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Hubert Pélouin, Ing.  
MARITIME STRUCTURES

**END OF SECTION**

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**END OF SECTION**

## **Part 1 General**

### **1.1 SCOPE**

- .1 This specification details the requirements for the supply and performance of conic marine fenders as shown on the project drawings. The fender systems also include all the assemblies, fasteners, accessories, chains and anchors required for their complete installation in concrete.
- .2 The scope of work includes the steel panels design to which the Ultra High Molecular Weight Polyethylene (UHMW-PE) pads and conic fender will be attached. In addition, the design and supply of all connections, fasteners, accessories, UHMW-PE pads, as well as all chain systems with hardware and anchors are included.

### **1.2 REFERENCE STANDARDS**

- .1 ASTM International
  - .1 ASTM A123, Standard Specification for Zinc Coating (Hot-Dip Galvanized) on Iron and Steel Products
  - .2 ASTM A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  - .3 ASTM D395-16e1, Test Methods for Rubber Property - Compression Set.
  - .4 ASTM D412-16, Test Methods for Rubber Properties in Tension.
  - .5 ASTM D429-14, Test Methods for Rubber Property - Adhesion to Rigid Substrates.
  - .6 ASTM D471-16a, Test Methods for Rubber Property - Effect of Liquids.
  - .7 ASTM 84, Specification for Titanium Dioxide Pigments.
  - .8 ASTM D573-04 (2015), Test Methods for Rubber - Deterioration in an Air Oven.
  - .9 ASTM D1053-92a (2012), Test Methods for Rubber Property - Stiffening at Low Temperatures: Flexible Polymers and Coated Fabrics.
  - .10 ASTM D2240-15e1, Test Methods for Rubber Property - Durometer Hardness.
  - .11 ASTM D256-10e1, Standard test methods for determining the Izod Pendulum Impact Resistance of Plastics.
  - .12 ASTM D570-98 (2010), Standard test method for water absorption of plastics.
  - .13 ASTM D1149-16, Standard test methods for rubber deterioration - Cracking in an Ozone Controlled Environment.
  - .14 ASTM A 307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .15 ASTM A572 / A572M-15 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- .2 ASME American Society of Mechanical Engineering
  - .1 ASME B30-26-2015 (R2020) Rigging Hardware

- .3 International Organization for Standardization (ISO)
  - .1 ISO 1183-1:2012, Plastics- Method for determining the density of non-cellular plastics.
  - .2 ISO 8295:1995, Plastics- Film and sheeting- Determination of coefficient of friction.
  - .3 ISO 527:2012 (Part 1 & 2), Plastics - Determination of tensile properties.
  - .4 ISO 2039-1:2001, Plastics-Determination of hardness- Part 1: Ball indentation method.
  - .5 ISO 868:2003, Plastics and ebonite-Determination of indentation hardness by means of a durometer (Shore hardness).
  - .6 ISO 15527:2010, Plastics-Compression-moulded sheets of polyethylene (PE-UHMW, PE-HD) - Requirements and test methods.
  - .7 ISO 12944, Corrosion Protection Of Steel By Protective Paint (Latest Edition of different parts).
- .4 British Standard (BS)
  - .1 BS903-A9: 1988 – Methods of testing vulcanized rubber part 9: Determination of abrasion resistance.
  - .2 BS ISO 4649: 2010 - Rubber, vulcanized or thermoplastic. Determination of abrasion resistance using a rotating cylindrical drum device.
  - .3 BS903-A21: 1997 – Physical testing of rubber. Determination of rubber to metal bond strength.
  - .4 BS ISO 813: 2016 - Rubber, vulcanized or thermoplastic. Determination of adhesion to a rigid substrate. 90°C peel method.
  - .5 AIPCN-PIANC 2002 – Recommandations relatives au dimensionnement de système de défense.
- .5 Office des normes générales du Canada (CGSB)
  - .1 CAN/CGSB-1.181-92, Zinc coating, organic and prepared.
  - .2 Association canadienne de normalisation (CSA)/CSA International.
  - .3 CSA G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .4 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .5 CSA S16-09, Design of Steel Structures.
  - .6 CSA S16-19, Canadian Highway Bridge Design Code
  - .7 CSA W47.1-F03, Certification of welding companies.
  - .8 CSA W48-06, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
  - .9 CSA W59-M03(R2008), Welded Steel Construction (Metal Arc Welding) Metric.

### **1.3 MANUFACTURER QUALIFICATIONS**

- .1 Fender manufacturer shall meet the following minimum requirements:
  - .1 Experience - Minimum of 20 years' experience manufacturing conic fenders of the type specified.
  - .2 Provide a list of not less than 20 completed projects where a similar fender has been installed for a minimum of 5 years.
  - .3 Provide a list of not less than 3 completed projects exposed to arctic and icy conditions where a similar fender has been installed for a minimum of 5 years.
  - .4 Manufacturing - Facility in which the fenders are manufactured shall have the following certifications:
    - .1 Quality Management System - ISO9001:2008.
    - .2 Environmental Management System – ISO14001:2004

### **1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 All documents submitted as part of the fender of berthing systems quality assurance should be in English or in French in their original version. No further translation will be accepted.
- .2 Shop Drawings:
  - .1 Submit calculation notes and shop drawings stamped and signed by professional engineer registered or licensed in the Quebec province, Canada.
  - .2 Indicate items as follows:
    - .1 General arrangement of fender units.
    - .2 Rubber fender geometry.
    - .3 Arrangement and attachment method to the steel panels.
    - .4 Structural details and design calculations for fenders.
    - .5 Structural details and design calculations for Supporting system, hardware parts (chains, shackles, etc.) and connection to the existing concrete structures (location, grades and sizes of anchor bolts, etc.).
    - .6 Structural details and design calculations for Fender panel, including surface coating (design criteria, materials, etc.).
    - .7 Fabrication and assembly details of the steel panel, including surface coating.
  - .3 Delivery schedules for fender systems shall be submitted with shop drawings.
- .3 Test and Evaluation Reports: submit reports signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Submit the certificate of quality ISO 9002 or equivalent of the manufacturer of defense systems.
- .5 Certificate of conformity of the rubber fender delivered to the requirements of this specification. Submit the documents signed by the manufacturer certifying that products, materials and equipment comply with the requirements as to the characteristics and performance criteria.

- .6 Each conic fender shall have serial number identification allowing traceability from manufacture to delivery to the job site.
  - .1 All documents requested below shall be provided simultaneously assembled and clearly identify the serial numbers of the fenders delivered, as well as the lot numbers or other means of identification.
- .7 The documents to be submitted are the following:
  - .1 Full scale mechanical property performance test curves and results for each fender tested according to PIANC 2002 recommendations. It is required that 2 fenders from the delivered lot be tested.
  - .2 Test reports of all mechanical and chemical properties of rubber fenders from the production lot of the fenders, according to the requirements of Tables 1 - Mechanical properties of fenders and 2 - Chemical properties of rubber fenders (rubber composition).
  - .3 Certificate of approval from an independent firm for the supervision of tests on the performance of the fenders and the physical properties of the rubber of the fenders.
  - .4 Certificate of conformity on the performance of the fenders and on the physical properties of the rubber of the fenders.
  - .5 Certificate of conformity of the UHMW-PE rubbing pads delivered to the requirements of these specifications. Submit documents signed by the manufacturer certifying that the products, materials and equipment comply with the physical, chemical and performance requirements.
  - .6 Certificate of conformity of steel, including panels, chains and fixing accessories) delivered to the requirements of these specifications. Submit documents signed by the manufacturer certifying that the products, materials and equipment comply with the physical, chemical and performance requirements.
    - .1 Certificates of physical and chemical tests in the plant;
    - .2 Welder qualification certificates;
    - .3 Welding procedures;
    - .4 Dimensional inspection report (including flatness for the panels);
    - .5 Inspection report on the tightness of the welds (pressurization of the panel);
    - .6 Report on paint application (paint used, temperature, humidity, dew point etc.);
    - .7 Certificate of conformity stipulating that the paint applied meets the required warranty for the specified conditions of use.
    - .8 Report on the dry film thickness of the applied paint layers;
    - .9 Certificates of conformity for all steel elements;
    - .10 Tests on the resistance of chains (after galvanization);
    - .11 Certificates of chemical and physical factory tests of chains;
    - .12 Certificate of conformity of hot-dip galvanizing (chains);
    - .13 Certificates of chemical and physical tests in factory (fixing accessories).

## **1.5 WARRANTY**

- .1 Delivered products must have a minimum 5-year warranty.
- .2 Warranty shall cover defects in compliance with the material and performance specifications of the fender systems delivered under the conditions of use stated in this specification.

## **1.6 QUALITY ASSURANCE AND CONTROL**

- .1 PWSGC reserves the right to carry out, at its own expense, any additional testing it deems necessary on new fender systems delivered to the site. PWSGC reserves the right, among other things and without limitation, to conduct independent sampling, testing and trials on the materials and all components of the new fender systems, including full-scale performance tests, to ensure the quality and compliance with specifications and certificates of the products delivered.
- .2 In the event that any component of a fender system fails to meet the technical specifications, the Vendor shall replace the component or complete defence system to the satisfaction of the Departmental representative at his own expense.
- .3 Any additional sampling, testing or testing required as a result of the failure of a test conducted on behalf of PWSGC shall be at the Vendor's expense.
- .4 No delay caused by the failure of a test shall result in any additional cost to PWSGC or delay in the delivery of the project.
- .5 PWSGC also reserves the right to apply penalties to the Vendor.

## **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations.
  - .2 Store and protect materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **1.8 FENDER SYSTEMS DESIGN CRITERIA**

- .1 Minimum energy absorption capacity at 72 % deflection: 540 kN-m
- .2 Maximum allowable reaction at minimum energy absorption capacity: 965 kN
- .3 The vessel is belted as shown on the attached set of drawings. The fender panels shall be designed to accommodate the vessel's belt for all water level conditions, including a 0.6m Sea Level Rise allowance.
- .4 The vessel berthing velocity to be considered is: 0.18 m/s
- .5 The vessel berthing angle to be considered is 6°.

- .6 Mean annual maximum and minimum temperatures are +27 °C and -25 °C respectively.
- .7 Chains, hardware parts and anchors:
  - .1 Weight chains, if required, shall be designed to support the dead weight of the fender system (including ice accretion loads according to CSA S6-19) and the downward force induced by friction on the ship's hatch during loading operations.
  - .2 Shear chains shall be designed for the horizontal force induced by the berthing of the ship.
  - .3 Additional chains might be required depending on the point of contact of the vessel on the fender panels.
  - .4 Hardware parts and anchors shall be designed to support all loads caused by berthing of vessel and ice accretion loads.

## Part 2 Products

### 2.1 MATERIALS

- .1 Rubber fender, conic type
  - .1 Material: Rubber fender must be a natural material, vulcanized, synthetic or a mixture of both and must be resistant to ageing, UV and abrasion. In addition, rubber must be of uniform quality and must contain no bubbles, cracks, tear or foreign materials.
  - .2 Each defence system is composed of one conic element with a height of 1 200 mm maximum, positioned as shown on the drawings, having the properties listed in Tables 1 and 2 of this section.
  - .3 The fender unit shall be designed to cope with the low temperatures. Specifically, the fender unit shall be adequately drained to prevent ice build-up within the rubber fender.
  - .4 Mechanical & chemical properties:

*Table 1 - Mechanical properties of rubber fenders*

	Properties	Testing Standard	Requirements
<b>Original</b>	Tensile strength	ASTM D412	16.0 MPa
	Elongation at break	ASDTM D412	350%
	Hardness	ASTM D2240	72° (max)
<b>Aged for 96 hours at 70 °C</b>	Tensile strength	ASTM D412	12.8 MPa
	Elongation at break	ASDTM D412	280 %
	Hardness	ASTM D2240	Original value + 8 ° Shore A



Tear resistance	ASTM D624	70 kN/m
Ozone resistance (50 pphm at 20% strain at 40°C for 100 hours)	ASTM D1149	No cracking visible by eye
Bond Strength Steel to rubber	BS903.A21	7 N/mm (min)

**Table 2 – Chemical properties of rubber fenders**

Properties	Testing Standard	Requirements
Density	ISO 2781	Max 1.2 g/cm <sup>3</sup>
Polymer (rubber)	ASTM D6370	Min 45%
Carbon black	ASTM D6370	Min 20%
Ash	ASTM D297	Max 5%

- .5 The maximum tolerance on the performance of the fenders (absorbed energy and reaction) is  $\pm 10\%$ .
- .6 To be monolithic construction.
- .7 Bolts connecting the cone to panel shall conform to ASTM F3125 Grade A325. Bolts shall be hot dip galvanized to ASTM A123 or A153.
- .2 Steel panels
  - .1 Dimension: 3200 mm height (without chamfers). The width must be designed to account for the maximum hull pressure and belt arrangement for the design vessel.
  - .2 Chamfers on the 4 sides of the panels of a minimum of 150 mm by 150 mm.
  - .3 Steel shall be Grade 350W according to CSA G40.20/21 or Grade 50 according to ASTM A572.
  - .4 Steel panels and fender systems must be closed and watertight to prevent corrosion.
  - .5 All steel shall be coated with a high abrasion resistant epoxy paint system proven to be suitable for the above conditions. Paint shall be applied according to manufacturer's recommendations.
  - .6 Paint System shall have a minimum Total NDFT of 450 microns min, and shall conform to ISO 12944, exposure class : C5M, durability class :H. Paint system shall be applied according to the manufacturer's instructions. Preparation of the surface must also be in accordance with the instructions of the manufacturer with a minimum of SSPC SP1 (Solvent Cleaning) and SP6 (Commercial sand blasting).
  - .7 Paint Color shall be approved by the Departmental Representative.
- .3 Rubbing pads:

- .1 Material: Ultra High Molecular Weight Polyethylene (UHMW-PE) low friction coating with a minimum thickness of 50 mm and having the properties presented in Table 3.
- .2 The pads consist of several sections to be sized by the manufacturer.
- .3 Shall have a smooth finish.
- .4 Surface coating shall be protected against ultraviolet (UV) rays with a minimum of 2.5% stabilizer.
- .5 Surface coating shall be ozone resistant and rot-proof.
- .6 Color: black
- .7 Physical properties:

*Table 3 – UHMW-PE Properties*

Properties	Testing Standard	Requirements
Yield Strength	ISO 527	17 N/mm <sup>2</sup>
Tensile Strength	ISO 527	40 N/mm <sup>2</sup>
Elongation at break	ISO 527	> 50%
Dynamic Friction (PE-Steel)	ISO 8295	0.15-0.20
Density	ISO 1183-1	0.94-0.96 g/cm <sup>3</sup>
Ball hardness (30 s)	ISO 2039-1	38 N/mm <sup>2</sup>
Hardness	ISO 868	63-66 Shore D
Abrasion Index (Sand-slurry)	ISO 15527	100-115
Impact Test Izod	ASTM D256 Method b	No Failure
Water absorption	ASTM D570	0%
Color		Black

- .8 Bolts connecting the UHMW pads to the panel shall conform to ASTM F3125 Grade A325. Bolts shall be hot dip galvanized to ASTM A123 or A153.
- .4 All chains, accessories and hardware required for the installation of fender panels on existing concrete shall be made of hot galvanized steel. In addition, their dimensions shall be according to the fender manufacturer's specifications.
  - .1 Hardware parts: hot-dip galvanized as per ASTM A153, conform to ASME B30.26 standard.

- .2 Steel plates: hot-dip galvanized as per ASTM A123, conforming to CAN/CSA-G40.21 standard of grade 350W or better.
  - .1 All steel plates to be installed on the vertical face of the dock must be levelled with SikaGrout 212 type mortar with a minimum thickness of 25 mm, according to the manufacturer's specifications.
- .3 Anchoring of fender systems to the wharf, including anchors for attaching chains to the wharf:
  - .1 The dimension and depth of the fender anchorages must be calculated considering a concrete strength of the existing structure of  $f'_c = 35$  MPa. In addition, an outer layer of 50 mm must be ignored in the anchor strength calculation.
- .4 Chain tensioners shall be provided to ensure that the weight of the steel panel is fully absorbed by the vertical chains.
- .5 Chain tensioners shall be provided to ensure that horizontal forces in the steel panel are absorbed by shear chains.
- .6 One shackle per chain shall be provided to act as a fuse to prevent damage to the panel and dock.
- .7 All chains shall be completely covered by strong rubber sleeves. The rubber sleeve may be made of rubber reinforced with synthetic-tire-cord. The standard color of the rubber sleeve shall be black.

## **2.2 TESTS AND INSPECTIONS**

- .1 A scale load test is to be performed on two fenders.
- .2 Furnish complete details of each scale test which demonstrates conformance to energy absorption and reaction criteria within 6 weeks of award of contract. Details of test procedure will be subject to approval of the Departmental Representative. Tests to be conducted at manufacturer's plant. The tests could be conducted under supervision of Departmental Representative.
- .3 Acceptance criteria: as described in the previous sections
- .4 Rubber Compound Analysis: after production of fenders, the manufacturer will be required to submit two 50-gram samples collected from the final product. The Client reserves the right to witness the sampling. The sample does not necessarily have to be in one piece, it can be thin pieces sliced or scraped by a sharp knife from the fender body without damaging the fender. If the fender sample collection is damaged, it shall be repaired before the product is dispatched. The manufacturer will submit this sample to an independent third party approved by the Departmental Representative for testing, to ensure that the final product adheres to the compound specification listed above. If the samples tested do not satisfy the specification, the entire batch of fenders will be rejected. The Departmental Representative reserves the right to request a second sample to confirm results from the initial testing. The manufacturer will only apply a test certificate to the final products once they have satisfied the criteria listed above.

## **2.3 SPARE PARTS**

- .1 Spare parts for operation on a 2-yr period shall be included.

**Part 3            Execution**

**3.1                NOT APPLICABLE**

**END OF SECTION**

## **Part 1 General**

### **1.1 SCOPE**

- .1 This section describes the requirements for the marine bollards.

### **1.2 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A27/A27M-17, Standard Specification for Steel Castings, Carbon, for General Application.
  - .2 ASTM A48/A148M-03 (2016), Standard Specification for Steel Castings, High-Strength, for Structural Purposes.
  - .3 ASTM A781-20a, Standard Specification for Castings, Steel and Alloy, Common requirements, for General Industrial Use.
  - .4 ASTM E186-15, Standard Reference Radiographs for Heavy-Walled (2 to 4,5 in. Steel Casting)
  - .5 ASTM E446-20 Standard Reference Radiographs for Steel Casting Up to 2 in. (50.8 mm) in Thickness.
  - .6 ASTM E709-15, Standard Guide for Magnetic Particle Testing.
  - .7 ASTM F1554-20, Standard Specification for Anchor Bolts, Steel, 36,55, and 105 ksi Yield Strength.
- .2 American Society of Mechanical Engineers (ASME)
- .3 International Organization for Standardization (ISO)
  - .1 ISO 12944, Corrosion Protection Of Steel By Protective Paint (Latest Edition of all parts of the Standard).
- .4 CSA Group (CSA)
  - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
- .5 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.61-2004, Exterior and Interior Marine Alkyd Enamel.
  - .2 CAN/CGSB-1.212-04, Chromate and Lead Free Marine Primer for Steel and Light Alloy Surfaces.

### **1.3 DESCRIPTION**

- .1 Design Requirements:
  - .1 Some units are to be installed on an existing concrete structure with epoxy grout anchors, and other units are to be installed on a new concrete structure. Refer to the set of drawings supplied for more information.
  - .2 Anchors must be calculated considering a concrete strength of the existing structure of  $f'_c = 35 \text{ MPa}$ .
  - .3 The bollards shall accommodate the following mooring line angles:

- .1 Vertical angle: from -5 to +60 degrees to the horizontal;
- .2 Horizontal angle: from -90 to +90 degrees relative to the wharf front.

#### **1.4 MANUFACTURER QUALIFICATIONS**

- .1 Bollards manufacturer shall meet the following minimum requirements:
  - .1 Experience - Minimum of 20 years' experience manufacturing bollards of the type specified.
  - .2 Provide a list of not less than 20 completed projects where similar bollards have been installed for a minimum of 5 years.
  - .3 Manufacturing - Facility in which the fenders are manufactured shall have the following certifications:
    - .1 Quality Management System - ISO9001:2008.
    - .2 Environmental Management System – ISO14001:2004

#### **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .2 Submit shop drawings stamped and signed by professional engineer registered or licensed in the Québec province, Canada, indicating following items:
  - .1 Bollards dimensions, clearance locations and direction of assemblies as installed on structures.
  - .2 Locations, sizes and installation tolerances of anchor bolts.

#### **1.6 WARRANTY**

- .1 Delivered products must have a minimum 5-year warranty.
- .2 Warranty shall cover defects in compliance with the material and performance specifications of the fender systems delivered under the conditions of use stated in this specification.

#### **1.7 QUALITY ASSURANCE AND CONTROL**

- .1 Manufacturer's Instructions: submit manufacturer's installation instructions.
- .2 The Departmental Representative reserves the right to proceed to destructive or non-destructive tests. The tests will be at the expense of the Departmental Representative, unless the results show a non-compliance of mooring devices as per the plans and specifications. The Vendor shall supply the manufacturing schedule of the mooring devices to the Departmental Representative.
- .3 The Vendor shall supply to the Departmental Representative the steel certificates, traction and resilience test results for each casting as per ASTM A781 standard and provide assistance necessary for additional testing free of charge to the Department's Representative.
- .4 Visual magnetic particles inspections: All accessible surfaces of mooring devices must be visually inspected and magnetic particles tested as per the latest edition of ASTM E709 standard. No abrupt (steep) section change will be tolerated.

- .1 Mooring device surface of borders shall be smooth, free of sand, slag, crack or the other harmful defect.
- .2 Visual and magnetic particles inspections acceptance criteria are as per ASME, section VIII, Division 1, Appendix 6 standard, latest edition.
- .5 Radiography: if the visual and/or magnetic particles inspections show signs of defects, the base plate and neck of one out of three identical model mooring device must be verified by radiography, at the Vendor's expense. For every mooring device found defective by the radiographic examination, two other borders will be X-rayed in the same way at the Vendor's expense.
  - .1 X-rays must be compared with ASTM E446 standard referencing to ASTM E186 standard depending on the X-rayed thickness.
  - .2 The acceptance criteria are as per ASME, section 8, Division 1, Appendix 7 standard, latest edition.
- .6 If the control inspection reveals a defect, the defective part will be discarded or the Vendor will propose a repair method to satisfaction of the Departmental Representative. Such repairs and all other inspections of the defective part will be at the Vendor's expense.

## **1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials off ground and in accordance with manufacturer's recommendations.
  - .2 Store and protect materials from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Bollards: Cast carbon steel
  - .1 Maximum service capacity: Twelve (12) units of 60 M.T and one (1) unit of 75 M.T.
  - .2 Type: mooring device of shape and dimensions of type T-Head.
  - .3 Steel cast respecting the requirements of the ASTM A-27 Grade 70-40.
  - .4 The minimum safety factor on breaking load shall be 2.0.
  - .5 Anchor bolts: meets the requirements of the standard ASTM F1554 Grade 105 (galvanized) as well as the specifications of the manufacturer.
- .2 Paint:
  - 1. Color : Yellow

2. Workshop: Minimum Total NDFT of 450 microns min. according to ISO 12944, exposure class : C5M, durability class :H, and applied according to the manufacturer's instructions. Preparation of the surface must also be in accordance with the instructions of the manufacturer with a minimum of SSPC SP1 (Solvent Cleaning) and SP6 (Commercial sand blasting)
- .3 Grout: shrinkage compensating non-metallic.
- .4 Identification plate of the capacity of bollards:
  - .1 The 3 mm of thickness of 150 mm X 200 mm brass plate.
  - .2 Letter height: 100 mm.

## **2.2 SPARE PARTS**

- .1 Spare parts for operations on a 2-yr period shall be included.

## **Part 3 Execution**

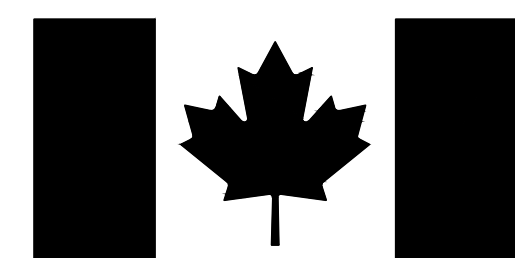
### **3.1 NOT APPLICABLE**

**END OF SECTION**



## **APPENDIX A**

### **DRAWINGS**



Public Works and  
Government Services  
Canada

Travaux publics et  
Services gouvernementaux  
Canada

# WHARF EXTENSION REINFORCEMENT AND NEW FENDERS CAP-AUX-MEULES CANADA PRINCE EDWARD ISLAND

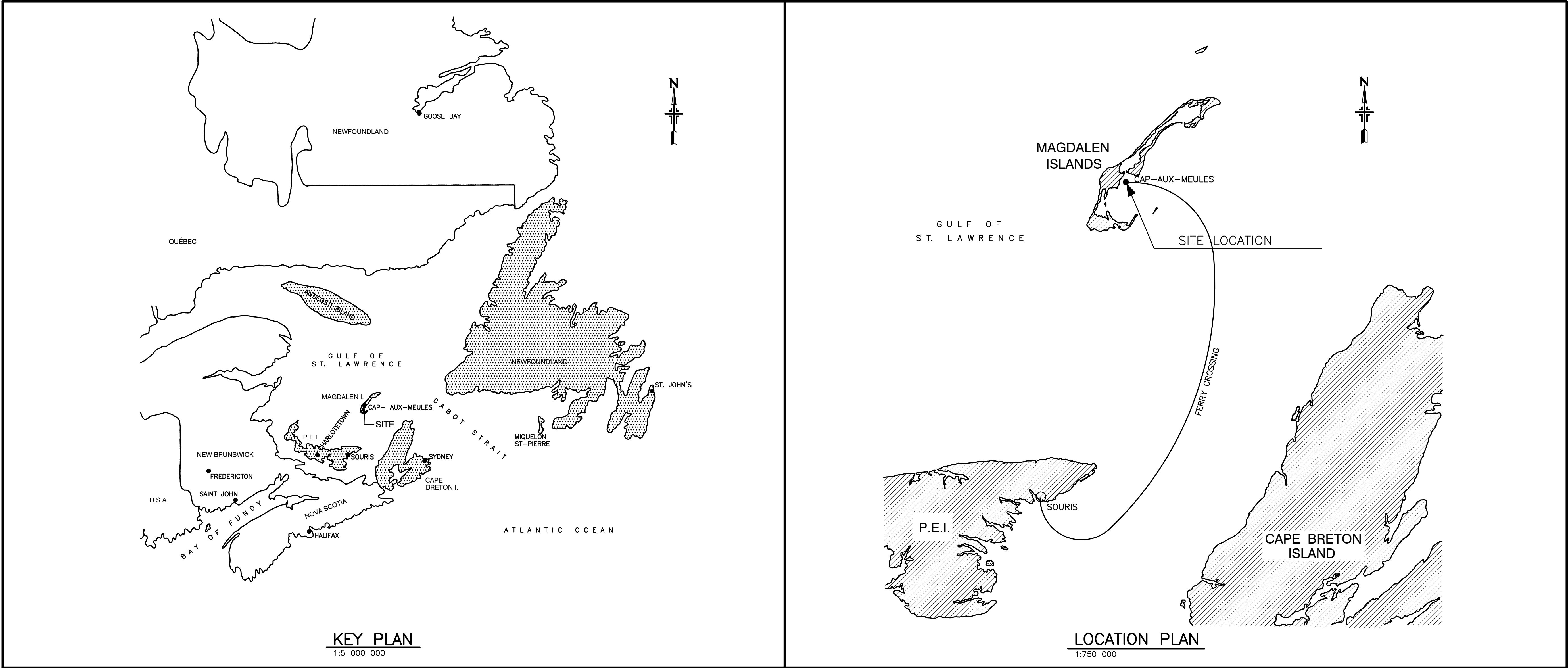
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SUBMISSION : ISSUED FOR BOLLARDS & FENDERS PROCUREMENT PURPOSES



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MONTRÉAL (QUÉBEC) CANADA H3H 1P9  
TÉL. : 514 340-0046 | TÉLÉC. : 514 340-1337 | WWW.WSP.COM

Canada



DRAWING LIST:

- 553216 G01 COVER PAGE
- 553216 G02 KEY PLAN – LOCATION PLAN – DRAWING LIST
- 553216 C01 EXISTING CONDITIONS – GENERAL LAYOUT AND SECTIONS
- 553216 C10 PROPOSED CONDITIONS – GENERAL LAYOUT AND SECTION
- 553216 C11 PROPOSED CONDITIONS – TURNING DOLPHIN DETAILS
- 553216 C20 PROPOSED CONDITIONS – NEW MOORING BOLLARDS DETAILS



Public Works and  
Government Services  
Canada

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Services gouvernementaux  
Canada

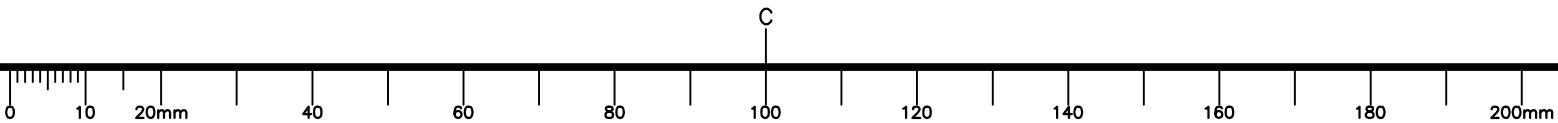


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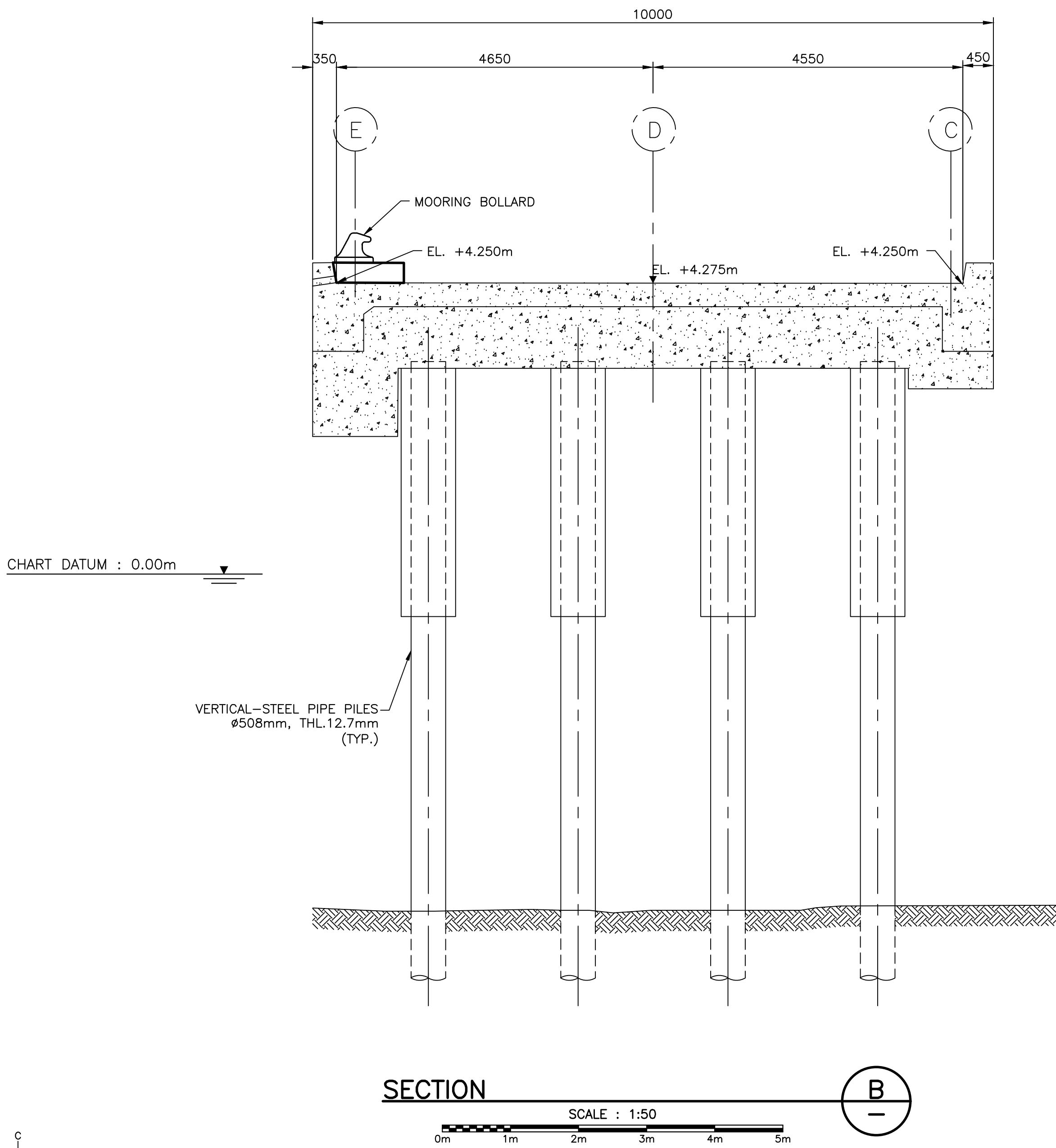
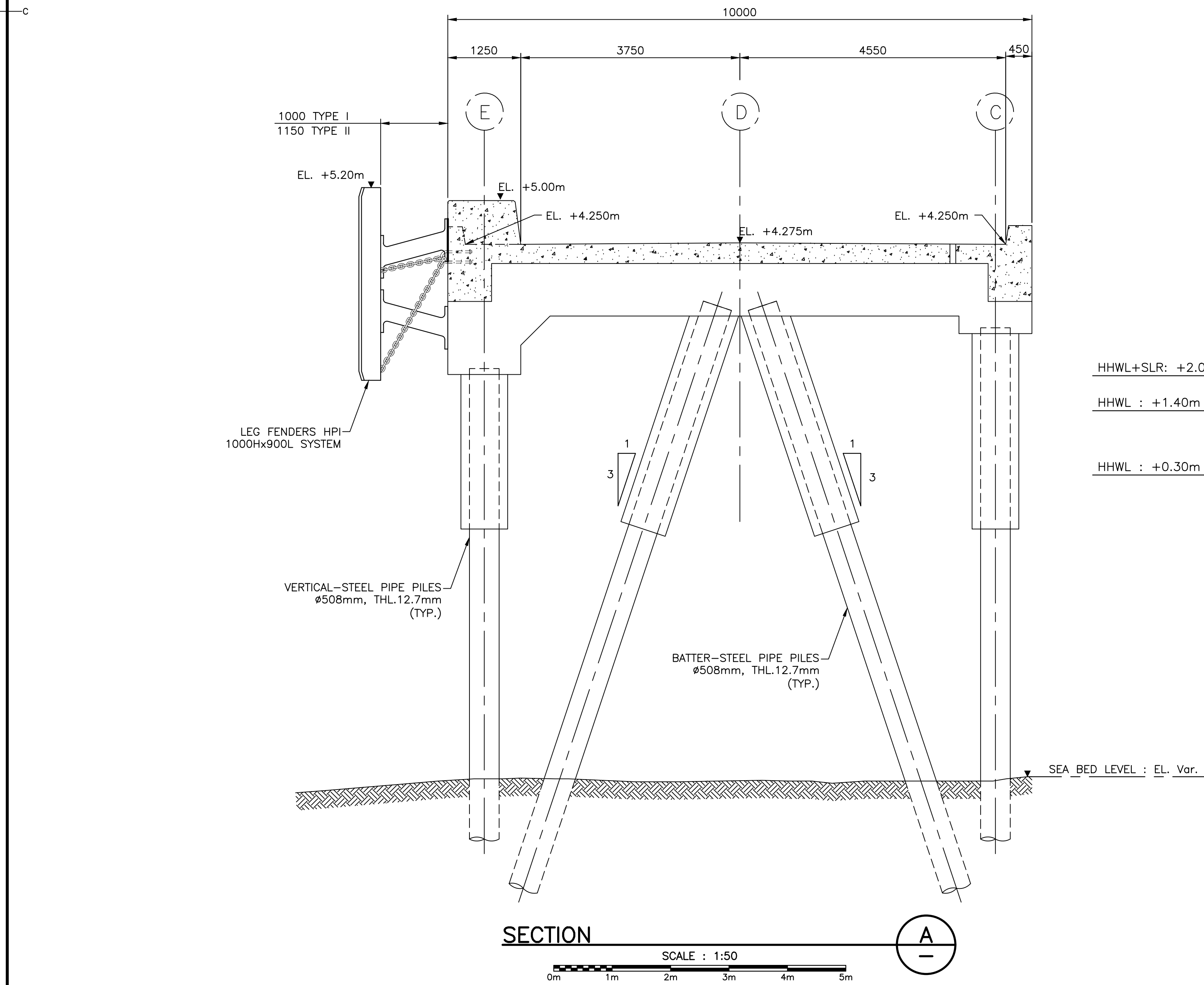
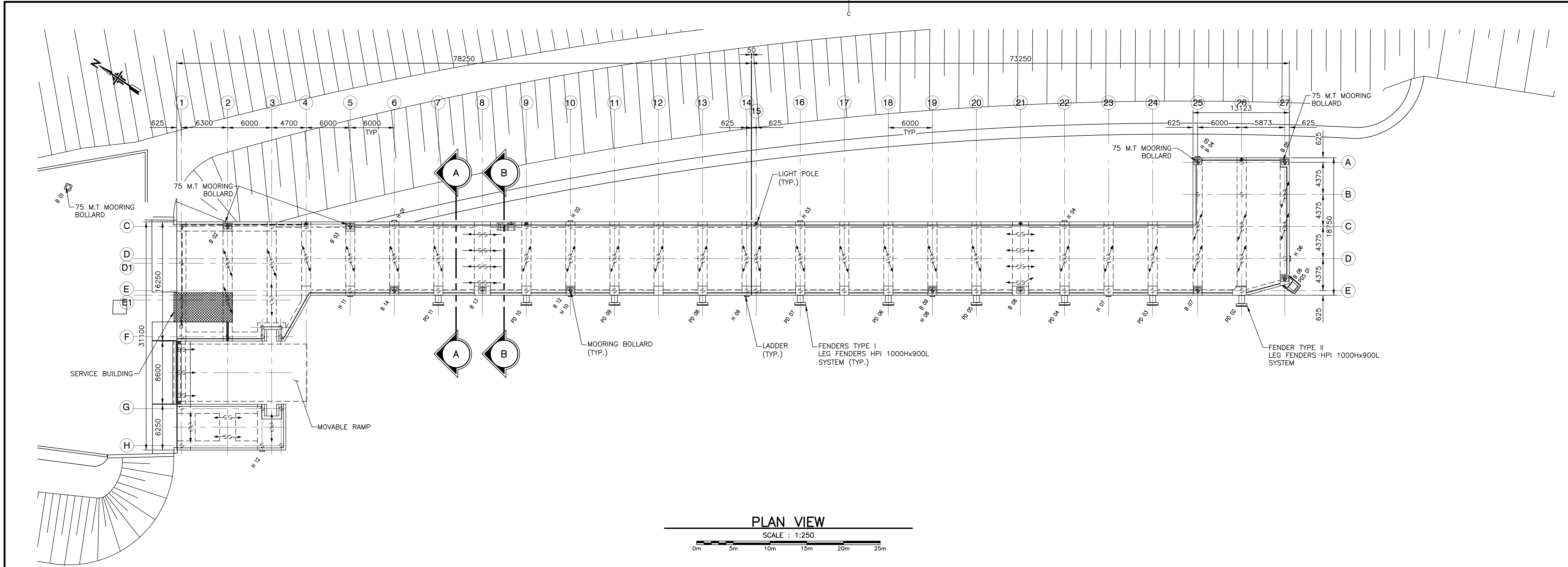
CAUTION

NOT TO BE USED FOR CONSTRUCTION

O	ISSUED FOR BOLLARDS & FENDERS PROCUREMENT PURPOSES	04.14.2021
revisions		date
project	project	
CAP-AUX-MEULES WHARF EXTENSION REINFORCEMENT AND NEW FENDERS		
drawing	dessin	
KEY PLAN LOCATION PLAN DRAWING LIST		
designed	HUBERT PÉLOQUIN, ing.	conçu
date		
drawn	QUIDED JATBI, tech.	dessiné
date		
approved	JHON PAEZ, ing.	approuvé
date		
Tender	Soumission	
PWSSC Project Manager	Administrateur de projets TPSSC	
project number	no. du projet	
R.114048.001		
drawing no.	no. du dessin	
553216-G02		







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CAUTION

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O	ISSUED FOR BOLLARDS & FENDERS PROCUREMENT PURPOSES	04.14.2021
revisions		date
project	CAP-AUX-MEULES WHARF EXTENSION REINFORCEMENT AND NEW FENDERS	
drawing	EXISTING CONDITONS GENERAL LAYOUT AND SECTIONS	
designed	HUBERT PÉLOQUIN, ing.	conçu
drawn	QUIDED JABBI, tech.	dessiné
approved	JHON PAEZ, ing.	approuvé
Tender	Soumission	
PWSSC Project Manager	Administrateur de projets TPSSC	
project number	no. du projet	
R.114048.001		
drawing no.	no. du dessin	
553216-C01		

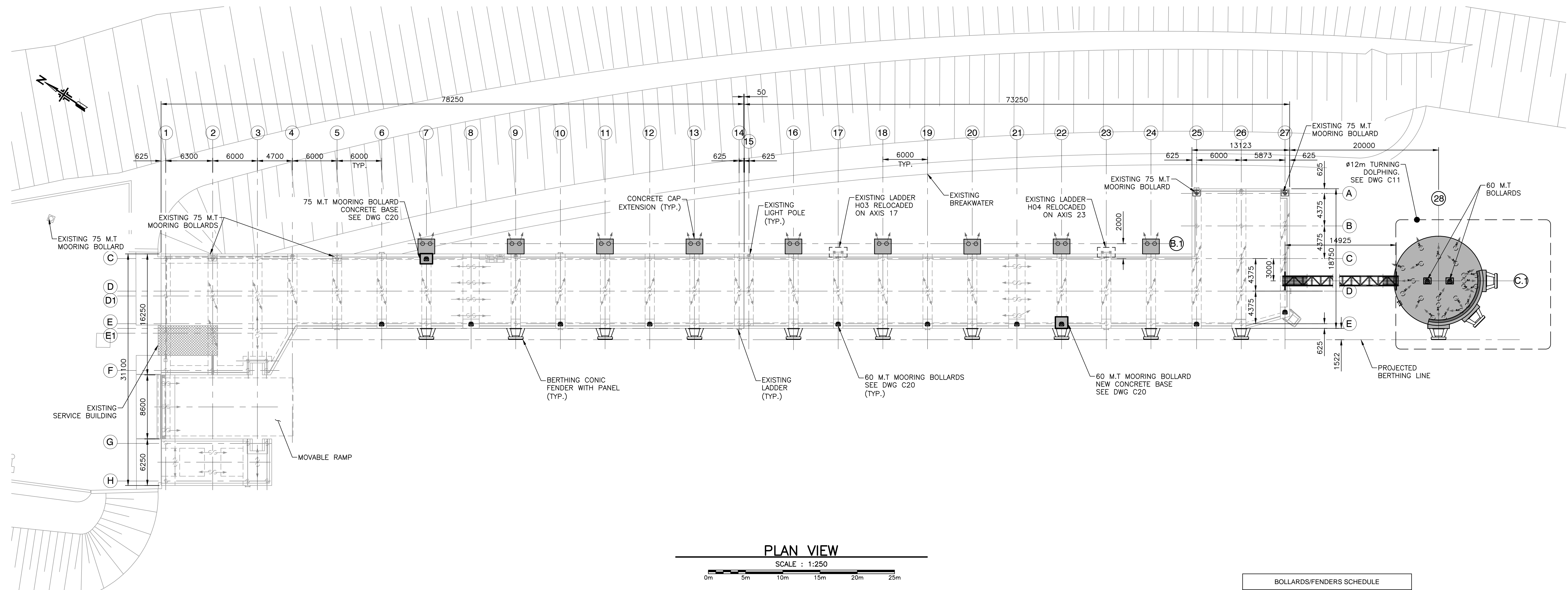
E-DRM/GDD-E: 553216

PWSSC B1 (2004)

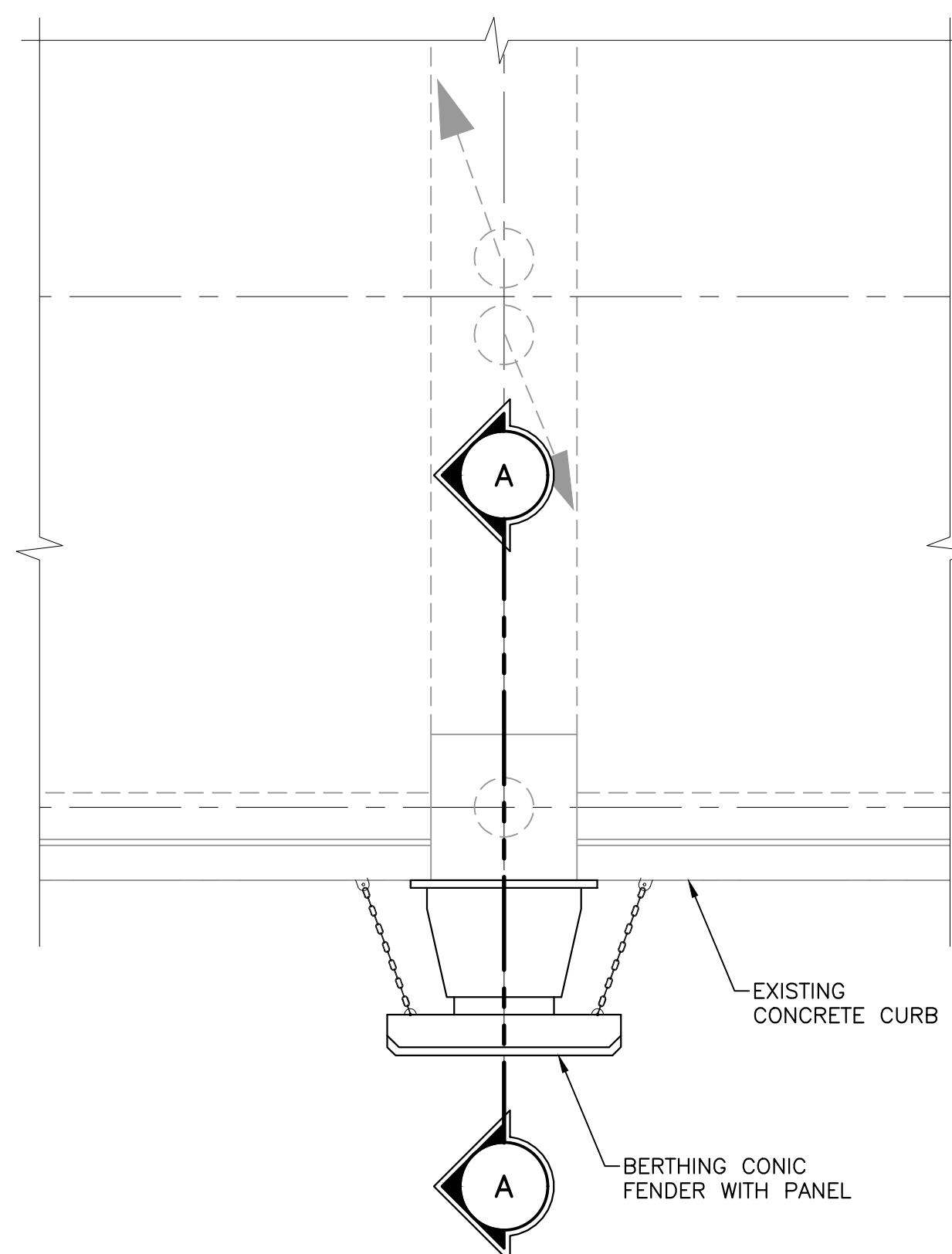
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E-DRM/GDD-E: 553216

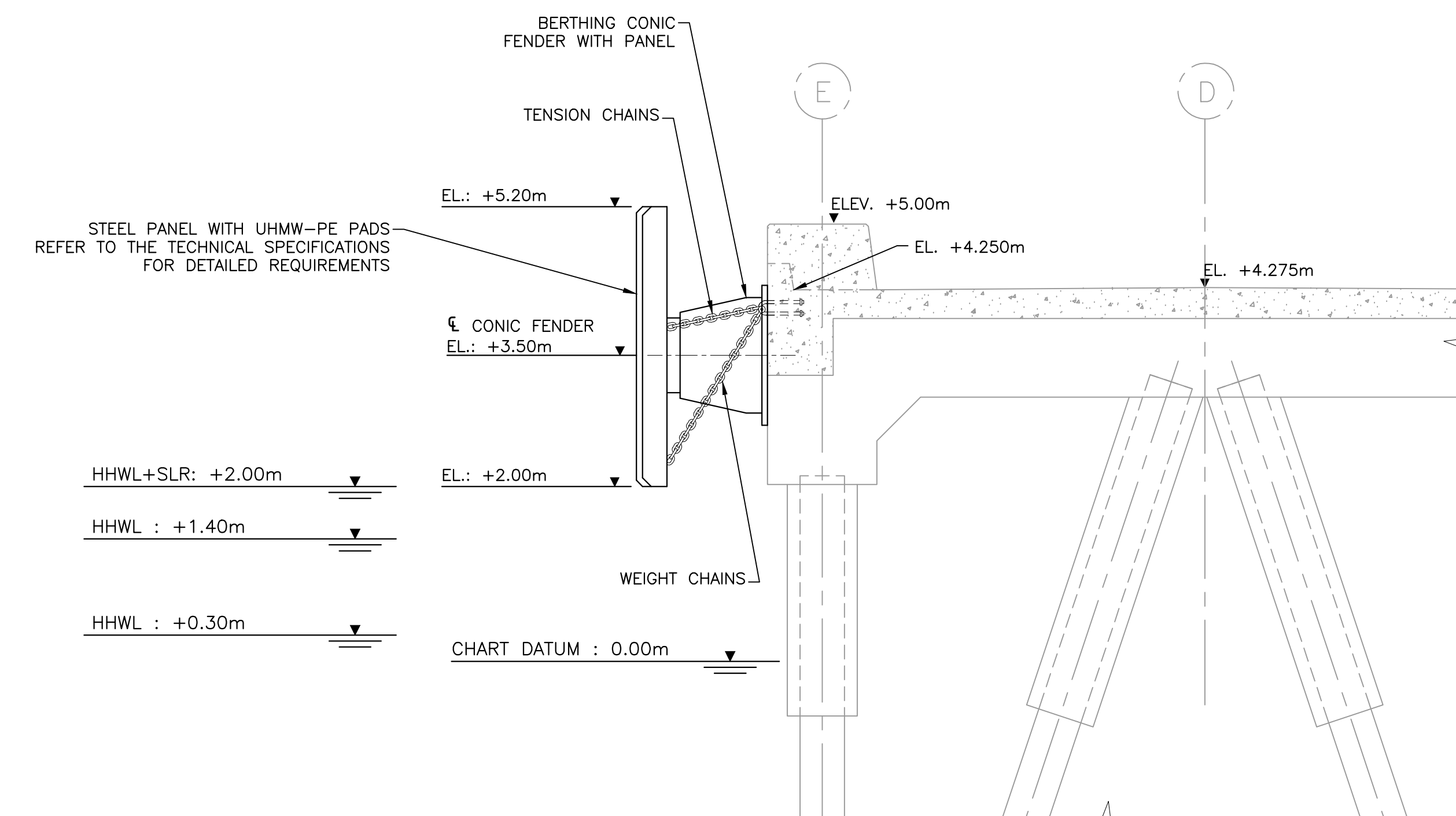
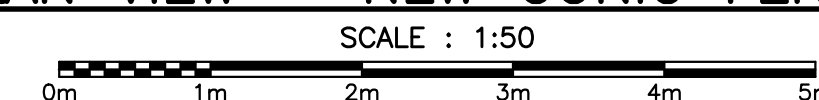




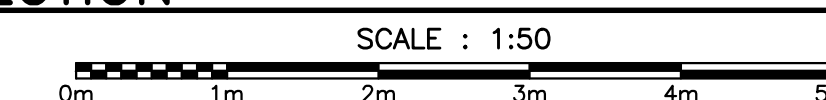
BOLLARDS/FENDERS SCHEDULE	
BOLLARDS	
60 M.T PILLAR HEAD	12 Units
75 M.T PILLAR HEAD	1 Units
FENDERS	
CONIC FENDER	13 Units



PLAN VIEW - NEW CONIC FENDER



SECTION

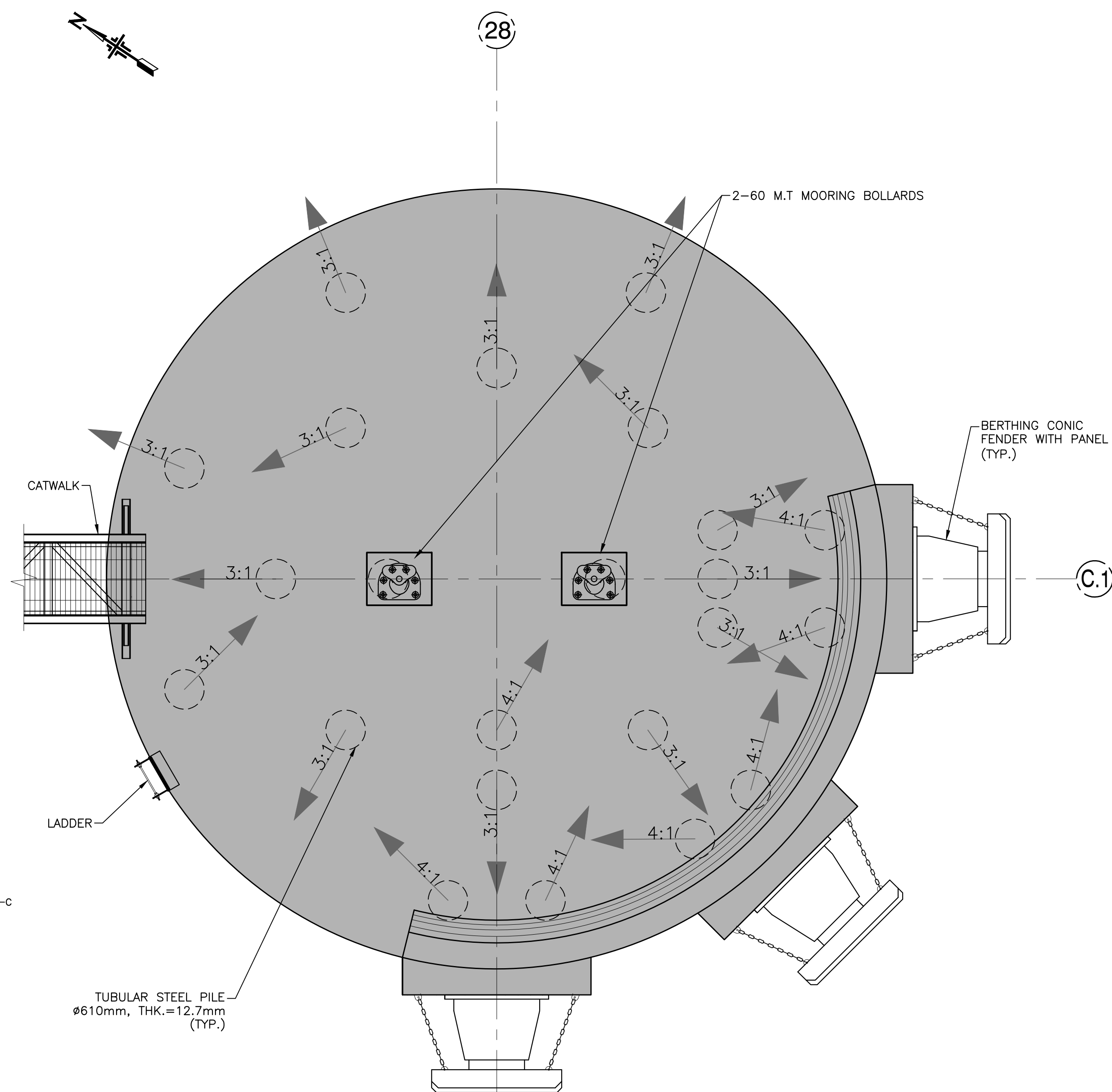


NOTE:

1. THE FENDER CONNECTIONS, FASTENERS, ACCESSORIES AS WELL AS THE CHAIN SYSTEMS ARE TO BE DESIGNED BY THE FENDER SUPPLIER.

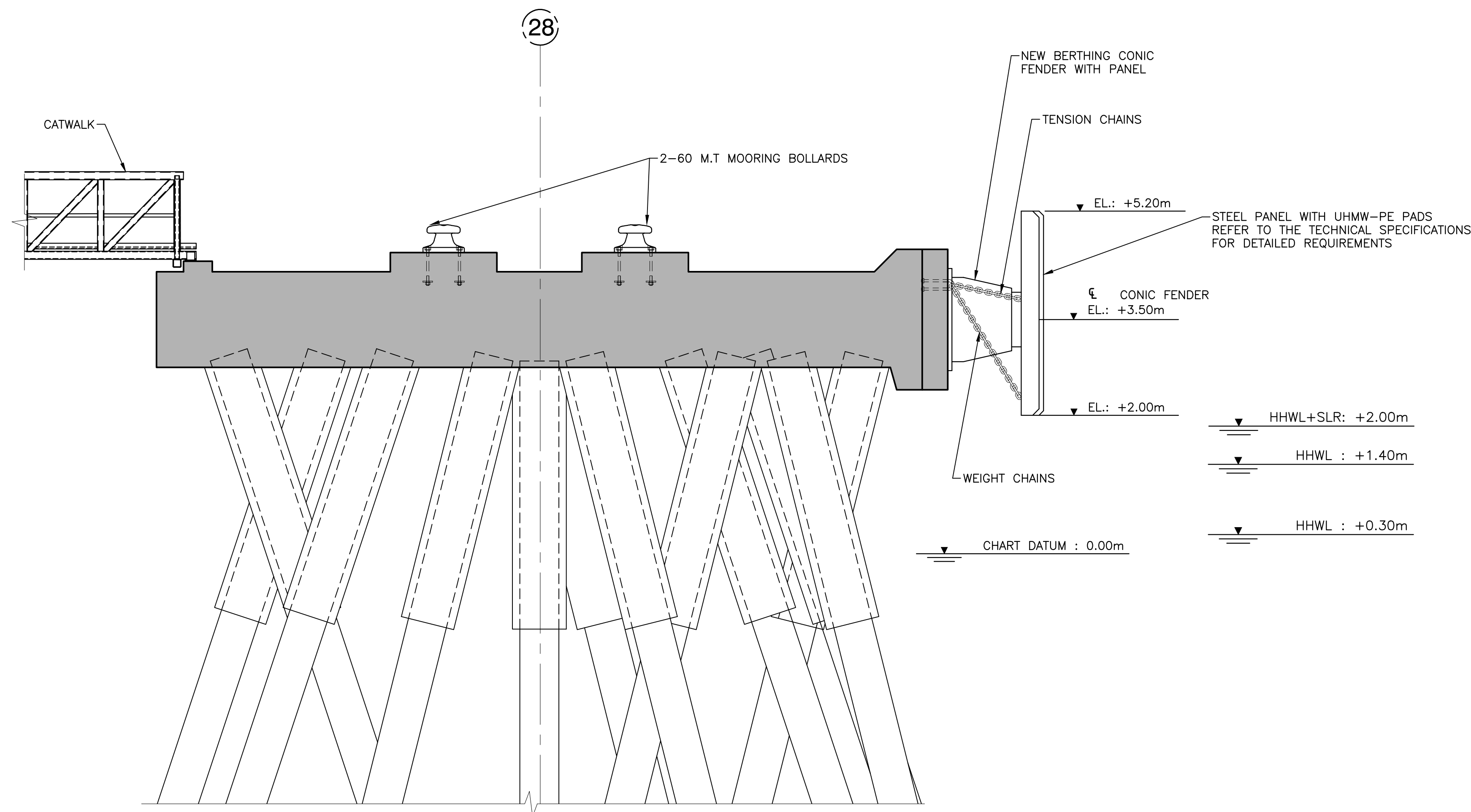
CAUTION

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PLAN VIEW — NEW CONIC FENDERS — TURNING DOLPHIN

SCALE : 1:50  
0m 1m 2m 3m 4m 5m



ELEVATION — NEW CONIC FENDERS — TURNING DOLPHIN

SCALE : 1:50  
0m 1m 2m 3m 4m 5m

**NOTE:**

1. THE FENDER CONNECTIONS, FASTENERS, ACCESSORIES AS WELL AS THE CHAIN SYSTEMS ARE TO BE DESIGNED BY THE FENDER SUPPLIER.

O	ISSUED FOR BOLLARDS & FENDERS PROCUREMENT PURPOSES	04/14/2021
revisions		date

project	CAP-AUX-MEULES WHARF EXTENSION REINFORCEMENT AND NEW FENDERS	project
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drawing	PROPOSED CONDITIONS TURNING DOLPHIN DETAILS	dessin
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designed	HUBERT PÉLOQUIN, ing.	conçu
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drawn	QUIDED JABBI, tech.	dessiné
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approved	JHON PAEZ, ing.	approuvé
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date		
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Tender	Soumission
--------	------------

PWSSC Project Manager	Administrateur de projets TPSSC
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project number	R.114048.001	no. du projet
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drawing no.	553216-C11	no. du dessin
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CAUTION

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O	ISSUED FOR BOLLARDS & FENDERS PROCUREMENT PURPOSES	04.14.2021
revisions		date
project	CAP-AUX-MEULES WHARF EXTENSION REINFORCEMENT AND NEW FENDERS	
project		

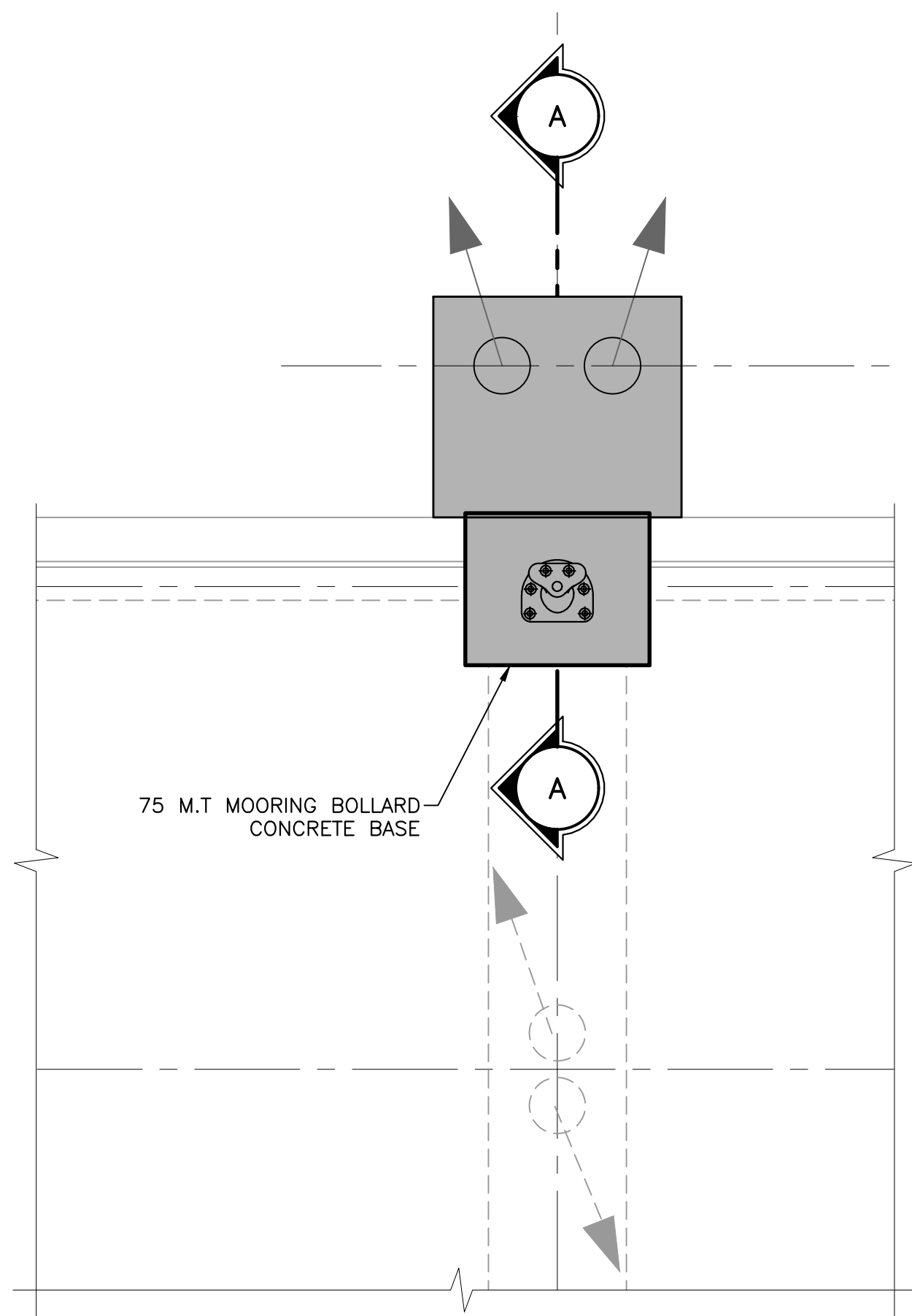
drawing  
desain

PROPODSED CONDITONS  
NEW MOORING BOLLARDS  
DETAILS

designed	HUBERT PÉLOQUIN, ing.	conçu
date		
drawn	QUIDED JABBI, tech.	dessiné
date		
approved	JHON PAEZ, ing.	approuvé
date		
Tender		Soumission
PWSSC Project Manager	Administrateur de projets TPSSC	
project number		no. du projet
	R.114048.001	
drawing no.		no. du dessin
	553216-C20	

NOTE:

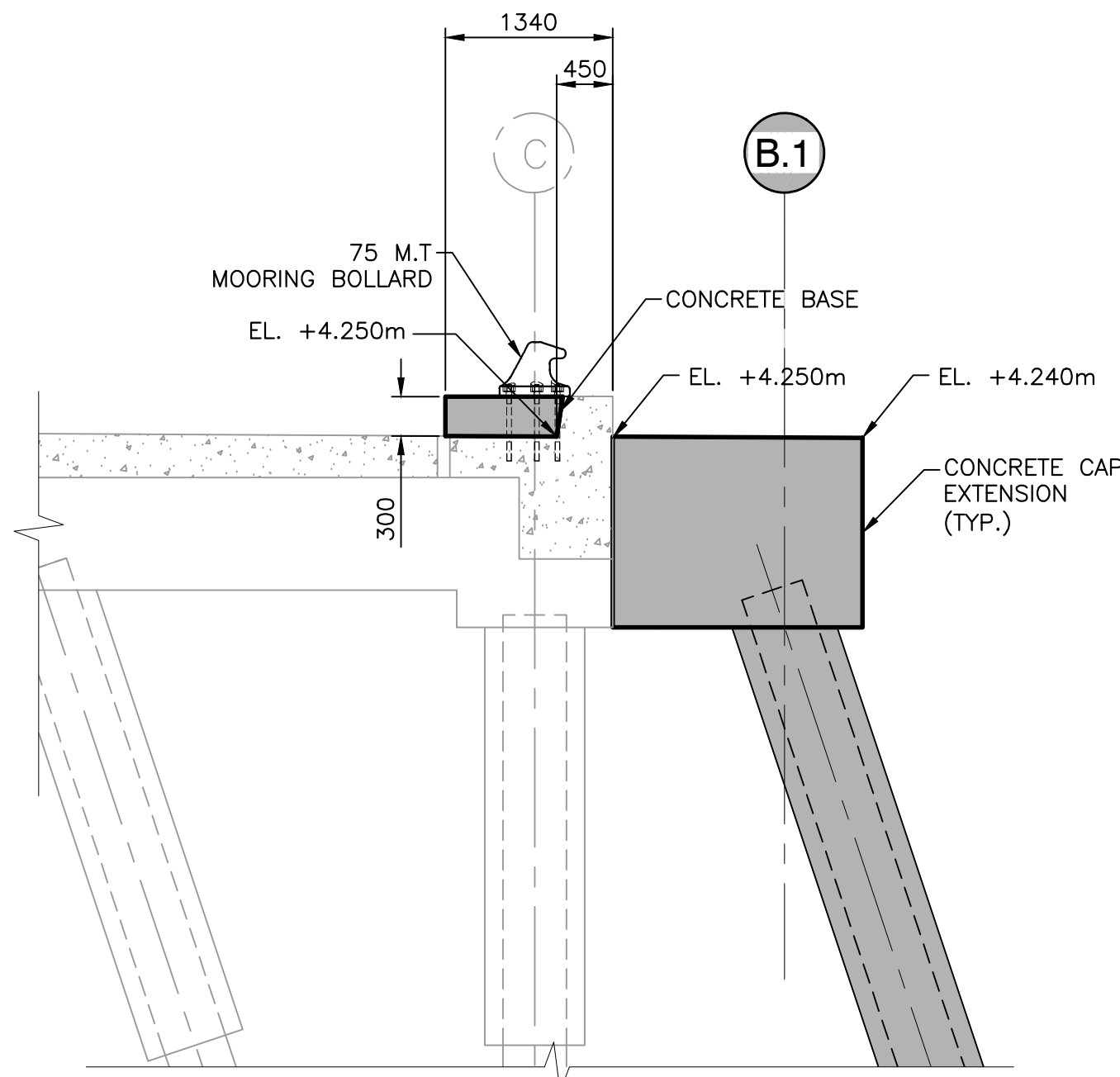
1. THE FENDER CONNECTIONS, FASTENERS, ACCESSORIES  
AS WELL AS THE CHAIN SYSTEMS ARE TO BE DESIGNED  
BY THE FENDER SUPPLIER.



PLAN VIEW — NEW MOORING BOLLARD — AXIS 7

SCALE : 1:50

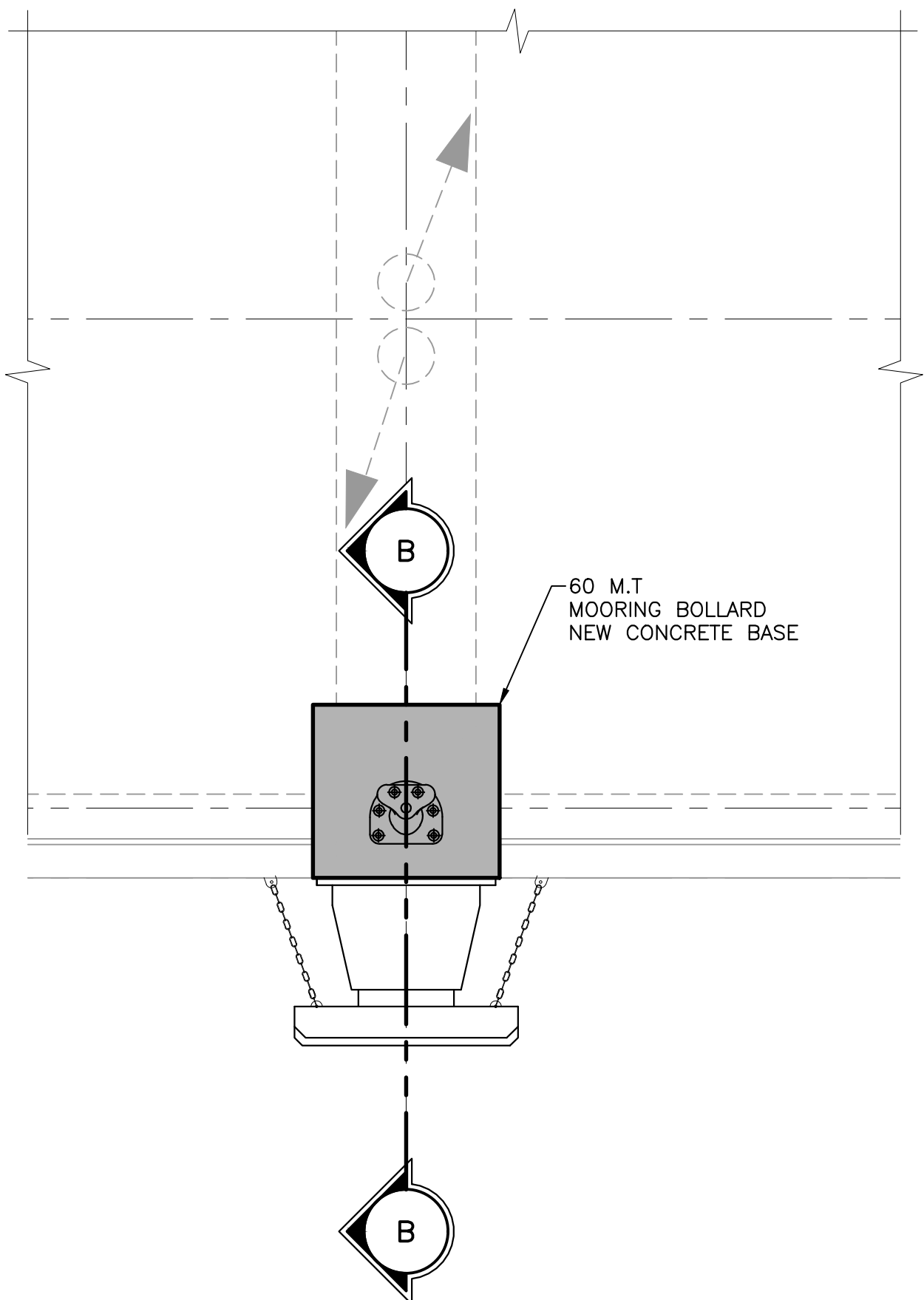
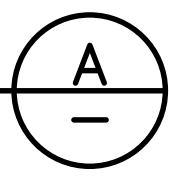
0m 1m 2m 3m 4m 5m



SECTION

SCALE : 1:50

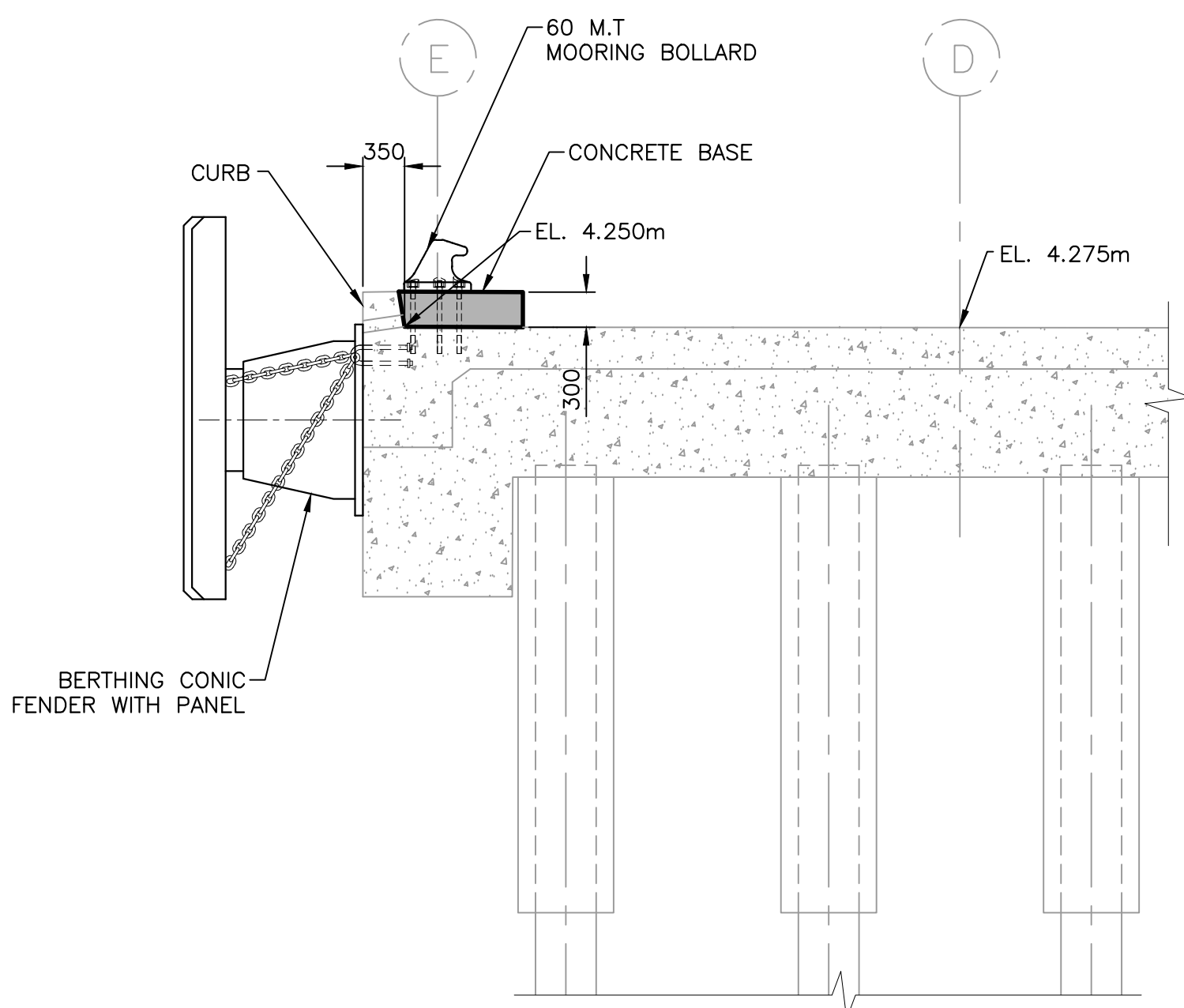
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PLAN VIEW — NEW MOORING BOLLARD — AXIS 22

SCALE : 1:50

0m 1m 2m 3m 4m 5m



SECTION

SCALE : 1:50

0m 1m 2m 3m 4m 5m

