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ITT - TOWER REPLACEMENT

LL 866, Port McNicoll, Front Range

Port McNicoll, ON

MARITIME AND CIVIL INFRASTRUCTURE Prepared by: DJ Approved by: BY Revision: 0 EWA 8010-20-0365 File: December 9, 2014 Rev Date:



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TABLE OF CONTENTS

SECTION:	011100 GENERAL INSTRUCTIONS	1
SECTION:	013300 SUBMITTAL PROCEDURES	6
SECTION:	013530 HEALTH AND SAFETY REQUIREMENTS	7
SECTION:	013543 ENVIRONMENTAL PROCEDURES	9
SECTION:	014500 QUALITY CONTROL	12
SECTION:	016100 COMMON PRODUCT REQUIREMENTS	14
SECTION:	024116 DEMOLITION OF STRUCTURES	16
SECTION:	033000 CONCRETE WORK	19
SECTION:	133613 METAL TOWERS	23
SECTION:	310000 EARTHWORK	28

APPENDICES

- APPENDIX B1 **EXISTING CONDITIONS**
- SUMMARY OF SUBMITTALS APPENDIX B2
- **APPENDIX B3** DRAWINGS
- APPENDIX B4 **GEOTECHNICAL INFORMATION**



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SECTION: 011100 GENERAL INSTRUCTIONS

PART 1 - GENERAL

- 1.1 <u>Minimum Standards</u>
 - .1 Perform work in accordance with National Building Code of Canada (NBC) and any other code of provincial or local application. In the case of any conflict or discrepancy, the more stringent requirements shall apply.
 - .1 Meet or exceed requirements of:
 - .1 Contract documents;
 - .2 Specified standards, codes and referenced documents.

1.2 Description of Work

- .1 Work under this Contract includes but is not limited to the provision of all labour, materials, and equipment required to:
 - .1 Fabricate a new steel aid to navigation (AtoN) tower;
 - .2 Transport the tower to the project site;
 - .3 Demolish and dispose of the existing steel towers and foundations;
 - .1 Salvage and keep safe existing aid to navigation equipment (lantern and appurtenances (solar panels, batteries, cabinets), navigational daymark).
 - .4 Construct new tower foundation as per the attached drawings;
 - .5 Erect the new AtoN tower;
 - .6 Mount and install a daymark;
 - .7 Restore all disturbed areas.
- .2 The following work will be undertaken by others and is hereby excluded:
 - .1 Fabrication of navigational daymarks and mounting assemblies. These will be supplied by the Canadian Coast Guard (CCG).

1.3 <u>Submittals</u>

- .1 Mandatory submittals and schedule for submission are detailed below and in Appendix B2. The following identifies general requirements only. The relevant sections must be consulted for a complete listing of mandatory content.
- .2 Detailed Schedule:
 - .1 Deadline:



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- .1 No later than ten (10) working days following award.
- .2 Deliverables, project construction schedule:
 - .1 The project construction schedule must detail as a minimum commencement, duration, and completion of the following tasks:
 - .1 Fabrication of the tower assembly;
 - .2 Demolition of the existing tower.
 - .3 Foundation installation (detail any anticipated curing period);
 - .4 Tower erection;
- .3 Construction Plan:
 - .1 Deadline:
 - .1 No less than 10 working days prior to mobilization.
 - .2 Deliverables:
 - .1 A Construction Plan of sufficient detail to demonstrate that the Contractor has considered all the challenges of the project and is prepared to undertake the works in a competent and professional manner in accordance with all legislation, including:
 - Bidder Qualifications (Section 011100 cl. 1.4), to include: .1
 - Core project members (Project Manager & Site Foreman); .1
 - .2 Complete listing of all Subcontractors (especially tower fabricator);
 - .1 Proof of CWB certification for tower fabricator;
 - .2 Project specific safety program (Section 013530);
 - .3 Project environmental protection plan (Section 013543);
 - .4 Detailed demolition plan (Section 024116);
 - .5 Concrete construction plan (Section 033000);
 - Tower erection plan (Section 133613); .6
 - .7 Anti-climb shop drawings (Section 133613);
 - .8 Excavation construction procedures (Section 310000)



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Bidder Qualifications 1.4

- .1 The work shall be carried out under the supervision and responsibility of a sole specialized Contractor.
- .2 The Contractor shall demonstrate experience in the fabrication and installation of aid to navigation structures or other similar free standing steel structures.
 - Provide one (1) current reference, complete with appropriate contact information for .1 verification purposes only.
- The Contractor shall designate the following key project members, including any subcontractors. .3 The project members shall have completed projects of similar scope and complexity to the work described herein.
 - .1 Project Manager and Site Foreman: The project manager shall have overall responsibility for the project completion and shall be the primary contact throughout the duration of the contract. The site foreman will be the main point of contact at site.
 - .2 Tower Manufacturer: The Tower Manufacturer shall be responsible for the fabrication of the tower. Manufacturer must be certified by CWB to CSA standard W47.1, division 1 or 2.1
 - .1 Provide a copy of Canadian Welding Bureau (CWB) Certification for the fabricator and for each worker assigned to this project.
 - Requests to amend the project team, following contract award, must be forwarded in writing. .3 Coast Guard reserves the right to reject any proposal to amend the project team.
- 1.5 Site Location
 - .1 The location of the site is as follows:
 - .1 LL 866 Front Range
 - .1 Lat./Long.: 44°45'44.79"N 79°50'2.20"W
 - .2 The closest settlement is Port McNicoll, ON (vicinity of Midland, ON).
- 1.6 Existing Conditions
 - .1 Bidders must make their own estimate of the difficulties associated with all phases of the works.
 - .2 The contractor must include in their costs all expenses related to the difficulties of working at the sites.
 - .3 Photographs of the existing site are included in Appendix B1.
 - .4 A geotechnical investigation has been completed for the adjacent site LL867 Port McNicoll Rear Range. A copy of the findings is provided in Appendix B4.
- 1.7 Contractor's Access to Site
 - Contractor is responsible for transportation of all labour, materials, and equipment to and from .1 the sites, including any and all material furnished or itemized for salvage by Coast Guard.



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- .2 The Site is accessible by road.
 - .1 Photographs of the site access are included in Appendix B1.
- .3 The Contractor should expect winter conditions. Any ploughing or snow clearing, if required, will be the responsibility of the Contractor.
- .4 The Contractor shall be responsible for the restoration of all routes utilized by their forces to the satisfaction of Coast Guard.

1.8 Completion, Scheduling and Planning of the Works

- .1 Work may commence as early as practical following coast guards acceptance and approval of mandatory submissions.
- .2 Service outages are to be minimized where practical. Demolition of the existing tower must not be completed until such time as the Contractor is prepared to execute the work to substantial completion, without unnecessary interruption.
- .3 Work shall be completed no later than March 20, 2015, unless otherwise negotiated and approved in writing.
 - .1 The front range must be constructed in stages as detailed below:
 - .1 Removal of the existing tower and foundation;
 - .2 Installation of the new foundation and tower in the same location.
- 1.9 <u>Temporary Facilities</u>
 - .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
 - .2 Arrange, pay for, and maintain temporary electrical power supply as required for construction, and water supply as required, in accordance with governing regulations and ordinances.
 - .3 Maintain emergency spills kit on-site at all times.
- 1.10 Fees, Permits, Certificates and Information
 - .1 Contractor shall provide authorities having jurisdiction with all information requested.
 - .1 Contractor shall provide copies to Coast Guard of any documentation submitted to other authorities related to the work described in this document.
 - .2 Contractor shall pay fees and obtain certificates and permits required.
 - .3 Contractor shall furnish certificates and permits when requested.
- 1.11 <u>Reference Documents</u>
 - .1 The most recent publication or edition of any document referenced in this specification should be used unless the referencing clause states that this clause does not apply.



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1.12 Required Submissions

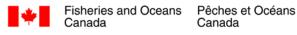
.1 A summary of the minimum mandatory submissions required can be found in Appendix B2. This summary is not an exhaustive list of all submissions required for the duration of the project. Additional submissions may be required after award.

PART 2 - PRODUCTS

2.1 Not Used

PART 3 - EXECUTION

3.1 Not Used



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SECTION: 013300 SUBMITTAL PROCEDURES

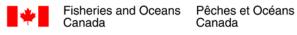
PART 1 - GENERAL

1.1 General

- .1 This section specifies general requirements and procedures for the Contractor's submissions of documents to Coast Guard for review.
- .2 Do not proceed with the work until submitted documents or samples have been reviewed by Coast Guard.
- .3 Where items or information is not produced in SI Metric units, converted values are acceptable.
- .4 Contractor's responsibility for errors and omissions in submission is not relieved by Coast Guard's review of the submitted documents.
- .5 Notify Coast Guard, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Coast Guard's review of submission, unless Coast Guard gives written acceptance of specific deviations.
- .7 Make any changes to submissions that Coast Guard may require consistent with Contract Documents and resubmit as directed by Coast Guard.
- .8 Provide Coast Guard with a written notice, when resubmitting, of any revisions other than those requested Coast Guard.

1.2 Submission Requirements

- .1 Coordinate each submission with requirements of work and Contract Documents. Individual submissions will not be reviewed until all related information is available.
- .2 Allow three (3) working days, or as stipulated in the specifications, for Coast Guard to review the submission.
- .3 The Contractor's Engineer shall stamp and sign any submissions requiring a Professional Engineer's seal certifying his approval of samples, verification of field measurements, and compliance with Contract Documents.



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SECTION: 013530 HEALTH AND SAFETY REQUIREMENTS

PART 1 - GENERAL

- 1.1 <u>Scope</u>
 - .1 The Contractor shall be responsible to develop, implement and enforce a safety program which addresses all elements of the work.
 - .1 Due to the specific requirements of the project the Contractor is required to include the following as minimum mandatory requirements of their submitted safety program.
 - .1 All persons working within the tower footprint shall be "Qualified" as defined in CAN-CSA S37-01
- 1.2 <u>References</u>
 - .1 Work under this section shall be undertaken in strict conformance with all listed references, In the case of any conflict or discrepancy the more stringent requirements shall apply.
 - .1 Canada Labour Code Part II January 2008
 - .2 NRC-CNRC National Building Code of Canada
 - .3 Ontario Occupational Health and Safety Act and Regulations (Latest Edition).
 - .4 CAN-CSA S37-13 Antennas, Towers, and Antenna-Supporting Structures
 - .5 Any and all other Provincial/Territorial Regulations and Policies; Worker's Compensation Board Policies; Local municipal regulations; pertaining to safety of the contractors workers

1.3 <u>Submittals</u>

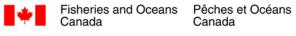
- .1 Project Specific Safety Program
 - .1 Deadline:
 - .1 With Construction Plan
 - .2 Deliverables:
 - .1 Safety Program Document, include:
 - .1 A listing of all activities specific to this phase of the project and their Health & Safety risks or hazards.
 - .2 Detailed descriptions of how the activities are to be carried out as well as methods for mitigating hazards and risks.
 - .3 A listing of personnel responsible for health and safety measures, and Emergency procedures.



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.4 Material Safety Data Sheets for hazardous products to be utilized in the execution of the works.



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SECTION: 013543 ENVIRONMENTAL PROCEDURES

PART 1 - GENERAL

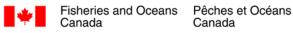
- 1.1 Scope of Work
 - .1 The Contractor must implement and enforce the following procedures throughout the duration of the work to mitigate potential negative impacts on the surrounding environment.

1.2 <u>References</u>

- .1 Work under this section shall be undertaken in strict conformance with all listed references, In the case of any conflict or discrepancy the more stringent requirements shall apply.
 - .1 Canadian Environmental Protection Act
- 1.3 Related Sections
 - .1 Not used.
- 1.4 <u>Submittals</u>
 - .1 Contractor shall submit and environmental protection plan
 - .1 Deadline:
 - .1 With Construction Plan
 - .2 Deliverables:
 - .1 Submit a plan addressing procedures to be implemented to mitigate any negative impact on the environment. Detail:
 - .1 Equipment features (age, spill containment);
 - .2 Staging, refueling, and cleaning areas;
 - .3 Clean-up and/or containment procedures (including concrete/grout);
 - .4 Waste disposal methods and sites;
 - .5 De-watering plan.

PART 2 - PRODUCTS

- 2.1 General
 - .1 Avoid use of hazardous products. Use environmentally friendly products where practical.



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PART 3 - EXECUTION

- 3.1 Construction Area
 - .1 Confine construction activities to as small an area as practical.
 - .2 Establish material storage, cleaning, and refueling areas where impacts to the surrounding environment will be negligible or readily mitigated.

3.2 Stockpiling of materials

- .1 Materials must be stockpiled as far from the shoreline as practical. Tarps must be used to control dust and run-off.
- .2 Stockpiled excavated materials shall be skirted using filter fabric to control run-off of fines during rain.

3.3 Disposal of Wastes

- .1 Clean-up the site at the end of each working day.
- .2 All waste material to be disposed of in a legal manner at a site approved by local authorities. Transporter/hauler must be appropriately licensed.
 - .1 Recycle or reuse materials where possible.
- .3 Fires and burning of rubbish on site not permitted.
- .4 Do not bury rubbish and waste materials on site.

3.4 Clearing and Grubbing

.1 Only clear vegetation that interferes with construction.

3.5 Drainage

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
 - .1 Suspend works during periods of heavy rainfall and add temporary covers to discourage runoff.
 - .2 Water pumped from excavation shall be adequately treated to ensure that water returning to the watercourse contains minimal fines. Procedures anticipated for preventing the pumping of fines shall be identified in the environmental protection plan, and may include the following:
 - .1 The use of filter bags;
 - .2 Straw bale check dams or silt fence;
 - .3 Discharge through naturally occurring vegetation.



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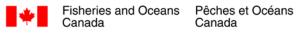
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- .3 The means for controlling silt run-off shall be dependent on the site and the quantity of water pumped, and shall be to the discretion of the CCG site staff.
- Sediment control measures shall be inspected and improved/cleaned/replaced as .4 necessary.
- 3.6 **Pollution Control**
 - .1 Provide methods, means, and facilities to prevent the contamination of soil, water, and atmosphere from the discharge of pollutants produced by construction operations.
 - Vehicles, machinery, and equipment shall be in good repair, equipped with emission controls as .2 applicable and operated within regulatory requirements.
 - .3 Abide by local noise by-laws.
 - .4 Avoid unnecessary idling of vehicles or heavy machinery.
 - .5 Limit use of equipment around the shoreline where possible.
 - .6 Implement and maintain dust and particulate control measures in accordance with provincial requirements:
 - .1 Use only non-toxic methods of dust control (water).
 - .2 All bulk material haul equipment shall be appropriately tarped. Watertight vehicles shall be used to haul wet materials
 - Designate a cleaning area for tools to limit water use and runoff. Do not allow deleterious .7 materials to enter waterways. Ensure emptied containers are sealed and stored safely for disposal.
 - .8 The contractor shall take all necessary precautions to guard against the release of any noxious substance or pollutant to the environment. In the event of any spill the Contractor shall take immediate action to contain the release and mitigate any impact.
 - Materials and equipment to intercept, contain, and clean-up any spill or other release shall .1 be maintained on site throughout the construction period and must be readily accessible at all times.
 - .2 Any uncontrolled release of a known contaminant (spills, fire/smoke) shall be reported to appropriate Provincial Authority and Coast Guard. Spills of deleterious substances to be immediately contained and cleaned up in accordance with provincial regulatory requirements.
 - .3 Provincial Authority: Ontario Spills Action Centre 1-800-268-6060

3.7 Traffic

- Minimize soil compaction by driving, parking vehicles, and walking, etc. on existing paved .1 roadways/laneways. If soil is impacted by compaction, compensate by restoring areas with new soil, as required.
 - .1 Avoid the use of heavy machinery in areas of sensitive slopes. Avoid using machinery on land during wet weather.



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SECTION: 014500 QUALITY CONTROL

PART 1 - GENERAL

1.1 Inspection

- .1 Canadian Coast Guard or its representative shall have access to the work at all times. If parts of the work are prepared off-site or in a shop, access shall be given to such work throughout the duration of the project.
- .2 In the event the work must be submitted to special testing, inspection or approvals prescribed by Canadian Coast Guard in these specifications or provided for in work-site regulations, the request for inspection must be made without unreasonable delay.
- .3 The below list identifies key milestones where the Canadian Coast Guard will require an opportunity to take samples/inspect:
 - .1 Tower fabrication: The Coast Guard will inspect the towers after fabrication, before galvanization and before the towers leave the fabrication shop.
 - .2 Subgrade verification: The Coast Guard will confirm that the subgrade is suitable and in line with expectations from the geotechnical study prior to the placing of either concrete or granular materials.
 - .3 Concrete testing: The Coast Guard will arrange for a third party to test the concrete for air, slump, and strength before the towers are erected.

1.2 Procedures

- .1 Provide Canadian Coast Guard with advance notice whenever testing is required in accordance with these specifications, so that all parties involved can be present.
- .2 Submit samples and material required for testing as per specifications without unreasonable delay and in a predetermined order so as not to delay work in progress.
- .3 Provide necessary manpower and installations for obtaining and handling samples and material on site.

1.3 Rejected Work

.1 Remove defective work, whether incorporated into the work or not, which has been rejected by Canadian Coast Guard as failing to comply with the contract documents. Replace or re-execute in accordance with the Contract Documents.

1.4 <u>Tests and Mixture Formulas</u>

.1 Supply test reports and required mixture formulas.

1.5 Factory Tests

.1 Submit test certificates as prescribed in the relevant section of the specifications.



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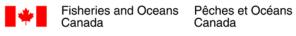
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Acceptance of Work 1.6

- .1 Canadian Coast Guard will make acceptance visits of work executed by the Contractor at critical milestones identified in the following sections.
- .2 The Contractor shall inform Canadian Coast Guard at least three (3) working days before these inspection visits.
- .3 All work shall be completed in compliance with the specifications before requesting the visit for inspection. If the work is not completed or deemed non-compliant, the Contractor shall be responsible for all costs incurred for subsequent inspections.



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SECTION: 016100 COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

- 1.1 General
 - .1 Secure Coast Guard approval of all products to be incorporated into the works. Work shall not commence until product data and/or samples have received Coast Guard approval.
 - .2 Supply and/or fabricate material and equipment of prescribed quality, with performance conforming to established standards.
 - .3 Use new material and equipment unless otherwise specified.
 - .4 Ensure replacements parts may be readily procured.
 - .5 Use products from one manufacturer for material and equipment of same type or classification, unless otherwise specified.

1.2 Manufacturer's Instructions

- .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 Notify Canadian Coast Guard in writing of any conflict between these specifications and manufacturer's instructions; Canadian Coast Guard will designate which document is to be followed.
- 1.3 Compliance
 - .1 When material or equipment is specified by standard or performance specifications, upon request of Canadian Coast Guard, obtain an independent testing laboratory report from the manufacturer, stating that material or equipment meets or exceeds specified requirements.

1.4 <u>Substitution</u>

- .1 Where specific products have been specified, proposals for substitution may only be submitted after award of contract. Such requests must include statements of respective costs of items originally specified and the proposed substitution.
- .2 No substitutions will be permitted without prior written approval of Canadian Coast Guard. Substitutions will be considered by Canadian Coast Guard only when:
 - .1 Materials specified in Contract Documents, are not available; or,
 - .2 Delivery date of materials selected from those materials specified would unduly delay completion of contract; or,
 - .3 Alternative materials to those specified which are brought to the attention of and considered by Canadian Coast Guard as equivalent to the material specified will result in a credit to the Contract amount.



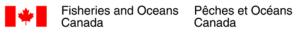
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- Should the proposed substitution be accepted either in whole or in part, the Contractor must .4 assume full responsibility and costs when such substitution affects other work on the project including any and all design or drawing changes required as a result of substitution.
- 1.5 **Submittals**
 - .1 Provide product specifications and/or samples upon request from Coast Guard.



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SECTION: 024116 DEMOLITION OF STRUCTURES

PART 1 - PART 1 - GENERAL

- 1.1 Scope of Work
 - .1 Work under this section consists of the provision of all labour, materials, and equipment necessary to complete the following activities:
 - .1 Demolition of the existing steel tower and concrete foundations;
 - .1 Salvage and keep safe existing aid to navigation equipment (lantern and appurtenances (solar panels, batteries, cabinets), navigational daymark).
 - .2 Disposal of all waste at a licensed waste disposal facility.

1.2 <u>References</u>

- .1 Work under this section shall be undertaken in strict conformance with all listed references. In the case of any conflict or discrepancy the more stringent requirements shall apply.
 - .1 Canada Labour Code Part II January 2008.
 - .2 NRC-CNRC National Building Code of Canada 2005.
 - .3 Ontario Occupational Health and Safety Act and Regulations (Latest Edition).
 - .4 CSA S350-[M1980(R1998)], Code of Practice for Safety in Demolition of Structures.

1.3 Submittals

- .1 Contractor to provide demolition plan.
 - .1 Deadline:
 - .1 With Construction Plan.
 - .2 Deliverables:
 - .1 Method of demolition including all associated tasks and schedule;
 - .2 Methods for protecting the site and surrounding private property from demolition debris.
 - .3 The ultimate disposal location of all waste materials and debris.
 - .1 Include documentation detailing regulatory approval for waste disposal facility and transporter.
- .2 Work under this section shall not proceed until written approval of the demolition plan has been received from the Coast Guard.
- .3 Submit copies of certified receipts from the disposal sites for all material removed from the work site upon request.



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1.4 Existing Conditions

- .1 Existing tower has reached its life expectancy. Contractor must insure that the tower is dismantled and demolished in a safe manner.
 - .1 Photos of the existing tower and structural takeoff are included in Appendix B1.
- .2 The existing foundations must be removed.
 - .1 Photographs of the existing tower foundations are included in Appendix B1.
 - The existing foundations are anticipated to be four shallow concrete blocks roughly .1 1.5x1.5x1.5m

PART 2 - PART 2 - PRODUCTS

2.1 Not used.

PART 3 - PART 3 - EXECUTION

- 3.1 General
 - .1 Work under this section shall be continuous and proceed without interruption unless otherwise approved be Coast Guard.
 - .2 Towers shall be dismantled in place. Towers shall not be felled without the specific authorization of Coast Guard.
 - .3 Demolition work shall not commence until the Canadian Coast Guard has approved the removal of the aid to navigation.

3.2 Protection

- .1 Prevent movement, settlement or damage of adjacent structures/vegetation.
- .2 Implement effective controls to catch/collect all tower debris during demolition, specifically paint.
- .3 Implement effective controls to prevent injury to workers, mariners, motorists, and pedestrians.

3.3 Preparation

- .1 Erect warning signs and barricades.
- .2 Ensure all environmental protection/mitigation measures are in place.
- .3 Ensure facilities have been de-energized.
- .4 Ensure all items identified for salvage have been removed and stored.



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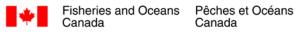
3.4 Demolition

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- .1 Demolish existing steel structures in their entirety.
- .2 Demolish existing concrete foundations
- .3 Ensure that demolition does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .4 Ensure demolition is undertaken safely. If at any period during demolition the safety of the Contractor's staff cannot be maintained take preventative measures, stop work and immediately notify Coast Guard.

3.5 Disposal

.1 All waste materials are to be disposed of off-site at a licensed disposal/recycling facility.



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SECTION: 033000 CONCRETE WORK

PART 1 - GENERAL

- 1.1 Scope of Work
 - .1 Work of this section includes the supply of all labour, material, and equipment, necessary to complete the installation of the tower foundation per the drawing provided in appendix B3
 - .2 Work includes any and all provisions necessary to ensure that the anticipated performance of the placed concrete will be obtained if work is undertaken in cold weather.

1.2 <u>References</u>

- .1 Work under this section shall be undertaken in strict conformance with all listed references, In the case of any conflict or discrepancy the more stringent requirements shall apply.
 - .1 Canada Labour Code Part II January 2008
 - .2 NRC-CNRC National Building Code of Canada 2010
 - .3 Ontario Occupational Health and Safety Act and Regulations
 - .4 CAN/CSA-A23.1-04 Concrete Materials and Methods of Concrete Construction
 - .5 CAN/CSA A23.2-04 Methods of Test and Standard Practices for Concrete
 - .6 CAN/CSA-G30.18 Billet Steel Bars for Concrete Reinforcement
 - .7 CAN/CSA S269.3 Concrete Formwork
 - .8 ACI Specification 306 Cold Weather Concreting
- 1.3 <u>Submittals</u>
 - .1 Submittals shall be forwarded to Coast Guard in accordance with the provisions of section 013530.
 - .2 Concrete Mix Parameters:
 - .1 Deadline: furnish with Construction Plan
 - .2 Deliverables:
 - .1 Provide a summary of mix properties and admixtures to demonstrate compliance with Coast Guard Criteria.
 - .2 Provide MSDS, (pre-mixed products only).
 - .3 Concrete placement methods and curing procedures
 - .1 Deadline: furnish with Construction Plan (Section 011100)



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- .2 Deliverables:
 - .1 detailed written description of concrete placement, including:
 - .1 The source of the ready mix concrete;
 - .2 Placement methods and procedures to control consolidation/segregation;
 - .3 Request for cold joints, contractor must submit a sketch identifying the location of any suggested cold joints if they are required.
 - .4 Finishing procedures
 - .5 Curing methods and schedule
 - .6 Clean-up procedures; and,
 - .7 Mitigation measures to account for hot or cold temperatures where reasonably anticipated during the construction period.
- 1.4 Quality Assurance
 - Coast Guards minimum inspection requirements are detailed below. The Contractor shall be .1 responsible to notify Coast Guard of the date and time that the works may be inspected. Notice must be provided no less than three (3) working days in advance to permit scheduling of quality assurance testing. All deficiencies in the works identified at the time of inspection shall be remedied to the satisfaction of Coast Guard, by the Contractor at their expense. Work shall not progress until inspections have been completed and the Contractor has been provided with written notice to proceed with the works.
 - .1 Upon completion of formwork and placement of reinforcement.
 - .2 During execution of concrete placement.

PART 2 - PRODUCTS

- 2.1 Formwork
 - Shall be in accordance with CAN CSA S269.3. .1
- Co<u>ncrete</u> 2.2
 - .1 Concrete shall possess the minimum characteristic detailed in the Contract Drawings.
 - For clarity, concrete employed may be commercially available pre-batched and prepackaged .1 mix or locally available ready-mix concrete.
- Water 2.3
 - Water utilized for the production concrete must be potable, unless otherwise approved in writing .1 by Coast Guard.



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Anchor Bolts 2.4

- .1 The contractor is responsible for the supply and installation of all anchor rods as per the foundation drawings. This includes the levelling nuts, washers and double nuts.
- .2 Bolts must be AISI 4140 HT 1" rod and shall be bent such that the vertical dimension is 730mm. including 140mm threads, and such that the horizontal dimension is 229mm. Bend radius shall be approximately 89mm.
 - Alternative arrangements maintaining required development length and material requirement .1 will be entertained.
- .3 Bolts shall be heavy hex conforming to ASTM A325, and washers shall be ASTM F436.
- .4 All hardware shall be hot dip galvanized to CSA G164.
 - .1 Each anchor bolt shall be long enough to allow for one [1] leveling nut under the baseplate and two [2] nuts and one [1] flat washer above the baseplate.

2.5 Reinforcement

- Reinforcing steel must be as mandated in CAN CSA A23.1 .1
 - .1 Grade 400W unless otherwise identified in the Contract Drawings.
 - All bars shall be deformed, uncoated unless otherwise identified in the Contract .1 Drawings.
- .2 Bar supports must be as mandated in CAN CSA A23.1, 6.6.7.2

PART 3 - EXECUTION

- 3.1 General
 - Concrete must be placed, finished, and cured in accordance with the Contractor's submitted .1 construction plan.

3.2 Preparation

- Preparation shall not commence until bearing surfaces have been inspected by Coast Guard. .1
- .2 Remove all loose and deleterious material.
- .3 Construct forms as detailed in the submitted construction plan.
- .4 Place reinforcement in accordance with Contract Drawings.
- .5 Surfaces to be heated as necessary to account for climatic conditions at the time of the pour.
- If the rebar cage as detailed is not strong enough to maintain the designed shape, the .6 contractor is responsible for installing additional bars to keep the cage in shape during construction.



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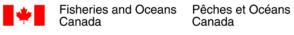
- .1 The cage shall be adequately supported to carry the weight of a worker, if the contractor intends on walking on the rebar.
- .7 75mm clearance shall be maintained on the top face, bottom face and on all sides.

Placement 3.3

- Concrete placement shall not commence until formwork and reinforcement have been inspected .1 by Coast Guard.
 - .1 Concrete cover over reinforcement shall be no less than 75mm (3"), typical.
- .2 Contractor shall place finish and cure concrete as per CAN CSA A23.1 making all adjustment necessary to account for climatic conditions anticipated during the curing period.
- .3 Concrete shall be placed in one continuous pour.
 - The development of cold joints must be previously approved in writing. .1
- Finish exposed concrete surfaces to provide a lightly brushed non-skid surface. .4
- .5 Cut control joints where specified.
- .6 Contractor shall provide samples as required during placement operation for the performance of quality assurance testing.
- .7 Concrete shall be finished so as to slope gently away from the center of the slab. No water shall pond on the finished surface.
- .All exposed 90° edges shall be chamfered. .8

3.4 Curing

- Shall be undertaken in accordance with CAN CSA A23.1 and the Contractor's approved .1 Construction Plan.
 - Curing regiment employed must take into account local climatic conditions reasonably .1 anticipated to occur during the curing period.
 - Heating and hording of the works must be anticipated. .1



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SECTION: 133613 METAL TOWERS

PART 1 - GENERAL

- 1.1 Scope of Work
 - .1 Work under this section includes the supply of all labour, material, and equipment required to complete:
 - .1 Fabrication of the tower;
 - .2 Transportation of the tower and all associated hardware to the project site;
 - .3 The installation of the tower as detailed in the appended Contract Drawings; .
 - .4 The installation of all salvaged aid to navigation equipment as detailed in Section 024116.

1.2 <u>References</u>

- .1 Work under this section shall be undertaken in strict conformance with all listed references. In the case of any conflict or discrepancy the more stringent requirements shall apply.
 - .1 Canada Labour Code Part II.
 - .2 NRC-CNRC National Building Code of Canada.
 - .3 CSA S37-01 Antenna Towers and Antenna Supporting Structures.
 - .4 CAN/CSA S16.1 Limit States Design of Steel Structures.
 - .5 CAN/CSA G164 Hot Dip Galvanizing of Irregularly Shaped Articles.

1.3 Related Sections

- .1 Section 033000, Concrete
- .2 Section 310000, Earthwork and Foundations
- 1.4 <u>Submittals</u>
 - .1 Submittals shall be forwarded to Coast Guard in accordance with the provisions of section 013530.



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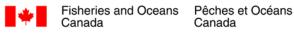
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- .2 Erection Plan:
 - .1 Deadline:
 - .1 With construction plan.
 - .2 Deliverables:
 - .1 Plan must clearly demonstrate procedures and methods to be employed to:
 - .1 Erect the tower;
 - .2 Monitor that turn of nut has been completed;
 - .3 Measures taken to protect surrounding property;
 - Field remedies to address any damage to the coating system incurred during .4 transportation and erection;
 - .5 Coast Guard reserves the right to request additional documentation verifying the suitability of the proposed labour and equipment anticipated to be employed in the erection of the tower. Certification required may include:
 - .1 Crane/helicopter capacity.
 - .3 As-built Drawings:
 - Deadline: .1
 - .1 Within 21 calendar days following final acceptance of the works by Coast Guard.
 - .2 Deliverables:
 - .1 A complete set of as-built drawings detailing any and all amendments or revisions to the previously submitted design drawings or documentation indicating final works are as detailed in design drawings.
 - .2 Provide one (1) electronic copy (.pdf) format or one (1) hard copy

1.5 Quality Assurance

- Coast Guards minimum inspection requirements are detailed below. The Contractor shall be .1 responsible to notify Coast Guard of the date and time that the works may be inspected. Notice must be provided no less than three (3) working days in advance to permit scheduling of quality assurance testing. All deficiencies in the works identified at the time of inspection shall be remedied to the satisfaction of Coast Guard, by the Contractor at their expense. Work shall not progress until inspections have been completed and the Contractor has been provided with written notice to proceed with the works:
 - Upon Completion of fabrication and prior to hot dip galvanizing. The tower shall be fully .1 constructed, however may be laid on its side for this inspection.
 - .2 During erection to confirm turn of nut procedures are being followed.

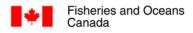


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PART 2 - PRODUCTS

- 2.1 <u>Materials</u>
 - .1 Steel:
 - .1 As specified in Contract Drawings.
 - .2 Coatings:
 - .1 Galvanizing:
 - .1 All materials, structural steel, pipe and fittings, including bolts, nuts and washers shall be hot dip galvanized to the requirement of the National Building Code, CAN/CSA S16.1, and CSA-G164 and as otherwise specified therein.
 - .3 Bolts, Nuts, Washers:
 - .1 As specified in Contract Drawings, and supplied by CCG.
 - .4 Miscellaneous Materials:
 - .1 Cotterman Gate:
 - .1 Tower shall be supplied with a fully functioning, automatically closing Cotterman gate installed between the upper platform and the step-off platform.
 - .1 Model AG2440SS 24" 40" stainless steel.
 - .2 Fall Restraint System.
 - .1 DBI SALA LAD-SAF flexible cable system, and supplied by CCG.
 - .3 Anti-Climb System:
 - .1 Towers shall be equipped with an anti-climb system.
 - .2 The Contractor shall determine the design and submit drawings for the proposed anticlimb system for approval by the CCG.
 - .3 Requirements of the proposed design include:
 - .1 Only the bottom 10' of the ladder shall be protected by the anti-climb;
 - .2 A method of locking the anti-climb shall be provided;
 - .3 The anti-climb system shall be hinged;
 - .4 All metal parts shall be hot dip galvanized;





- .4 Base grout:
 - .1 Non shrink, gassing, cementitious grout.

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.1 Sika M-Bed Standard, or equal.

PART 3 - EXECUTION

3.1 Fabrication

- .1 All members shall be fabricated in accordance with the Contract Drawings and as per the specified references.
- .2 Fabricator must be certified by CWB to CSA standard W47.1, division 1 or 2.1. Fabricators will be asked to provide proof of such certification.
- .3 In any bending or reworking of any material, methods employed shall ensure that the physical properties of the material are not impaired.
- .4 The Contractor shall ensure that electrical continuity exists between all tower sections.

3.2 Protective Coatings

- .1 Galvanizing:
 - .1 The contractor will be responsible to ensure that all tower components have been hot dip galvanized to the standards identified herein.
 - .2 All materials and welded assemblies shall be completely fabricated before galvanizing (except the tapping of nuts).
 - .3 Before galvanizing, the steel shall be thoroughly cleaned of all paint, grease, rust, scale or other materials that will interfere with proper binding of the zinc with the steel.

3.3 Handling of Material and Transportation

- .1 The Contractor shall take all necessary precautions to avoid damage to the tower members or to tower coating during transport, unloading and erection. All components or damaged members shall be replaced to the satisfaction of Coast Guard at the expense of the Contractor.
- .2 It is the responsibility of the Contractor to ensure that the tower sections, particularly the joints are protected from bending and alignment damage.

3.4 Site preparation

- .1 Complete installation of all foundation elements prior to tower erection.
- .2 Extra concrete cylinders shall be cast and broken to determine foundation strength prior to erection. This will be coordinated by CCG staff.
- .3 Adjust supporting/leveling nuts to uniform elevation.



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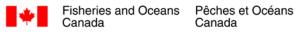
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3.5 **Erection**

- .1 Erect tower in accordance with submitted plan.
- .2 Preserve electrical continuity between all sections.
- .3 Grout between tower base and prepared concrete foundation.
- .4 All bolted connections shall be made following the turn of nut procedure.



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SECTION: 310000 EARTHWORK

PART 1 - GENERAL

1.1 <u>General</u>

- .1 Work of this section includes the supply of all labour, material and equipment required to complete:
 - .1 The excavation for the installation of tower base foundation, including:
 - .1 Stripping and stockpiling of existing topsoil or granular materials to expose subgrade;
 - .2 Completing the excavation to the required depth and area, while maintaining side slopes;
 - .3 Installation and operation of heating and hording system and/or other measures required to prevent exposed subsoils from freezing.
 - .1 Alternately the contractor may elect to ensure that the excavation is not left open, and that all granular 'B' is placed immediately after opening the exaction;
 - .4 Backfilling of the excavation, including:
 - .1 Supply of all required materials;
 - .2 Placement and compaction of granular base for the footing;
 - .3 Placement and compaction of back-fill around the completed footing.
 - .2 The restoration of all disturbed areas within the work site, to a level equal to that at which the site was found.

1.2 <u>References</u>

- .1 Work under this section shall be undertaken in strict conformance with all listed references, In the case of any conflict or discrepancy the more stringent requirements shall apply.
 - .1 Canada Labour Code Part II January 2008.
 - .2 NRC-CNRC National Building Code of Canada 2010.
 - .3 Ontario Occupational Health and Safety Act and Regulations.
 - .4 CAN/CSA-A23.1-04 Concrete Materials and Methods of Concrete Construction.
 - .5 Any and all other Provincial/Territorial Regulations and Policies; Worker's Compensation Board Policies; Local municipal regulations; pertaining to work of this section.

1.3 Related Sections

.1 Section 133613, Metal Towers



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1.4 Submittals

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- .1 Submittals shall be forwarded to Coast Guard in accordance with the provisions of section 013530.
- .2 Construction procedures:
 - .1 Deadline: with Construction Plan.
 - .2 Deliverables:
 - .1 Written Plan: Excavation and backfill procedures detail:
 - .1 Proposed side slopes and control measures
 - .2 Include shop drawings of any shoring or bracing required. Drawings must be stamped by a licensed professional engineer.
 - .3 Dewatering measures, if necessary
 - .4 Measures to be undertaken to prevent exposed soils from freezing;
 - .5 Stockpile locations and methods for controlling erosion.
 - .6 Backfill placement: document equipment and procedures. Provide methods for undertaking backfill placement in cold weather, if reasonably anticipated.

1.5 **Existing Conditions**

- A geotechnical investigation has been completed at this site a copy of the report is included in .1 Appendix B4.
- .2 Before commencing work under this section the Contractor must establish the location of all buried services that may interfere with the execution of the work.

1.6 Quality Assurance

- Coast Guards minimum inspection requirements are detailed below. The Contractor shall be .1 responsible to notify Coast Guard of the date and time that the works may be inspected. Notice must be provided no less than three (3) working days in advance to permit scheduling of quality assurance testing. All deficiencies in the works identified at the time of inspection shall be remedied to the satisfaction of Coast Guard, by the Contractor at their expense. Work shall not progress until inspections have been completed and the Contractor has been provided with written notice to proceed with the works.
 - .1 Bearing surfaces prior to backfill or formwork placement.
 - .2 Work of this section shall be undertaken in the presence of Coast Guard or its designated representative.



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PART 2 - PRODUCTS

- 2.1 General
 - .1 All materials described in this section shall be supplied by Contractor.

2.2 <u>Water</u>

.1 Shall be free of deleterious material.

2.3 Aggregate

.1 Aggregate shall be 20-0mm Type II Granular 'B' as per OPSS 1010.

2.4 Backfill

- .1 Backfill must not be frozen.
- .2 Backfill must consist of stockpiled native (excavated) materials; or,
- .3 20-0mm Granular 'B' Type II as per OPSS 1010.

PART 3 - EXECUTION

3.1 Site Preparation

- .1 Prior to commencing excavation, document the condition of all existing structures, landscaping, roadways, and other adjacent facilities anticipated to be impacted by the work.
- .2 Install any features required to protect existing infrastructure.
- .3 Contractor shall ensure that appropriate locates have been completed at the site prior to excavating.

3.2 Excavation

- .1 Strip topsoil over areas impacted by new construction. Stockpile materials on-site
- .2 Excavate the area indicated in Appendix B3.
 - .1 Side slopes must be maintained around the perimeter of the excavation in accordance with provincial legislation.
 - .2 Engineered shoring and bracing to be constructed in accordance with submitted excavation plan.
- .3 Install measures as detailed in Construction Plan to prevent excavation from freezing.
- .4 Take all reasonable precautions to minimize the disturbance of the existing vegetation.



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3.3 Backfill

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- .1 Ensure that surrounding soil is unfrozen or take measures required to thaw frozen materials.
- .2 Backfill to be placed in uniform lifts to a maximum depth of 0.15m (6") and compacted to 95% SPMDD.
- 3.4 Restoration
 - Restore all disturbed areas within work area and along haul routes. Fill and grade all ruts. .1 Ensure positive drainage away from completed and existing foundations.
 - .2 Excavated materials shall not be removed from site, but shall be used given the following priority:
 - .1 Backfill around new foundation;
 - .2 Backfill any voids created during the demolition of existing tower;
 - .3 Spread remaining soils on site to the discretion of the CCG staff representative on-site.
 - Any damage to grass on the residential property to the south of the range line shall be .4 repaired using sod in the spring.



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APPENDIX B1: EXISTING CONDITIONS

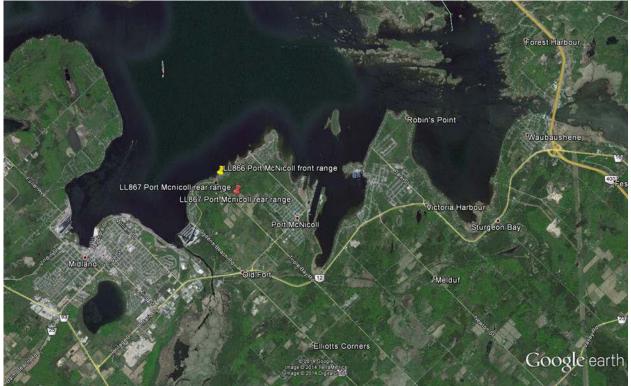


Figure 1, Project location LL866 Port McNicoll, Front Range Tower location, 44°45'44.79"N 79°50'2.20"W



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Figure 2: Project Location LL 866, Surrounding Properties

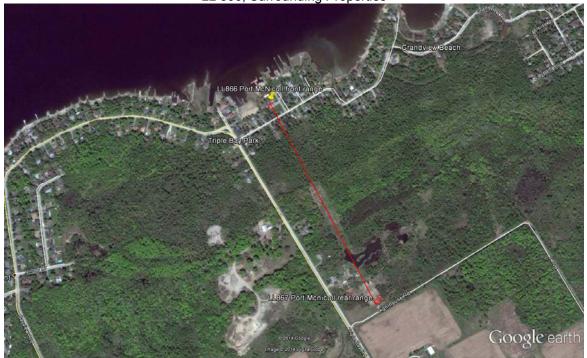


Figure 3: Range Alignment Rear Range, LL867, 44°45'22.25"N 79°49'45.69"W Distance between sites approximately 780m



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Figure 4: Existing Tower



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Figure 5: Existing Range Configuration



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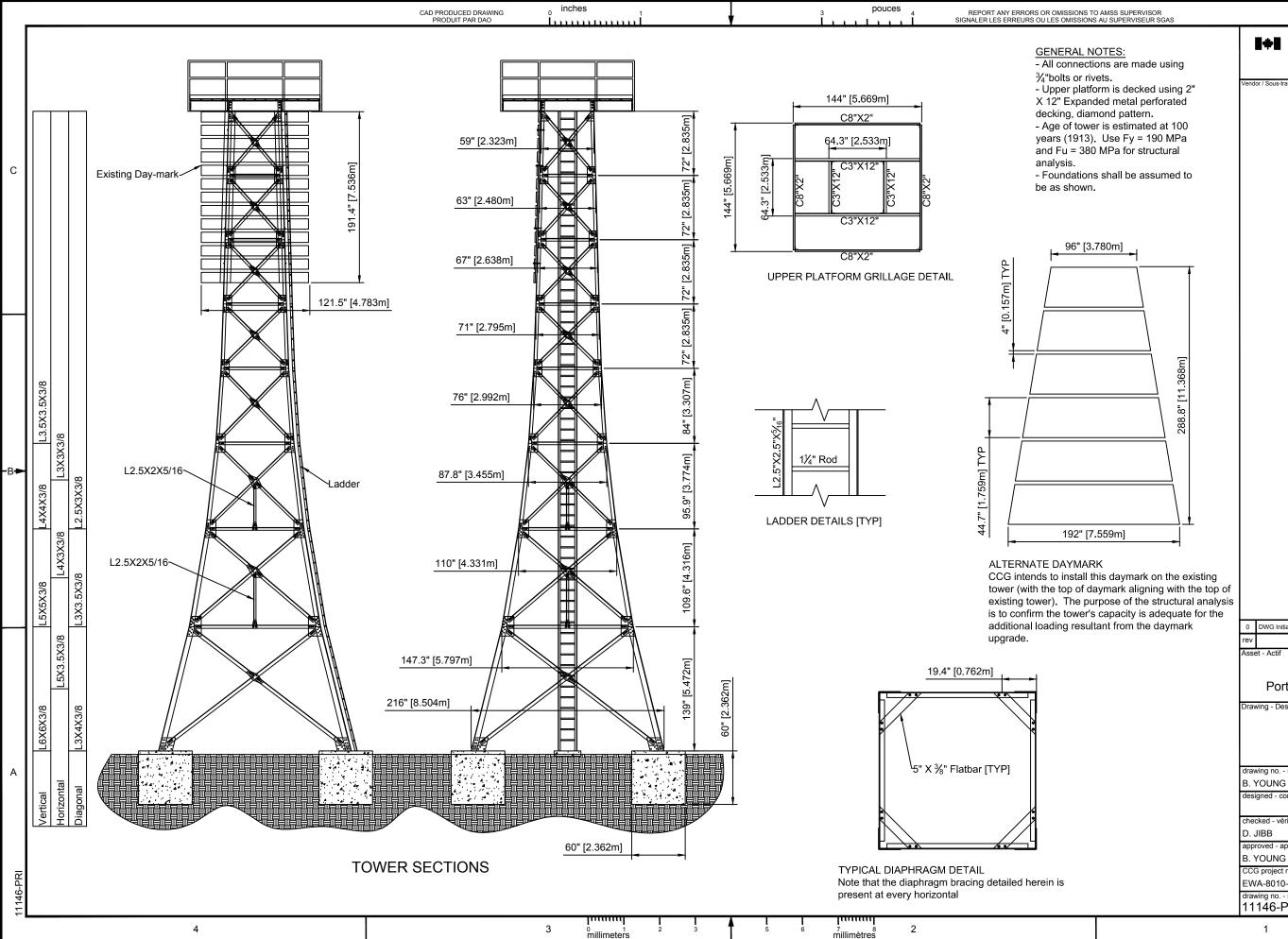




Figure 6: Existing foundation



Figure 7: Existing Foundation



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APPENDIX B2 – SUMMARY OF SUBMITTALS

	Following Contract Award	
	Submission Description	Section(s)
	Deadline: 10 working days following award	
Detai	ed schedule:	011100
	Deadline: 10 working days prior to mobilization	
Proof	of registration with Ontario WSIB	
Cons	truction Plan – Final Submission	
a)	Bidder Qualification (Inc. proof of CWB certification)	011100
b)	Complete listing of personnel	011100
c)	Complete listing of subcontractors	011100
d)	Final project specific safety plan	013530
e)	Project environmental protection program	013543
f)	Detailed demolition plan	024116
g)	Concrete construction plan (include Concrete Mix Parameters)	033000
h)	Tower erection plan	133613
i)	Anti-climb shop drawings	133613
j)	Excavation construction procedures	310000
	Deadline: 21 calendar days following acceptance of the	e works
Wast	e disposal receipts	024116
As-bı	ilt drawings	133613

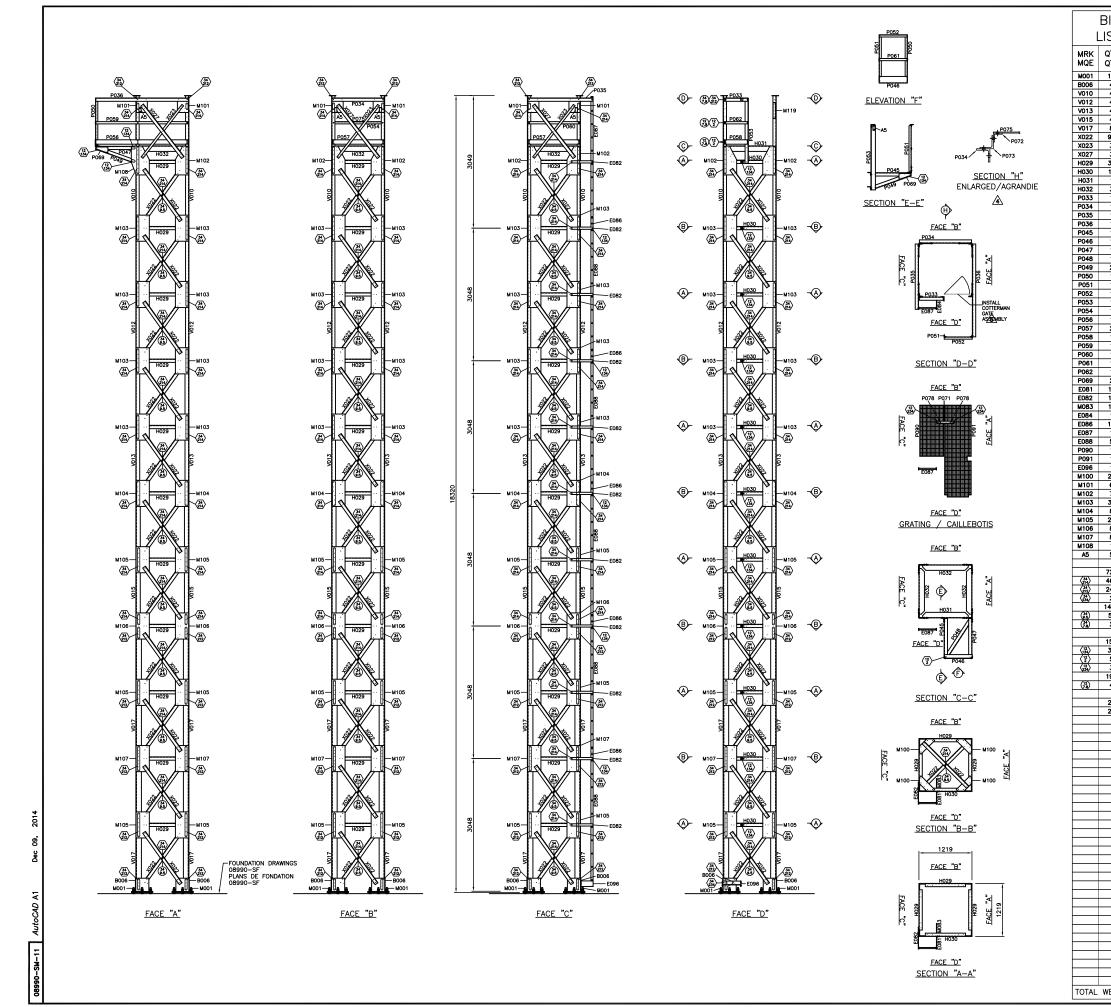


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APPENDIX B3 – DRAWINGS

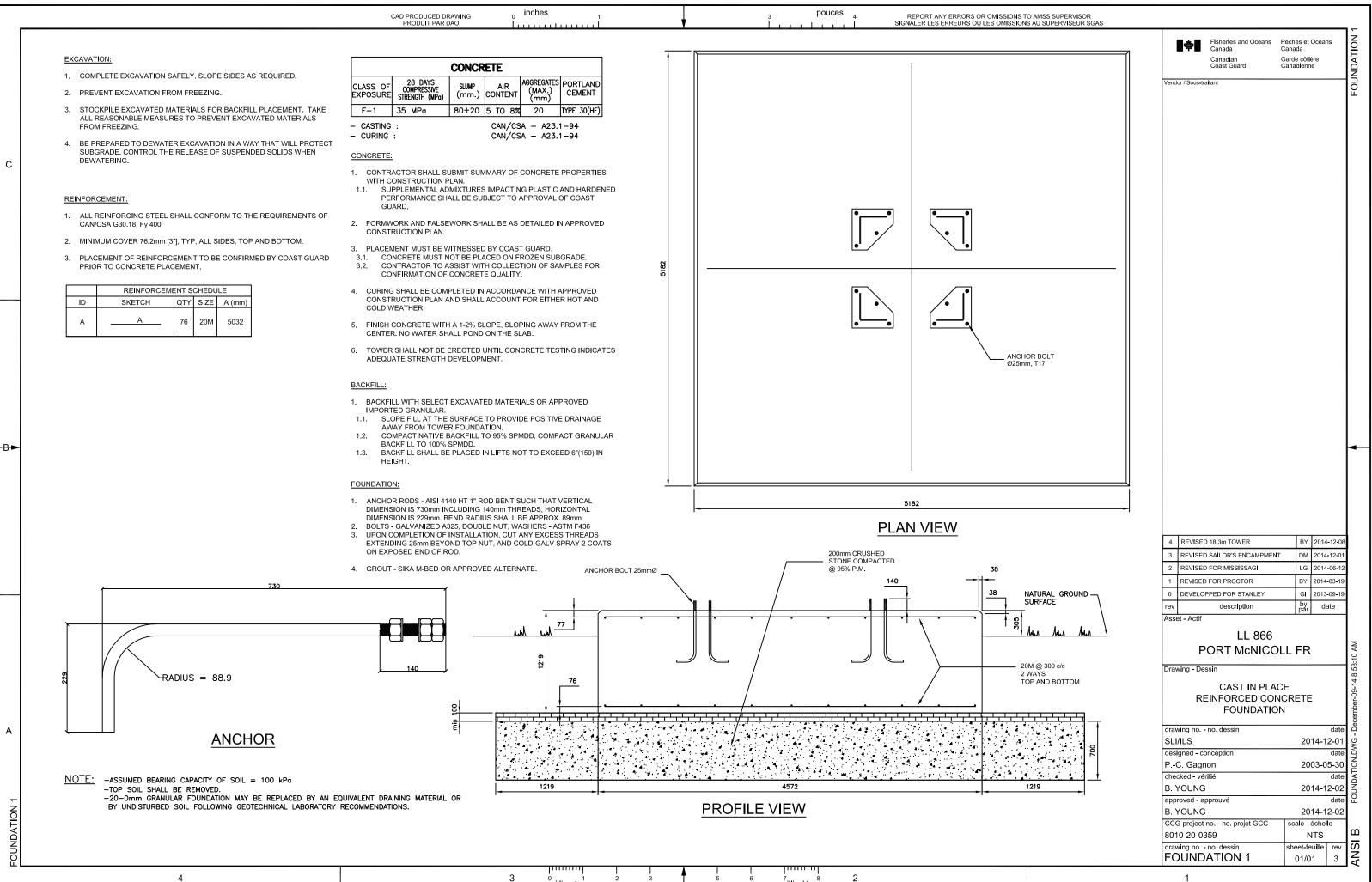


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18 4	ANCHORS/ANCRAGES 250 BASE ASS./ASS. BASE	105.6 215.2	Services techniques
4	L-76x76x9.5x3038	139.2	Systèmes électroniques et informatiques Informations techniques et graphiques
4 4	L-76x76x9.5x3038 L-89x89x9.5x3038	134.4 158.4	101 Brail, Champion (1848) 18) Guidean (Californ) Cold 7/7
4	L-102x102x12.7x3038	240.0	
8 98	L-127x127x15.9x3038 L-76x76x7.9x1450	749.6 1244.6	NOTES 🗟
3	FB-6.4x51x1525	12.0	-CAPACITÉ DE LA STRUCTURE AUX POINTS D'ANCRAGE =18 kN
3 33	L-76x76x7.9x1525 L-76x76x7.9x925	40.2 267.3	-ANNEAUX DE SÉCURITÉ "D-RING":
11	L-76x76x7.9x925	89.1	-CAPACITÉ MAXIMALE = 140 kg. -HAUTEUR DE CHUTE LIBRE MAXIMALE = 1.8m.
1 3	L-127x127x7.9x1049 L-127x127x7.9x1049	16.6 49.8	-JAMAIS PLUS D'UN SYSTÈME DE PROTECTION PERSONNEL À LA FOIS
1	L-76x76x7.9x549	5.2	-NUANCE D'ACIER: TOUS LES ÉLÉMENTS 300 Mpg SAUF LES ÉLÉMENTS SUIVANTS
1	L-76x76x7.9x1199 L-76x76x7.9x1500	11.3 14.1	LES CORNIÈRES: 350 Mpa LES PROFILÉS W: 350 Mpa
1	L-76x76x7.9x2132	20.1	-TOUS LES BOULONS SELON ASTM A-325, TYPE 1.
1	L-76x76x7.9x909 L-152x89x7.9x644	8.6 9.7	-TOUTES LES RONDELLES DE BLOCAGE SELON ASME B18.21.1
1	L-76x76x7.9x909	8.6	-TOUS LES ESPACEURS ANNULAIRES SELON ANSI B18.22.1
1 2	L-76x76x7.9x1033 L-76x76x7.9x755	9.7 14.2	-LONGUEUR DES BOULONS: 2" LG POUR BOULON 3/4"ø, S.I.C.
1	L-51x51x6.4x1082	5.3	1 1/2" LG POUR BOULON 1/2", S.I.C.
1	L-51x51x6.4x1082 L-51x51x6.4x644	5.3 3.2	-TOUTES LES QUANTITÉS DE BOULON INCLUENT UN SURPLUS DE 5 %.
1	L-102x76x7.9x1499	16.6	-CAPACITY OF THE STRUCTURE AT ANCHOR POINTS =18 kM
1	L-51x51x6.4x1179 FB-6.4x102x2122	5.8 11.1	-SECURITY RINGS "D-RING":
2	FB-6.4x102x1179	12.4	SECURIT RINGS D-RING: - MAXIMUM CAPACITY = 140 kg. - MAXIMUM FALLING HEIGHT = 1.8m.
1	FB-6.4x102x539 FB-6.4x51x2122	2.8 5.6	-MAXIMUM FALLING HEIGHT = 1.8m. -NEVER MORE THAN ONE PERSONNAL SECURITY SYSTEM AT THE SAME TIME
1	FB-6.4x51x1179	3.1	-STEEL GRADE:
1	FB-6.4x51x644 FB-6.4x51x539	1.7 1.4	ALL MEMBERS 300 Mpa EXCEPT FOR: ANGLES: 350 Mpa
2	FB-9.5x127x270	4.2	W SHAPE: 350 Mpa
11 11	FB-6.4x51x259 FB-6.4x51x508	9.9 14.3	-ALL BOLTS ACCORDING TO ASTM A-325, TYPE 1. -ALL LOCK WASHERS ACCORDING TO ASME B18.21.1
11	FB-6.4x51x377	11.0	-ALL RING FILLS ACCORDING TO ANSI B18.22.1
1 10	FB-6.4x51x315 FB-6.4x51x259	0.8 7.0	-BOLT LENGTH: 2" LG FOR 3/4"ø BOLT, U.N.
1	LADDER/ÉCHELLEx2915	31.7	2 LG FOR 3/4 9 BOLT, U.N. 1 1/2" LG FOR 1/2"9 BOLT, U.N.
5	LADDER/ÉCHELLEx3035 GRATING/CAIL. 548x1173	161.5 28.8	-All Bolt quantities include 5 % extra.
1	GRATING/CAIL. 608x2110	57.5	
1 20	L-127x89x7.9x414 FB-9.5x152x446	10.9 90.0	
6	FB-9.5x254x335	39.6	
7 32	FB-9.5x305x662 FB-9.5x305x600	95.2 454.4	
8	FB-9.5x305x600	113.6	
24 8	FB-9.5x305x600 FB-9.5x305x600	340.8 113.6	9 PARTS REMOVED/PIÈCES ENLÉVÉES DJ 2014.02.1
8	FB-9.5x305x600	113.6	Image: Second state Second state Second state Image: Second state Second state Second state Second state
1 5	PL-9.5x415x662 D-RING "SALA" #2101630	18.0 2.5	7 PIÈCES AJOUTÉES / ADDED MATERIAL GCC 2010.11.3
			6 NOTES CHANGED / NOTES CHANGES M.V. 2008.03.2
725 462	BOLTS/BOULONS 3/4"# X 2" BOLTS/BOULONS 3/4"# X 2 1/4"	197.3 133.6	5 M122 ADDED/W122 AJOUTÉ M.V. 2006.03.1 4 SECTION H ADDED/SECTION H AJOUTÉE M.V. 2006.02.0
243	BOLTS/BOULONS 3/4"# X 2 1/2"	73.8	 SECTION IN ADDED/SECTION IN ADDITE SECTION IN ADDITE <lin< td=""></lin<>
2 432	BOLTS/BOULONS 3/4° X 2 3/4° LOCK W./R. DE BLOCAGE 3/4°	0.6 42.5	2 SELON COMMENTAIRES DE LA GCC M.V. 2006.01.2
51	R. FILLS/ESPACEURS 3/4"# X 9.5	42.5 4.8	1 SELON APPROBATION M.V. 2006.01.1
2	R. FILLS/ESPACEURS 3/4 # X 7.9	0.2	New Deservition Par/by Date
154	BOLTS/BOULONS 1/2"# X 1 1/2"	13.9	
37 5	BOLTS/BOULONS 1/2"# X 1 3/4" BOLTS/BOULONS 1/2"# X 2"	3.6 0.5	
3	BOLTS/BOULONS 1/2"# X 2 3/4"	0.4	C: Foulle our lequelo lo difuil est dessiné
199 4	LOCK W./R. DE BLOCAGE 1/2"# R. FILLS/ESPACEURS 1/2"# X 7.9	1.9 0.2	Touto gradilactivo dall'Altre reportito de 21 anniantes anni Lo republi Lo
			GARDE CÔTIÈRE, RÉGION LAURENTIENNE
20 20	CLIPS/ATTACHES TYPE "D-19" BOLTS/BOULONS 5/16"# X 2 1/2"	0.5 0.5	SERVICES TECHNIQUES Systèmes électroniques et informatiques
20	BULIS/ BUULUNS 5/ 16 9 X 2 1/2	0.5	Informations Techniques 777
			et Graphiques
			TOUR D'ACIER A CLAIRE-VOIE
			TOUR DE 3,05m (10pi) @ 24,42m (80pi)
			Dessite
			Breaky:
			TOUR DE 18,32m (60pi)
			PLAN DE MONTAGE
			Çengu gan Da
			P-C.GAGNON, ing. 2003/05/30
			MICHEL VACHON 2006/01/04
			MICHEL VACHON 2006/01/06
			Approved pare Dat
			No. deseñer:
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G۲		5991.0 kg	08990 SM-11

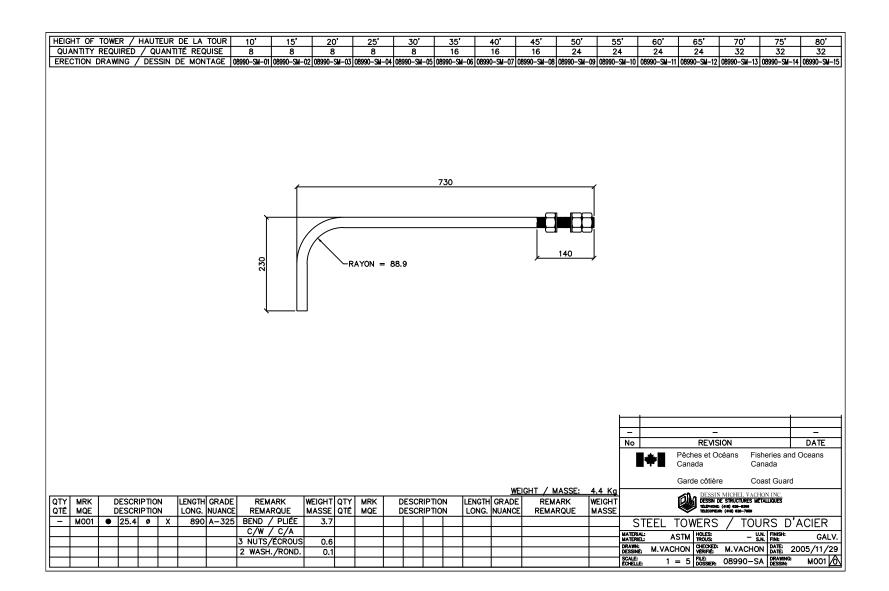
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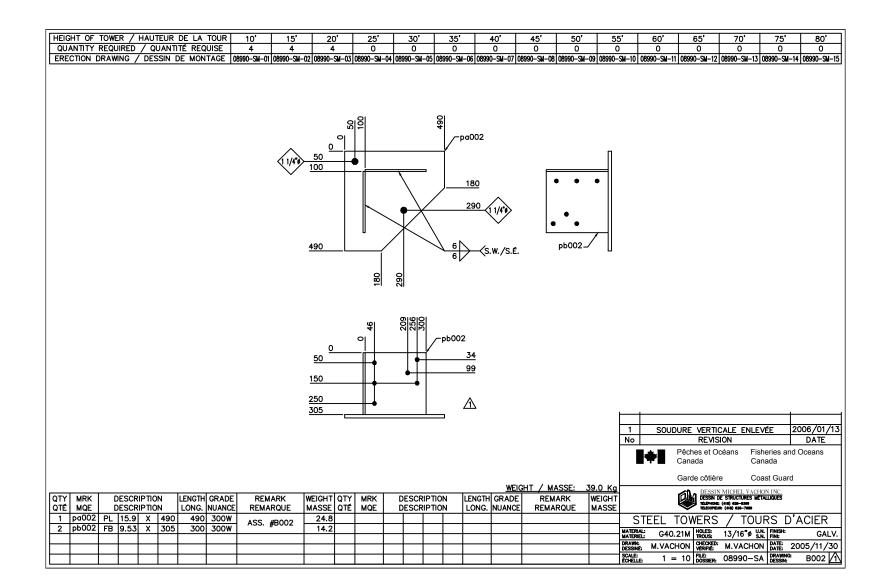


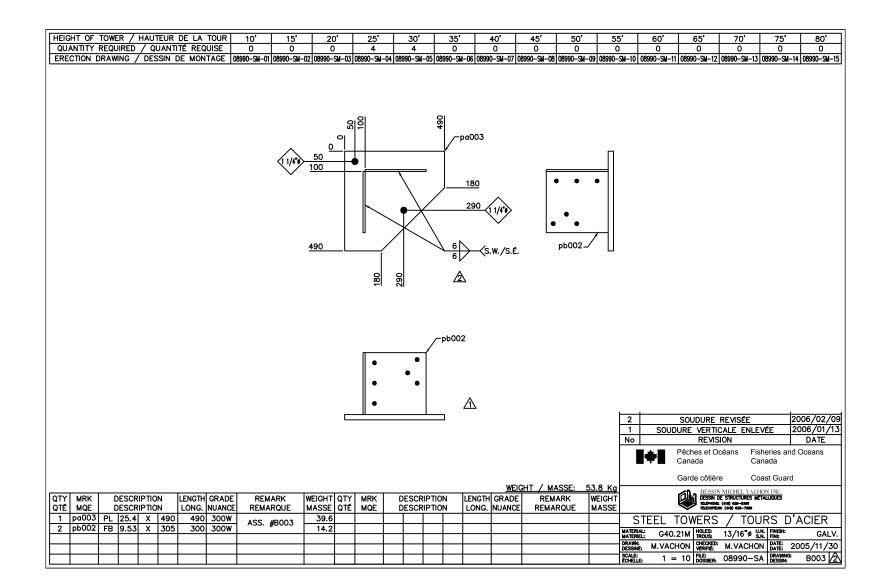
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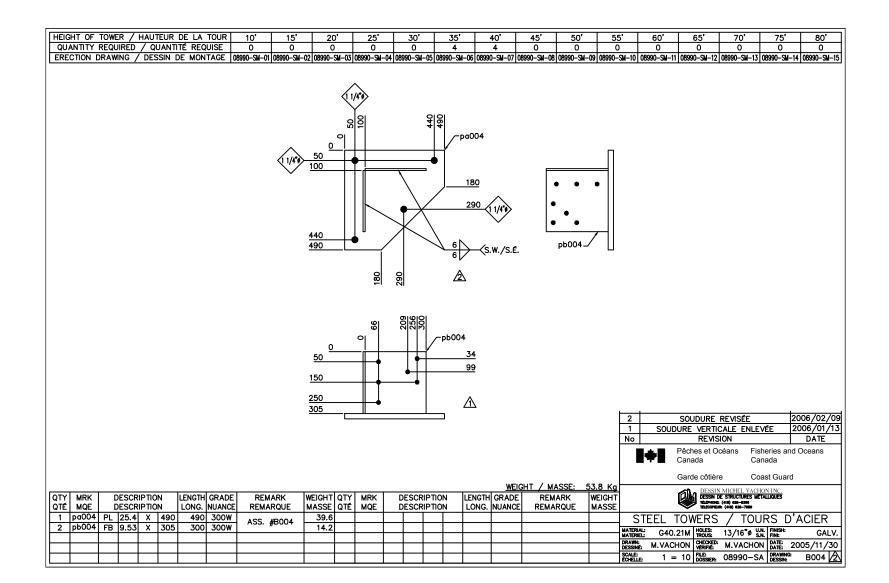
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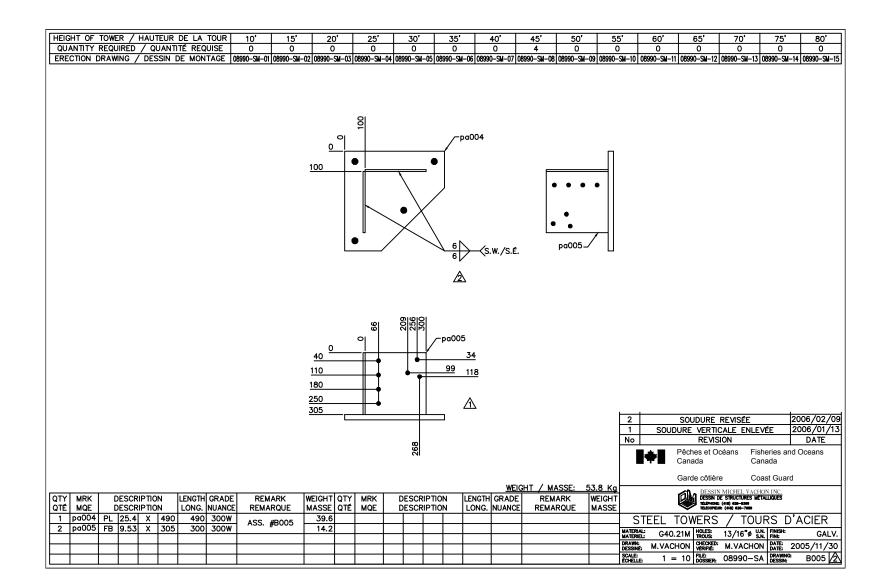
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DRAWING/DESSIN	REV.	DATE	DRAWING/DESSIN	REV.	DATE	DRAWING/DESSIN	REV.	DATE	
M001	0	2005/11/29	P052	1	2006/03/22	M103	0	2005/12/16	
B002	1	2006/01/13	P053	2	2006/03/22	M104	0	2005/12/16	
B003	2	2006/02/09	P054	1	2006/03/22	M105	0	2005/12/16	
B004	2	2006/02/09	P055	1	2006/03/22	M106	0	2005/12/16	-
B005	2	2006/02/09	P056	0	2005/12/08	M107	0	2005/12/16	
B006	2	2006/02/09	P057	0	2005/12/08	M108	0	2005/12/16	-
B007	2	2006/02/09	P058	0	2005/12/08	M109	0	2005/12/16	-
B008	2	2006/02/09	P059	0	2005/12/08	M110	0	2005/12/16	-
B009	2	2006/02/09	P060	0	2005/12/08	M111	0	2005/12/17	-
V010	0	2005/12/01	P061	0	2005/12/08	M112	0	2005/12/17	
V011	0	2005/12/05	P062	0	2005/12/08	M113	0	2005/12/17	-
V012	0	2005/12/05	P063	0	2005/12/08	M114	0	2005/12/17	-
V013	0	2005/12/05	P064	0	2005/12/08	M115	0	2005/12/17	
V014	0	2005/12/05	P065	0	2005/12/08	M116	0	2005/12/17	-
V015	0	2005/12/05	P066	0	2005/12/08	M117	0	2005/12/17	4
V016	0	2005/12/05	P067	0	2005/12/08	M118	0	2005/12/17	4
V017	0	2005/12/05	P068	0	2005/12/08	M119	1	2011/01/06	-
V018	0	2005/12/05	P069	0	2005/12/08	M120	3	2006/03/22	-
V019	0	2005/12/05	P070	1	2006/03/22	M121	0	2005/12/17	-
V020	0	2005/12/05	P071	1	2006/03/22	M122	0	2006/01/11	-
V021	0	2005/12/05	P072	1	2006/03/22	E123	0	2010/09/14	4
X022	1	2006/03/22	P073	1	2006/03/22	E124	0	2010/09/14	-
X023	0	2005/12/05	P074	0	2005/12/13	E125	0	2010/09/14	
X024	1	2006/03/22	P075	0	2005/12/13				-
X025	1	2006/03/22	P076	0	2005/12/14				-
X026	0	2005/12/05	P077	1	2006/01/19				
X027	1	2006/03/22	P078	0	2005/12/14				-
X028	1	2006/03/22	R079	0	2005/12/14				-
H029	1	2006/03/22	R080	0	2005/12/14				
H030	1	2006/03/22	E081	1	2006/01/19				-
H031	1	2006/03/22	E082	1	2006/01/19				-
H032	1	2006/03/22	M083	0	2005/12/14				4
P033	2	2006/03/22	E084	1	2006/01/19				-
P034	2	2006/03/22	E085	1	2006/01/19				M119 REVISÉ
P035	2	2006/03/22	E086	1	2006/01/19				4 E123,E124,E125 AJOUTÉ 2011/01/06
P036	2	2006/03/22	E087	0	2005/12/15				@ P073, E094 @ E099 & M120 REV.
H037	1	2006/03/22	E088	0	2005/12/15				3 X022,X024,X025,X027 @ P055,P070 2006/03/22
H038	1	2006/03/22	E089	0	2005/12/15				2 B003 @ B009 REVISED/REVISÉS 2006/02/09
H039	1	2006/03/22	P090	0	2005/12/15				1 B002 @ B009 REVISED/REVISÉS 2006/01/25
H040	1	2006/03/22	P091	0	2005/12/15				No REVISION DATE
P041	2	2006/03/22	P092	0	2005/12/15				
P042	2	2006/03/22	P093	0	2005/12/15				Pêches et Océans Fisheries and Oceans Canada Canada
P043	2	2006/03/22	E094	2	2006/03/22				41
P044	2	2006/03/22	E095	2	2006/03/22				Garde côtière Coast Guard
P045	1	2006/03/22	E096	2	2006/03/22				DESSIN MICHEL VACHON INC.
P046	1	2006/03/22	E097	2	2006/03/22				DESSIN MICHEL VACHON INC. DESSIN DE STRUCTURES METALLIQUES
P047	1	2006/03/22	E098	2	2006/03/22				TELEPHONE: (+18) 636-5366 TELECOPIELIR: (+16) 636-7368
P048	1	2006/03/22	E099	2	2006/03/22				STEEL TOWERS / TOURS D'ACIER
P049	1	2006/03/22	M100	0	2005/12/16				DRAW: DESSINE: M.VACHON CHECKED: M.VACHON DATE: 2006/01/23
P050	1	2006/03/22	M101	0	2005/12/16				
P051	1	2006/03/22	M102	0	2005/12/16				$\begin{array}{c c} \text{SCALE:} & 1 = 1 \\ \hline \text{DOSSIER:} & 08990 - \text{SA} \\ \hline \text{DESSIN:} & 00A \\ \hline \text{A} \end{array}$

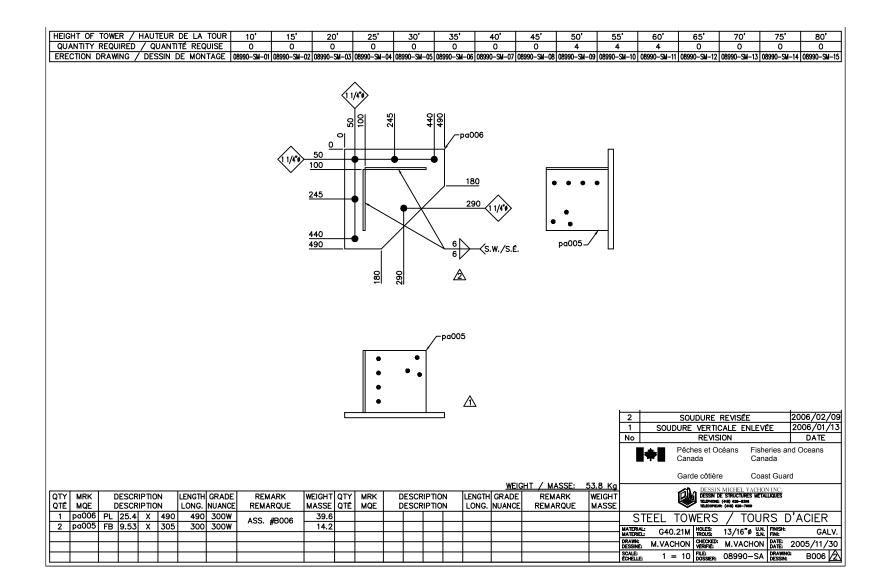


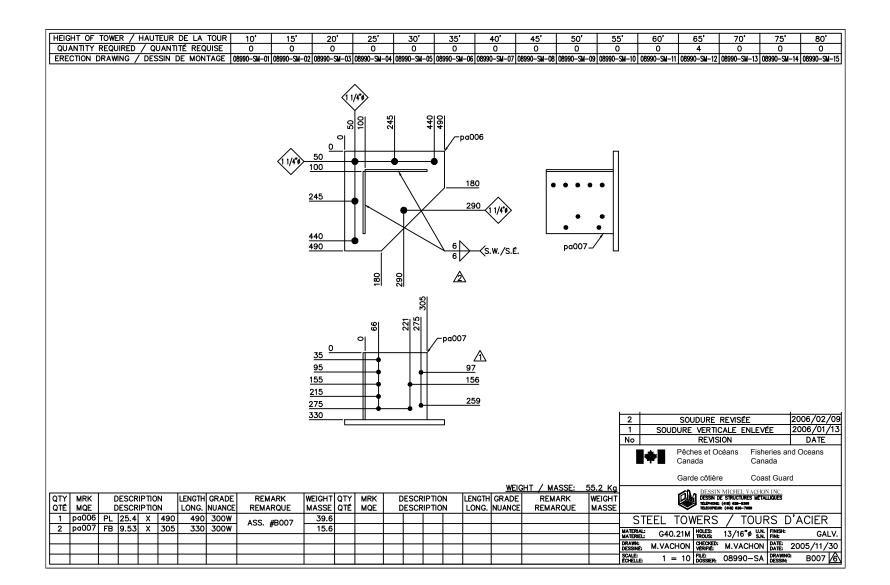


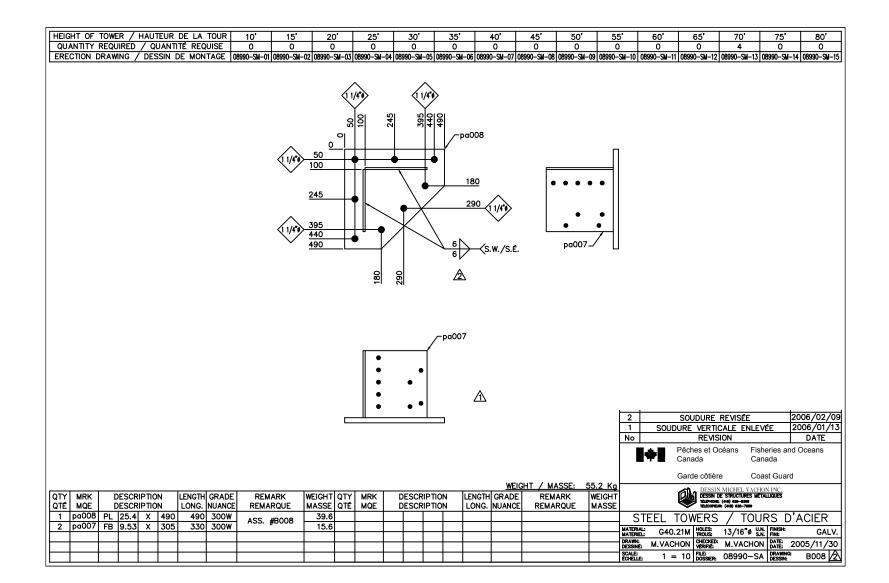


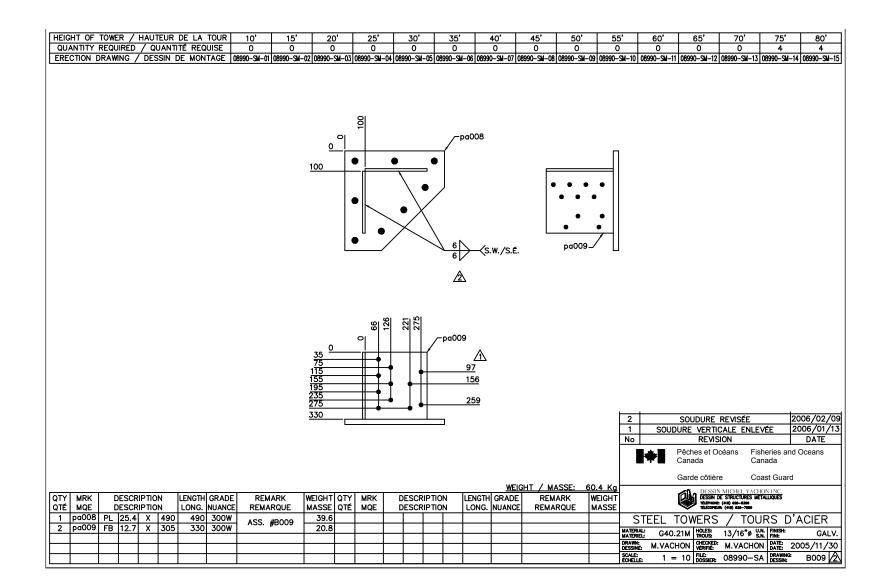


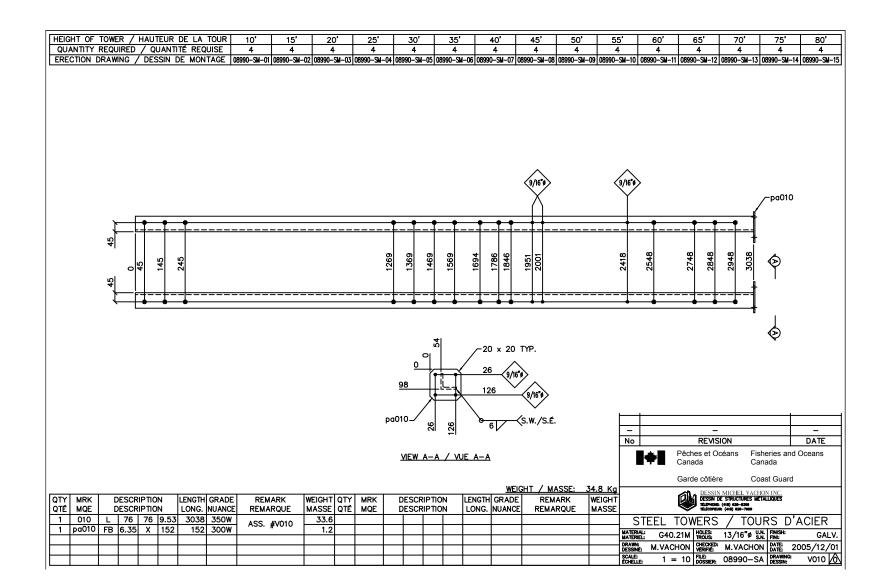


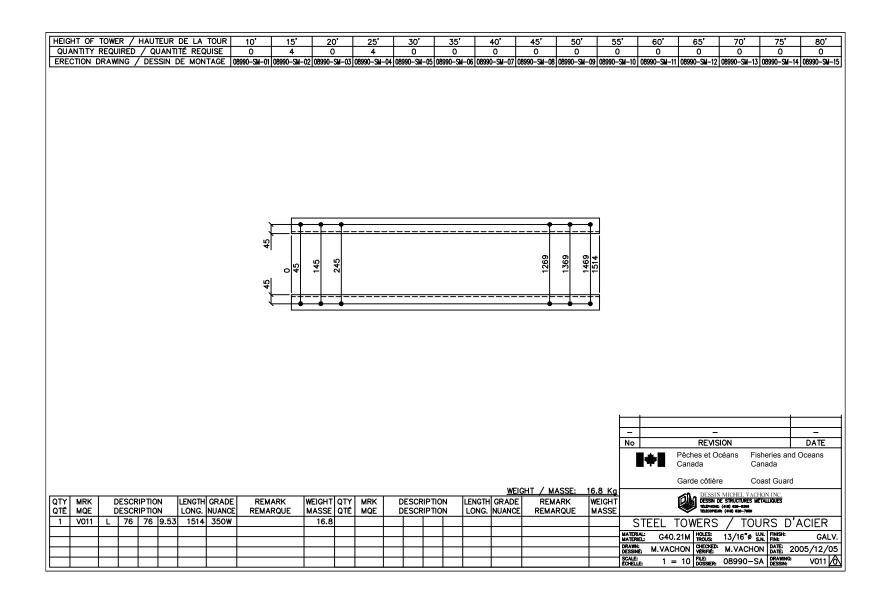






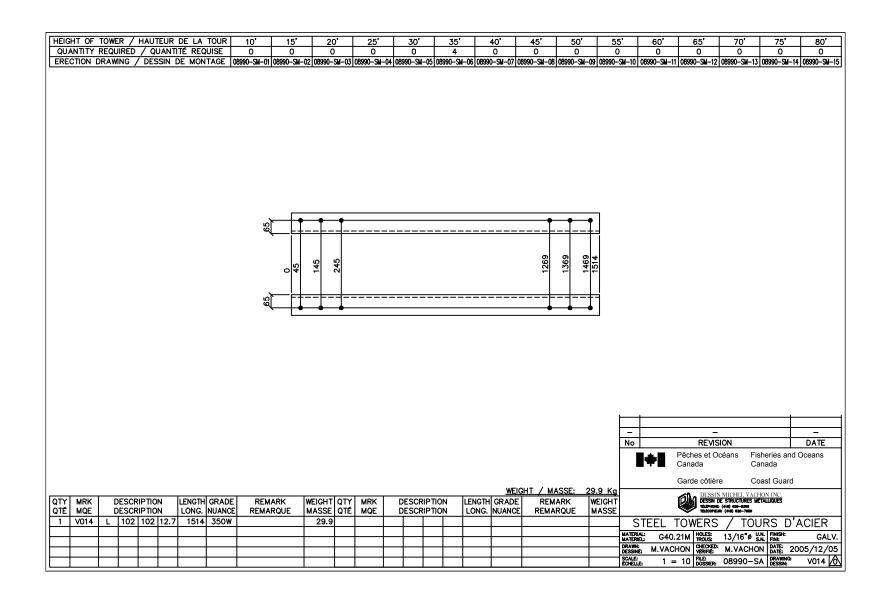




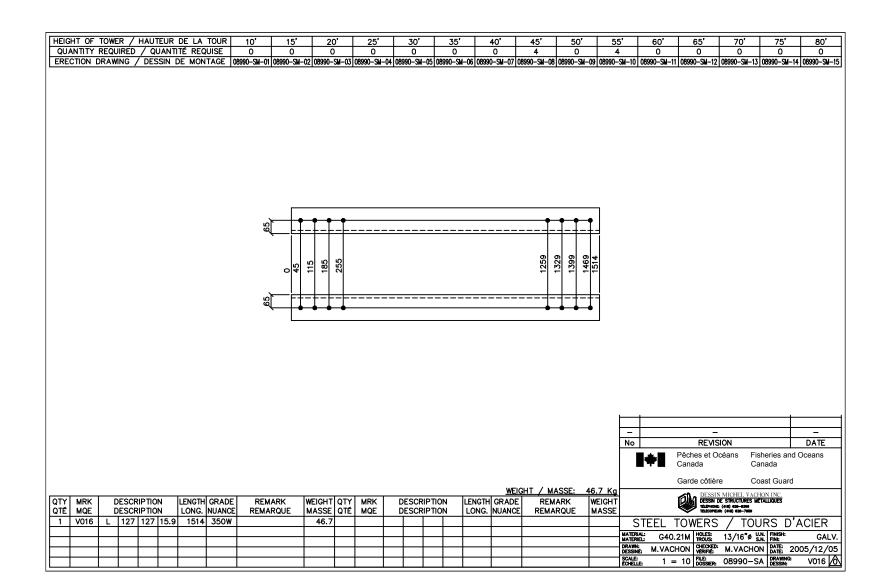


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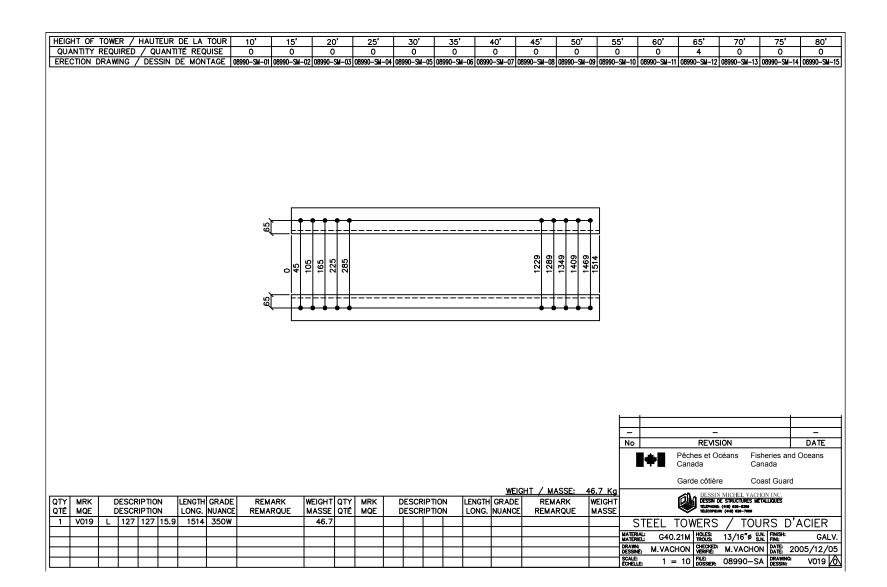


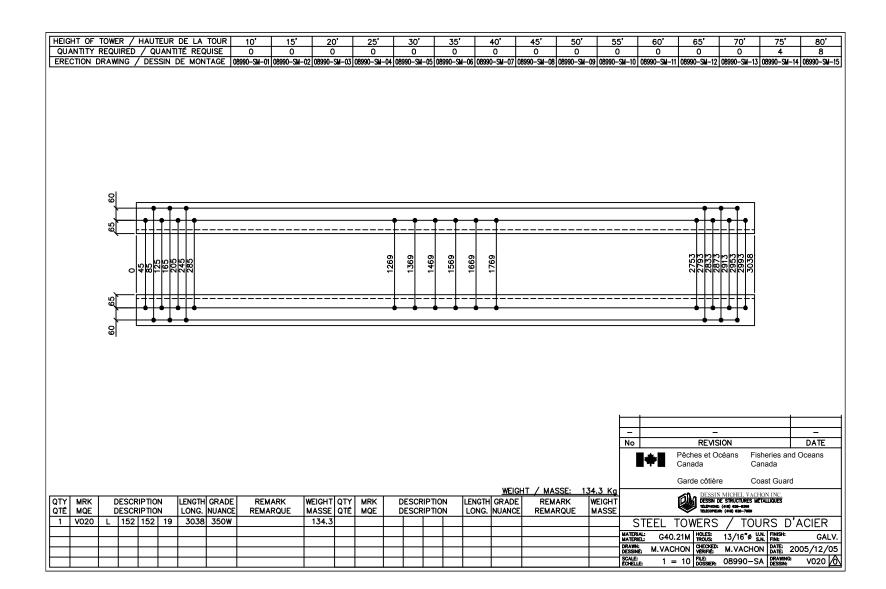
EIGHT OF	TOWER	7 1	ALL TELID	DELA		> I	10'	15'	1 201	• I	25'	3	<u>^'</u>	35	,	40'	45	5'	50'	55	,	60'	65'		70'	75'	80'
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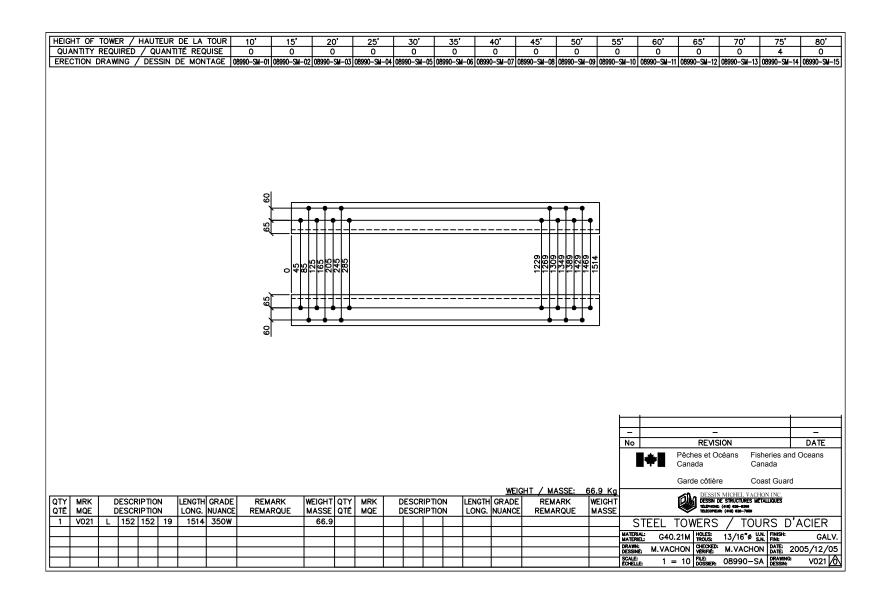


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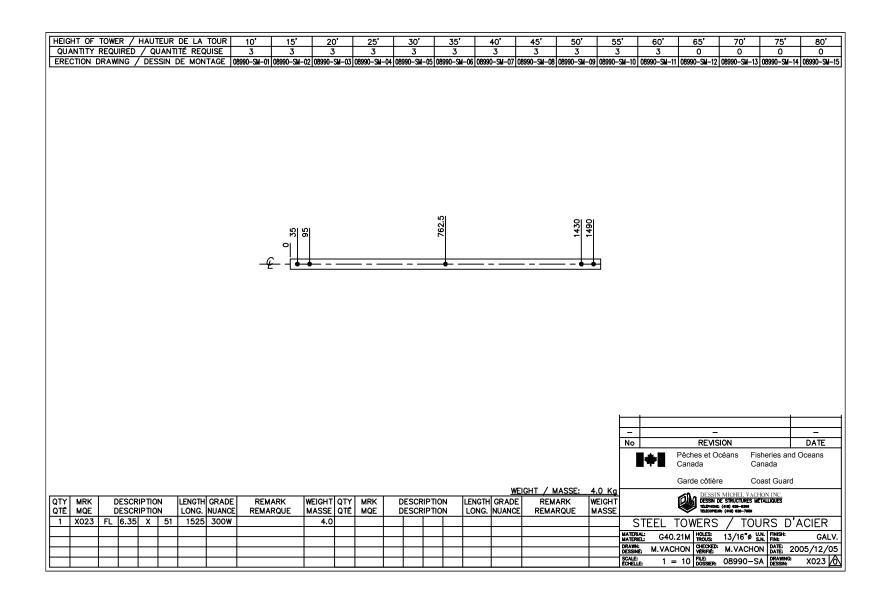
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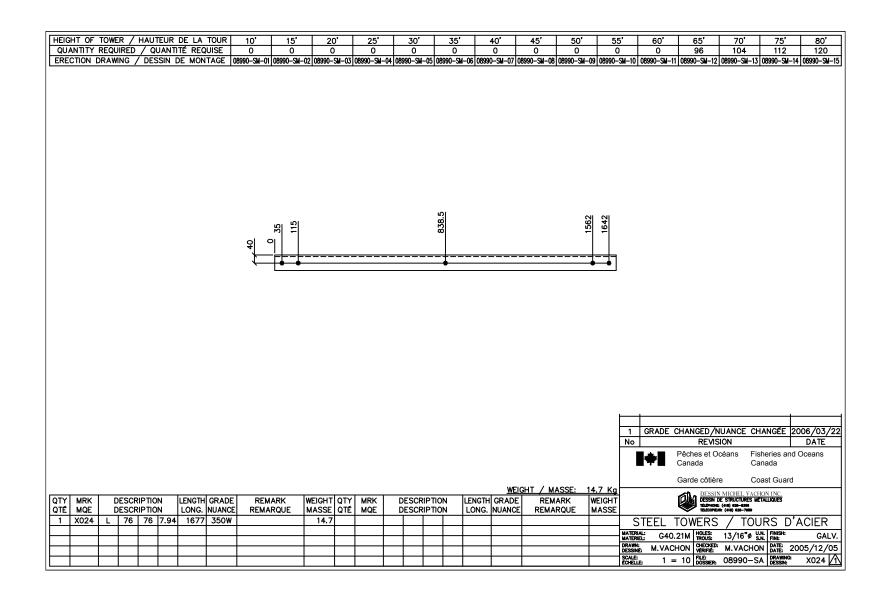


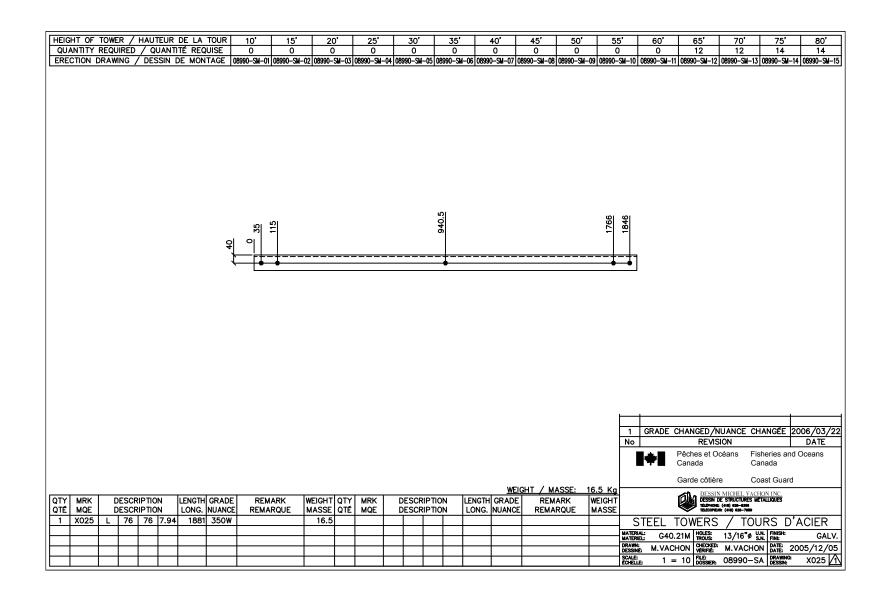


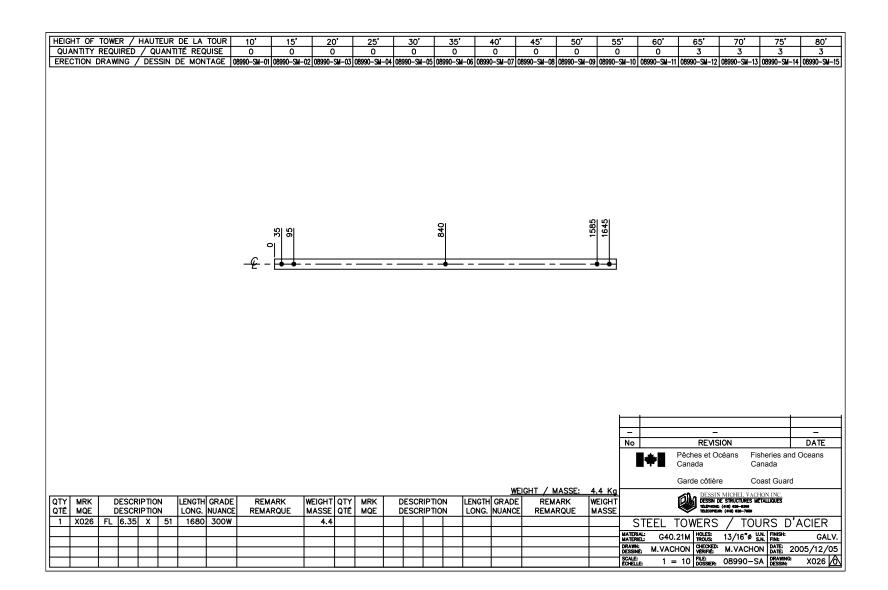


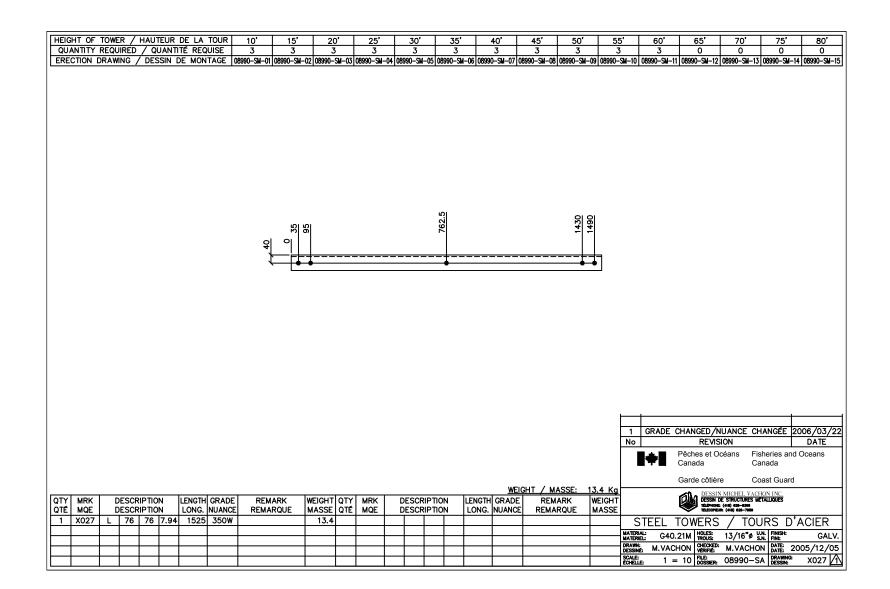
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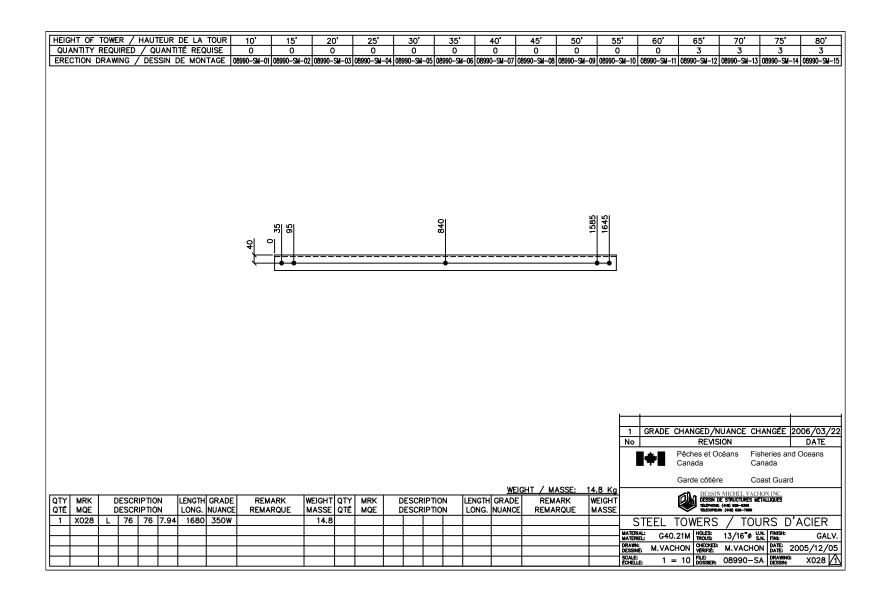


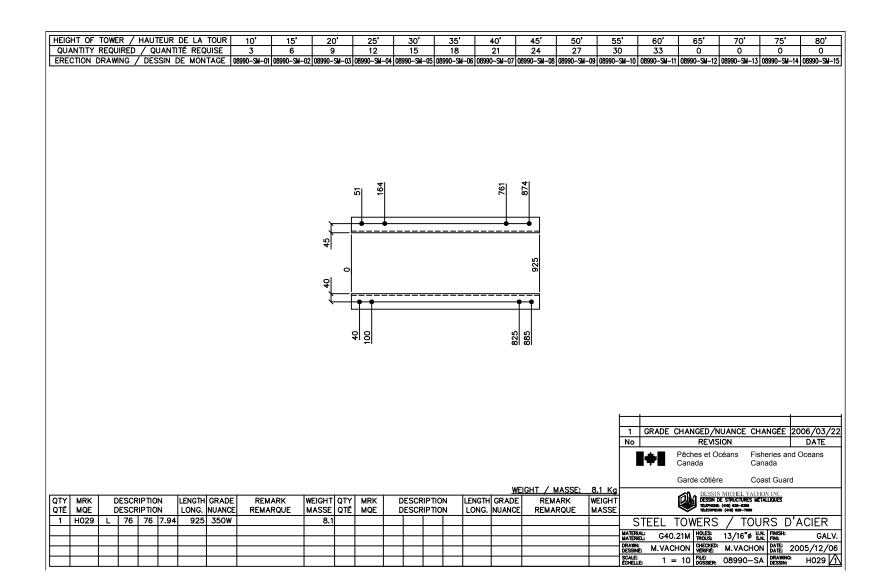


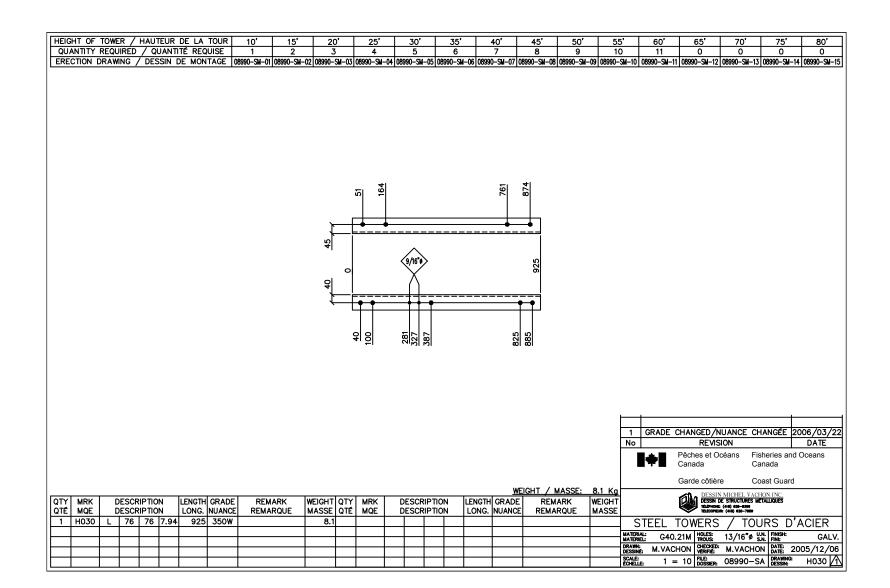


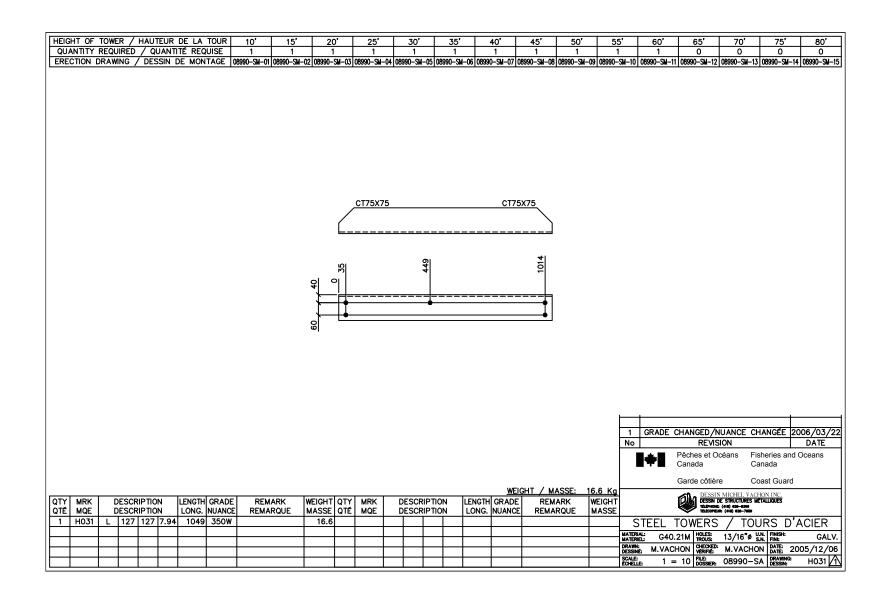


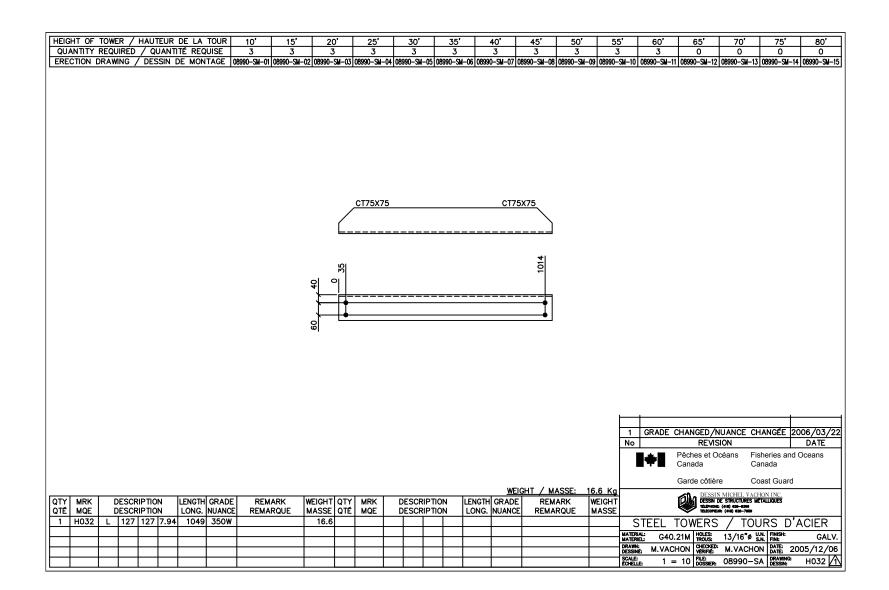




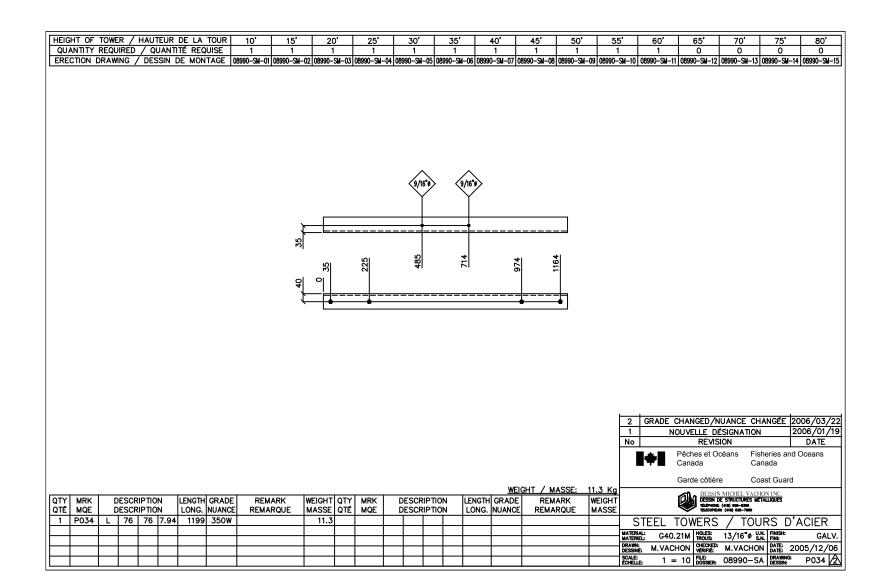


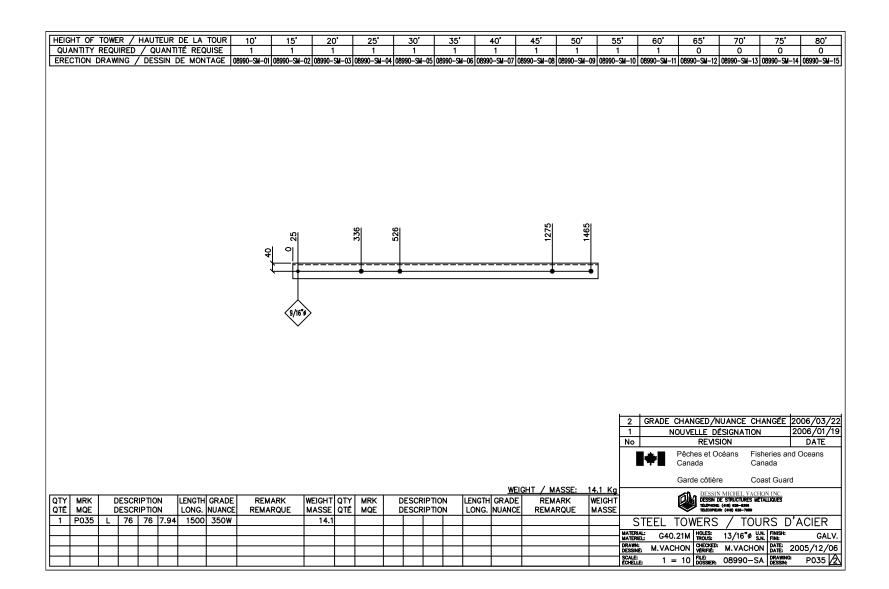


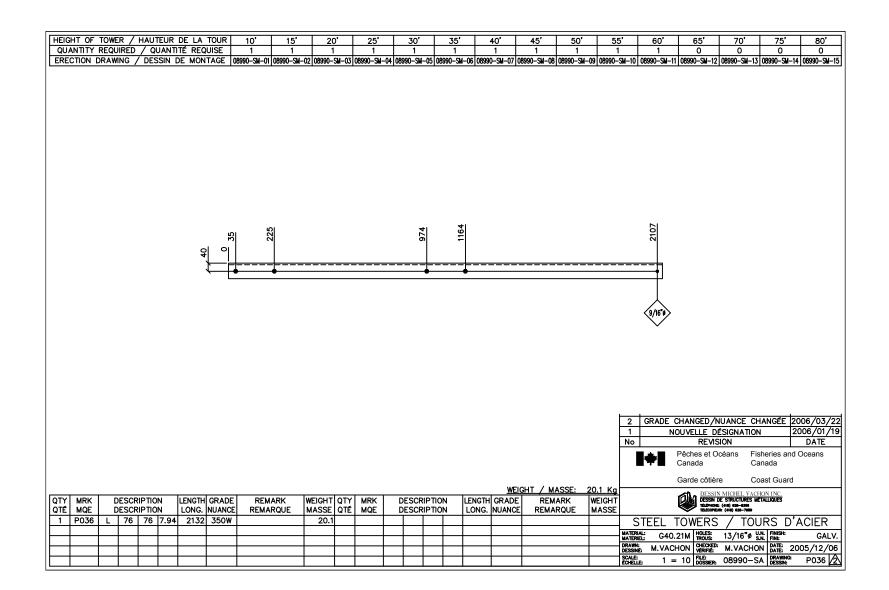


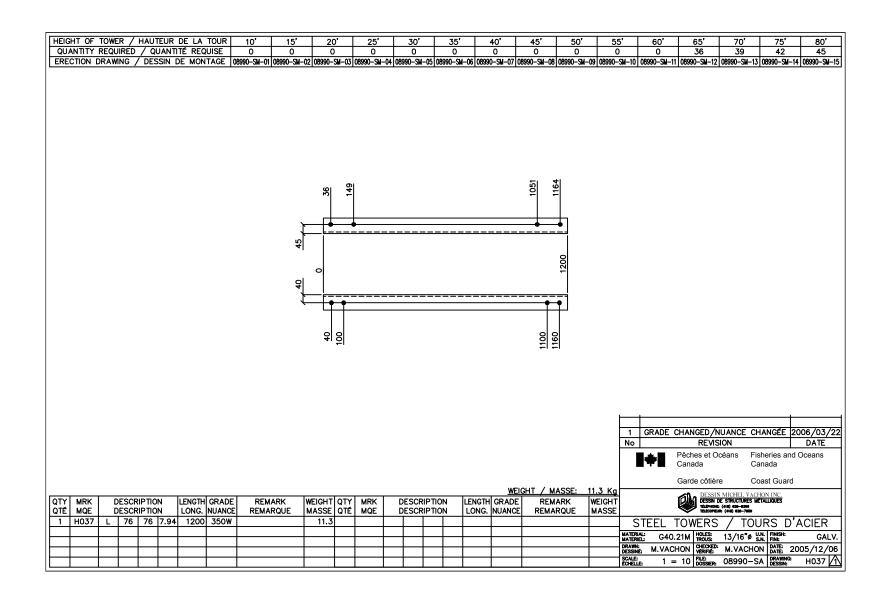


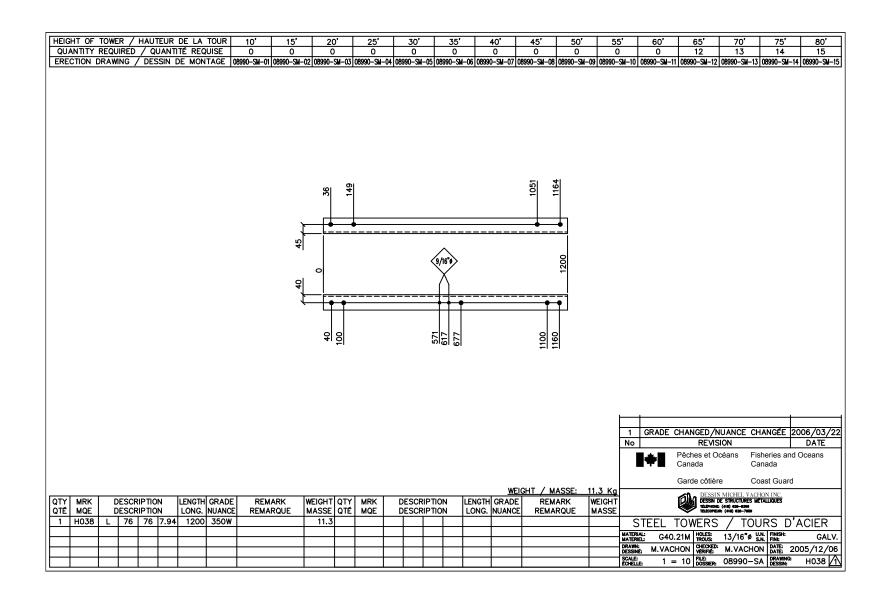
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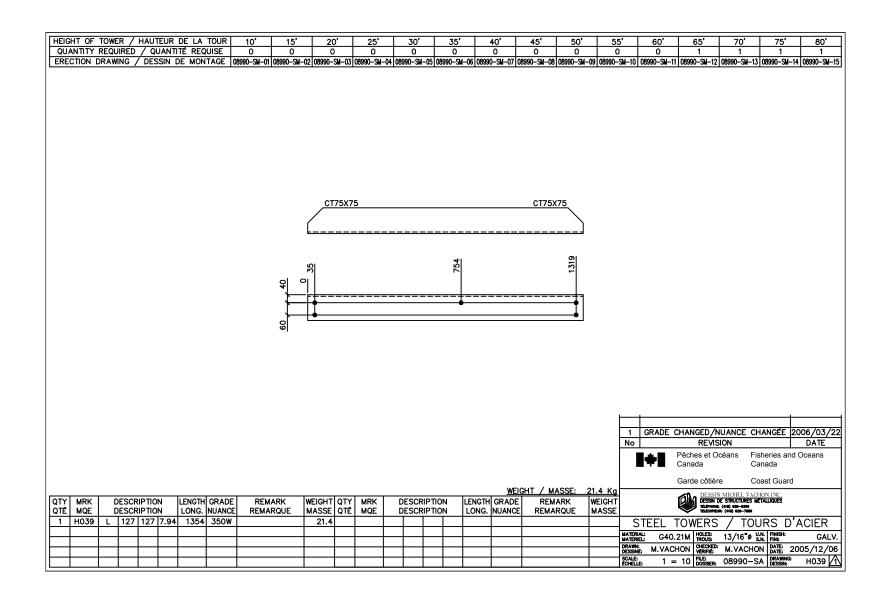


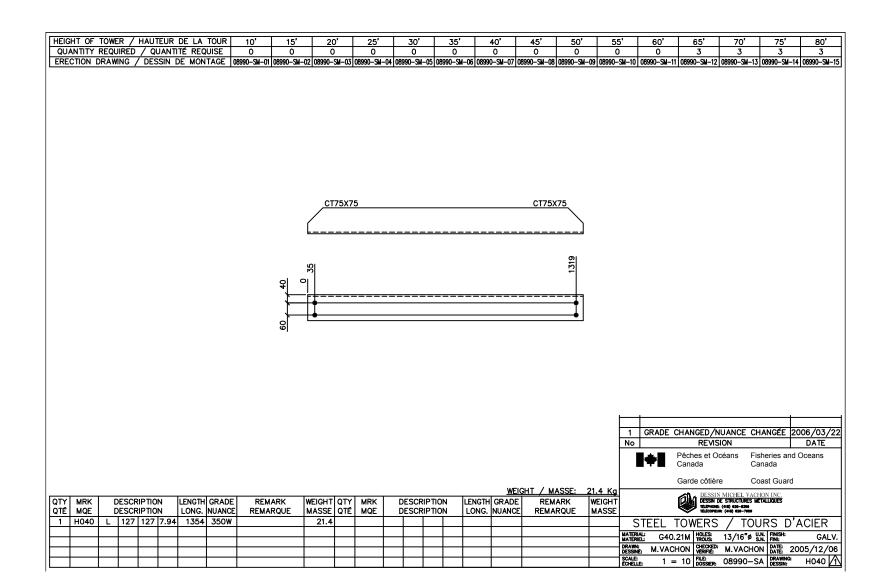




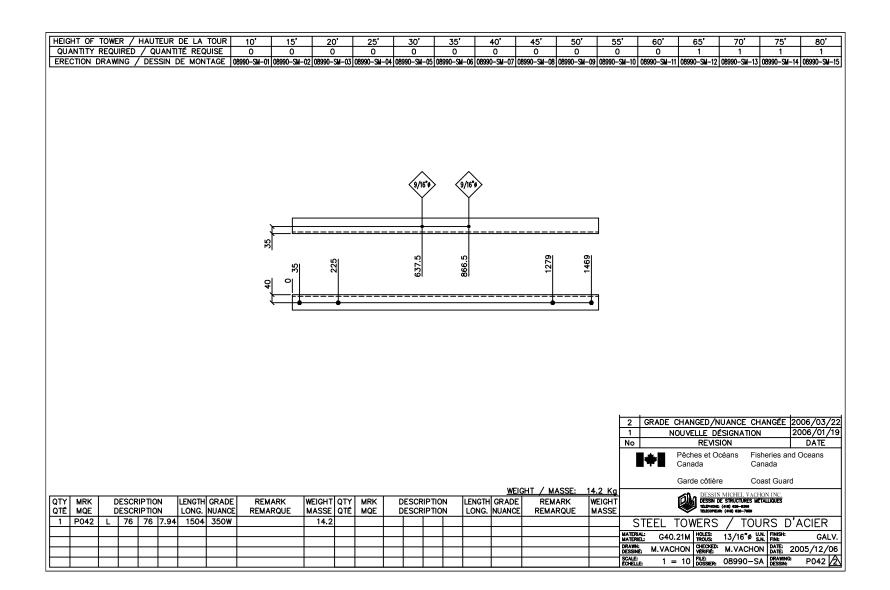




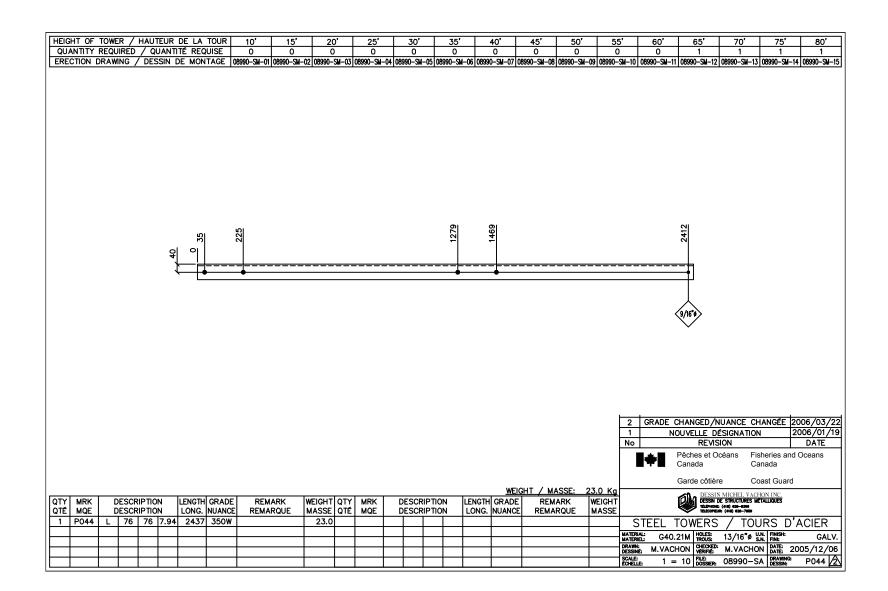


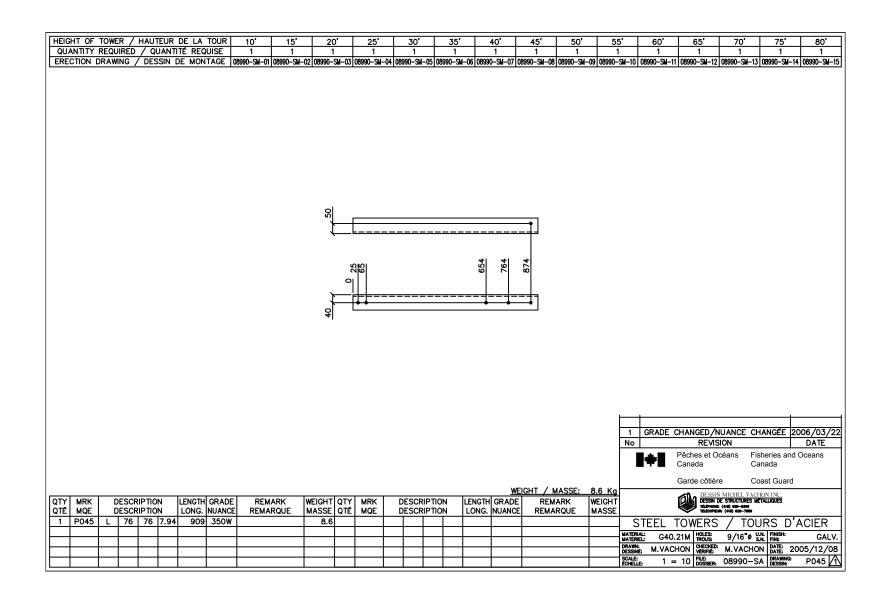


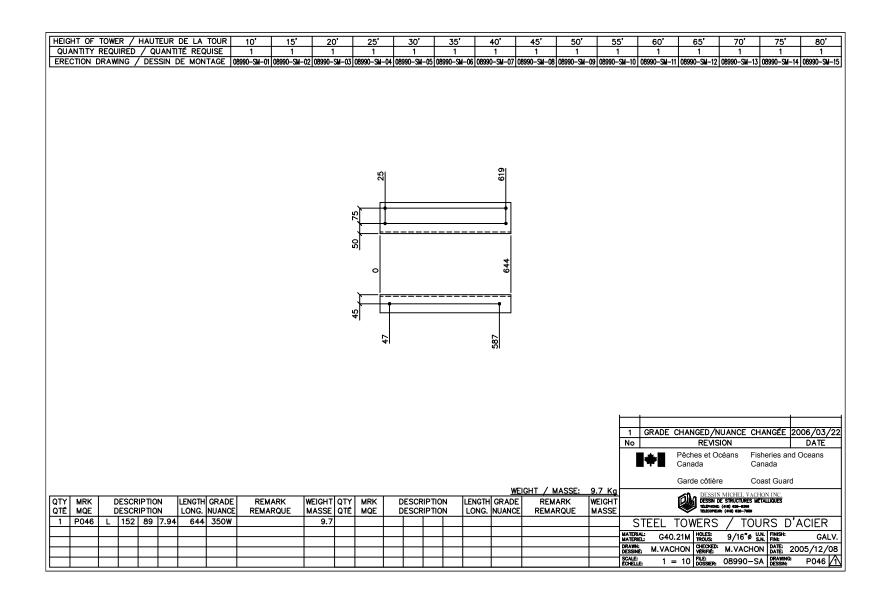
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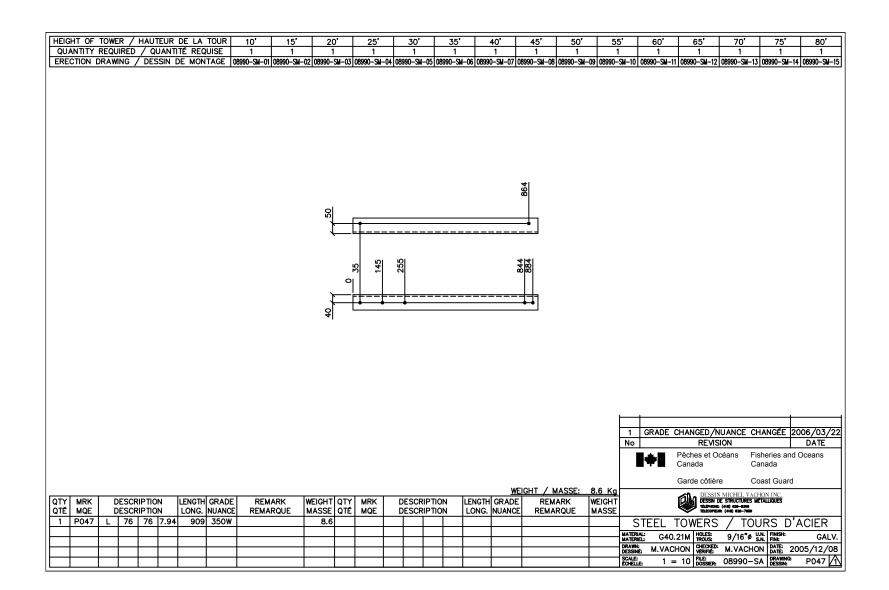


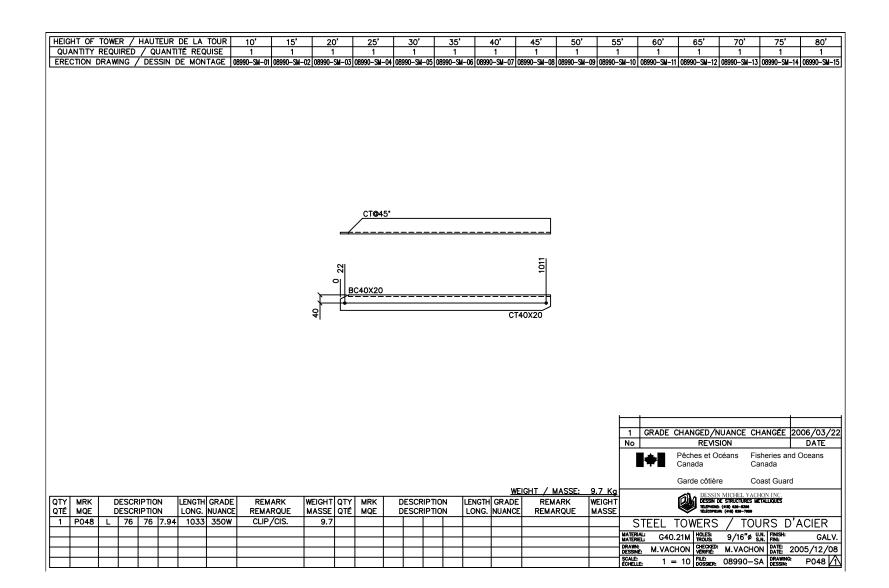
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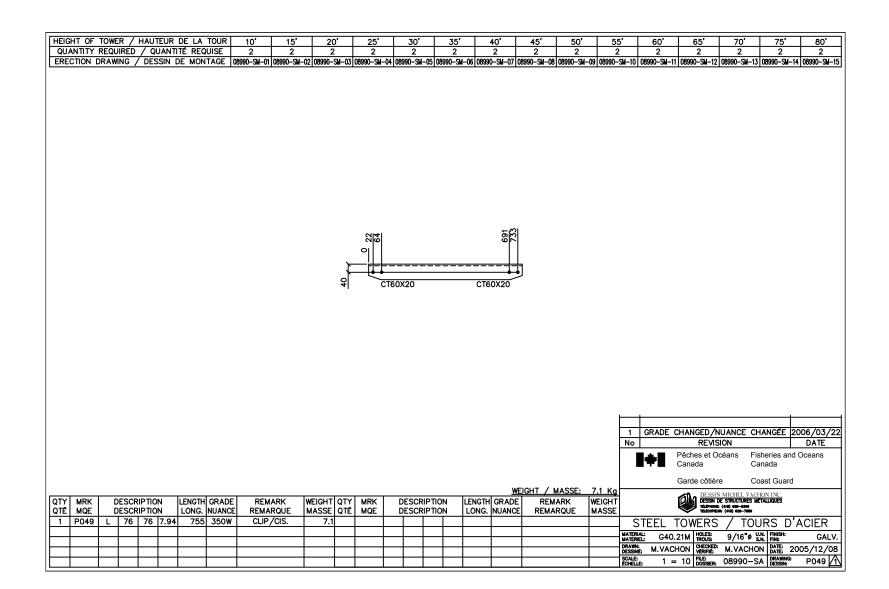




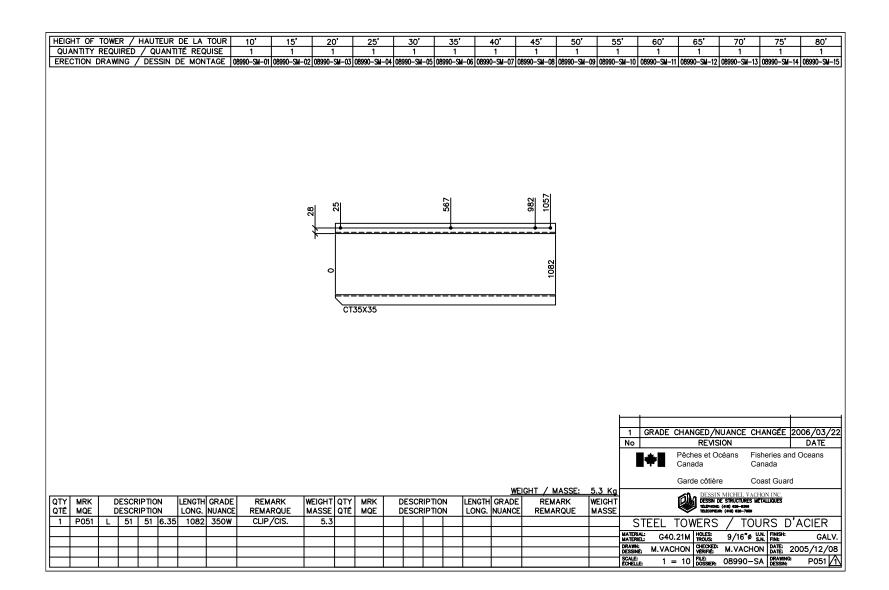




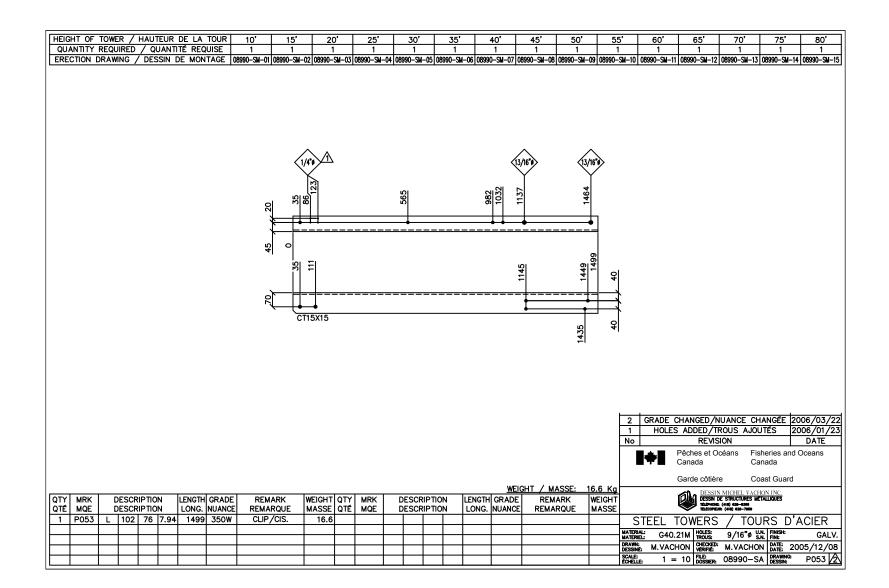




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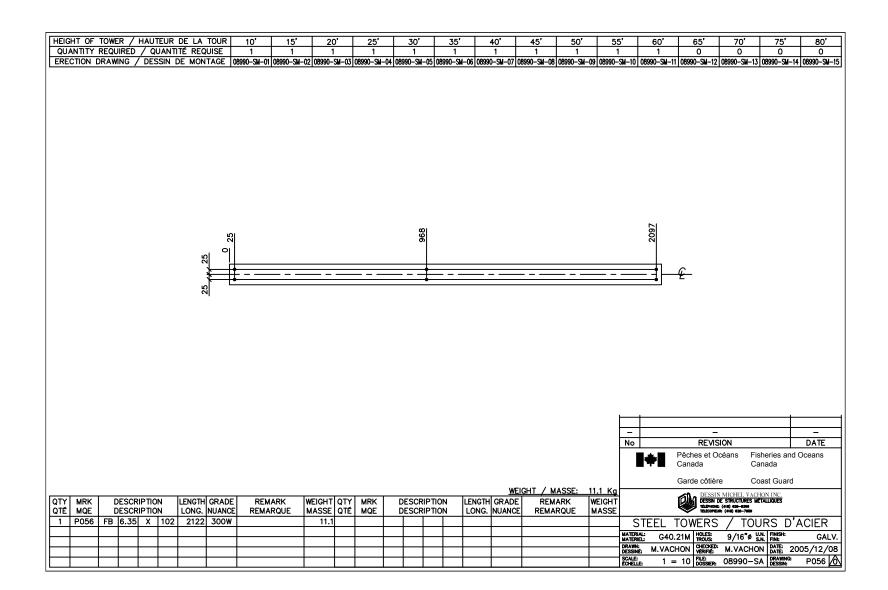


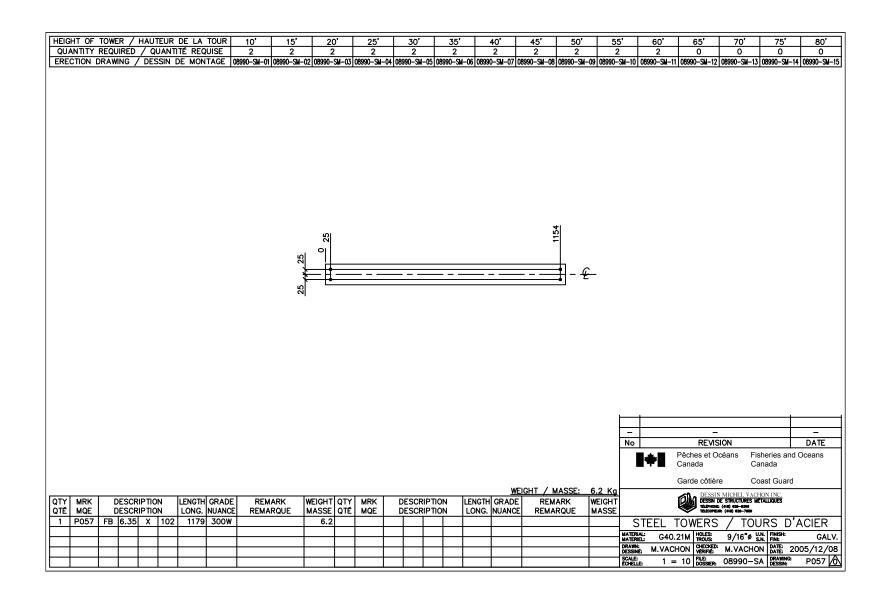
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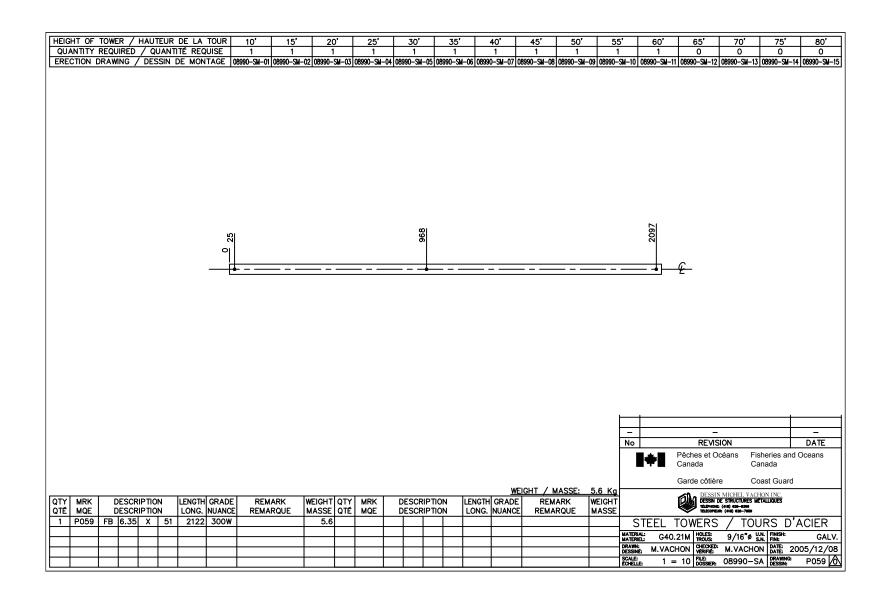
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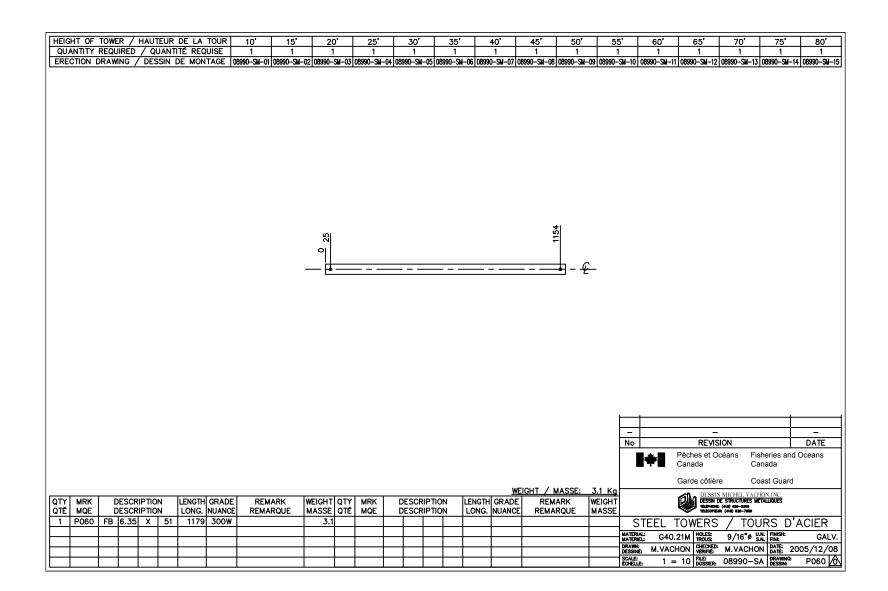
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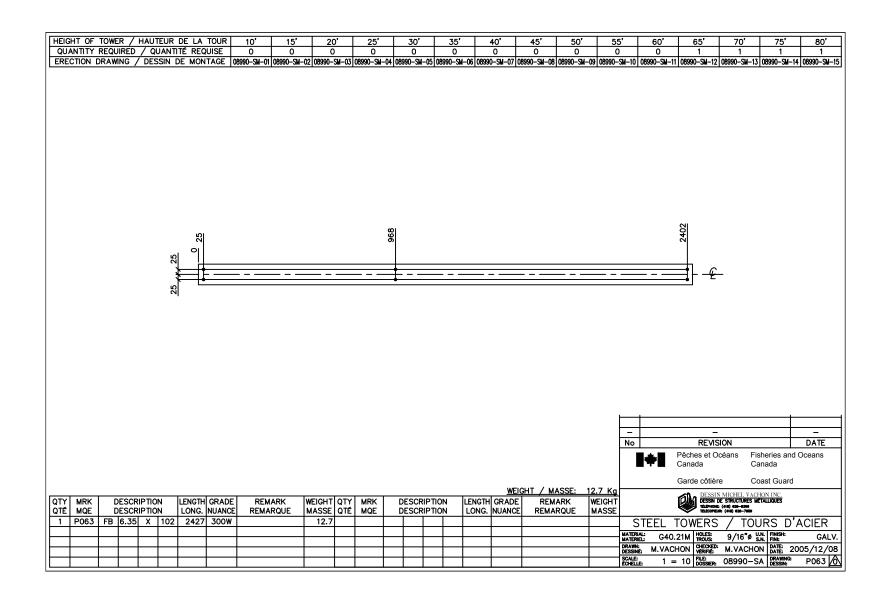
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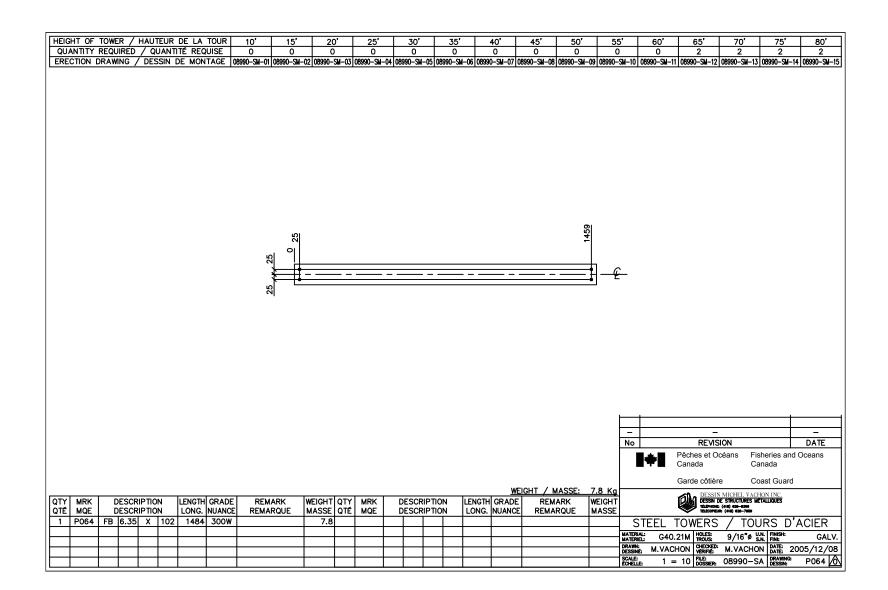


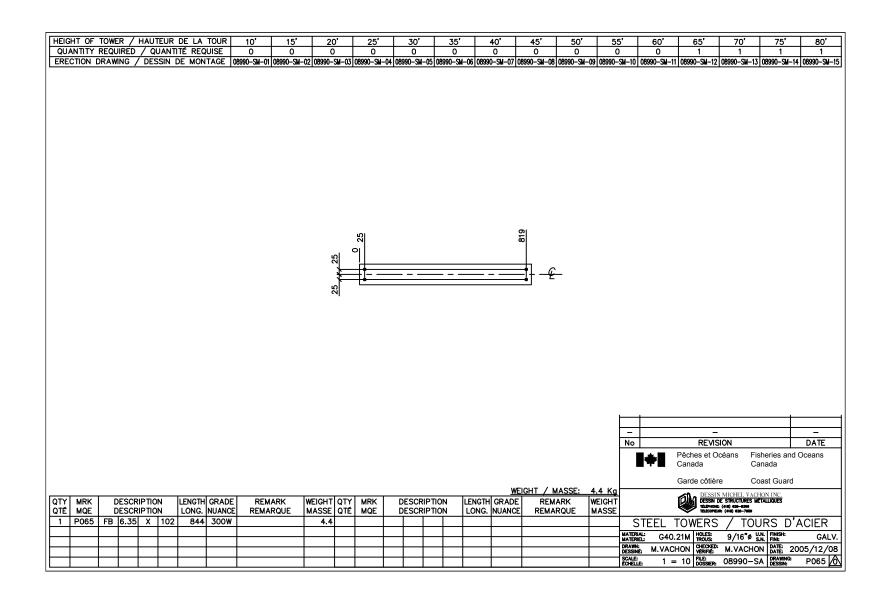


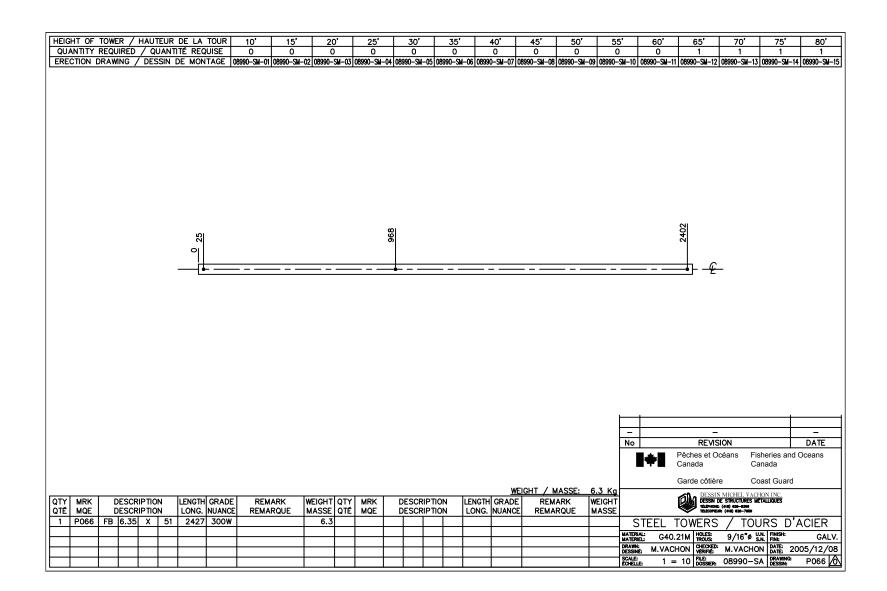
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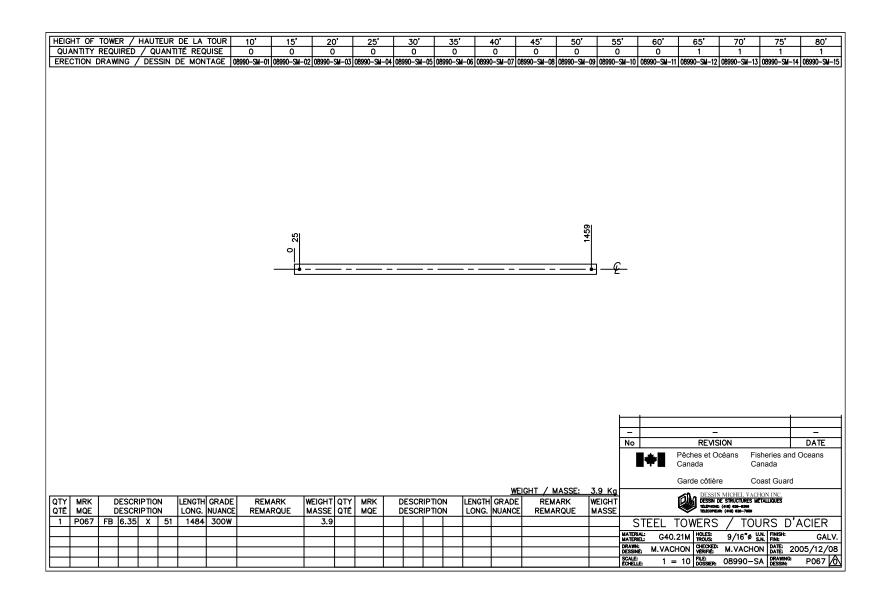
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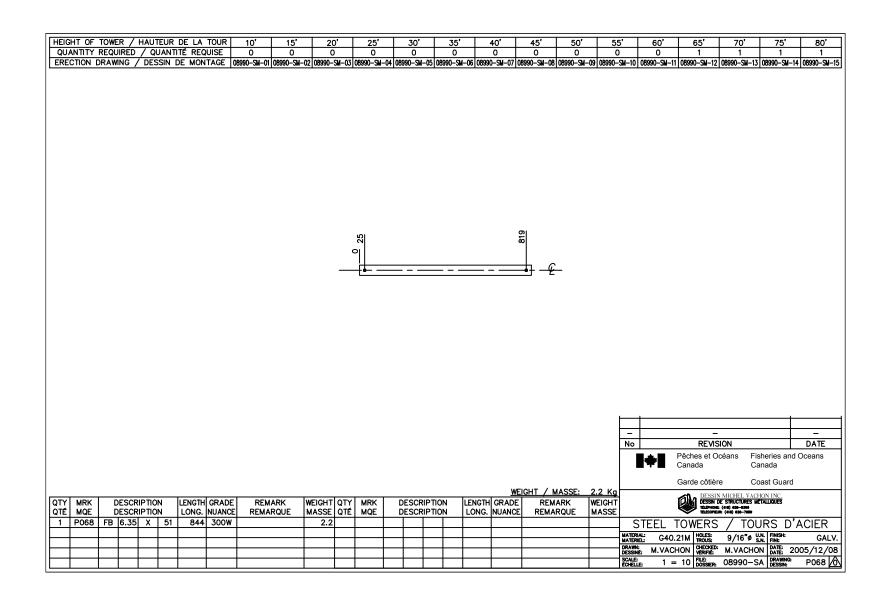




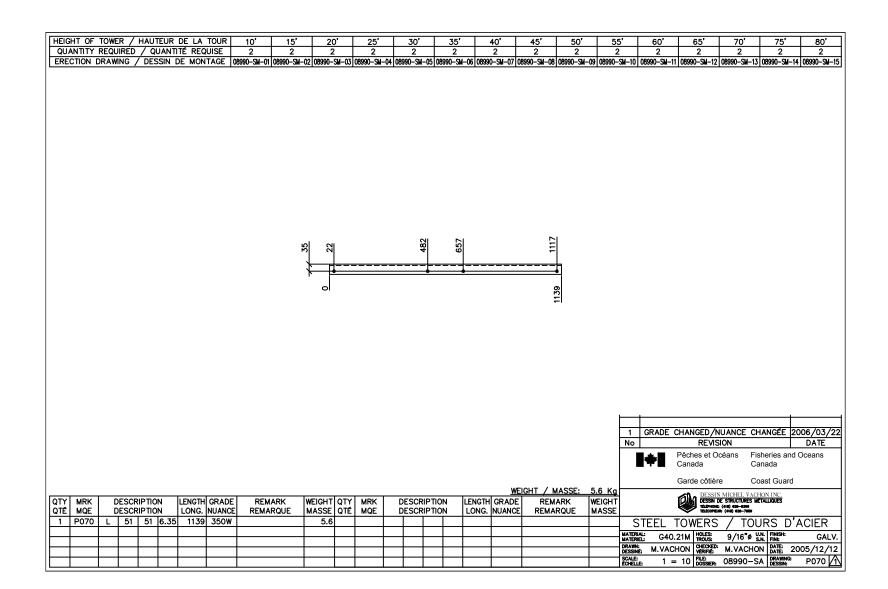


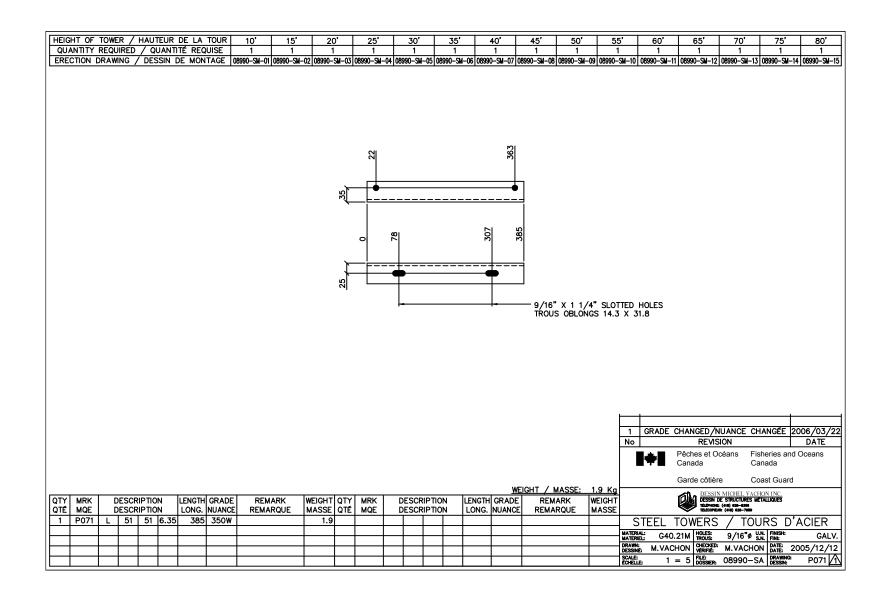


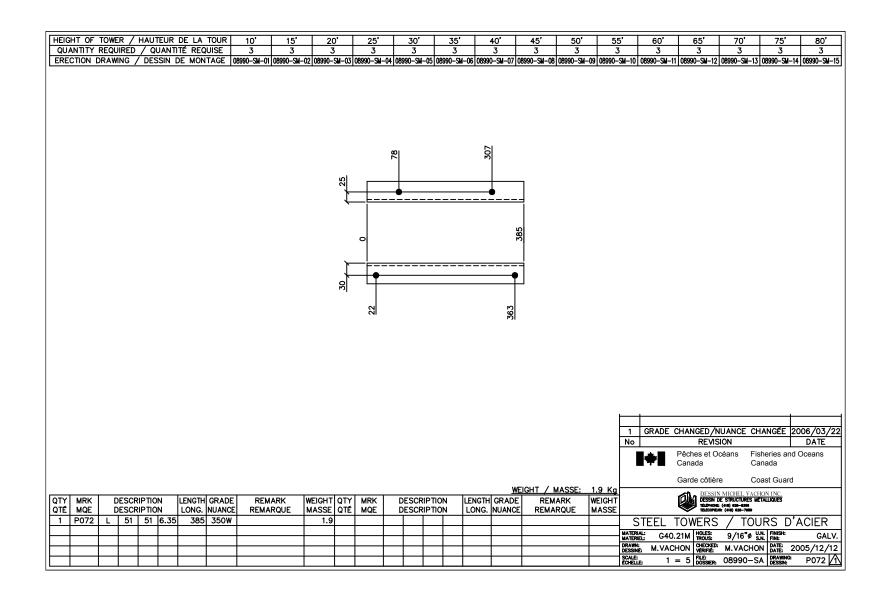


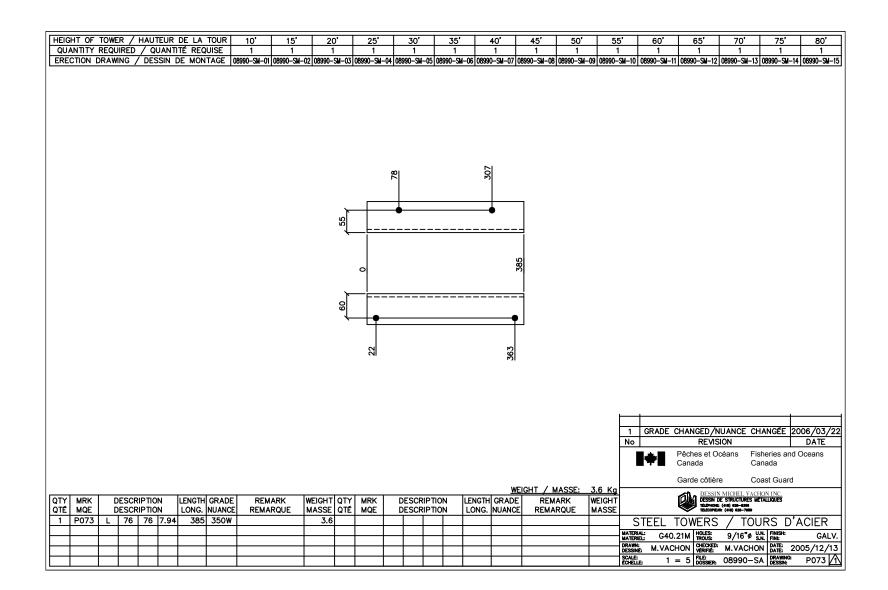


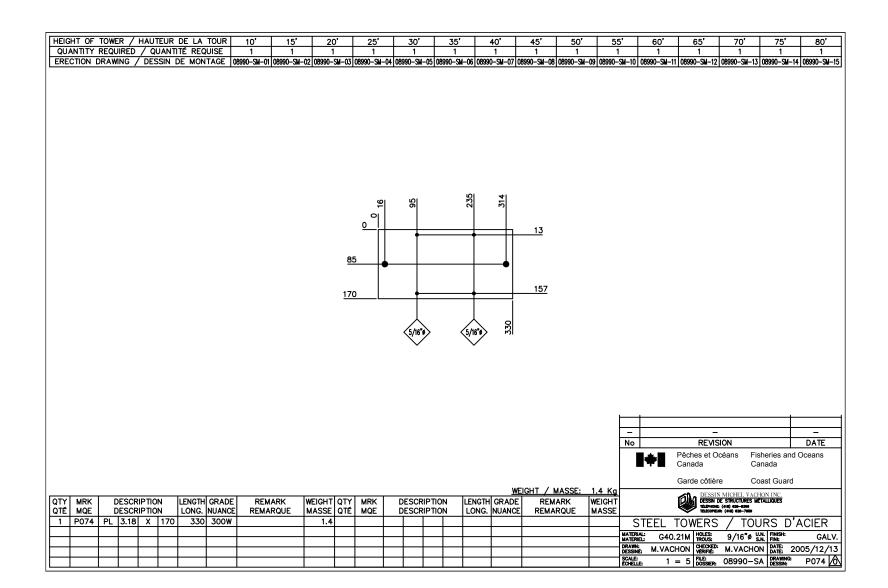
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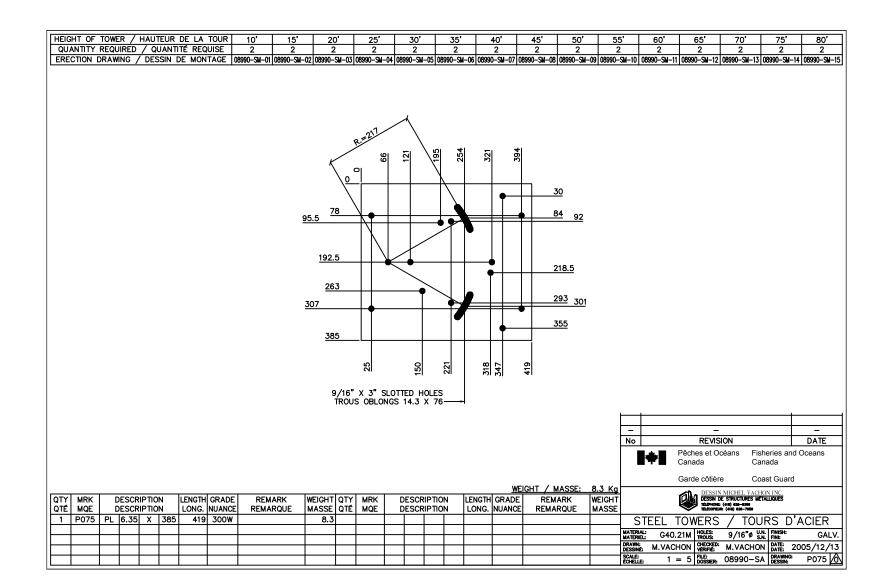


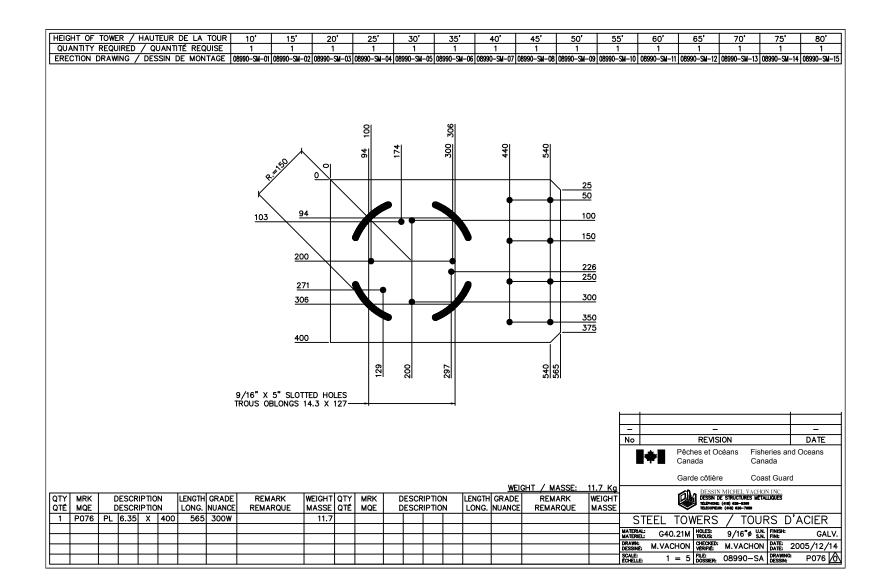


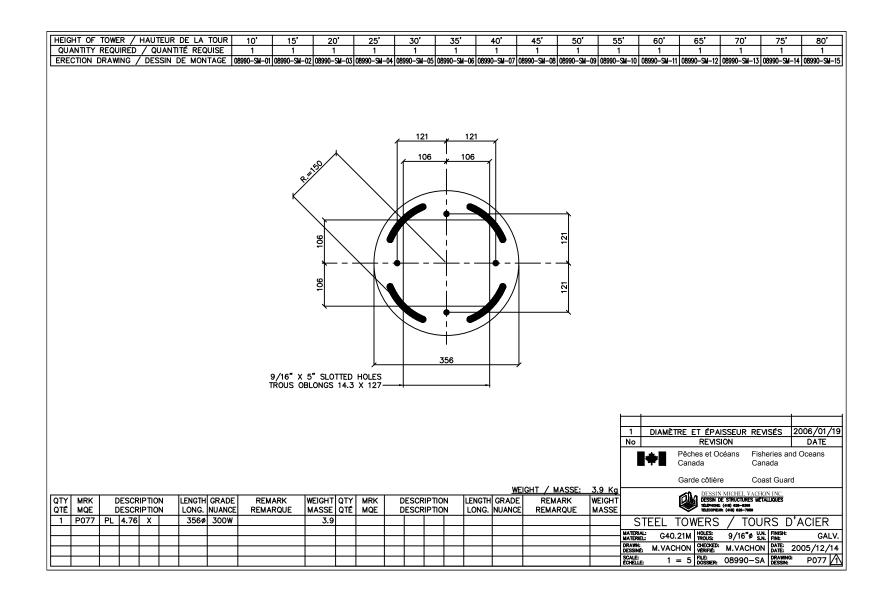




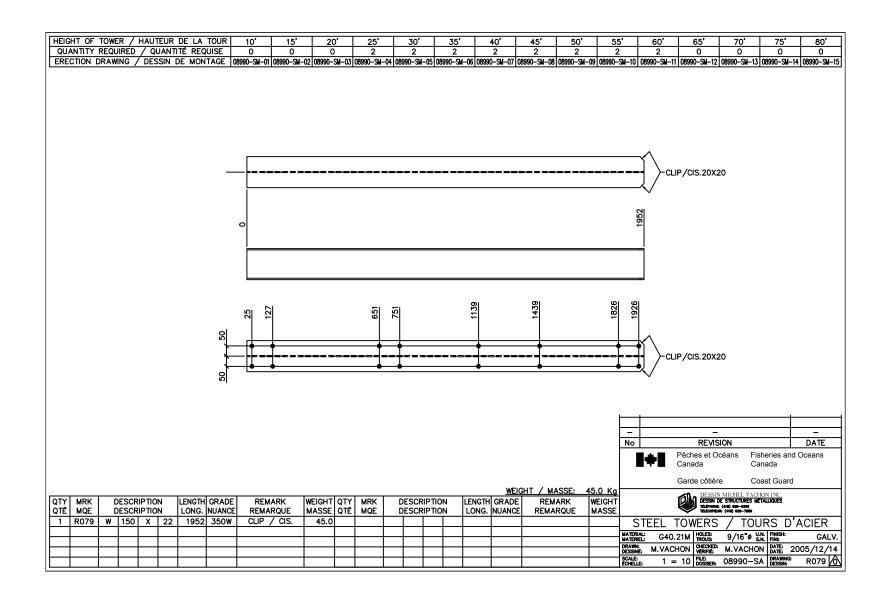


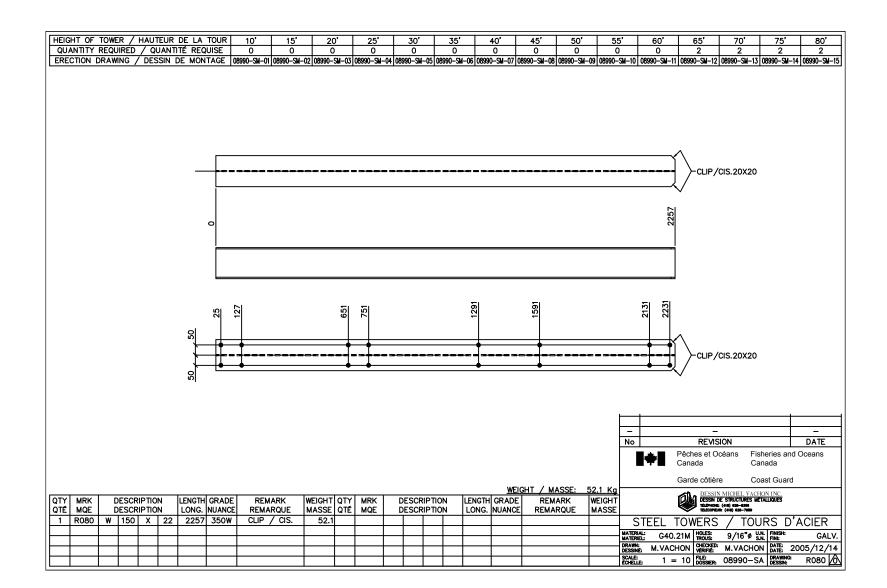






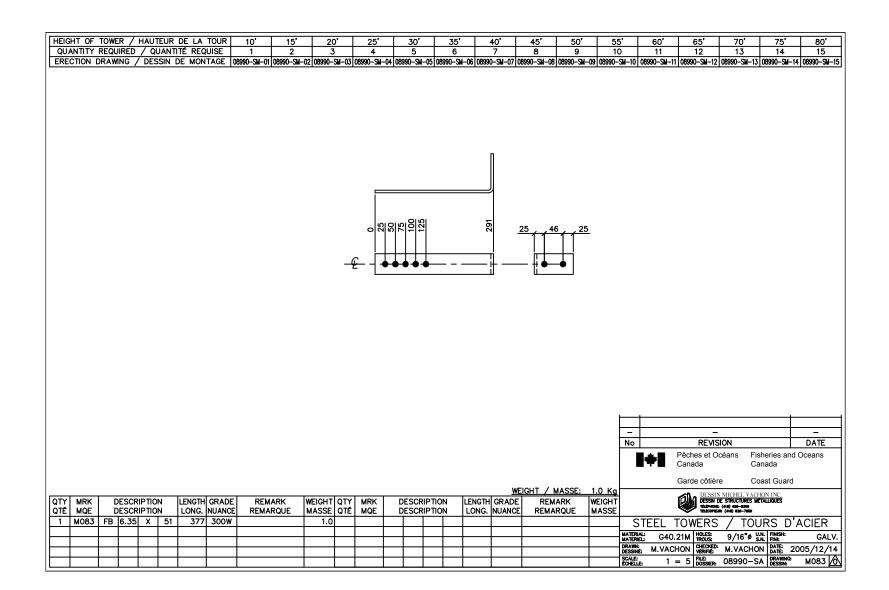
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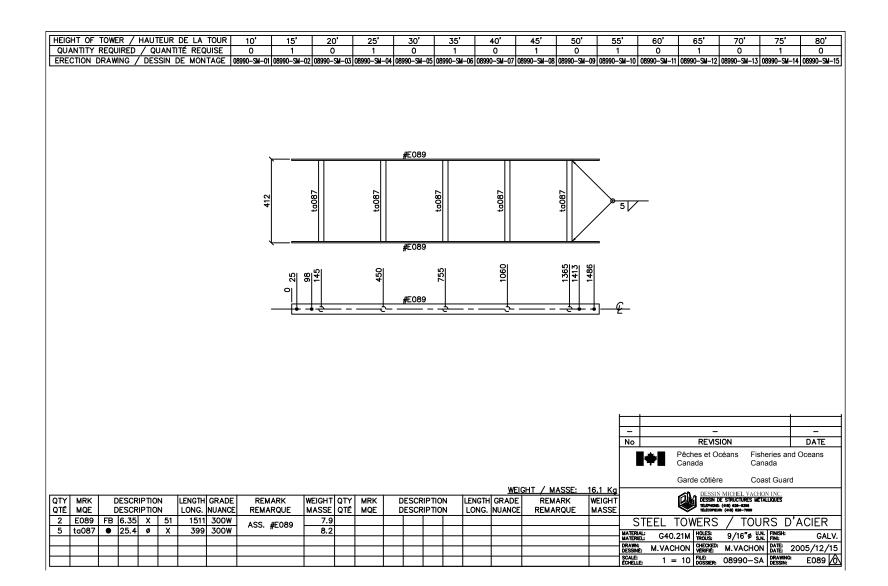
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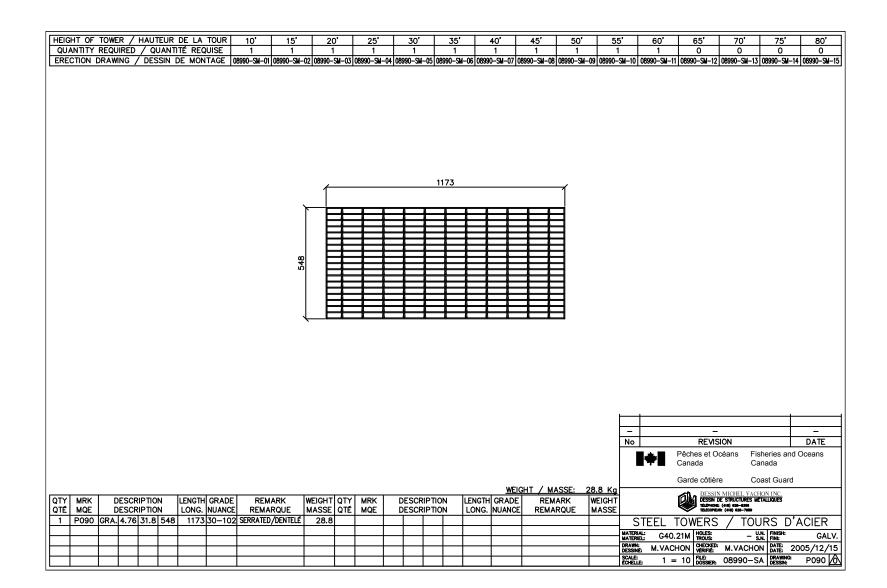
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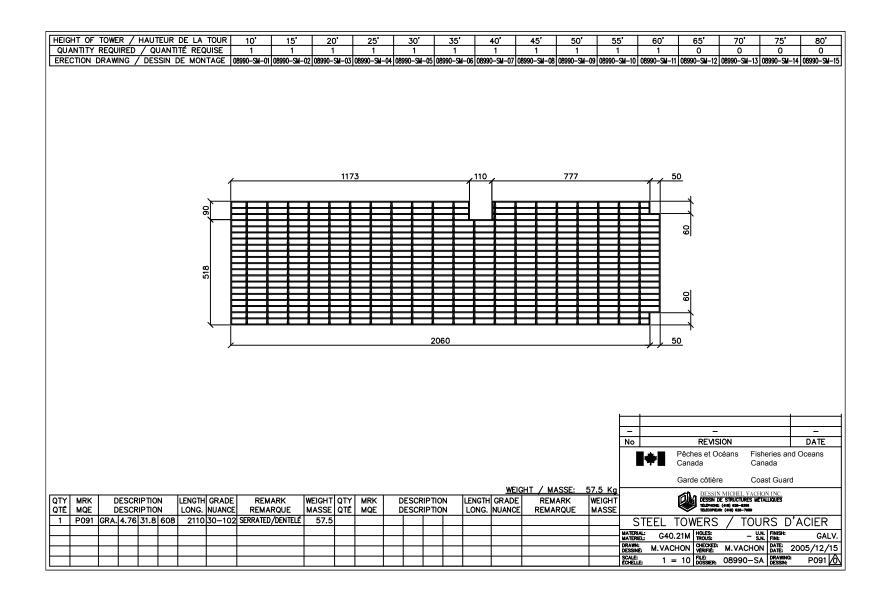
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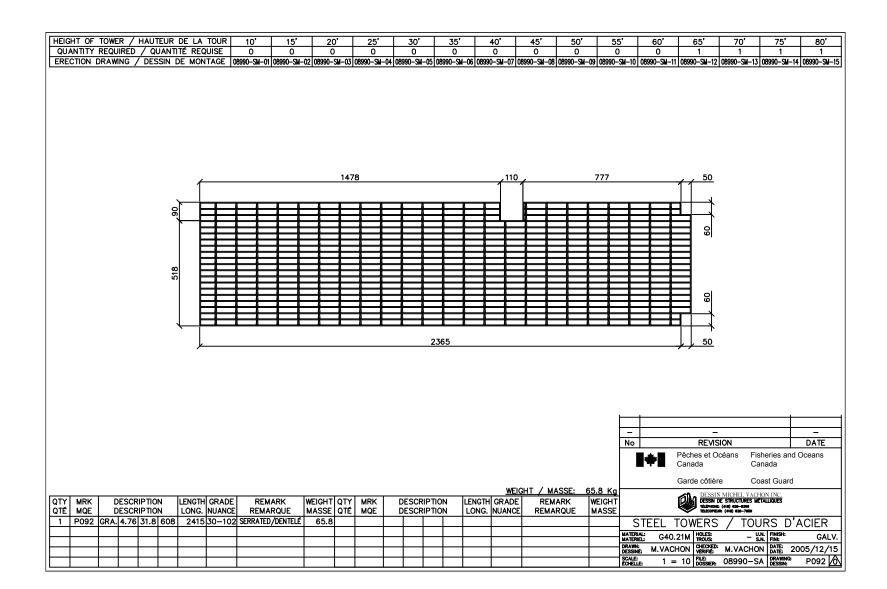
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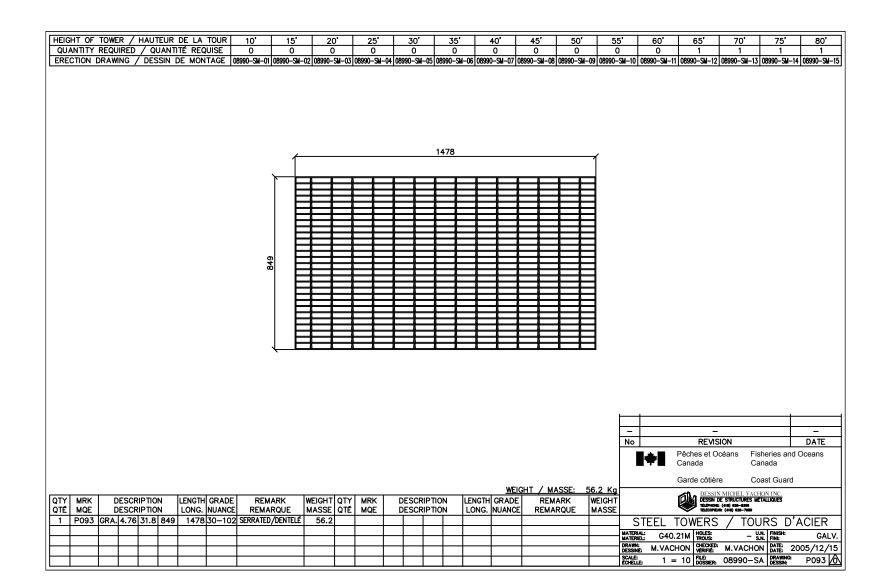
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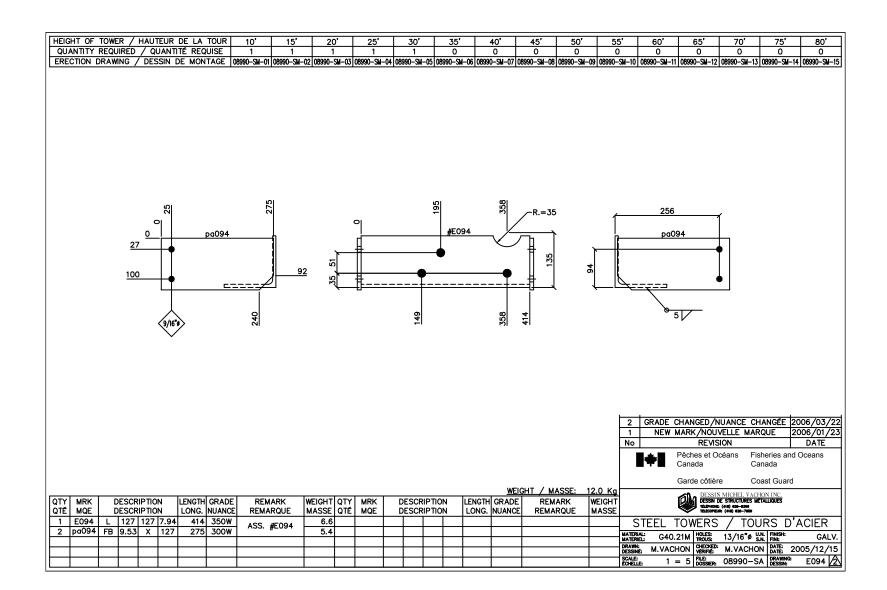


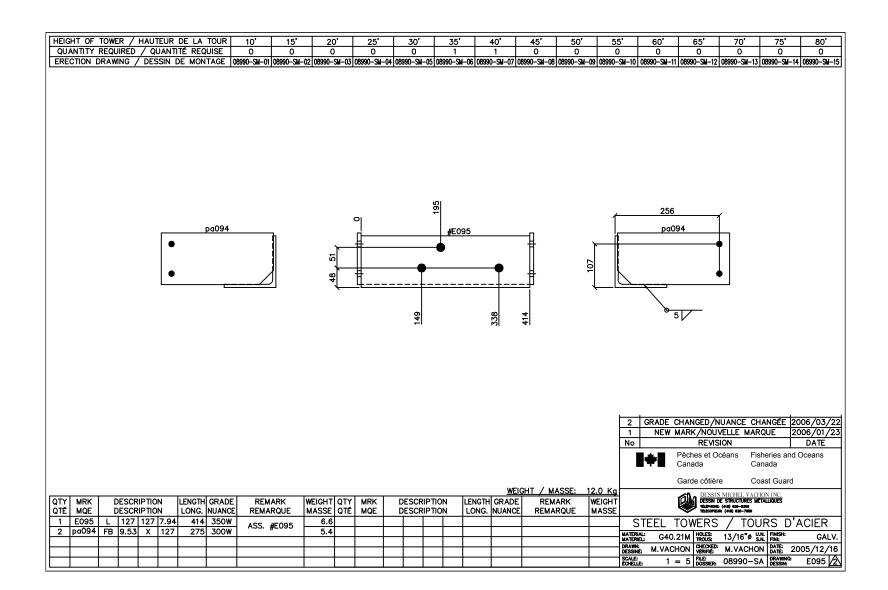


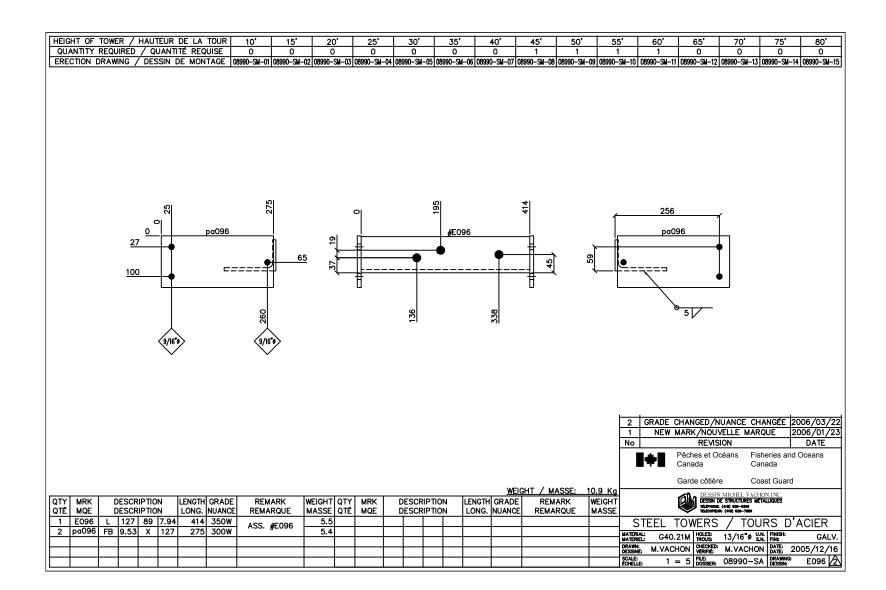


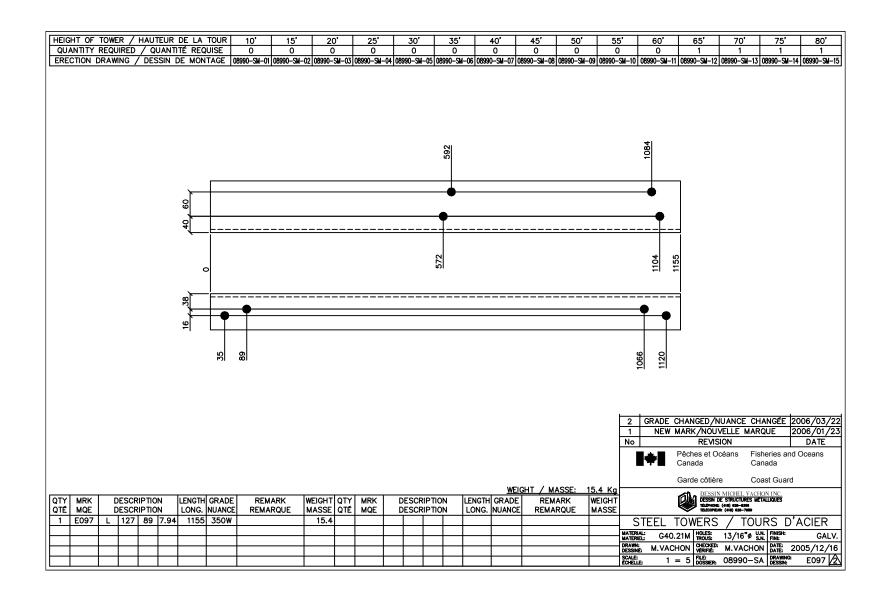


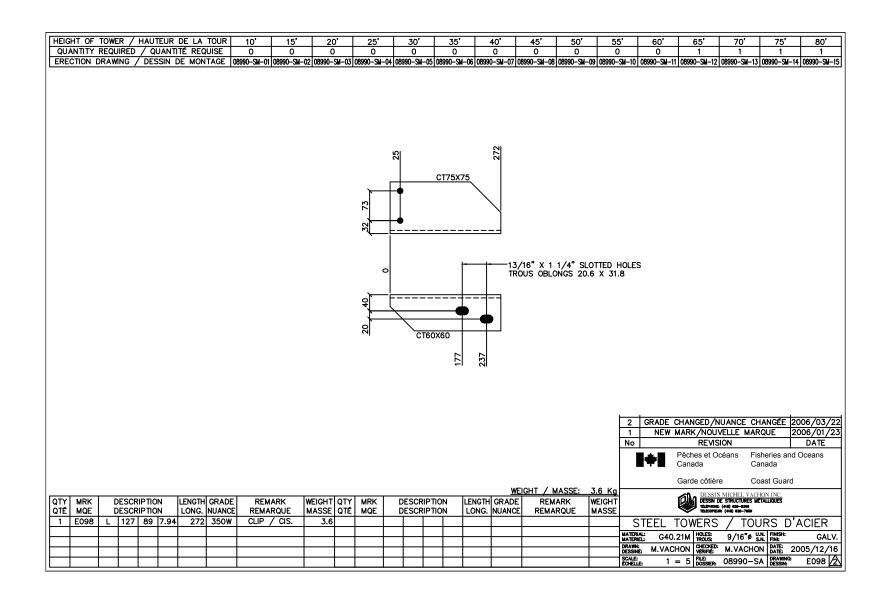


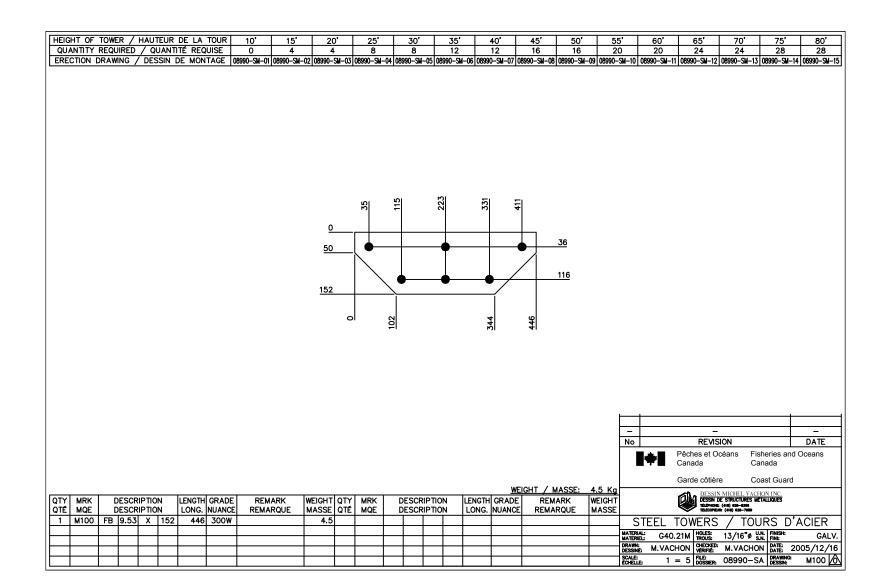


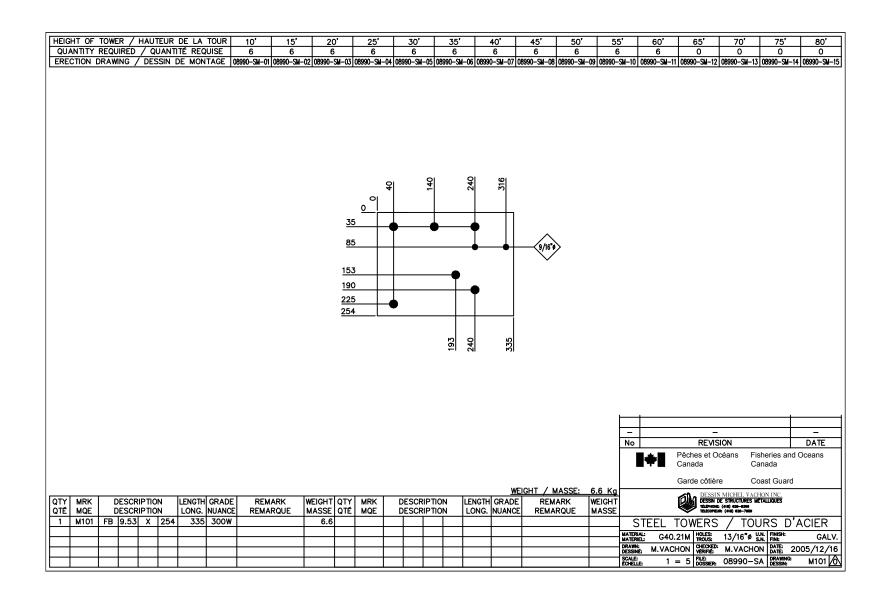


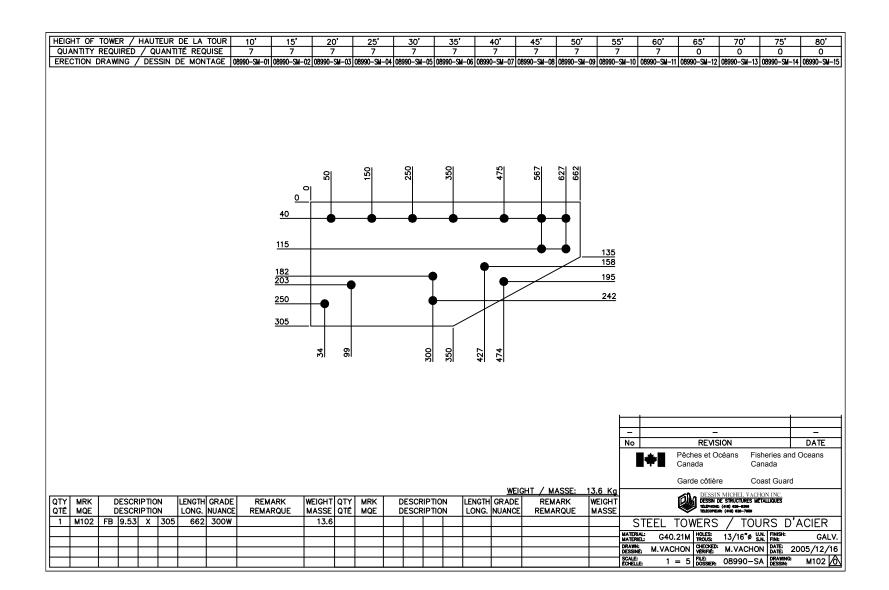


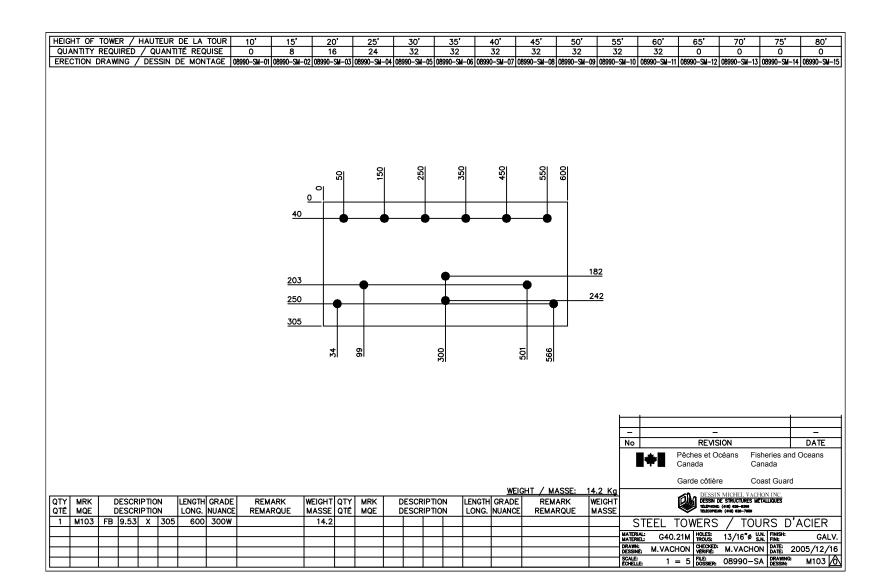


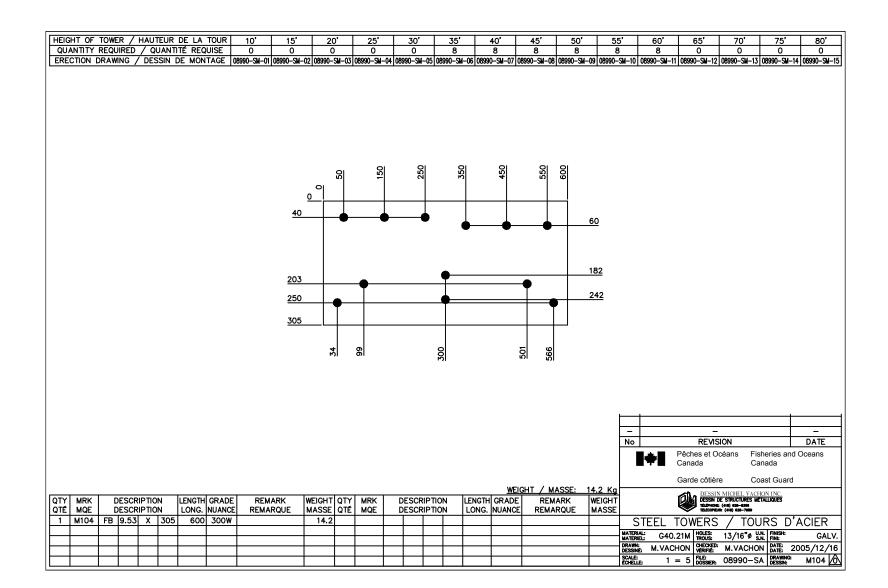


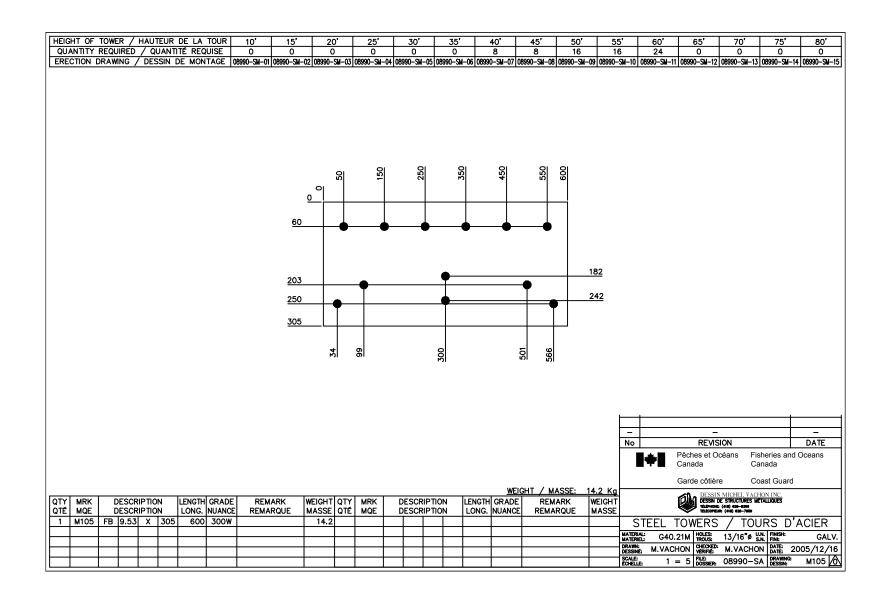


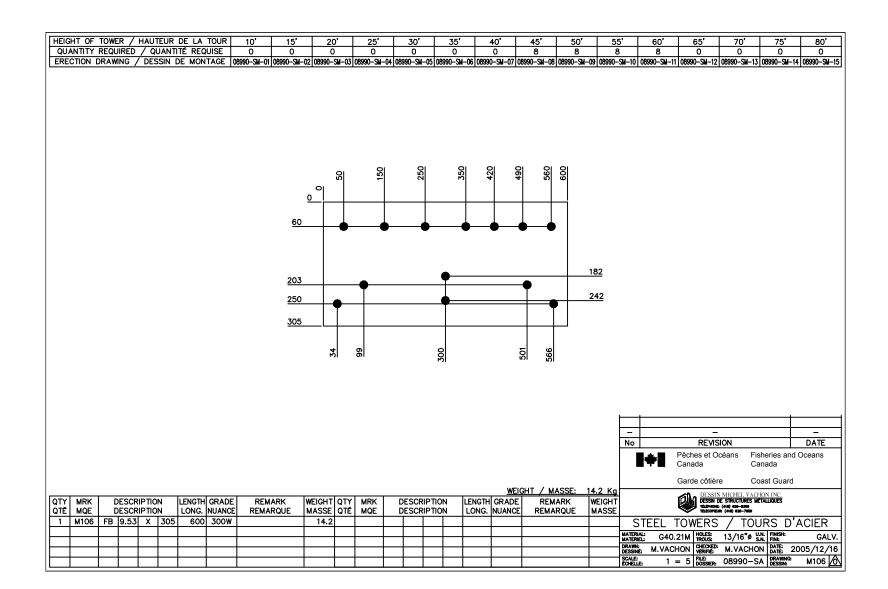


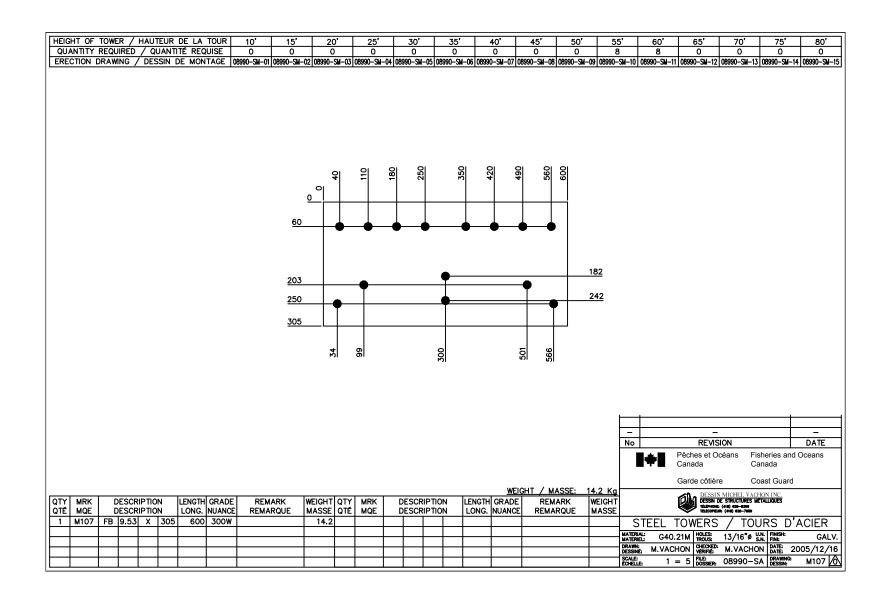


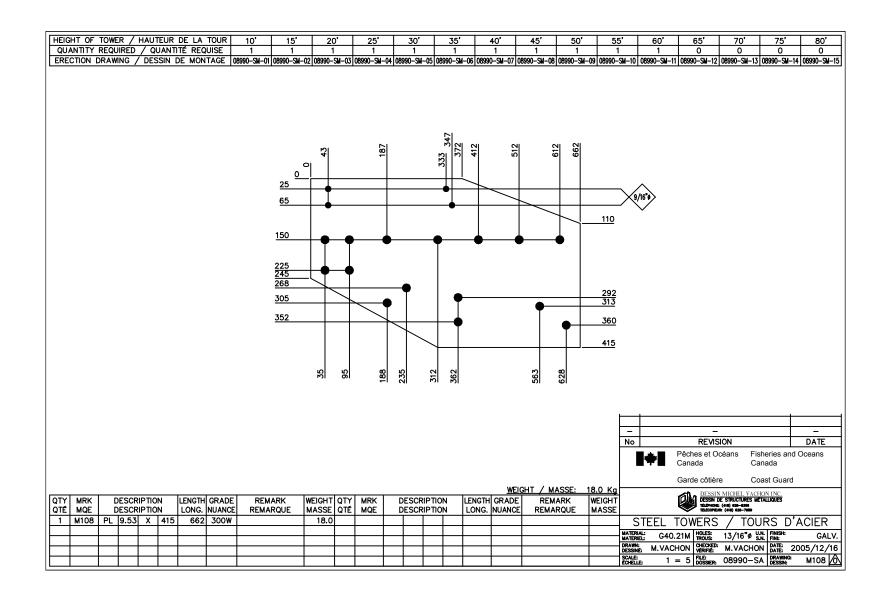


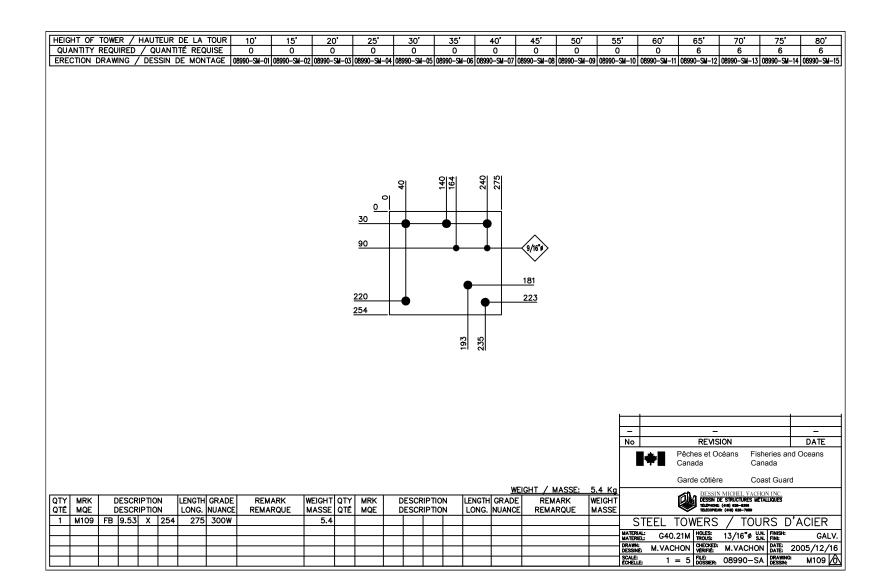




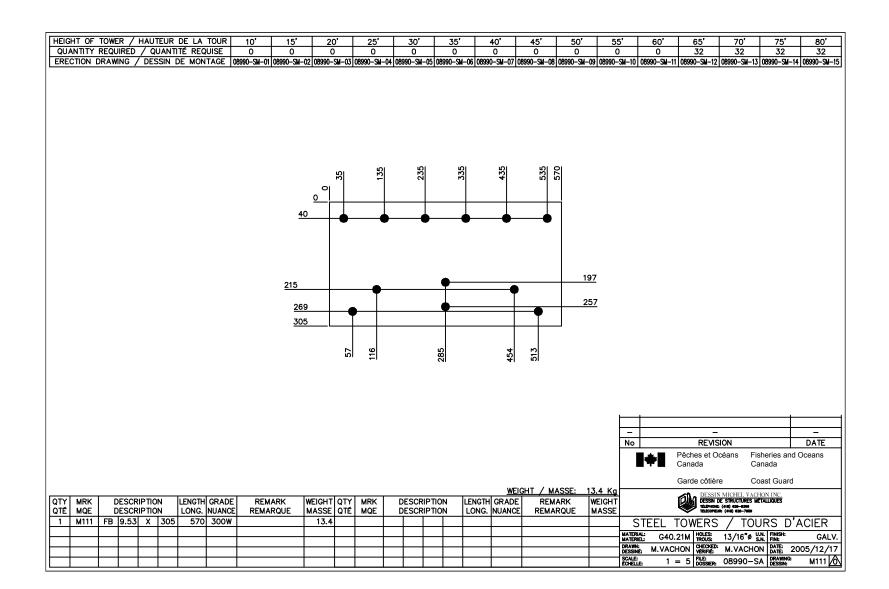


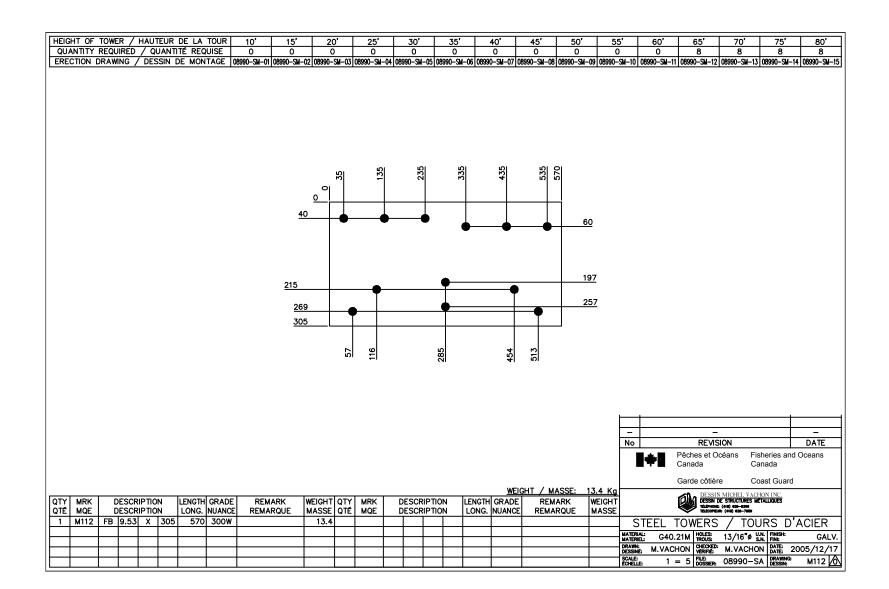


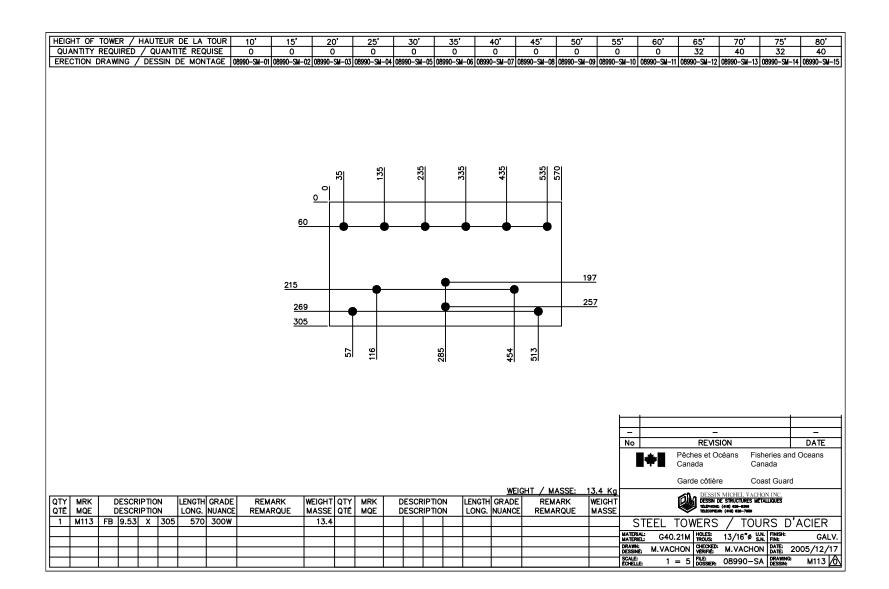


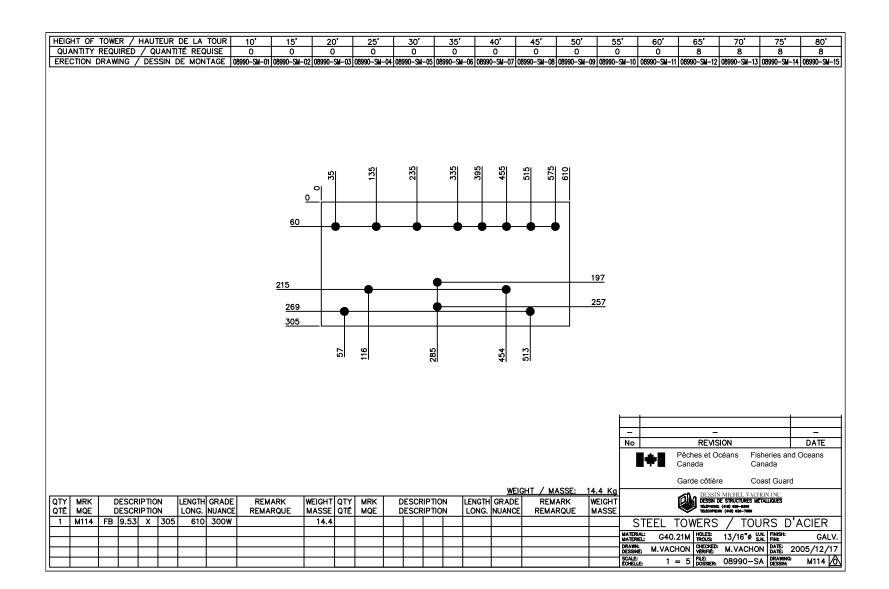


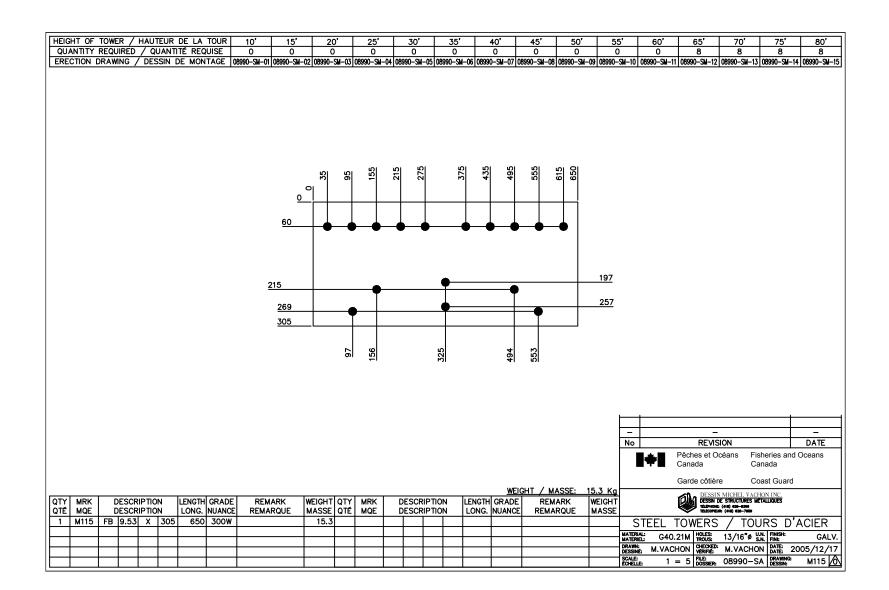
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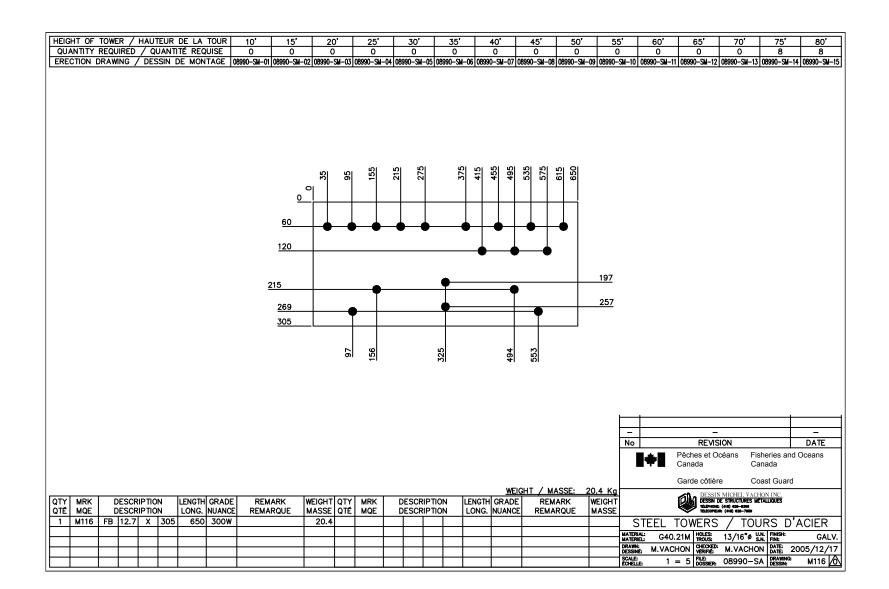


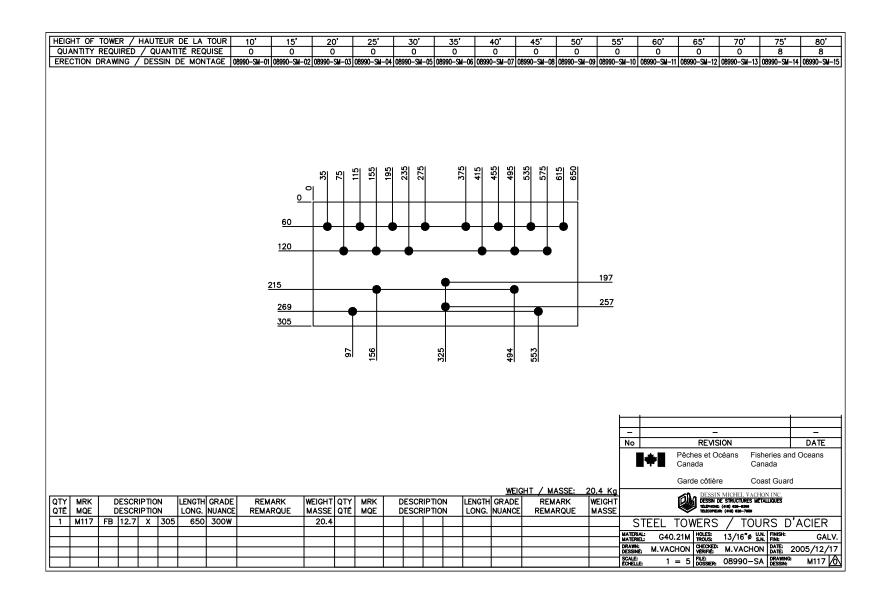


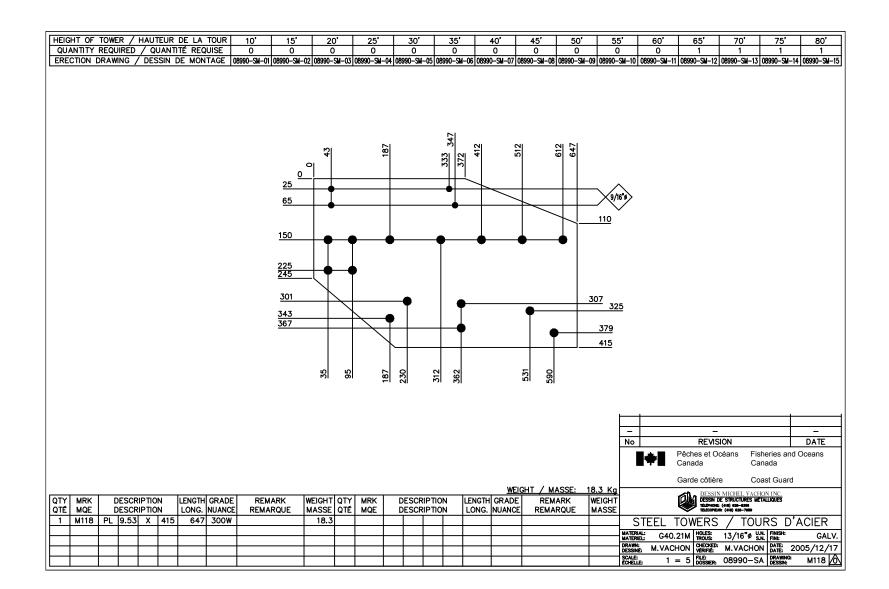


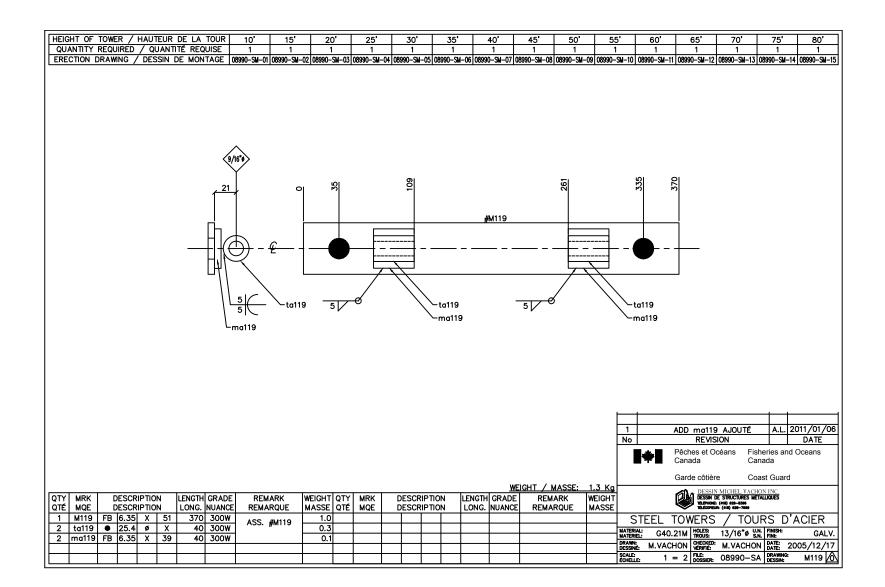


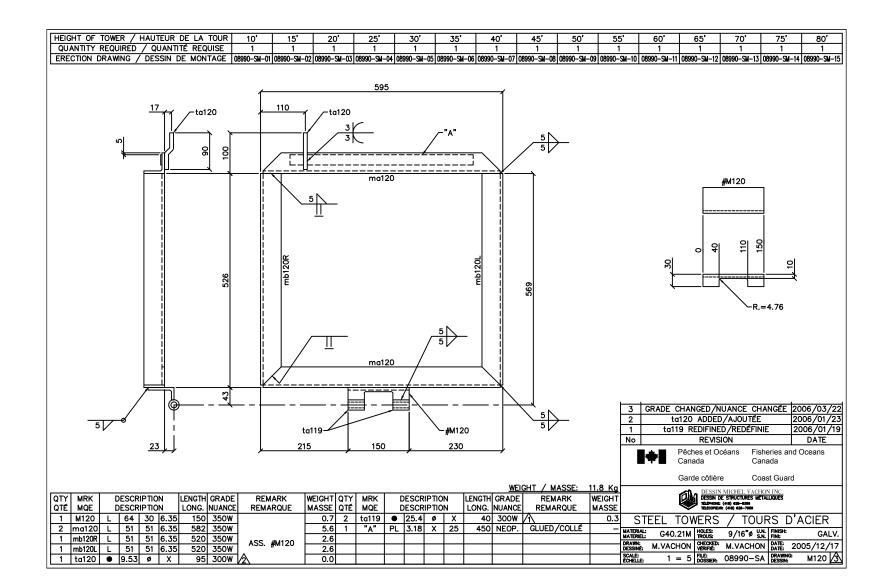


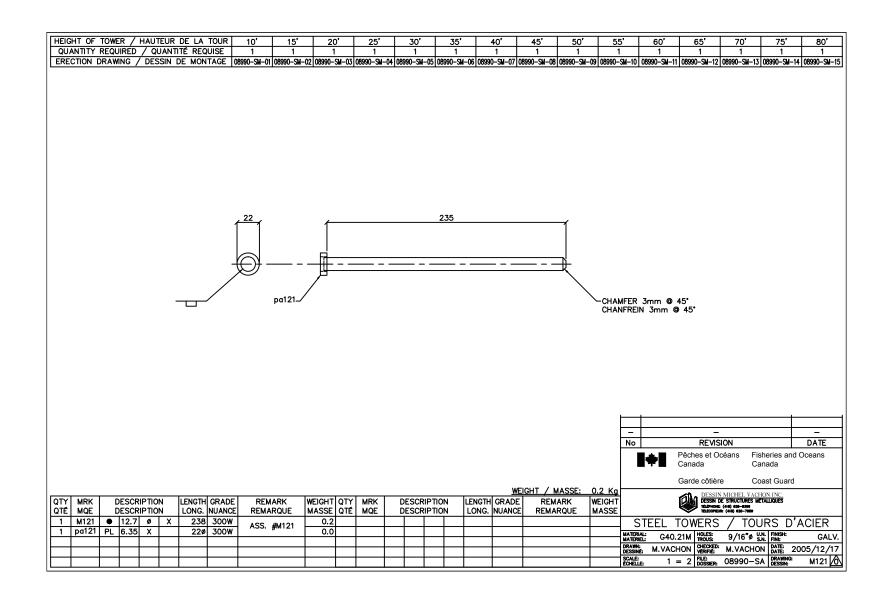


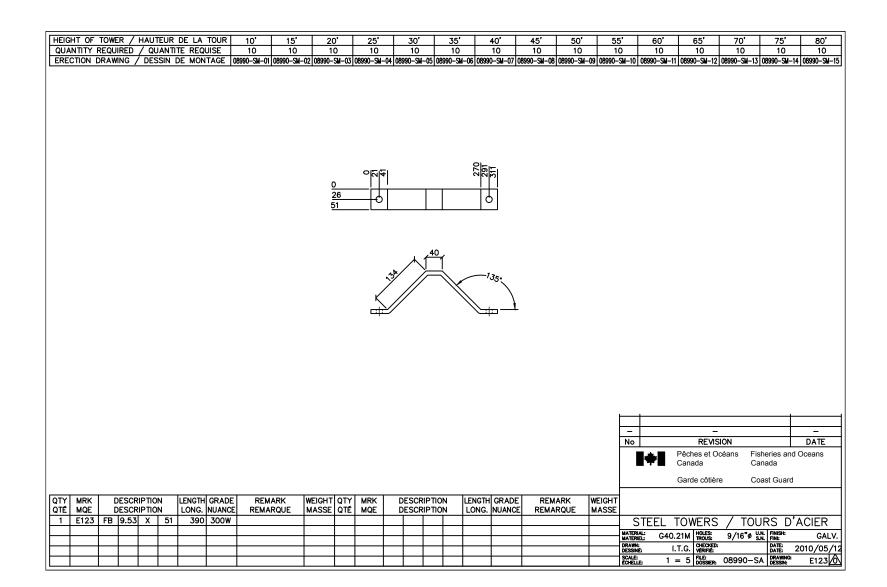


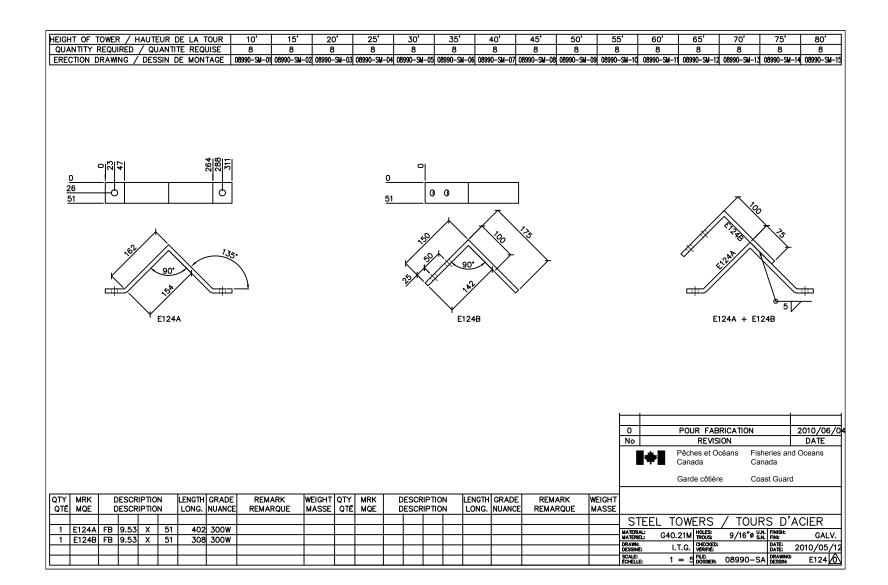


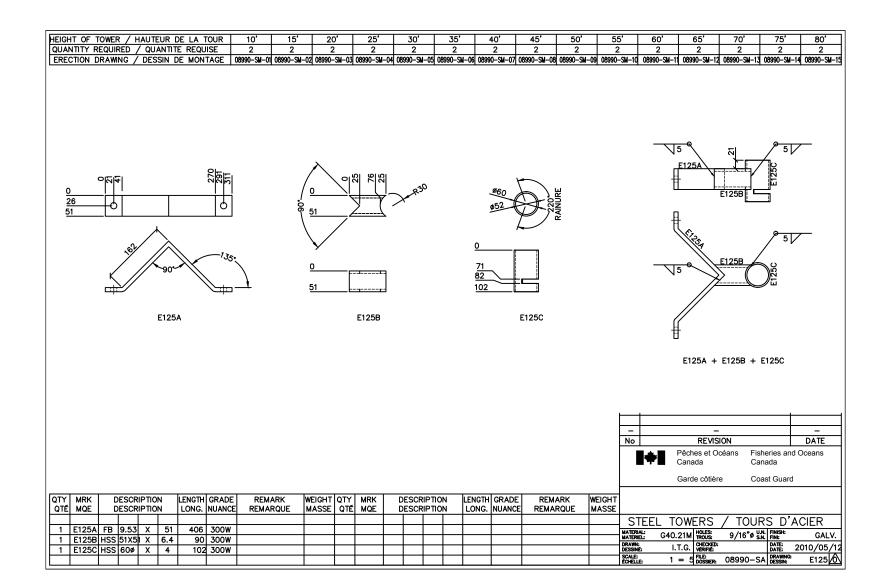


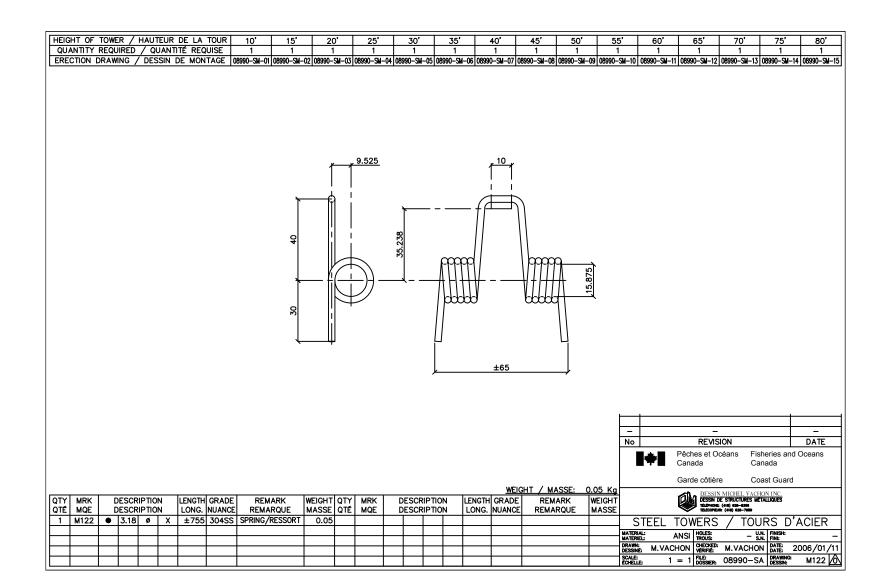














Fisheries and Oceans Canada Pêches et Océans Canada

Canadian Coast Guard Garde côtière canadienne



APPENDIX B4 – GEOTECHNICAL INFORMATION

REFEREN	CE No.	·	T050159a1								ENCLOSURE No.: 1				
			60 1	BOREHOLE No.						B	OREHOLE REPORT				
Î N	ISP	EC•	SOL	ELEVATION:* _		98.	07 m				Page: <u>1</u> of <u>1</u>				
CLIENT: _		Fishe	eries and Oceans Ca	anada						<u>LE</u>	GEND				
				on Structure / Tower						SS - SPLIT SPOON					
LOCATION	l:	Port	McNicoll Rear Rang	e, Near Midland, Ontar	io						ST - SHELBY TUBE AU - AUGER PROBE				
DESCRIBE	D BY:	R. Kł	habbaznia	CHECKED BY:		F. Bag	neri			Ţ					
DATE (STA	ART):	Augu	ust 10, 2012	DATE (FINISH)	:	August	10, 2	012							
Depth	Elevation (m)	Stratigraphy		IPTION OF) BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) $\bigoplus_{w_p \ W_1}$ Atterberg limits (%) \bigcirc "N" Value (blows / 12 in30 cm)				
Feet Metres	98.07 98.01						%			N	10 20 30 40 50 60 70 80 90				
			FILL :			SS-1	42	9	2-2-3-5	5					
3 1.0 4 	97.31		Greyish brown, cob disturbed native)	ble pieces (Possible		SS-2	42	2	3-5-4-4	9					
6 — - 2.0	96.55 95.94		NATIVE : SAND and GRAVE moist, compact	L, greyish brown,		SS-3	58	3	4-8-12-15	20					
8 - 2.29 8 - 2.29 9	95.78		Auger grinding SANDY SILT TILL, trace clay, cobble p dense	trace to some gravel, ieces, grey, moist,		SS-4	94	8	15-21-24-25	45					
	95.02 94.41		Auger grinding, trad	ce to some clay		SS-5	94	8	20-26-30-30	56					
			END OF BOREHO NOTE : End of Borehole at Borehole was foun- upon completion												
15 — 16 — 16 — 17 — 17 — 17 —				ground surface op of the existing gate de (assumed 100m)											
18 — 															
21 —															
22															
•		·			-										



REPORT: T050159A1



Proposed Aid to Navigation Tower/Structure LL867 Port McNicoll Rear Range Near Midland, Ontario

FISHERIES AND OCEANS CANADA Geotechnical Investigation Report

August 31, 2012





Waterloo, August 31, 2012

Mr. Blair Young Fisheries and Oceans Canada 520 Exmouth Street Sarnia, Ontario N7T 8B1

Subject: Geotechnical Investigation Report T050159A1 Proposed Aid to Navigation Tower (ATON) Structure LL867 Port McNicoll Rear Range, Near Midland, Ontario

Dear Mr. Young;

In accordance with your request, Inspec-Sol has conducted a geotechnical investigation at the above-noted site and is pleased to present our report.

We trust that this information meets with your approval. Please do not hesitate to contact us, should any questions arise.

Yours very truly,

INSPEC-SOL INC.

Hassan Gilani. M.Sc., P. Eng. Senior Geotechnical Engineer

HG/cr/1

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FISHERIES AND OCEANS CANADA

Geotechnical Investigation Report Proposed Aid to Navigation Tower/Structure LL867 Port McNicoll Rear Range Near Midland, Ontario

Date : August 31, 2012

Our Ref. : **T050159a1**



FISHERIES AND OCEANS CANADA 520 Exmouth Street Sarnia, Ontario N7T 8B1

Geotechnical Investigation Report Proposed Aid to Navigation Tower/Structure LL867 Port McNicoll Rear Range Near Midland, Ontario

T050159a1

August 31, 2012

Prepared by :

Farsheed Bagheri, P.Eng.

Approved by :

Hassan Gilani. M.Sc., P. Eng.

Distribution : Fisheries and Oceans Canada- Mr. Blair Young (Copy by e-mail)

Respect for the environment and the preservation of our natural resources are priorities for Inspec-Sol Inc. With this in mind, we print our documents double-sided on 50 % recycled paper.



TABLE OF CONTENTS

1.0	INTR	DDUCTION	1
2.0	PROJ	ECT DESCRIPTION	1
3.0	FIELD	O AND LABORATORY WORK PROCEDURES	2
4.0	GEOI	OGY AND SUBSURFACE CONDITIONS	3
4.1		OUND COVER	
4.2		SILTY SAND TO SAND AND GRAVEL	
4.3		TIVE DEPOSITS	
	4.3.1	Sand and Gravel	
	4.3.2	Sandy Silt Till	4
4.4	GR	OUNDWATER	5
5.0	DISC	USSION AND RECOMMENDATIONS	5
5.1	I Gei	NERAL	5
5.2	E Fou	INDATION OPTIONS	5
5.3	SHA	ALLOW PAD FOUNDATION	6
!	5.3.1	Cast-in-Place Pile/Caisson	6
į	5.3.2	Helical Pile	7
ł	5.3.3	Adfreeze Forces	8
5.4	LA1	ERAL FORCES	8
5.5	5 SEI	SMIC SITE CLASS	8
5.6	6 Exc	CAVATIONS AND GROUNDWATER CONTROL	9
!	5.6.1	Excavations	9
!	5.6.2	Dewatering1	0
5.7	7 BAG	CKFILLING1	
5.8	Col	RROSION POTENTIAL1	1
6.0	LIMIT	ATIONS OF THE INVESTIGATION1	3



TABLE OF CONTENTS (CONT'D)

р
ıp

- Figure 2 Borehole Location Plan
- Appendix 1 Soil Description Terminology Borehole Log
- Appendix 2 Soil Analytical Laboratory Test Results



1.0 INTRODUCTION

Inspec-Sol Inc., (Inspec-Sol) has been retained by the Department of Fisheries and Oceans Canada (DFO) to conduct a geotechnical investigation for the proposed Aid to Navigation Tower (ATON) Structure located at LL867 Port McNicoll Rear Range (Site), Near Midland, Ontario. The Site location in shown on the location map included as Figure 1.

The authorization for the geotechnical investigation was provided through the DFO Purchase Order No. 2563-120041.

The purpose of the geotechnical investigation was to determine the subsurface soil and groundwater conditions within the footprint of the proposed ATON structure. This report contains a description and findings of our geotechnical investigation, as well as professional opinions and recommendations regarding subsurface conditions and the design and construction of the proposed foundation system.

2.0 **PROJECT DESCRIPTION**

The Site is located on the east side of Triplebay Drive, on the north side of Rangelight Road. An existing tower is located inside a fenced area on Site. An approximate Site layout plan based on field measurements is included as Figure 2.

Based on the information provided by DFO and Canadian Coast Guard (CCG), Central and Arctic Region, it is understood that DFO and CCG is planning to construct a new antenna tower with hot dipped galvanized structure. A review of the Fabrication Detail (Drawing 4892.960.102-1, dated November 14, 2000), provided in Appendix C of the Request for Quotation (RFQ) dated July 20, 2012, shows that the height of the proposed tower will be 18.29 m (60 ft). The proposed tower structure will be erected in close proximity of the existing tower on the Site.

1



3.0 FIELD AND LABORATORY WORK PROCEDURES

The scope of work (SOW) for the geotechnical investigation for the proposed ATON structure was specified by DFO in the RFQ to comprise one borehole to a depth of 3 metres (m) below the existing ground surface (bgs) or auger refusal, whichever is earlier.

Inspec-Sol obtained underground utility clearance in the general Site area though Ontario One Call, and Hydro One. Services of a private utility locator were also engaged. At the time of investigation the fenced area was locked and inaccessible. The DFO on-Site representative directed Inspec-Sol to advance the borehole outside the fenced area close to the existing tower at the approximate location shown on Figure 2. The private utility locator hired by Inspec-Sol scanned the selected location for the presence of underground utilities and cleared the area. The subsequent drilling operations were completed in the presence of the DFO representative.

Walker Drilling Inc., a specialist drilling subcontractor, advanced borehole BH-1 on August 10, 2012 using a propane powered Geoprobe® track mounted rig. The borehole was installed under the full time supervision of Inspec-Sol's geotechnical staff to the depth of 3.7 m bgs, who logged the borehole and observed groundwater conditions during and upon completion of the borehole. Continuous disturbed samples of the strata penetrated were obtained utilizing a 50 mm diameter split-barrel sampler, advanced by dropping a 63.5 kg hammer from a height of 760 mm, in accordance with the standard penetration test (SPT) method as described in the American Society for Testing and Materials (ASTM) standard ASTM D1586. The results of SPT are reported as 'N' values on the borehole log provided in **Appendix 1** at the corresponding depths. The borehole was backfilled with bentonite pellets and auger cuttings in accordance with O. Reg. 903. Subsurface soil and groundwater conditions encountered at the borehole location are shown on the borehole log provided in **Appendix 1**.

The borehole ground elevation was found to be 98.07 m above site datum (ASD) with reference to a temporary Site datum set at the top of the existing gate post on the west side of the gate. The temporary bench mark was assigned an assumed elevation of 100 m. It should be noted that the measuring point elevations may change, as the gate post is susceptible to movements due to thermal stresses and other forces.

Upon completion of the field investigation program, the soil samples obtained were sealed in clean, airtight containers and transferred to the Inspec-Sol laboratory in Mississauga,



Ontario, where they were re-examined by a geotechnical engineer to confirm the field descriptions. The geotechnical laboratory testing consisted of moisture content tests on all recovered soil samples. The results of the moisture content determinations are recorded at their corresponding depths on the borehole log provided in **Appendix 1**.

One soil sample was analyzed for chemical properties to determine the potential for corrosion of buried steel structures and potential of sulphate attack on below-grade concrete structures. The soil sample was submitted under chain-of-custody to AGAT Laboratories (an accredited laboratory by the Canadian Association for Laboratory Accreditation – CALA). The analytical test results are discussed in Section 5.8 and the laboratory test result sheets are provided in **Appendix 2**.

4.0 GEOLOGY AND SUBSURFACE CONDITIONS

Based on our experience in the general Site area and a review of the Quaternary geology map¹ shows that the Site is located in a beveled till plain, with the glacial till comprised of silty sand/sandy silt rich in Paleozoic rock fragments. The Paleozoic bedrock is anticipated to be more than 30 m below the existing grades in the general Site area.

Details of the subsurface conditions encountered at the Site at the borehole location are summarized in the following sections of the report. The detailed borehole log is provided in **Appendix 1**. It should be noted that the subsurface conditions are only confirmed at the borehole location and may vary beyond the borehole location. The boundaries between the various strata, as shown on the borehole log are based on non-continuous sampling and observations of drilling resistance at the drilled borehole location. These boundaries represent an inferred transition between the various strata, rather than precise planes of geological change.

4.1 Ground Cover

A very thin approximately 60 mm thick layer of topsoil with vegetation and organics was encountered at the ground surface in BH1.

¹ Bajc, A. F. and Paterson, J. T., (1992): Quaternary geology of the Penetanguishene and Christian Island areas, southern Ontario; Ontario Geological Survey, Open File Map 194, Scale 1:50,000.



4.2 Fill Silty Sand to Sand and Gravel

A fill deposit comprised of silty sand, some gravel, trace silt and containing rootlets, probably disturbed native, was encountered beneath the surficial topsoil and vegetation, and extended to a depth of 1.5 m bgs. The sand and gravel contains occasional cobbles and a trace of silt.

The SPT 'N' values in the Silty Sand to Sand and Gravel deposit ranged from 5 to 9 blows per 300 mm of penetration indicating a loose state.

The natural moisture content of the native sand and gravel ranged from 2 percent to 9 percent, indicating moist conditions.

4.3 Native Deposits

4.3.1 Sand and Gravel

A stratum of Sand and Gravel, trace silt was encountered beneath the fill/disturbed native materials in BH1 and extended to the depth of 2.3 m bgs.

The SPT 'N' value of 20 blows per 300 mm of penetration was recorded in the sand and gravel deposits indicating a compact state.

The natural moisture content of samples obtained from the sand and gravel deposit was measured to be 3 percent, indicating damp-moist conditions.

4.3.2 Sandy Silt Till

4

Underlying the native sand and gravel deposit, a deposit of native Sandy Silt till, trace clay and gravel was encountered that continued to the termination depth of borehole at 3.66 m bgs.

The SPT 'N' values of 45 and 56 blows per 300 mm of penetration were recorded in the native Sandy Silt till deposits indicating a dense to very dense compactness of the deposit.

The natural moisture content of the two samples obtained from the sandy silt deposits was measured at 21 percent and 17 percent, respectively, indicating moist-wet to moist conditions.



4.4 Groundwater

Groundwater observations were made during advancement and upon completion of borehole. The borehole remained dry upon completion.

Seasonal groundwater conditions can develop in the Site soils especially in the fill and sand and gravel deposits in response to weather events such as spring thaw and precipitation events. The groundwater levels tend to fluctuate with seasonal conditions, and periods of precipitation

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 General

The purpose of this geotechnical investigation was to determine the subsurface soil and groundwater conditions at the proposed tower structure location and to provide geotechnical design and construction recommendations for the proposed tower.

Based on our understanding of the project, discussed in Section 2.0, and the subsurface soil and groundwater conditions at the borehole location, the following geotechnical design and construction recommendations are provided for the proposed structure. The geotechnical design and construction recommendations in the following sections are provided for the guidance of the design engineer. Contractors bidding on or undertaking the works should decide on their own investigation, and their own interpretation of the factual borehole result, so that they may draw their own conclusions how the sub-surface conditions may affect them.

5.2 Foundation Options

The proposed tower is expected to be a lightly loaded structure that could be subjected to significant wind forces. The major factor governing the design of a footing system supporting the proposed structure is therefore expected to be the lateral wind forces. The recommendations for three foundation systems are provided in the following sections.

5



5.3 Shallow Pad Foundation

A review of the Ontario Provincial Standard (OPS) Drawing OPSD – 3400.011 shows that minimum 1.6 m earth-cover is required, in the general Site area, to protect a footing against frost (**frost depth**). The ATON structure footing can therefore be placed on approved undisturbed and properly dewatered, native sand and gravel subgrade approved by the geotechnical engineer at a minimum depth of 1.8 m bgs. The footing placed on the approved undisturbed sand and gravel deposits can be designed for an allowable net bearing pressure/soil resistance of 200 kPa (4,177 psf) for a Service Limit State (SLS) design, to limit the total settlement to 25 mm, and 300 kPa (6,266 psf) for a factored (Φ =0.5) Ultimate Limit State (ULS) design.

The shallow pad foundation installed in accordance with this recommendation should be provided with at least 1.6 m of earth cover or equivalent insulation for frost protection. If construction proceeds during freezing weather conditions, adequate temporary frost protection for the footing base and concrete must be provided by means of loose straw and tarpaulins, heating, etc, to provide for proper curing of the concrete.

The footing pad depth and its size are expected to be governed by the lateral wind forces. The soil parameters for shear strength and lateral design are provided in Section 5.3.

The base of all foundation excavations must be inspected by qualified geotechnical personnel prior to pouring concrete, to confirm the design bearing pressures with respect to soil conditions encountered.

5.3.1 Cast-in-Place Pile/Caisson

For the installation of cast-in-place drilled pile/caisson use of a temporary steel liner will be required in order to prevent caving in and neck formation of the drilled hole in the relatively unstable sand and gravel deposits in the upper zone, and to cut off groundwater seepage from these deposits and sandy silt till deposits.

If the use of a temporary steel liner is considered non-feasible, auger cast piles can be used. Auger-cast piles are constructed by augering to the required bearing depth, using a continuous flight hollow-stem auger in a continuous downward movement. Soil travels upward as the auger rotates, keeping the flights full of soil cuttings. Once the required depth is achieved, concrete is pumped under pressure through the interior of the hollow stem auger to the pile tip. The auger is slowly withdrawn and concrete is continuously pumped, ensuring



there is no open, unsupported hole at any location in the vertical profile. Perched water, if encountered, could flow down the auger, however, the upward movement of soil at all times and the advance of the rising concrete minimizes water infiltration. A concrete head of at least 1 m should be maintained inside the hollow stems (auger-cast pile) or steel liner (drilled pile), at the time of concreting, in order to avoid voids and neck formation.

It is recommended that the pile foundation should be bearing into the competent native stratum at the shallowest depth of 2.6 m bgs. The cast-in-place concrete pile supported at the depth of 2.6 m bgs can be designed for an axial compression of 600 kPa for SLS design and 750 kPa for a factored ($\Phi = 0.4$) for a ULS design. The uplift capacity of the pile can be calculated using 18 kPa for SLS design and 22 kPa for a factored ($\Phi = 0.4$) ULS design, plus the dead weight of the pile.

The above-recommended SLS axial compression capacity values correspond to an allowable settlement of 12 mm. The SLS and ULS values are based on the assumption that pre-cast driven or cast-in-place concrete pile will be set at a depth of at least 2.6 m bgs into the hard clay deposits.

The pile must be installed under geotechnical supervision to ensure that the pile is constructed in accordance with the above recommendations.

The lateral capacity of a single pile can be estimated using a horizontal modulus of subgrade reaction values of 60,000.

5.3.2 Helical Pile

Given the presence of sand deposits at the Site, the use of helical piles may be a suitable option for the relatively lightly loaded Pipe Mast. Since the helical pile system is a proprietary system, it is recommended that the piers be designed and installed by an experienced design-build contractor. The allowable axial (compression and uplift), and lateral capacity should be confirmed in writing by the installer.

For preliminary design purposes a single helical pier with a series of 250 mm, 300 mm and 350 mm helix combination can be designed for a typical allowable axial pile capacity of 100 kN. The helical pile(s) should be torqued to the required capacity. The helical piles should be installed in the presence of the Geotechnical Engineer to confirm that the appropriate torque has been achieved.



In order to provide for increased lateral stability, we recommend that the helical pile shaft be installed inside a PVC casing (minimum 150 mm diameter) and the interior of the casing grouted on completion.

5.3.3 Adfreeze Forces

Based on the Canadian Foundation Manual (4th Edition) uplift forces due to sandy soils similar to those encountered at the Site freezing against concrete can exceed 100 kPa. It is therefore recommended that the top 1.6 m of the cast-in-place pile should be isolated from the surrounding soils by using a sonotube wrapped with poly material stapled at seams or other suitable means. Subsequently the top 1.6 m length of the pile must not be considered while computing the axial compression or uplift capacity of the pile. It is our understanding that pile caps will not be used, however if a pile cap is used, it should be totally supported on the pile and must not be in contact with the ground surface so that it is not subjected to uplift pressures due to ground heave.

5.4 Lateral Forces

The pad footing can be designed for lateral forces using the following soil parameters:

Soil	φ	γ (kN/m³)	Ka	Ko	K _p
Compacted Granular backfill and on-Site sand and gravel deposits	32	21	0.31	0.47	3.25
Native very dense sandy silt soils	36	22	0.26	0.41	3.85

The resistance to sliding can be calculated using the friction factor of 0.7 for the interface between the footing and the native undisturbed soil strata, approved by the geotechnical engineer.

5.5 Seismic Site Class

8

The 2006 Ontario Building Code (2006 OBC) requires the assignment of a Seismic Site Class for calculations of earthquake design forces and the structural design based on a two percent probability of exceedance in 50 years. According to the 2006 OBC, the Seismic Site Class is a function of soil profile, and is based on the average properties of the subsoil strata



to a depth of 30 m below the ground surface. The 2006 OBC provides the following three methods to obtain the average properties for the top 30 m of the subsoil strata:

- Average shear wave velocity;
- Average Standard Penetration Test (SPT) values (uncorrected for overburden); or
- Average undrained shear strength.

Based on the results of the recent geotechnical investigation, the borehole extend to a maximum depth of 3.7 m bgs only and the subsurface profile below this depth is not known. For a preliminary design purposes, based on the criteria listed in Table 4.1.8.4.A. of the 2006 OBC and our knowledge of the regional geology, a Seismic Site Class 'D' can be used.

5.6 Excavations and Groundwater Control

5.6.1 Excavations

Excavations must be carried out in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. These regulations designate four broad classifications of soils to stipulate appropriate measures for excavation safety. The undisturbed cohesive and cohesionless soil deposits found at this Site are considered generally as a Type 3 soil.

Where workmen must enter a trench or excavation carried deeper than 1.2 m, the trench or excavation must be suitably sloped and/or braced in accordance with the regulation requirements. The regulation stipulates maximum slopes of excavation by soil type as follows:

Soil Type	Base of Slope	Maximum Slope Inclination
1	Within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
2	Within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	From bottom of trench	1 horizontal to 1 vertical
4	From bottom of trench	3 horizontal to 1 vertical

Maximum Slope Inclinations

9



The sand and gravel deposits, and the underlying very dense to dense till soils encountered at the borehole location can be classified as Type 3 soils respectively, when not affected by the groundwater seepage, in accordance with the OHSA regulations. For an excavation carried out below the groundwater table without dewatering, the soils must be considered as Type 4. Section 226 of the OHSA Regulations specifies maximum slope inclination of 1 horizontal to 1 vertical (1H:1V) for a Type 3 soil to the bottom of an excavation, 1H:1V slope up to 1.2 m from the bottom of an excavation, and 3H:1V slope to the bottom of an excavation for a Type 4 soil.

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 238 and 241 of the Act and Regulations and include provisions for timbering, shoring and moveable trench boxes.

Excavations for the proposed Tower foundation at this Site will probably encounter cobbles and possible boulder. The frequency and distribution of these cobbles and boulders within the native sand and gravel deposit is unpredictable. Excavations carried out using mechanical excavators may be slow if significant amounts of cobbles and boulders are encountered. The risk and responsibility for these issues must be addressed in the contract documents for foundation and excavation contractors.

5.6.2 Dewatering

Based on the borehole investigation, significant groundwater infiltration is not expected in the shallow excavations anticipated for raft foundation and underground utility construction. Perched groundwater seepage, if encountered, should be controlled by conventional sump pump methods provided with a filter liner in order to prevent migration of fines. Surface water should be directed away from open excavations. Spoil piles should be kept a minimum of 1.0 m away from the top of any excavation to prevent excess loading on excavation sidewalls.

The borehole was found to be dry at completion of investigation. However excavation for a pad footing is expected to be 1.8 m deep, groundwater seepage should be expected especially if construction occurs during spring thaw or after a wet weather event. If the depth of excavation below the groundwater table is in the order of 0.5 m or less, the groundwater seepage can be controlled using the filtered sump pumps. The sump pits must be lined with a geotextile filter fabric held in place by 19 mm clear stone. The pump inlet must be set in the clear stone such that dewatering occurs only through the geotextile filter fabric.

10



Excavations carried deeper below the groundwater table in sandy soil will require positive dewatering. A specialist dewatering contractor should provide dewatering recommendations based on the depth of excavation, and anticipated groundwater conditions. For dewatering below the groundwater table only the filtered dewatering methods must be used. Unfiltered techniques will cause migration of soil fines, loosening the soil strata from their existing state of compactness, and consequent reduction in soil bearing capacity.

Surface water should be drained away from the open excavations.

5.7 Backfilling

Backfilling of excavations can be accomplished by reusing the excavated soils or similar fill material provided the moisture content is maintained within 2 percent of optimum. Backfill materials used for site grading or backfilling should be placed in thin lifts not exceeding 200 mm and thoroughly compacted using a sheeps foot roller to a minimum of 95 percent SPMDD. Care will be required to separate these materials from the Site stockpiles. Cobbles and boulders in excess of 150 mm diameter should be excluded from the soils used as backfill material.

All excavations must be widened sufficiently to accommodate the appropriate compaction equipment. Provided the trenches are backfilled with materials similar to the adjacent subgrade soils then frost tapers will not be required.

Backfilling operations should be carried out with the following minimum requirements:

- adequate heavy vibratory compaction equipment is used to compact the material;
- loose lift thickness should not exceed 200 mm;
- the soils be at suitable moisture contents to achieve compaction to at least 95 percent SPMDD or in settlement sensitive areas to at least 98 percent SPMDD; and
- General backfill materials to consist of earth fill comprised of inorganic soils, with no particle sizes greater than 150 mm, and containing no topsoil, organics, or other deleterious materials.

5.8 Corrosion Potential

Analytical testing was carried out on one soil sample recovered from 1.5 m to 2.1 m bgs in order to determine corrosion potential of the subsurface soils. The sand and gravel soil



sample was tested for pH, resistivity, sulphides, sulphate, and redox potential. The test results are summarized in the following table. The detailed laboratory analytical report is provided in **Appendix 2**.

Sample ID	BH-1 (SS-3)
Depth (m bgs)	1.5 to 2.1
рН	8.80
Redox Potential (mV)	270
Resistivity (ohm-cm)	11100
Sulphide (%)	0.01
Sulphate (Kg/g)	5.2
Chloride (Kg/g)	4

The American Water Works Association (AWWA) publication 'Polyethylene Encasement for Ductile-Iron Pipe Systems' ANSI/AWWA C105/A21.5-10 dated October 1, 2010 assigns points based on the results of the above tests. A soil that has a total point score of 10 or more is considered to be potentially corrosive to ductile iron pipe. Based on the results obtained for the sample submitted, only one point can be assigned due to continuously wet conditions caused by the shallow groundwater table. The results, however, indicate non corrosive conditions, therefore the Site soils, represented by the analyzed sample, are not considered to be potentially corrosive.

Table 3 of the Canadian Standards Association (CSA) document A23.1-04/A23.2-04 'Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete' divides the degree of exposure into the following three classes:

Degree (Class) of Exposure	Water Soluble (SO ₄) in Soil Sample (%)
Very Severe (S-1)	> 2.0
Severe (S-2)	0.20 – 2.0
Moderate (S-3)	0.10 – 0.20



A review of the analytical test results shows the sulfate content in the tested samples was found to be less than 0.002 percent, which was the detection limit of the test. In view of the test results, the degree of exposure of the subsurface concrete structures to sulphate attack is low. Therefore normal Portland cement can be used for the below grade concrete structures.

6.0 LIMITATIONS OF THE INVESTIGATION

This report is intended solely for Fisheries and Oceans Canada, Canadian Coast Guard and other party/parties explicitly identified in the report, and is prohibited for use by others without Inspec-Sol's prior written consent. This report is considered Inspec-Sol's professional work product and shall remain the sole property of Inspec-Sol. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to Inspec-Sol. Client shall defend, indemnify and hold Inspec-Sol harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevations and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, Inspec-Sol will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.



By issuing this report, Inspec-Sol is the geotechnical engineer of record. It is recommended that Inspec-Sol be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test location only [Borehole BH1]. The subsurface conditions confirmed at the one (1) borehole location may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (ex. excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by Inspec-Sol is completed.

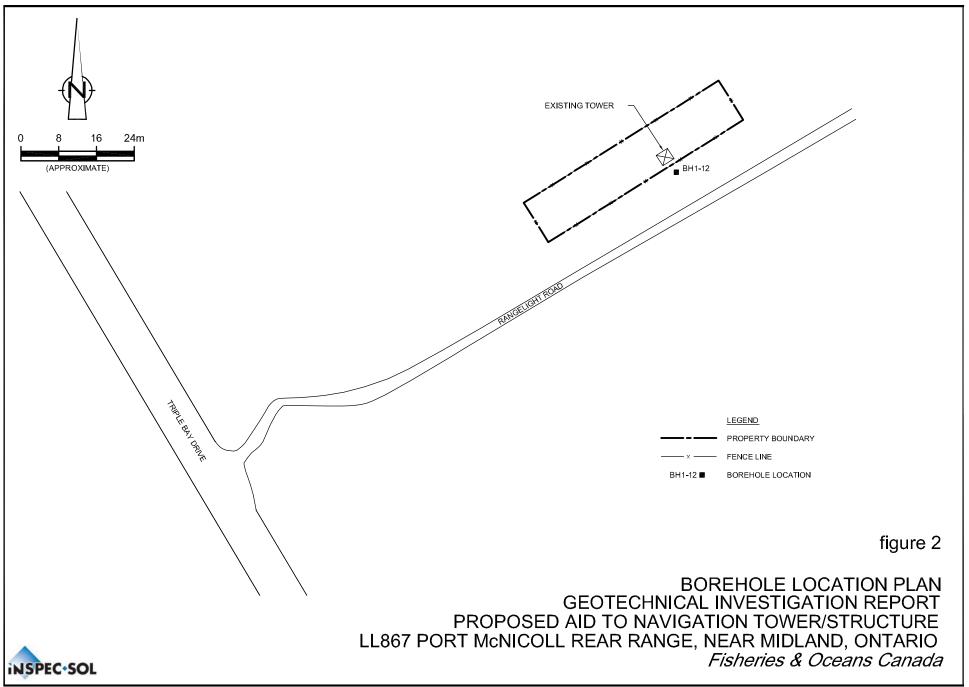
We trust that this report meets with your present requirements. Please do not hesitate to contact us should any questions arise.



Figures

- Figure 1: Site Location Map
- Figure 2: Borehole Location Plan





T050159-A1(001)GN-TO001 AUG 24/2012



Appendix 1

- Borehole Log
- Soil Description Terminology

REFEREN	CE No.	·	T050159a1								ENCLOSURE No.: 1
			60 1	BOREHOLE No.						B	OREHOLE REPORT
Î N	ISP	EC•	SOL	ELEVATION:* _		98.	07 m				Page: <u>1</u> of <u>1</u>
CLIENT: _		Fishe	eries and Oceans Ca	anada						<u>LE</u>	GEND
				on Structure / Tower							SS - SPLIT SPOON
LOCATION	l:	Port	McNicoll Rear Rang	e, Near Midland, Ontar	io						ST - SHELBY TUBE AU - AUGER PROBE
DESCRIBE	D BY:	R. Kł	habbaznia	CHECKED BY:		F. Bag	neri			Ţ	
DATE (STA	ART):	Augu	ust 10, 2012	DATE (FINISH)	:	August	10, 2	012			
Depth	Elevation (m)	Stratigraphy		IPTION OF) BEDROCK	State	Type and Number		Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetraion Index	Shear test (Cu) \triangle Field Sensitivity (S) \Box Lab \bigcirc Water content (%) $\bigoplus_{w_p \ W_1}$ Atterberg limits (%) \bigcirc "N" Value (blows / 12 in30 cm)
Feet Metres	98.07 98.01						%			N	10 20 30 40 50 60 70 80 90
			FILL :			SS-1	42	9	2-2-3-5	5	
3 1.0 4 	97.31		Greyish brown, cob disturbed native)	ble pieces (Possible		SS-2	42	2	3-5-4-4	9	
6 — - 2.0	96.55 95.94		NATIVE : SAND and GRAVE moist, compact	L, greyish brown,		SS-3	58	3	4-8-12-15	20	
8 - 2.29 8 - 2.29 9	95.78		Auger grinding SANDY SILT TILL, trace clay, cobble p dense	trace to some gravel, ieces, grey, moist,		SS-4	94	8	15-21-24-25	45	
	95.02 94.41		Auger grinding, trad	ce to some clay		SS-5	94	8	20-26-30-30	56	
			END OF BOREHO NOTE : End of Borehole at Borehole was foun- upon completion								
15 — 16 — 16 — 17 — 17 — 17 —				ground surface op of the existing gate de (assumed 100m)							
18 — 											
21 —											
22											
•		·			-						



SOIL DESCRIPTIVE TERMINOLOGY

MOISTURE CONDITIONS

TERM	DESCRIPTION
Dry	Seems dry, but contains some moisture; contains no noticeable moisture
Damp	Contains a trace amount of moisture
Moist	Contains a noticable amount of moisture, but no free water
Moist-wet	Contains free water in a limited quantity
Wet	Contains considerable free water, voids may or may not be water filled

CONSISTENCY

TERM	Undrained Shear <u>Strength (kPa)</u>	<u>"N"-Value</u>
Very Soft	0 to 12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 16
Very Stiff	100 to 200	16 to 30
Hard	> 200	>30

less than 0.002mm

RELATIVE DENSITY

TERM	<u>"N"-VALUE</u>
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

PARTICLE SIZES

Clay

TERM	<u>SIEVE SIZES</u>	RELATIVE PROPORT					
Boulders	> 300mm (12")	TERM	RANGE				
Cobbles	75mm (3") to 300mm (12")	Trace	0 to 10%				
Gravel -Coarse Gravel -Fine	19mm (3/4") to 75mm (3") #4 (4.75mm) to 19mm (3/4")	Some	10% to 20%				
Sand -Coarse	#10(2mm) to #4	Minorty, Majority	20% to 35%				
Sand -Medium Sand -Fine	#40(0.425mm) to #10 #200(0.075mm) to #40	And	> 35%				
Silt & Clay (usually detemined by Atterberg Limits)							
Silt	0.002 to 0.075mm						



Appendix 2

Soil Analytical Laboratory Test Results



CLIENT NAME: INSPEC-SOL INC. 111 Brunel Road, Suite 200 MISSISSAUGA, ON L4Z1X3 (905) 712-4771

ATTENTION TO: Farsheed Bagheri

PROJECT NO: T05015901

AGAT WORK ORDER: 12T629623

SOIL ANALYSIS REVIEWED BY: Inesa Alizarchyk, Inorganic Lab Supervisor

DATE REPORTED: Aug 20, 2012

PAGES (INCLUDING COVER): 4

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

<u>*NOTES</u>		

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories (V1)

Member of: Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA) Western Enviro-Agricultural Laboratory Association (WEALA) Environmental Services Association of Alberta (ESAA) AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Page 1 of 4



Certificate of Analysis

AGAT WORK ORDER: 12T629623 PROJECT NO: T05015901 5835 COOPERS AVENUE MISSISSAUGA, ONTARIO CANADA L4Z 1Y2 TEL (905)712-5100 FAX (905)712-5122 http://www.agatlabs.com

CLIENT NAME: INSPEC-SOL INC.

ATTENTION TO: Farsheed Bagheri

Corrosivity Package									
DATE SAMPLED: Aug 10, 20	IPLED: Aug 10, 2012 DATE RECEIVED:			CEIVED: Aug 13, 2012	2 DATE REPORTED: Aug 20, 2012	SAMPLE TYPE: Soil			
				BH-1 SS3					
Parameter	Unit	G/S	RDL	3601227					
Sulphide*	%		0.01	0.01					
Chloride (2:1)	µg/g		2	4					
Sulphate (25:1)	µg/g		2.0	5.2					
pH (2:1)	pH Units		N/A	8.80					
Electrical Conductivity (2:1)	mS/cm		0.005	0.090					
Resistivity (2:1)	ohm.cm		1	11100					
Redox Potential (2:1)	mV		5	270					

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

3601227 * Analysis was performed at AGAT's Mining Division.

EC,pH,Chloride,Redox Potential and Sulphate were determined on the extract obtained from the 2:1 extraction procedure (2 parts DI water: 1 part soil).

Certified By:



Quality Assurance

CLIENT NAME: INSPEC-SOL INC.

PROJECT NO: T05015901

AGAT WORK ORDER: 12T629623 ATTENTION TO: Farsheed Bagheri

Soil Analysis															
RPT Date: Aug 20, 2012			DUPLICATE				REFERENCE MATERIAL		METHOD	BLANK	SPIKE	MAT	MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptabl Limits	
								Lower	Upper	-	Lower	Upper		Lower	Upper
Corrosivity Package															
Sulphide*	1		< 0.01	< 0.01	0.0%	< 0.01	99%	80%	120%	NA			NA		
Chloride (2:1)	1	3601227	4	4	0.0%	< 2	101%	80%	120%	94%	80%	120%	92%	70%	130%
Sulphate (25:1)	1	3601227	3.9	4.3	9.8%	< 2.0	94%	70%	130%	97%	70%	130%	94%	70%	130%
pH (2:1)	1	3601227	8.80	8.79	0.1%	N/A	101%	90%	110%	NA			NA		
Electrical Conductivity (2:1)	1	3601227	0.090	0.089	1.1%	< 0.005	93%	90%	110%	NA			NA		
Redox Potential (2:1)	1	3601227	270	265	1.9%	< 5	96%	70%	130%	NA			NA		

Comments: NA - Not Applicable.

Certified By:

AGAT QUALITY ASSURANCE REPORT (V1)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific tests tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Page 3 of 4



Method Summary

CLIENT NAME: INSPEC-SOL INC.

AGAT WORK ORDER: 12T629623

PROJECT NO: T05015901		ATTENTION TO: Farsheed Bagheri	
PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis	•	•	•
Sulphide*	MIN-200-12000	ASTM E1915-07a	LECO C_S
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (25:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Electrical Conductivity (2:1)	INOR 1036	McKeague 4.12, SM 2510 B	EC METER
Resistivity (2:1)	INOR 1036		CALCULATION
Redox Potential (2:1)		McKeague 4.12 & SM 2510 B	REDOX POTENTIAL ELECTRODE

Chain of Custody Record	SR-5 aboratories www.agatlabs.com Ph.: 905.712.5100 · Fax: 905.712.5122 ·	5835 Coopers Avenue Mississauga, Ontario L4Z 1Y2 •webearth.agatlabs.com •Toll Free: 800.856.6261
Client Information: Company: INSPEC-SOL INC. Contact: FOYENCED Bagheyi Address: Buite 200 III Brunel Road MICOI 3500900 Phone: (905)712 - 4777 Fax: (905)712 - 0515 Project: TO50 15901 PO: AGAT Quotation #: Please note, if quotation number is not provided, client will be billed full price for analysis.	Regulatory Requirements: Regulation 153/09 (reg. 511 Amend.) Sewer Use	Regulation 558 CCME Other (specify) Prov. Water Quality Objectives (PWQO) None OR
SW Surface Water P Paint Email: <u>Fbogheri@inc</u> SD Sediment S Sail 2. Name: <u>Nive Roma</u>	(potable water intended for human consumption) □ □ Yes ○ No If "Yes", please use the 0 Drinking Water Chain of Custody Form support De sent to: 0 Dec Poll-Com 0	03 In votal Hg DH 03 In votal Hg DH 1002 In votal Hg DH 1002 In votal In Kin BIEX 1003 In votal In Kin In Extended 1003 In votal In votal In votal 1001 In votal In votal In votal 1010 In votal In votal In votal 1010 In votal In votal In votal
Sample Identification Date Sampled Sampled Matrix Conta BH-1 (003) Av 10.10 B 1 Conta BH-1 (003) Av 10.10 B 1 Samples Refination Sample Sample Av 1 Date Time Sample		Image: Solution of the second seco