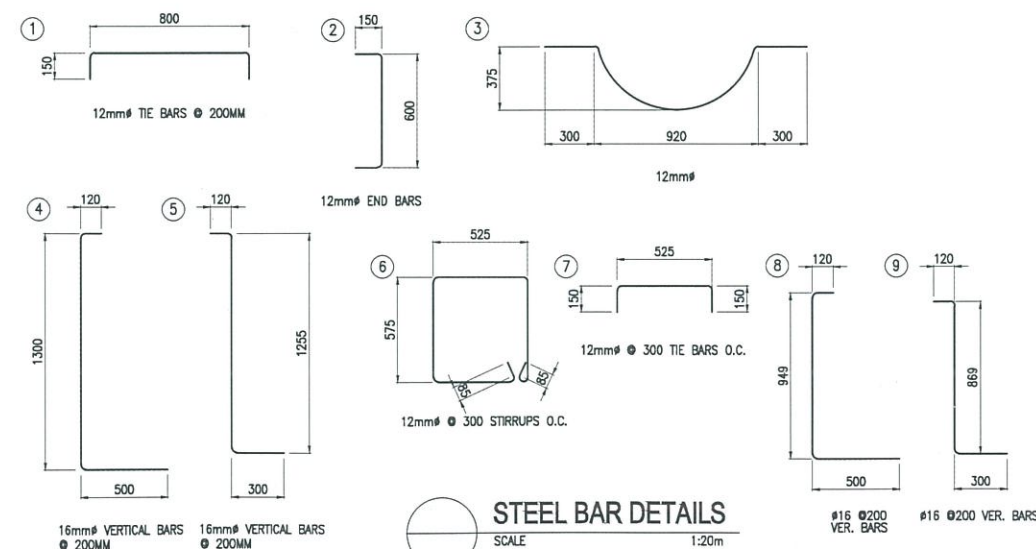
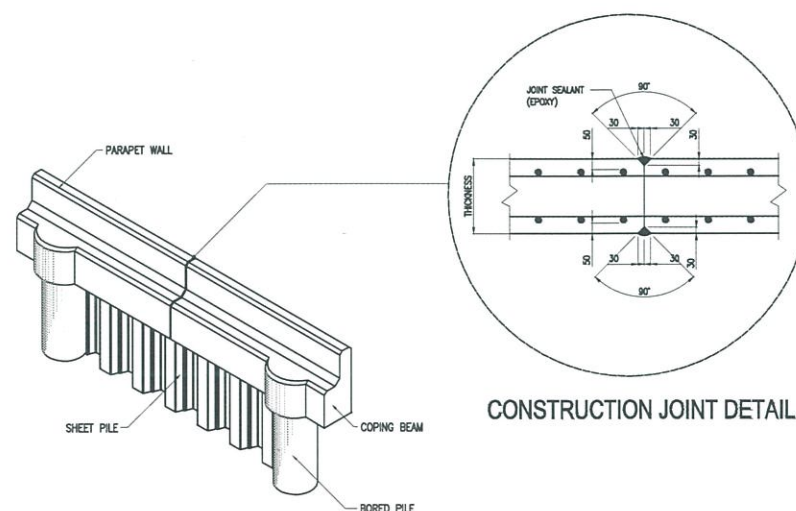
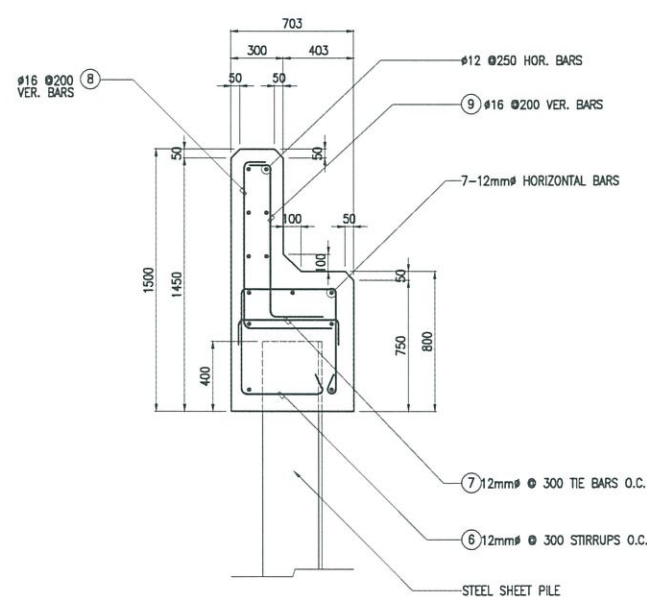
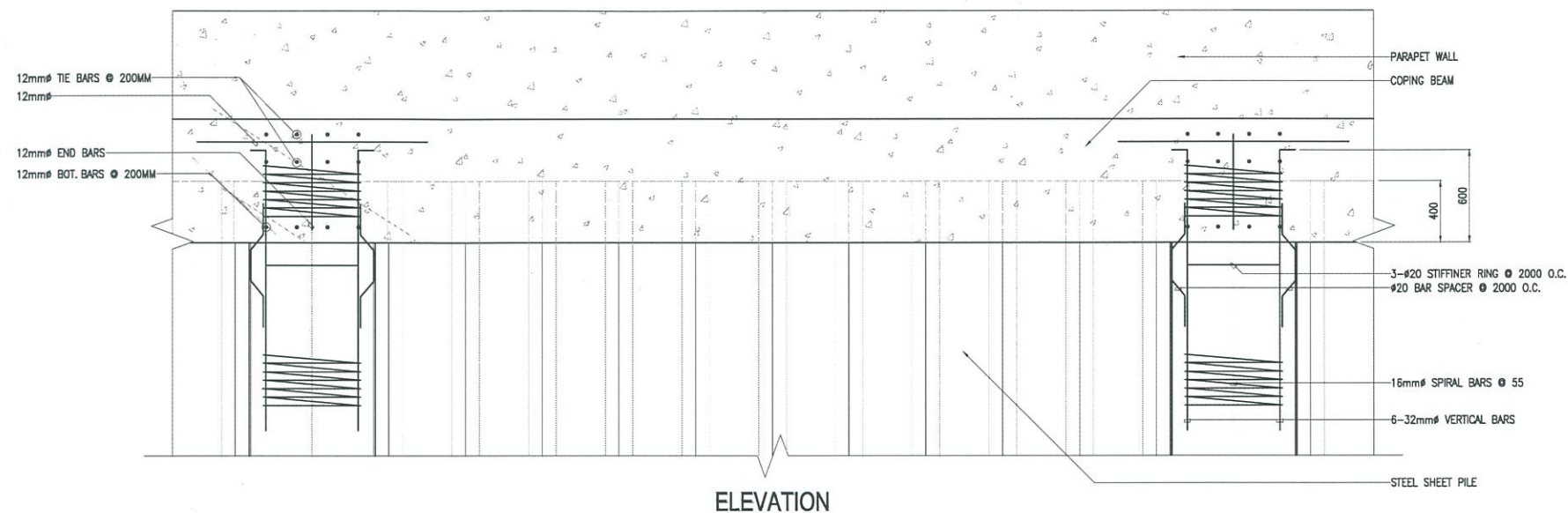
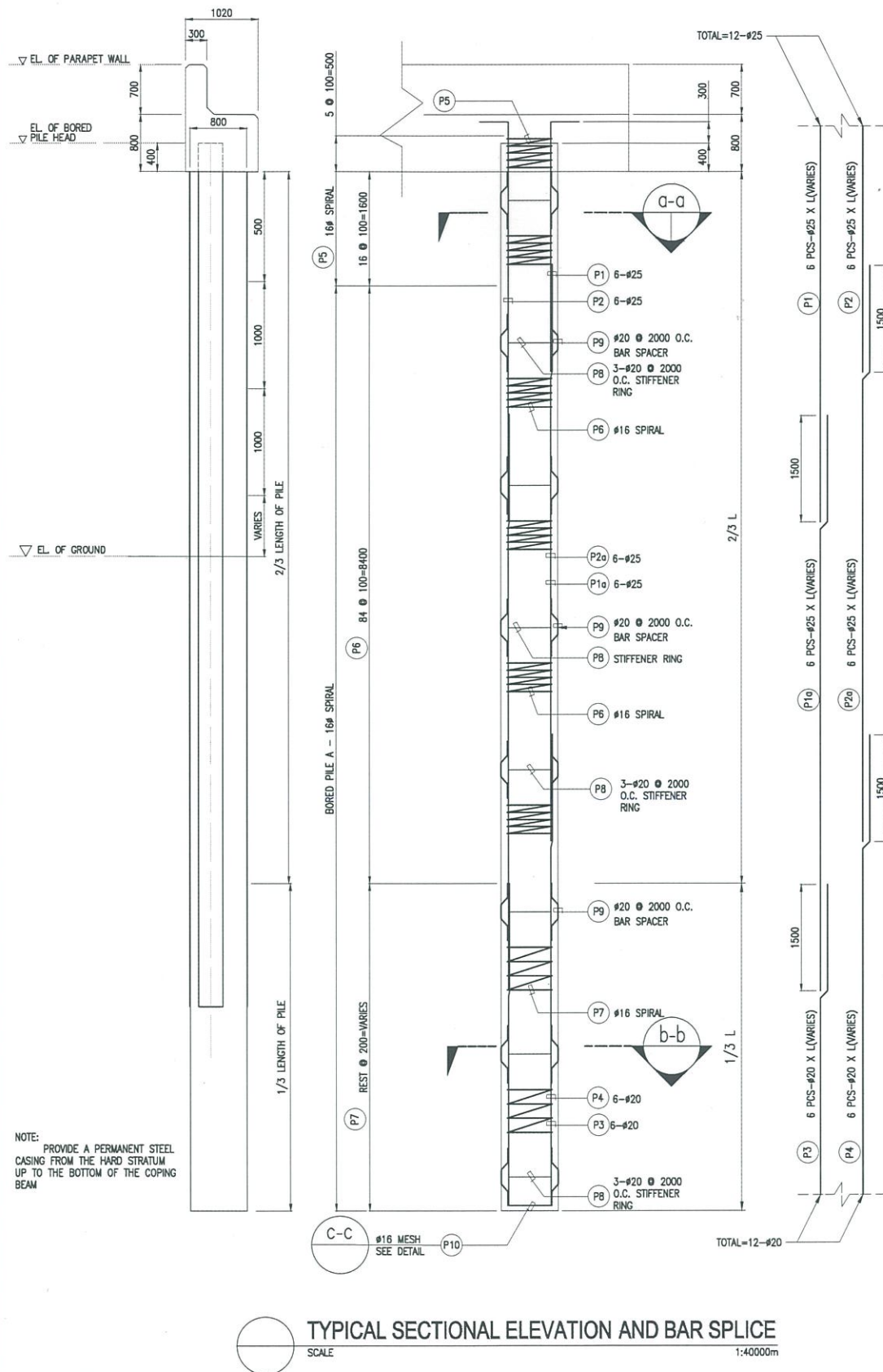


REPUBLIC OF THE PHILIPPINES  
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS  
**BUREAU OF DESIGN, WATER PROJECTS DIVISION**  
BONIFACIO DRIVE, PORT AREA, MANILA

# **STANDARD COMBINATION OF BORED/STEEL SHEET PILE FOR BANK PROTECTION**







SCHEDULE OF REINFORCEMENT FOR STANDARD 15M LENGTH BORED PILE												
BAR BENDING DIAGRAM												
PILE DIAMETER (mm) = 800												
BAR MARK	DIA (mm)	QUANTITY	SPACING (mm)	BAR BENDING SHAPE	PILE LENGTH, L (mm) 15000			LENGTH EACH BAR (mm)	TOTAL BAR LENGTH (m)	UNIT WEIGHT (kg/m)	TOTAL WEIGHT (kg)	CONCRETE (m³)
					a	b	c					
P1	25	6	as shown	A	6000			6000	36.000	3.853	138.720	7.340
P2	25	6	as shown	A	3900			3900	23.400	3.853	90.170	
P1a	25	6	as shown	A	8100			8100	48.600	3.853	187.270	
P2a	25	6	as shown	A	8100			8100	48.600	3.853	187.270	
P3	20	6	as shown	A	4600			4600	27.600	2.466	68.070	
P4	20	6	as shown	A	6700			6700	40.200	2.466	99.140	
P5	16	21	as shown	B	600	100 (min)	200 (max)	1885	39.590	1.578	62.480	
P6	16	84	as shown	B	600	100 (min)	200 (max)	1885	158.340	1.578	249.910	
P7	16	22	as shown	B	600	100 (min)	200 (max)	1885	41.470	1.578	65.450	
P8	20	24	2000	D	1630	800		2430	58.320	2.466	143.830	
P9	20	48	2000	C	200	100	200	800	38.400	2.466	94.700	
P10	16	10	150	A	600			600	6.000	1.578	9.470	
TOTAL (GRADE 60):											1396.480	

NOTE: THE ALLOWABLE BEARING CAPACITIES OF BORED PILES AT NORMAL CONDITION SHALL BE AS SHOWN BELOW:

PILE DIAMETER (mm)	PILE LENGTH (M)	REQUIRED ULTIMATE BEARING CAPACITY (kN)	ALLOWABLE BEARING CAPACITY (kN)
800	15.000	2134.940	1067.470

THE DIAMETER OF THE BORED PILE AND REINFORCING BAR SIZES, ARRANGEMENT AND SPACING INDICATED ARE STANDARD FOR THE INTENDED LENGTH OF 15 METERS UNDER NORMAL CONDITIONS AND SHALL BE SUBJECTED FOR ANALYSIS IN CASE THE NECESSARY BEARING CAPACITY INDICATED ABOVE IS NOT MET AND LONGER PILES ARE REQUIRED.

#### NOTES:

##### A. GENERAL:

INDICATED DIMENSIONS SHALL GOVERN AND DISTANCES OR SIZES SHALL NOT BE SCALED FOR CONSTRUCTION PURPOSES.

##### B. MATERIALS:

1. MINIMUM COMPRESSIVE STRENGTH OF CONCRETE @ 28 DAYS SHALL BE,  $f'_c = 21 \text{ MPa}$ .

2. ALL REBARS SHALL BE GRADE 60,  $f_y = 414 \text{ MPa}$ .

##### C. SPLICING:

1. SPLICING OF MAIN BARS SHALL BE STAGGERED ALTERNATELY BETWEEN ADJACENT BARS SO AS NOT TO OCCUR AT THE SAME HORIZONTAL PLANE IN ACCORDANCE TO ASHTO ART. 4.6.6.2.2.

2. SPLICES IN SPIRAL REINFORCEMENT SHALL BE LAP SPLICES OF 60 BAR DIAMETER. IN THIS CASE, LAP SPLICES FOR #20 SPIRAL SHALL BE 1000mm WHILE 800mm SHALL BE ADOPTED FOR #16 SPIRAL.

3. ANCHORAGE OF SPIRAL REINFORCEMENT SHALL BE PROVIDED BY 1 1/2 EXTRA TURNS OF SPIRAL BAR AT EACH END OF SPIRAL UNIT.

##### D. CAST-IN-PLACE (CIP) CONCRETE PILE:

1. THE CONSTRUCTION OF CIP PILES SHALL FOLLOW THE REQUIREMENTS OF SPECIFICATIONS FOR CAST-IN-PLACE PILES OR DRILLED SHAFTS.

2. THE ACTUAL LENGTHS OF PILES SHALL BE BASED ON THE SOIL CONDITIONS ENCOUNTERED DURING BORING WHICH WILL YIELD THE REQUIRED BEARING CAPACITY.

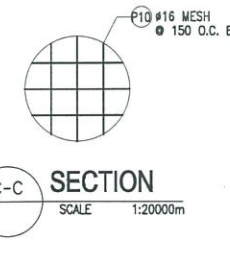
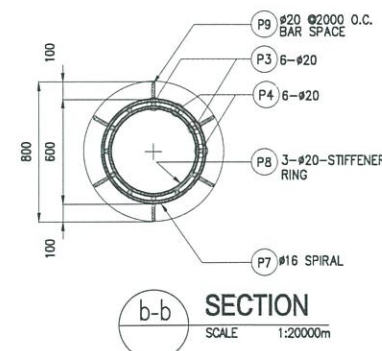
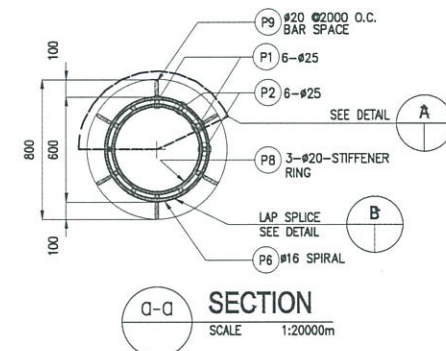
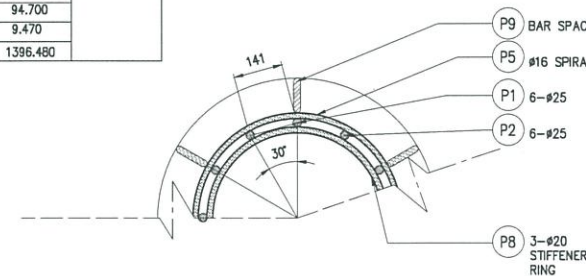
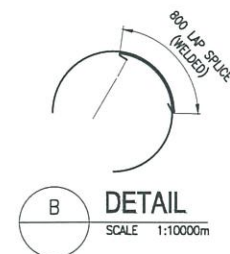
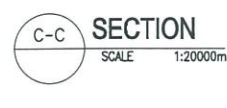
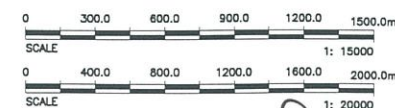
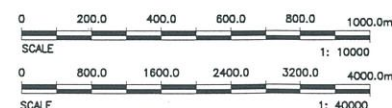
3. BOTTOM OF PILES SHALL BE EMBEDDED AT LEAST THREE PILE DIAMETER (3D) INTO HARD STRATA WITH AN N-VALUE OF AT LEAST 20 CAPABLE OF DEVELOPING THE REQUIRED ULTIMATE BEARING CAPACITY. IF THE ABOVE CONDITION CANNOT BE MET DURING CONSTRUCTION, THE DESIGNER SHALL BE NOTIFIED FOR ADJUSTMENT OF PILE LENGTH IF NECESSARY.

4. AN ON-SITE SUBSURFACE INVESTIGATION SHALL ALSO BE UNDERTAKEN DURING CONSTRUCTION FOR CONFIRMATION/VERIFICATION OF SOIL DATA USED IN THE DESIGN.

5. DRILLED SHAFT SHALL BE CONSTRUCTED IN A STABLE WAY WITHOUT SLOUGHING THE SOIL, AND EXAMINE GROUND WATER. THE HOLE SHALL BE INSPECTED FOR STRAIGHTNESS AND SHALL BE CLEAN OF ALL LOOSE MATERIAL THAT HAVE ACCUMULATED AT THE BOTTOM AFTER DRILLING OPERATIONS. IF BORED PILE CANNOT BE CONSTRUCTED IN DRY CONDITIONS, COMBINATION OF TEMPORARY CASING OR WET METHOD USING BENTONITE MAY BE USED.

6. CONCRETING OF BORED PILE SHALL BE BY TREMIE METHOD. IN CASE OF DRY CONDITION, THE UPPER 3 METERS OF THE CONCRETE SHALL BE CONSOLIDATED BY VIBRATOR.

7. DETAILED METHODOLOGY AID PROCEDURE FOR THE BORED PILE CONSTRUCTION SHALL BE SUBMITTED BY THE CONTRACTOR FOR APPROVAL BY THE ENGINEER AT LEAST ONE WEEK BEFORE START OF BORED PILING WORKS.



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SHEET TITLE:

STANDARD COMBINATION OF  
BORED/STEEL SHEET PILE FOR BANK  
PROTECTION

SHEET CONTENTS:

TYPICAL SECTIONAL ELEVATION AND BAR  
SPLICE, SCHEDULE OF REINFORCEMENT  
FOR STANDARD 15m LENGTH BORED PILE  
& GENERAL NOTES

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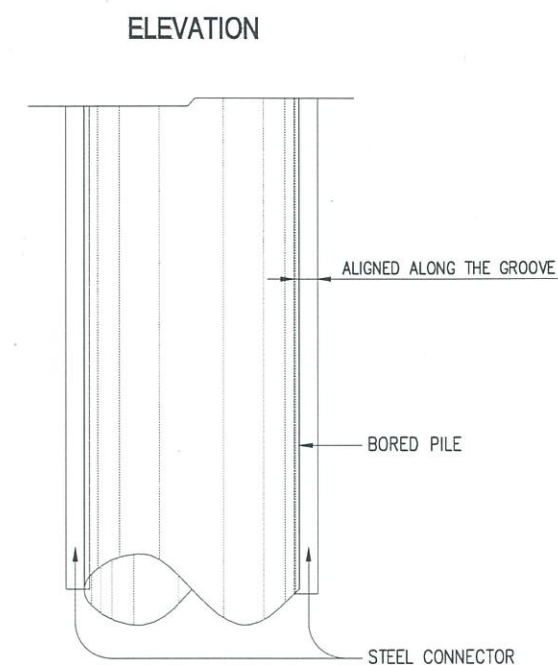
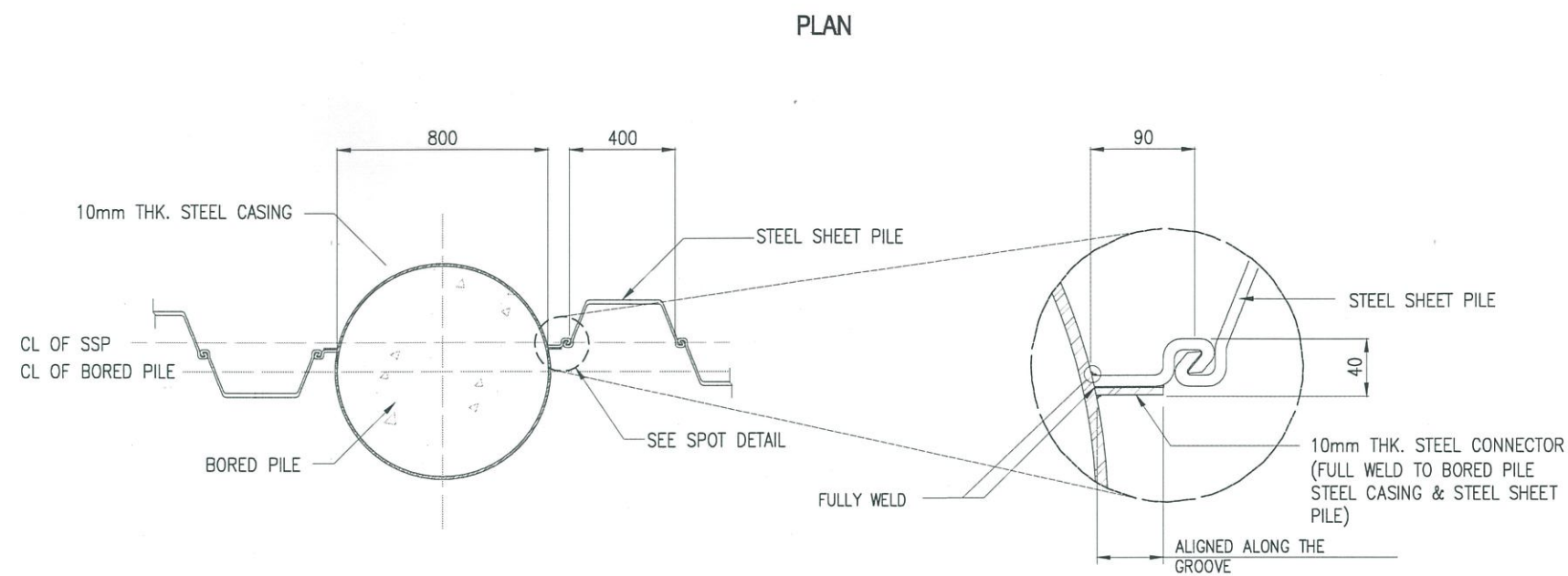
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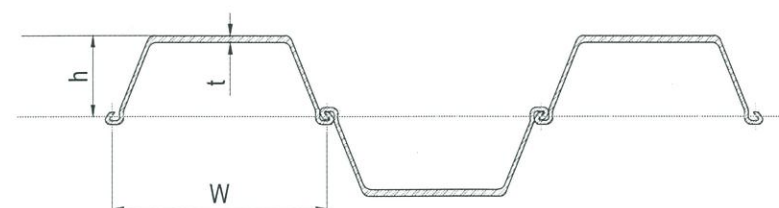




○ TYPICAL BORED PILE TO SSP CONNECTION DETAIL  
NOT TO SCALE

**GENERAL NOTES:**

1. ALL WORK SHALL BE DONE IN ACCORDANCE WITH ALL PROVISIONS IN ITEM 1716-PILING AND ITEM 1717-SHEET PILES OF DPWH STANDARD SPECIFICATIONS.
2. BEFORE ANY WORK BEGINS IN ENVIRONMENTALLY SENSITIVE AREAS, TEMPORARY EROSION CONTROL MEASURES AND PROPER MANAGEMENT PRACTICES SHALL BE IN PLACE.
3. ALL TEMPORARY FENCING FOR PROTECTED AREAS SHALL BE INSTALLED PRIOR TO COMMENCEMENT OF WORK.
4. LOW GROUND DISTURBING EQUIPMENT SHALL BE UTILIZED IN ENVIRONMENTALLY SENSITIVE AREAS AS APPROVED BY THE CIVIL ENGINEER-IN-CHARGE.
5. STEEL SHEET PILES SHALL MEET THE REQUIREMENTS OF AASHTO M 202 (ASTM A328), OR AASHTO M 223. THE JOINTS SHALL BE PRACTICALLY WATER-TIGHT WHEN THE PILES ARE IN PLACE.
6. SHEET PILES SHALL BE DRIVEN TO ELEVATION SHOWN IN THE PLAN OR AS DIRECTED BY ENGINEER-IN-CHARGE.
7. THE REQUIREMENTS GOVERNING THE INSTALLATION OF SHEET PILING SHALL CONFORM IN GENERAL TO THOSE GOVERNING BEARING PILES AS SET FORTH UNDER ITEM 400-PILING OF DPWH STANDARD SPECIFICATION.
8. THE LENGTH AND SECTION MODULUS OF STEEL SHEET PILE SHALL BE BASED ON THE RESULT OF THE GEOTECHNICAL INVESTIGATION AND STABILITY ANALYSES.



W = WIDTH, h = HEIGHT, t = THICKNESS

○ STEEL SHEET PILE DETAIL  
NOT TO SCALE

**NOTE:**

1. THE STEEL CONNECTOR TO BE WELDED ALONGSIDE OF THE STEEL CASING OF THE BORED PILE SHALL HAVE A LENGTH EQUAL TO THE LENGTH OF THE ADJACENT STEEL SHEET PILE.
2. ALL SURFACES TO BE WELDED SHOULD BE FREE OF PAINT, SLAG, LOOSE SCALE, RUST AND OTHER FOREIGN MATERIALS.
3. GROOVE WELD SHALL EXTEND THE FULL LENGTH DIAMETER OF THE BORED PILE CASING DESIGN CRITERIA:  
  
WELDING (SMAW PROCESS)  
CAPACITY OF WELDING =  $0.707T + 0.3FU$   
ALLOWABLE SHEARING STRESS =  $0.30FU$   
MILD STEEL ELECTRODE, LOW HYDROGEN AWS/ASME: 5.1: E7016  
TENSILE STRENGTH = 595 MPA  
YIELDING STRENGTH = 450 MPA  
FU = 483 MPA
4. THE CENTERLINE OF SSP SHALL HAVE PARALLEL DISTANCE FROM THE CENTERLINE OF THE BORED PILE OF AT LEAST HALF THE HEIGHT OF THE SSP BUT NOT GREATER THAN  $\frac{1}{6}$  OF THE DIAMETER OF THE BORED PILE.



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