modified)	m3												410.4					410.4
6 cm AC-25 coarse-grained asphalt concrete (SBS modified)													615.6					615.6
Polyurethane waterproof coating for roads and bridges	m2												10260.0					10260.0
C50 concrete	m3	4503.8	543.4															5047.2
C40 concrete				816.0	935.9								1026.0					2777.9
C35 concrete						1032.8		53.4	39.2	328.2	324.0			1140.0				2917.6
C30 underwater concrete							3264.0					288.0						3552.0
C15 concrete				75.1		75.1					22.8							173.1
Φs15.2 steel stranded wire	kg	220020.0																220020.0
Number of small box girders	The span 30m	114.0																114.0
Number of small box girders	Φ1000mm						136.0				24.0							160.0
Ordinary rebar	HRB400	893535.8	81886.2	310080.0	355646.0	123930.0	342720.0	14952.0	3923.6	16409.9	38880.0	30240.0	126608.4	125400.0				2464211.9
Support	LNR-370×470×147	pcs													228.0			228.0
Expansion joint	D80-type expansion joint															270.0		270.0
Drainage		m															3069.7	3069.7
Excavation volume		m3				5680.1					1782.0							7462.1
Filling volume						4647.4					1458.0							6105.4

Bill of Quantities for Main Engineering of Interchange between New Ring Road and Tuul Expressway in Section III

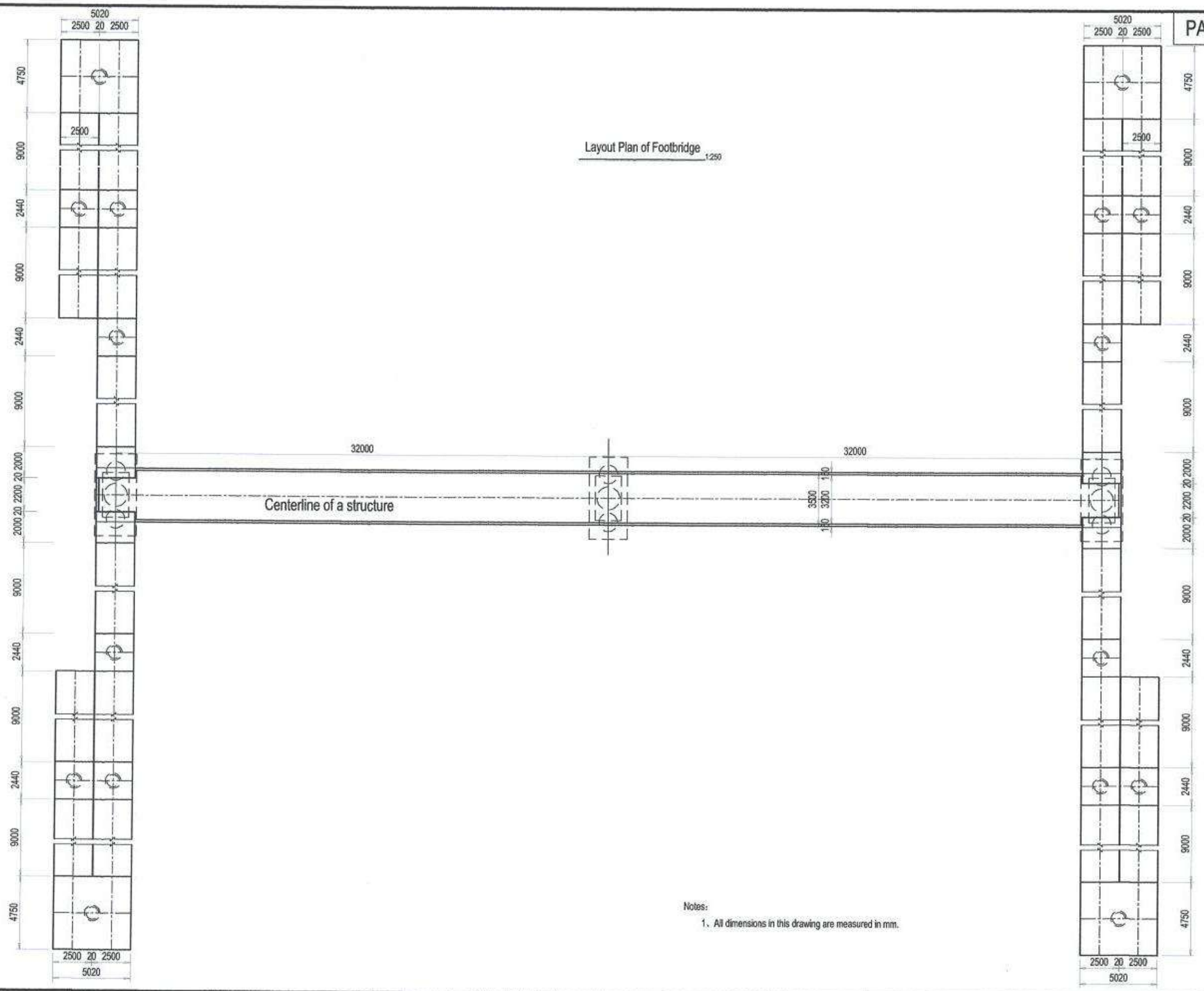
Item / Material		Dimensions	Cast-in-place Box Girder	Pier and foundation				Abutment and foundation			Ancillary structure					Total
				Bent cap	Pier column	Pile cap	Pile foundation	Abutment body and ear-back wall	Pile cap	Pile foundation	Bridge Deck Pavement	Anti-collision guardrail	Support	Expansion joint	Drainage pipe	
C50 concrete		m3	8310.5	483.0												8793.5
C40 concrete		m3			1591.3						977.7					2569.0
C35 concrete		m3				2025.0		212.7	382.3			793.0				3413.0
C30 underwater concrete		m3					4712.4			277.1						4989.5
C15 concrete		m3				220.9			48.8							269.7
Asphalt concrete		m3									977.7					977.7
Polyurethane waterproof coating for roads and bridges		m2									9777.0					9777.0
Φs15.2 steel stranded wire		kg	373970.3	26565.0												400535.3
Number of small box girders	Φ1000mm	pcs					200.0			12						212.0
	Φ1200mm						0.0			8.0						8.0
Ordinary rebar	HRB400	kg	1662090.0	86940.0	438084.0	243000.0	471238.9	34027.2	45878.4	29094.3	120648.2	120377.4				3251378.4
Support	GPZ5.0-JZGD-F	pcs											2.0			2.0
	GPZ5.0-JZZX-±100-F												2.0			2.0
	GPZ5.0-JZHX±50-F												2.0			2.0
	GPZ5.0-SX±100-F												2.0			2.0
	GPZ3.0-JZZX±100-F												4.0			4.0
	GPZ3.0-SX±100-F												4.0			4.0
	LNR-470×570×167												122.0			122.0
Expansion joint	D80-type expansion joint	m												190.0		190.0
Drainage	PVC pipe with a diameter of 150 mm	m													2830.0	2830.0
	Excavation volume	m3				11137.5			2102.8							13240.3
	Filling volume	m3				9112.5			1720.4							10832.9

Bill of Quantities for Main Engineering of a Footbridge in Section III

Item / Material		Dimensions	Small Box Girder	Cast-in-place part	Pier and foundation					Ancillary structure					Total
			Prefabricated part		Bent cap	Pier column	Pile cap	Pile foundation	Staircase footing	M15 mortar	10 mm thick anti-slip tile	Footbridge railing	Support	Drainage pipe	
C50 concrete		m3	112.0	368.6	13.3										493.9
C40 concrete		m3				135.5									135.5
C35 concrete		m3					78.0		109.2						187.2
C30 underwater concrete		m3						573.0							573.0
10 mm thick anti-slip tile		m2								24.0	800.0				824.0
Φs15.2 steel stranded wire		kg	3920.0												3920.0
Ordinary rebar	HRB400	kg	22400.0	88473.6	2926.0	33875.0	9360.0	59656.0	9289.0			1045.0			227024.6
Q235C steels		kg										57273.8			57273.8
Number of small box girders	The span 32m	pcs	2.0												2.0
Number of pile foundations	Φ1000mm	pcs						40.0							40.0
	Φ1200mm							6.0							6.0
Support	GYZ d400X69(NR)	pcs											8.0		8.0
Drainage	PVC pipe with a diameter of 150 mm	m												194.0	194.0
Excavation volume		m3					429.0		327.6						756.6
Filling volume		m3					351.0		218.4						569.4

Bill of Quantities for Main Engineering of a Box Culvert in Section III

Item / Material		Dimensions	Culvert body	Foundation	Bedding	Wing-type wall		Pavement of the entrance	Waterproof wall	Total
						Wall body	Foundation			
C35 concrete		m3	6049.2							6049.2
C20 concrete		m3		3534.4		307.2	169.2			4010.8
C20 rubble concrete		m3						400.0	64.0	464.0
Gravel bedding		m3			17577.8					17577.8
Ordinary rebar	HRB400	kg	1077888.0							1077888.0



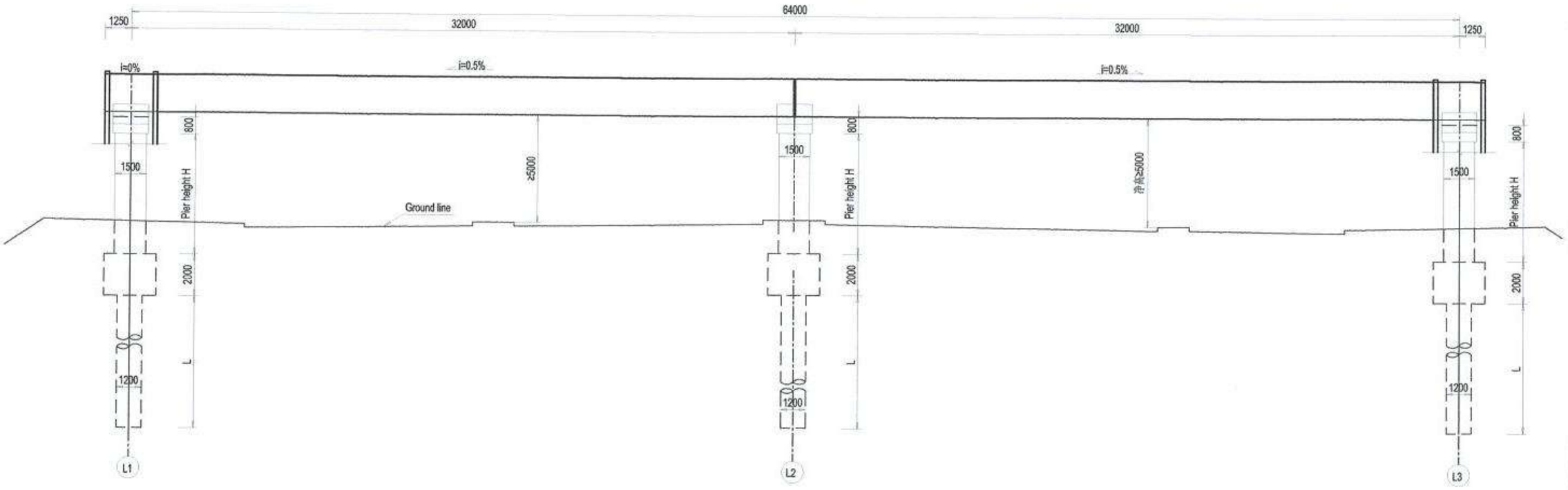
Layout Plan of Footbridge 1:250

Notes:

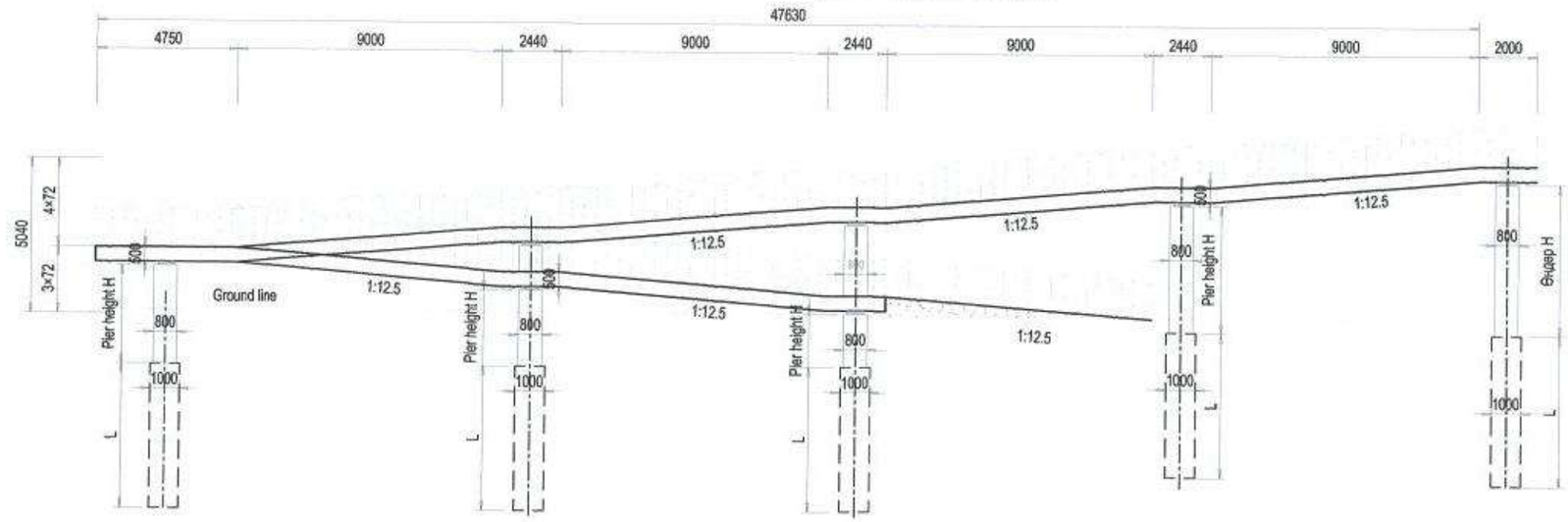
1、All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI	SUB.MANAGER	GAO JINCHUN	CHECKED	GAO JINCHUN	SCALE	1: 250
		Layout of Footbridge				MASTER DES.	CAO YONGXIANG	SPE.MANAGER	ZHANG BO	EXAMINED	PANG WEI	DRAWING NO.	II-61
						MASTER DES.	PAN HAOGUO	SPE.MANAGER	MA JUN	APPROVED	ZHU ANJING		
								DESIGNED	LI MAOJUN			DATE	2025.07

Layout Elevation of Footbridge 1:200



Layout Elevation of Slope 1:200

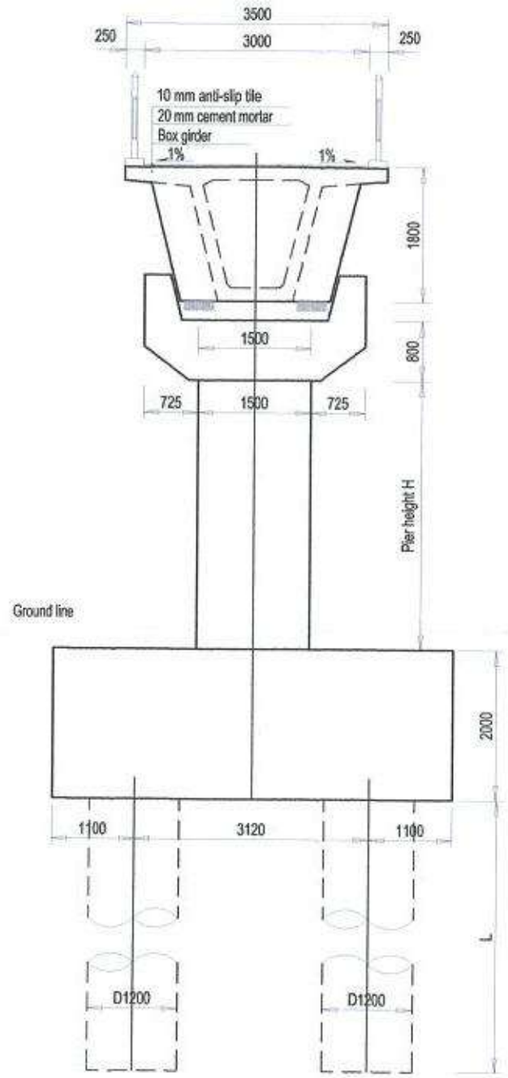


Notes:

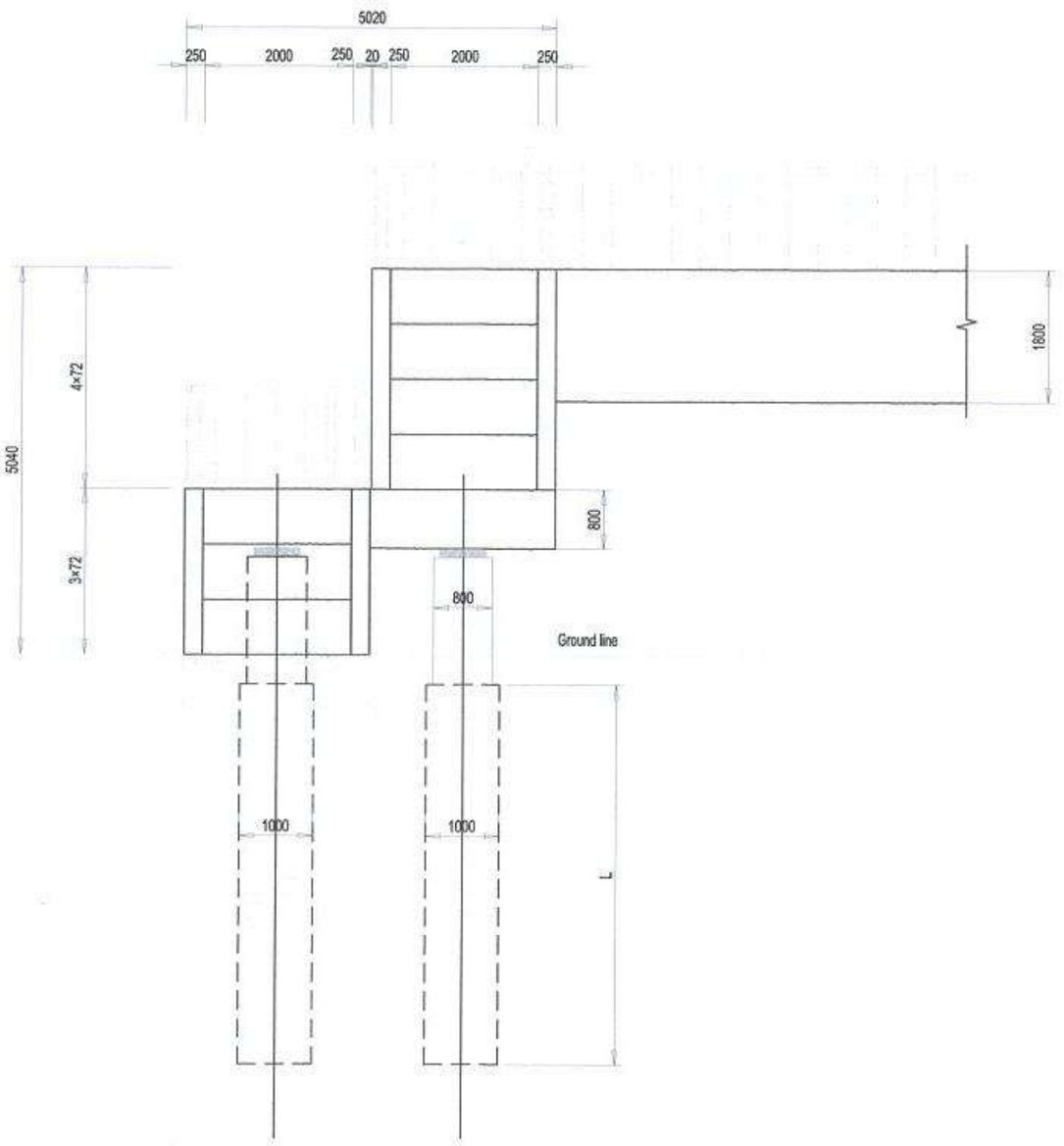
1. All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 200
		Layout of Footbridge				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-61
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING		DATE	2025.07
									DESIGNED	LI MAOJUN						

Cross Section Layout of Footbridge 1:80



Cross Section Layout of Slope 1:80



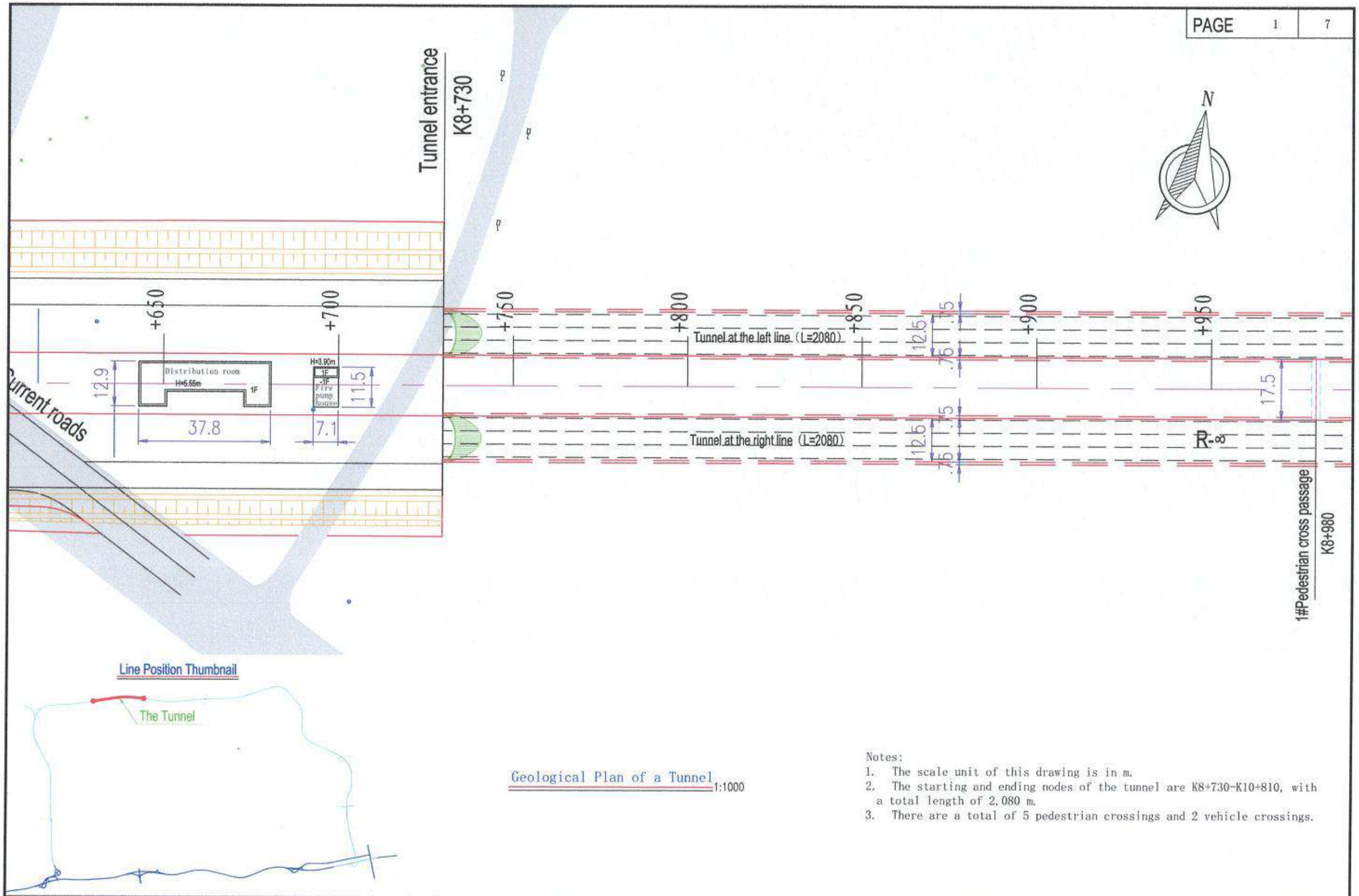
Notes:

1、All dimensions in this drawing are measured in mm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES.MANAGER	PANG WEI		SUB.MANAGER	GAO JINCHUN		CHECKED	GAO JINCHUN		SCALE	1: 80
		Явган хүний гүүрэн гарцын байршлын зураг				MASTER DES.	CAO YONGXIANG		SPE.MANAGER	ZHANG BO		EXAMINED	PANG WEI		DRAWING NO.	II-61
						MASTER DES.	PAN HAOGUO		SPE.MANAGER	MA JUN		APPROVED	ZHU ANJING			
									DESIGNED	LI MAOJUN					DATE	2025.07

Tunnel Table

No.	Tunnel name	Starting and ending pile Nos.	Length (m)	Tunnel classification	Vehicle cross passage	Pedestrian cross passage	Construction clearance (width x height) (m)	Route type inside the tunnel		Type of tunnel portal	Lighting mode	Ventilation mode
								Slope(%)	Horizontal curve radius(m)			
1	Mongolian New Ring Road Tunnel	K8+730~K10+810	2080	Category I	2	5	14.0×5.0	0.95%、-0.99%	∞、R=3500、∞	Bamboo cutting type	LED lamp	Mechanical ventilation

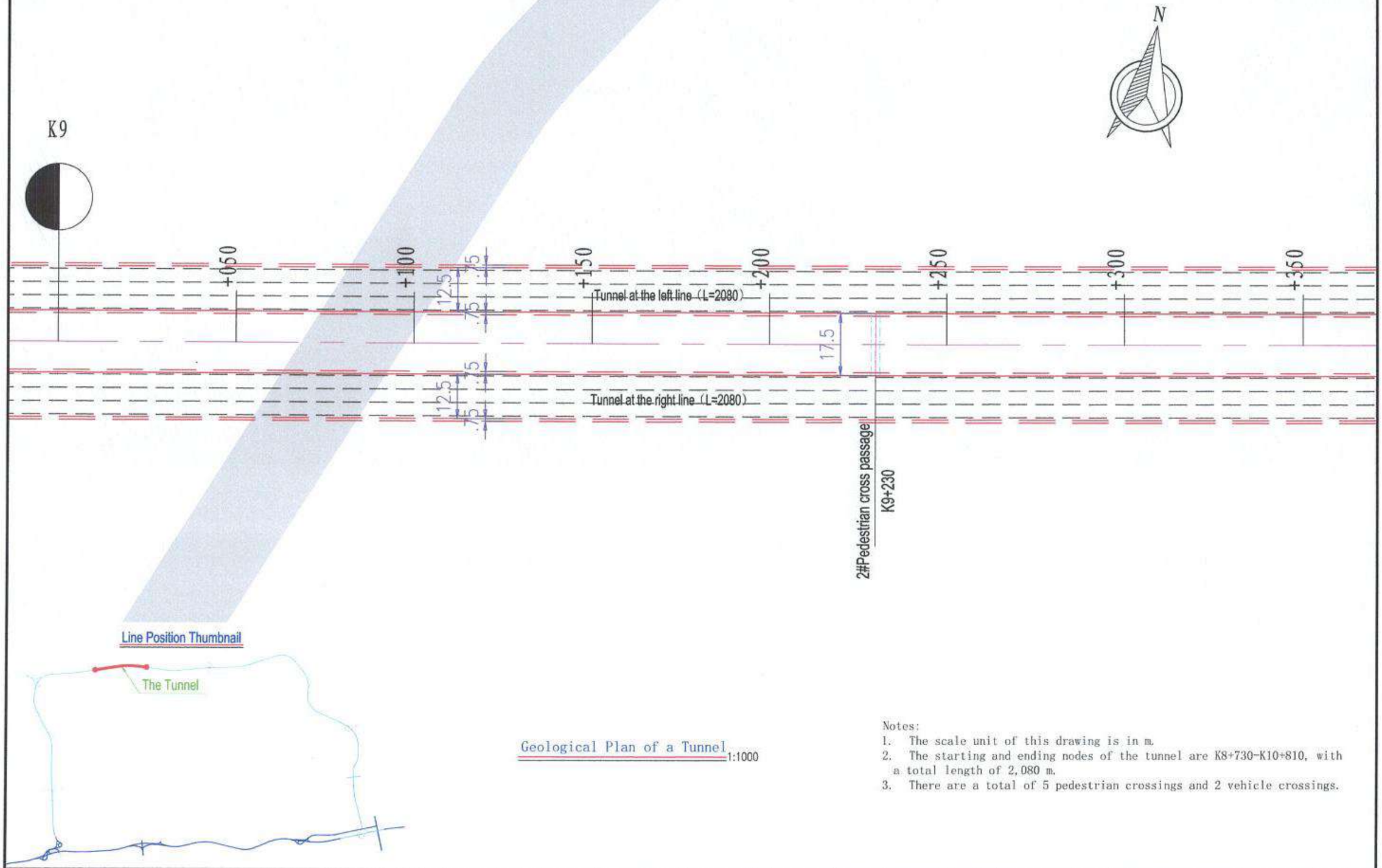


Line Position Thumbnail

Geological Plan of a Tunnel 1:1000

Notes:
1. The scale unit of this drawing is in m.
2. The starting and ending nodes of the tunnel are K8+730-K10+810, with a total length of 2,080 m.
3. There are a total of 5 pedestrian crossings and 2 vehicle crossings.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:1000
		Geological Plan of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-02
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



Line Position Thumbnail

Geological Plan of a Tunnel 1:1000

Notes:
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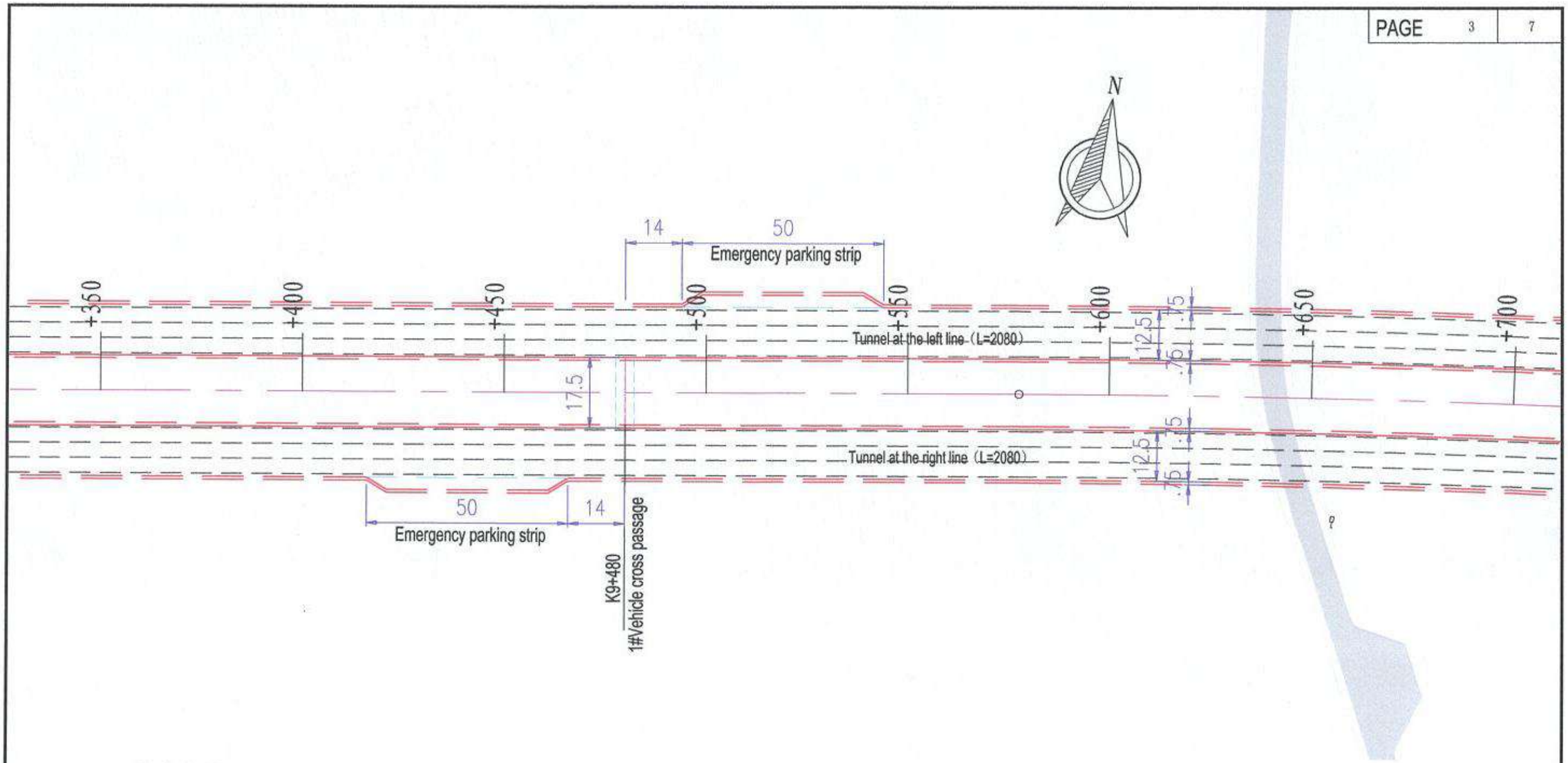
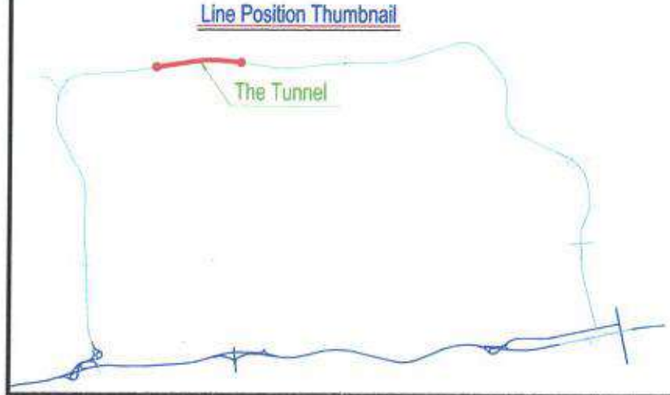
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:1000
		Geological Plan of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-02
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



Line Position Thumbnail



Geological Plan of a Tunnel 1:1000

Notes:
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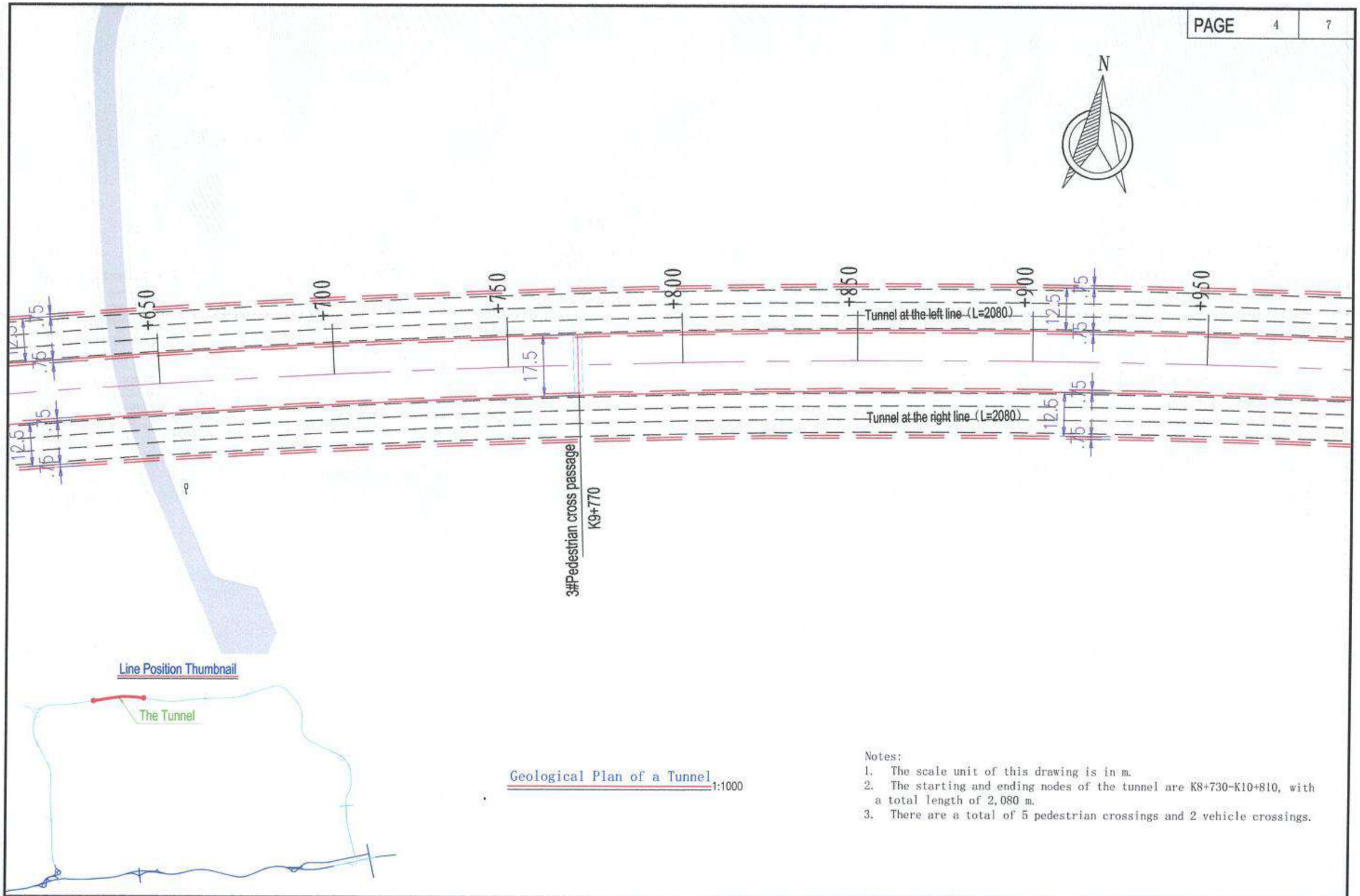
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:1000
		Geological Plan of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-02
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



Line Position Thumbnail

Geological Plan of a Tunnel 1:1000

Notes:
1. The scale unit of this drawing is in m.
2. The starting and ending nodes of the tunnel are K8+730~K10+810, with a total length of 2,080 m.
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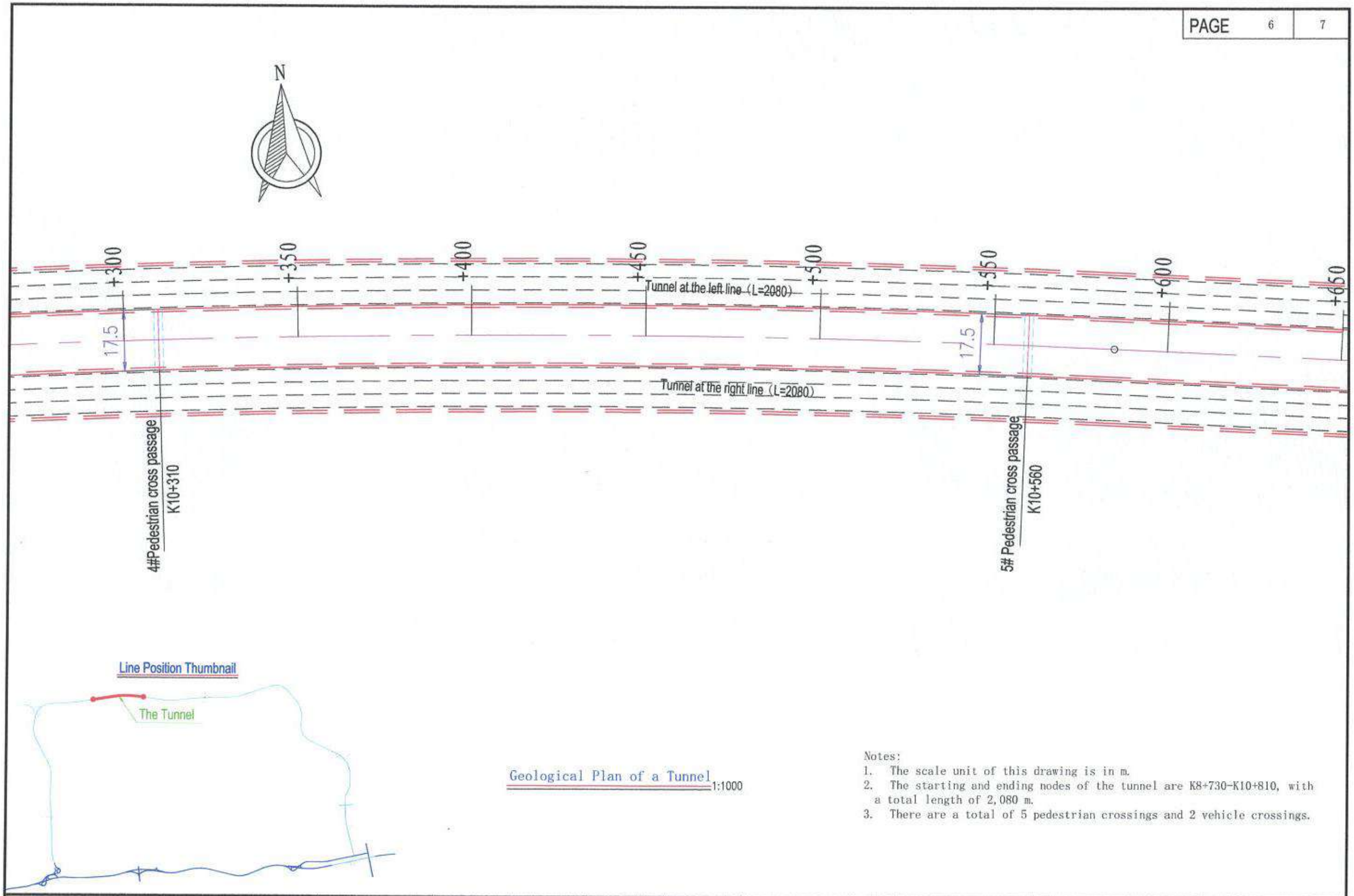
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:1000
		Geological Plan of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-02
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



Line Position Thumbnail

Geological Plan of a Tunnel 1:1000

Notes:
1. The scale unit of this drawing is in m.
2. The starting and ending nodes of the tunnel are K8+730-K10+810, with a total length of 2,080 m.
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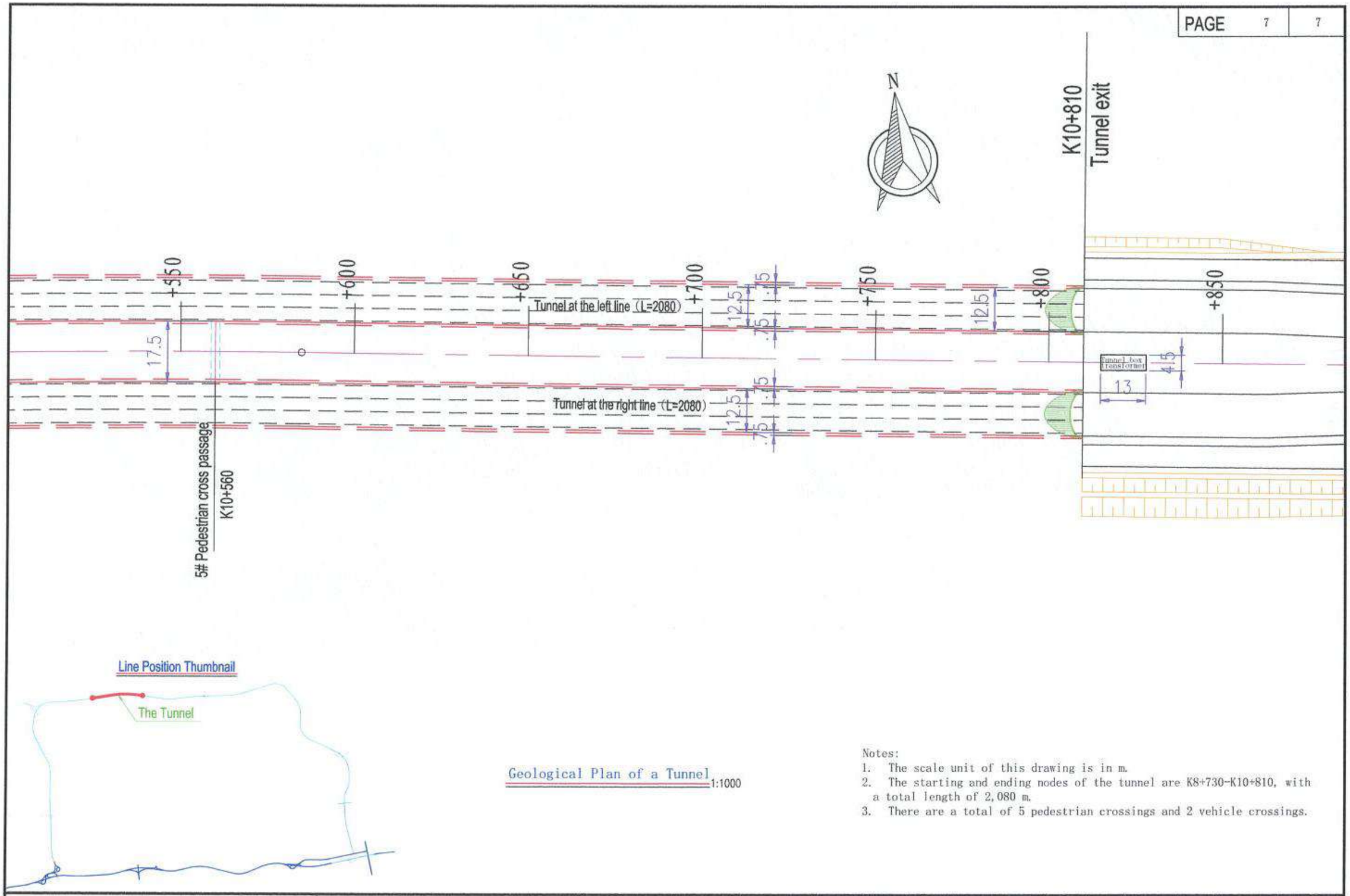
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA	王大发	SCALE	1:1000
		Geological Plan of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO	纪天骄	EXAMINED	MA XIAO HU		DRAWING NO.	III-02
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG	童京盛		
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG	王军堂	APPROVED			DATE	2025.07



Line Position Thumbnail

Geological Plan of a Tunnel 1:1000

Notes:
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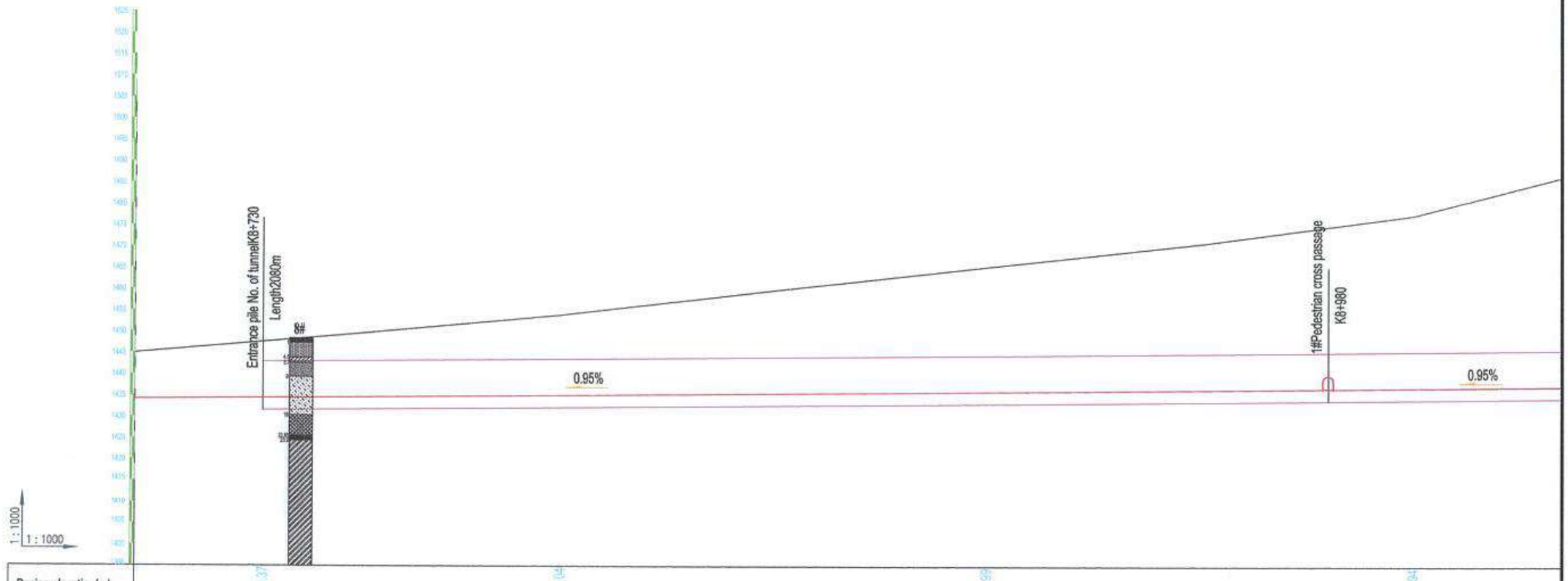
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:1000
		Geological Plan of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-02
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



Design elevation(m)	1434.37	1435.04	1435.99	1436.94
Ground elevation(m)	1447.56	1453.94	1465.36	1477.45
Slope (%)Slope length(m)	+730 1434.37		0.95	490
Mileage pile No.	K8+700	K8+800	K8+900	K9+000
Straight line and horizontal curve			R-∞	

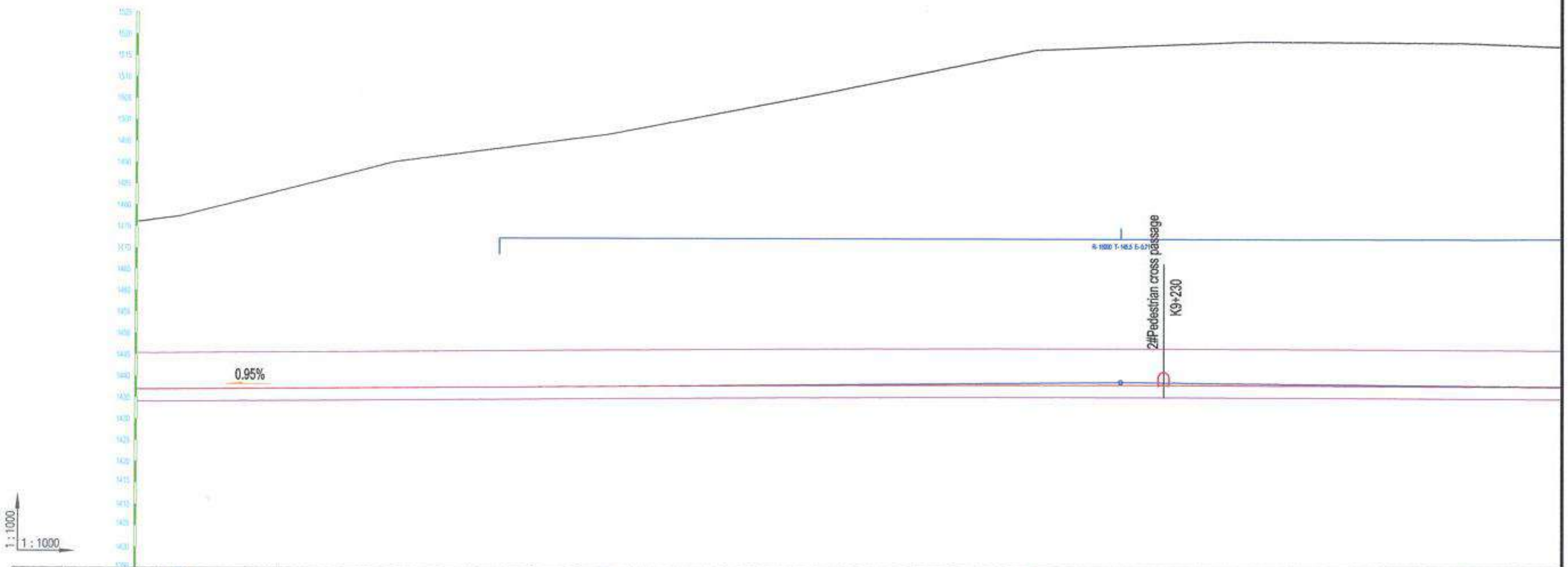
Legend

- Brown sandy soils, clayey soils and hard plastic soils
- Gravels containing brown clays and sand aggregates
- Brown and brown gray sandstones
- Brown gray shales
- Thin layer of dark gray and gray silty mudstones
- Dark gray plain shales
- Dark gray sandstones with gravel inclusions
- Dark gray gravels

Design Drawing of a Tunnel Longitudinal Section 1:1000

Notes:
1. The scale unit of this drawing is in m.
2. The starting and ending nodes of the tunnel are K8+730-K10+810, with a total length of 2,080 meters.
3. There are a total of 5 pedestrian crossings and 2 vehicle crossings.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:1000
		Design Drawing of a Tunnel Longitudinal Section				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-03
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



	K9+000	K9+100	K9+200	K9+300
Design elevation(m)	1436.54	1437.67	1438.31	1438.09
Ground elevation(m)	1477.45	1496.83	1516.63	1518.40
Slope (%)Slope length(m)			+220 1439.03	
Mileage pile No.	K9+000	K9+100	K9+200	K9+300
Straight line and horizontal curve				

Design Drawing of a Tunnel Longitudinal Section

1:1000

Notes:

1. The scale unit of this drawing is in m.
2. The starting and ending nodes of the tunnel are K8+730-K10+810, with a total length of 2,080 meters.
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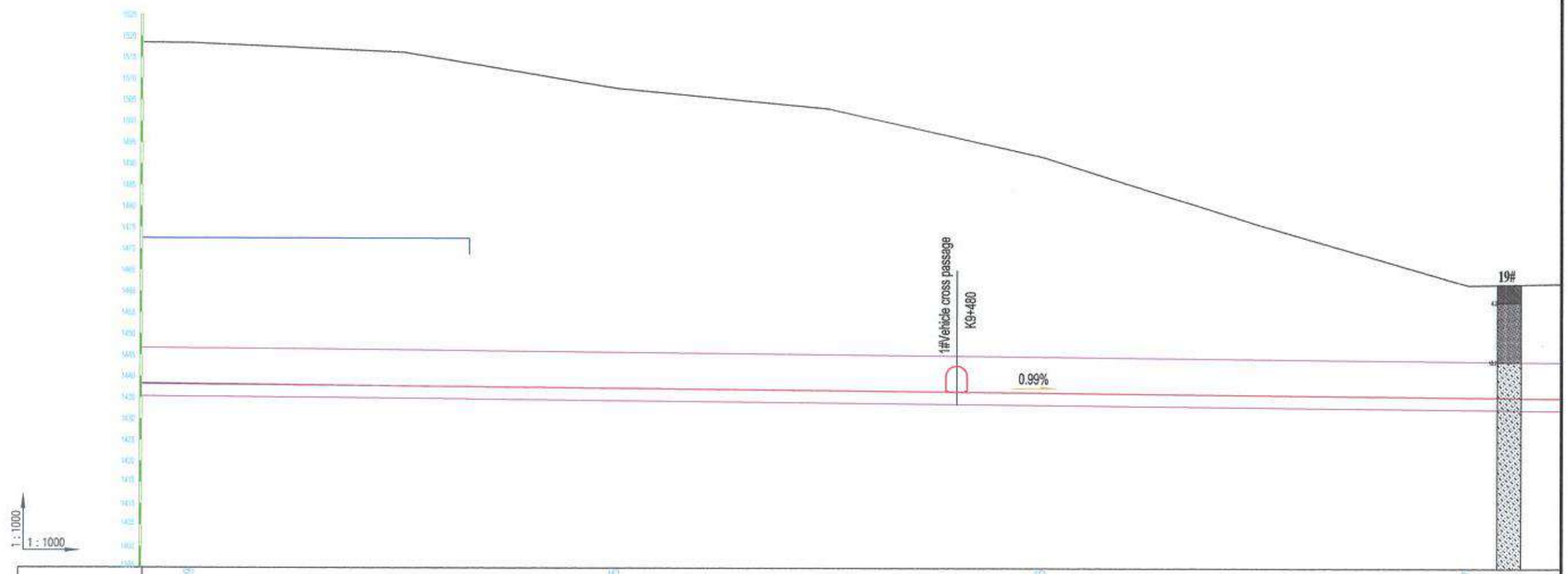
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI	SUB. MANAGER		CHECKED	WANG DA FA	SCALE	1:1000
						MASTER DES.	CAO YONG XIANG	SPE. MANAGER	JI TIAN JIAO	EXAMINED	MA XIAO HU	DRAWING NO.	III-03
		Design Drawing of a Tunnel Longitudinal Section				MASTER DES.	PAN HAO GUO	SPE. MANAGER		APPROVED	TONG JING SHENG		
						SUB. MANAGER	MA XIAO HU	DESIGNED	WANG JUN TANG	APPROVED		DATE	2025.07



Design elevation(m)	1518.40 1438.09		1491.77 1436.26	1461.65 1435.27
Ground elevation(m)		1507.89 1437.25		
Slope (%)Slope length(m)				
Mileage pile No.	K9+300	K9+400	K9+500	K9+600
Straight line and horizontal curve				

Design Drawing of a Tunnel Longitudinal Section

1:1000

Legend

- Brown gray and gray brown medium-grained sandstones
- Brown yellow clay gravels with hard flow characteristics
- Light blue and gray fine-grained siltstones interbedded with sandstones

Notes:
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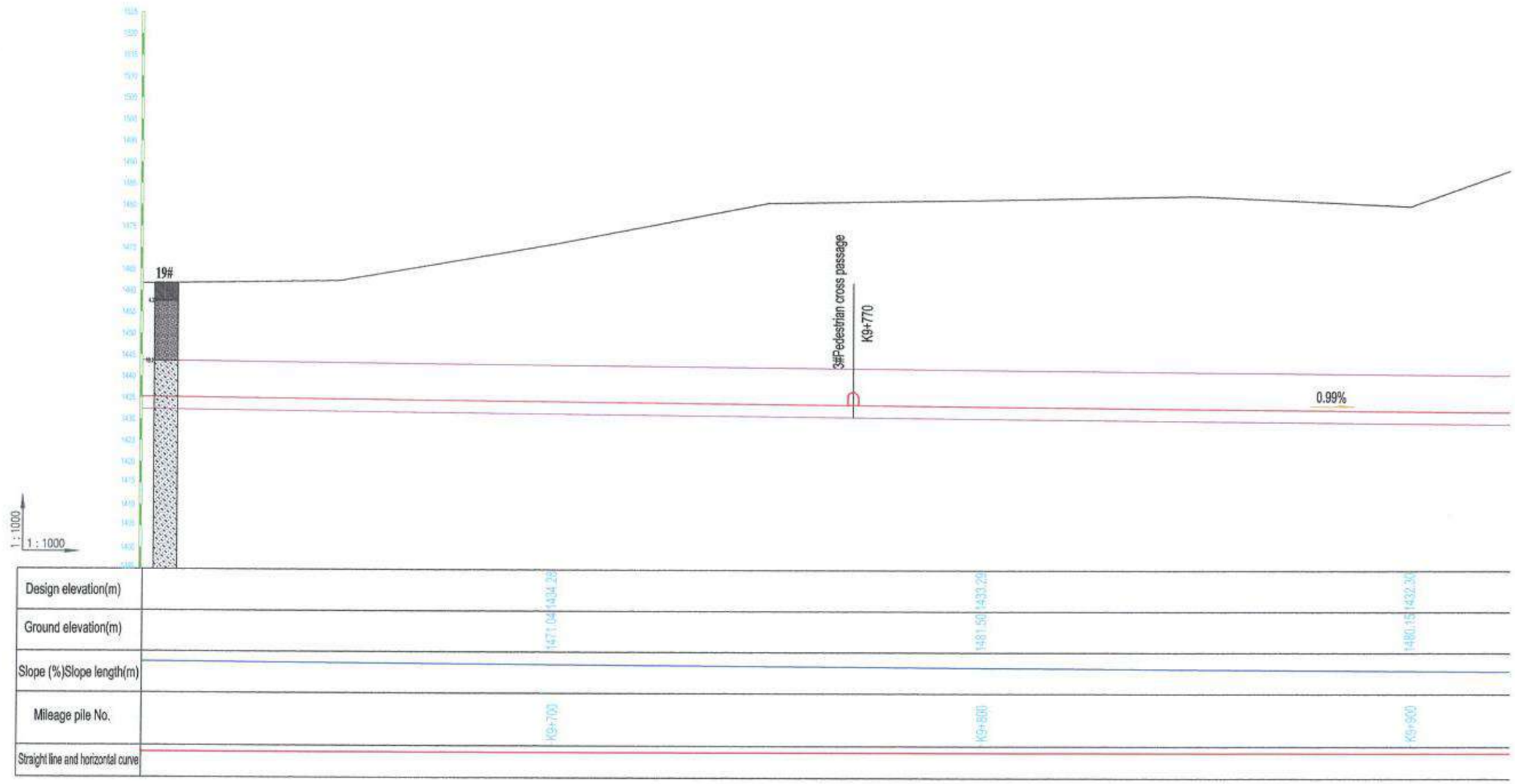
3. There are a total of 5 pedestrian crossings and 2 vehicle crossings.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:1000
		Design Drawing of a Tunnel Longitudinal Section				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-03
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



Design Drawing of a Tunnel Longitudinal Section

1:1000

Legend

- Brown gray and gray brown medium-grained sandstones
- Brown yellow clay gravels with hard flow characteristics
- Light blue and gray fine-grained siltstones interbedded with sandstones

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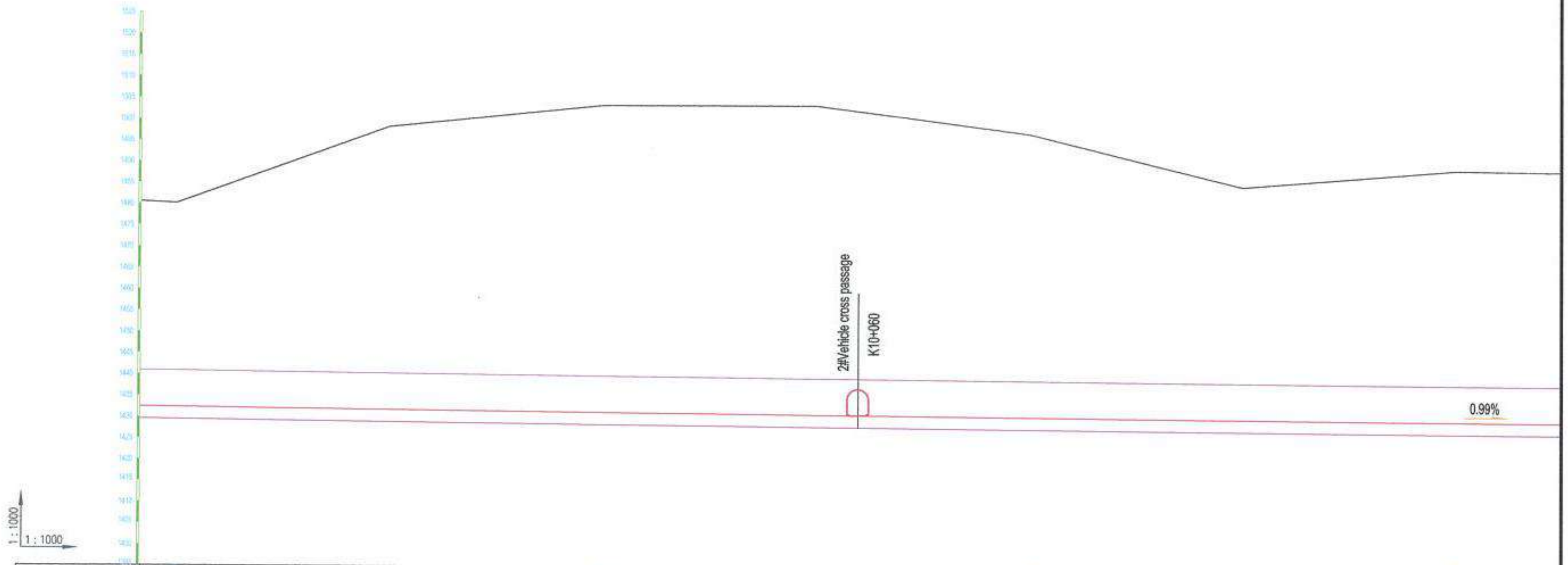
		Design Drawing of a Tunnel Longitudinal Section				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-03
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



Item				
Design elevation(m)	1432.30	1431.31	1430.32	1429.33
Ground elevation(m)	1480.15	1503.45	1496.86	1488.43
Slope (%)Slope length(m)	-0.99 / 1590			
Mileage pile No.	K9+900	K10+000	K10+100	K10+200
Straight line and horizontal curve	JD9 I-16°29'16.6"(Y) R-3500			

Design Drawing of a Tunnel Longitudinal Section

1:1000

Notes:

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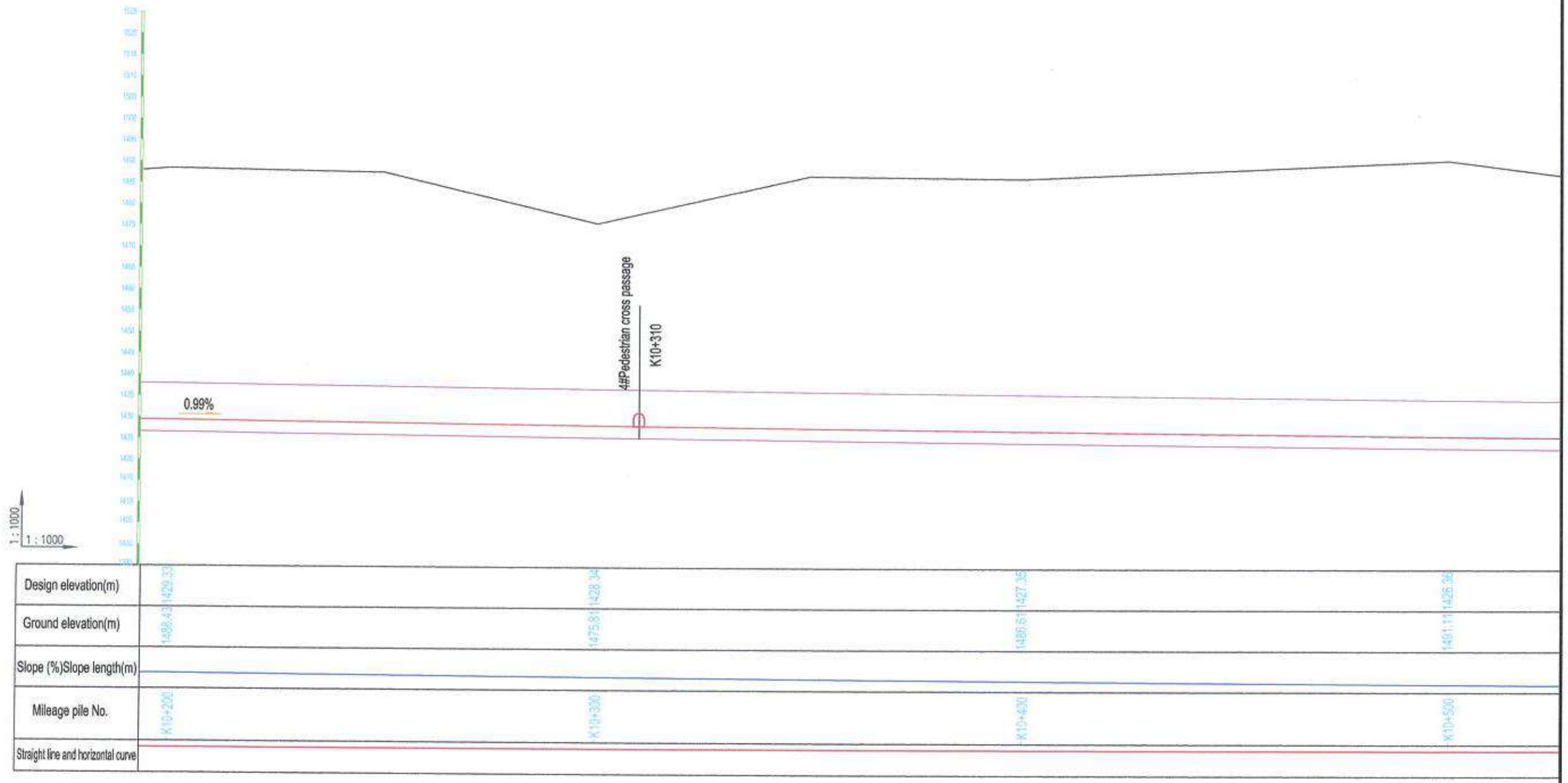
2. The starting and ending nodes of the tunnel are K8+730-K10+810, with a total length of 2,080 meters.
3. There are a total of 5 pedestrian crossings and 2 vehicle crossings.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER	PANG WEI	SUB. MANAGER		CHECKED	WANG DA FA	SCALE	1:1000
		Design Drawing of a Tunnel Longitudinal Section		MASTER DES.	CAO YONG XIANG	SPE. MANAGER	JI TIAN JIAO	EXAMINED	MA XIAO HU	DRAWING NO.	III-03
				MASTER DES.	PAN HAO GUO	SPE. MANAGER		APPROVED	TONG JING SHENG		
				SUB. MANAGER	MA XIAO HU	DESIGNED	WANG JUN TANG	APPROVED		DATE	2025.07



Design Drawing of a Tunnel Longitudinal Section 1:1000

Notes:
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2. The starting and ending nodes of the tunnel are K8+730-K10+810, with a total length of 2,080 meters.
3. There are a total of 5 pedestrian crossings and 2 vehicle crossings.

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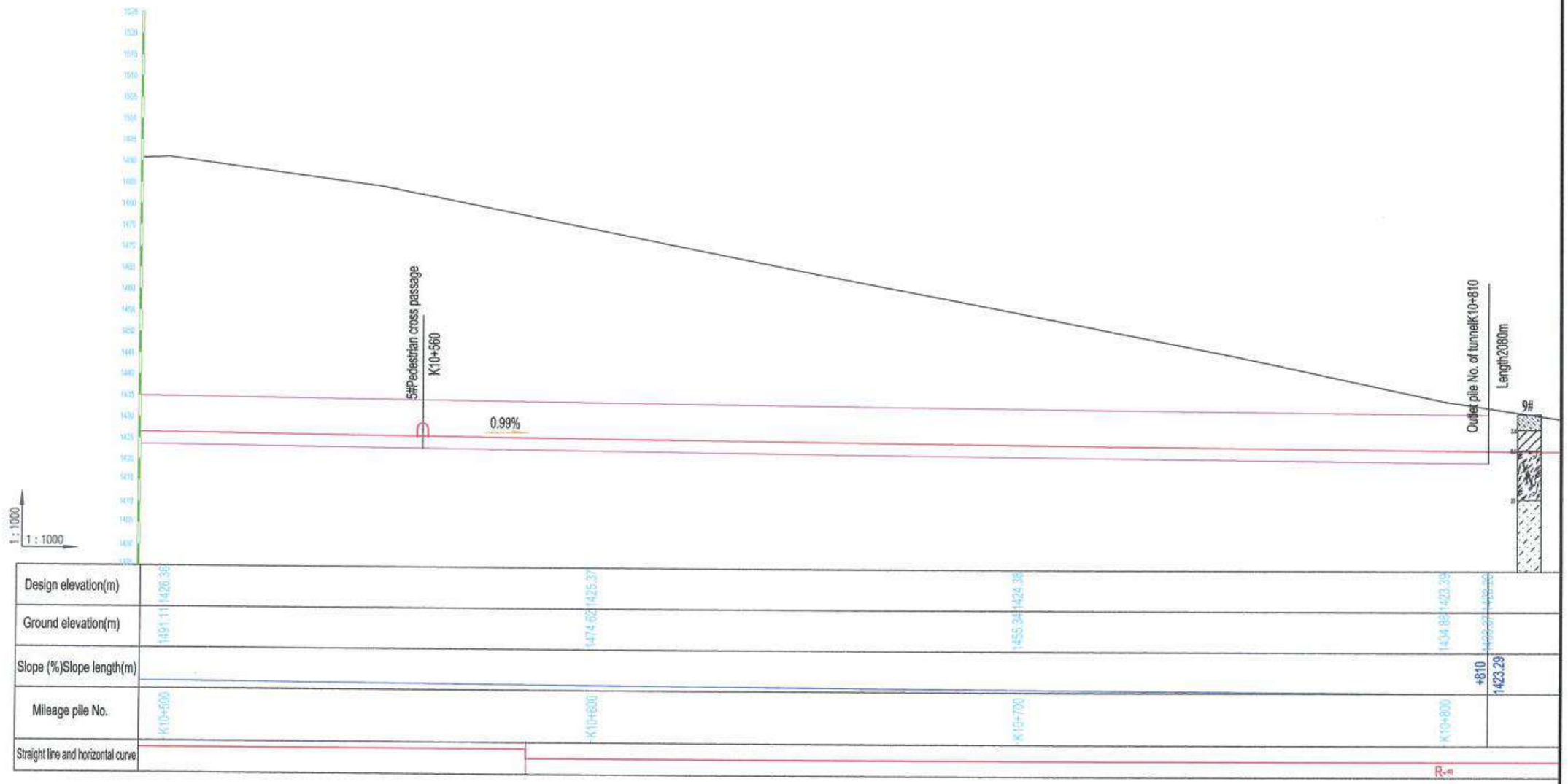
		Design Drawing of a Tunnel Longitudinal Section				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO	纪天骄	EXAMINED	MA XIAO HU		DRAWING NO.	III-03
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG	童京盛		
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG	王军堂	APPROVED			DATE	2025.07



Design Drawing of a Tunnel Longitudinal Section 1:1000

Legend

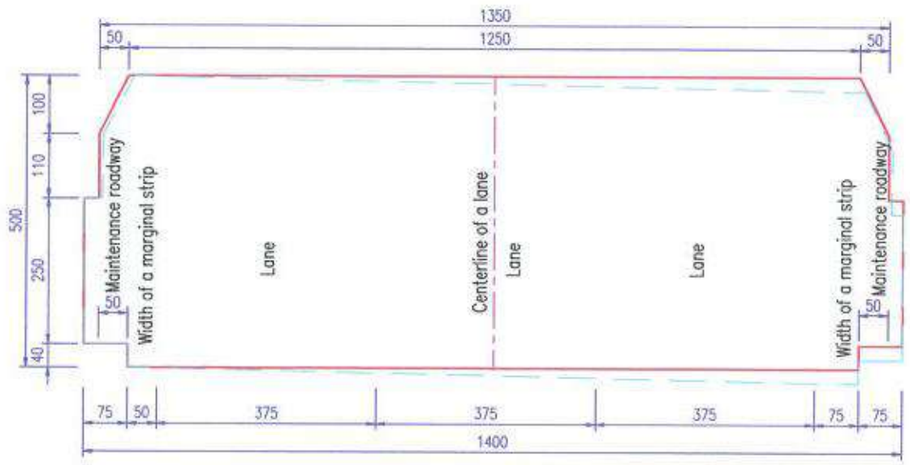
- Grey and brown sandstones and gravels
- Medium-grained sandstones broken into gray and brown gray crushed stone layers
- Thin layer gray and brown gray siltstones and sandstones
- Small grained gray sandstones

Notes:

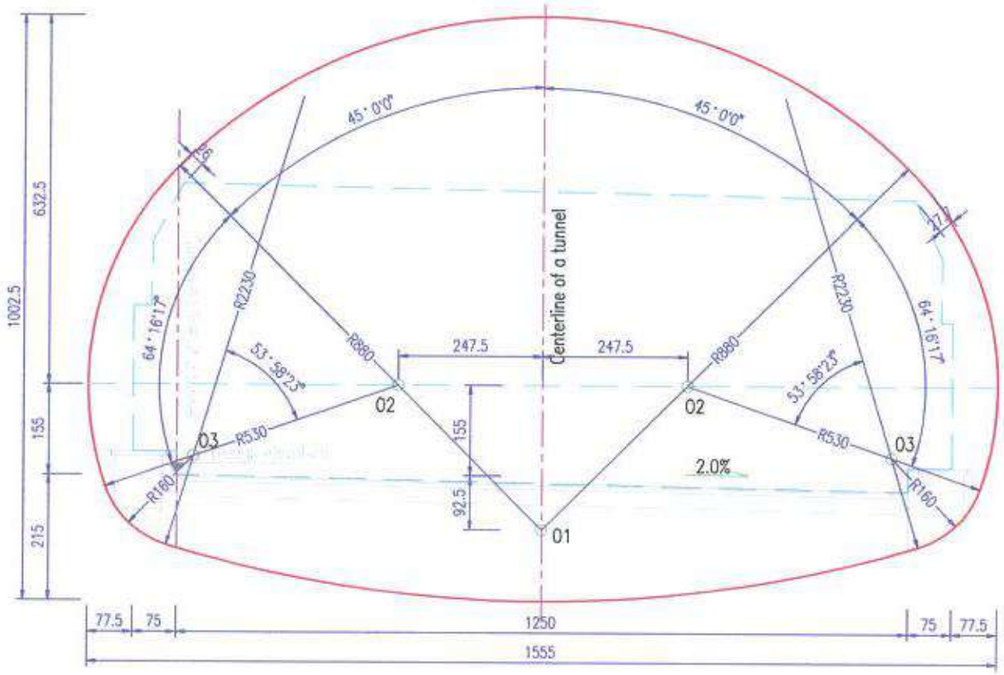
1. The scale unit of this drawing is in m.
2. The starting and ending nodes of the tunnel are K8+730~K10+810, with a total length of 2,080 meters.
3. There are a total of 5 pedestrian crossings and 2 vehicle crossings.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA	王大发	SCALE	1:1000
		Design Drawing of a Tunnel Longitudinal Section				MASTER DES.	CAO YONG XIANG	曹永祥	SPE. MANAGER	JI TIAN JIAO	纪天骄	EXAMINED	MA XIAO HU		DRAWING NO.	III-03
						MASTER DES.	PAN HAO GUO	潘浩国	SPE. MANAGER			APPROVED	TONG JING SHENG	童士盛		
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG	王军堂	APPROVED			DATE	2025.07

Construction clearance of a tunnel 1:100



Design Drawing for an Inner Contour of a Tunnel 1:100



Inner contour parameters of a tunnel lining

Item	Unit	Quantity
Section area of a tunnel clearance	m^2	101.45

Construction clearance parameters of a tunnel

Item	Unit	Quantity
Tunnel clearance width	m	14.00
Tunnel clearance height	m	5.00

Notes:
1.All dimensions in this drawing are measured in cm.

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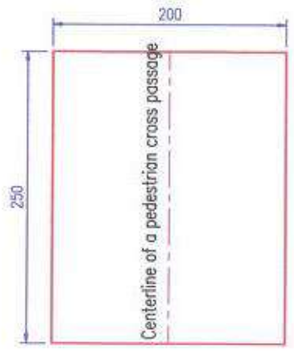
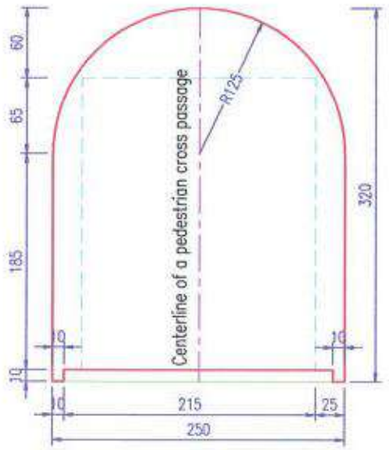
		Design Drawing of Tunnel Construction Clearance and Inner Contour		MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.: III-04
				MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG		
				SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE: 2025.07

Construction clearance of a pedestrian cross passage 1:50



Inner contour of a pedestrian cross passage 1:50



Parameters for an inner contour of a pedestrian cross passage

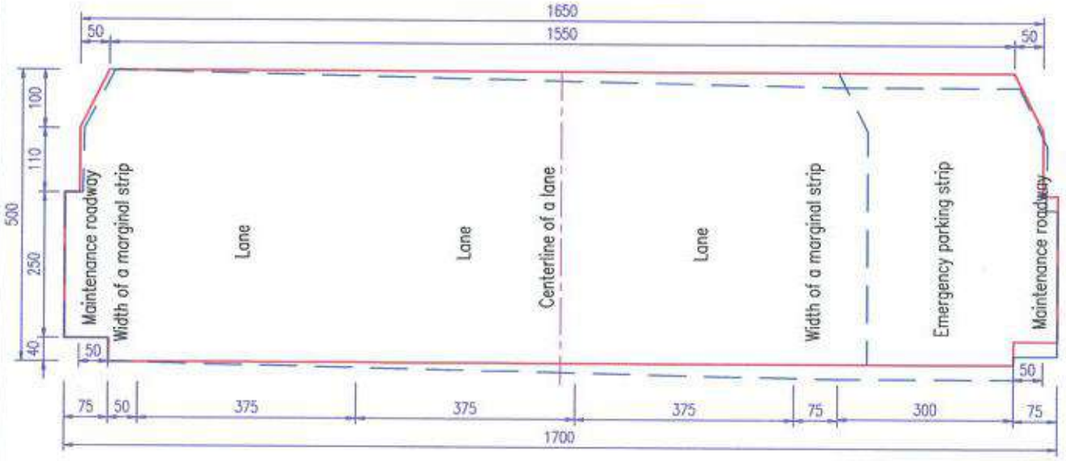
Item	Unit	Quantity
Section area of a tunnel clearance	m^2	7.10

Construction clearance parameters of a pedestrian cross passage

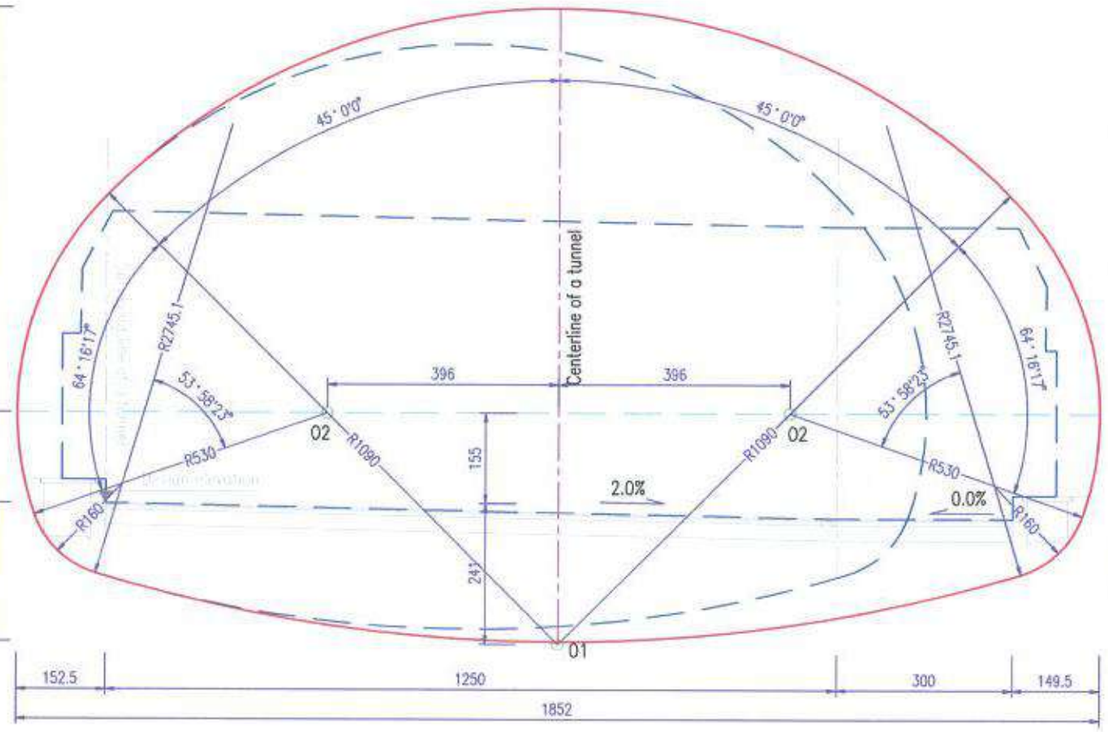
Item	Unit	Quantity
Tunnel clearance width	m	2.00
Tunnel clearance height	m	2.50

Notes:
1.All dimensions in this drowing are measured in cm.

Construction clearance of a tunnel 1:100



Design Drawing for an Inner Contour of a Tunnel 1:100



Inner contour parameters of a tunnel lining

Item	Unit	Quantity
Section area of a tunnel clearance	m^2	129.74

Construction clearance parameters of a tunnel

Item	Unit	Quantity
Tunnel clearance width	m	17.00
Tunnel clearance height	m	5.00

Notes:
1.All dimensions in this drawing are measured in cm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER: PANG WEI	SUB. MANAGER:		CHECKED: WANG DA FA	SCALE: 1:100
		Design Drawing of Tunnel Construction Clearance and Inner Contour		MASTER DES.: CAO YONG XIANG	SPE. MANAGER: JI TIAN JIAO		EXAMINED: MA XIAO HU	DRAWING NO.: III-04
				MASTER DES.: PAN HAO GUO	SPE. MANAGER:		APPROVED: TONG JING SHENG	
				SUB. MANAGER: MA XIAO HU	DESIGNED: WANG JUN TANG		APPROVED:	DATE: 2025.07

Design Drawing of a Tunnel Open-cut Lining

1: 100

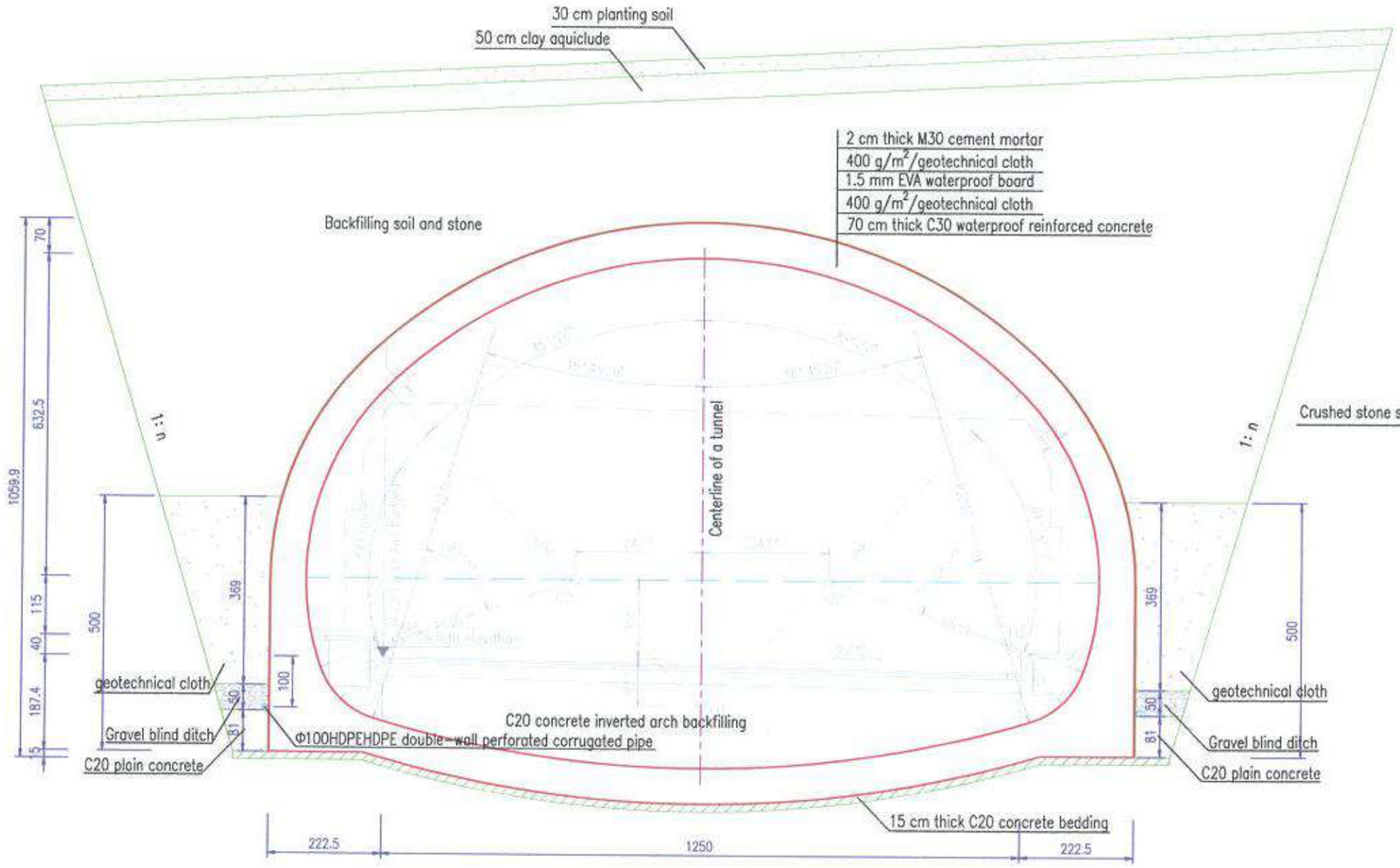
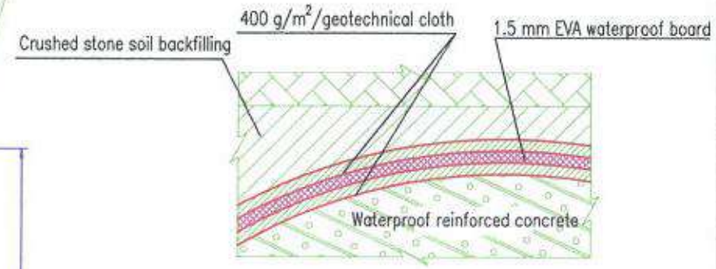


Diagram of Waterproofing Layer for Mingdong



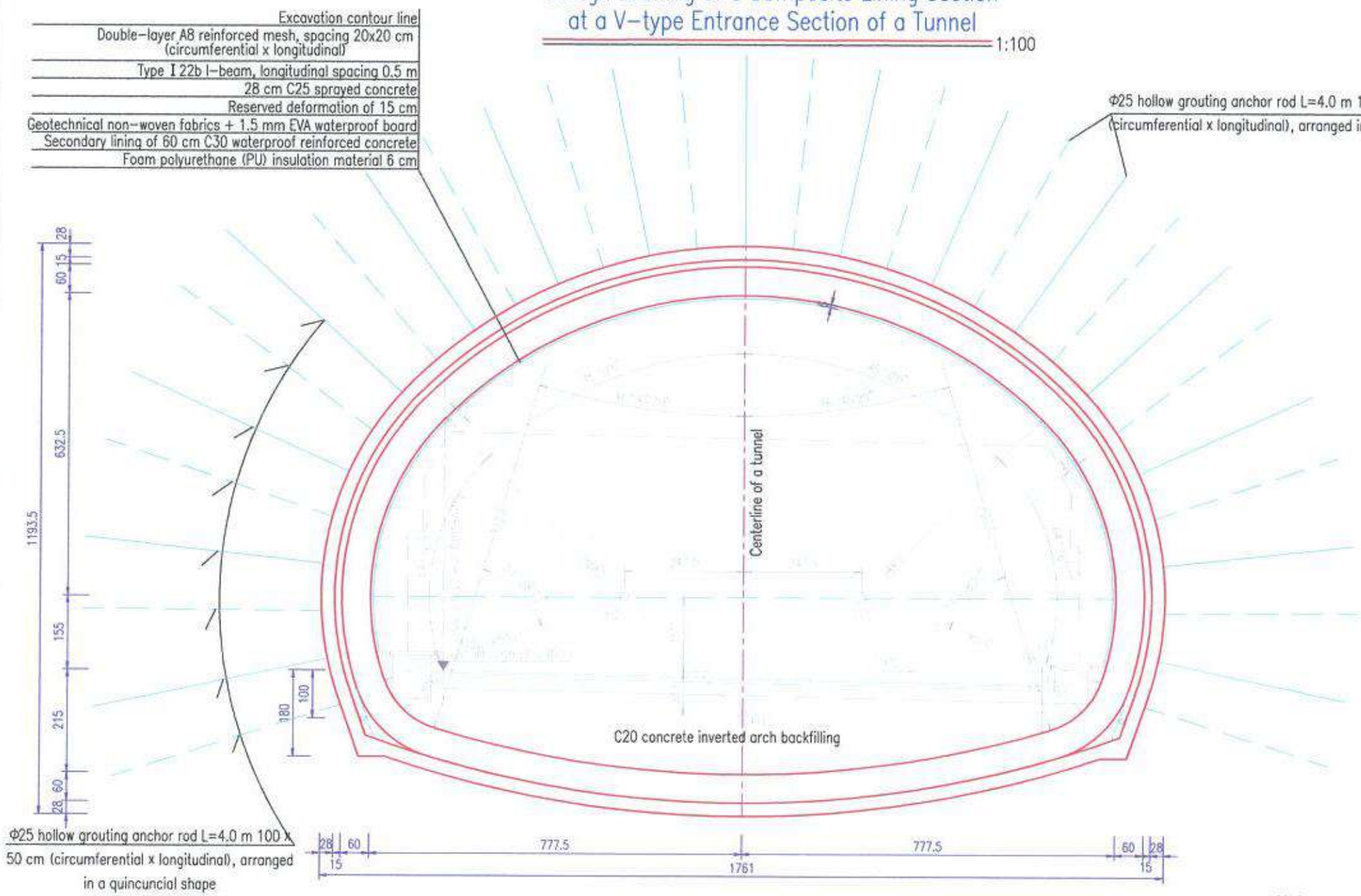
Notes:

1. All dimensions in this drawing are measured in cm.
2. This drawing shows a general open-cut lining at the entrance of a tunnel, which is suitable for sections with fill heights less than 5 m and gentle ground cross slopes.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:100
		Design Drawing of a Tunnel Open-cut Lining				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-05
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

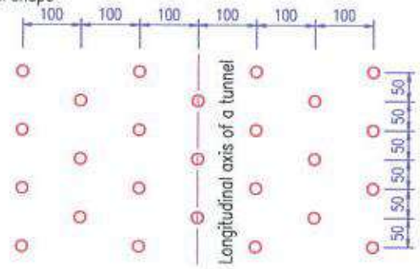
Design Drawing of a Composite Lining Section at a V-type Entrance Section of a Tunnel

1:100



Quincuncial Layout of Anchor Rods

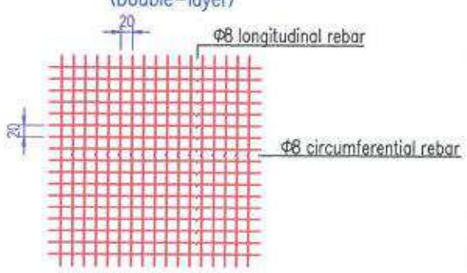
1:100



Reinforced Mesh Layout

(Double-layer)

1:100



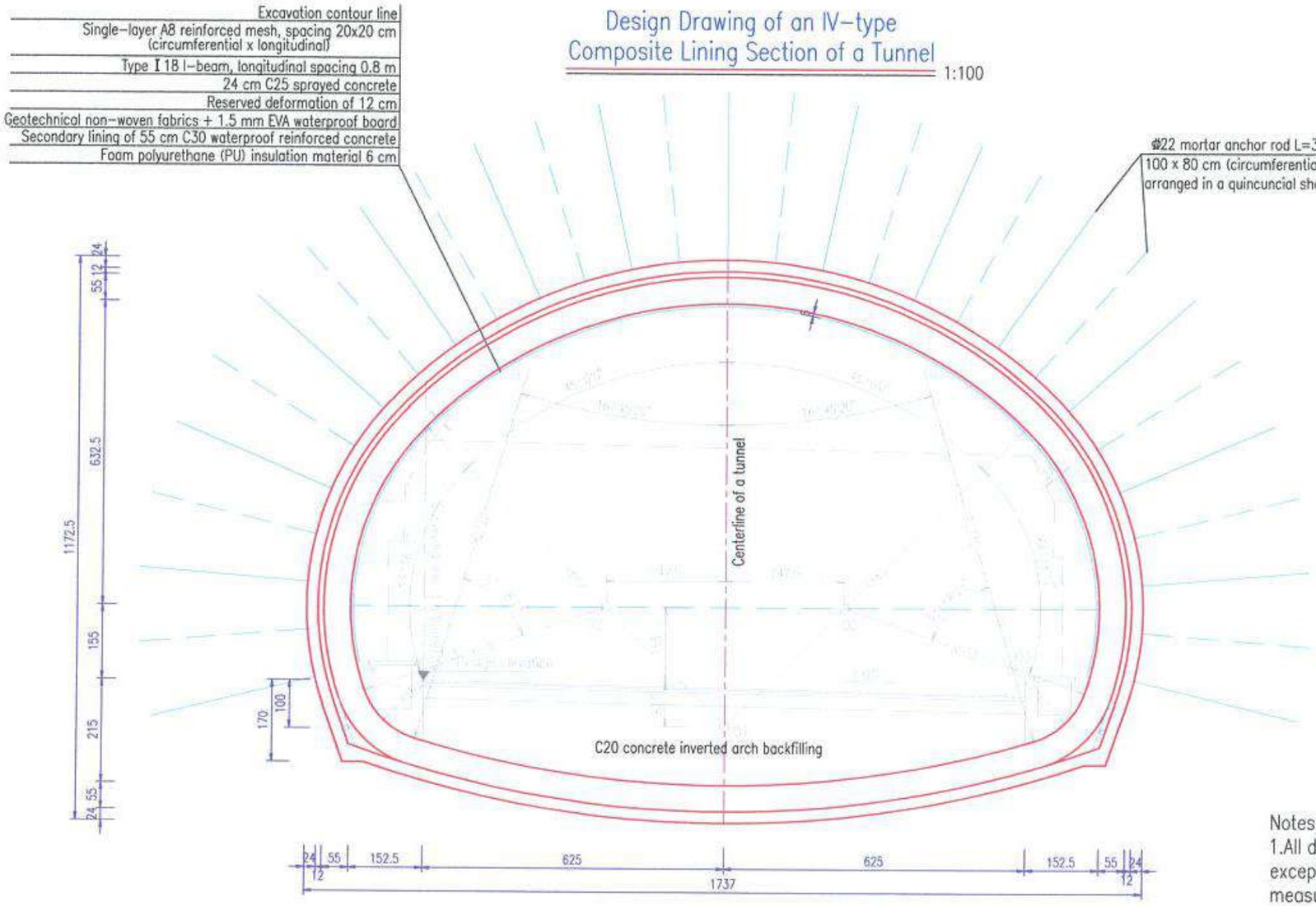
Notes:

1.All dimensions in this drawing are measured in centimeters, except for the diameters of rebars and anchor rods which are measured in mm and units indicated.

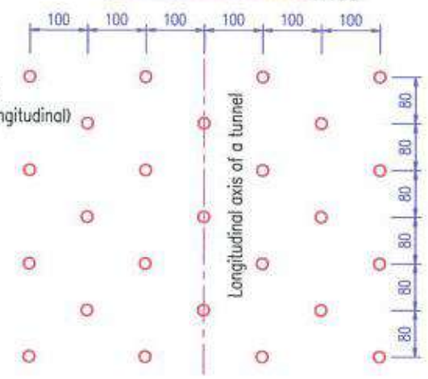
2. This drawing is applicable to the entrance section of Grade-V surrounding rock in a tunnel.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:100
		Design Drawing for a Composite Lining of a Main Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-06
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

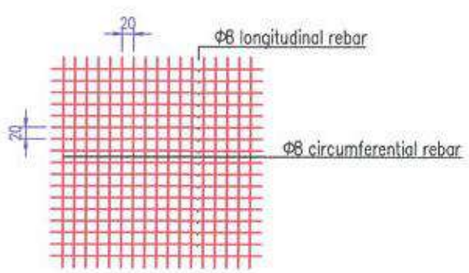
Design Drawing of an IV-type Composite Lining Section of a Tunnel 1:100



Quincuncial Layout of Anchor Rods 1:100



Reinforced Mesh Layout 1:100



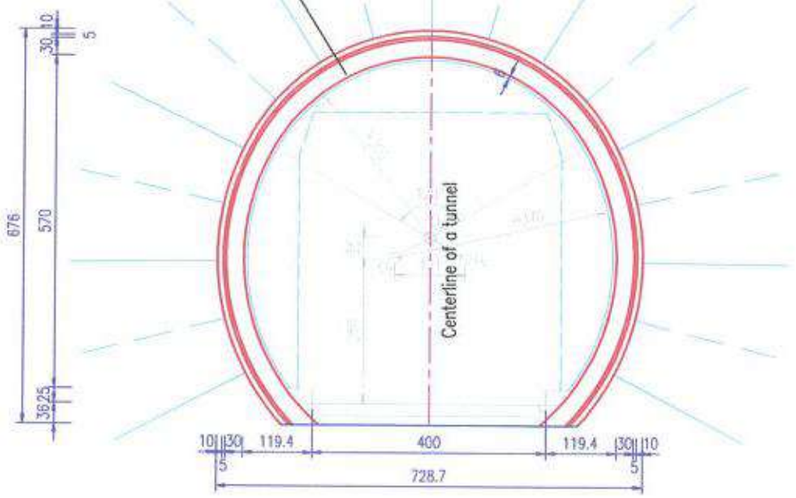
Notes:
1.All dimensions in this drawing are measured in centimeters, except for the diameters of rebars and anchor rods which are measured in mm and units indicated.
2.This drawing is applicable to the Grade-IV surrounding rock section in a tunnel.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE: 1:100
		Design Drawing for a Composite Lining of a Main Tunnel		MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	NA XIAO HU		DRAWING NO.: III-06
				MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG		DATE: 2025.07
				SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			

Design drawing of composite lining section for vehicle passage tunnel 1:100

Excavation contour line
Single-layer A8 reinforced mesh, spacing 20x20 cm (circumferential x longitudinal)
10 cm C25 sprayed concrete
Reserved deformation of 5 cm
Geotechnical non-woven fabrics + 1.5 mm EVA waterproof board
Secondary lining of 30 cm C30 waterproof reinforced concrete
Foam polyurethane (PU) insulation material 6 cm

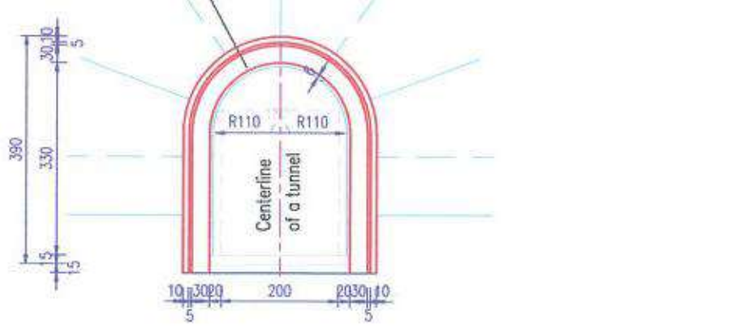
Φ22 mortar anchor rod L=2.5 m
100 x 80 cm (circumferential x longitudinal)
arranged in a quincuncial shape



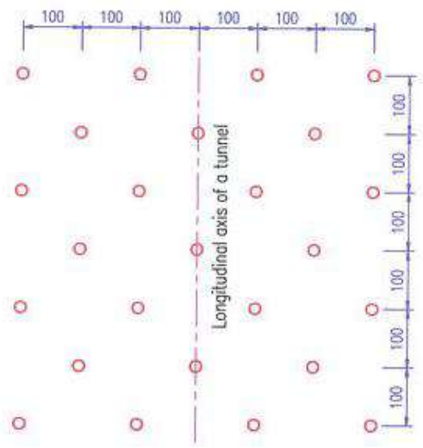
Design drawing of composite lining section for pedestrian passage 1:100

Excavation contour line
Single-layer A8 reinforced mesh, spacing 20x20 cm (circumferential x longitudinal)
10 cm C25 sprayed concrete
Reserved deformation of 5 cm
Geotechnical non-woven fabrics + 1.5 mm EVA waterproof board
Secondary lining of 30 cm C30 waterproof reinforced concrete
Foam polyurethane (PU) insulation material 6 cm

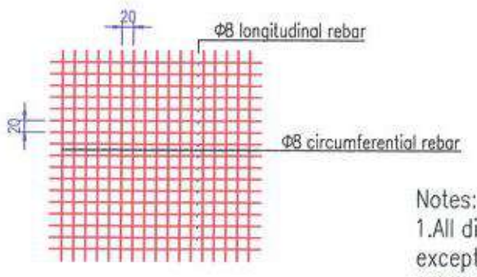
Φ22 mortar anchor rod L=2 m
100 x 80 cm (circumferential x longitudinal)
arranged in a quincuncial shape



Quincuncial Layout of Anchor Rods 1:100



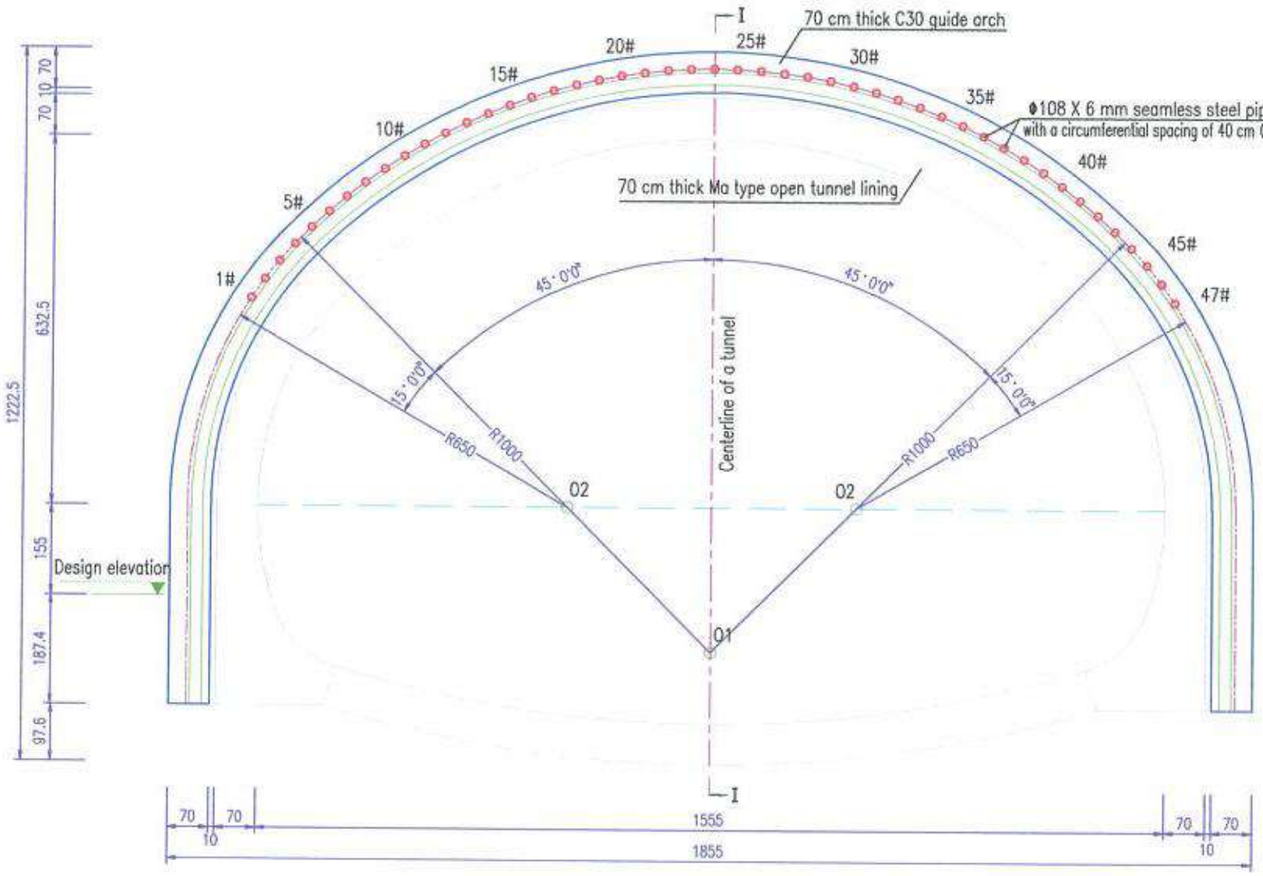
Reinforced Mesh Layout 1:100



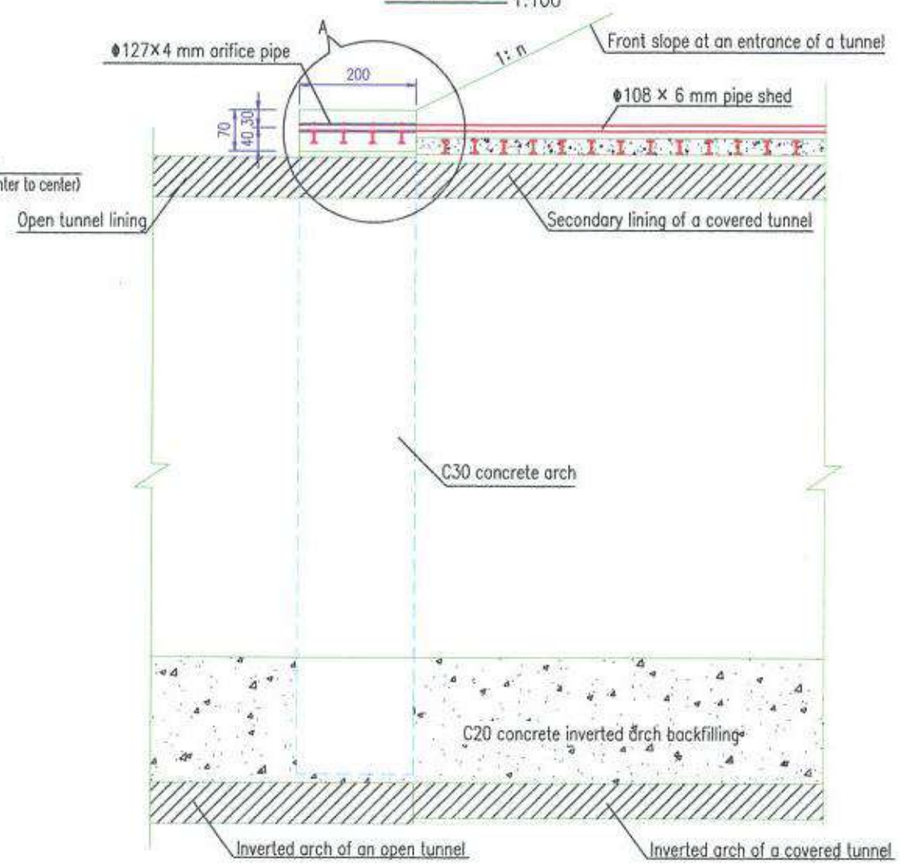
Notes:
1.All dimensions in this drawing are measured in centimeters, except for the diameters of rebars and anchor rods which are measured in mm and units indicated.
2. This drawing is applicable to vehicle and pedestrian cross passages in tunnels.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:100
		Design Drawing for a Composite Lining of a Main Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-07
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

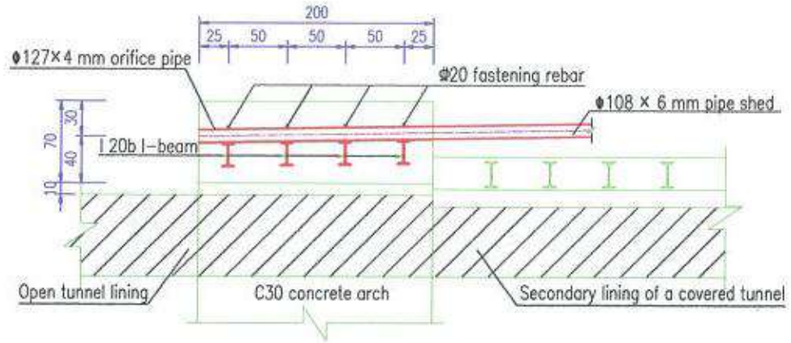
Layout of Arch Facade and Pipe Shed 1:100



I–I profile 1:100



A Detailed Drawing 1:50

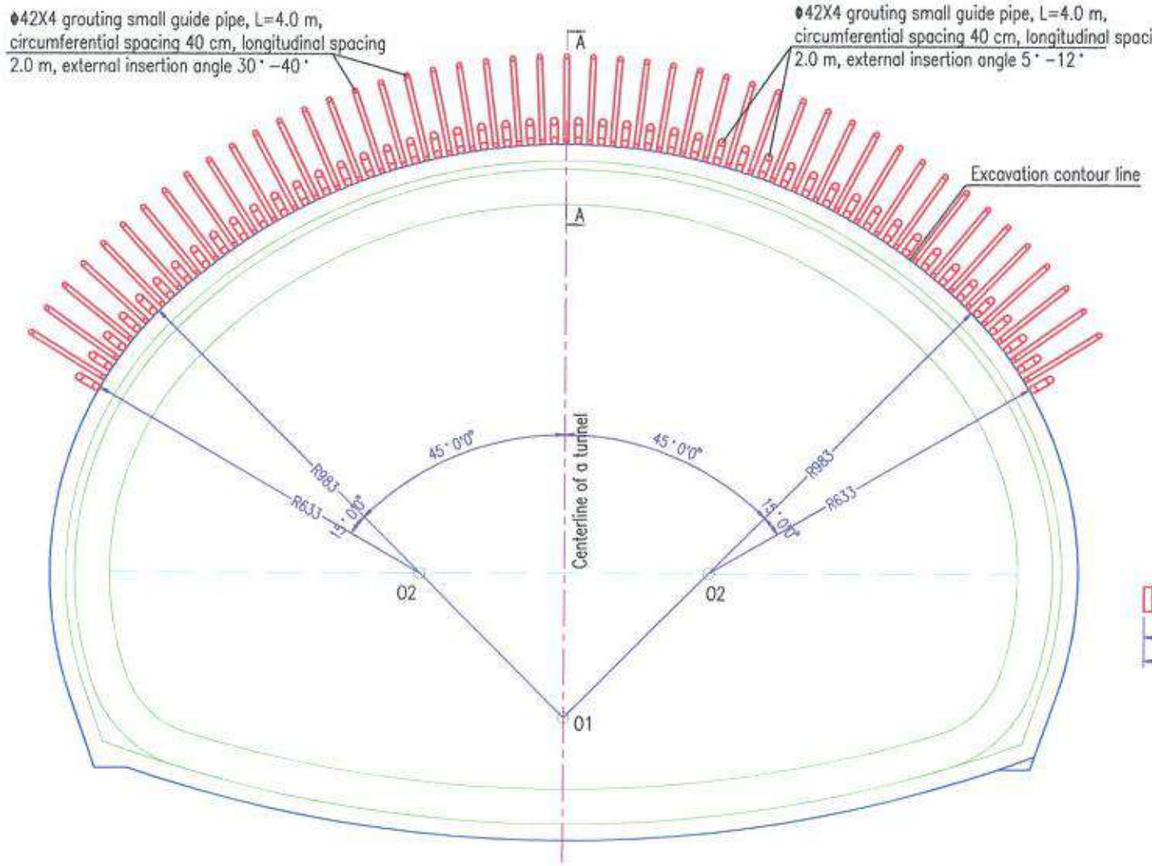


Notes:
1. All dimensions in this drawing are measured in centimeters (cm), except for the diameters of steel pipes and wall thickness which are measured in millimeters (mm).
2.This drawing is applicable to the design drawing of an advanced long pipe shed support for the lining of the Grade-V surrounding rock entrance section of the tunnel.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA	王大发	SCALE	1:100
		Design Drawing of Tunnel Entrance Arch and Pipe Shed				MASTER DES.	CAO YONG KANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-08
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

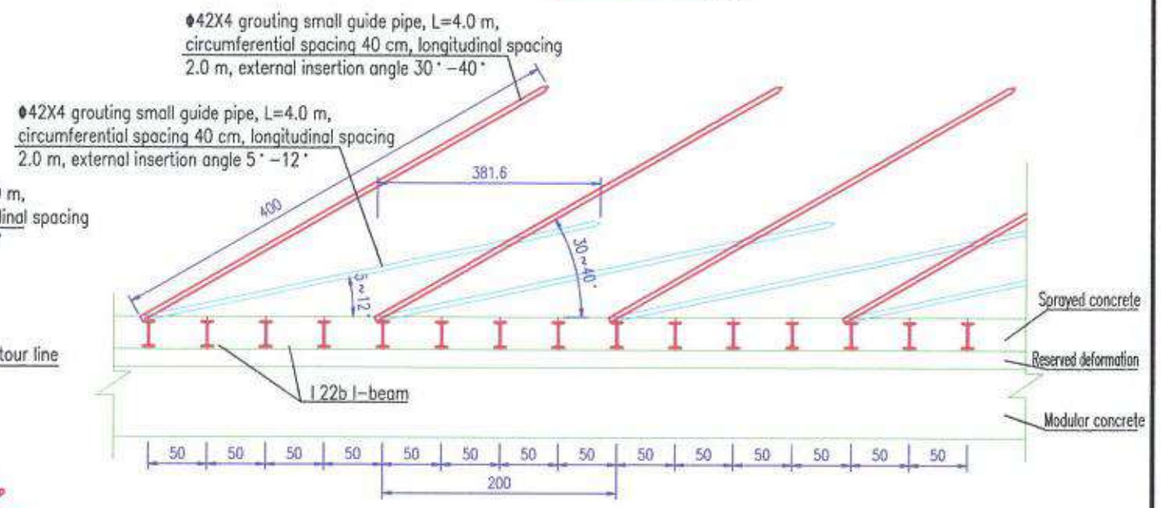
Layout of Advanced Small Guide Pipes at a V-type Entrance Section of a Tunnel

1:100



A--A profile

1:50



Detailed Drawing of Steel Flower Pipe

1:10

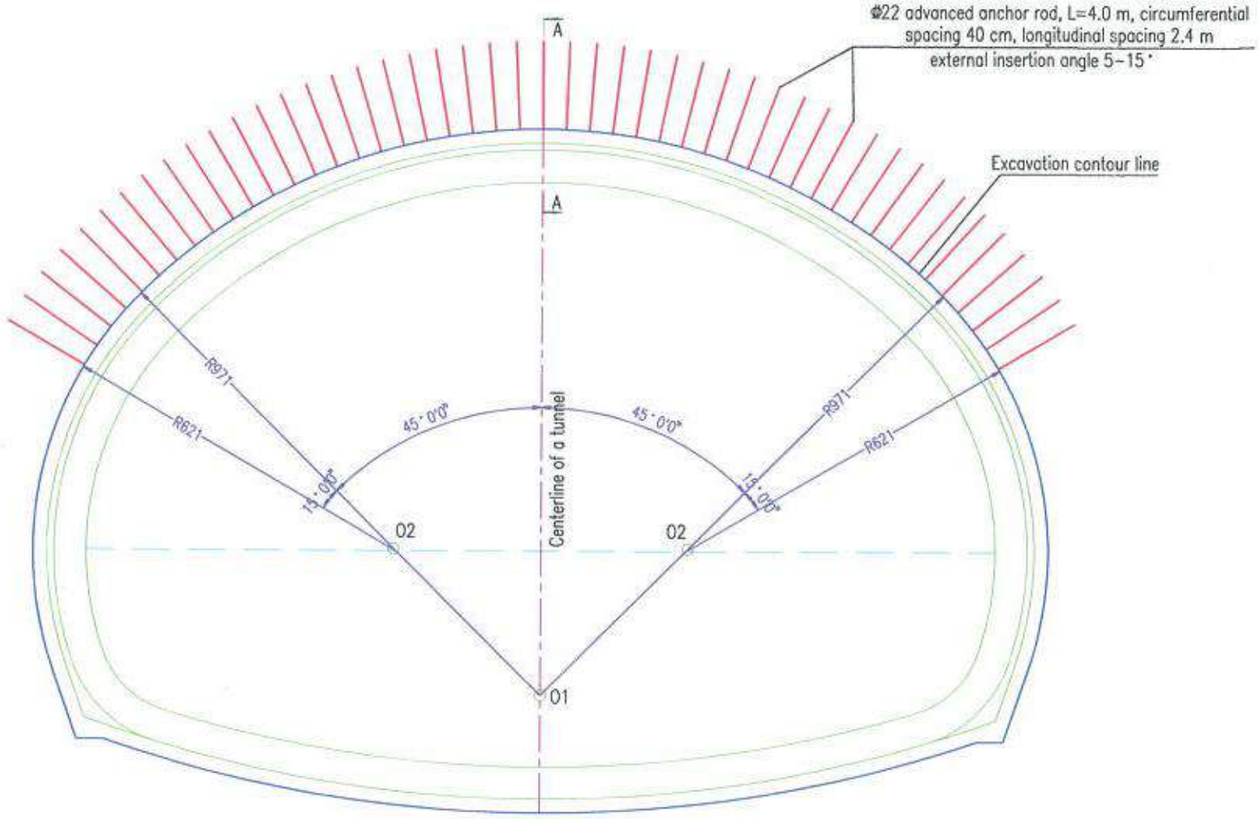
Notes:

1. All dimensions in this drawing are measured in cm, except for the diameters of steel pipes and wall thickness which are measured in mm.
2. This drawing is applicable to the advanced support at a V-type entrance section of a tunnel.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:100
		Design Drawing for an Advanced Support of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-09
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

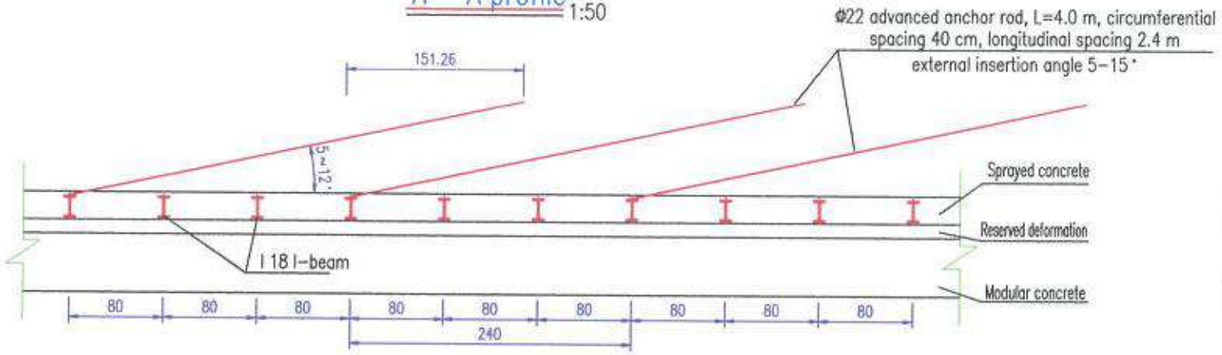
Layout of an IV–type Advanced Anchor Rods of a Tunnel

1:100



A–A profile

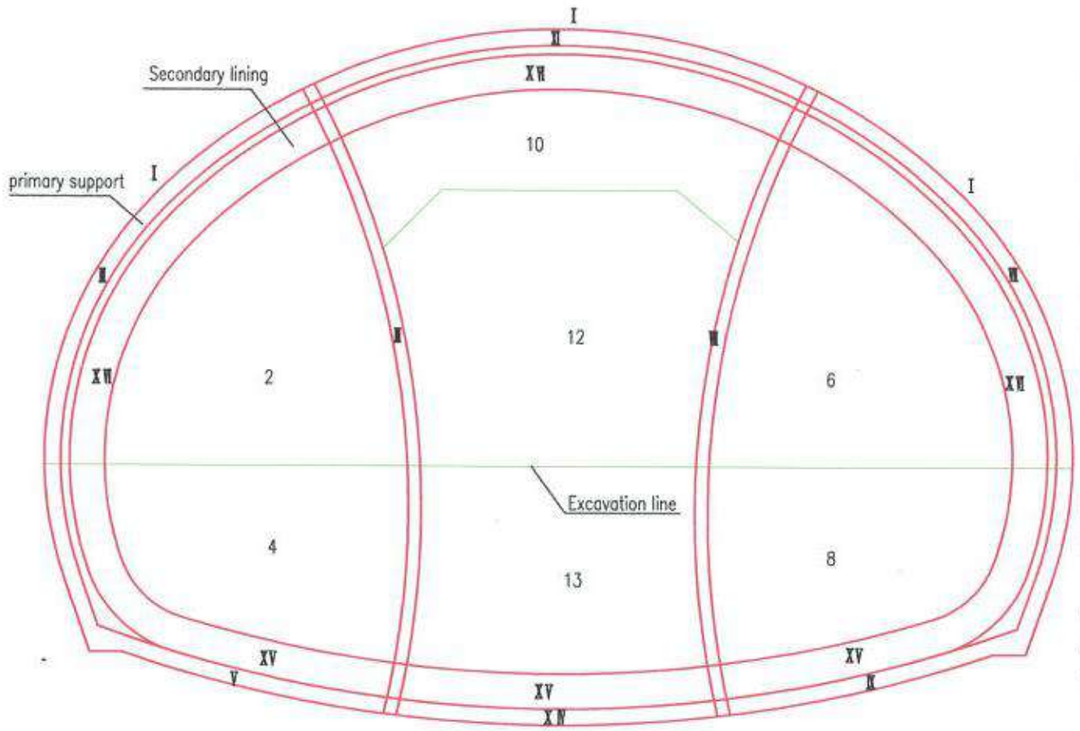
1:50



Notes:

1. All dimensions in this drawing are measured in centimeters (cm), except for the diameters of anchor rods which are measured in millimeters (mm).
2. This drawing is applicable to the advanced support at an IV–type lining section of a tunnel.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	WANG DA FA		SCALE	1:100
		Design Drawing for an Advanced Support of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-09
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07



Cross Section of a Construction Plan for a V-shaped Lining Section of a Tunnel 1:100

Notes for excavation and support sequences:

I .Pre-support of advanced grouting of a main tunnel long pipe shed or grouting of an advanced small guide pipe

2. Excavation of an upper half section of the left guide tunnel

II .Initial support for an upper section of the left guide tunnel (installation of steel arches, hanging of a reinforced mesh, installation of anchor rods, and spraying of concrete)

4.Excavation of a lower half section of the left guide tunnel

V .Initial support for a lower half section of the left guide tunnel

6.Excavation of an upper half section of the right guide tunnel

VI. Initial support for an upper half section of the right guide tunnel

8.Excavation of a lower half section of the right guide tunnel

IV .Initial support for a lower half section of the right guide tunnel

10.Excavation of an upper part of the main tunnel

III. Initial support for an upper part of the main tunnel

12.Excavation of a central part of the main tunnel

13. Excavation of a lower part of the main tunnel

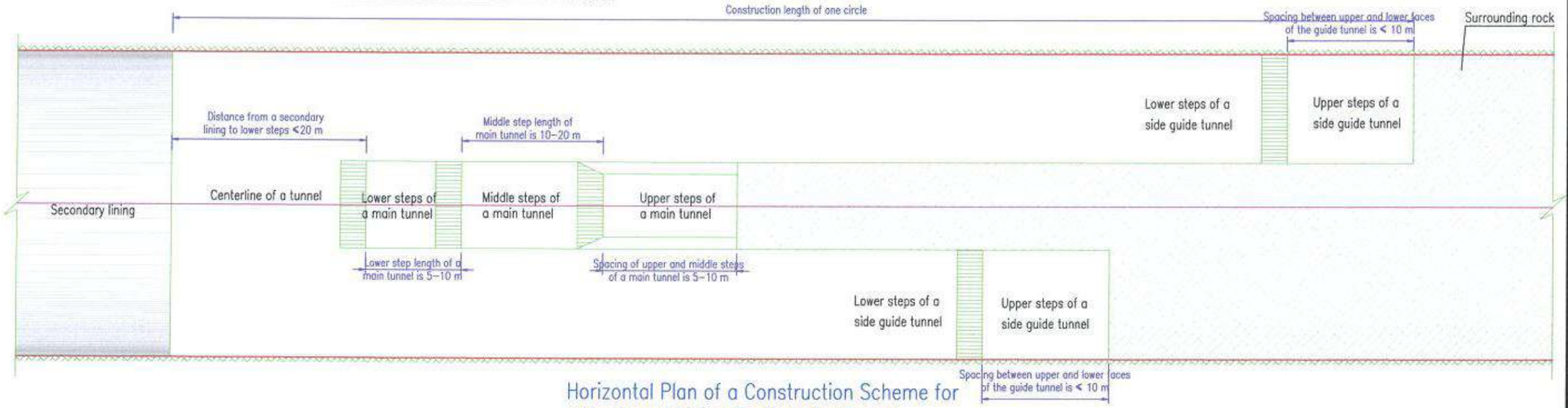
XIV .Initial support for a lower part of the main tunnel; demolition of temporary side walls

XV . Pouring of an inverted arch of the main tunnel

XVI .Laying waterproof boards, and using a formwork trolley to construct a full section of one-time formwork and secondary lining with concrete

Notes:

This is a construction scheme plan for the Grade-V surrounding rock section of the tunnel. The double-sided guide pit method is used. A mechanical excavation method shall be used for this section of tunnel.



Horizontal Plan of a Construction Scheme for a V-shaped Lining Section of a Tunnel

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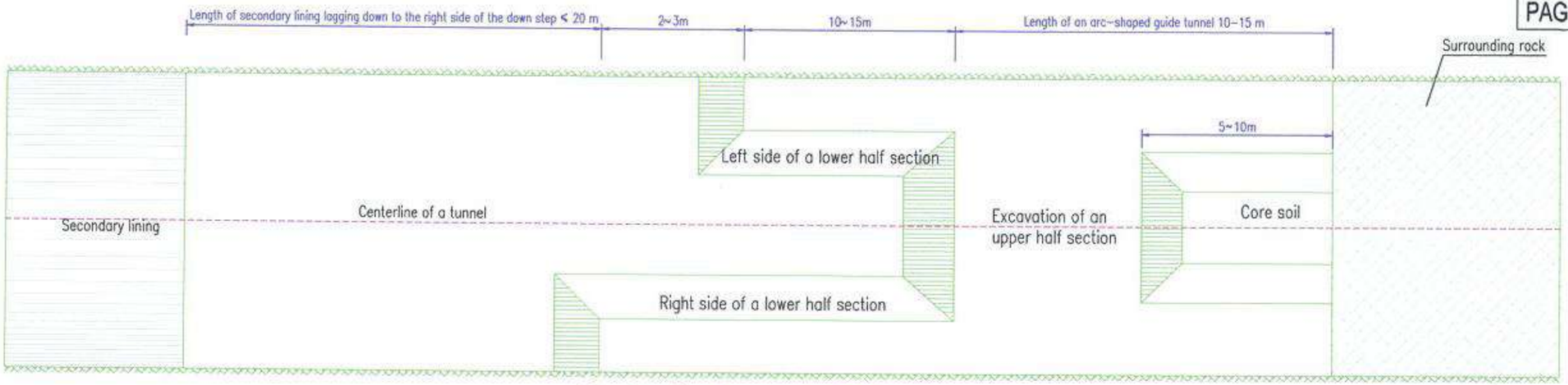
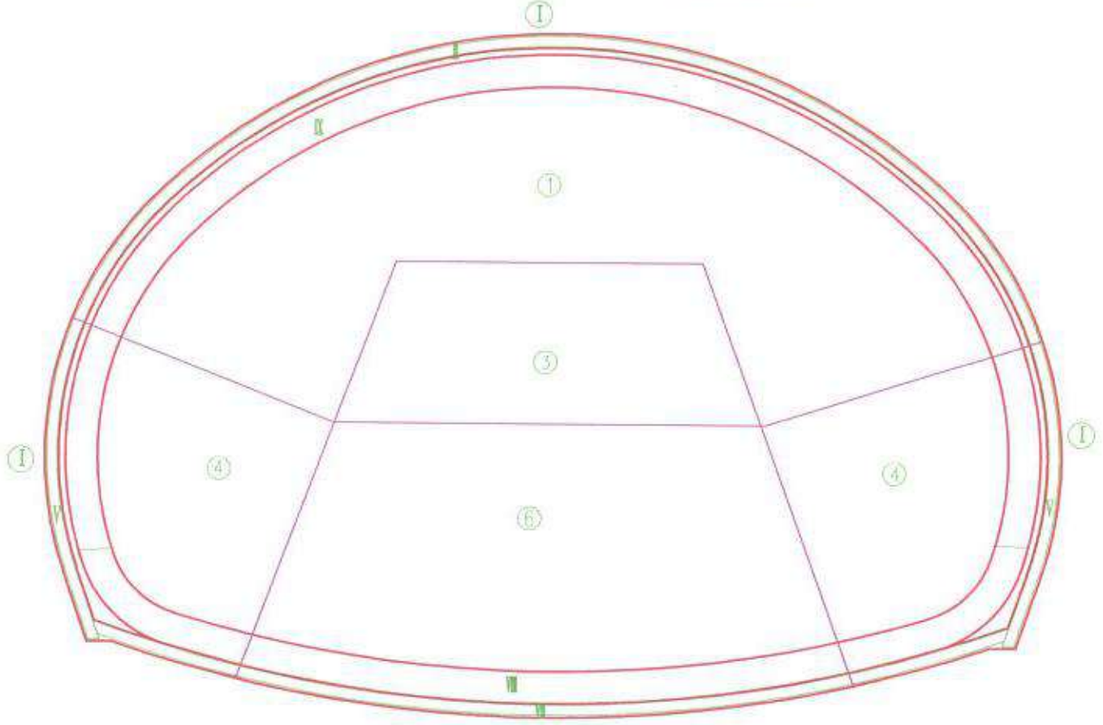
		Design Drawing of a Tunnel Construction Scheme		MASTER DES.: CAO YONG XIANG	SPE. MANAGER: JI TIAN JIAO		EXAMINED: MA XIAO HU	DRAWING NO.	III-10
				MASTER DES.: PAN HAO GUO	SPE. MANAGER		APPROVED: TONG JING SHENG		
				SUB. MANAGER: MA XIAO HU	DESIGNED: WANG JUN TANG		APPROVED	DATE	2025.07



Construction Scheme Plan for Reserved Core Soil with Step Method

Elevation for a Construction Scheme of Reserved Core Soil with a Step Method 1:100



Notes for excavation and support sequences:

I --Grouting pre-support of an advanced small guide pipe at an arch
1--Excavation of an upper circumferential guide pit
II--Initial support of an upper circumferential guide pit
3--Excavation of upper steps for core soils
4--Excavation of left and right lower steps
V--Initial support of left and right lower steps
6--Excavation of lower steps for core soils
VII-Initial support of lower steps for core soils
VIII--Pouring of an inverted arch with concrete and filling of a tunnel bottom
IX--Pouring secondary lining molded concrete for side walls and arches.

Notes:

This is a construction scheme plan for the Grade-IV surrounding rock section of the tunnel. The method of circumferential excavation and reservation of core soils is used.

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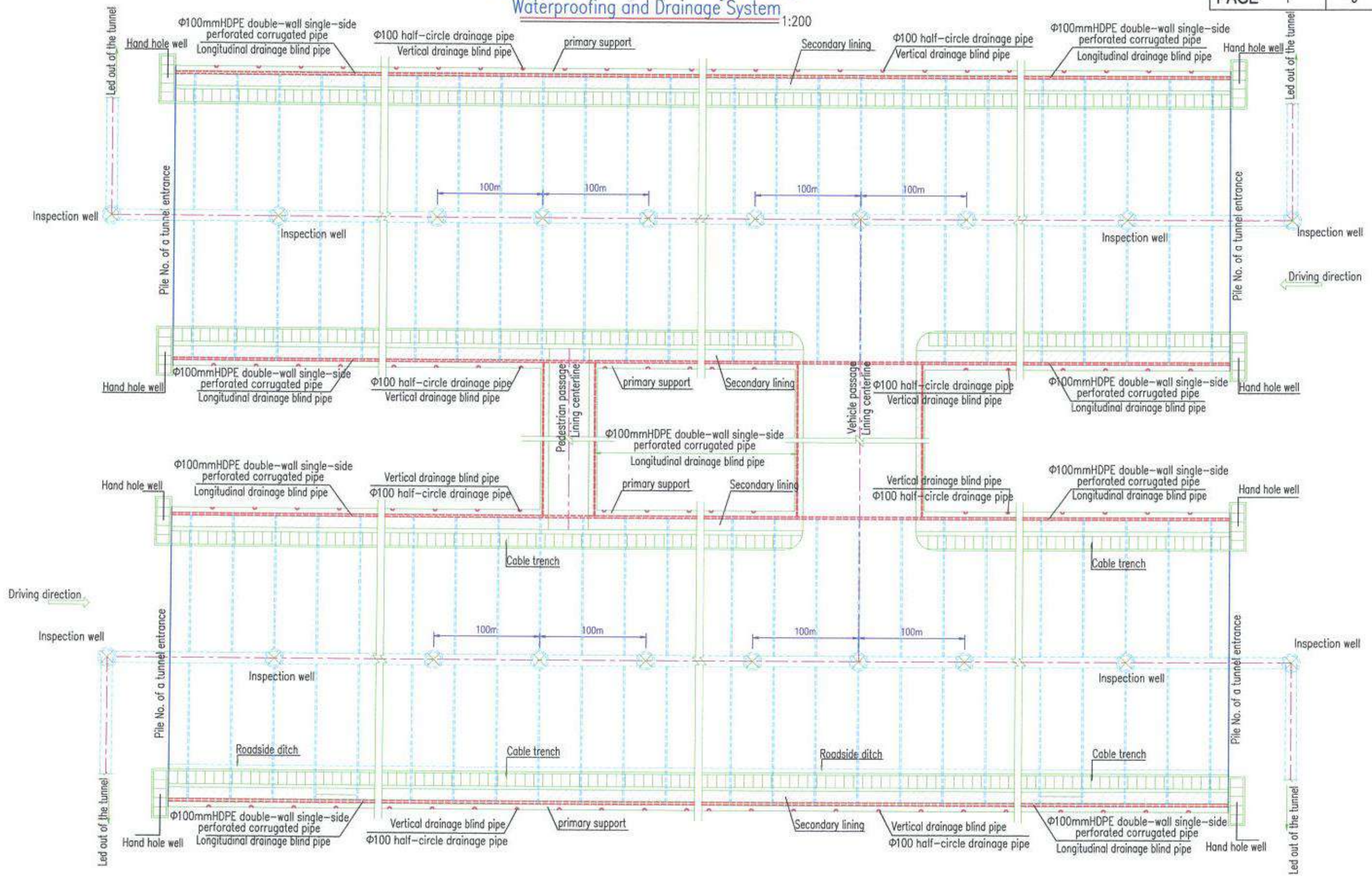
		Design Drawing of a Tunnel Construction Scheme				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-10
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

Comprehensive Layout Drawing of Tunnel Waterproofing and Drainage System

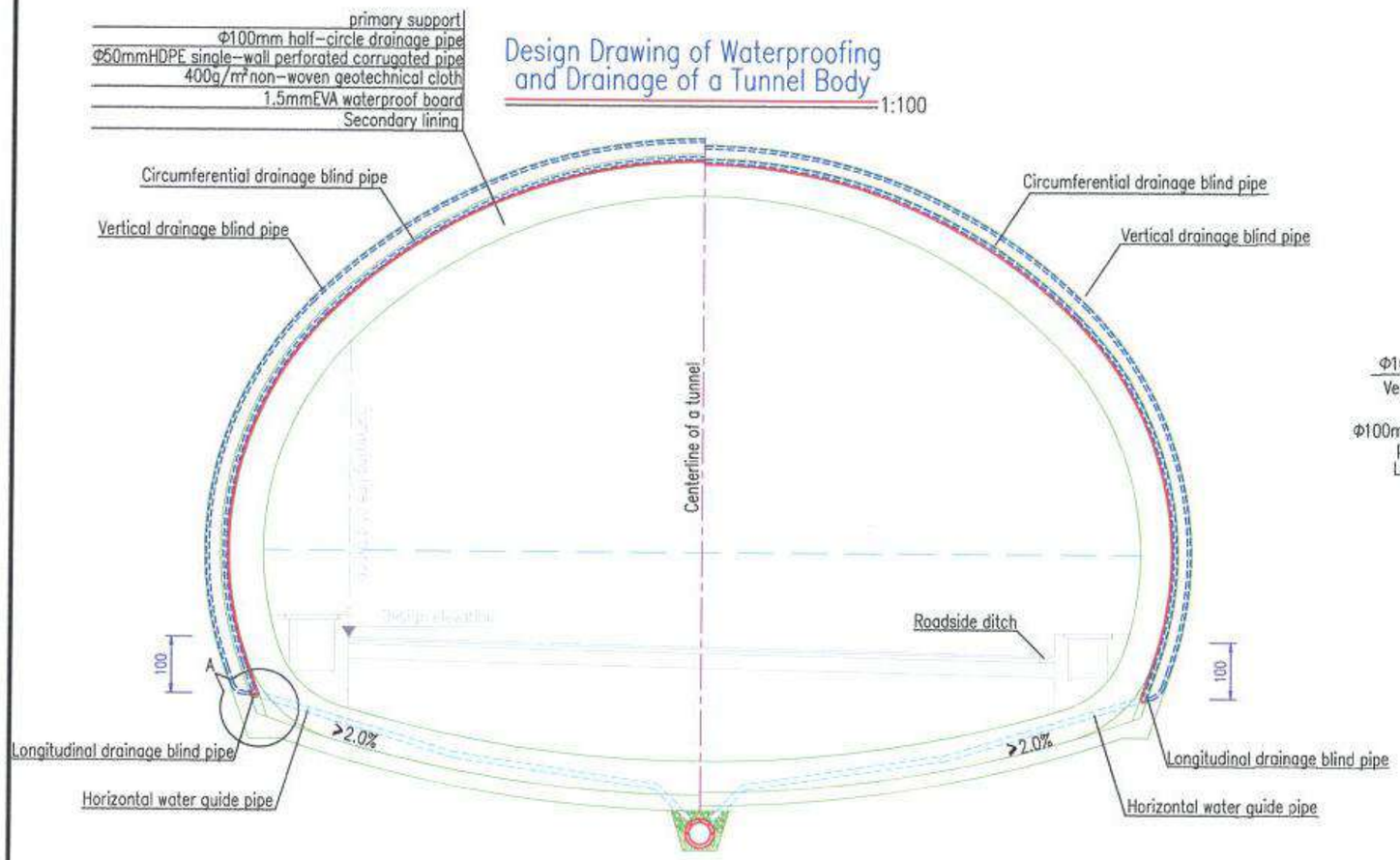
1:200



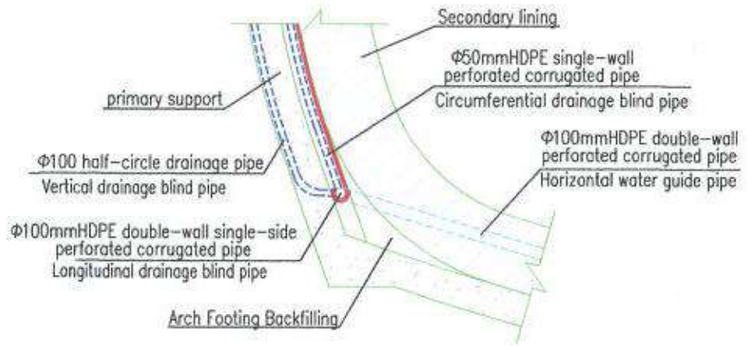
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER: PANG WEI	SUB. MANAGER:		CHECKED: WANG DA FA	SCALE: 1:200
		Design Drawing of Waterproofing and Drainage of a Tunnel		MASTER DES.: CAO YONG XIANG	SPE. MANAGER: JI TIAN JIAO		EXAMINED: MA XIAO HU	DRAWING NO.: III-11
				MASTER DES.: PAN HAO GUO	SPE. MANAGER:		APPROVED: TONG JING SHENG	
				SUB. MANAGER: MA XIAO HU	DESIGNED: WANG JUN TANG		APPROVED:	DATE: 2025.07

Design Drawing of Waterproofing and Drainage of a Tunnel Body

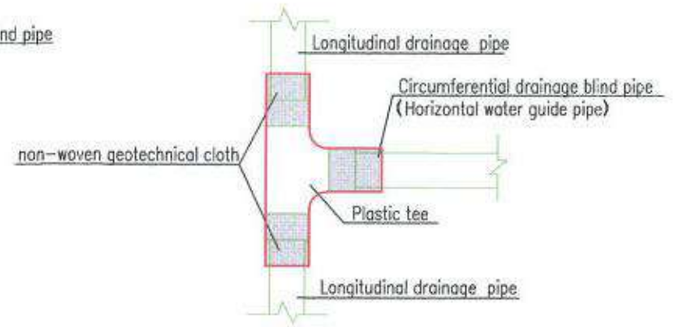
1:100



A Detailed Drawing



Detailed Drawing of Tee Connection



Layout Table of Tunnel Drainage Engineering

Item	Name of material	Arrangement form	Spacing arranged longitudinally
Roadside ditch	C20 concrete cast-in-place	Longitudinal	Arrangement is carried out along the whole length of one side of the tunnel
Central Drainage Ditch	C30 Precast Concrete	Longitudinal	Arrangement is carried out along the whole length of Centerline of a tunnel
Inspection well	C30 concrete cast-in-place	Longitudinal	100 m
Longitudinal drainage pipe	Φ100mmHDPEdouble-wall single-side perforated corrugated pipe	Longitudinal	Arrangement is carried out along the whole length of both sides of a tunnel
Horizontal water guide pipe	Φ100mmHDPE double-wall perforated corrugated pipe	Horizontal	10 m
Circumferential drainage pipe	Φ50mmHDPE single-wall perforated corrugated pipe	Circumferential	10 m
Vertical drainage pipe	Φ100mm half-circle drainage pipe	Circumferential	10 m

Notes:
1. All dimensions in this drawing are measured in cm, except for the diameters of drain pipes which are measured in mm.
2. This drawing is applicable to the design of waterproofing and drainage of a composite lining of a tunnel body

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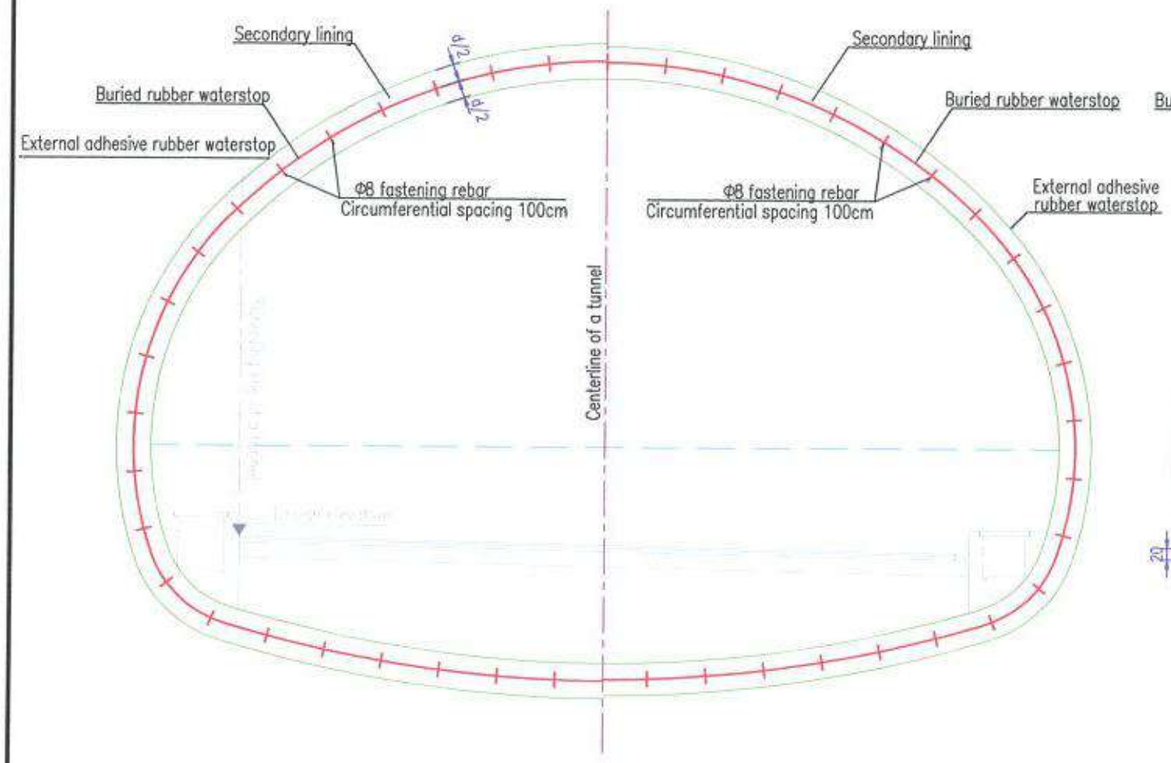
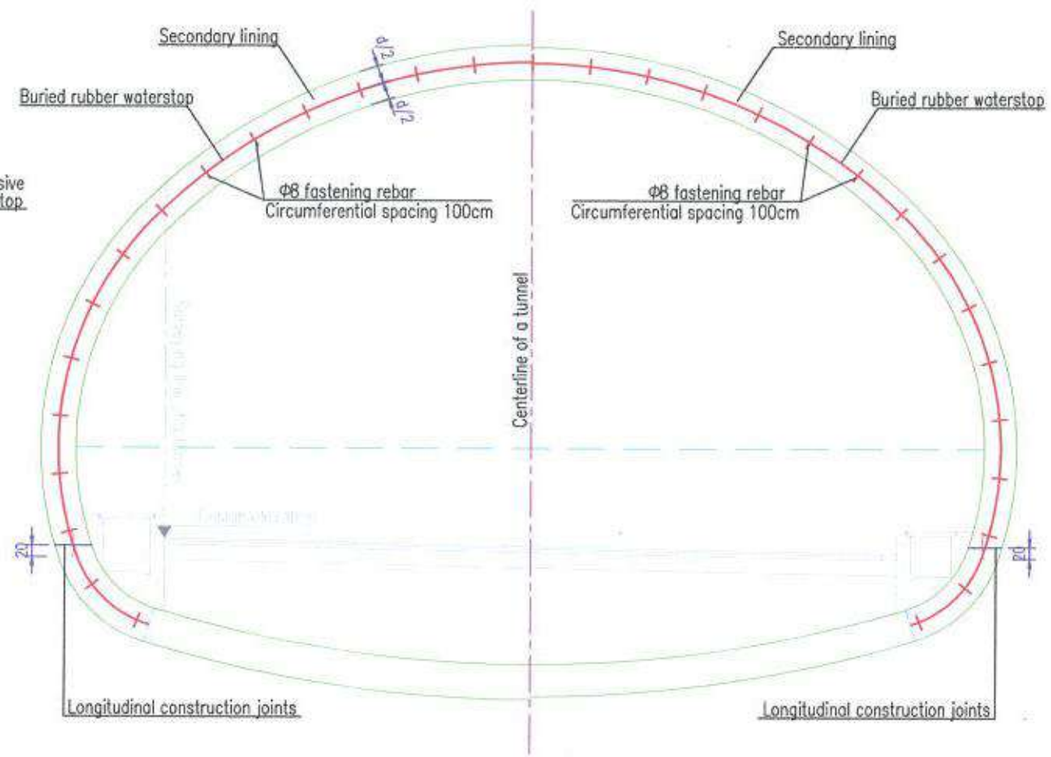
		Design Drawing of Waterproofing and Drainage of a Tunnel		MASTER DES.: CAO YONG XIANG	SPE. MANAGER: JI TIAN JIAO		EXAMINED: MA XIAO HU		DRAWING NO.: III-11		
				MASTER DES.: PAN HAO GUO	SPE. MANAGER:		APPROVED: TONG JING SHENG		DATE: 2025.07		
				SUB. MANAGER: MA XIAO HU	DESIGNED: WANG JUN TANG		APPROVED:				

Cross Section View for Waterstop Layout of a Tunnel Settlement Joint



Cross Section View for Waterstop Layout of a Tunnel Construction Joint



Notes:
1. All dimensions in the drawing are measured in cm.
2. Deformation joints are set at places with structural and geological changes, with each deformation joint set across the entire section.
3. The circumferential construction joints are set at the arch wall of the tunnel; longitudinal construction joints are set at the side walls of the tunnel and are not to be higher than the maintenance roadway.

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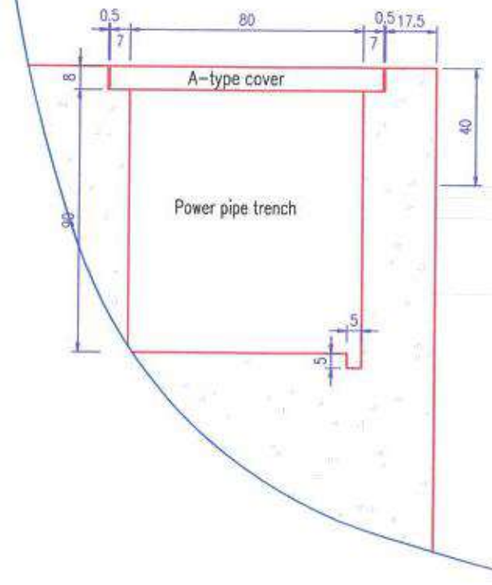
		Design Drawing of Waterproofing and Drainage of a Tunnel				MASTER DES.	CAO YONG KANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-11
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

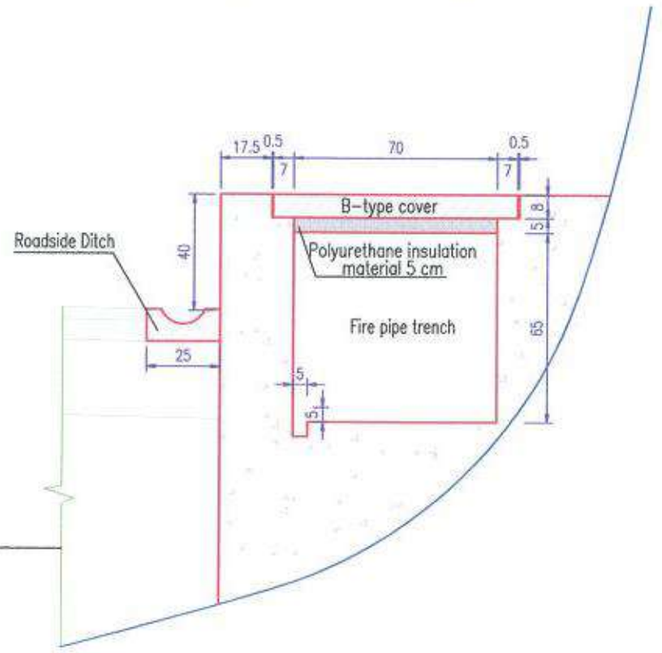
Detailed Drawing of a Tunnel Ditch and a Cable Trench

1:20

(Left side of a driving direction)

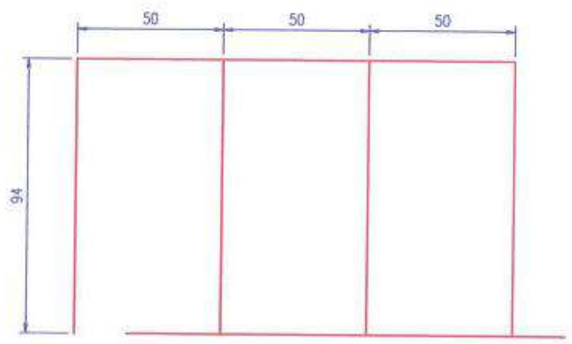


(Right side of a driving direction)



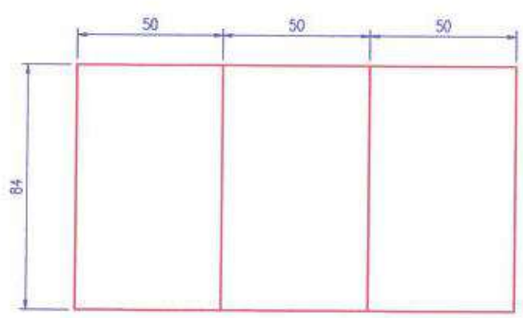
Layout Plan of A-type Cable Trench Covers

1: 20



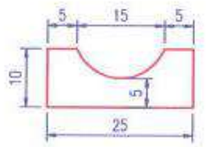
Layout Plan of B-type Cable Trench Covers

1: 20



Detailed Drawing of a Roadside Ditch

1: 10



Notes:
1. All dimensions in the drawing are measured in cm unless specially indicated.

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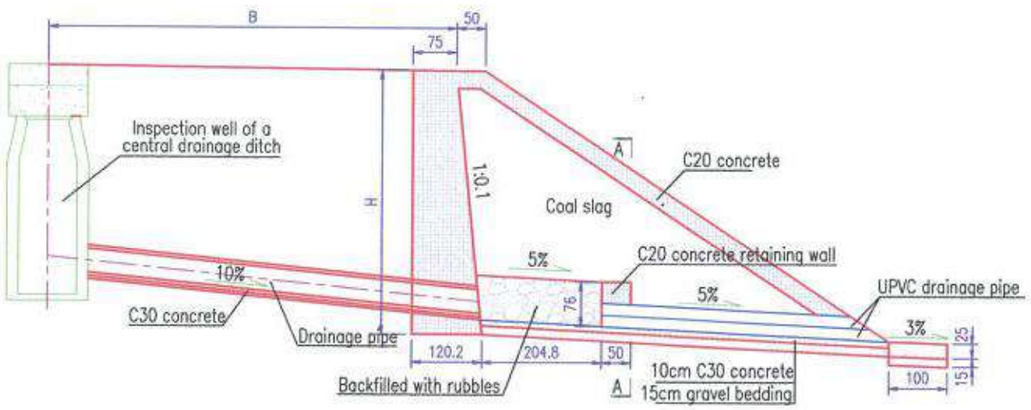
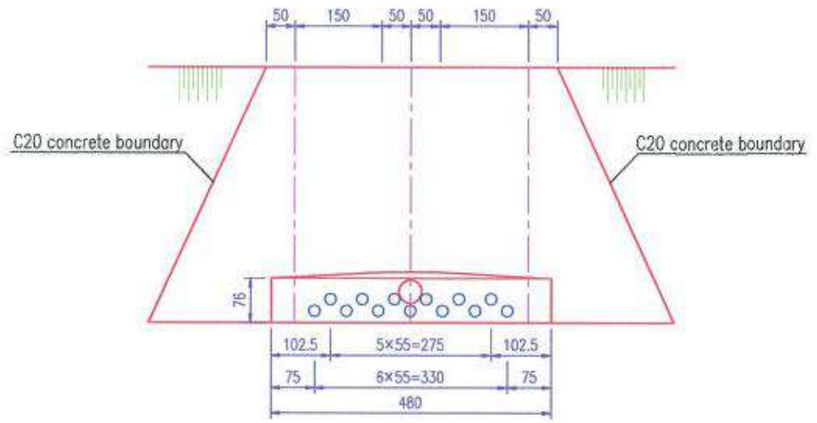
		Design Drawing of a Tunnel Trench		MASTER DES.: CAO YONG XIANG	SPE. MANAGER: JI TIAN JIAO		EXAMINED: MA XIAO HU		DRAWING NO.: III-12	
				MASTER DES.: PAN HAO GUO	SPE. MANAGER:		APPROVED: TONG JING SHENG			
				SUB. MANAGER: MA XIAO HU	DESIGNED: WANG JUN TANG		APPROVED:		DATE: 2025.07	

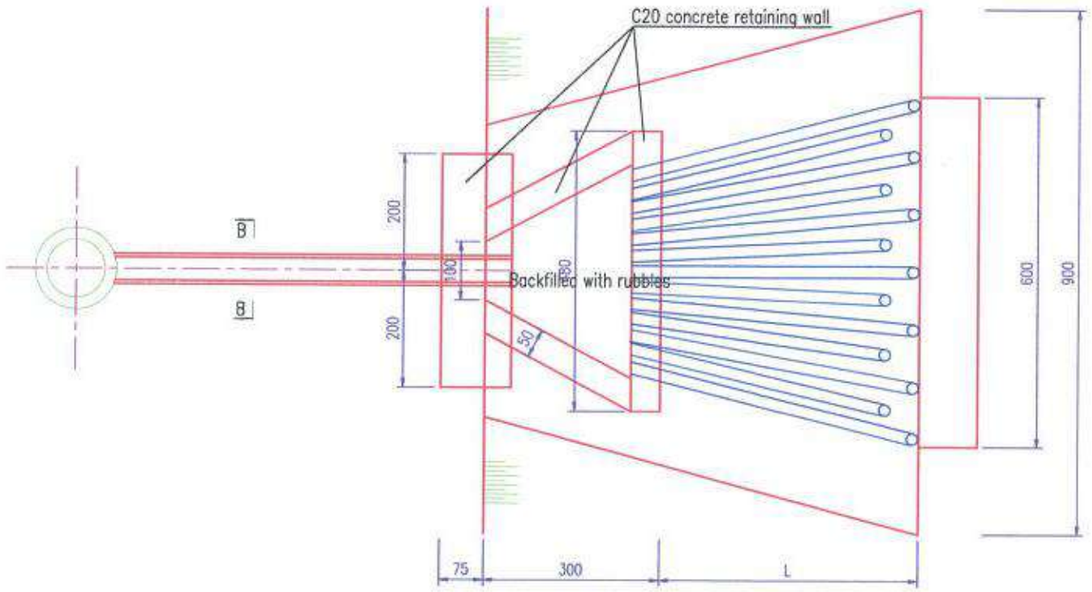
Facade Design Drawing of an Insulated Water Outlet
1:100



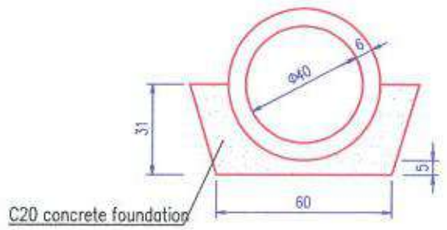
A–A profile
1:100



Layout Plan of an Insulated Water Outlet
1:100



B–B profile
1:20



Notes:
1. All dimensions in the drawing are measured in cm.
2. UPVC plastic drainage pipes with an inner diameter of 20 cm are used at the insulated water outlet.
3. The insulated water outlet is to be set on the side with more sunlight, avoiding being set on shady slopes.

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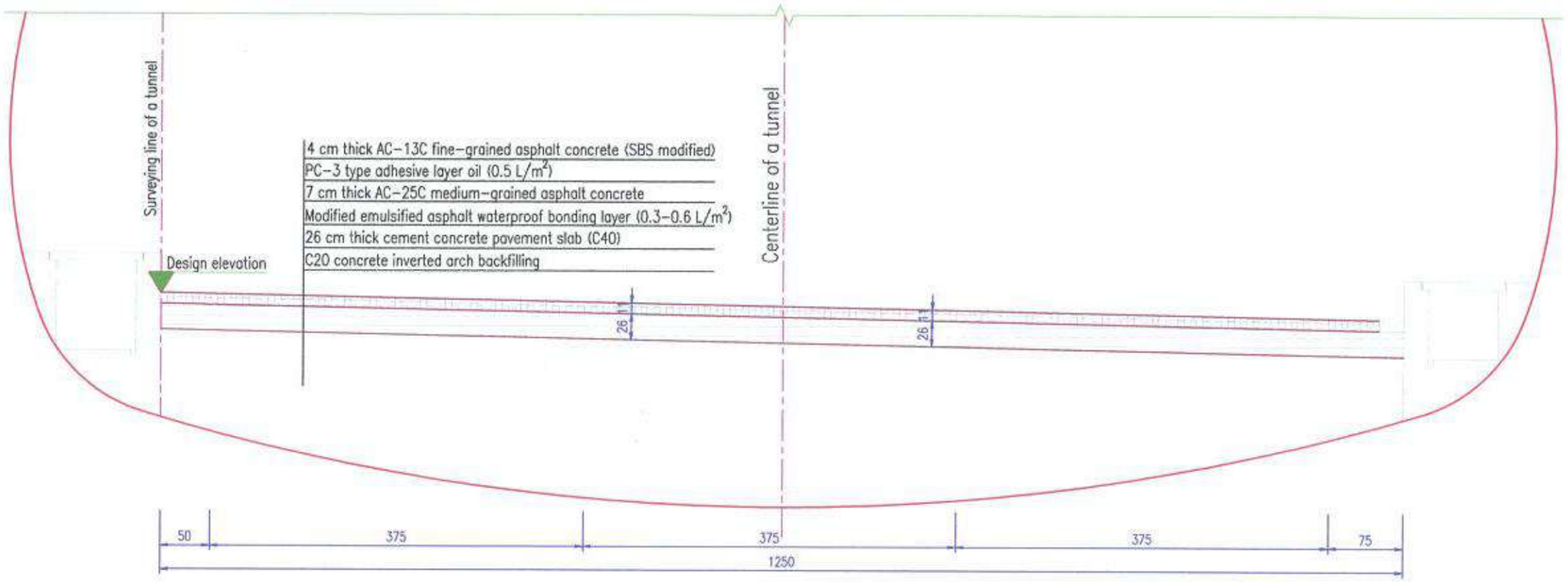
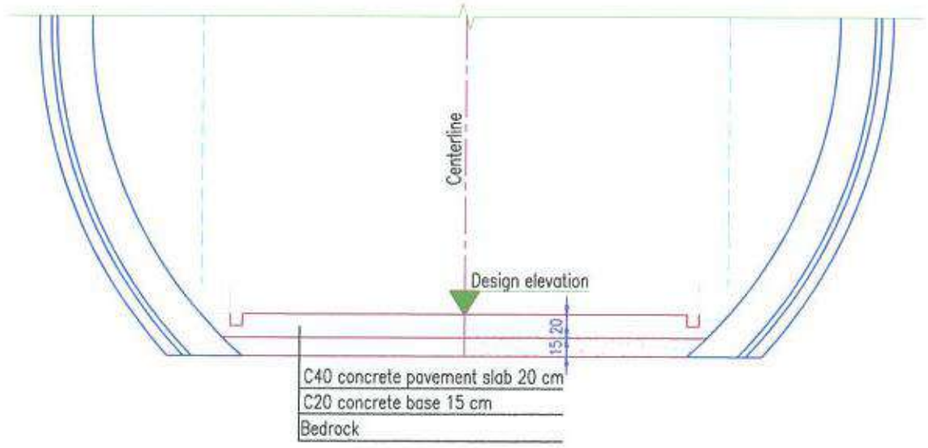
		Design Drawing of a Tunnel Trench				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-12
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

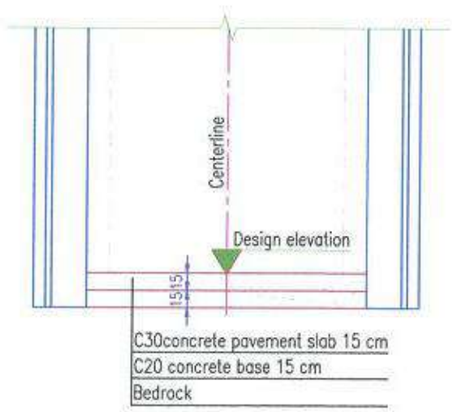
Pavement structure of a main tunnel 1:50



Pavement structure of a vehicle cross passage 1:50



Pavement structure of a pedestrian cross passage 1:50



Notes:
1. All dimensions in the drawing are measured in cm.

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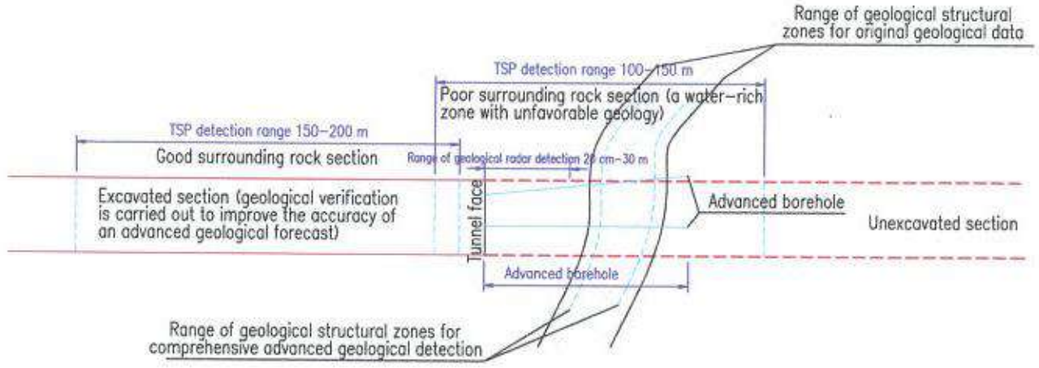
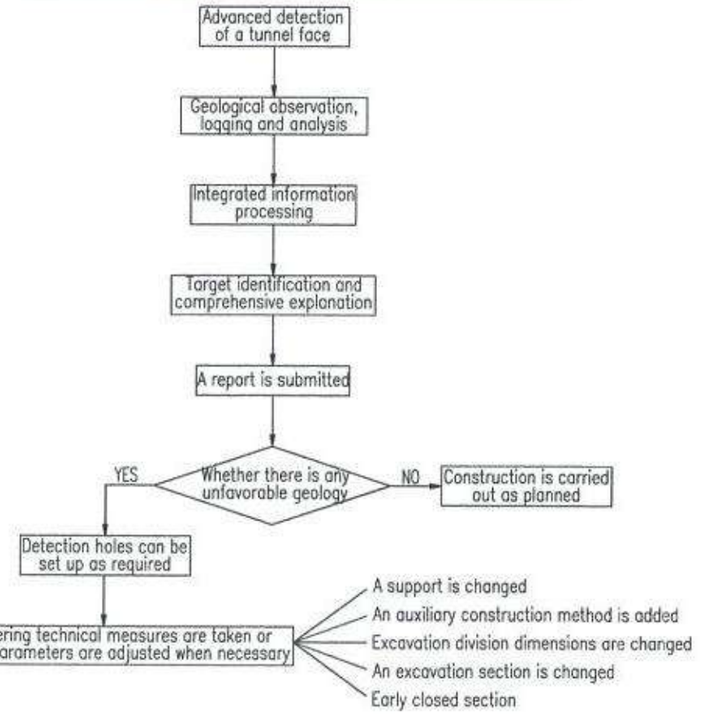
		Pavement Structure Design of a Tunnel				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-13
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

Advanced geological forecast scheme



Schematic Diagram of a Construction Process

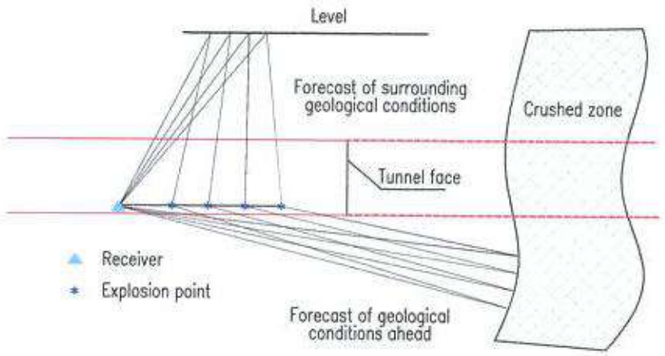


Advanced geological forecast method

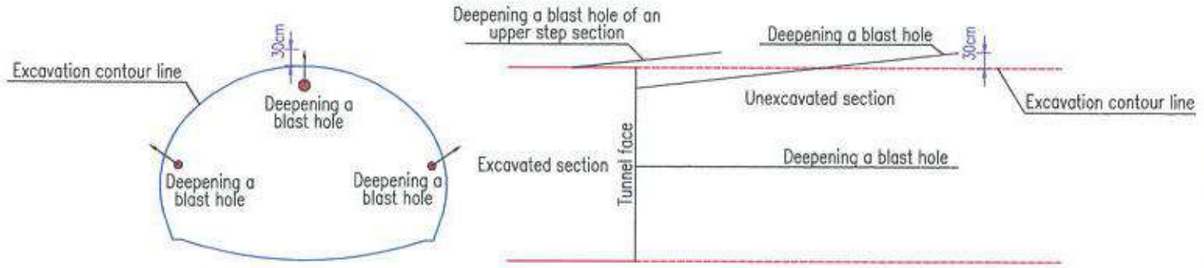
Forecast method		Forecast length	Scope of application
Geological analysis			Total length of a tunnel
Advanced drilling	Advanced horizontal drilling	Determined based on the length of an unfavorable geological body	Section with unfavorable geology Water-rich section
	Deepening a blast hole	30m	Total length of a tunnel
Forecast method	TSP advanced forecast	100~150m (Poor surrounding rock section) 150~200m (Good surrounding rock section)	Total length of a tunnel
	Geological radar detection	20~30m	Reinforced detection for an unfavorable geological section
	Infrared water detection	20~30m	Water-rich section

Notes:
1. Geological analysis, advanced horizontal drilling, deepening a blast hole, TSP advanced forecast, geological radar advanced detection and other methods are mainly used in the tunnel to predict the geology ahead.
2. Geological analysis, deepening a blast hole detection hole and TSP tunnel are applied cross the whole line. The water-rich section adopts advanced geological drilling and advanced water detection. Advanced geological drilling verification is used in areas with poor geology.
3. In the construction process, the forecast method is to be comprehensively adopted based on the on-site conditions to forecast the geology ahead, mutually confirming and complementing each other, and improving the ground quality prediction accuracy.

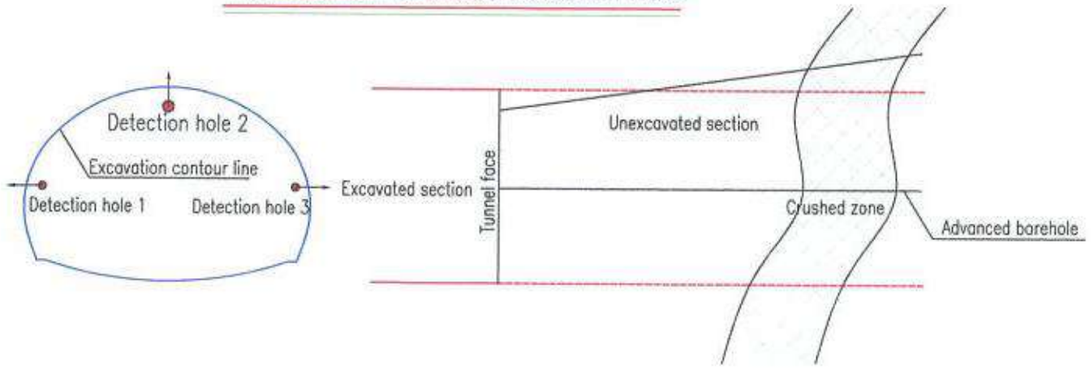
Layout Plan of a TSP Advanced Geological Forecast



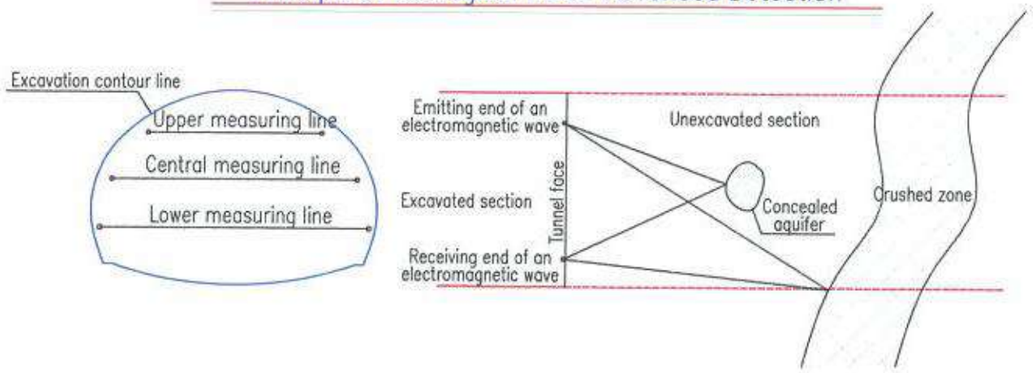
Schematic Layout Diagram of a Longitudinal Profile of an Advanced Detection Hole



Schematic Layout Diagram of a Longitudinal Profile of an Advanced Detection Hole



Schematic Layout Diagram of a Longitudinal Profile for a Principle of Geological Radar Advanced Detection



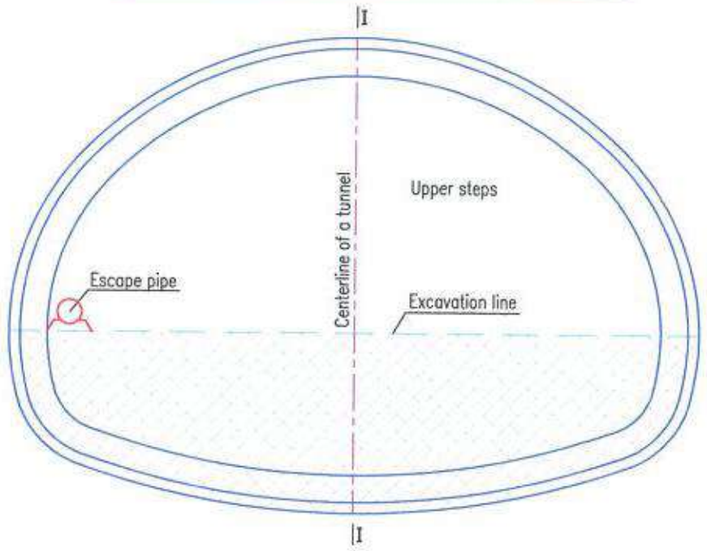
Advanced Geological Forecast Method Table

Broadcast type	Advanced geological forecast level			Remarks
	C1	C2	C3	
Geological filling analysis	√	√	√	
Long-distance geophysical detection	√	√	√	TSP instrument
Short-distance geophysical detection	If necessary	√	√	Geological radar, infrared water detection, etc.
Super-deep blast hole	If necessary	√	√	Boreholes is the same as general blasting holes
Drilling verification	If necessary	If necessary	√	Φ110 Drilling (coring when necessary)

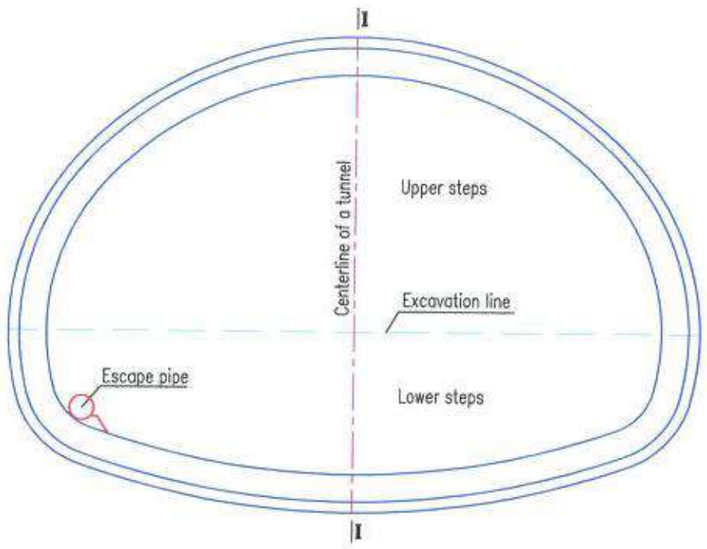
Notes:
1. An advanced geological forecast is to be based on comprehensive engineering geological analysis, and adhere to rough and fine inspections; the principle of combining long-distance and short-range detections, geophysical detection and drilling, combined with previous geological results and actual revealed situations, comprehensively is to be adopted for analysis and prediction.
2. An advanced geological forecast is to be carried out by experienced professionals.

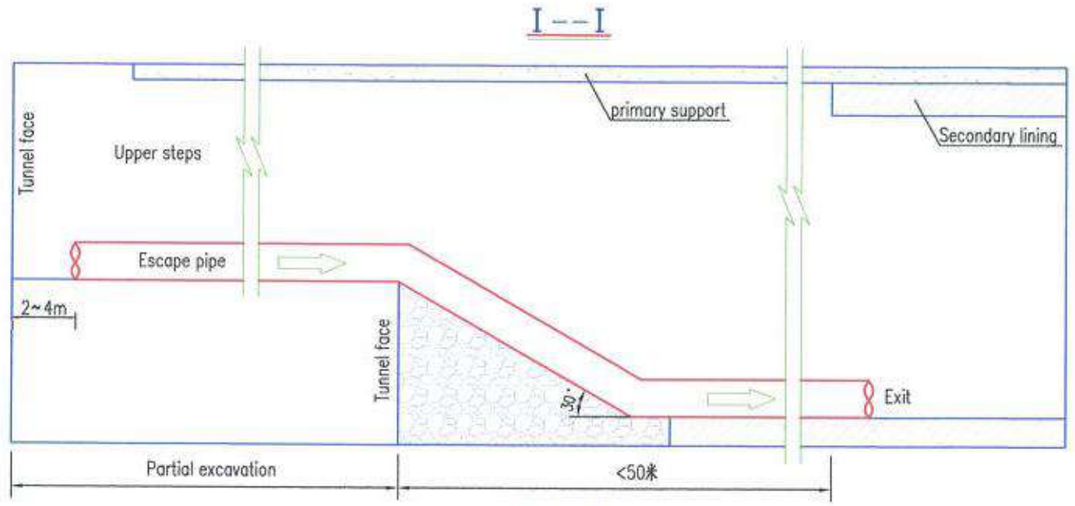
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER: PANG WEI	SUB. MANAGER:		CHECKED: WANG DA FA	SCALE:	
		Scheme Plan for an Advanced Geological Forecast of a Tunnel		MASTER DES.: CAO YONG XIANG	SPE. MANAGER: JI TIAN JIAO		EXAMINED: MA XIAO HU	DRAWING NO.:	III-15
				MASTER DES.: PAN HAO GUO	SPE. MANAGER:		APPROVED: TONG JING SHENG		
				SUB. MANAGER: MA XIAO HU	DESIGNED: WANG JUN TANG		APPROVED:	DATE:	2025.07

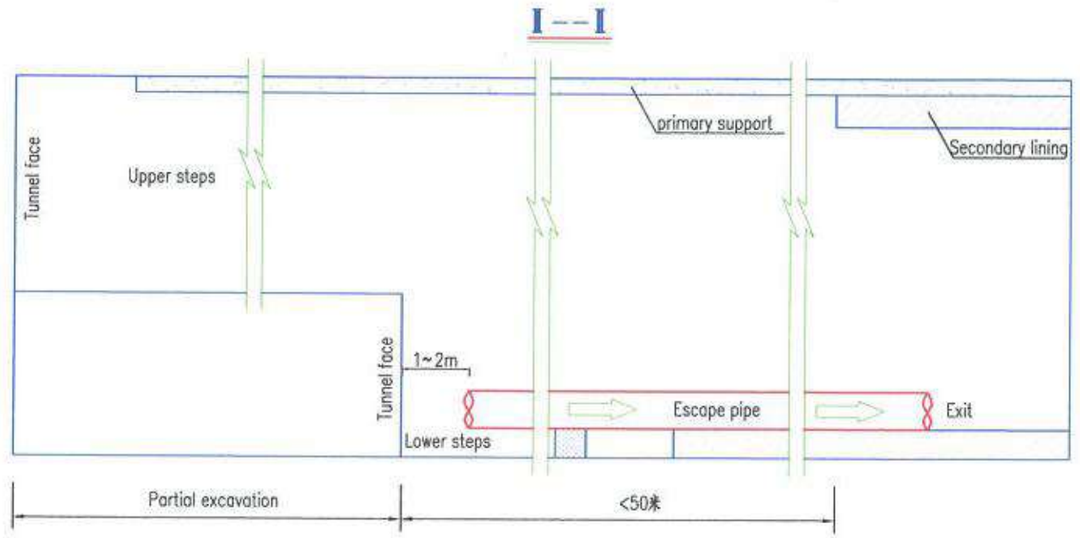
Schematic Layout Diagram of Construction Escape Pipes for Upper Steps



Schematic Layout Diagram of Construction Escape Pipes for Lower Steps







Notes:

Based on past experience and lessons learned, accidents such as collapses at the rear of the face in the tunnel easily cause construction workers to be trapped inside the tunnel; to ensure safe, quick and effective rescue of trapped personnel and minimize accident losses, relevant engineering measures are to be taken and related rescue facilities and equipment are to be prepared in the stage of tunnel construction.

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		Design Drawing for an Emergency Plan of Tunnel Construction				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	JI TIAN JIAO		EXAMINED	MA XIAO HU		DRAWING NO.	III-16
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	TONG JING SHENG			
						SUB. MANAGER	MA XIAO HU		DESIGNED	WANG JUN TANG		APPROVED			DATE	2025.07

Bill of quantities

No.	Item				Unit	Quantity	Notes
1	Length				m	2080×2=4160	Sum of left and right tunnels
2	Excavation	Grade-V		Stonework	m^3	319359.92	
3		Grade-IV		Stonework	m^3	479512.11	
4	Open tunnel	Lining	C30 P8 reinforced concrete		m^3	2474.01	
5			M20 cement mortar		m^3	46.31	
6			HRB400 rebar		t	172.09	
7			HPB300 rebar		t	12.54	
8			Filling concrete of a C20 inverted arch		m^3	1248.77	
9			C20 concrete bedding		m^3	204.33	
10		Backfilling	C20 plain concrete backfilling		m^3	992.25	
11			Soil and tone backfilling		m^3	14204.40	
12			Clay aquiclude		m^3	2765.07	
13			Planting soil		m^3	1659.04	
14			Grass planting for landscaping		m^2	5530.14	
15	Tunnel portal engineering	Bamboo cutting type tunnel portal	Tunnel portal	C30 waterproof concrete	m^3	871.51	
16			Base	C20 concrete bedding	m^3	90.55	
17			Waterproof	Cement-based capillary crystalline waterproof coating	m^2	741.09	
18			Tunnel portal rebar	HPB300 rebar	t	4.89	
19				HRB400 rebar	t	64.63	
20		Tunnel nameplates and signs		C30 concrete	m^3	180.00	
21		Gutter and intercepting ditch at a tunnel portal	C25 concrete		m^3	778.80	
22		Retaining wall at a tunnel entrance	C25 concrete		m^3	74.58	
23		Slope protection	C20 mesh sprayed concrete (spraying thickness: 15 cm)		m^3	1205.60	
24			Φ8 reinforced mesh (HPB300)		t	31.75	
25			Φ22 mortar anchor rod		t	58.21	
26	Advanced support	Arch	Arch masonry	C30 cast-in-pace concrete	m^3	191.77	
27			I-beam frame	I20b I-beam	t	16.75	
28			Fixed connection rebar	Φ20 (HRB400)	t	2.16	
29			Guide steel pipe	Φ127x4 mm hot-rolled seamless steel pipe	m	395.00	
30			Joint connecting steel plate	Q235 steel arch pad	t	1.49	
31			Bolts/nuts	M22x70	Set	403.00	

Bill of quantities

No.	Item				Unit	Quantity	Notes
32	Advanced support	Pipe shed support	Steel flower tube	Φ108x6 mm hot-rolled seamless steel pipe	m	5920.00	
33			Connecting steel pipe	Φ114x8 mm hot-rolled seamless steel pipe	m	270.00	
34			Sealing holes (filling of large pipe sheds)	M30 cement mortar	m^3	45.70	
35			Grouting stop	Grouting stop plug	Pcs	197.40	
36			Grouting	42.5# cement slurry	m^3	72.91	
37				Water glass (35 Baume degrees)	m^3	3.65	
38			Rebar cage	Φ20（HRB400）	t	59.29	
39		Advanced small conduit	Small conduit	φ42 wall thickness 4 mm seamless steel pipe	m	246365.00	
40			Hole drilling (cleaning)	Φ50 mm	m	246365.00	
41			Cement slurry grouting	Cement slurry	m^3	6159.13	
42			Φ22 advanced anchor rod (early strengthening mortar anchor rod)		t	651.98	
43	Formal tunnel and tunnel chamber	Initial support	Sprayed concrete	C25 sprayed concrete (thickness: 28 cm)	m^2	75014.10	
44				C25 sprayed concrete (thickness: 24cm)	m^2	132920.13	
45				I22b steel arch	t	5090.85	
46				I18 steel arch	t	5126.90	
47				Q235 steel arch pad	t	1092.25	
48				Bolt and nut (M20x70)	Set	335244.00	
49				Φ22 connecting reinforcement	t	987.59	
50				Φ8 reinforced mesh (HPB300)	t	741.53	
51			Anchor rod	Φ25 hollow grouting anchor rod	m	197303.40	
52				Φ22 early strengthening mortar anchor rod	t	528.29	
53				M18 bolt and nut	Set	50063.00	
54				Anchor rod pad 150 mm×150 mm×8 mm	t	73.80	
55				Φ42 grouting foot locking anchor pipe	m	70728.00	
56				Cement slurry	m^3	1768.20	
57				Φ25 foot locking anchor rod	t	415.57	
58				Borehole	m	10794.00	
59		Secondary lining	Tunnel body	C30 P8 waterproof concrete	m^3	106967.39	
60				C30 overexcavation and arch foot backfilling	m^3	22179.99	
61				HRB400 rebar	t	6752.18	
62				HPB300 rebar	t	369.14	
63			Inverted arch backfilling	C20 concrete	m^3	74223.56	
64			Grouting behind a lining	M30 cement mortar	m^3	1073.63	

Bill of quantities

No.	Item				Unit	Quantity	Notes
65	Cross passage engineering	Vehicle cross passage	Initial support	C25 sprayed concrete (thickness: 10 cm)	m^2	667.01	
66				Φ8 reinforced mesh (HPB300)	t	2.63	
67				⌀22 early strengthening mortar anchor rod	t	2.46	
68				Nut M18	Set	330.75	
69				Q235 anchor rod pad 150 mm×150 mm×8 mm	t	0.47	
70			Secondary lining	C30 P8 waterproof concrete	m^3	191.10	
71				C30 overexcavation backfilling	m^3	86.73	
72				HRB400 rebar	t	10.81	
73				HPB300 rebar	t	0.49	
74		Pedestrian cross passage	Initial support	C25 sprayed concrete (thickness: 5 cm)	m^2	916.91	
75				Φ8 reinforced mesh (HPB300)	t	3.62	
76				⌀22 early strengthening mortar anchor rod	t	2.74	
77				Nut M18	Set	459.38	
78				Q235 anchor rod pad 150 mm×150 mm×8 mm	t	0.65	
79			Secondary lining	C30 P8 waterproof concrete	m^3	248.98	
80				C30 overexcavation backfilling	m^3	124.95	
81	Pavement and decoration engineering	Pavement structure	Main tunnel	4 cm thick AC-13C fine-grained asphalt concrete (SBS modified)	m^2	47400.00	
82				7 cm AC-25 coarse grained asphalt concrete	m^2	47400.00	
83				26 cm thick cement concrete pavement slab (C40)	m^2	47594.10	
84				Modified emulsified asphalt waterproof bonding layer (0.3-0.6 L/m2)	m^2	47400.00	
85				PC-3 type adhesive layer oil (0.5 L/m^2)	m^2	47400.00	
86				Tie rod ⌀16 rebar	t	19.55	
87				Corner reinforcement rebars φ8	t	1.60	
88				Dowel bar φ32 rebars	t	0.56	
89			Cross passage pavement	C40 concrete pavement slab 20 cm	m^2	140.00	
90				C20 concrete base 15 cm	m^2	560.00	
91		Insulation decoration inside a tunnel	Tunnel specific fireproof coating topcoat		t	21.58	
92			12 cm thick tunnel specific fireproof coating		t	841.54	
93			5cm thick foam polyurethane (PU) insulation material		m^2	107890.02	
94			1 cm thick XPS fiberboard		m^2	107890.02	
95		Aluminum alloy reflective ring			m^2	107.23	

Bill of quantities

No.	Item			Unit	Quantity	Notes
96	Temporary engineering		I18 I-beam	t	1494.28	
97			Φ42 wall thickness 4 mm seamless steel pipe	m	106092.00	
98			Cement slurry	m^3	8398.95	
99			22 cm C25 sprayed concrete	m^2	32876.55	
100			Φ8 reinforced mesh (HPB300)	t	121.97	
101			Bolt and nut (M24X80)	Pcs	88410.00	
102			⌀22 connecting reinforcement (HRB400)	t	110.66	
103			⌀22 mortar anchor rod	t	105.38	
104			Anchor pad, node connecting steel plate (Q235)	t	235.90	
105	Waterproofing and drainage engineering	Membrane	1.5 mm EVA waterproof board	m^2	204770.08	
106			Geotechnical non-woven fabrics (400 g/m^2)	m^2	212545.50	
107		Pipe material	Horizontal φ100 mm double-wall corrugated pipe	m	7103.19	
108			Longitudinal φ100 mm double-wall corrugated pipe	m	9077.25	
109			Circumferential φ50 mm HDPE perforated corrugated pipe	m	13044.43	
110			φ100 Ω-type half-circle drainage pipe	m	13498.64	
111			Tee coupling	Pcs	2628.00	
112		Waterstop	Buried waterstop (300x10 mm)	m	18085.61	
113			Back mounted waterstop (300x10)	m	5042.81	
114			Galvanized steel sheet waterstop	m	8320.00	
115		Others	Φ8 fixed reinforcement (HPB300)	t	5.10	
116			Polystyrene rigid foam board	m^2	2494.91	
117			Caulking material (two-component polysulfide sealant)	m	4910.64	
118		Grouting at a top of an arch	Φ42×4 grouting pipe	m	901.85	
119			Mortar slurry	m^3	1073.63	
120		Gravel blind ditch		m	140.00	
121	Side ditch engineering	C30 Concrete ditch side	C30 concrete	m^3	7906.08	
122			HPB300 rebar	t	162.45	
123			HRB400 rebar	t	376.48	
124		C30 concrete cover	Polyurethane plastic foam insulation layer	m^3	152.88	
125			C30 concrete	m^3	585.31	
126		Roadside ditch	C30 concrete	m^3	96.10	
127		Cable trench of a cross passage	Φ102×4 steel pipe	m	364.00	
128			C20 filling concrete	m^3	5.88	

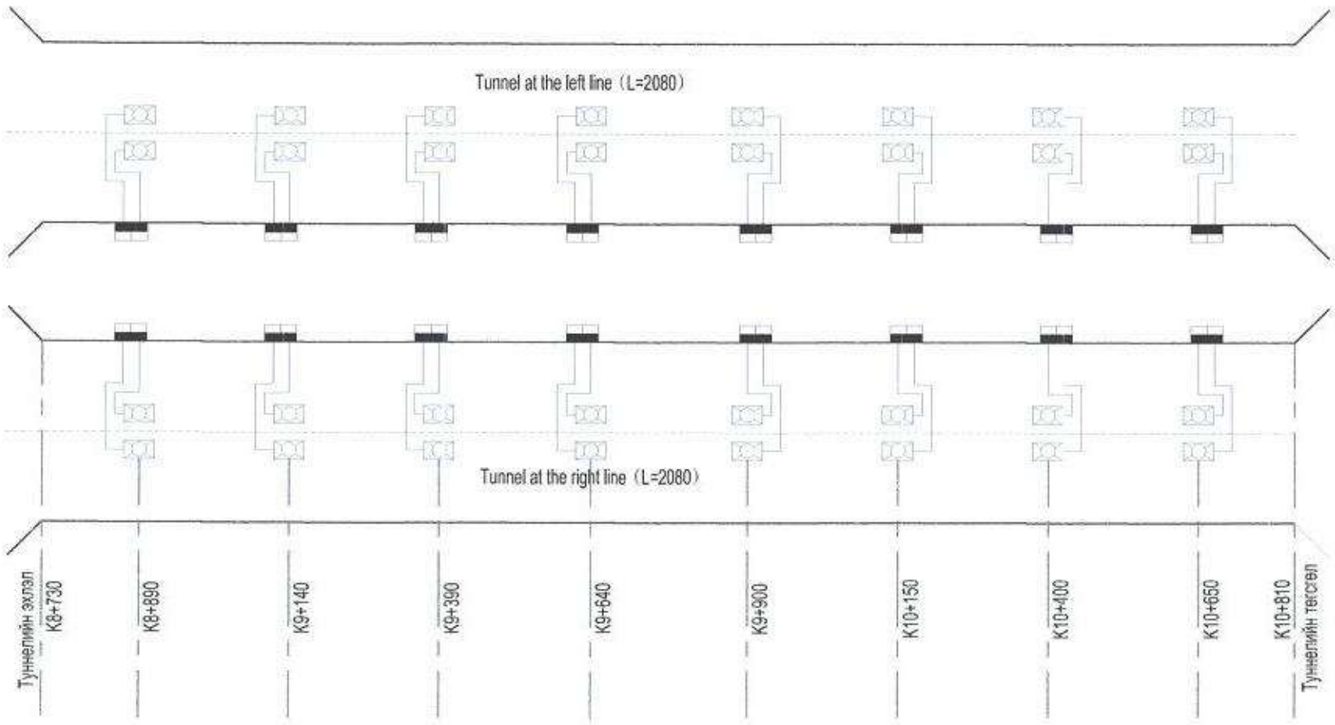
Bill of quantities

No.	Item			Unit	Quantity	Notes
129	Side ditch engineering	Central drainage ditch	Excavation of stonework	m^3	2703.79	
130			Reinforced concrete pipe DN600	m	4200.00	
131			C20 pipe seat concrete	m^3	480.48	
132			Geotechnical non-woven fabrics（400 g/m^2）	m^2	6333.60	
133			Crushed stone (grain diameter 3-5 cm)	m^2	1310.40	
134		Sand settling well of a central drainage ditch	C30 concrete	m^3	117.94	
135			HRB400 rebar	t	1.41	
136			HPB300 rebar	t	0.13	
137		Insulated water outlet	Geotechnical non-woven fabrics（400 g/m^2）	m^2	45.36	
138			Coal slag	m^3	302.82	
139			C20 cast-in-place concrete foundation	m^3	3.19	
140			C30 concrete	m^3	134.45	
141			Backfilled with rubbles	m^3	16.84	
142			Excavation of earthwork	m^3	326.13	
143			Gravel bedding	m^3	35.28	
144			UPVC plastic drainage pipe	m	285.18	
145			C30 concrete cast-in-place bottom slab	m^3	27.93	
146	Others	Escape pipe	Φ950 mm×10 mm steel pipe	t	77.89	
147		Dynamic construction	Construction monitoring and measurement	m	4160.00	
148			Geological advanced forecast	m	4160.00	

图例：

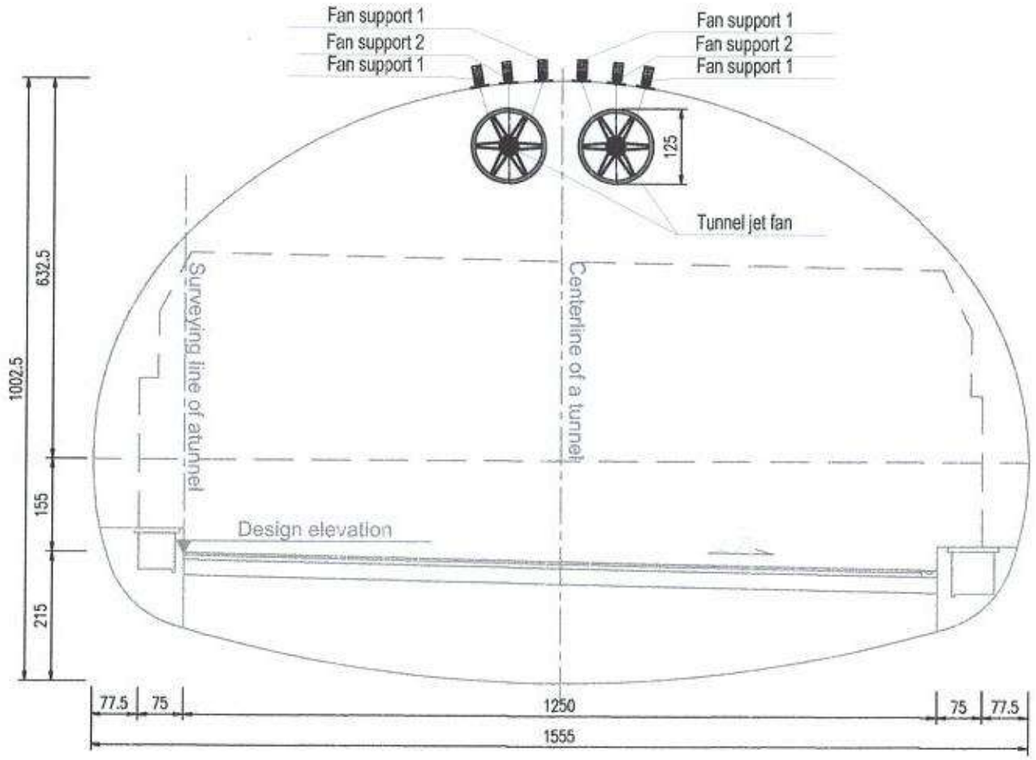
Tunnel jet fan

On-site control box of a fan



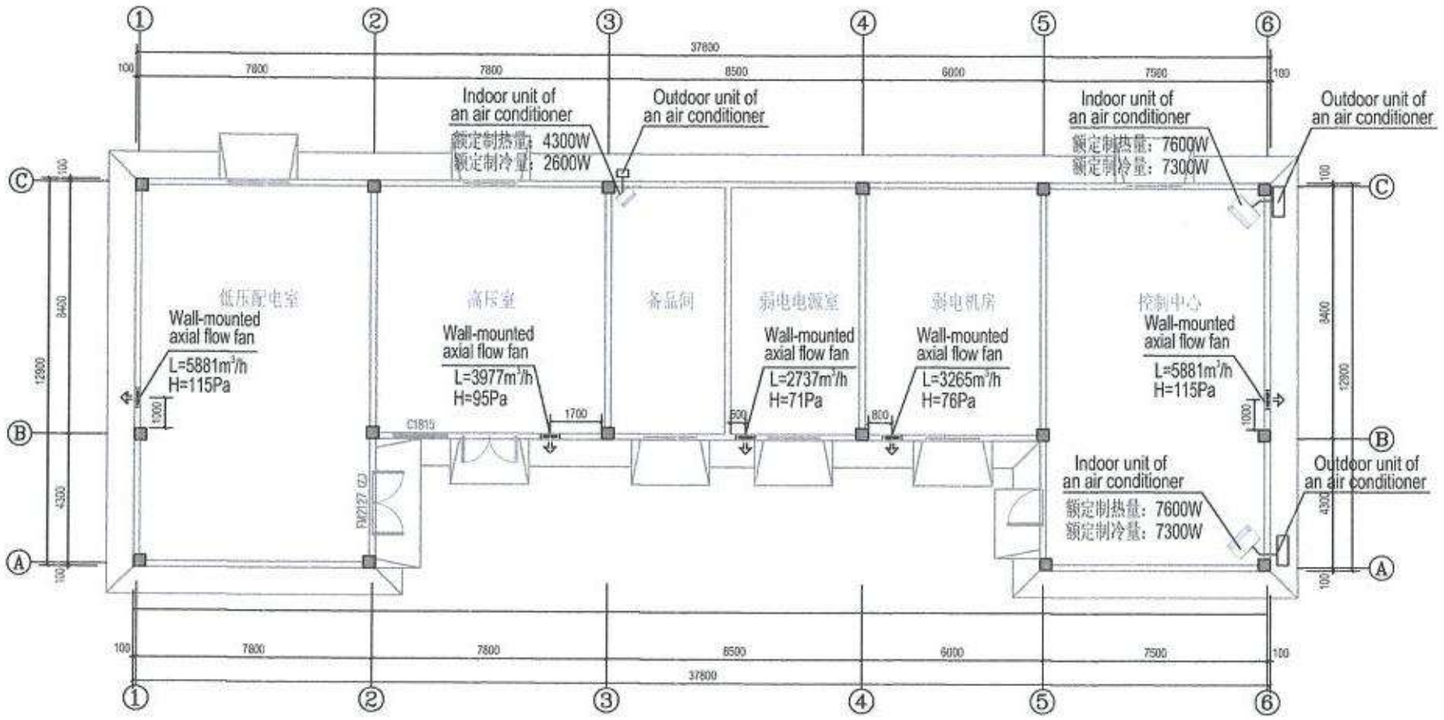
Layout Plan of a Tunnel Fan

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER	MA XIAO HU		CHECKED	ZHAO KE XIN		SCALE	
		Layout Plan of a Tunnel Fan				MASTER DES.	CAO YONGXIANG		SPE. MANAGER	ZHANG YANG		EXAMINED	ZHANG XIAO HE		DRAWING NO.	III-18
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	ZHANG WEI			
						SUB. MANAGER			DESIGNED	ZHANG YANG		APPROVED			DATE	2025.07



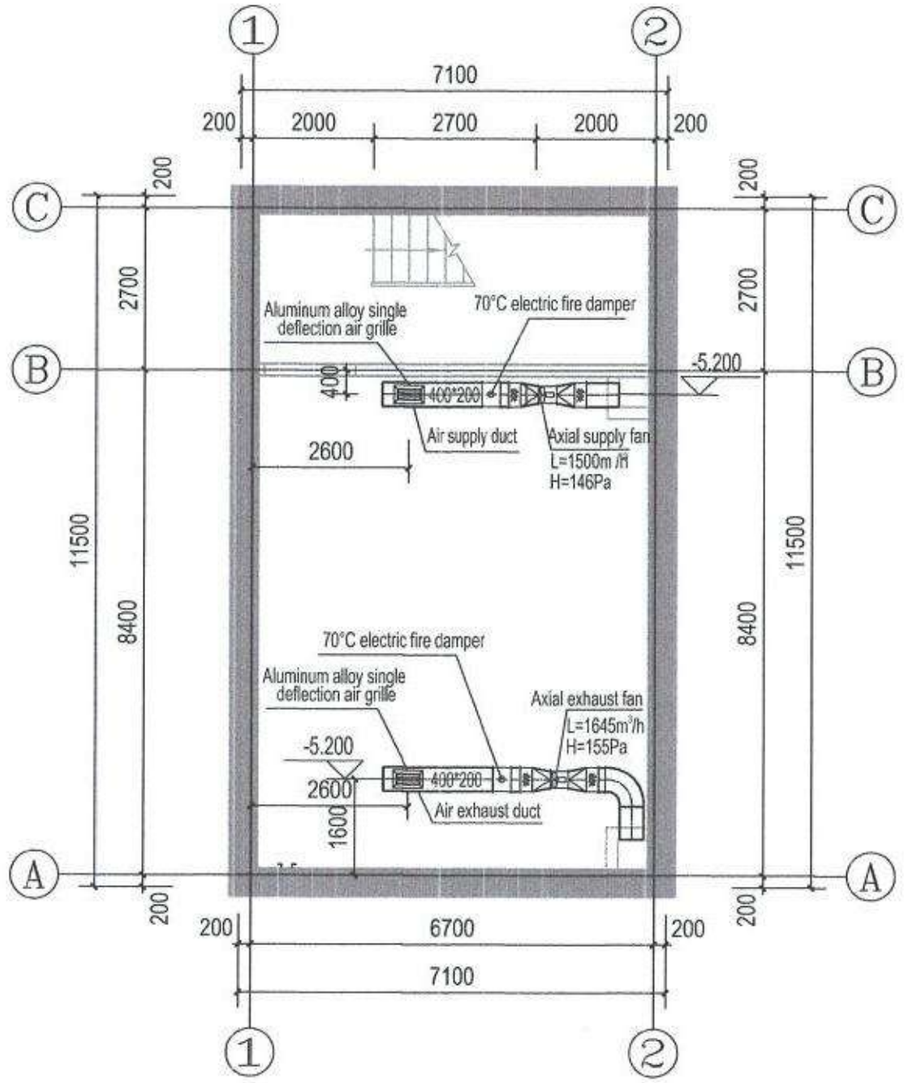
Cross Section Layout of a Tunnel Fan

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER	MA XIAO HU		CHECKED	ZHAO KE XIN		SCALE: 1:100
		Cross Section Layout of a Tunnel Fan		MASTER DES.	CAO YONGXIANG		SPE. MANAGER	ZHANG YANG		EXAMINED	ZHANG XIAO HUI		DRAWING NO.: III-19
				MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	ZHANG WEI		DATE: 2025.07
				SUB. MANAGER			DESIGNED	ZHANG YANG		APPROVED			



Layout Plan for a Ventilation Air Conditioner of a Main Substation of a Tunnel

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER	MA XIAO HU		CHECKED	ZHAO KE XIN		SCALE	1:200
		Layout Plan for a Ventilation Air Conditioner of a Main Substation of a Tunnel				MASTER DES.	CAO YONGXIANG		SPE. MANAGER	ZHANG YANG		EXAMINED	ZHANG XIAO HI		DRAWING NO.	III-20
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	ZHANG WEI			
						SUB. MANAGER			DESIGNED	ZHANG YANG		APPROVED			DATE	2025.07

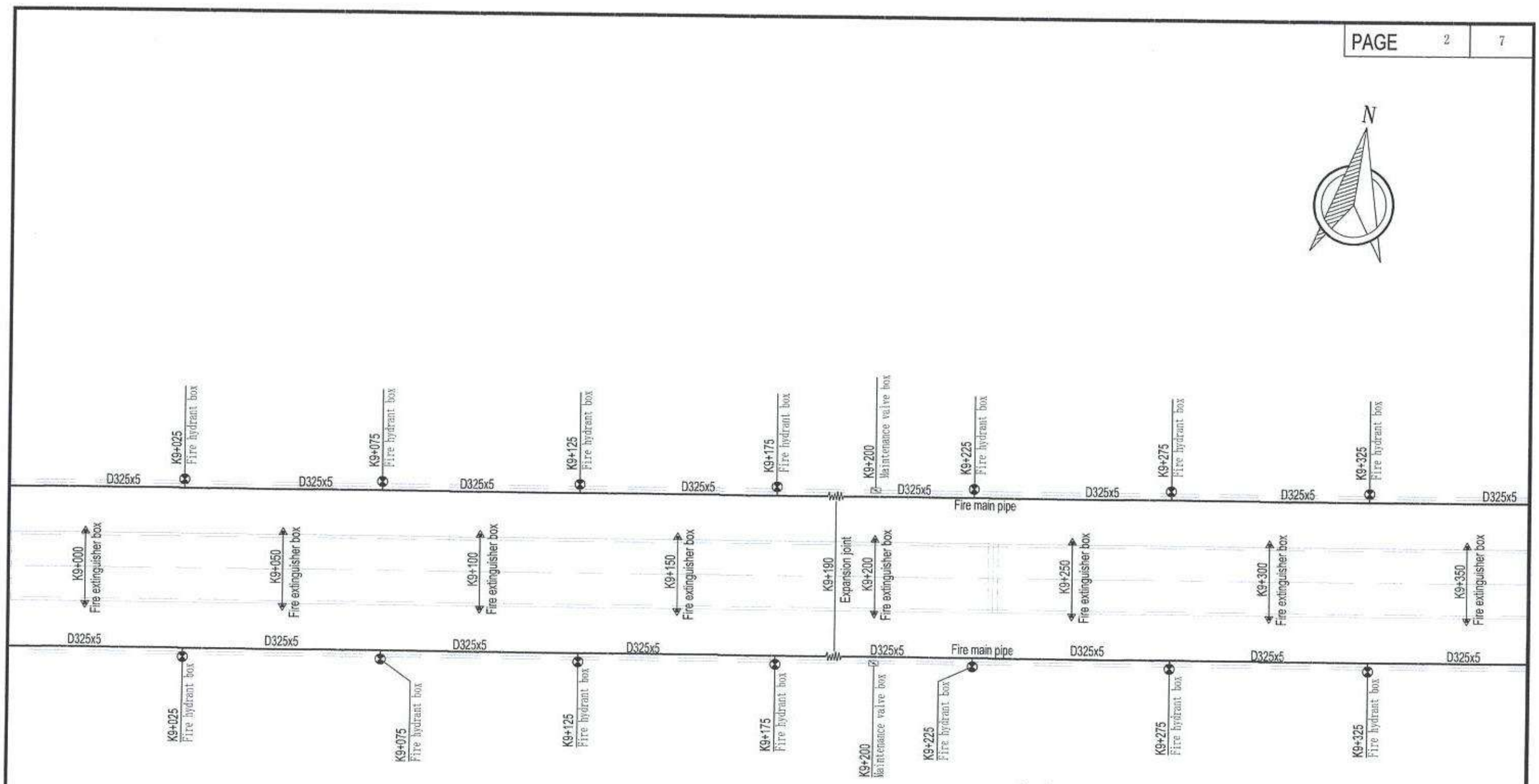


Layout Plan for Ventilation Equipment of a Fire Pump House of a Tunnel

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER	MA XIAO HU		CHECKED	ZHAO KE XIN		SCALE	1:100
		Layout Plan for Ventilation Equipment of a Fire Pump House of a Tunnel				MASTER DES.	ZAO YONGLIANG		SPE. MANAGER	ZHANG YANG		EXAMINED	ZHANG XIAO HU		DRAWING NO.	III-21
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	ZHANG WEI			
						SUB. MANAGER			DESIGNED	ZHANG YANG		APPROVED			DATE	2025.07

List of Main Ventilation Equipment of a Tunnel

Tunnel					
Serial Number	Equipment name	Parameter and specification	Unit	Quantity	Note
1	Tunnel jet fan	Impeller diameter: 1250mm; outlet flow rate: 43.5m³/s; wind speed at the outlet: 35.5m/s; weight: 1280kg; thrust: 1668N; sound pressure: 77dB（A）; power: 55KW	Set	16×2	Service life: 15 years, to be imported
2	CO/VI detector	CO:0~500ppm	Piece	5×2	Service life: 15 years, to be imported
3	Wind speed and direction detector	0~30m/s	Piece	5×2	Service life: 15 years, to be imported
4	NO2 detector	0~10cm³/m³	Piece	5×2	Service life: 15 years, to be imported
Main distribution substation of the tunnel					
Serial Number	Equipment name	Parameter and specification	Unit	Quantity	Note
1	Wall-mounted axial flow fan	L=5881m³/h,H=115Pa,N=0.25KW,220V,n=1450rpm	Set	2	Service life: 10 years, no need for import
2	Wall-mounted axial flow fan	L=3977m³/h,H=95Pa,N=0.12KW,220V,n=1450rpm	Set	1	Service life: 10 years, no need for import
3	Wall-mounted axial flow fan	L=2737m³/h,H=71Pa,N=0.09KW,220V,n=1450rpm	Set	1	Service life: 10 years, no need for import
4	Wall-mounted axial flow fan	L=3265m³/h,H=76Pa,N=0.09KW,220V,n=1450rpm	Set	1	Service life: 10 years, no need for import
5	Air conditioner	Rated heating capacity: 7600W; rated cooling capacity:7300W; heating power consumption: 2100W; cooling power consumption:2350W;	Set	2	Service life: 10 years, no need for import
6	Air conditioner	Rated heating capacity: 4300W; rated cooling capacity:2600W; heating power consumption: 1050W; cooling power consumption:1280W;	Set	1	Service life: 10 years, no need for import
Fire pump house of the tunnel					
Serial Number	Equipment name	Parameter and specification	Unit	Quantity	Note
1	Axial supply fan	L=1500m³/h; n=1450r/min dB(A)≤63; H=146Pa N=0.37KW	Set	1	Service life: 10 years, no need for import
2	Axial exhaust fan	L=1645m³/h; n=2900r/min dB(A)≤79; H=155Pa N=0.12KW	Set	1	Service life: 10 years, no need for import
3	70°C electric fire damper	400×200,normally open	Set	2	Service life: 10 years, no need for import
4	Aluminum alloy single deflection air grille	500×300,normally open	Set	2	Service life: 10 years, no need for import
5	Galvanized steel plate	1mm-thick	Kg（m²）	105Kg（13.5m²）	Service life: 10 years, no need for import



General Layout Plan of Tunnel Firefighting Equipment 1:1000

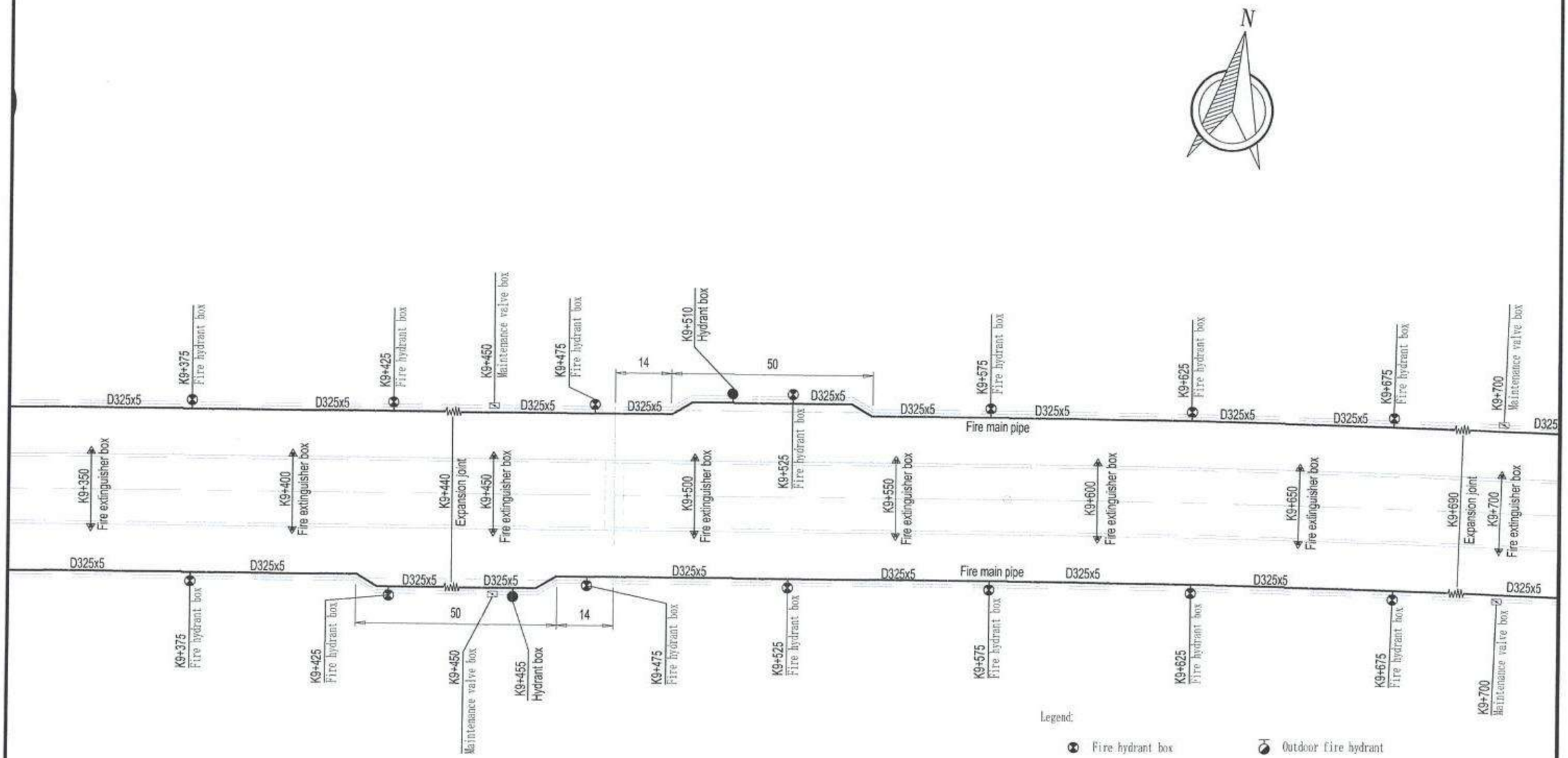
Legend:

- Fire hydrant box
- Outdoor fire hydrant
- Fire extinguisher box
- Valve chamber
- Maintenance valve box
- Siamese connection
- Hydrant box
- Sediment well
- Expansion joint
- Exhaust valve well

Explanation:

1. Except for special indication, sizes in the drawing are calculated by meters.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	BAI TING ZHOU		SCALE	1:1000
		General Layout Plan of Tunnel Firefighting Equipment		MASTER DES.	CAO YONGXIANG		SPE. MANAGER	BAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-23
				MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI MEI			
				SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED			DATE	2025.07



General Layout Plan of Tunnel Firefighting Equipment 1:1000

Legend:

- Fire hydrant box
- Outdoor fire hydrant
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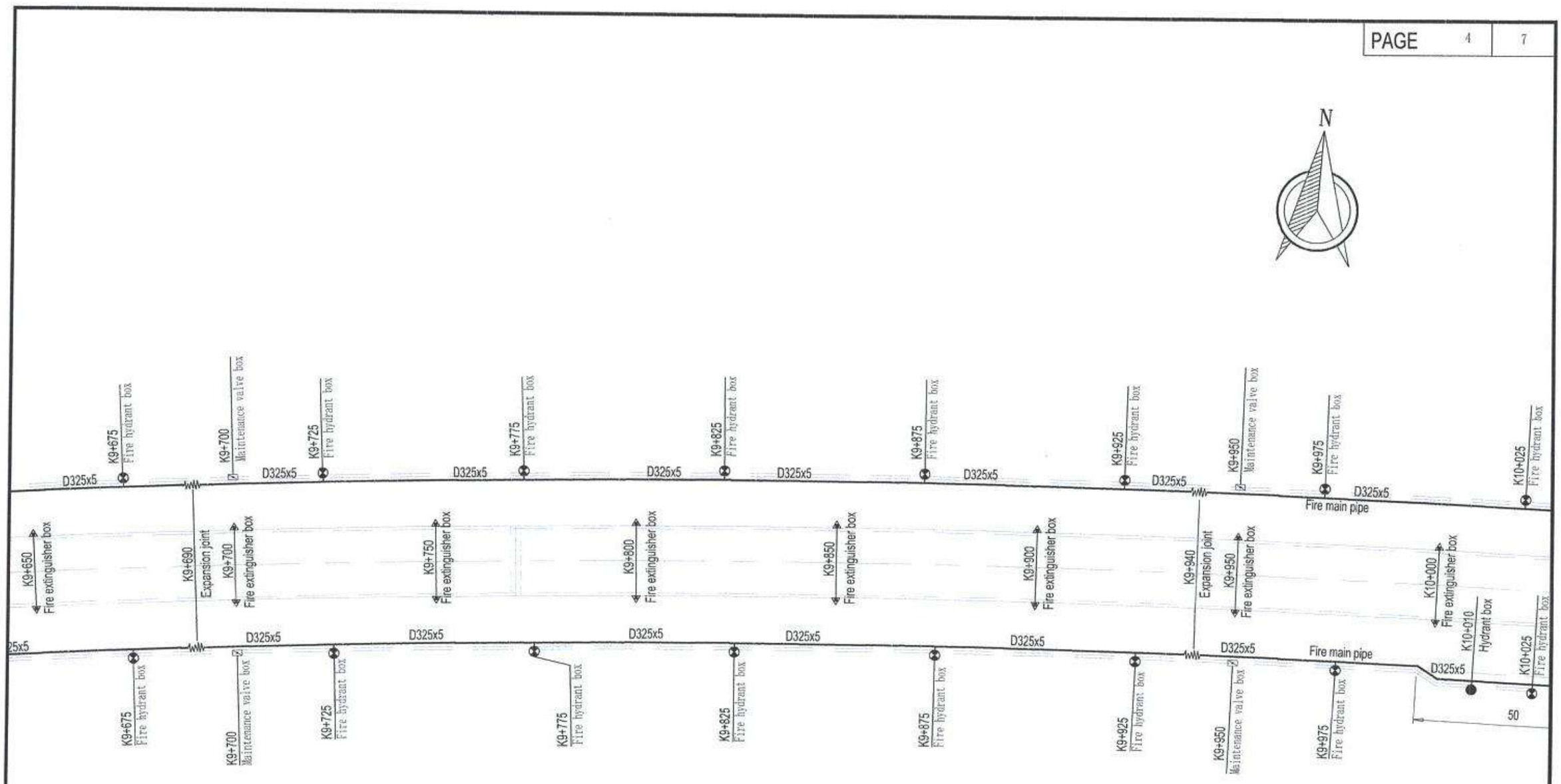
Explanation:

1. Except for special indication, sizes in the drawing are calculated by meters.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	BAI TING ZHOU		SCALE	1:1000
		General Layout Plan of Tunnel Firefighting Equipment		MASTER DES.	CAO YONGXIANG		SPE. MANAGER	BAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-23
				MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI MEI			
				SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED			DATE	2025.07



General Layout Plan of Tunnel Firefighting Equipment 1:1000

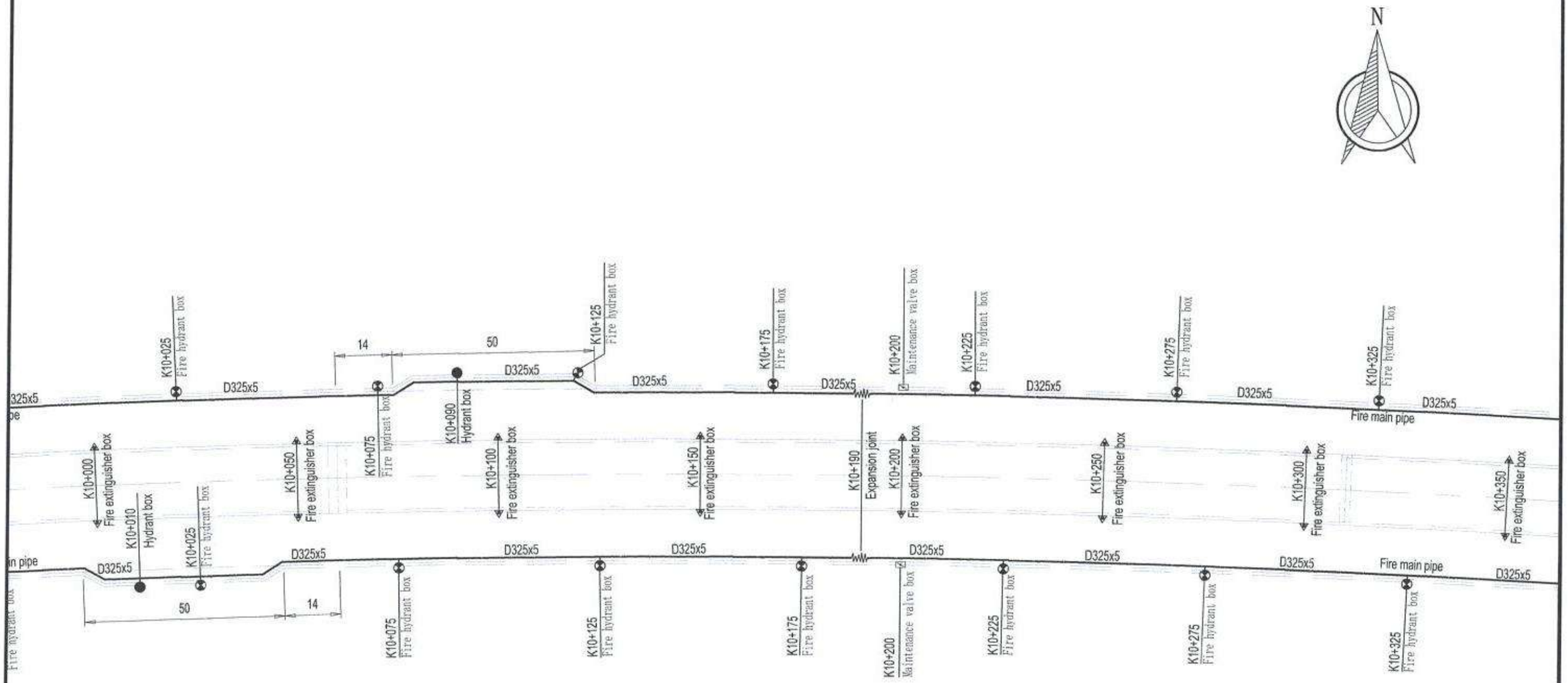
Legend:

Fire hydrant box	Outdoor fire hydrant
Fire extinguisher box	Valve chamber
Maintenance valve box	Siamese connection
Hydrant box	Sediment well
Expansion joint	Exhaust valve well

Explanation:

1. Except for special indication, sizes in the drawing are calculated by meters.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	HAI TING ZHOU		SCALE	1:1000
		General Layout Plan of Tunnel Firefighting Equipment				MASTER DES.	CAO YONGXIANG		SPE. MANAGER	HAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-23
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI MEI		DATE	2025.07
						SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED				



General Layout Plan of Tunnel Firefighting Equipment 1:1000

Legend:

Fire hydrant box	Outdoor fire hydrant
Fire extinguisher box	Valve chamber
Maintenance valve box	Siamese connection
Hydrant box	Sediment well
Expansion joint	Exhaust valve well

Explanation:

1. Except for special indication, sizes in the drawing are calculated by meters.

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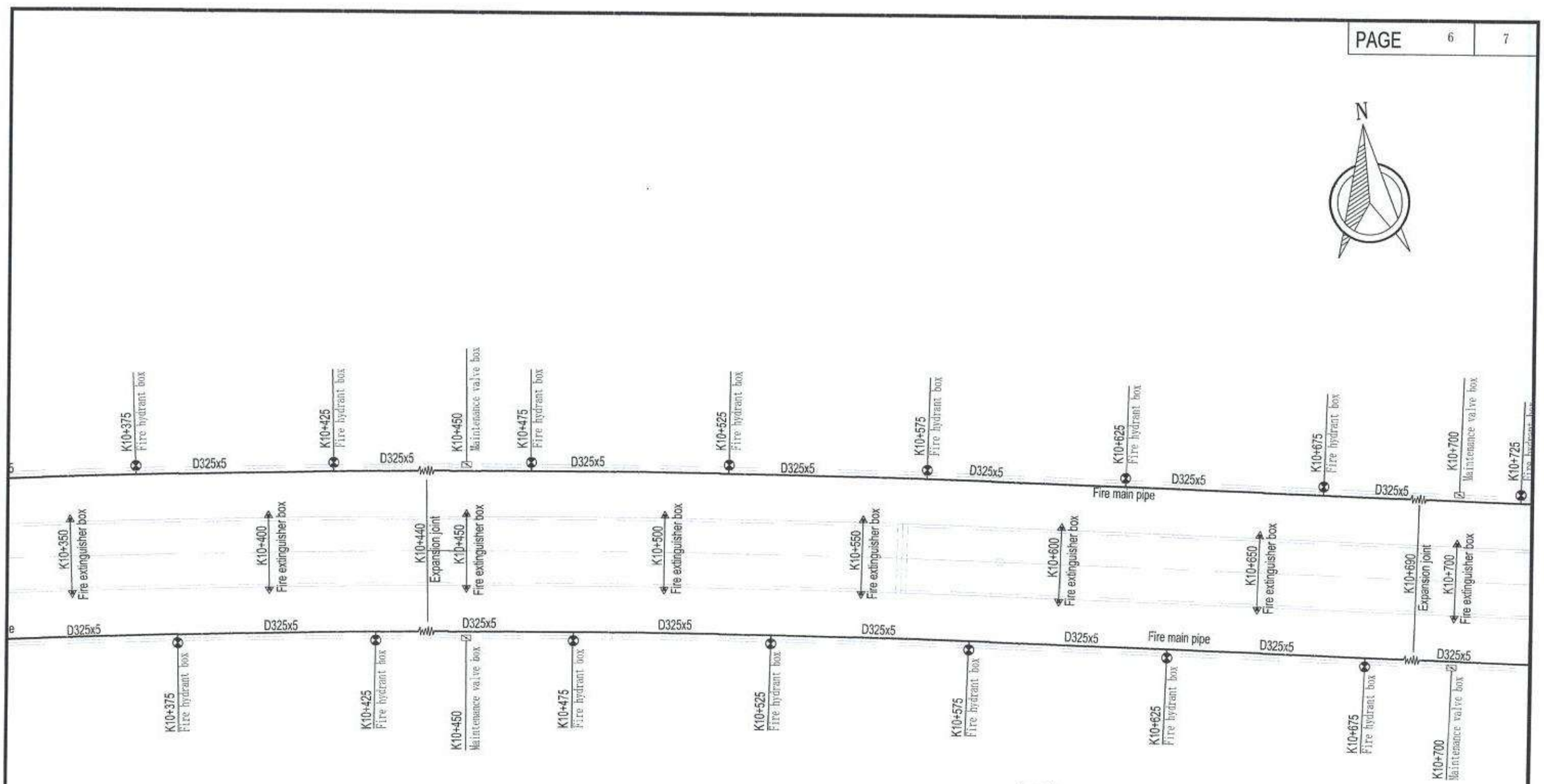
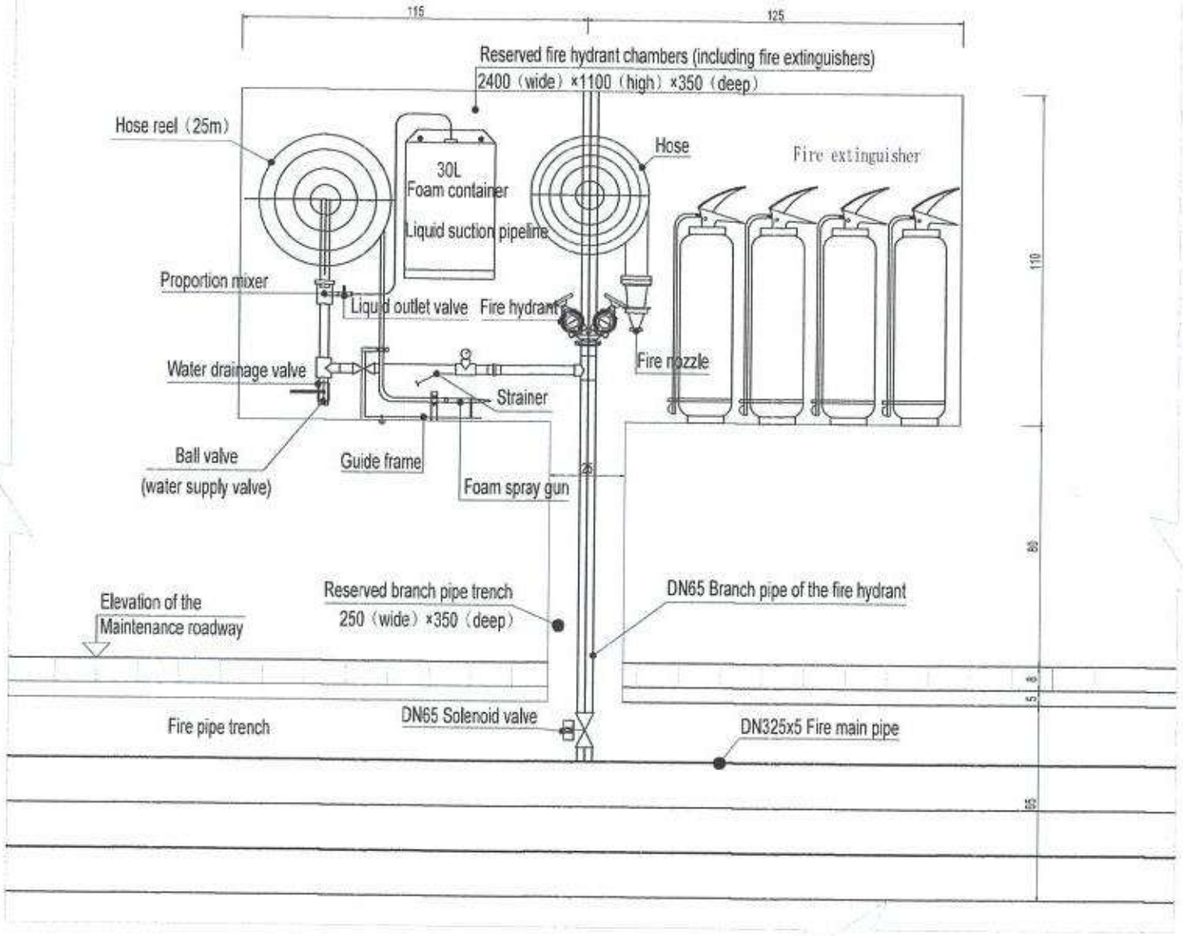
		General Layout Plan of Tunnel Firefighting Equipment		MASTER DES.	CAO YONGXIANG		SPE. MANAGER	BAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-23
				MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI HEI			
				SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED			DATE	2025.07



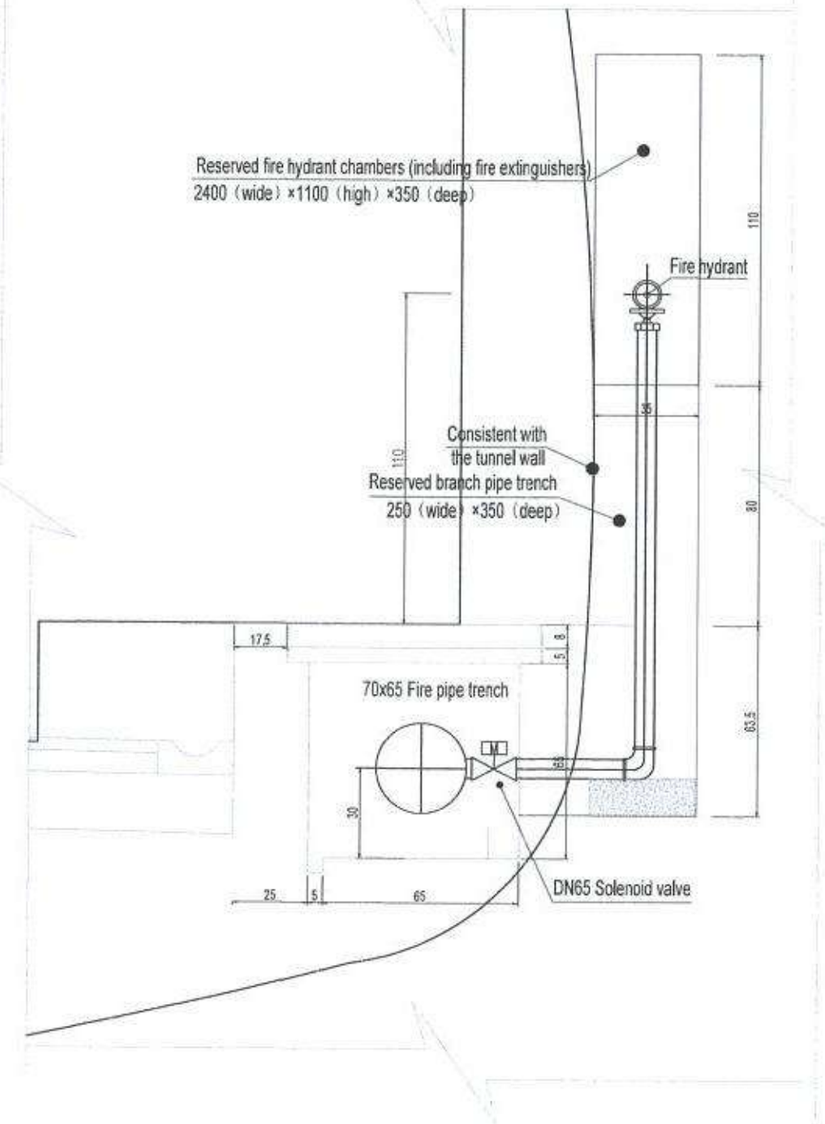
General Layout Plan of Tunnel Firefighting Equipment 1:1000

Explanation:
1. Except for special indication, sizes in the drawing are calculated by meters.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER: PANG WEI	SUB. MANAGER:		CHECKED: BAI TING ZHOU	SCALE: 1:1000
		General Layout Plan of Tunnel Firefighting Equipment		MASTER DES.: CAO YONGXIANG	SPE. MANAGER: BAI TING ZHOU		EXAMINED: CUI YONG	DRAWING NO.: III-23
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: WANG HAI MEI	
				SUB. MANAGER: MA XIAO HU	DESIGNED: JIANG FENG		APPROVED:	DATE: 2025.07



Fire hydrant chambe elevation

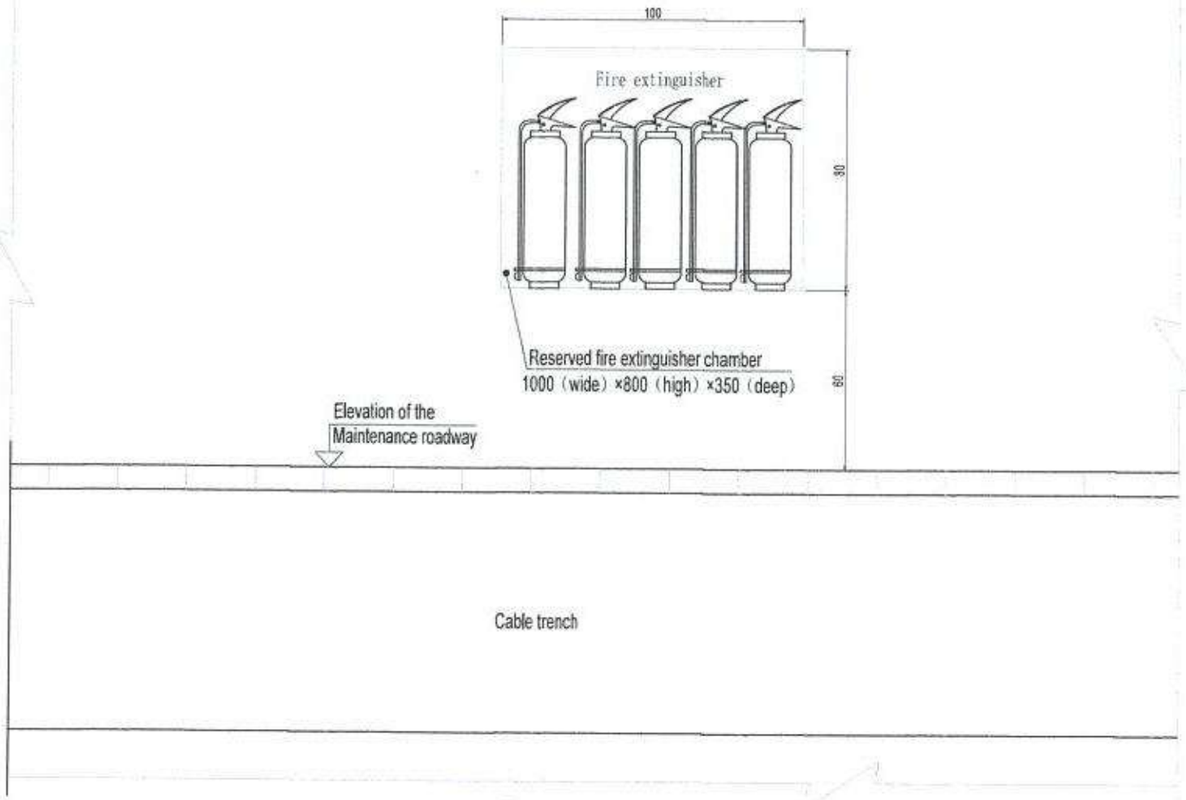


Fire hydrant chamber side elevation

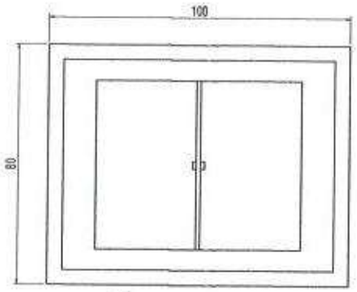
Explanation:

Except for special indication, sizes in the drawing are calculated by cm.

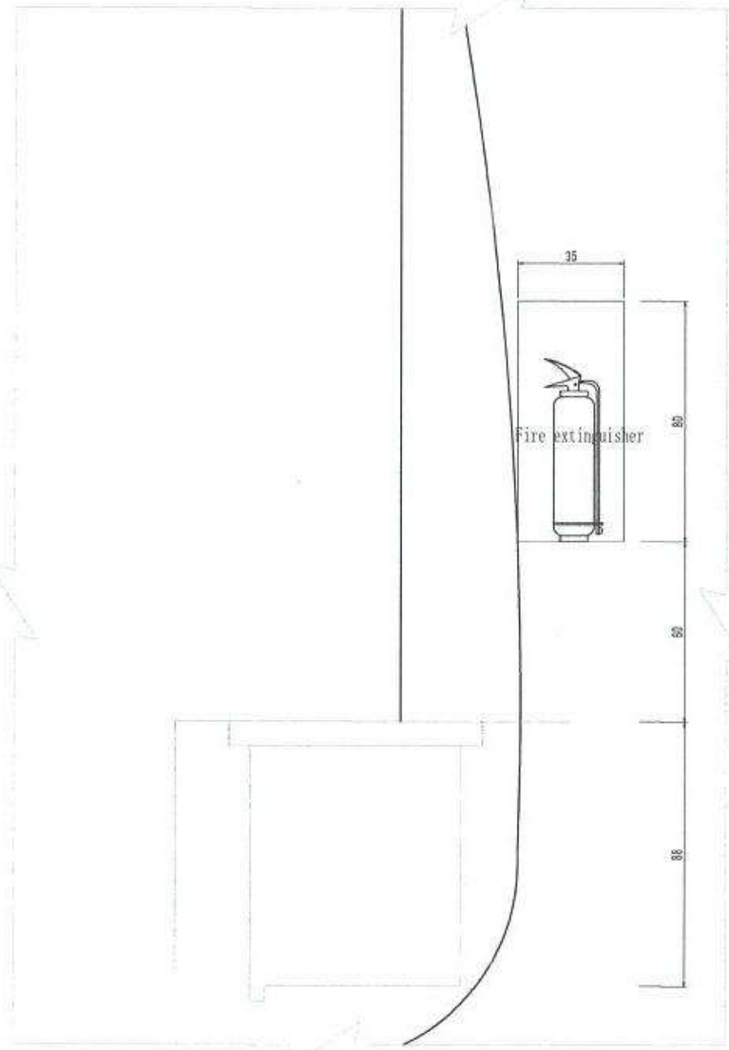
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	BAI TING ZHOU		SCALE	1:20
		Elevation and Side Elevation of Fire hydrant chamber				MASTER DES.	CAO YONGXIANG		SPE. MANAGER	BAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-25
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI WEI			
						SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED			DATE	2025.07



Fire extinguisher chambe elevation



Fire extinguisher box elevation

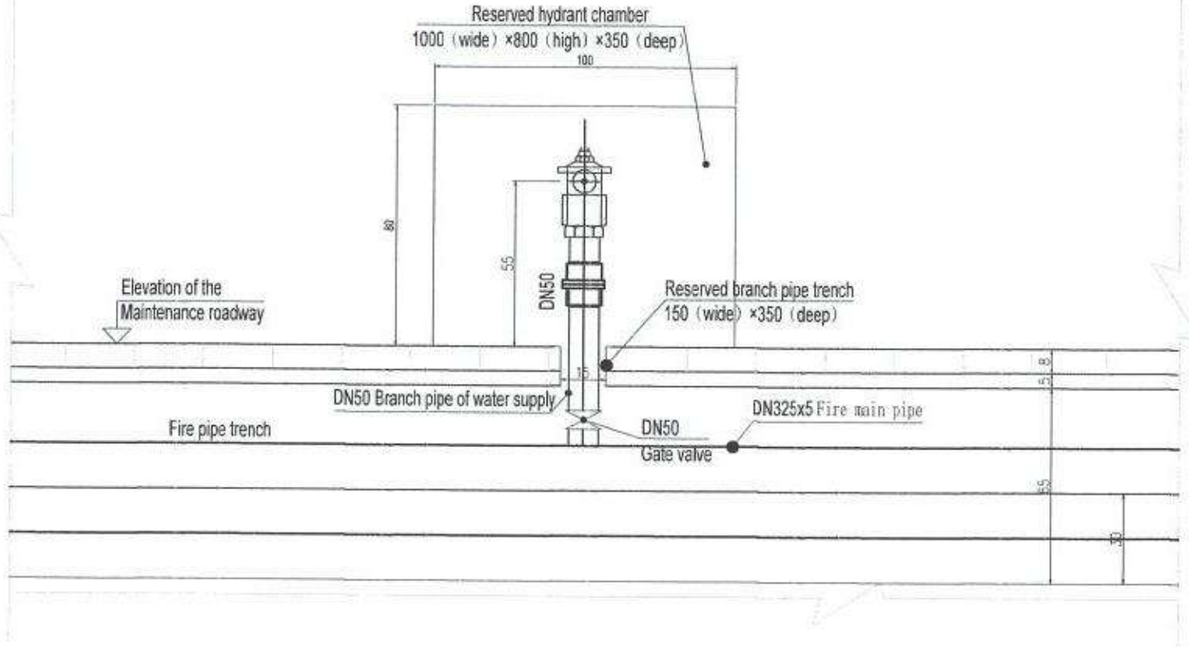


Fire extinguisher chamber side elevation

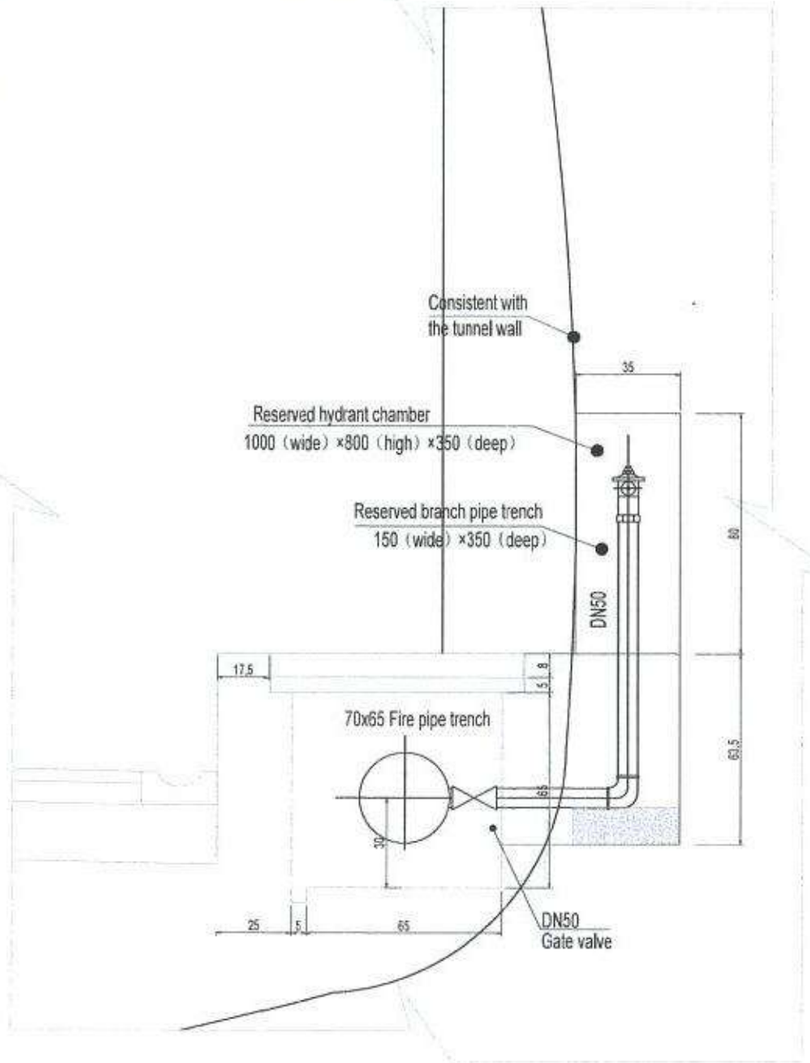
Explanation:

Except for special indication, sizes in the drawing are calculated by cm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	BAI TING ZHOU		SCALE	1:20
		Elevation and Side Elevation of Fire extinguisher chamber				MASTER DES.	CAO YONGXIANG		SPE. MANAGER	BAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-26
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI MEI			
						SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED			DATE	2025.07



Hydrant chamber elevation

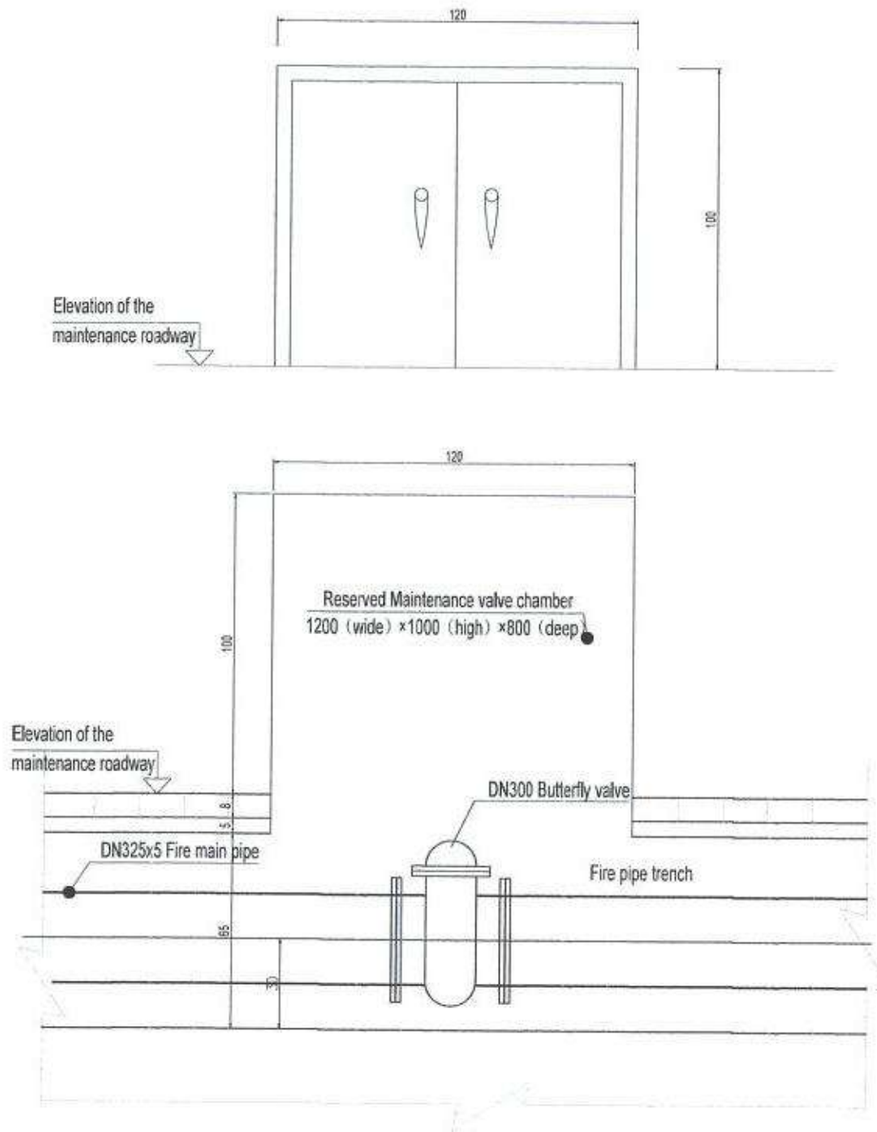


Hydrant chamber side elevation

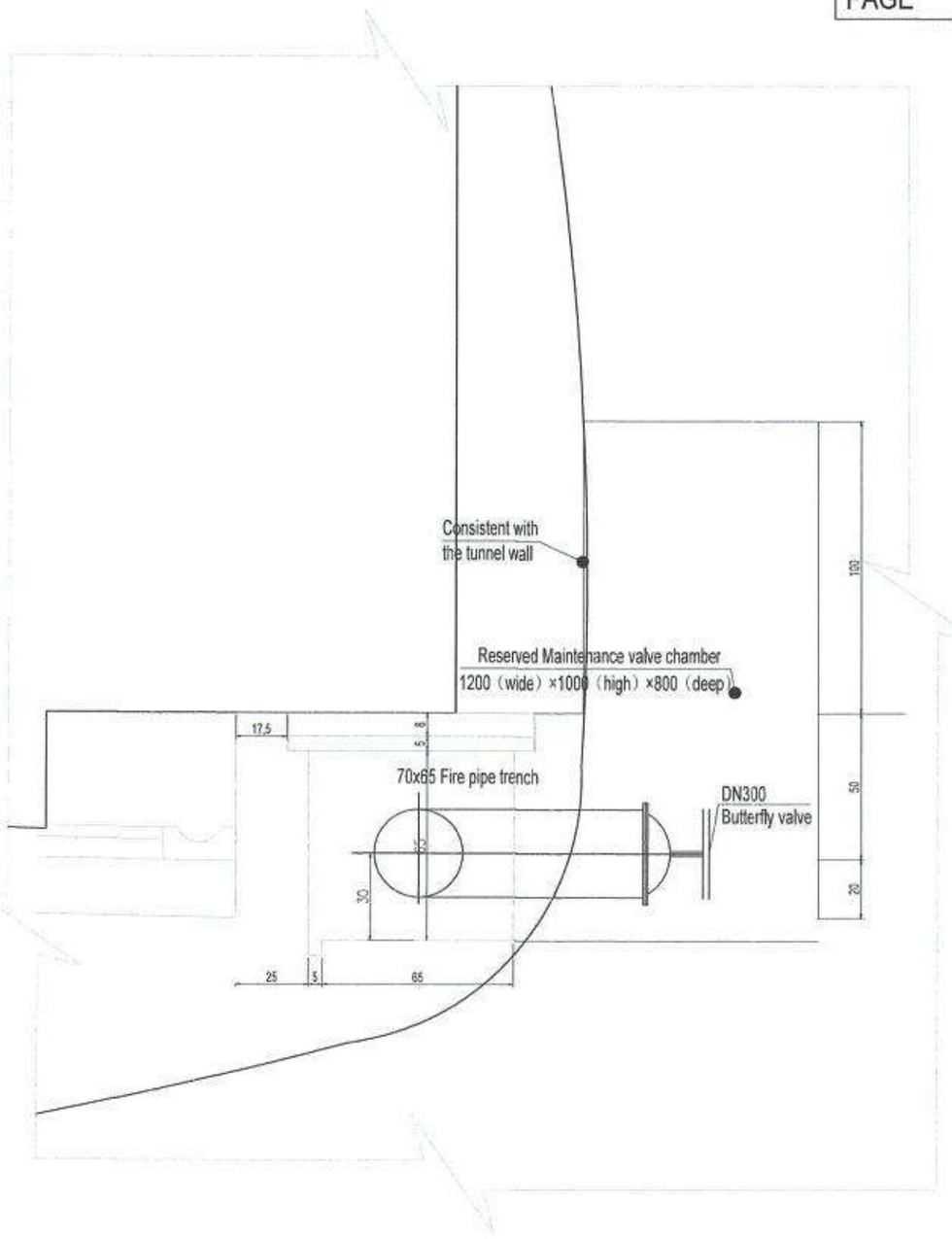
Explanation:

Except for special indication, sizes in the drawing are calculated by cm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	BAI TING ZHOU		SCALE	1:20
		Elevation and Side Elevation of Hydrant chamber				MASTER DES.	ZHO YONGXIANG		SPE. MANAGER	BAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-27
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI WEI			
						SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED			DATE	2025.07



Maintenance valve chamber elevation

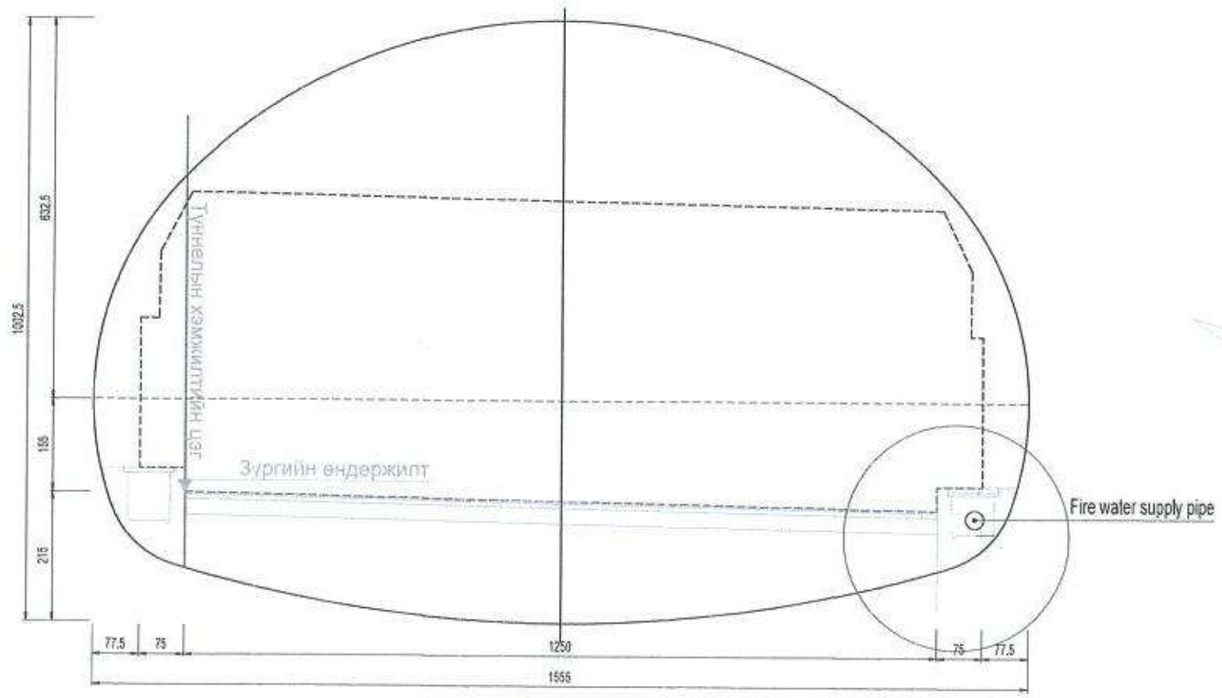


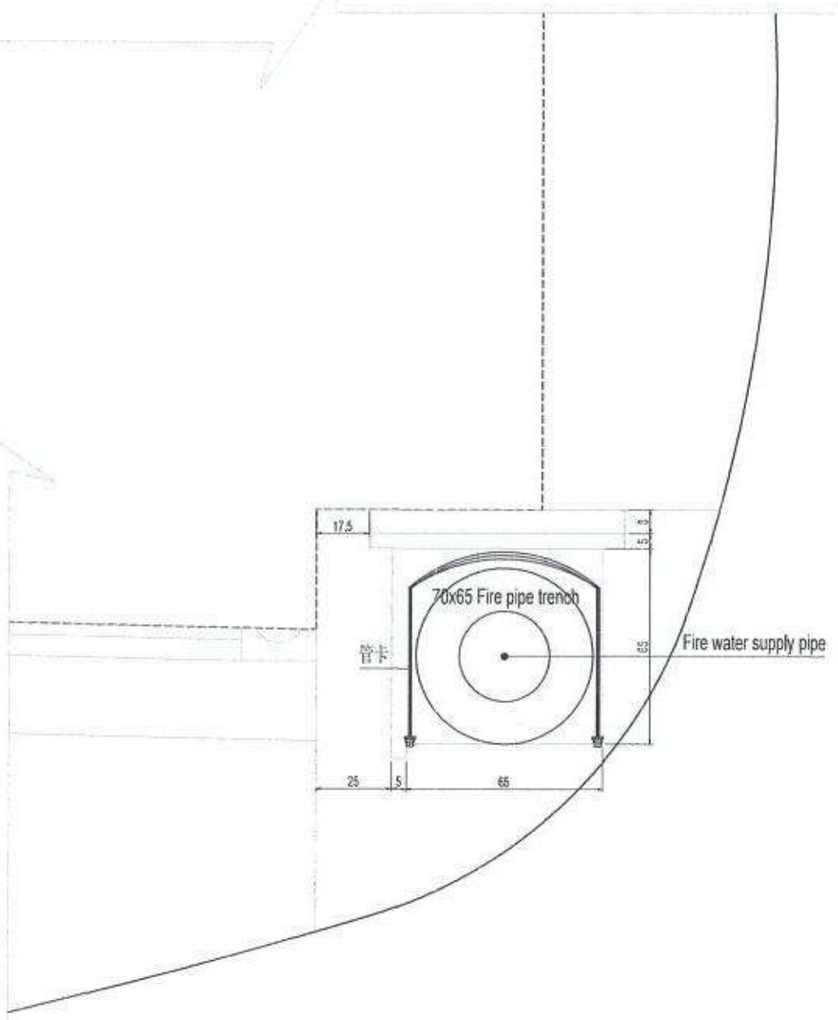
Maintenance valve chamber side elevation

Explanation:

Except for special indication, sizes in the drawing are calculated by cm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	BAI TING ZHOU		SCALE	1:20
		Elevation and Side Elevation of Maintenance valve chamber				MASTER DES.	CAO YONGXIANG		SPE. MANAGER	BAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-28
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI MEI			
						SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED			DATE	2025.07





Detailed Drawing of Fire hydrant trench

Explanation:

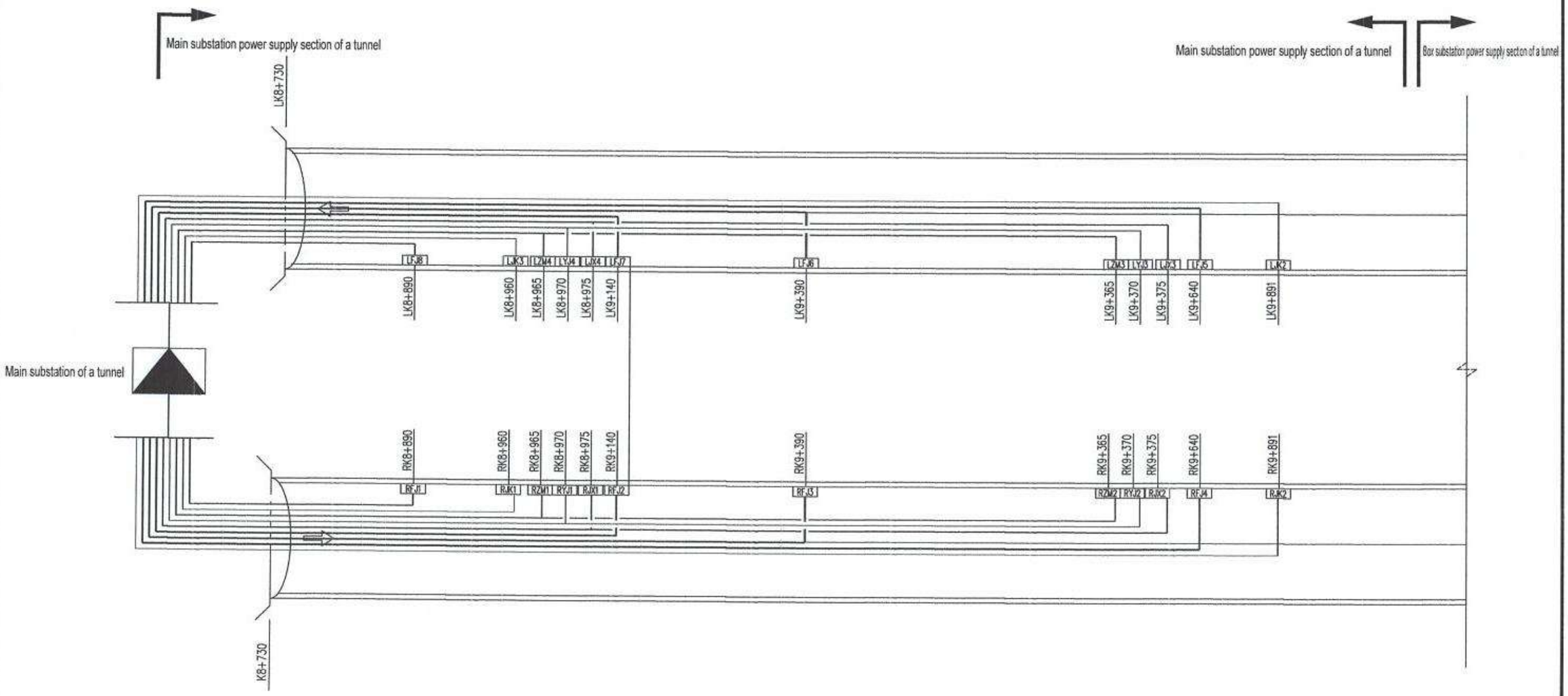
Except for special indication, sizes in the drawing are calculated by cm.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	BAI TING ZHOU		SCALE	
		Detailed Drawing of Fire hydrant trench				MASTER DES.	ZAO YONGLIANG		SPE. MANAGER	BAI TING ZHOU		EXAMINED	CUI YONG		DRAWING NO.	III-29
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG HAI MEI			
						SUB. MANAGER	MA XIAO HU		DESIGNED	JIANG FENG		APPROVED			DATE	2025.07

NO.	Bill of Quantities				
1	Inside the tunnel				
2	Name	Specification	Unit	Quantity	Remarks
3	Fire hydrant box	2400×1100×350（wide×high×deep）	set	84	Each location contains one SN65 single-head double-bolt pressure-reducing and pressure-stabilizing type fire hydrant, two 25-meter-long rubber hoses, two fire nozzles, aqueous film forming foam extinguishing installation, connecting accessories, box doors, etc., and is subject to annual maintenance.
4	Fire extinguisherbox	1000×800×350（wide×high×deep）	set	84	Annual maintenance
5	Foam extinguishing installation	PMZ30	set	84	Environmentally friendly water film forming type, up to DN80 branch pipe three-way, including complete set of accessories, working pressure no less than 0.4MPa, annual maintenance.
6	Hydrant box	1000×800×350（wide×high×deep）	set	4	Including hydrants and matching accessories.
7	Portable dry powder fire extinguisher	MF/ABC6,6kg	set	756	The validity period is 10 years.
8	Fire pump start button	Complete sets of products	set	84	Annual maintenance.
9	Maintenance valve box	1200×1000×800（wide×high×deep）	set	16	Annual maintenance.
10	Maintenance of butterfly valves	DN300	pcs	16	The validity period is 5 to 8 years.
11	Inner and outer hot-dip galvanized steel pipes	D325x5 PN=1.0MPa	meter	4200	It only includes the main fire pipes inside the cave, with one pipe support pier every 6 meters, and the validity period is 15 years.
12	Inner and outer hot-dip galvanized steel pipes	D76x4.5 PN=1.0MPa	meter	168	Fire branch pipe, which connects the main fire pipe to the fire hydrant, has a validity period of 15 years.
13	Steel three-way valve	DN300×65	pcs	84	Refer to 02S403-37. The weight is 13.7kg.
14	Steel three-way valve	DN300×50	pcs	4	Emergency parking belt water hydrant, refer to 02S403-37, weighs 13.7kg.
15	90° steel elbow	DN300	pcs	20	Refer to 02S403-7. The a weight of 15.2kg.
16	90° steel elbow	DN65	pcs	84	Refer to 02S403-7. The weight is 2.33kg.
17	90° steel elbow	DN50	pcs	4	Refer to 02S403-7. The weight is 0.99kg.
18	Grooved clamp	DN300	set	700	Annual maintenance.
19	Grooved clamp	DN65	set	84	Annual maintenance.
20	Grooved clamp	DN50	set	4	Annual maintenance is carried out for branch pipe gate valves, tees and elbows.
21	Pipe expansion joint	DN200JS-16P	set	16	Annual maintenance.
22	Steel flange plate	DN300	pcs	32	Refer to 02S403-77. The weight is 4.88kg.
23	Steel flange plate	DN65	pcs	168	Refer to 02S403-77. The weight is 1.43kg.
24	Steel flange plate	DN50	pcs	8	Refer to 02S403-77. The weight is 0.954kg.

NO.	Bill of Quantities				
1	Inside the tunnel				
2	Name	Specification	Unit	Quantity	Remarks
3	Fire-fighting equipment indication marking	wide×high=25×40cm	set	168	Fluorescent marker
4	Fire branch pipe support	L50 Angle steel support, dimensions determined based on actual conditions	set	84	
5	Rubber and plastic insulation materials	8cm thick	Square meters	4300	The length is 4,200 meters.
6	Polyurethane foam	5cm thick	Square meters	6300	The length is 4,200 meters.
7	Aluminum foil	0.5mm thick	Square meters	6300	The length is 4,200 meters.
8	Solenoid valve	DN65	set	84	The validity period is 5 to 8 years. It is applicable to fire protection branch pipes, including power distribution and monitoring cables, with a power consumption of 30w.
9	Gate valve	DN50	set	4	The validity period is 5 to 8 years and it is suitable for branch pipes of water supply hydrants.
10	Electric heating tape	10w/m	meter	12600	Each fire main pipe is equipped with three electric heating tapes and operates under constant pressure.
11	Outside the tunnel				
12	Exhaust valve	DN25 main pipe installation, including short pipes, stop valves, tees and other accessories.	set	2	Annual maintenance is carried out and it is set at the highest point of the pipeline network.
13	Drain valve	DN25 main pipe installation, including short pipes, stop valves, tees and other accessories.	set	2	Annual maintenance is carried out and it is set at the lowest point of the pipeline network.
14	Siamese connection		set	4	Annual maintenance is carried out. It is an underground type, arranged in a single group, with a reinforced concrete well chamber. The top surface can accommodate cars.
15	Underground fire hydrant		set	4	Annual maintenance.
16	Fire hydrant well	φ1500	set	4	Refer to 04S531-4-6.
17	Valve chamber	φ1500	set	4	Refer to 04S531-4-6.
18	Gate valve	DN300	pcs	8	Double-layer insulated manhole covers, including a complete set of ancillary facilities and insulation materials.
19	Welded steel tube	Φ450×6.0	meter	100	Fire protection crossing pipe sleeve, calculated based on actual quantity.
20	Inner and outer hot-dip galvanized steel pipes	D325x5 PN=1.0MPa	meter	300	Based on the actual quantity.
21	Fire pump house and fire water tank				
22	Rectangular reservoir	600m³	set	1	Refer to the national standard drawing set 05S804-109, including attachments.
23	Fire pump	Q=50L/s,H=58m,N=45kW	set	2	The validity period is 15 years, with one in use and one on standby.
24	Jockey pump	Q=1L/s,H=40m,N=3kW）	set	2	The service life is 15 years, with one in use and one on standby.
25	Air pressure tank	SQL800-1.0	set	1	The validity period is 15 years.
26	Submersible sewage pump	Q=25Lm³/h,H=10m,N=1.5kW	set	2	The validity period is is 15 years, with one in use and one on standby.

NO.	Bill of Quantities				
1	Fire pump house and fire water tank				
2	Name	Specification	Unit	Quantity	Remarks
3	Inner and outer hot-dip galvanized steel pipes	D273x5 PN=1.0MPa	meter	50	The validity period is 15 years.
4	Inner and outer hot-dip galvanized steel pipes	D108x5 PN=1.0MPa	meter	50	The validity period is 15 years.
5	Inner and outer hot-dip galvanized steel pipes	D76x4 PN=1.0MPa	meter	30	The validity period is 15 years.
6	Flexible waterproof casing	DN300	pcs	2	Refer to 02S404.
7	Flexible waterproof casing	DN250	pcs	5	Refer to 02S404.
8	Flexible waterproof casing	DN100	pcs	6	Refer to 02S404.
9	Flexible waterproof casing	DN65	pcs	1	Refer to 02S404.
10	Non-return valve	DN300	pcs	2	Annual maintenance.
11	Non-return valve	DN100	pcs	2	Annual maintenance.
12	Gate valve	DN300	pcs	2	Annual maintenance.
13	Gate valve	DN250	pcs	2	Annual maintenance.
14	Gate valve	DN100	pcs	4	Annual maintenance.
15	Flexible rubber joint	DN250	pcs	2	Annual maintenance.
16	Flexible rubber joint	DN100	pcs	2	Annual maintenance.
17	Y-type strainer	DN250	pcs	2	Annual maintenance.
18	Y-type strainer	DN100	pcs	2	Annual maintenance.
19	Steel grating cover plate	2100x1100	pcs	1	Annual maintenance.
20	Pressure gauge	DN250	pcs	2	
21	Pressure gauge	DN100	pcs	2	Annual maintenance.
22	Pressure testing device	Product	set	2	Annual maintenance.
23	Flow rate testing device	Product	set	2	Annual maintenance.
24	Test valve	DN65	pcs	4	Annual maintenance.
25	Portable dry powder fire extinguisher	MF/ABC5,5kg	pcs	2	In the pump house, the validity period is 10 years.
26	Transformer and distribution house and box transformer				
27	Portable dry powder fire extinguisher	MF/ABC3,3kg	pcs	14	The validity period is 10 years.

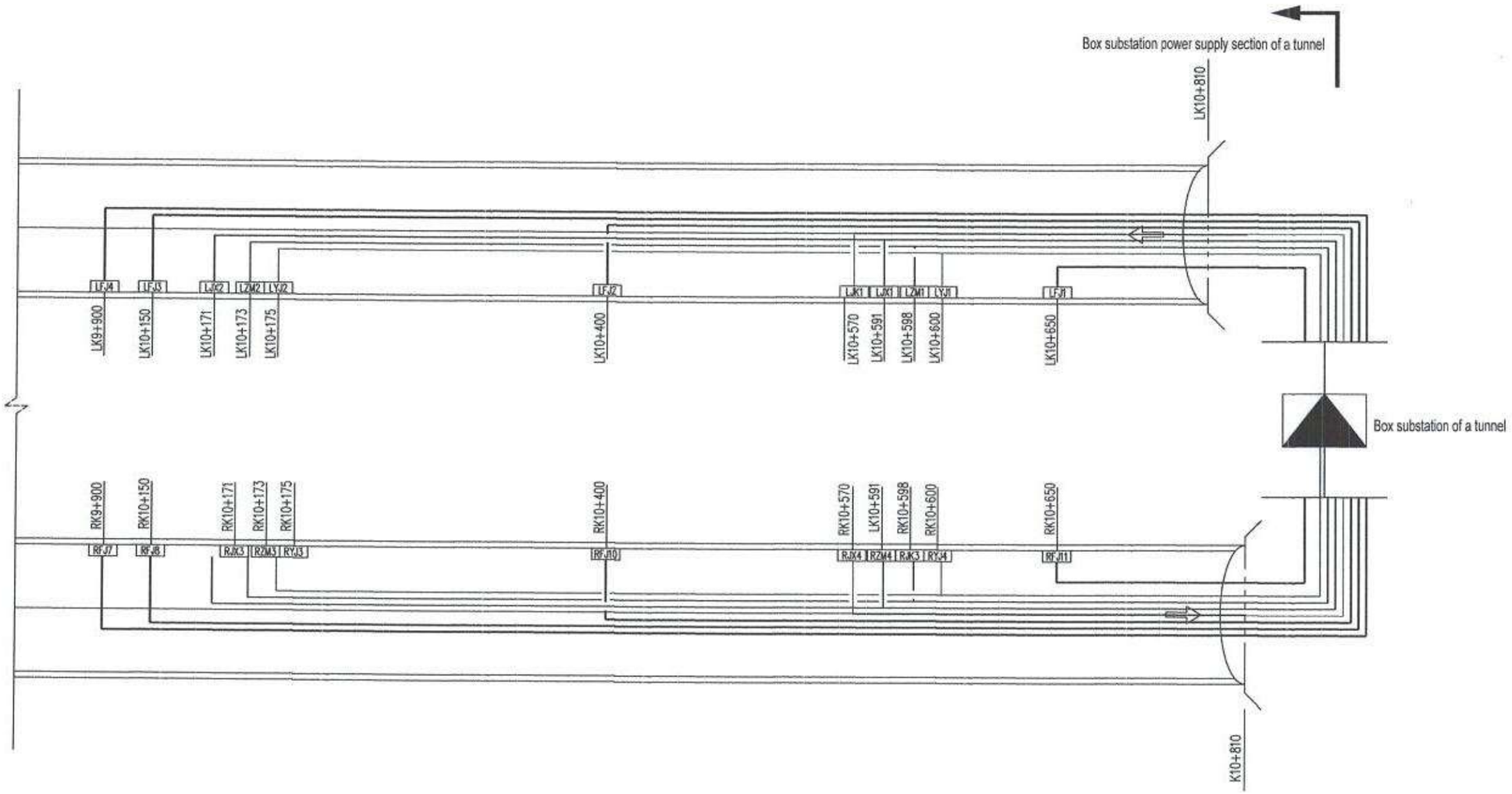


Legend:

- RF.Jx Fan control box at a right line of a tunnel
- LF.Jx Fan control box at a left line of a tunnel
- RJKx Maintenance socket box at a right line of a tunnel
- LJKx Maintenance socket box at a left line of a tunnel
- RJKx Monitoring distribution box at a right line of a tunnel
- RZMx Reinforced lighting distribution box at a right line of a tunnel
- LZMx Reinforced lighting distribution box at a left line of a tunnel
- RYJx Emergency lighting distribution box at a right line of a tunnel
- LYJx Emergency lighting distribution box at a left line of a tunnel
- LJKx Monitoring distribution box at a left line of a tunnel

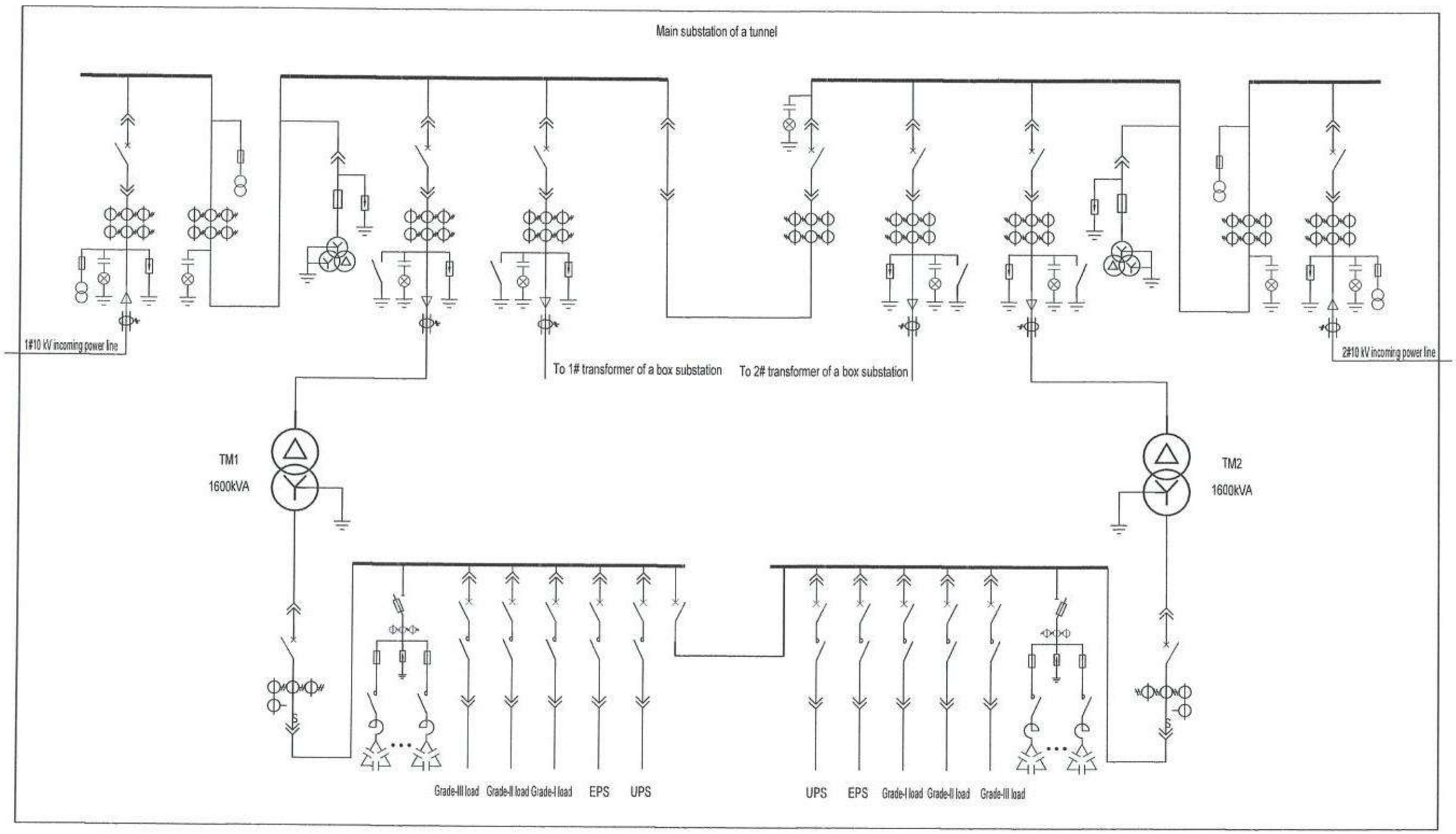
Schematic Diagram of a Tunnel Main Power Supply Line (I)

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER: PANG WEI	SUB. MANAGER:		CHECKED: YIN XUPING	SCALE:	
		Schematic Diagram of a Tunnel Main Power Supply Line		MASTER DES.: CAO YONGXIANG	SPE. MANAGER: KANG QIAN		EXAMINED: KANG QIAN	DRAWING NO.:	III-31
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: WANG AN MIN		
				SUB. MANAGER: BA XIAOHU	DESIGNED: ZHANG WEIWEI		APPROVED: ZHANG JIHUI	DATE:	2025.07



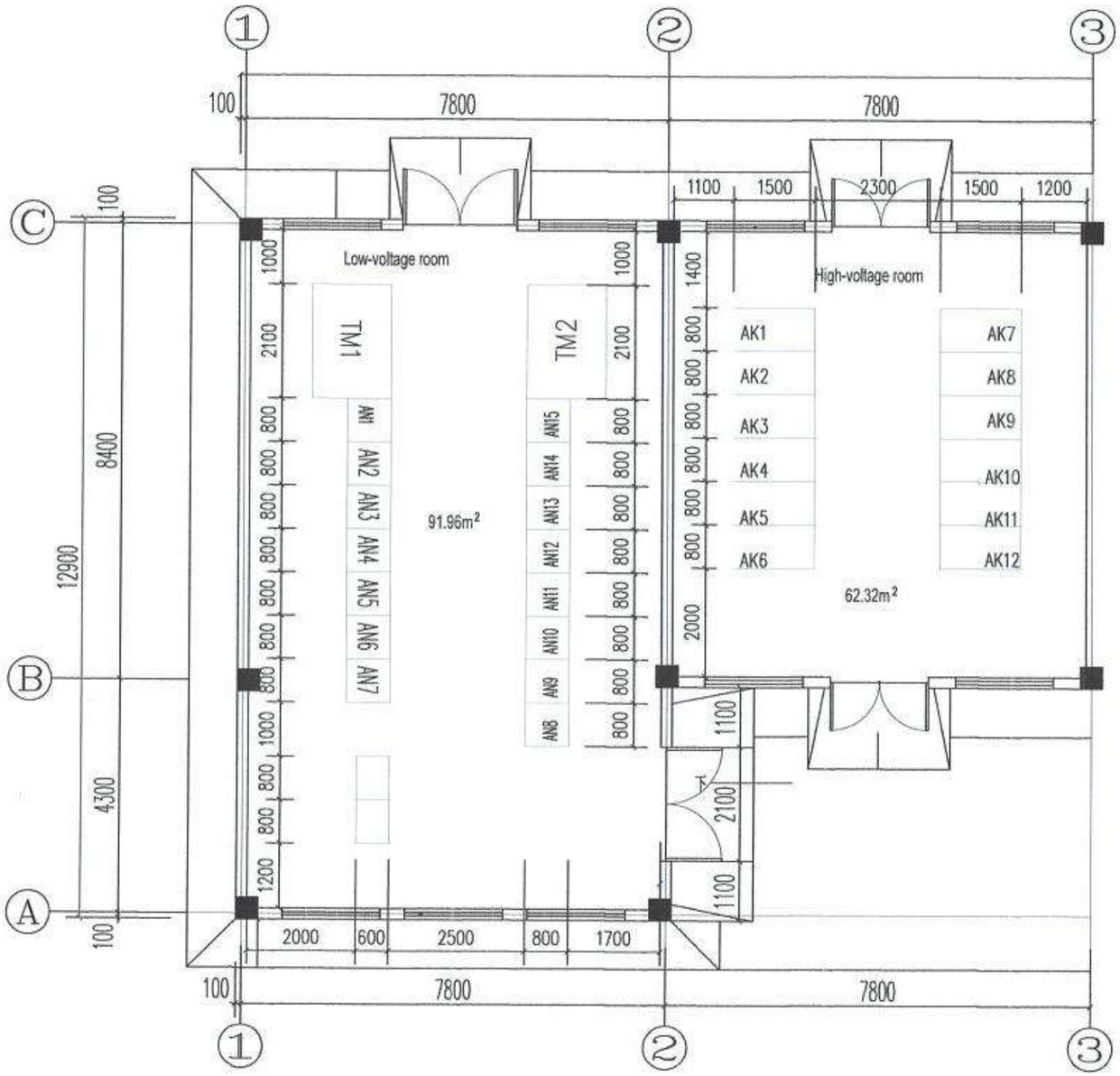
Schematic Diagram of a Tunnel Main Power Supply Line (II)

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	YIN XUPING		SCALE	
		Schematic Diagram of a Tunnel Main Power Supply Line				MASTER DES.	CAO YONGLIANG		SPE. MANAGER	KANG QIAN		EXAMINED	KANG QIAN		DRAWING NO.	III-31
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG AN MIN			
						SUB. MANAGER	MA XIAOHU		DESIGNED	ZHANG WEIWEI		APPROVED	ZHAO JIHUI		DATE	2025.07



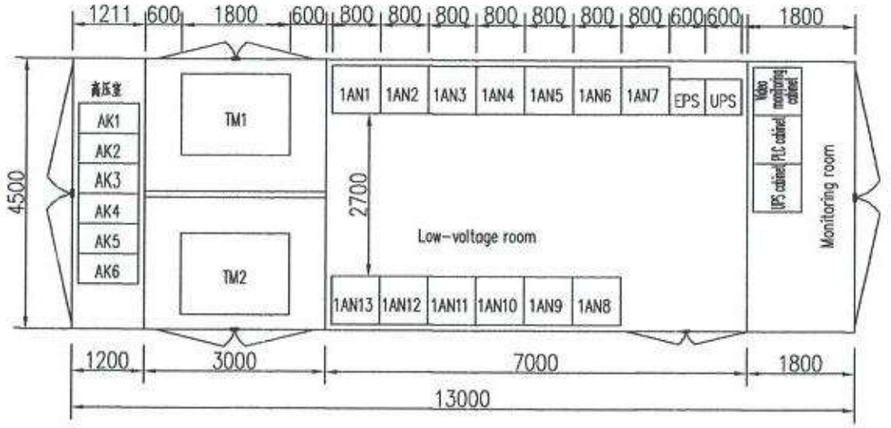
Schematic Diagram of a Tunnel Power Supply System

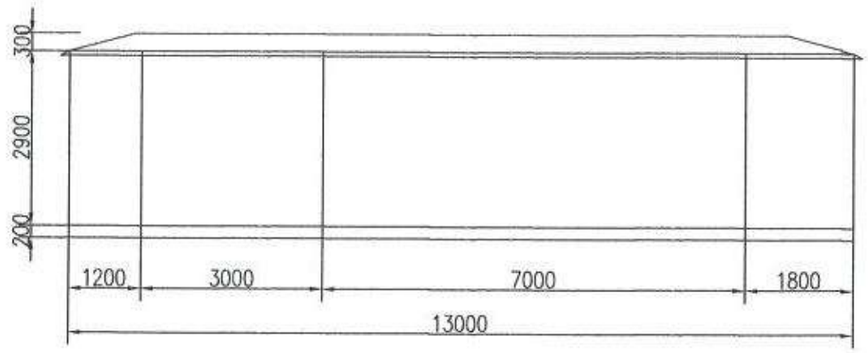
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	YIN XUPING		SCALE	
		Schematic Diagram of a Tunnel Power Supply System		MASTER DES.	CAO YONGLIANG		SPE. MANAGER	KANG QIAN		EXAMINED	KANG QIAN		DRAWING NO.	III-32
				MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG AN MIN			
				SUB. MANAGER	MA XIAOBU		DESIGNED	ZHANG WEIWEI		APPROVED	ZHANG JIHUI		DATE	2025.07



Electrical Layout Plan for a Main Substation of a Tunnel

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER: PANG WEI	SUB. MANAGER:		CHECKED: YIN XUPING	SCALE:	
		Electrical Layout Plan for a Main Substation of a Tunnel		MASTER DES.: CAO YONGXIANG	SPE. MANAGER: KANG QIAN		EXAMINED: KANG QIAN	DRAWING NO.:	III-33
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: WANG AN MIN		
				SUB. MANAGER: MA XIAOHU	DESIGNED: ZHANG WEIWEI		APPROVED: ZHANG JIHUI	DATE:	2025.07

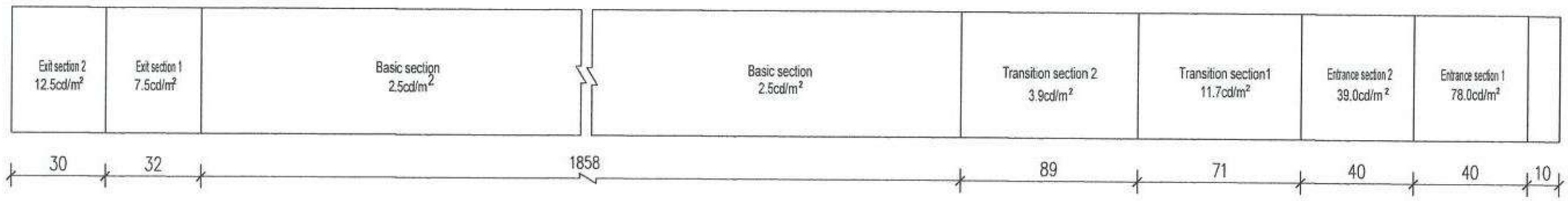




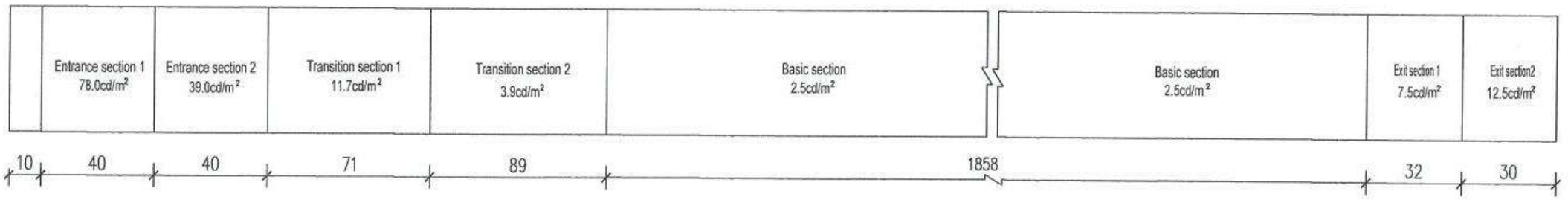
Layout Plan for a Box Substation of a Tunnel

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER: PANG WEI	SUB. MANAGER:		CHECKED: YIN XUPING	SCALE:	
		Layout Plan for a Box Substation of a Tunnel		MASTER DES.: CAO YONGLIANG	SPE. MANAGER: KANG QIAN		EXAMINED: KANG QIAN	DRAWING NO.:	III-34
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: WANG AN MIN		
				SUB. MANAGER: MA XIAOBU	DESIGNED: ZHANG WEIWEI		APPROVED: ZHAO JIHUI	DATE:	2025.07

No.	Description	Specification / Model	Unit	Quantity	Note(s)
I. Power supply and distribution of a main substation					
1	Tunnel 10 kV overhead external line	10 kV steel cored aluminum stranded wire	km	5	Service life 20 years
2	High-voltage system				
2.1	High-voltage incoming cabinet	KYN28A-12 800×1500×2300	Set	2	Service life 20 years
2.2	High-voltage metering cabinet	KYN28A-12 800×1500×2300	Set	2	Service life 20 years
2.3	High-voltage PT cabinet	KYN28A-12 800×1500×2300	Set	2	Service life 20 years
2.4	Bus coupler cabinet	KYN28A-12 800×1500×2300	Set	1	Service life 20 years
2.5	Bus section cabinet	KYN28A-12 800×1500×2300	Set	1	Service life 20 years
2.6	High-voltage outgoing cabinet	KYN28A-12 800×1500×2300	Set	4	Service life 20 years
3	Dry-type transformer	SCB13-1600 kVA 10±2x2.5/0.4 kV D,yn11	Unit	2	Service life 20 years
4	Low-voltage system				
4.1	Low-voltage incoming cabinet	MNS 800×800×2200	Set	2	Service life 20 years
4.2	Low-voltage compensation cabinet	MNS 800×800×2200	Set	2	Service life 20 years
4.3	Low-voltage outgoing cabinet	MNS 800×800×2200	Set	11	Service life 20 years
II. Power supply and distribution of box substation					
1	High-voltage system				
1.1	High-voltage incoming cabinet	SF6 fully insulated ring main unit 800×1500×2300	Set	2	Service life 20 years
1.2	High-voltage PT cabinet	SF6 fully insulated ring main unit 800×1500×2300	Set	2	Service life 20 years
1.3	High-voltage outgoing cabinet	SF6 fully insulated ring main unit 800×1500×2300	Set	2	Service life 20 years
2	Dry-type transformer	SCB13-1600 kVA 10±2x2.5/0.4 kV D,yn11	Unit	2	Service life 20 years
3	Low-voltage system				
3.1	Low-voltage incoming cabinet	GGD 800×800×2200	Set	2	Service life 20 years
3.2	Low-voltage compensation cabinet	GGD 800×800×2200	Set	2	Service life 20 years
3.3	Low-voltage outgoing cabinet	GGD 800×800×2200	Set	11	Service life 20 years
III. Low-voltage distribution system					
1	On-site start-up control box of a fan	IP65 LFJ1-LFJ7 RFJ1-RFJ7 80*95*40 cm	Unit	16	Service life 10 years
2	Lighting distribution box of a tunnel	IP65 LZM1-LZM4 RZM1-RZM4 80*95*40 cm	Unit	8	Service life 10 years
3	Emergency lighting distribution box	IP65 LYJ1-LYJ4 RYJ1-RYJ4 80*95*40 cm	Unit	8	Service life 10 years
4	Maintenance power box	IP65 LJX1-LFJ6 RJX1-RFJ6 80*95*40 cm	Unit	12	Service life 10 years
5	Monitoring distribution box	IP65 LJK1-LJK3 RJK1-RJK3 80*95*40 cm	Unit	6	Service life 10 years
6	EPS main power control cabinet	10kW three-phase lighting type	Set	2	Service life 10 years
7	EPS power battery cabinet	Continuous power supply time 180 min	Set	2	Service life 10 years
8	UPS main power control cabinet	40 kVA Online three-in three-out UPS	Set	2	Service life 10 years
9	UPSpower battery cabinet	Tfd=180 min	Set	2	Service life 10 years
10	SCADA control cabinet	19-inch standard cabinet	Set	2	Service life 10 years
11	Surge protection module	19-inch standard cabinet	Set	2	Service life 10 years
12	DC screen	800×600×2200	Set	2	Service life 8 years



Schematic Layout Diagram for Each Lighting Section at a Left Line of a Tunnel



Schematic Layout Diagram for Each Lighting Section at a Right Line of a Tunnel

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		Schematic Layout Diagram for a Lighting Section of a Tunnel				MASTER DES.	ZAO YONGXIANG		SPE. MANAGER	KANG QIAN		EXAMINED	KANG QIAN		DRAWING NO.	III-36
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG AN MIN			
						SUB. MANAGER	MA XIAOHU		DESIGNED	ZHANG WEIWEI		APPROVED	ZHANG JIHUI		DATE	2025.07

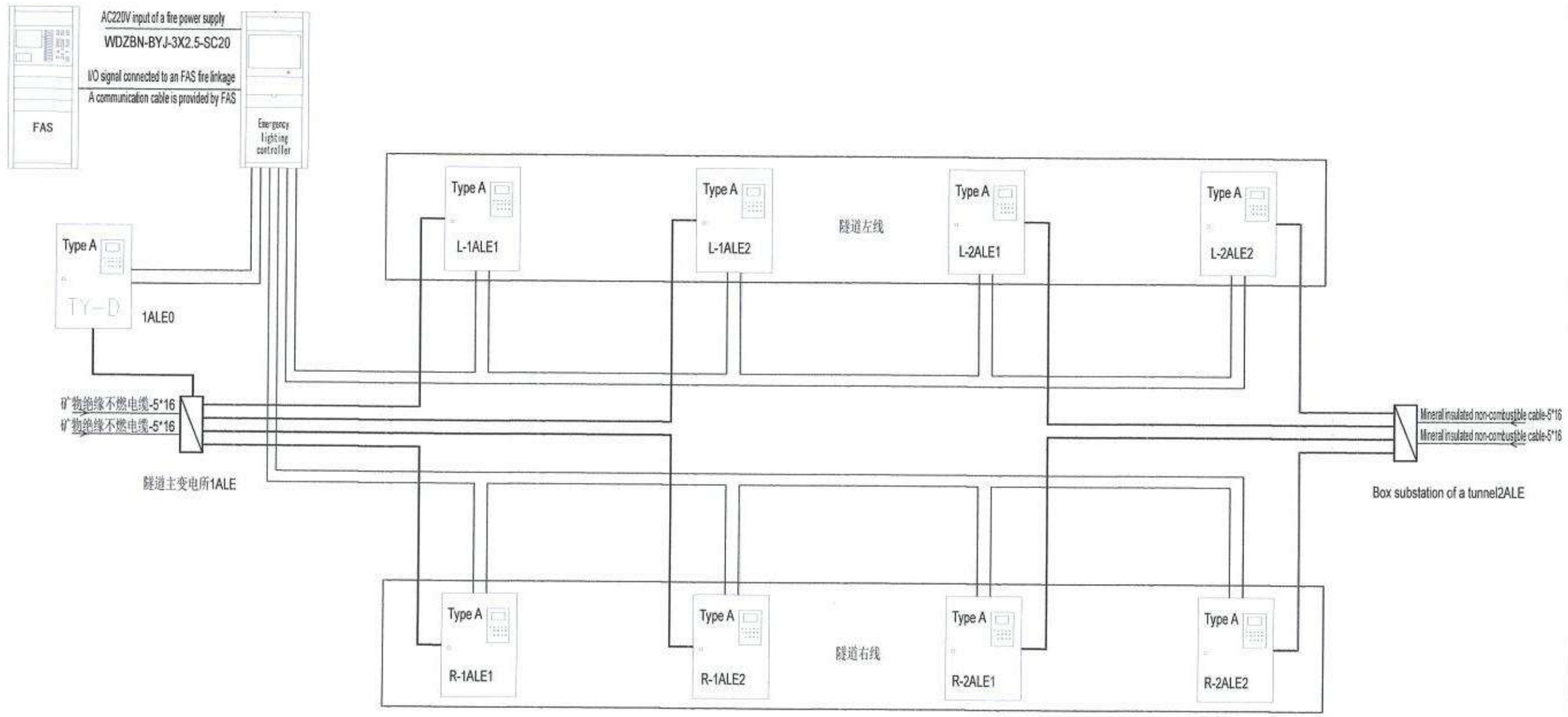

Diagram for a Fire Emergency Lighting and Evacuation Indication System of a Tunnel

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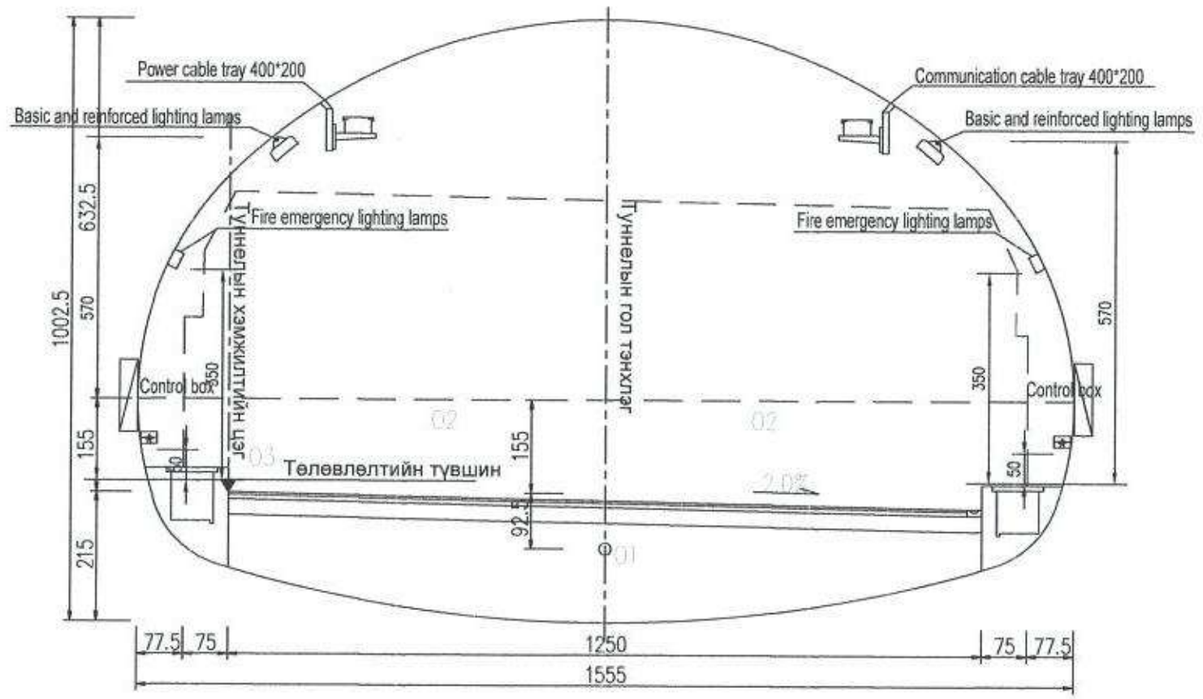
		Diagram for a Fire Emergency Lighting and Evacuation Indication System of a Tunnel				MASTER DES.	ZAO YONGXIANG		SPE. MANAGER	KANG QIAN		EXAMINED	KANG QIAN		DRAWING NO.	III-37
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG AN MIN			
						SUB. MANAGER	MA XIAOHU		DESIGNED	ZHANG WEIWEI		APPROVED	ZHANG JIHUI		DATE	2025.07



Schematic Cross Section Diagram for Installation of Tunnel Electrical Equipment

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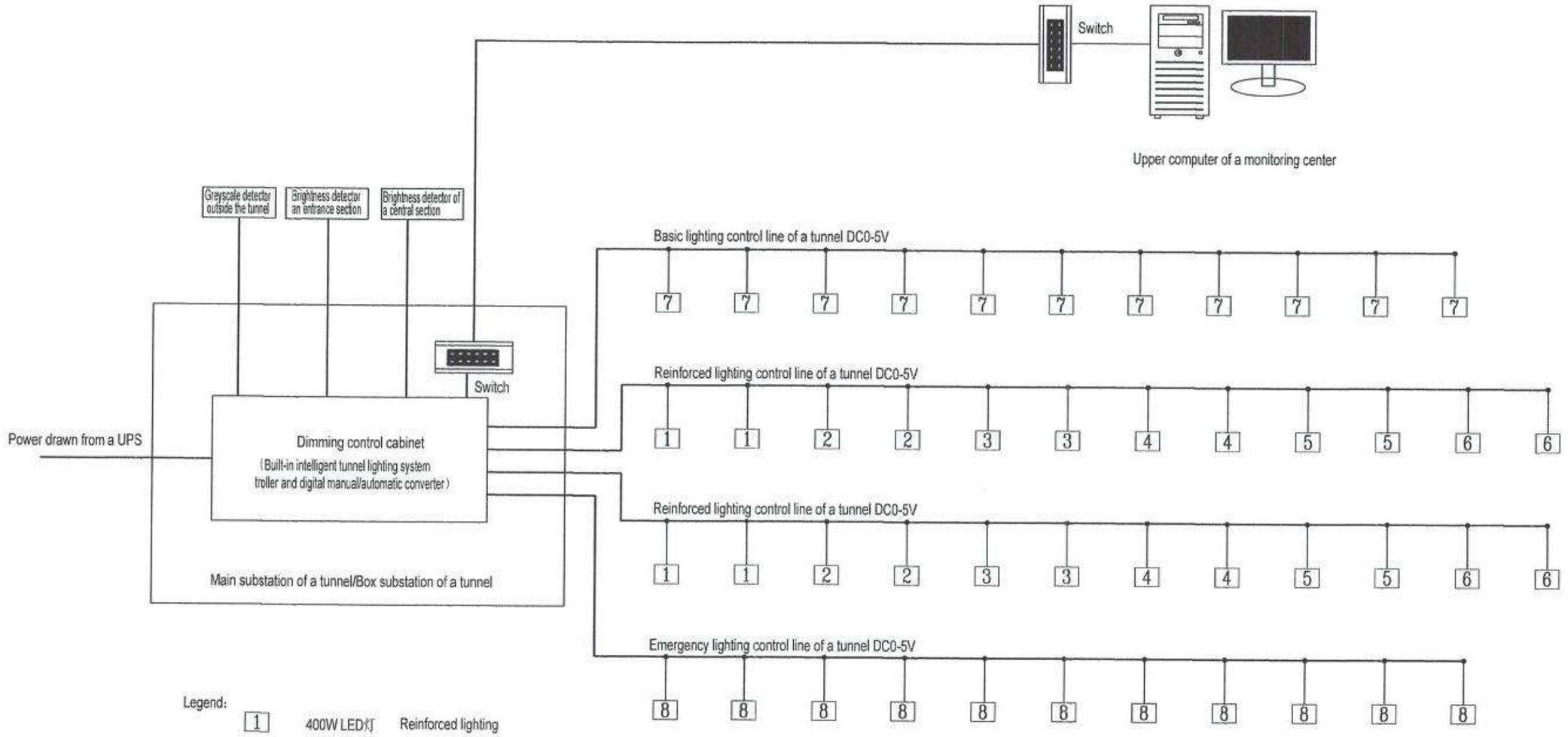
		Schematic Cross Section Diagram for Installation of Tunnel Electrical Equipment		MASTER DES.: CAO TONGXIANG	SPE. MANAGER: KANG QIAN		EXAMINED: KANG QIAN	DRAWING NO.:	III-38
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: WANG AN MIN		
				SUB. MANAGER: MA XIAOHU	DESIGNED: ZHANG WEIWEI		APPROVED: ZHANG JUNLI	DATE:	2025.07



Legend:

1	400W LED灯	Reinforced lighting
2	250W LED灯	Reinforced lighting
3	100W LED灯	Reinforced lighting
4	100W LED灯	Reinforced lighting
5	100W LED灯	Reinforced lighting
6	100W LED灯	Reinforced lighting
7	100W LED灯	Basic lighting
8	27W LED灯	Emergency lighting

Architecture Diagram of a Tunnel Lighting and Dimming Control System

(Stepless dimming and lighting method that adjusts the brightness outside and inside the tunnel is used)

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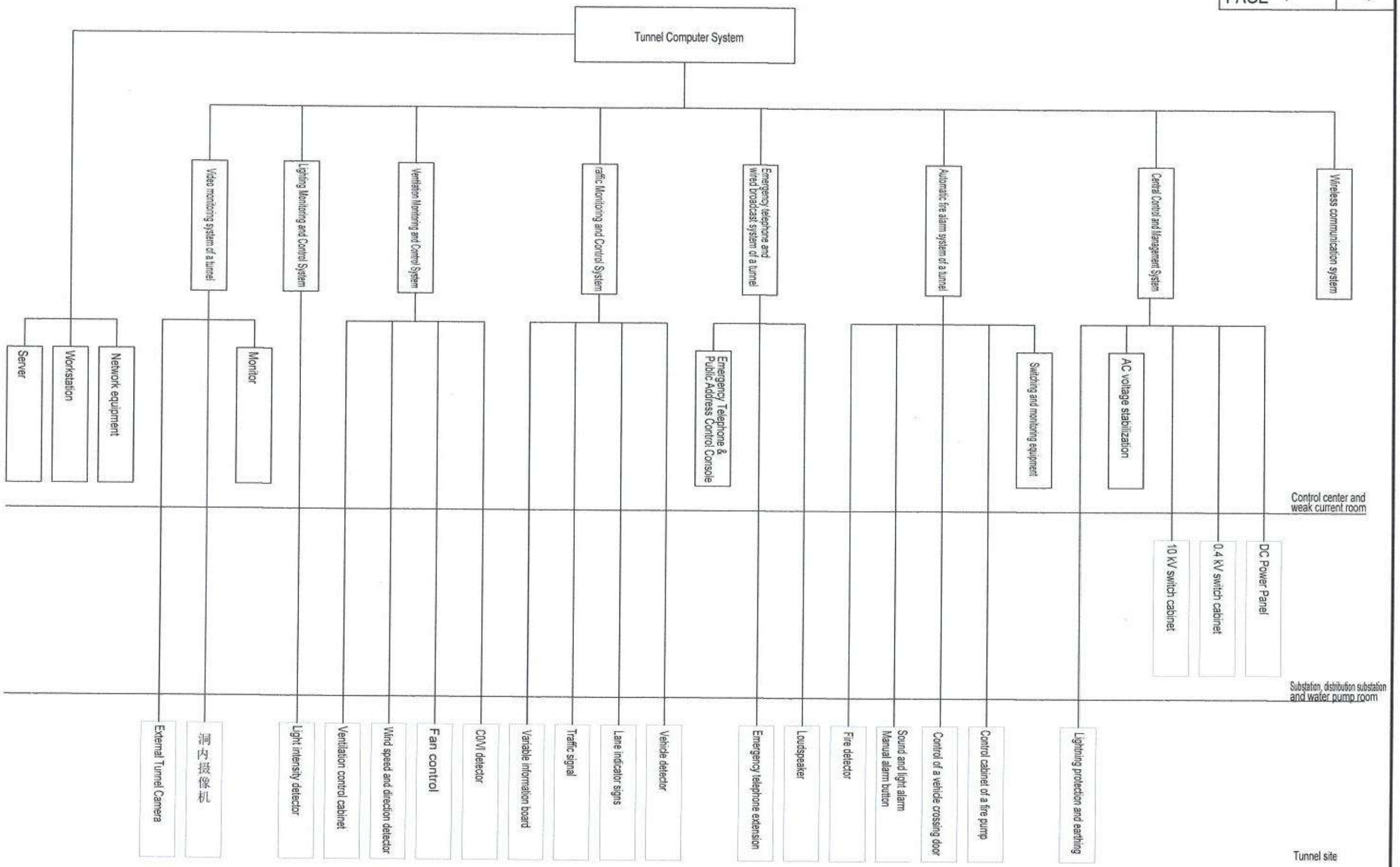
		Architecture Diagram of a Tunnel Lighting and Dimming Control System		MASTER DES.: CAO YONGXIANG	SPE. MANAGER: KANG QIAN		EXAMINED: KANG QIAN	DRAWING NO.:	III-39
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: KANG AN MIN		
				SUB. MANAGER: MA XIAOHU	DESIGNED: ZHANG WEIWEI		APPROVED: ZHANG JIHUI	DATE:	2025.07

No.	Description	Specification / Model	Unit	Quantity	Note(s)
I. Tunnel lighting					
1	Reinforced lighting at the entrance section TH1 of the tunnel	Linear LED tunnel lamp 400 W IP65 wide band symmetrical illumination	Set	54	Service life 5 years
2	Reinforced lighting at the entrance section TH2 of the tunnel	Linear LED tunnel lamp 250 W IP65 wide band symmetrical illumination	Set	40	Service life 5 years
3	Reinforced lighting at the tunnel transition section TR1	Linear LED tunnel lamp 100 W IP65 wide band symmetrical illumination	Set	52	Service life 5 years
4	Reinforced lighting at the tunnel transition section TR2	Linear LED tunnel lamp 100 W IP65 wide band symmetrical illumination	Set	24	Service life 5 years
5	Basic lighting of a tunnel	Linear LED tunnel lamp 100 W IP65 wide band symmetrical illumination	Set	464	Service life 5 years
6	Reinforced lighting at the tunnel exit section EX1	Linear LED tunnel lamp 100 W IP65 wide band symmetrical illumination	Set	16	Service life 5 years
7	Reinforced lighting at tunnel exit section EX2	Linear LED tunnel lamp 100 W IP65 wide band symmetrical illumination	Set	28	Service life 5 years
8	Emergency lighting of a tunnel	Linear LED tunnel lamp 27 W IP65 wide band symmetrical illumination	Set	693	Service life 5 years
9	A-type centralized power control box for emergency lighting	5 kVA IP65	Set	8	Service life 10 years
10	Evacuation instruction	1 W A-type lamp DC24V IP65	Set	818	Service life 3 years
11	Fire emergency lighting	10 W A-type lamp DC24V IP65	Set	842	Service life 3 years
12	Cross linked polyethylene polyolefin casing Halogen-free low smoke flame-retardant cable	WDZB-YJY-0.6/1 kV-5×10	m	12355	Service life 20 years
13	Cross linked polyethylene polyolefin casing Halogen-free low smoke flame-retardant and fire-resistant cable	WDZBN-YJY-0.6/1 kV-5×4	m	8195	Service life 20 years
14	Basic lighting for a crossing	LEDtunnel lamp 30 W IP65	Set	70	Service life 5 years
15	Emergency lighting for a crossing	30 W IP65	Set	70	Service life 5 years
16	Copper cored cross-linked polyethylene insulation Halogen-free low smoke flame-retardant and fire-resistant wire	WDZBN-BYJ-3×2.5	m	594	Service life 20 years
17	Copper cored cross-linked polyethylene insulation Halogen-free low smoke flame-retardant wire	WDZB-BYJ-3×2.5	m	2442	Service life 20 years
18	Intelligent dimming control signal line of tunnel Lighting	WDZB-RYJSP-2×2.5	m	34980	Service life 10 years
19	Fire emergency lighting of a tunnel and Communication line for an evacuation instruction system	WDZBN-RYJSP-2×2.5	m	17600	Service life 10 years



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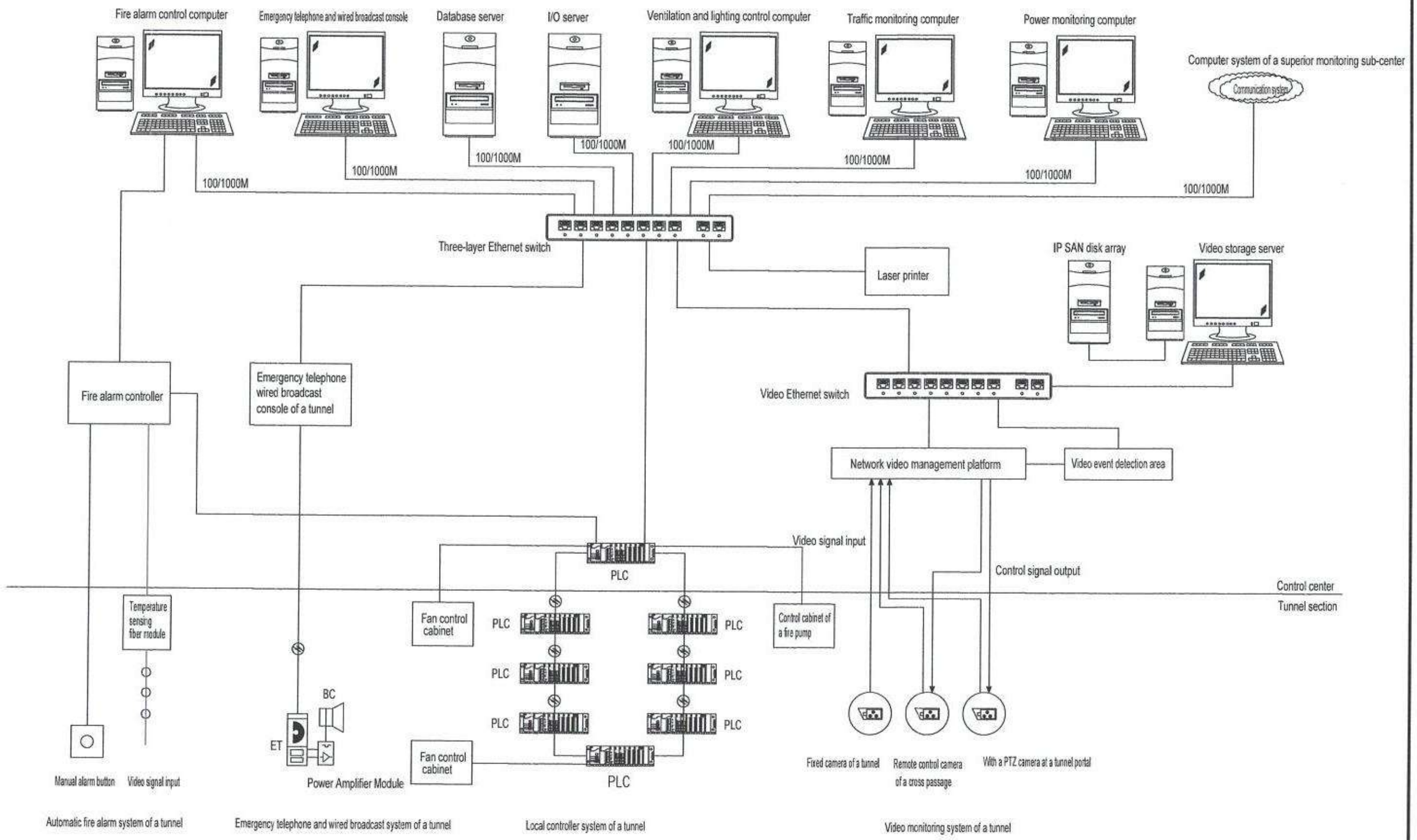
		Scheme Plan for a Tunnel Monitoring System				MASTER DES.	CAO YONGJIANG		SPE. MANAGER	KANG QIAN		EXAMINED	KANG QIAN		DRAWING NO.	III-41
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG AN MIN			
						SUB. MANAGER	MA XIAOHU		DESIGNED	ZHANG WEIWEI		APPROVED	ZHAO JIHUI		DATE	2025.07



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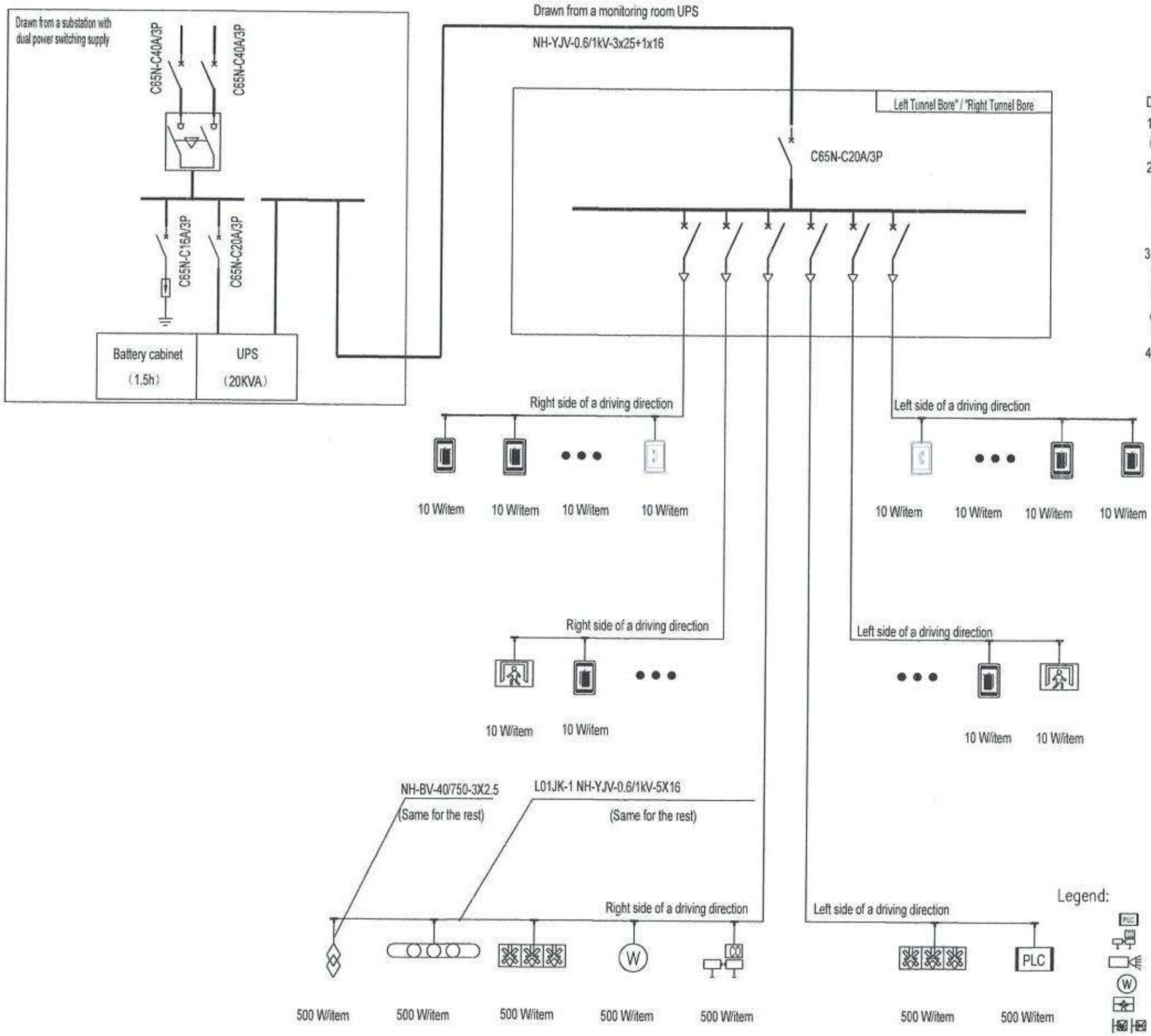
		Computer System Diagram of a Tunnel Management Office		MASTER DES.: CAO YONGXIANG	SPE. MANAGER: KANG QIAN		EXAMINED: KANG QIAN	DRAWING NO.:	III-42
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: WANG AN MIN		
				SUB. MANAGER: MA XIAOHU	DESIGNED: ZHANG WEIWEI		APPROVED: ZHANG JIHUA	DATE:	2025.07



Definition:

1. All monitoring equipment in this project is powered by a UPS, which is located in the tunnel monitoring room and the main substation with a protection level of IP65.
2. The main power supply cable for the monitoring equipment on the right side of the tunnel driving direction is led out from the monitoring distribution box and laid along the buried pipe to the cable tray. The cable is then laid along the cable tray and is in T-connection at the monitoring equipment with insulation puncture clamps.
3. The main power supply cable for the monitoring equipment on the left side of the tunnel driving direction is led out from the monitoring distribution box and laid along the buried pipe to the cable trench on the left side of the driving direction. The cable is then laid along a cable and is in T-connection at the monitoring equipment with insulation puncture clamps. Three-phase balance shall be kept as much as possible for the power supply of the equipment.
4. The casing of the monitoring distribution box is reliably grounded.

Legend:

- Local controller (PLC)
- Carbon monoxide/visibility indicator (CO/VI)
- Brightness detector
- Wind speed and direction detector (WS)
- Evacuation indicator mark (EX)
- Lane indicator (LI)
- Indicator mark of a driving cross tunnel
- Emergency telephone inside the tunnel (ET)
- Variable message sign (CMS)
- Fire signs
- Traffic signal (TS)（TS）
- Vehicle detector (VD)
- Indicator mark of a pedestrian cross tunnel

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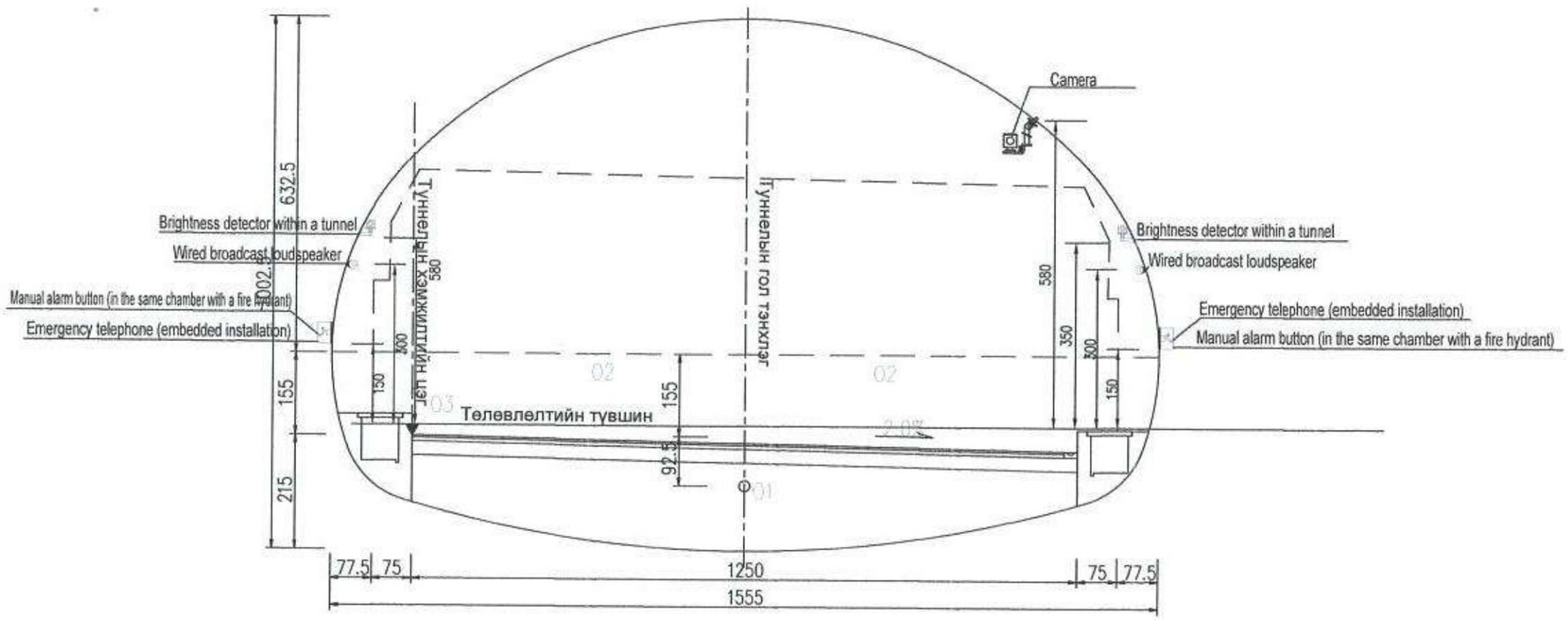
		Distribution System Diagram of Tunnel Monitoring Equipment		MASTER DES.: CAO YONGXIANG	SPE. MANAGER: KANG QIAN		EXAMINED: KANG QIAN	DRAWING NO.:	III-43
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: WANG AN MIN		
				SUB. MANAGER: MA XIAOHU	DESIGNED: ZHANG WEIWEI		APPROVED: ZHAO JIHUI	DATE:	2025.07



Cross-section Layout of Tunnel Monitoring Facilities

Definition:
The unit for dimensions in this drawing is in

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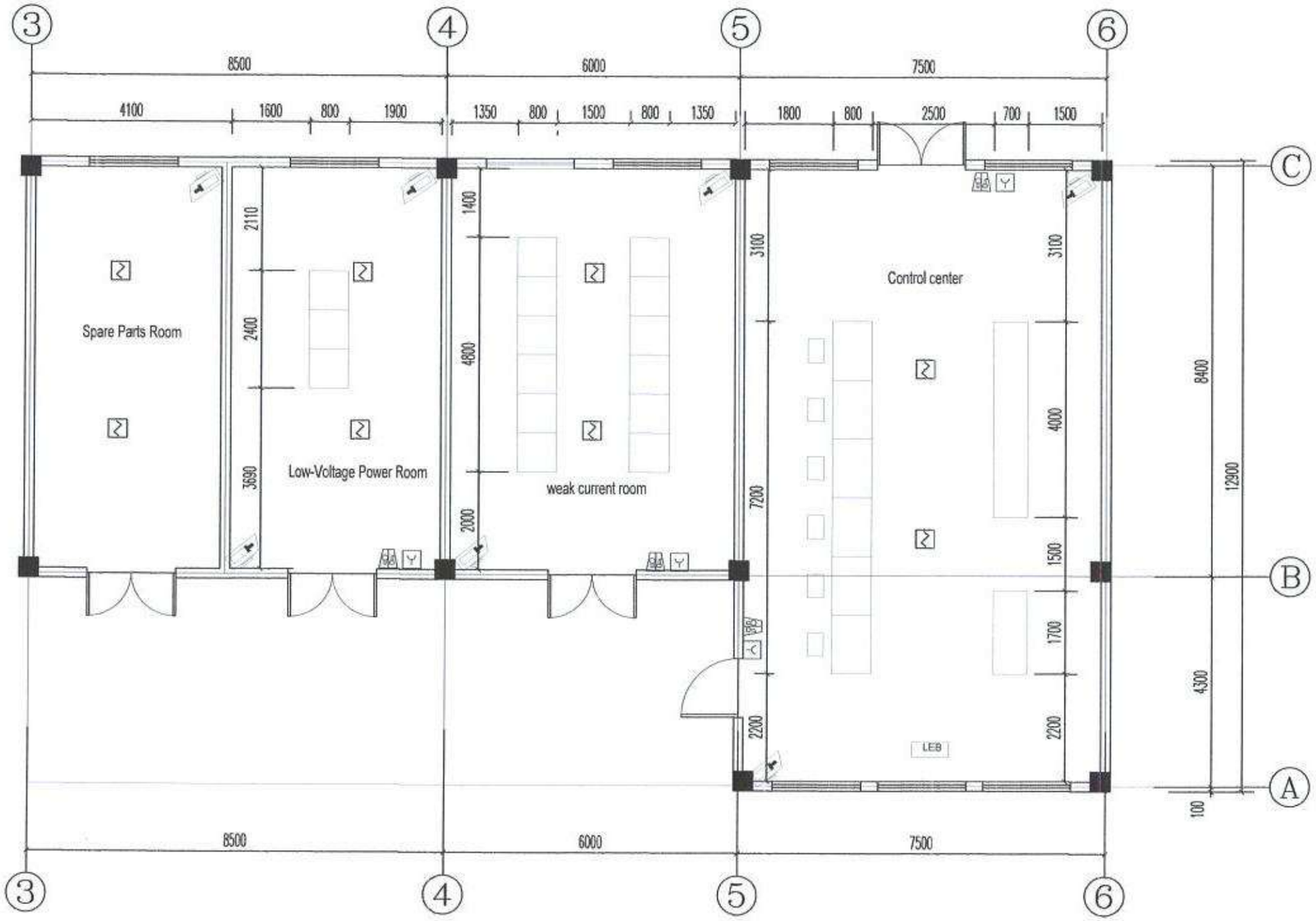
		Cross-section Layout of Tunnel Monitoring Facilities				MASTER DES.	CAO YONGXIANG		SPE. MANAGER	KANG QIAN		EXAMINED	KANG QIAN		DRAWING NO.	III-44
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	WANG AN MIN			
						SUB. MANAGER	MA XIAOHU		DESIGNED	ZHANG WEIWEI		APPROVED	ZHANG JIHUI		DATE	2025.07



Control Room Layout Plan

Legend

4		Camera
3		Smoke detector
2		Sound and light alarm
1		Manual alarm butto

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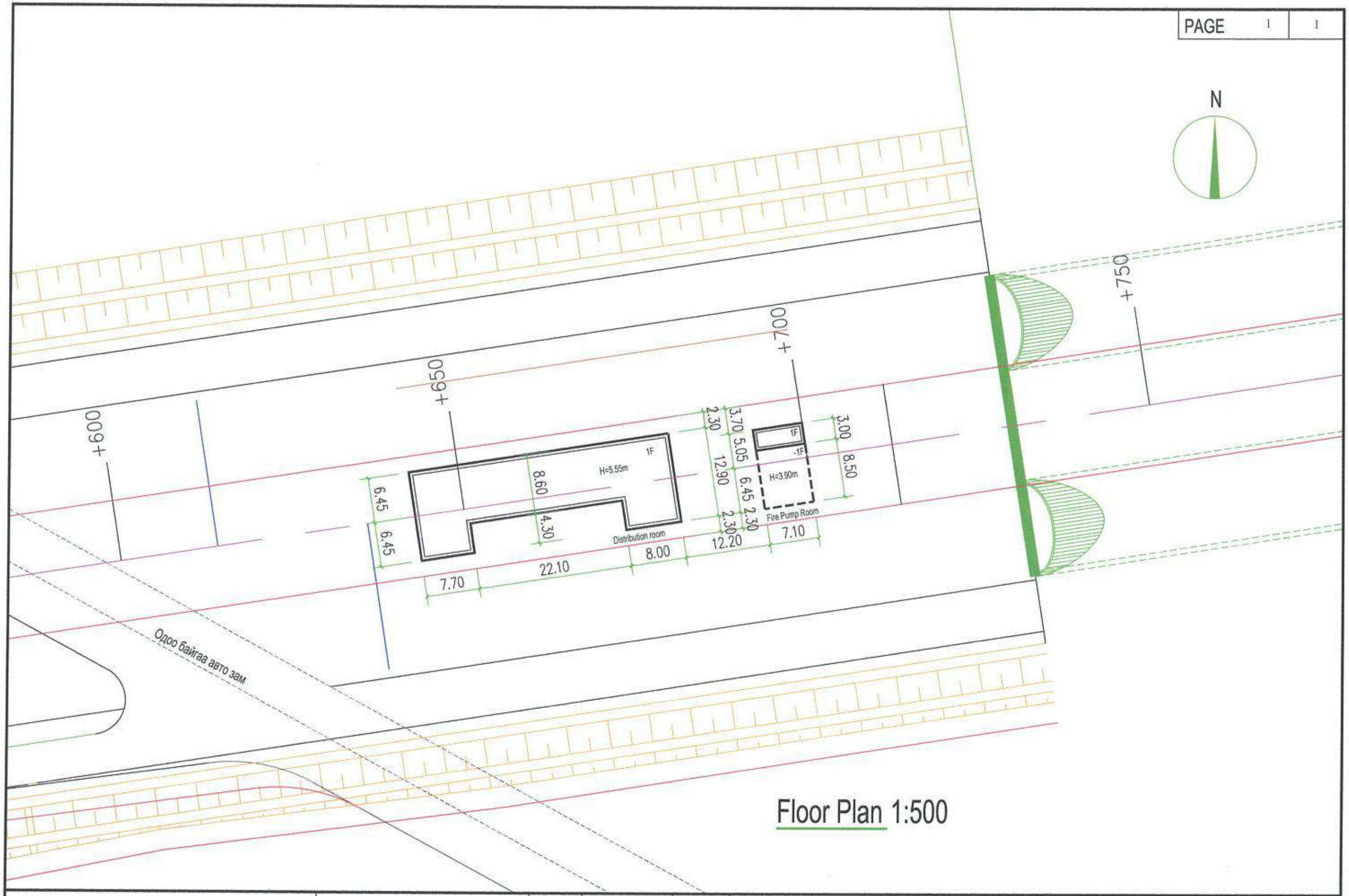
		Control Room Layout Plan		MASTER DES.: CAO YONGXIANG	SPE. MANAGER: KANG QIAN		EXAMINED: KANG QIAN	DRAWING NO.:	III-45
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: WANG AN MIN		
				SUB. MANAGER: MA XIAOHU	DESIGNED: ZHANG WEIWEI		APPROVED: ZHANG JIHUI	DATE:	2025.07

No.	Description	Specification / Model	Unit	Quantity	Note(s)
—	Monitoring system software				
1	Tunnel monitoring software		Set	1	Service life 5 years
2	Operating system software		Set	8	Including a server, a database, a client software and a multi-user license; service life 5 years
3	Network management software		Set	1	Including a multi-user license; service life 5 years
4	Antivirus software		Set	1	Including a multi-user license; service life 5 years
5	Application software		Set	1	Service life 5 years
II	Computer system of a tunnel management office				
1	Dedicated server		Unit	2	Service life 5 years
2	Monitoring and management computer		Unit	8	Service life 5 years
3	Laser printer	A3 format, printing speed 8 ppm/16 ppm	Unit	1	Service life 5 years
4	3-layer Ethernet switch	48-port	Unit	1	Service life 5 years
5	Industrial Ethernet Switch	48-port	Unit	1	Service life 5 years
6	Video Ethernet switch	48-port	Unit	1	Service life 5 years
7	Color inkjet printer	(1) Printing format: A4; (2) Printing speed: 4 pcs/min.; (3) Resolution: 1200 dpi;	Unit	1	Service life 5 years
8	19" standard cabinet	Customized, cabinet dimensions 800×800×1800	Set	10	Service life 10 years
9	Monitoring console	Length 5.0 m, width 1.2 m, height 0.74 m	Set	1	Service life 5 years
10	Movable seat		Pcs	8	Service life 5 years
11	Stabilized voltage supply	20 kVA	Set	1	Service life 5 years
12	Over-voltage protection device		Set	1	Service life 5 years
13	Emergency telephone and tunnel broadcast controller	Including a console	Set	1	Service life 5 years
14	DVD burner	External	Unit	1	Service life 5 years
15	Distribution panel	Customized	Set	6	Service life 5 years
16	Data optical transceiver		Pcs	9	Service life 5 years
17	Metal wire protection groove	Under the floor of a control room	m	400	Service life 10 years
18	Network cable	Cat5e UTP	m	500	Service life 10 years
19	Ethernet signal lightning arrester		Pcs	25	Service life 5 years
20	Power cable	YJV22-3*10	m	800	Service life 20 years
21	Power cable	YJV22-3*16	m	600	Service life 20 years
III					
1	46"LCD display		Set	9	Service life 5 years
2	Multi-screen splicing display controller (including control and management software)		Set	1	Service life 5 years
IV					
1	Remote access equipment	4-channel video IP65	Pair	29	Service life 5 years
2	Video coaxial cable		m	3960	Service life 5 years
3	GYTA-16-core single-mode fiber		m	10560	Service life 5 years
4	Video signal lightning arrester		Pcs	70	Service life 5 years

5	Signal lightning arrester of a coaxial cable		Pcs	35	Service life 5 years
6	TV wall bracket		Set	1	Service life 5 years
7	Control keyboard		Set	1	Service life 5 years
8	29" LCD main monitor		Set	1	Service life 5 years
9	Network video management platform		Set	1	Service life 5 years
10	Frequency storage/streaming media server		Set	1	Service life 5 years
11	IP SAN disk array		Set	1	Service life 5 years
12	Enterprise-level monitoring storage hard drive	6T	Pcs	12	Service life 5 years
V	Variable message sign				
1	Cantilever-type variable information board	Including a display screen, a microprocessor, a driver, a casing, a control box, a cable and a junction box, a power supply and software IP65	Set	2	Service life 5 years
2	Column and lightning protection device		Set	2	Including a foundation
3	Variable information board inside the tunnel	Including a display screen, a microprocessor, a driver, a casing, a control box, a cable and a junction box, a power supply and software IP65	Set	2	Service life 5 years
VI	Fire alarm system				
1	Fire management software for an expressway tunnel		Set	1	Service life 5 years
2	Button box of a cross passage	Customized IP65	Pcs	14	Service life 5 years
3	Control box	Customized IP65	Pcs	14	Service life 10 years
4	Infrared detector	IP65	Unit	14	Service life 5 years
5	Gate contactor	IP65	Set	14	Service life 5 years
6	Fiber grating fire detector		Set	14	Service life 5 years
7	Fiber optic splice enclosure		Pcs	10	Service life 5 years
8	Flame-retardant optical cable	GYTZA-4B1	m	4510	Service life 20 years
9	Galvanized steel stranded wire		m	3850	Service life 15 years
10	Mounting bracket		Set	120	Service life 15 years
12	8-channel signal processor		Set	2	Service life 5 years
13	Instrument cabinet	IP65	Set	2	Service life 10 years
14	24V UPS	IP65	Unit	2	Service life 5 years
15	Terminal box		Pcs	2	Service life 5 years
16	Fiber grating protocol converter		Pcs	2	Service life 5 years
17	Fire alarm controller		Unit	1	Service life 5 years
18	Data optical transceiver	IP65	Pcs	2	Service life 5 years
19	Manual fire alarm button	IP65	Pcs	85	Service life 5 years
20	Sound and light alarm	IP65	Pcs	85	Service life 5 years
21	Shielded paired and stranded wire		m	9600	Service life 5 years

24	Industrial Ethernet switch		Unit	2	Service life 5 years
VII	Light intensity detector				
1	Light intensity detector		Set	4	Service life 5 years
2	Detector column of tunnel light intensity		Set	4	Service life 5 years
VIII	Emergency telephone and broadcasting system				
1	Tunnel broadcast inside a tunnel	15w# drum-type IP65	Unit	85	Service life 5 years
2	Tunnel broadcast outside the tunnel	30w	Unit	4	Service life 5 years
3	Duty telephone number of a tunnel management office		Unit	2	Service life 5 years
4	Tunnel emergency telephone	IP65	Unit	26	Service life 5 years
5	Emergency telephone outside the tunnel (including a lightning arrester)		Unit	4	Service life 5 years
6	Remote broadcast amplifier and control module		Pcs	26	Service life 5 years
7	Power cord of an emergency telephone and a wired broadcast	NH-VV-3X4	m	9600	Power supply cable for an emergency telephone and broadcasting system; service life 10 years
8	Signal line of an emergency telephone and a wired broadcast	RVVP2X1.5	m	9600	Connecting cable between an amplifier and a speaker; service life 10 years
9	Signal line of an emergency telephone and a wired broadcast	HYAT5X2X0.9	m	700	Cable between an emergency telephone and an amplifier box; service life 10 years
10	Fiber distribution frame		Pcs	2	Service life 5 years
IX	Wireless communication system of a tunnel				
1	Control cabinet of a wireless communication system	Including a router, a firewall and a VPN gateway	Set	1	Service life 10 years
2	Wireless AP		Unit	44	Service life 5 years
X	Field control system of a tunnel				
1	PLC	Including a DI/DO AI module, a dual CPU and dual power supplies	Set	8	Service life 10 years
2	Industrial switch	2 single-mode optical ports, 6 electrical ports, supporting redundant fiber ring network	Unit	8	Service life 5 years
3	Control cabinet of a field controller	Customized, including a relay terminal block IP65	Unit	8	Service life 10 years
4	8-Core-core single-mode fiber		m	5170	Service life 5 years
5	Fiber optic splice enclosure	8-core	Pcs	20	Service life 5 years
6	Local controller software		Set	1	Service life 5 years
XI	Power supply of a monitoring system				
1	Power cable	NH-YJV-1 KV-3X25+1X16	m	1320	Service life 20 years
2	Power cable	NH-YJV-1 KV-5X16	m	15400	Service life 20 years
3	Power cable	NH-BV-1 KV-3X2.5	m	4180	Service life 20 years
4	Control signal cable	ZR-KVVP 12X2.5	m	3850	Service life 20 years
5	Control signal cable	ZR-KVVP 8X2.5	m	1210	Service life 20 years
6	Control signal cable	ZR-KVVP 3X2.5	m	1100	Service life 20 years
7	Over-voltage protection device	Three-phase high current parallel over-voltage protector, rated current capacity of each phase: 60-100 KA,	Set	2	Service life 5 years

8	Signal lightning arrester		Pcs	90	Service life 5 years
9	Power lightning arrester		Pcs	112	Service life 5 years
10	Angle steel	50x5 L=2.5 m	Pcs	66	Service life 20 years
11	Flat steel	4x50	m	330	Service life 20 years
XII	Galvanized steel pipe				
1	Galvanized steel pipe	SC100	m	520	Service life 20 years
2	Galvanized steel pipe	SC50	m	260	Service life 20 years
3	Galvanized steel pipe	SC32	m	1140	Service life 20 years
4	Galvanized steel pipe	SC25	m	1320	Service life 20 years
5	Galvanized steel pipe	SC20	m	1650	Service life 20 years
For the list of tray materials, see the list of lighting materials					



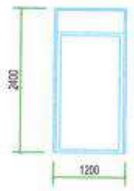
Floor Plan 1:500

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	PANG WEI				ZHAO BING		1:500
		Floor Plan		CAO YONG XIANG		ZHAO BING		WANG JI KAI		III-47
				PAN HAO GUO				WANG JI KAI		2025.07
				MA XIAO HU		CAO BAI				

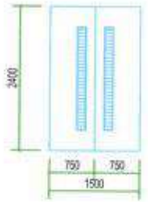
Architectural Finishes Schedule	
Project Name	Structural Details
Roof Polymer-modified bitumen membrane Waterproof roof Non-trafficable flat roof	20mm thick 1:2.5 cement–sand mortar protective layer
	One layer of 4mm thick SBS modified bitumen or polymer membrane
	One coat of primer for base course treatment 25mm thick 1:3 cement-sand mortar leveling layer
	25mm thick 1:3 cement-sand mortar leveling layer
	20mm thick (minimum) crushed stone blocks with 2% slope
	50mm thick dry-laid roof waterproof rock wool insulation board
	15mm thick 1:3 cement-sand mortar leveling layer
	Reinforced concrete roof slab, surface cleaned and dust-free
Exterior Wall (Applicable to all exterior walls)	Wall surface cleaned
	14mm thick 1:3 cement-sand mortar base coat, applied in two coats, broom finished or grooved for bonding
	8mm thick 1:0.15:2 cement–lime–sand mortar (with professional bonding agent)
	Exterior wall tiles fixed, with joints pointed with 1:1 cement-sand mortar
Interior Wall Mixed Mortar Wall Finish	Base course treatment
	9mm thick 1:1:6 cement–lime–sand mortar base coat, broom finished for bonding
	7mm thick 1:1:6 cement–lime–sand mortar leveling course
	5mm thick 1:0.3:2.5 cement–lime–sand mortar finishing coat, steel troweled
	2mm thick enamel coating (applied in two coats with even smoothing)
Floor (Type 1) Cement-Sand Mortar Floor For all surfaces except floor (type 2)	20mm thick 1:2 cement–sand mortar surface finish, steel trowelled
	One coat of cement slurry with construction adhesive
	Cast-in-place concrete blinding layer
Floor (Type 2) Cable Trench Inner Walls and Base Slab For cable trench inner walls and base slab	20mm thick 1:2 cement–sand mortar plaster for external walls
	One coat of primer for base course treatment
	2mm thick silicone rubber waterproof coating
	Cast-in-place concrete blinding layer
Ramp Fine Aggregate Concrete Rramp	50mm thick C20 fine aggregate concrete surface course
	80mm thick C20 concrete
	300mm thick 3:7 lime-soil compacted in two stages
	Compacted fill
Apron 900mm wide concrete apron	60mm thick C15 concrete with slurry finish, sloped outwards at 4%
	100mm thick compacted bedding layer of broken bricks (or stones, pebbles) mixed with clay
	Cast-in-place concrete blinding layer
Ceiling Ceiling with Mixed Sand Mortar Enamel coating	Reinforced concrete slab bottom surface cleaned
	One layer of cement slurry (with appropriate amount of construction adhesive)
	10mm thick 1:1:4 cement–lime–sand mortar
	4mm thick 1:0.3:3 cement–lime–sand mortar
	2mm thick enamel coating (applied in two coats with even smoothing)
Note: No plastering for substation ceiling. After cleaning and sanding the base course to a smooth finish, apply putty and sand with sandpaper, then brush with white latex paint.	
Skirting Cement-Sand Mortar Skirting (Height: 150mm)	6mm thick 1:2 cement–sand mortar surface course, steel trowel finish
	7mm thick 1:3 cement–sand mortar base course
	13mm thick 1:3 cement–sand mortar base coat

Door and Window Schedule

Type	Design No.	Opening size (Unit: mm)	Quantity	Drawing Set	Remarks
Fire Door	FM1224（B）	1200X2400	1	Fabricated by approved specialist manufacturers	Class B Fire Door
	FM1524（A）	1500X2400	1	Fabricated by approved specialist manufacturers	Class A Fire Door
	FM1524（B）	1500X2400	1	Fabricated by approved specialist manufacturers	Class B Fire Door
	FM1824（B）	1800X2400	6	Fabricated by approved specialist manufacturers	Class B Fire Door
	FM2127（B）	2100X2700	2	Fabricated by approved specialist manufacturers	Class B Fire Door
Standard Window	C1815	1800X1500	19	Fabricated by approved specialist manufacturers	Series-70 Thermal Break Aluminum Alloy Energy-saving Casement/Fixed Window



FM1224（B） 1:50



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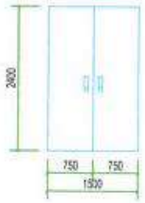
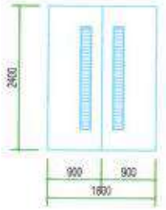
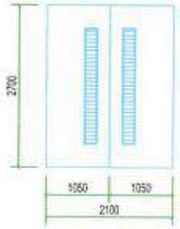


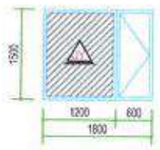
FM1524（B） 1:50



FM1824（B） 1:50



FM2127（B） 1:50



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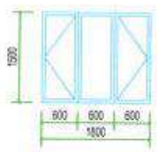
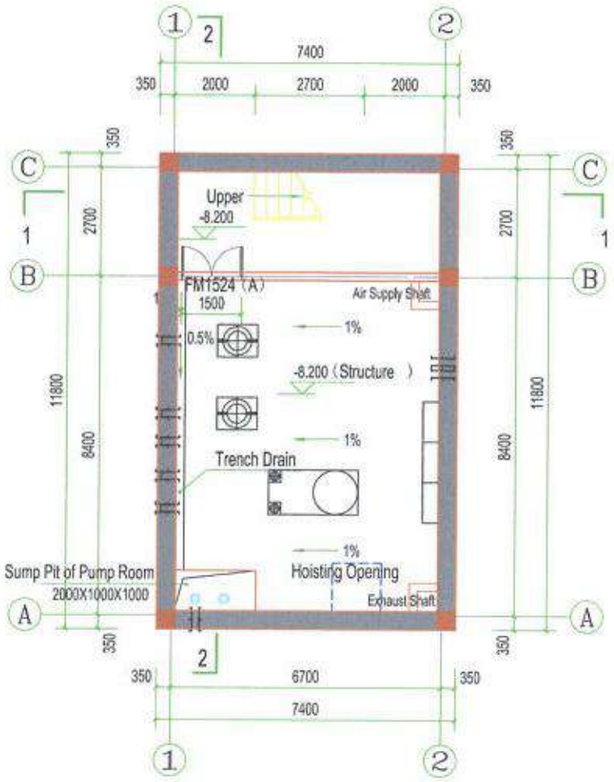
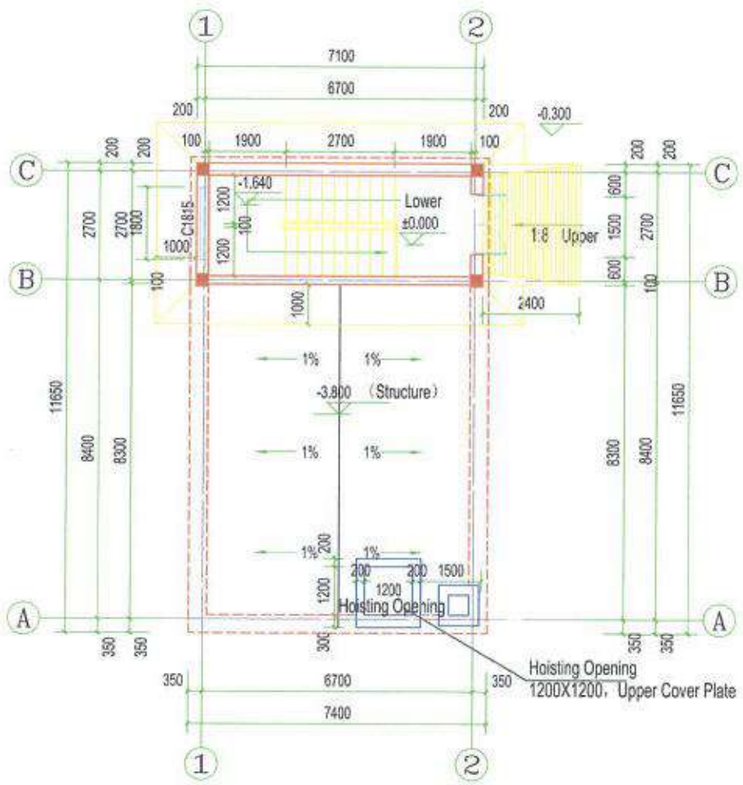


C1815 1:50

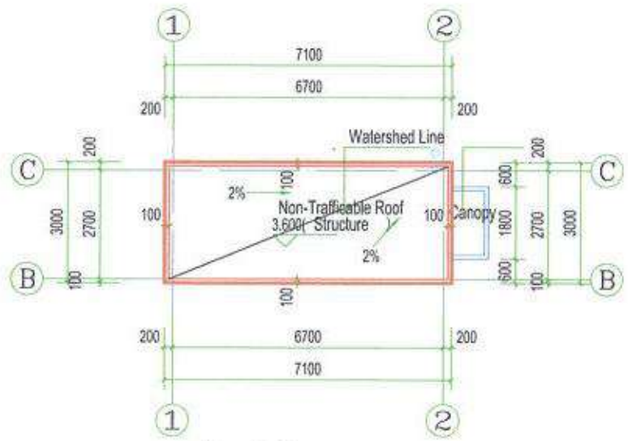
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	ZHAO BING		SCALE	1:50
		Door and Window Schedule				MASTER DES.	CAO YONG XIANG		SPE. MANAGER	ZHAO BING		EXAMINED	WANG JI KAI		DRAWING NO.	III-49
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	WANG JI KAI			
						SUB. MANAGER	MA XIAO HU		DESIGNED	CAO BAI		APPROVED			DATE	2025.07



Basement Floor Plan 1:100

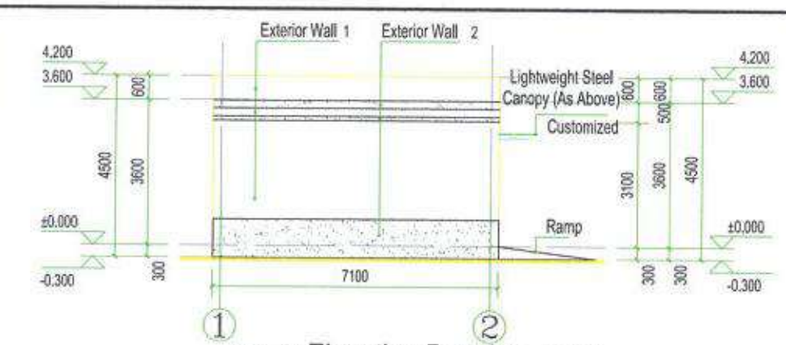


First Floor Plan 1:100

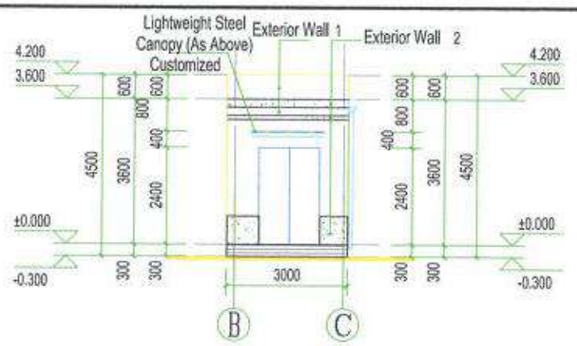


Roof plan 1:100

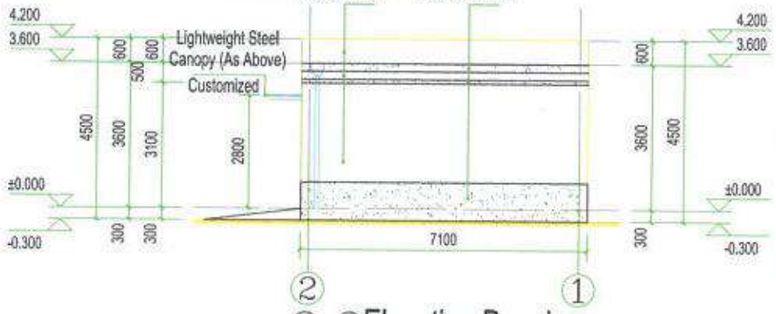
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the "First Ring Road" Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	ZHAO BING		SCALE	1:100
		Fire pump room Plan				MASTER DES.	CAO YONG XING		SPE. MANAGER	ZHAO BING		EXAMINED	WANG JI KAI		DRAWING NO.	III-50
						MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	WANG JI KAI			
						SUB. MANAGER	MA XIAO HU		DESIGNED	GAO BAI		APPROVED			DATE	2025.07



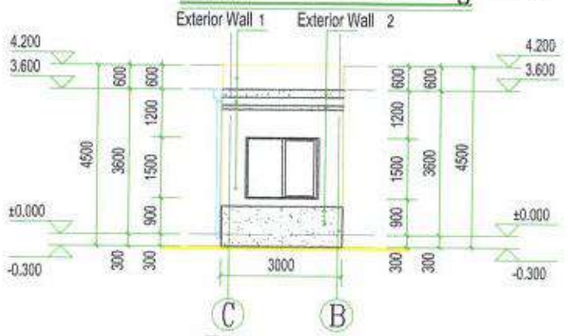
①- ②Elevation Drawing 1:100



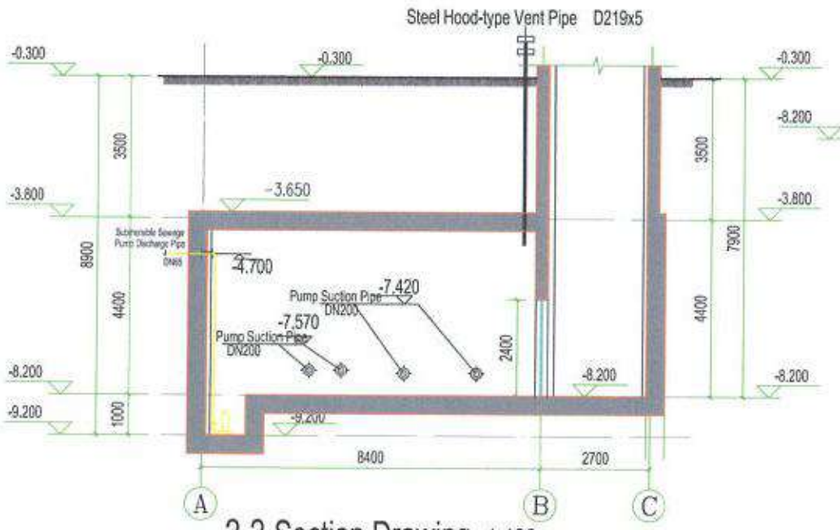
Ⓑ- ⓒElevation Drawing 1:100



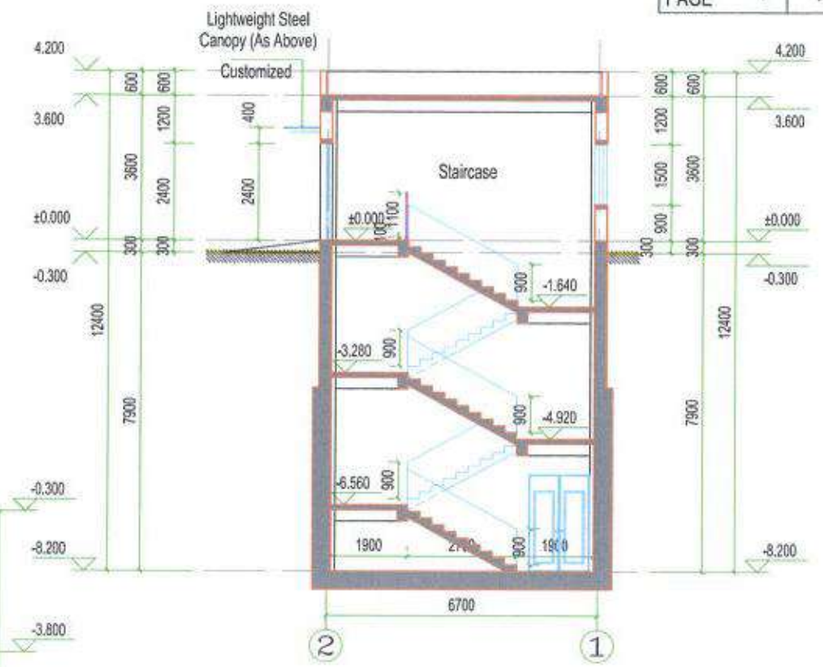
②- ①Elevation Drawing 1:100



ⓒ- ⒷElevation Drawing 1:100



2-2 Section Drawing 1:100



1-1 Section Drawing 1:100

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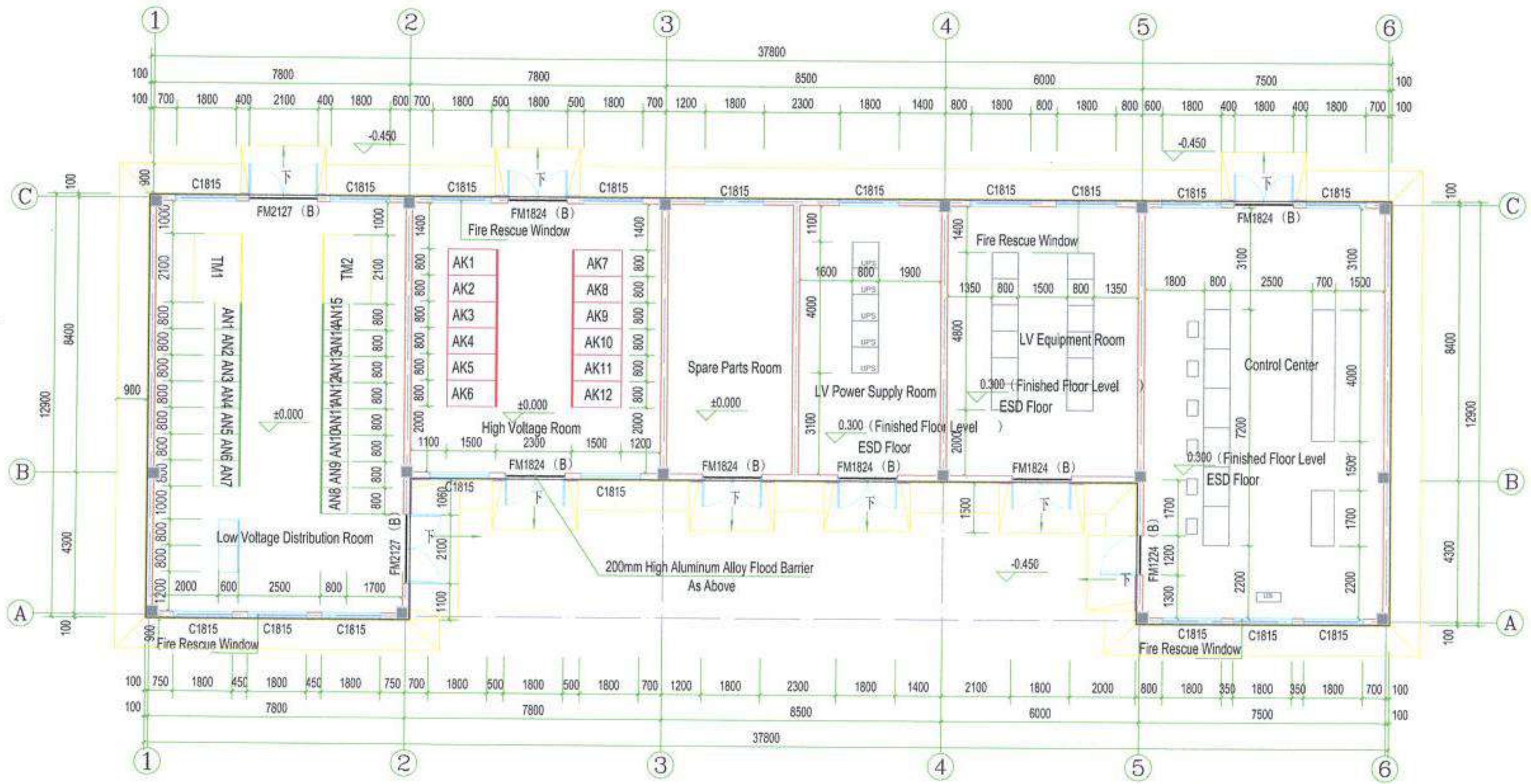
		Fire pump room Elevation Drawing and Section Drawing		MASTER DES.: QIAO YONG HANG		SPE. MANAGER: ZHAO BING			EXAMINED: WANG JI KAI		DRAWING NO.: III-51
				MASTER DES.: PAN HAO GUO		SPE. MANAGER:			APPROVED: WANG JI KAI		DATE: 2025.07
				SUB. MANAGER: MA XIAO HU		DESIGNED: QIAO BAI			APPROVED:		

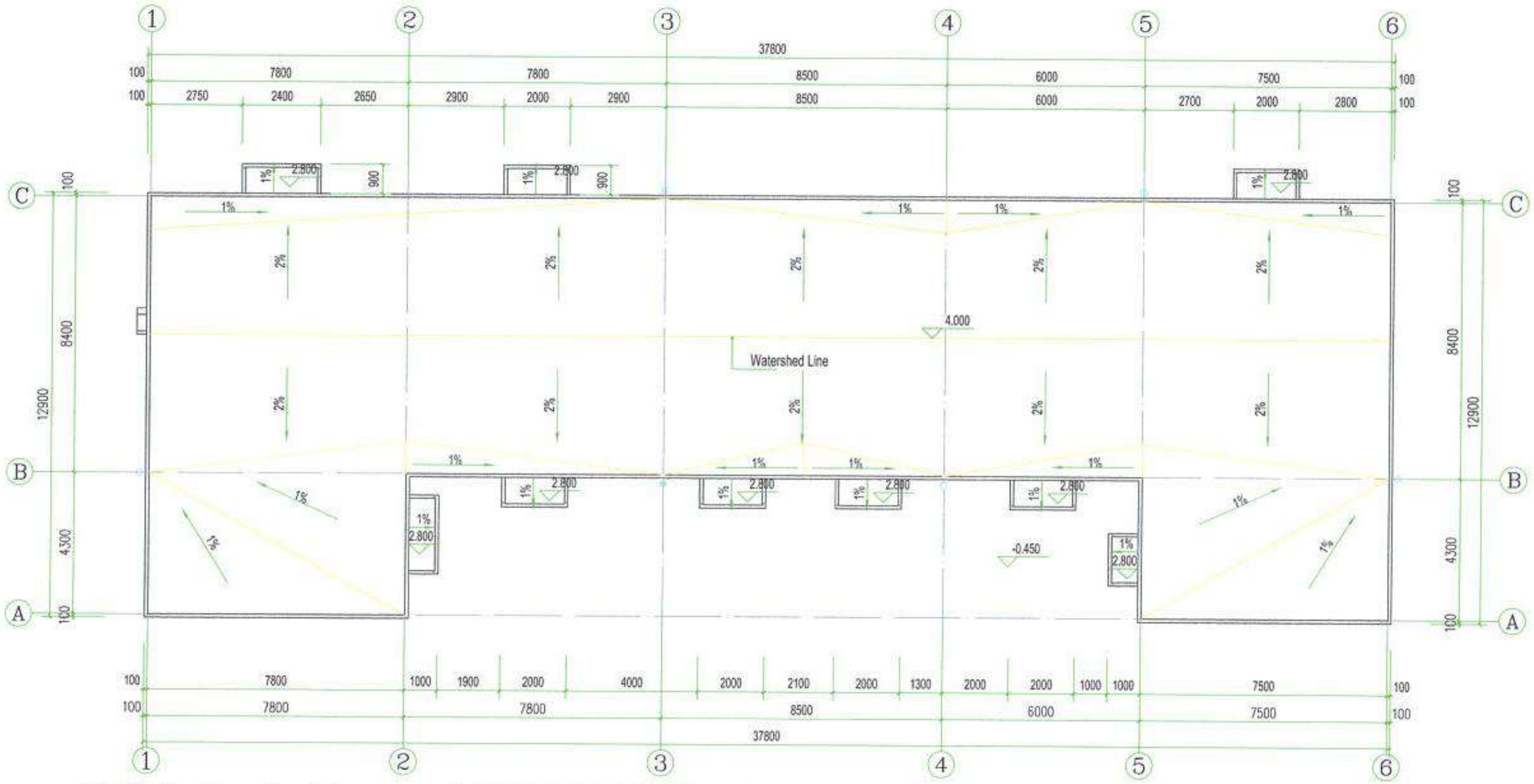


Distribution Room First Floor Plan 1:100

Gross Floor Area : 392.59m²

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the "First Ring Road" Project of Ulaanbaatar City	Drawing Stage: Technical Drawings; Project No.: 10-2024-2509	Distribution Room First Floor Plan

DES. MANAGER	FANG WEI	SUB. MANAGER		CHECKED	ZHAO BING	SCALE	1:100
MASTER DES.	CAO YONG XIANG	SPE. MANAGER	ZHAO BING	EXAMINED	WANG JI KAI	DRAWING NO.	III-52
MASTER DES.	PAN HAO GUO	SPE. MANAGER		APPROVED	WANG JI KAI		
SUB. MANAGER	MA XIAO HU	DESIGNED	CAO BIN	APPROVED		DATE	2025.07

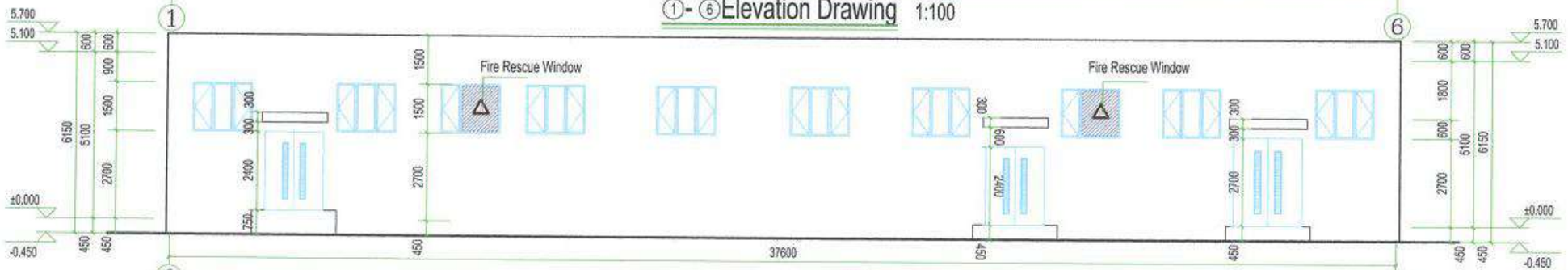


Distribution Room Roof plan 1:100

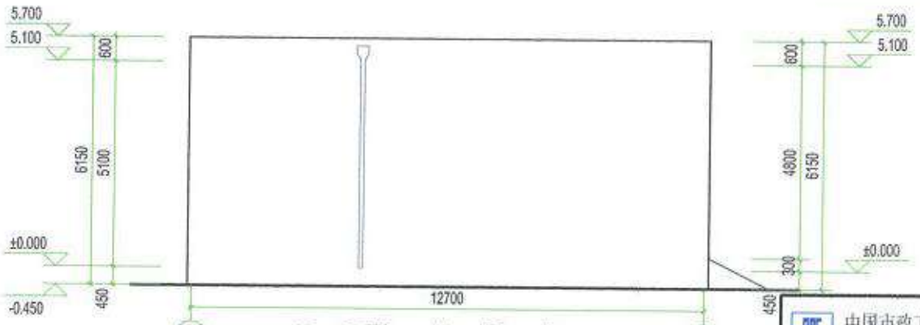
中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the "First Ring Road" Project of Ulaanbaatar City	DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI	SUB. MANAGER		CHECKED	ZHAO BING	SCALE	1:100
			Distribution Room Roof plan			MASTER DES.	QIAO YONG BING	SPE. MANAGER	ZHAO BING	EXAMINED	WANG JI CAI	DRAWING NO.	III-53
						MASTER DES.	PAN HAO GUO	SPE. MANAGER		APPROVED	WANG JI CAI	DATE	2025.07
						SUB. MANAGER	MA XIAO HU	DESIGNED	QIAO BAI	APPROVED			

PAGE 1 1

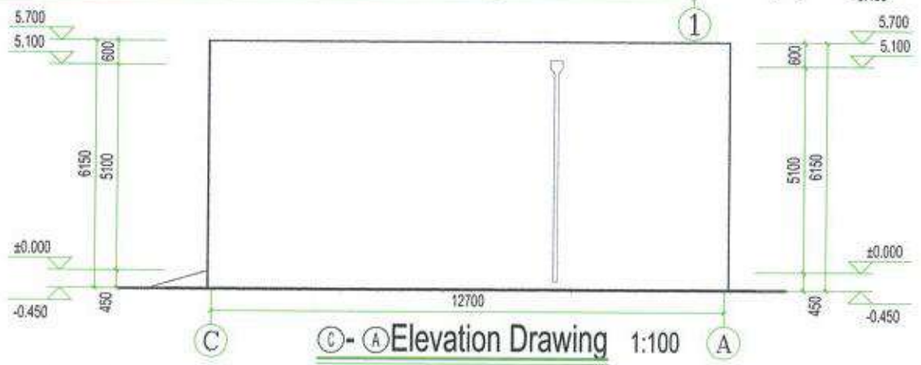
①- ⑥Elevation Drawing 1:100



⑥- ①Elevation Drawing 1:100



Ⓐ- ⓒElevation Drawing 1:100



ⓒ- ⒶElevation Drawing 1:100

中国市政工程西北设计研究院有限公司
CSCEC AECOM CONSULTANTS CO., LTD

The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulanhaotar City

Distribution Room Elevation Drawing

DRAWING STAGE	Technical Drawings	PROJECT NO.	10-2024-2509	DES. MANAGER	PANG WEI		SUB. MANAGER			CHECKED	ZHAO BING
				MASTER DES.	CAO YONG YANG		SPE. MANAGER	ZHAO BING		EXAMINED	WANG JIKAI
				MASTER DES.	PAN HAO GUO		SPE. MANAGER			APPROVED	WANG JIKAI
				SUB. MANAGER	MA XIAO HU		DESIGNED	CAO BAI		APPROVED	

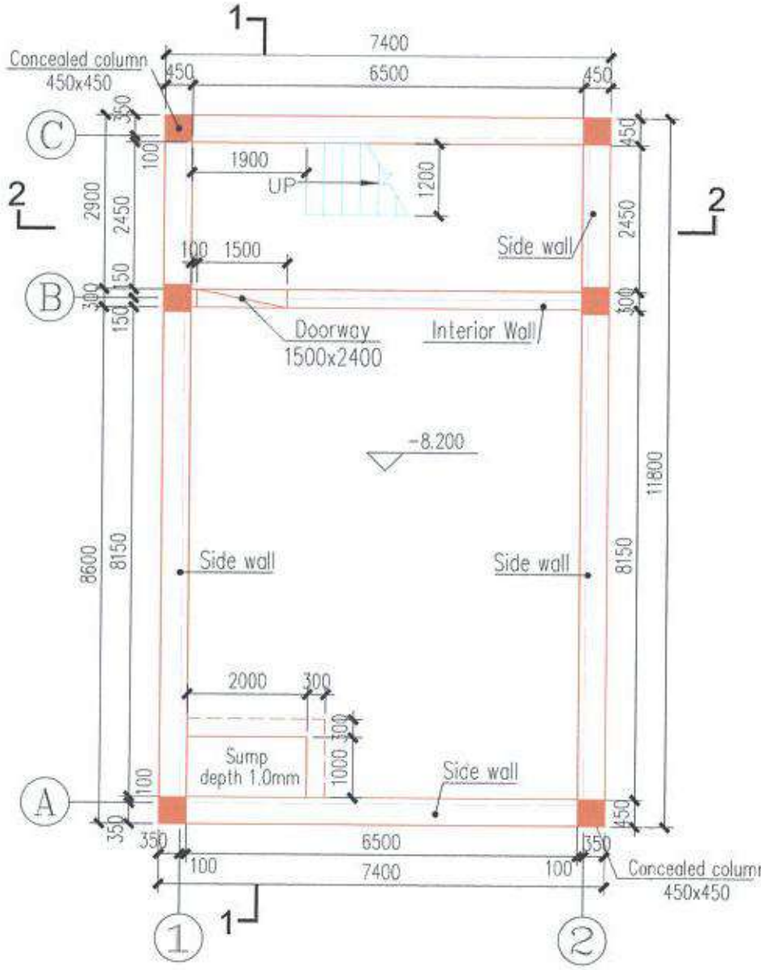
SCALE	1:100
DRAWING NO.	III-55
DATE	2025.07

Quantity List of Fire Pump Room Construction Works

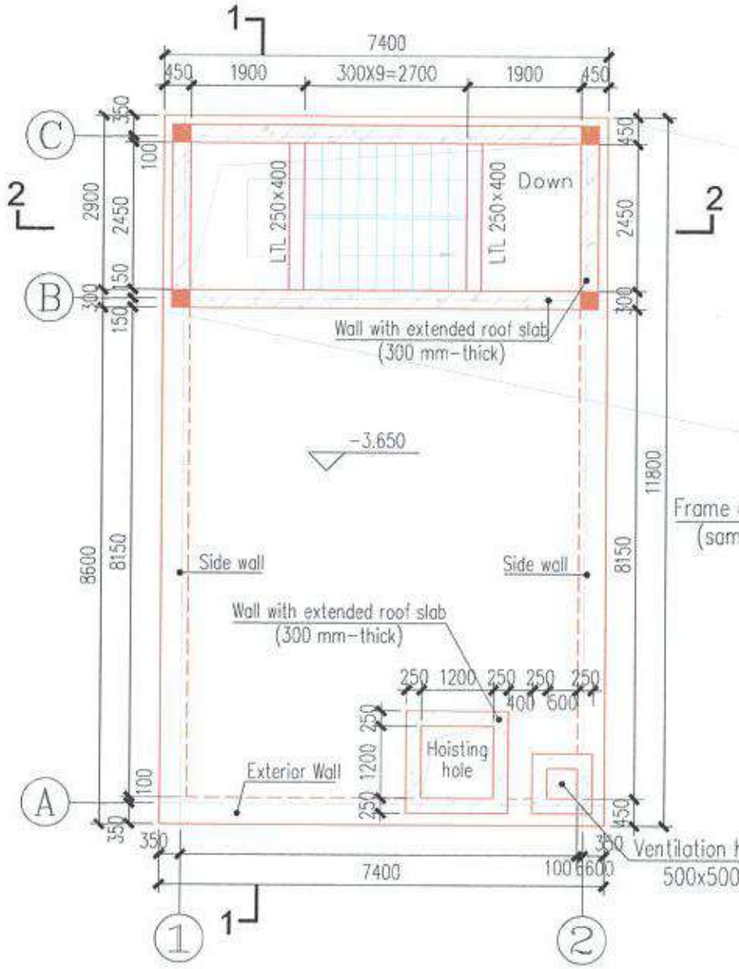
Item		Unit	Quantity
Polymer-Modified Bitumen Membrane Waterproof Roofing System	20mm thick 1:2.5 cement-sand mortar protective layer	m^2	21.3
	One layer of 4mm thick modified bitumen or polymer waterproofing membrane	m^2	21.3
	One coat of primer for base course treatment	m^2	21.3
	25mm thick 1:3 cement-sand mortar leveling layer	m^2	21.3
	20mm thick (minimum) crushed stone blocks with 2% slope	m^2	21.3
	50mm thick dry-laid roof waterproof rock wool insulation board	m^2	21.3
	15mm thick 1:3 cement-sand mortar leveling layer	m^2	21.3
	Reinforced concrete roof slab, surface cleaned and dust-free	m^2	See the Structural Quantity Table for reference
Exterior Wall	300mm thick autoclaved aerated concrete blocks, wall surface cleaned	m^3	84.84
	14mm thick 1:3 cement-sand mortar base coat, applied in two coats, broom finished or grooved for bonding	m^2	84.84
	8mm thick 1:0.15:2 cement–lime–sand mortar (with professional bonding agent)	m^2	84.84
	Exterior wall tiles fixed, with joints pointed with 1:1 cement-sand mortar	m^2	84.84
Interior Wall (Plastered with Mixed Mortar)	200mm thick autoclaved aerated concrete blocks, base course treatment	m^2	26.65
	9mm thick 1:1:6 cement–lime–sand mortar base coat, broom finished for bonding	m^2	26.65
	7mm thick 1:1:6 cement–lime–sand mortar leveling course	m^2	26.65
	5mm thick 1:0.3:2.5 cement–lime–sand mortar finishing coat, steel troweled	m^2	26.65
	2mm thick enamel coating (applied in two coats with even smoothing)	m^2	26.65
Cement-Sand Mortar Floor (Including Staircase)	20mm thick 1:2 cement–sand mortar surface finish, steel troweled	m^2	110.59
	One layer of cement slurry (with appropriate amount of construction adhesive)	m^2	110.59
	Cast-in-place concrete blinding layer	m^3	See the Structural Quantity Table for reference
Concrete Apron	60mm thick C15 concrete with slurry-finished surface, sloped outwards at 4%	m^2	21.2
	100mm thick compacted bedding layer of broken bricks (or stones/pebbles) and clay	m^2	21.2
	Cast-in-place concrete blinding layer	m^2	21.2
Ceiling with Mixed Sand Mortar Enamel coating (Including Stairs)	Reinforced concrete slab; bottom surface cleaned	m^2	See the Structural Quantity Table for reference
	One layer of cement slurry (with appropriate amount of construction adhesive)	m^2	110.59
	10mm thick 1:1:4 cement–lime–sand mortar	m^2	110.59
	4mm thick 1:0.3:3 cement–lime–sand mortar	m^2	110.59
	2mm thick enamel coating (applied in two coats with even smoothing)	m^2	110.59
Cement-Sand Mortar Skirting	6mm thick 1:2 cement–sand mortar surface course, steel trowel finish	m^2	5.99
	7mm thick 1:3 cement–sand mortar base course	m^2	5.99
	13mm thick 1:3 cement–sand mortar base coat	m^2	7.2
Fine Aggregate Concrete Ramp	50mm thick C20 fine aggregate concrete surface course	m^2	7.2
	80mm thick C20 concrete	m^2	7.2
	300mm thick 3:7 lime-soil mixture, compacted in two layers	m^2	7.2
	Compacted backfill	m^3	5.99
Lightweight Steel Canopy		m^2	19.44
Fire Door		m^2	7.2
Thermal Break Aluminum Alloy Window		m^2	2.7

Quantity List of Power Distribution Room Construction Works

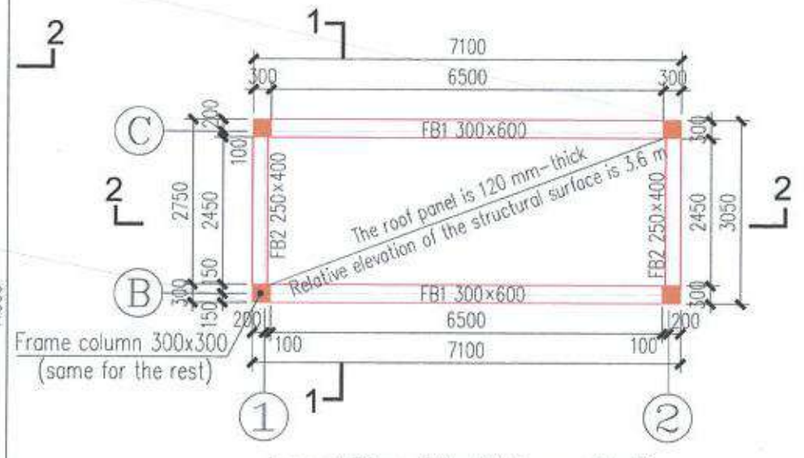
Item		Unit	Quantity
Polymer-Modified Bitumen Membrane Waterproof Roofing System	20mm thick 1:2.5 cement-sand mortar protective layer	m^2	392.59
	One layer of 4mm thick modified bitumen or polymer waterproofing membrane	m^2	392.59
	One coat of primer for base course treatment	m^2	392.59
	25mm thick 1:3 cement-sand mortar leveling layer	m^2	392.59
	20mm thick (minimum) crushed stone blocks with 2% slope	m^2	392.59
	50mm thick dry-laid roof waterproof rock wool insulation board	m^2	392.59
	15mm thick 1:3 cement-sand mortar leveling layer	m^2	392.59
	Reinforced concrete roof slab, surface cleaned and dust-free	m^2	See the Structural Quantity Table for reference
Exterior Wall	200mm thick autoclaved aerated concrete blocks, wall surface cleaned	m^2	676.5
	14mm thick 1:3 cement-sand mortar base coat, applied in two coats, broom finished or grooved for bonding	m^2	676.5
	8mm thick 1:0.15:2 cement–lime–sand mortar (with professional bonding agent)	m^2	676.5
	Exterior wall tiles fixed, with joints pointed with 1:1 cement-sand mortar	m^2	676.5
Interior Wall (Plastered with Mixed Mortar)	200mm thick autoclaved aerated concrete blocks, base course treatment	m^2	152.1
	9mm thick 1:1:6 cement–lime–sand mortar base coat, broom finished for bonding	m^2	152.1
	7mm thick 1:1:6 cement–lime–sand mortar leveling course	m^2	152.1
	5mm thick 1:0.3:2.5 cement–lime–sand mortar finishing coat, steel troweled	m^2	152.1
	2mm thick enamel coating (applied in two coats with even smoothing)	m^2	152.1
Cement-Sand Mortar Floor	20mm thick 1:2 cement–sand mortar surface finish, steel troweled	m^2	392.59
	One layer of cement slurry (with appropriate amount of construction adhesive)	m^2	392.59
	Cast-in-place concrete blinding layer	m^2	See the Structural Quantity Table for reference
Concrete Apron	60mm thick C15 concrete with slurry-finished surface, sloped outwards at 4%	m^2	79.75
	100mm thick compacted bedding layer of broken bricks (or stones/pebbles) and clay	m^2	79.75
	Cast-in-place concrete blinding layer	m^2	79.75
Ceiling with Mixed Sand Mortar Enamel coating	Reinforced concrete slab bottom surface cleaned	m^2	See the Structural Quantity Table for reference
	One layer of cement slurry (with appropriate amount of construction adhesive)	m^2	393.59
	10mm thick 1:1:4 cement–lime–sand mortar	m^2	394.59
	4mm thick 1:0.3:3 cement–lime–sand mortar	m^2	395.59
	2mm thick Enamel coating (applied in two coats with even smoothing)	m^2	396.59
Cement-Sand Mortar Skirting	6mm thick 1:2 cement–sand mortar surface course, steel trowel finish	m^2	11
	7mm thick 1:3 cement–sand mortar base course	m^2	11
	13mm thick 1:3 cement–sand mortar base coat	m^2	11
Fine Aggregate Concrete Ramp	50mm thick C20 fine aggregate concrete surface course	m^2	37.14
	80mm thick C20 concrete	m^2	37.14
	300mm thick 3:7 lime-soil mixture, compacted in two layers	m^2	37.14
	Compacted backfill	m^2	37.14
Lightweight Steel Canopy		m^2	19.44
Fire Door		m^2	40.14
Thermal Break Aluminum Alloy Window		m^2	48.6



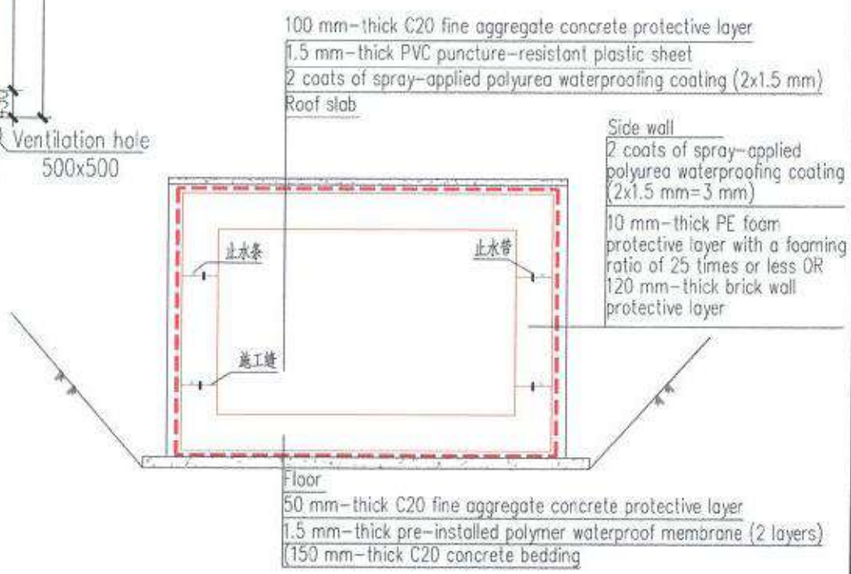
Floor Layout Plan 1:100



Layout Plan of the Roof Slab 1:100



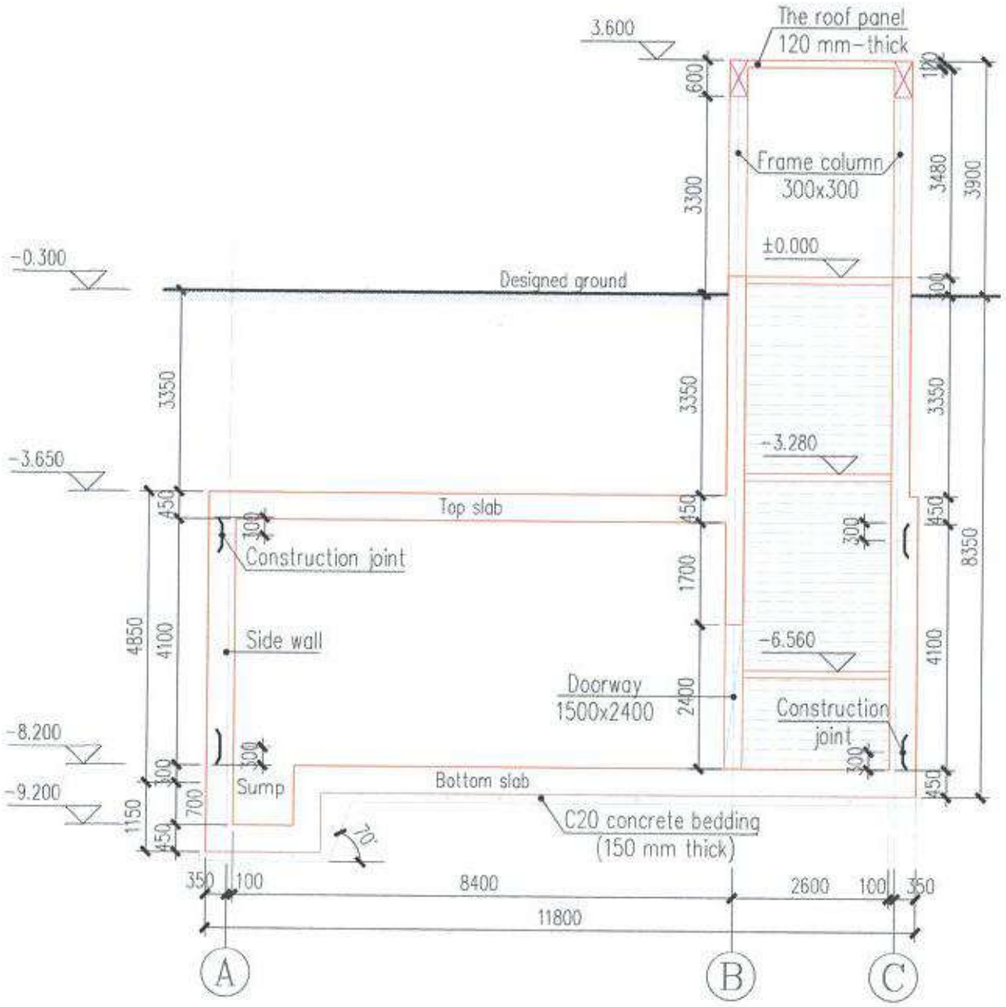
Layout Plan of the Staircase Roof 1:100



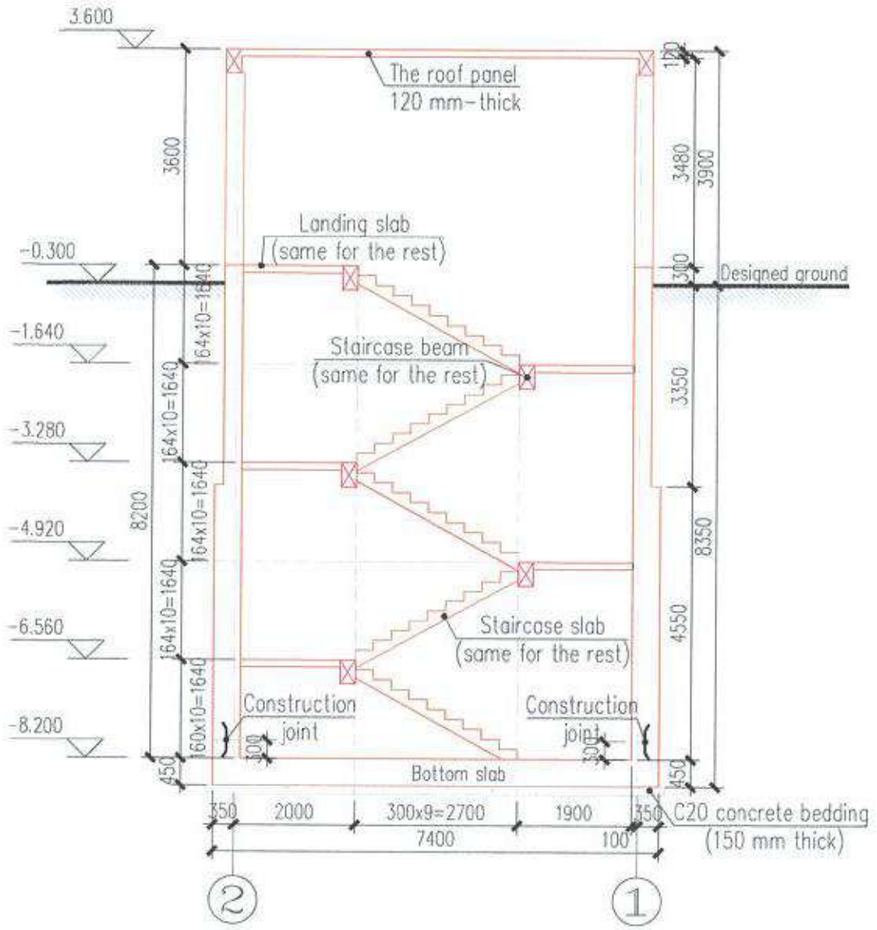
Basement Waterproofing Section

Note: 1. Except for the elevation in the drawing is calculated by meter (m), all remaining dimensions are calculated by millimeter (mm). All elevations in the drawing represent the relative elevation of the structural surface.
2.Part of the walls and slabs of the underground fire pump house are made of the C30 waterproof concrete with the impermeability grade of P8, and above-ground staircase beams, slabs and columns are made of C30 concrete.
3.Stair stringer size that is not indicated in the drawing is 250 x 400 mm (width x height), the stair column size is 300 x 300 mm, and both the stair slab and the landing slab are 120 mm-thick.

中国市政工程西北设计研究院有限公司 CSCEC AECOM CONSULTANTS CO., LTD	The Feasibility Study and Concept Design of the 'First Ring Road' Project of Ulaanbaatar City	DRAWING STAGE: Technical Drawings	PROJECT NO.: 10-2024-2509	DES. MANAGER: PANG WEI	SUB. MANAGER:		CHECKED: XIE BAOPING	SCALE: 1:100
		Structural Plan of the Fire Pump House and Fire Pool		MASTER DES.: CAO YONGLIANG	SPE. MANAGER: MA XIAOHU		EXAMINED: SUN HAIFENG	DRAWING NO.: III-57
				MASTER DES.: PAN HAOGUO	SPE. MANAGER:		APPROVED: SUN HAIFENG	
				SUB. MANAGER: MA XIAOHU	DESIGNED: ZHANG KEXUN		APPROVED:	DATE: 2025.07

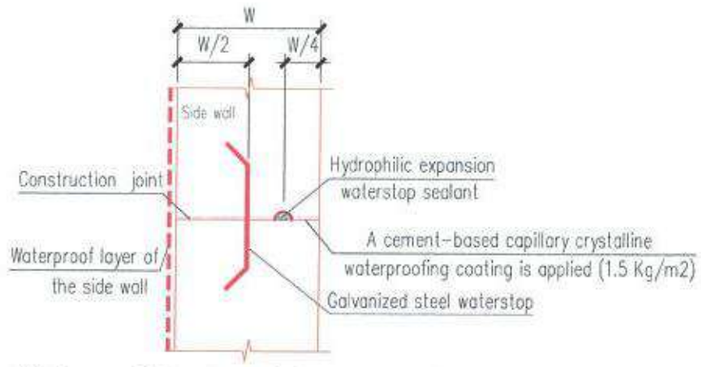


1-1 Profile 1:100



2-2 Profile 1:100

Note: 1. Except for the elevation in the drawing is calculated by meter (m), all remaining dimensions are calculated by millimeter (mm). All elevations in the drawing represent the relative elevation of the structural surface.
2.Part of the walls and slabs of the underground fire pump house are made of the C30 waterproof concrete with the impermeability grade of P8, and above-ground staircase beams, slabs and columns are made of C30 concrete.
3.Stair stringer size that is not indicated in the drawing is 250 x 400 mm (width x height), the stair column size is 300 x 300 mm, and both the stair slab and the landing slab are 120 mm-thick.



Waterproof structure of the construction joint

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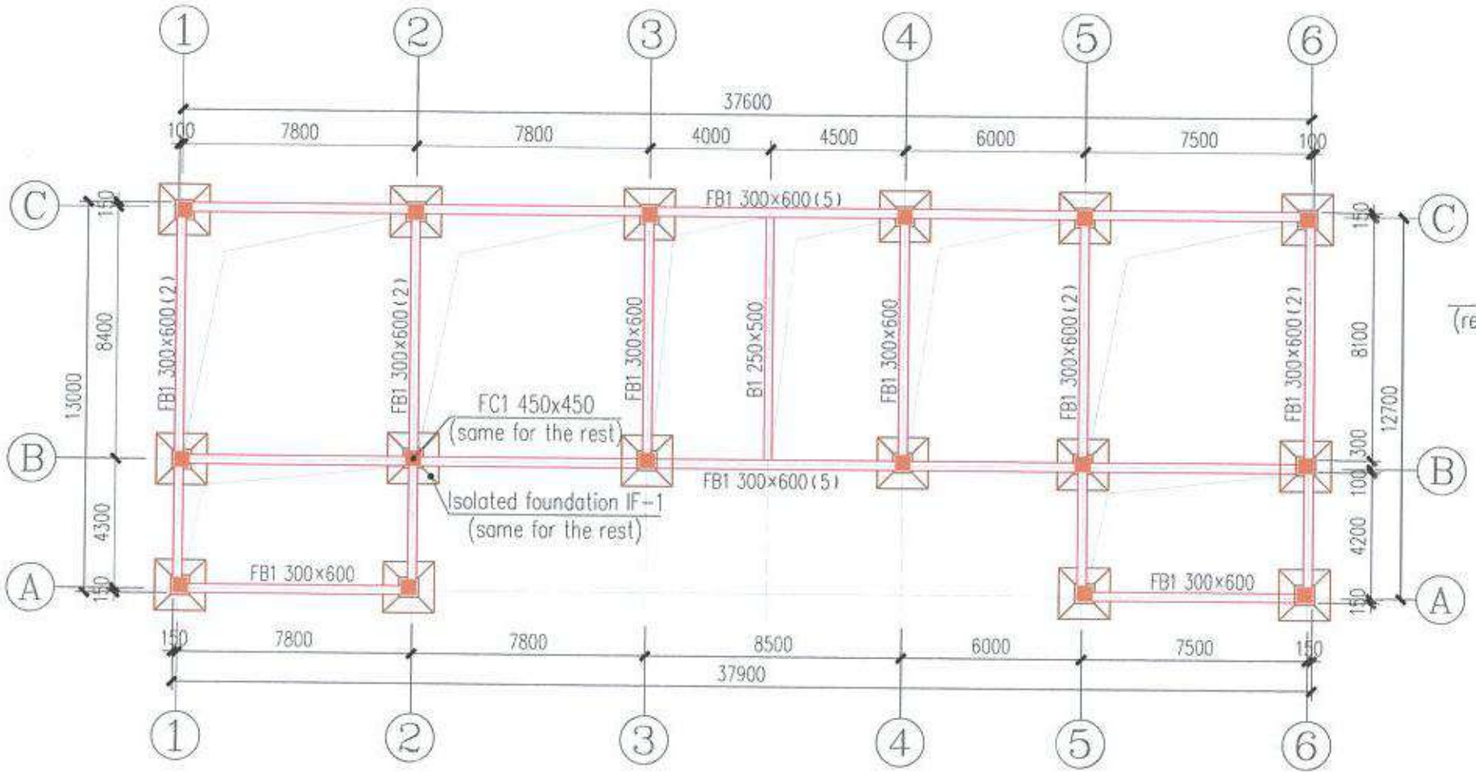
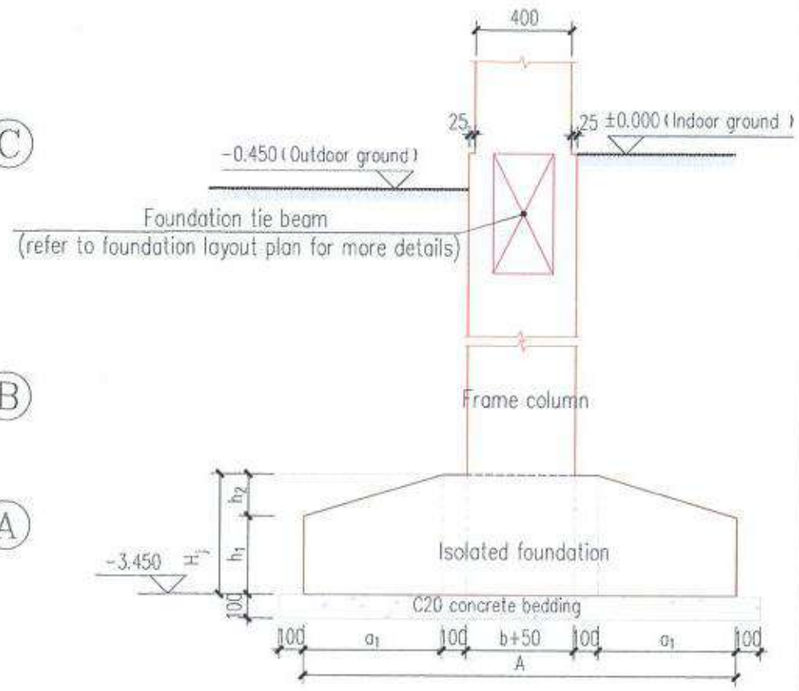
		Structural Profile of the Fire Pump House and Fire Pool				MASTER DES.	CAO YONGLIANG		SPE. MANAGER	MA XIAOHU		EXAMINED	SUN HAIFENG		DRAWING NO.	III-58
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	SUN HAIFENG			
						SUB. MANAGER	MA XIAOHU		DESIGNED	ZHANG KEXUN	张克勋	APPROVED			DATE	2025.07



Foundation Layout Plan 1:200



Foundation Section 1:25

Notes: 1.Except for the elevation in the drawing is calculated by meter (m), all remaining dimensions are calculated by millimeter (mm). All elevations in the drawing represent the relative elevation of the structural surface.
2. Due to lack of geological exploration data, the buried depth of the foundation is temporarily set as 3.0 m, and the characteristic value of bearing capacity of the foundation is temporarily set as 350 KPa.
3.Foundation of the Project adopts the isolated footing beneath the reinforced concrete column, and the foundation and its tie beam are made of concrete of the strength grade C35.
4.All the centers of the isolated foundations are aligned with the column centers.
5.Refer to the table shown at right side for the dimensions of the isolated foundation.

Dimension Parameter Table of the Isolated Foundation

No.	Foundation base size	Foundation height		
	A x B	Hj	h1	h2
IF1	1700x1700	500	325	175

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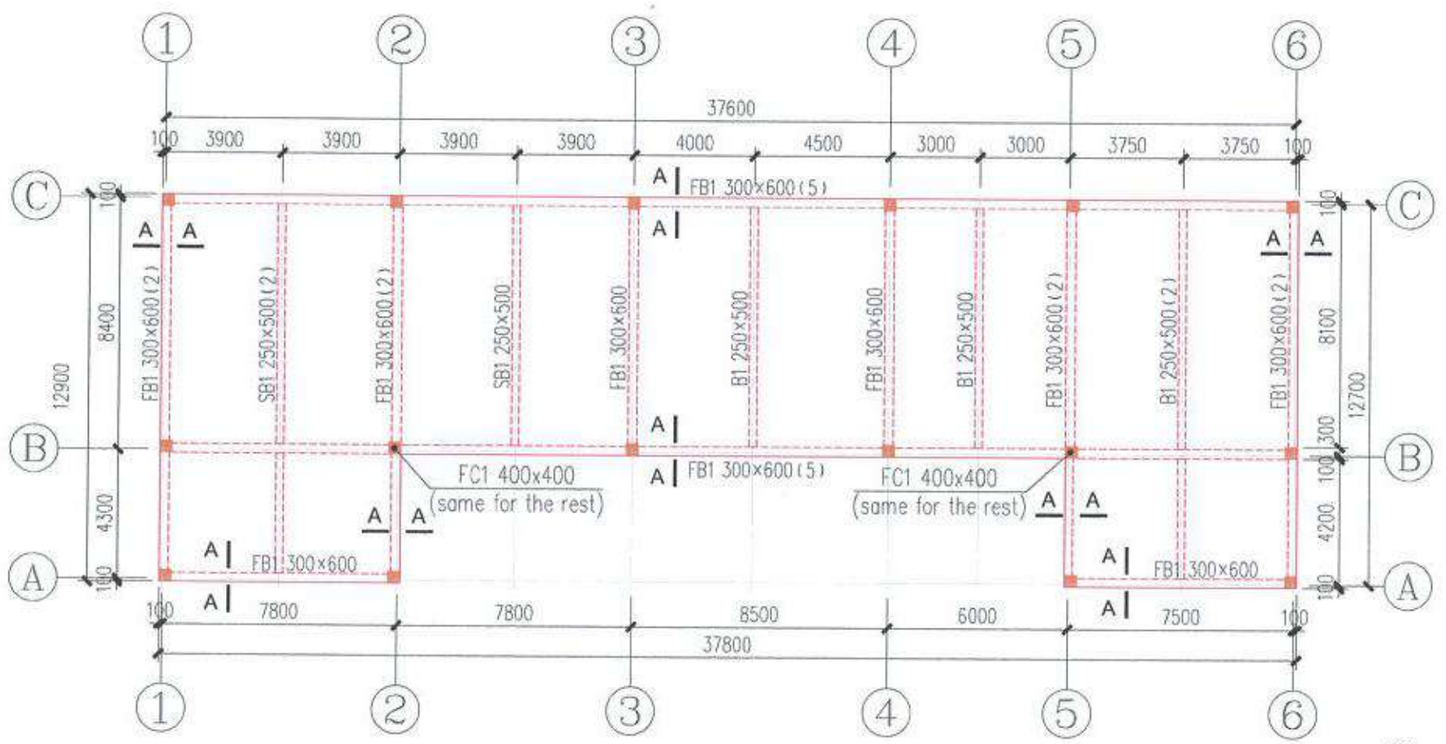
		Structural Plan of the Distribution Substation Foundation				MASTER DES.	CAO YONGJIANG		SPE. MANAGER	MA XIAOHU		EXAMINED	SUN HAIFENG		DRAWING NO.	III-59
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	SUN HAIFENG			
						SUB. MANAGER	MA XIAOHU		DESIGNED	ZHANG KEXUN		APPROVED			DATE	2025.07



First Floor Layout Plan 1:100

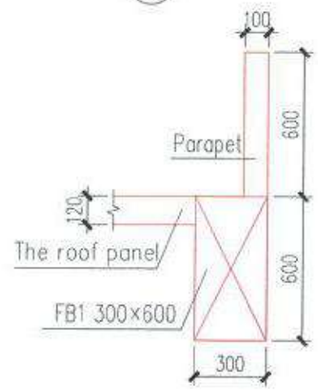
5.100m

Notes: 1. Except for the elevation in the drawing is calculated by meter (m), all remaining dimensions are calculated by millimeter (mm). All elevations in the drawing represent the relative elevation of the structural surface.

2. All the beams, slabs and columns of this floor are made of C35 concrete; except for special indication, the beam in the drawing is centered along with the axis.

3. Roof slabs without indicated thickness are all be 120 mm-thick.

4. Sloping is achieved through building, and the unspecified beam top of the structure is flush with the slab top.



A-A Profile 1:25

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		Structural Plan of the Distribution Substation Beams and Columns				MASTER DES.	CAO YONGXIANG		SPE. MANAGER	MA XIAOHU		EXAMINED	SUN HAIFENG		DRAWING NO. III-60
						MASTER DES.	PAN HAOGUO		SPE. MANAGER			APPROVED	SUN HAIFENG		
						SUB. MANAGER	MA XIAOHU		DESIGNED	ZHANG KEXIN		APPROVED			DATE 2025.07

Fire Pump House Structural BOQ

NO.	Item	Unit	Quantity
1	**Foundation pit**		
1.1	Rock excavation	m³	1489.28
12	Earthwork backfilling	m³	1030.38
2	**Basement structure**		
2.1	Plain concrete blinding layer (C20)	m³	12.81
2.2	Base slab concrete (C35, P8)	m³	38.43
2.3	Base slab reinforcement (HRB400)	t	6.92
2.4	Side wall concrete (C35, P8)	m³	103.19
2.5	Side wall reinforcement (HRB400)	t	18.57
2.6	Side wall formwork	㎡	458.60
2.7	Top slab concrete (C35, P8)	m³	28.85
2.8	Top slab reinforcement (HRB400)	t	5.19
2.9	Top slab formwork	㎡	85.41
3	**Basement waterproofing**		
3.1	Base slab waterproofing layer		
	1.5 mm pre-laid polymer waterproofing membrane (2 layers)	㎡	85.41
3.2	Side wall waterproofing layer		
	1.5 mm thick self-adhesive waterproofing membrane	㎡	155.80
	1.5 mm thick spray-type polyurea waterproofing coating	㎡	155.80
	120 mm thick brick wall protective layer	㎡	155.80
3.3	Top slab waterproofing layer		
	1.5 mm self-adhesive waterproofing membrane	㎡	64.11
	1.5 mm spray-type polyurea waterproofing coating	㎡	64.11
	1.5 mm puncture-resistant PVC	㎡	64.11
3.4	Horizontal construction joint		
	Galvanized steel sheet waterstop	m	76.00
	Water swelling strip	m	76.00
	Cement-based permeable crystalline waterproofing coating	㎡	34.20
4	**Staircase structure**		
4.1	First-floor column concrete (C35)	m³	2.30
4.2	First-floor column reinforcement (HRB400)	t	0.58
4.3	First-floor column formwork	㎡	23.04
4.4	Roof beam concrete (C35)	m³	2.05
4.5	Roof beam reinforcement (HRB400)	t	0.37
4.6	Roof beam formwork	㎡	17.10
4.7	Roof slab concrete (C35)	m³	2.56
4.8	Roof slab reinforcement (HRB400)	t	0.29
4.9	Roof slab formwork	㎡	21.30
5	Staircase concrete (C35)	m³	5.4
5.1	Staircase reinforcement (HRB400)	t	0.611573226
5.2	Staircase formwork	㎡	42.6

Distribution Substation Structural BOQ

Item	Unit	Quantity
Rock excavation	m³	1355.88
Earthwork backfilling	m³	1336.68
Base plain concrete blinding layer (C20)	m³	8.66
Foundation tie beam concrete (C35)	m³	27.46
Foundation tie beam reinforcement (HRB400)	t	3.30
Foundation tie beam formwork	㎡	240.00
Foundation column concrete (C35)	m³	6.48
Foundation column reinforcement (HRB400)	t	1.95
Foundation column formwork	㎡	57.60
Isolated foundation concrete (C35)	m³	19.20
Isolated foundation reinforcement (HRB400)	t	0.51
Isolated foundation formwork	㎡	65.28
Roof beam concrete (C35)	m³	33.40
Roof beam reinforcement (HRB400)	t	6.28
Roof beam formwork	㎡	600.00
First-floor column concrete (C35)	m³	13.06
First-floor column reinforcement (HRB400)	t	2.90
First-floor column formwork	㎡	130.56
Roof slab concrete (C35)	m³	39.88
Roof slab reinforcement (HRB400)	t	4.30
Roof slab formwork	㎡	392.60