

# Bridges & Highway Structures CADD Standards



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## **SECTION 1 - GENERAL**

### **1.1 INTRODUCTION**

This computer aided design and drafting (CADD) manual, appendices and references shall be used for the provision of CADD services on projects where an Engineering Service Provider (ESP) is retained by Bridges and Highway Structures (B&HS).

Under no circumstances does Manitoba Transportation & Infrastructure (MTI) warrant or certify the information to be free from errors or discrepancies of any kind. The use of any of this information for work which is under contract with MTI, does not relieve the user from any obligations assumed by the contract or from complete and proper fulfillment of terms of the contract, nor does it entitle the user to compensations for damages of loss which could be attributed to such use.

The information is subject to change and anyone relying on this information should satisfy himself/herself as to the most current version.

The ESP retained by MTI is responsible for the engineering integrity and professional liability of all work performed under their Agreement, including work by any Sub-ESP. The checking of the ESP's or Sub-ESP's work or the signing of drawings by MTI staff does not relieve the ESP from any responsibility for the work. Therefore, this manual will generally use the terminology of "acceptance" rather than "approval" when referring to engineering issues submitted to MTI by the ESP.

### **1.2 SCOPE / PURPOSE**

The sharing and proper use of this CADD Manual is a vital part of ensuring consistency and quality of B&HS projects. Bridges and Highway Structures needs to have all CADD work submitted by an ESP in a standardized format that has already been established. MTI becomes the owner of the CADD work submitted by the ESP and MTI must be able to file and easily work with this information for the immediate project or for future projects.

The standardization of CADD details allows B&HS personnel to easily use CADD details supplied by an ESP, as several different ESP's may be retained at any given time. In addition, contractors and suppliers also become equally familiar with consistent detailing practice. This consistency provides a more efficient and economical workflow.

When an ESP submits CADD details to MTI it is important to note that any one project does not typically end. As the project and specific site will be worked on in the future. Therefore, standardization of the CADD detailing format allows different ESP's or MTI B&HS staff to work with the files on future assignments.

### **1.3 DEFINITIONS**

The following words when used in this document shall have the meaning as defined below:

Acceptance	Work is accepted by MTI without detailed checking of the engineering principles and calculations.
Agreement	Engineering services agreement between MTI and the ESP, normally called the "ESP Agreement".
Approval	Subject work shall be "approved" by B&HS for matters relating to the CADD Manual.

Record Drawings	Updated and authenticated contract drawings that show any changes that occurred during construction.
Authentication	Means affixing the professional member's seal, then validating it by signing and dating.
Bridge Structure	Structure typically built on provincial highway network and water control system that cross waterways.
CADD	Computer aided design and drafting.
Contract	The contract between MTI and the Contractor covering the performance of the work.
Contractor	The person or company that has entered into a construction contract with MTI.
Drawing	The compilation of engineering data in a clear concise drafting procedure. Typically, in a standard MTI format on 24" x 36".
Engineering Service Provider (ESP)	The person or company that has entered into an Engineering Service Provider services agreement with MTI.
EGM	Engineers Geoscientists Manitoba
MTI	Manitoba Transportation & Infrastructure, heirs and successors.
PDF	Portable Document File
Professional Engineer	A person registered to practice engineering in the Province of Manitoba, under the Engineering and Geoscientific Professionals Act.
Shop Drawing	A Shop Drawing is a drawing or set of drawings produced by the Contractor, Supplier, Manufacturer, Sub-Contractor or fabricator.
Sub-ESP	A person or company that enters into an agreement with the ESP to carry out part or all of the work covered in the agreement.
Survey Control	This is the survey control established at the initial stages of a project. It includes the survey control points. It is required for ALL projects and established using the parameters identified in Section 5.3.1 COVER SHEET.
Terms of Reference	A document, that describes the assignment, the scope of the work. It provides technical requirements, schedules and expected deliverables.
B&HS	Bridges and Highway Structures Division
Working Points	These are defined as locations shown in the proposed contract details that describe a location in point format (i.e. Northing-Easting-Elevation).

## **SECTION 2 - COMPUTER SOFTWARE**

### **2.1 SOFTWARE**

It is MTI policy to accept CADD files in Microstation (dgn) format only. In support of this policy, this manual focuses on Microstation operations and procedures and does not attempt to include other CADD software programs.

All CADD files shall be produced electronically using Microstation V8i (Select Series 4) – 08.11.09.829 compatible with the version used by the branch.

Portable Document Files (PDF) is an accepted static electronic format for all CADD submissions.

### **2.2 WEB SITE DISCLAIMER**

See Web Site for Disclaimer

## SECTION 3 - MICROSTATION DRAWING STANDARDS

### 3.1 WORKING UNITS

The standard working units are millimeters (mm). If units other than mm are used, a note shall be added to the drawing to identify the non-standard units.

### 3.2 FONT

- Font type used shall be Bentley **No. 1 Working**.
- Text sizes: (th=text height, tw=text width, wt=weight)
- All dimensions and general text shall be th=2.75 mm, tw=2.475 mm, wt=2
- Secondary titles (sub-titles and Cross Section letters) shall be th=4.0 mm, tw=3.6 mm, wt=3
- Main titles shall be th=5.5 mm, tw=4.95 mm, wt=5

#### 3.2.1 MAIN TITLES

Used to describe most views, sections, or details.

DETAIL "A" ← th=5.5 mm, tw=4.95 mm, wt=5  
Scale 1:20 ← th=2.75 mm, tw=2.475 mm, wt=2

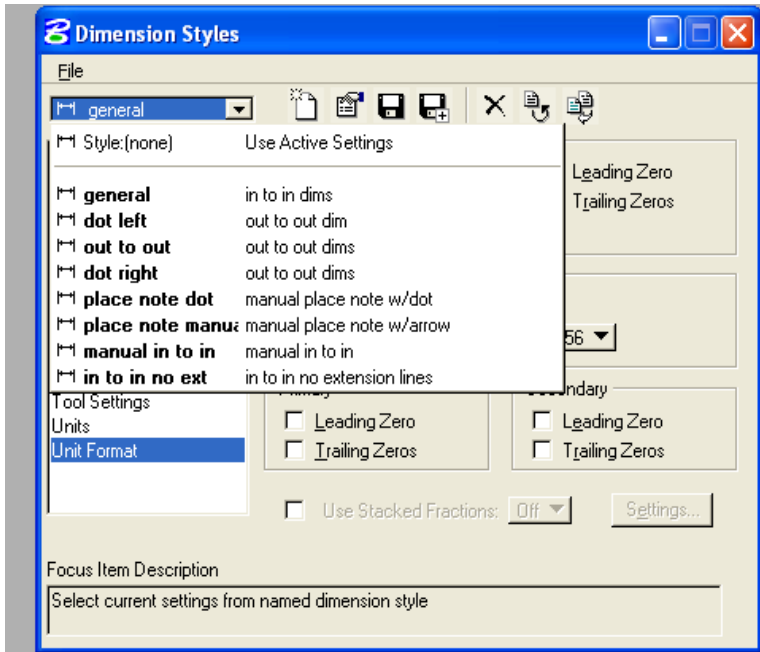
#### 3.2.2 SECONDARY TITLES

Used to describe individual views where several views make one detail. A main title is required to describe the overall detail.

ELEVATION ← th=4.0 mm, tw=3.6 mm, wt=3  
GIRDER CONCRETE DETAILS ← th=5.5 mm, tw=4.95 mm, wt=5  
Scale 1:20 ← th=2.75 mm, tw=2.475 mm, wt=2

### 3.3 DIMENSIONS

Dimension styles are provided within seedfile.



### 3.4 MICROSTATION LEVELS

- Level names to be used to separate the different components of a bridge and/or structure.
- Level names must clearly define the component represented. Dimensions, text, patterns and shading shall have their own level and named as such.
- Level Library is available for download from our web site.

### 3.5 MICROSTATION LINE WEIGHTS

- The use of line weights contributes to the consistency, readability and understanding of the drawings. There should be a clear distinction between object lines, dimensions, and notes.
- Weights may vary from standard if necessary to emphasize some object or text.

Line Weight standards are as follows:

Branch Line Weight Standards	
Shading	wt = 0
Dimensions lines, leader lines, patterns, secondary lines (concrete lines on reinforcing details, etc.)	wt = 1
Main object lines (concrete lines on concrete details, reinforcing lines on reinforcing details, etc.)	wt = 2
Text (2.75mm), dimension text	wt = 2
Secondary titles (4mm)	wt = 3
Cross section symbols	wt = 4
Main titles (5.5mm), Title box border outline	wt = 5
Sheet border outline	wt = 7



### 3.6 SCALES

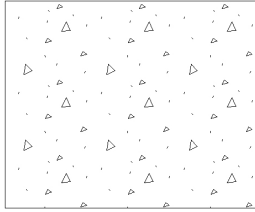
Scales to be used for CADD Drawings are as follows. If the drawing becomes over crowded at the preferred scale, the use of a second sheet is recommended.

<b>METRIC SCALES</b>	<b>APPLICATION</b>
1: 500 1: 400 1: 300 1: 250 1: 200 1: 150 1: 100	For General Elevation and Information Sheets
1: 100 1: 75 1: 50 1: 25 1: 20 1: 15 1: 10 1:7.5 1: 5 1: 2 1: 1	For Detail Drawings

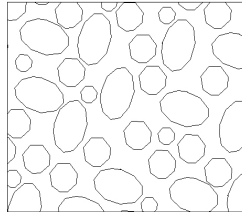
### 3.7 PATTERNS

We currently use some of the standard area patterns that are supplied from Bentley Microstation cell library called: **Bentleyareapat.cel**.

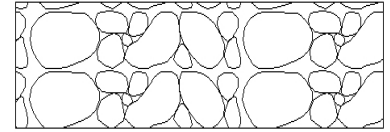
Below is a list of pattern cells to be used when detailing.



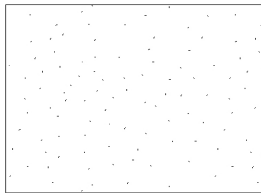
Concrete  
**CONCR2**



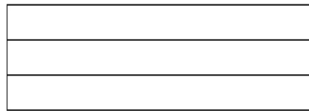
Rip rap (plan view)  
**POROUS**



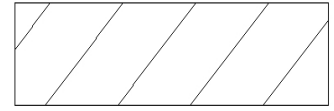
Rip rap (elevation view)  
**STONWL**



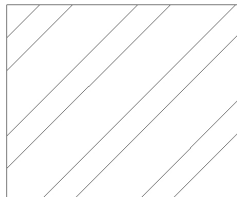
Working base  
**STUCCO**



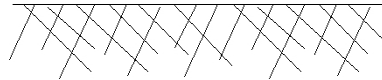
Asphalt overlay (Pattern hatching)



Flexcell (Pattern hatching at  
45 degrees)



Steel  
**ANSI 32**



Existing ground (line style – **Ground line**)

### 3.8 SHADING

The designated color number **46** from the **650c.tbl** color table shall be used for all shading and will plot as grey. Please refer to the Printer Configuration File which can be downloaded from our website.

### 3.9 COLORS

The **650c.tbl** shall be the color table in all files.

- Colors are used only for visual presentation on computer
- Do not use red as red is the default highlight color when selecting.
- Do not use black as it won't show on a computer screen if using a black background.
- When plotting;
  - For all drawings, black is the only color used.

### 3.10 REFERENCE FILES

ESP's shall use the "Save Relative Path" when referencing drawings. The goal is to make project files portable. Broken reference paths are CADD standard violations. The "Save Relative Path" option will help to keep the reference path integrity when the files are moved from one drive to another.

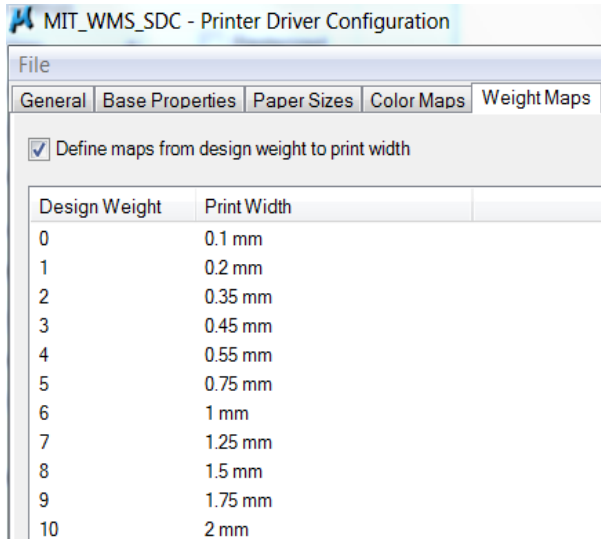
The Contract Drawing files shall only include the essential CADD files. Temporary, junk, alternative drawings not used in the final drawings, backups, and other interim drawings shall not be submitted. The goal is to make it easy to review the project files and avoid the transmittal and storage of unnecessary files. Drawing display setting (levels, reference files, view attributes and other rendering settings) shall be set and saved as they were used to create the final printed drawings. The goal is to make it easy to review and print files. The reviewer should not have to figure out what reference files need to be turned on and what display settings need to be used.

All files required for completed drawings, including referenced files, shall be included in the final submission.

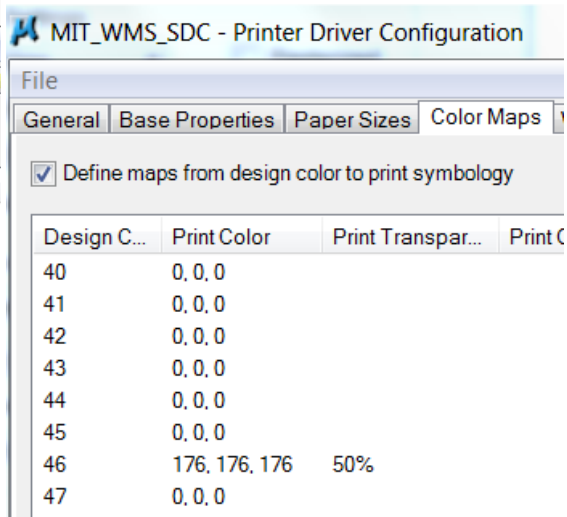
### 3.11 PLOTTING

The following is the current printer driver configuration file settings.  
A printer driver configuration file is available for download from our website.

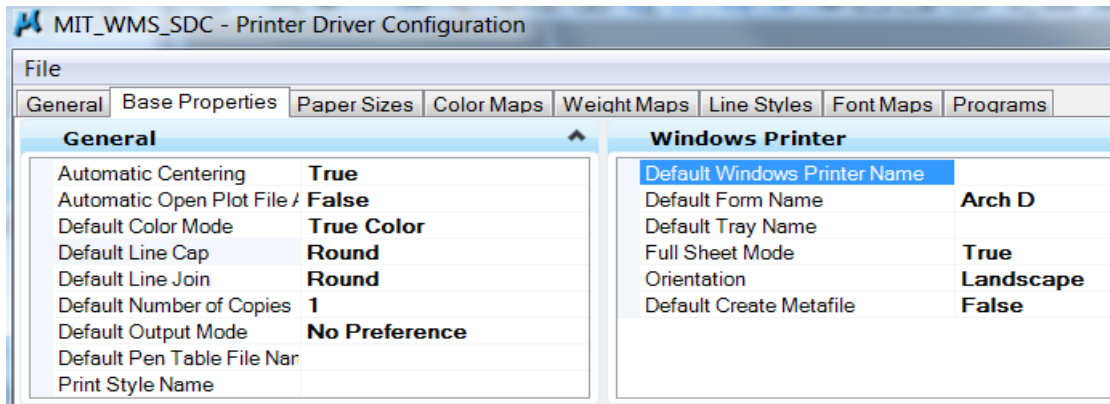
#### Weight maps



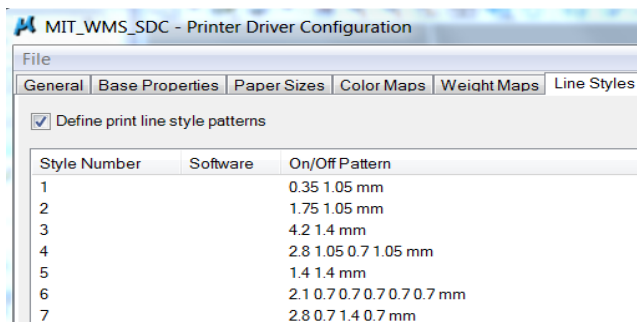
#### Color maps



#### Base properties



#### Line Styles



### 3.12 METHOD OF MICROSTATION DETAILING

- All B&HS detailing shall be done in 3D Microstation files with Z depth set to zero.
- The file shall have one design model and several sheet models made up from references from design model.
- Design models
  - Detailed at a 1:1 scale.
- Sheet models
  - Are composed with scaled reference files clipped to give the presentation view required.
  - All details are scaled appropriately to fit 1:1 border/s.
  - All dimensioning and labeling is done in the sheet models.
  - Levels can be turned off or on to get the look required.

## SECTION 4 - CADD SECTION STANDARDS

### 4.1 SHEET SIZE

B&HS uses the following full size sheet for engineering drawings.

- 914 mm wide x 610 mm high (Arch D , 24" x 36") on 3 mil thick mylar film, matte finish both sides

### 4.2 SHEET BORDERS


A border file will be supplied at the commencement of a project. Margins as follows:

- 15 mm top, bottom and right margins.
- 40 mm left margin (allocated for stapling of contract prints).


### 4.3 TITLE BLOCK

A Microstation file containing the borders will be made available to the ESP on our website.

No alteration to the Title's work area is allowed.

REVISIONS							RELEASED FOR CONSTRUCTION	
							BY:	
							DIRECTOR OF BRIDGES AND HIGHWAY STRUCTURES	
							DATE	
							SCALE:	
							SHEET No.	
							SITE No.	
			DESIGN					
			BY: .....					
			CHECKED: .....					
			DETAILS					
			BY: .....					
			CHECKED: .....					

### 4.3.1 LETTERING FOR TITLE BLOCKS

REVISIONS		<p style="text-align: center;"><b>GENERAL ELEVATION</b></p> <p style="text-align: center;">FOR 12 352 P.P.C.C. BRIDGE OVER PETERSON CREEK ON P.R. 315 10 800 ROADWAY WIDTH N. S.W. 1/4 SEC.7-17-14E</p> <p style="text-align: center;"><b>R.M. OF ALEXANDER</b></p>		
DATE	BY	DESCRIPTION	RELEASED FOR CONSTRUCTION BY:	
DESIGN SEAL	RECORD SEAL	 <p>Infrastructure Bridges and Highway Structures</p>	DIRECTOR OF BRIDGES AND HIGHWAY STRUCTURES	
			DATE	
			SCALE: <b>1/75</b>	SHEET No. <b>2</b>
			CHECKED: <b>LK/MFB</b>	SITE No.: <b>2033-12</b>
th=2.75 mm, tw=2.475mm wt=2		↑	↑	↑

th=5.5mm, tw=4.95mm, wt=5

th=4.0 mm, tw=3.6 mm, wt=3

th=5.5 mm, tw=4.95 mm, wt=5

### 4.3.2 TITLE BLOCK FORMAT AND CONTENT

- First line = **Sheet title**
- Length of structure followed by type of structure**
- Over river name, stream name, creek name or drain name**
- On P.R. No. , P.T.H. No. followed by roadway width**
- Location description Section-Township-Range**
- Last line = **Rural Municipality Name, Electoral Division Name or City Name**

### 4.3.3 TITLE BLOCK FOOTNOTES

- Generally, use the format items strictly in the order given on three or four title block lines. The first title block line is reserved for the sheet title. Use appropriate abbreviations wherever possible for commonly used words.
- Qualify the type of drawing with “REPAIR”, “REHABILITATION”, “MODIFICATION” or “STRENGTHENING” when necessary.
- Qualify the road name with a directional specification “EBL”, “WBL”, “NBL”, or “SBL” when applicable.
- Location spec: at, in, or E of NE ¼, etc. SEC. – TWP – RGE if available. This may be an LGD or other therefore coordinate with B&HS for other bridge locations.
- Reference town name, to a name that appears on the Manitoba Roadmap. Avoid use of redundant words such as “CITY OF”, “TOWN OF”, etc.
- Title sheets supplied by MI are **NOT** to be altered. No extraneous information is to be added to the title block area. This strict control on the title blocks is to facilitate MI’s document management system.

#### 4.4 SITE NO. AND SEQUENCER

- B&HS will provide site numbers for all Projects to ensure that the integrity of the inventory database is maintained.
- The structure site number is developed using the following format: A unique number between 1 & 9999, assigned to each structure within the Province of Manitoba. Once established, the number should never change.
  - All site numbers are associated with a sequence number. If a structure is replaced at the same location then the sequencer is changed to 10, then 20,30 etc...Structures on parallel highways may have the same site number, but are distinguished by the sequence number.

01	North/West bound lanes only
02	South/East bound lanes only
03	North/West service road
04	South/East service road

Sequencer must be one of the following:  
00, 10, 20, or 01, 02, 03, 04, or  
Combination 11, 12, 13, 14, or PP- Proposed

- There may be instances that do not meet these criteria.

#### 4.5 NUMBERING OF SHEETS

- All sheets should be numbered numerically, beginning with 1 and consecutively thereafter. **Except** Reference drawings, which shall have a unique Sheet No. assigned Ex. G01\_ Girders
- No sheet numbers should be missed or duplicated.
- Sheet numbers along with corresponding sheet names shall be listed in the sheet legend shown on the Cover Sheet.

#### 4.6 CADD FILE NAMING CONVENTIONS

- Electronic File naming conventions
  - All files shall have the Site No. and sequencer followed by the drawing type. Ex. 304910girder.dgn (Site 3049, Sequencer 10, drawing type girder).
  - Any ESP identification shall not be part of file name submitted.
  - Single or two digit site numbers shall be preceded by zeros. Ex. 002110railing.dgn (Site 21, Sequencer 10, drawing type railing).

#### 4.7 REVISION PRESENTATION

- The ESP shall ensure that all revisions are clearly identified.

#### 4.8 AUTHENTICATION OF DRAWINGS

- Professional Engineers employed by the ESP's and Sub-ESP's shall affix and validate their seal on all drawings they issue, in accordance with EGM guidelines for "Authentication of Professional Documents".
- For "RECORD" drawings see Section 6.2.4.
- Where the ESP is required by the EGM bylaws to hold a Certificate of Authorization, every drawing prepared by the ESP shall contain the Certificate of Authorization stamp near the Professional Engineers seal as prescribed in the EGM bylaws.



- The procedure required for completing the cover sheet and title blocks for “Issued for Construction” or “As-tendered” and “Record Drawing” packages see Section 6.2.2 and 6.2.4.
- All CADD drawings issued for tendering must be at the “Released for Construction” stage.

#### **4.9 WEB SITE LOCATION**

- The web site can be found at <https://www.gov.mb.ca/mti/wms/structures/technical.html>  
See Web Site for various CADD background documents, standards and examples in support of this Manual.

## **SECTION 5 - DRAWING PREPARATION**

### **5.1 INTENT**

- The key intent of any drawing or drawing package prepared by an ESP or B&HS staff is to provide clear, comprehensive, and accurate information to whoever may be using these drawings, such as Engineers, construction inspectors, contractors, and suppliers.
- The drawings shall leave no questions unanswered. The reader should be able to find all the answers on the drawings, to any question that may arise. There should be no need to make any assumptions.
- The drawings are the Design Engineer's means of conveying his/her intent accurately to the Contractor and as a record of construction. Any errors or omissions on the drawings could be cause for extra costs or legal action.
- All engineered drawings must be clear, comprehensive, accurate and detailed using the most current procedures.
- All engineered drawings used for tendering shall provide all necessary information to the contractors, fabricators, or suppliers so that they can undertake the work without any need for additional costs, delays, or disagreements and ultimately MI receives what was originally intended by the Design Engineer.
- Survey Control

This is the survey control established at the initial stages of a project. It includes the survey control points. Survey control is established for ALL projects and is shown on the Cover Sheet for all drawing packages (see Section 5.3.1 COVER SHEET). This requirement is defined in the "Bridge Survey Manual for the Manitoba Transportation & Infrastructure (MTI) Department"
- Working Points

Working points are to be shown on the General Elevation sheet. This shall include 2 WORKING POINTS. The working points shall be as follows:

  - Working point 1 (WP1)
    - Only 1 working point with UTM coordinates identified shall be located on the proposed structure. This point shall called working point 1 (WP1) and shall be located on the centerline of proposed roadway-centerline of proposed bearings at one of the abutments and clearly labeled. Accessibility to the proposed structure is an important consideration when choosing the abutment to locate the working point. For example, if one abutment is accessible and the other is not, WP1 should be place on the accessible abutment.
  - Working point 2 (WP2)
    - This point with UTM coordinates shall be located on the proposed centerline of roadway at a distance approximately 10 m off the proposed abutment NOT chosen for WP1. Identify and label this point as Centerline of proposed roadway, approximately 10 m North/South/East or West of proposed abutment.
- All drawings shall be prepared by competent personnel with the ability to handle the task at hand, and all drawings shall have a thorough independent check by a qualified person.
- All concrete details and reinforcing details are shown separately.
- CADD drawings issued for tendering must be at the "Released for Construction" stage.
- The "RECORD" drawings shall accurately convey any changes made during construction, and will become record drawings for future inspection or work on any structure.
- ESP's are encouraged to contact B&HS and obtain a sample set of drawings (if available) for a recently completed project similar to the one they are currently handling.

## 5.2 PRESENTATION ORDER OF CONTRACT DRAWINGS

### FABRICATION CONTRACT DRAWING PACKAGE/S

(For contracts such as Precast, Steel or Fabrication contracts, etc.)

- G01\_Girder Concrete Details (Sheet number shall have a unique name Ex. G01, SG01)
- G02\_Girder Details (Sheet number shall have a unique name Ex. G02, SG02)
- G03\_Girder Reinforcing Details (Sheet number shall have a unique name Ex. G03, SG01)

Ensure that any Design Data related to these components are supplied on the Drawings. Precast, Steel or Fabrication Contract drawings shall not require a Cover Sheet.

**Note: these sheet numbers shall be the same when used in the General Contract drawing package under Reference drawings.**

### GENERAL CONTRACT DRAWING PACKAGE

- Drawings shall be presented in the drawing package in roughly the order of construction. (i.e. from the bottom up, such as: Abutments, piers, bearings, girder erection, deck, etc.).
- A typical order of drawings for a bridge would be :
  - Cover Sheet
  - General Elevation
  - Erosion and Sediment Control
  - Pile and Footing Layout
  - Boring Logs
  - Concrete Details for Abutments
  - Reinforcing Details for Abutments
  - Concrete Details for Piers
  - Reinforcing Details for Piers
  - Girder Drain Details
  - Bearing Details
  - GE\_Girder Erection Details (Sheet number shall have a unique name Ex. GE)
  - Deck
  - Curb Concrete Details
  - Curb Reinforcing Details
  - Expansion Joint Details
  - Fixed Joint Details
  - Guardrail Layout
  - Railing Details
  - Railpost Details
  - Railing Assembly Details
  - Approach Slab Details

#### Reference Drawings

(Precast, Steel, Fabrication or any other contracts shall be reference drawings, listed in the Sheet Legend as such and drawings to have the same unique sheet numbering as used in the Fabrication Contract drawing package)

- G01\_Girder Concrete Details (Sheet number shall have a unique name Ex. G01)
- G02\_Girder Details (Sheet number shall have a unique name Ex. G02)
- G03\_Girder Reinforcing Details (Sheet number shall have a unique name Ex. G03)

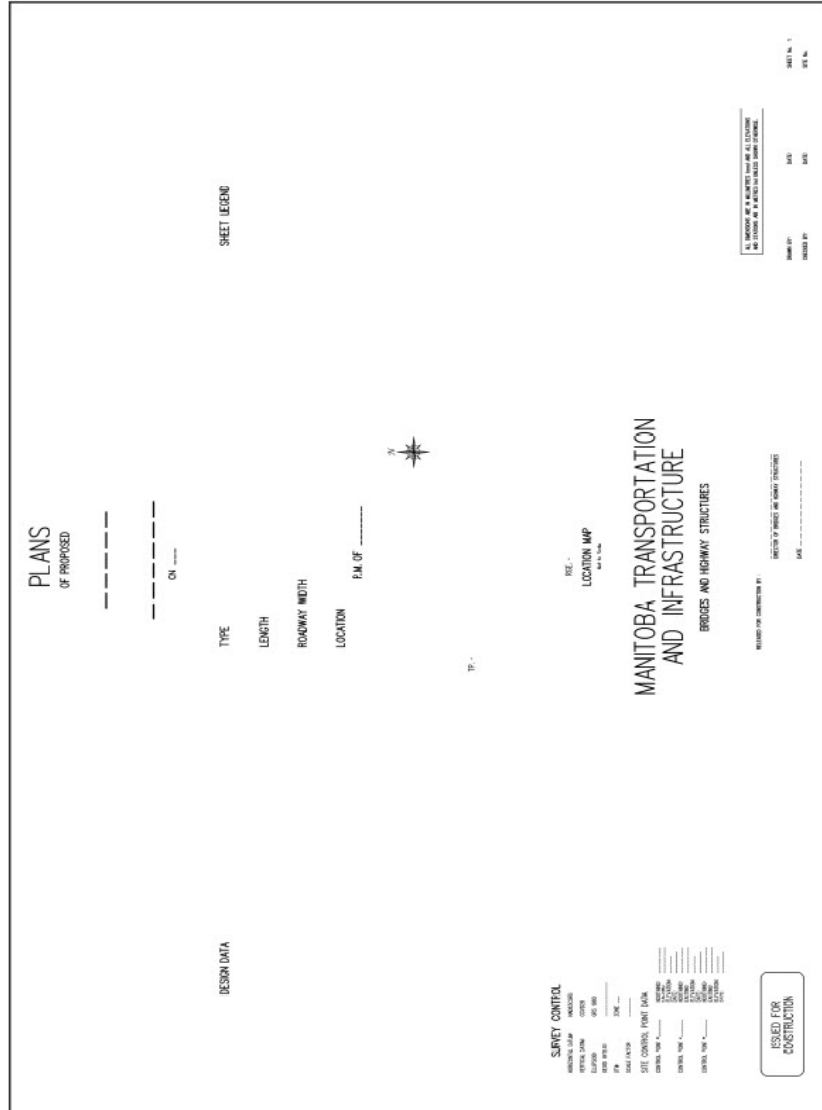
- There may be any number of sheets required to clearly detail any one of the above components.
- Other types of structures (culverts, etc.) should follow the same basic order.

### 5.3 TYPICAL SHEET LAYOUTS

- The following information provides general sheet layout direction. The ESP shall ensure that, where practical, these points should be followed;
  - A typical drawing shall follow conventional drafting procedures by showing such views as Plan, Elevation, End View, and any number of Sections required ensuring all information is presented clearly. If there is not enough space on the sheet to show all the necessary Sections, do not hesitate to use another sheet.
  - If showing half plan etc. or part view and using symmetrical or opposite hand the ESP shall ensure that all details are correct. If there is any doubt, draw full view.
  - Drawings shall be planned from the upper left hand corner, leaving blank areas in the right and lower portions of the sheet.
  - Place general notes on the right hand side of the drawing above the title block.
  - Bill of Materials and Quantities shall appear on the right hand side of sheet close to the title block.
  - Notes shall appear as close as practical to the referred figures. In no case shall lettering obscure any part of the drawing details.
  - No stick-on-decals, or letraset is allowed.
  - In general, arrange drawings so that North or West is orientated towards the left side of the drawing. A North arrow must be included on all land-related plans or maps. The north direction shall remain consistent throughout the tender package.
  - Substructure units shall be named as follows;
    - For rehabilitation or modification projects the existing substructure naming convention shall apply.
    - For new or replacement projects the substructure units shall be named SU1, SU2, etc. increasing from North to South or West to East (left to right on detailing sheet).
- The following sheet descriptions are only a basic guideline and may have to be altered for many reasons.

#### 5.3.1 COVER SHEET

A cover sheet shall be included for ALL General Contract drawing packages.

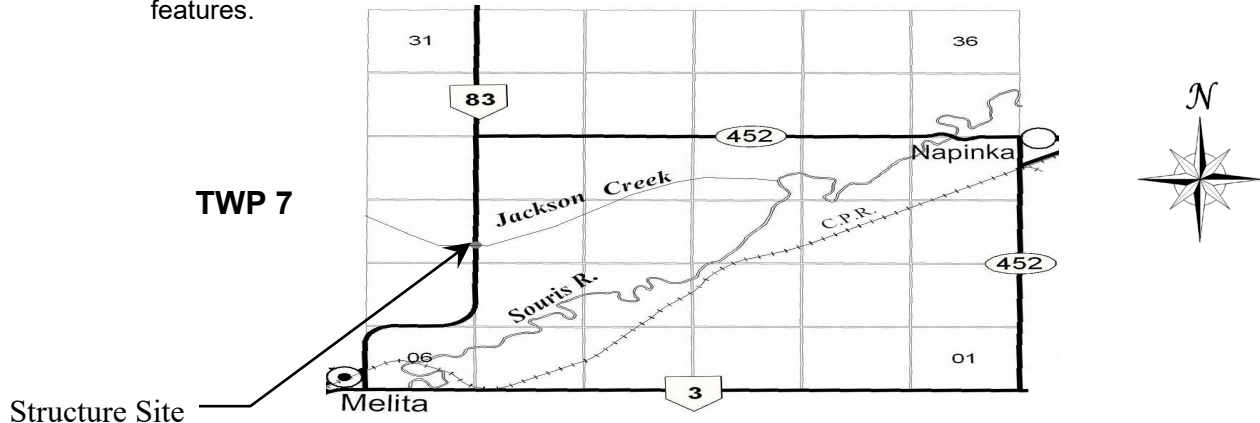


- The cover sheet shall show the following:
  - A description of the structure. This information is used if B&HS need a quick synopsis of the structure such as length, superstructure type, substructure type, roadway width, or location.
  - A location map showing legal position of the structure.
  - The Department name and signatures of signing authorities.
  - The sheet legend.
  - The design data.
  - Hydraulic design data.
  - A general note that all dimensions shown are in millimeters (mm) and all elevations and stations are shown in meters (m).
  - Particulars relating to, detailed by and date, checked by and date, as well as sheet no. and site no.
  - An environmental approvals box (available on the web site).
  - Survey Control data including;
    - Horizontal Datum: NAD83
    - Vertical Datum: CGVD28
    - Ellipsoid:

- Geoid (HT 2.0):
- SCALE FACTOR:
- A bench mark description and elevation placed on record details.

**5.3.1.1 Location Map**

- Map is not to scale.
- The size of the Site Map shall be 6 sections x 6 sections and is located in the center of the Cover Sheet.
- The structure site shall be clearly located and be circled and noted as “STRUCTURE SITE” on the Location Map.
- Use standard abbreviations and symbols for township, range, roads, etc.
- Town, village, city, etc. used to reference structure shall be shown on the map in bold letters (e.g. Napinka).
- All names that appear on the Location Map must be complete (e.g. if the word “JACKSON” is cut off, then it shall be written in to indicate the creek name is “JACKSON CREEK” and not “CREEK”.
- Boundaries of cities, reservations, etc. must be clearly shown and crosshatched at 45 degrees.
- If possible, eliminate all straight lines not associated with highways, roads, townships, and ranges.
- Place “NORTH ARROW” on top right half of map. Locate arrow so as not to cover significant features.



**RGE 3E  
LOCATION MAP  
Not to Scale**

**5.3.1.2 Design Data (Sample)**

**DESIGN DATA**

**SPECIFICATONS**

AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, 2007 FOURTH EDITION  
ANSI AASHTO AWS BRIDGE WELDING CODE D.1.5M/D1.5:2002 EDITION

**LOADING**

- VEHICULAR LIVE LOADING (WHICHEVER GOVERNS)
- 1. MODIFIED AASHTO HSS 25 TRUCK LOADING
- 2. AASHTO LRFD HL-93 LOADING

**CEMENTITIOUS MATERIAL**

CSA A3001-03

**STRUCTURAL CONCRETE**

CURBS ON DECK AND ABUTMENTS, ABUTMENT END BLOCKS AND APPROACH SLABS,

ABUTMENTS, WINGWALLS AND PRECAST PRESTRESSED CONCRETE GIRDERS:

CSA A23.1-04 EXPOSURE CLASS S-1  
f<sub>c</sub>=35 MPa @ 28 DAYS  
TYPE GU CEMENT OR GUb BLENDED CEMENT  
CATEGORY 1 AIR ENTRAINMENT  
20 mm NORMAL AGGREGATE

REINFORCING STEEL  
CSA G30.18-M92 GRADE 400W

STRUCTURAL STEEL  
ALL STRUCTURAL STEEL SHALL CONFORM TO CAN/CSA-G40.21 GRADE 300W  
UNLESS NOTED OTHERWISE.  
HSS TUBING FOR BRIDGE RAIL SHALL CONFORM TO CAN/CSA - G40.21  
GRADE 350W.

PRESTRESSING STRAND  
ASTM A416M 12.7 mm Ø SEVEN WIRE LOW RELAXATION STRAND, f<sub>pu</sub>= 1 860 MPa

PILE LOADING	ABUTMENTS	PIERS
MAXIMUM FACTORED LOAD	_____ kN	_____ kN
FACTORED ULTIMATE RESISTANCE	_____ kN	_____ kN

**HYDRAULIC DESIGN DATA**

DESIGN DISCHARGE

Q<sub>2%</sub> = \_\_\_\_\_ m<sup>3</sup>/sec

V = \_\_\_\_\_ m/s

**SURVEY CONTROL**

HORIZONTAL DATUM: NAD83  
VERTICAL DATUM: CGVD28  
ELLIPSOID: GRS 1980  
GEOID (HT 2.0):  
SCALE FACTOR:

### 5.3.2 GENERAL ELEVATION

Shall at minimum show the following:

- Standard views of type of structure
- Overall length and width of structure
- Clear roadway width
- Elevations and roadway profile
- Working Points

Working points are to be shown on the General Elevation sheet. This shall include 2 WORKING POINTS. The working points shall be as follows:

- Working point 1 (WP1)
  - Only 1 working point with UTM coordinates identified shall be located on the proposed structure. This point shall called working point 1 (WP1) and shall be located on the centerline of proposed roadway-centerline of proposed bearings at one of the abutments and clearly labeled. Accessibility to the proposed structure is an important consideration when choosing the abutment to locate the working point. For example, if one abutment is accessible and the other is not, WP1 should be place on the accessible abutment.
- Working point 2 (WP2)
  - This point with UTM coordinates shall be located on the proposed centerline of roadway at a distance approximately 10 m off the proposed abutment NOT chosen for WP1. Identify and label this point as Centerline of proposed roadway, approximately 10 m North/South/East or West of proposed abutment.
- Critical vertical clearances
- Limits of work such as excavation, rip rap etc.
- Control lines such as roadway stations and centerline of roadway
- Location of substructure units using their control lines such as inside face of abutment backwalls or centerline of piers
- Numbering or naming of substructure units
- Direction such as North
- Direction of flow of waterway
- Roadway cross section showing type of girders and girder spacing's, deck details and curb and bridge rail details.
- Design water levels, river training works & permanent erosion control details.
- Details of embankment construction including embankment slopes and retaining walls.
- Drainage details
- Hazard protection
- Structure should be arranged as indicated in Section 5.3 TYPICAL SHEET LAYOUT

### 5.3.3 EROSION AND SEDIMENT CONTROL

Shall at minimum show the following:

- Show limits of erosion and sediment control
- Show examples of installation of erosion control details. These should provide information relating to the installation of these items and should be relevant to the estimated erosion control methods determined for the site.
- Show edge detail and overlap details for geotextile
- Show notes
- Show limits of disturbed areas



### 5.3.4 PILE AND FOOTING LAYOUT

Shall at minimum show the following:

- Show Plan View of all footings, located by stations
- Dimension size of footings and limits of excavation around footings
- Show layout of all piles in each footing
- Show type of pile and orientation of piles
- Show direction (North, East, etc.)
- Show Cross Section of each typical footing with piles shown indicating embedment into footing and direction and amount of batter.
- Show Bill of Piles
- Show detail of pile splice. NOTE: This should be shown whether pile splices are required or not.
- Show detail of pile tip if required
- Show details of Abutment drainage (plan, cross section, end treatment)
- Show Bill of Abutment Drainage Material (supplied by the Contractor)
- Show general notes:
  - E.g.-Limit of excavation for substructure footings shall not extend beyond a maximum horizontal distance of 750 mm for piers and 600mm for abutments from all sides of footing.

### 5.3.5 BORING LOGS

Shall at minimum show the following:

- Show standard boring log presentation form used by MTI
- Show Plan of structure with boring holes pictorially located with respect to the structure.
  - See **Section 5.7** for further details on Boring Log presentation.

### 5.3.6 ABUTMENT CONCRETE DETAILS

Shall at minimum show the following:

- Front Elevation for vertical dimensions of concrete faces showing and any cross-fall on roadway or bearing seats, or footing, etc.
- Rear Elevation for vertical dimensions of concrete faces showing and any cross-fall on roadway or bearing seats, or footing, etc.
- Plan to show horizontal dimensions, especially on a skewed structure to show precisely which way the dimension is running.
  - Use Plan to layout railpost anchorage or bearings etc.
- Side Elevation for dimensioning of wingwalls.
- Section showing inside elevation view of wingwall to dimension inside face of curb and show extent of fillets.
- Cross Section through abutment backwall to establish precise horizontal dimensions to concrete faces with respect to the inside face of abutment backwall.
- Cross Section through curb to clearly dimension concrete faces of curb.
- Enlarged details of any lateral restraint anchorages in abutment or bearing seats or water drip detail used along outside face of wingwall under overhang on curb.
- Quantity of formwork liner in m<sup>2</sup> used on exposed faces of curbs and exposed faces of wingwalls.
- Any required notes such as;
  - All exposed edges to be chamfered 20 mm unless noted otherwise.
  - Curbs on abutments shall not be poured until curbs on adjacent spans are poured.
  - For Bill of Preset Anchor Units see sheet No.\_\_\_\_
  - For location of Sections \_\_, \_\_, \_\_ see sheet No.\_\_\_\_

### 5.3.7 ABUTMENT REINFORCING DETAILS

Shall at minimum show the following:

- Every type of bar cast into the abutment is identified, located either by clearance or dimension, and number of spaces given.
- No. of spaces can be used for quantity take off of reinforcing bars.
- Spacing of bars from a control point or control line. If using a concrete face, use a face that will be accurately located and fixed, not one that could possibly vary with temperature or some other reason.
- Enough views or sections to locate, and show the shape of every different reinforcing bar.
- Each reinforcing bar shown shall be identified with a bubble containing the appropriate Mark No. or range of No's.
- Each set of spacing's shall be identified as to what bar Marks they apply to.
- Show only bars in near face or cut face for clarity. Take another section to show bars in another layer. Choose the best view to show and space the particular bar. Do not cut corners and try and overlap information.
- Do not identify or space dots for bars. Take a section or view where the bar would be shown as a line, or true shape.
- Bar Mk. No's. for abutments shall usually use prefix "A", next 2 digits indicate bar diameter, and next 2 digits indicate unique no. (A1501)
- Numbering of bars shall start from 1 and be consecutive for each different bar diameter.
- Bill of Reinforcing Steel for abutments, on the drawings with the abutment reinforcing details. See drawings from sample projects on web site for typical practice.

### 5.3.8 CONCRETE DETAILS FOR PIERS

Shall at minimum show the following:

- Side Elevation of pier with critical elevations such as bottom of footing, top of footing, bearing seat elevations.
- Horizontal and vertical dimensions of pier with horizontal dimensions tied into control line such as centerline of roadway and or centerline of pier.
- Direction such as North or East.
- Outline of ice breaker if applicable.
- Plan View of pier showing dimensions for width and length of footing and pier cap tied into control line such as centerline of roadway and or centerline of pier.
- On plan view show dimensions for bearing seats.
- End Elevation showing horizontal dimensions for footing and pier shaft and pier cap.
- On End View locate ice breaker unit with an elevation.
- Standard note for ice breaker:
  - The Contractor shall supply 12 dia. Machine bolts for erection purposes only. The Contractor shall install the 12 dia. x 20 galvanized hex. head cap screws after the erection bolts have been removed.
- Standard pier nose chamfer detail.
- Bill of Miscellaneous Metal for piers. See drawings from sample projects on web site for typical practice.

### 5.3.9 REINFORCING DETAILS FOR PIERS

Shall at minimum show the following:

- Ensure that every type of bar cast into the pier is identified, located either by clearance or dimension, and no. of spaces given.
- No. of spaces can be used for quantity take off of reinforcing bars.
- Spacing of bars from a control point or control line. If using a concrete face use a face that will be accurately located and fixed, not one that could possibly vary with temperature or some other reason.
- Enough views or sections to locate, and show the shape of every different reinforcing bar.

- Each reinforcing bar shown shall be identified with a bubble containing the appropriate Mark No. or range of No's. if need be.
- Each set of spacing's shall be identified as to what bar Marks they apply to.
- Only bars in near face or cut face for clarity. Take another section to show bars in another layer. Choose the best view to show and space the particular bar. Do not cut corners and try and overlap information.
- Do not identify or space dots for bars. Take a section or view where the bar would be shown as a line, or true shape.
- Bar Mk. No's. for piers shall use prefix "P", next 2 digits indicate bar diameter, and next 2 digits indicate unique no. (P1501).
- Numbering of bars shall start from 1 and be consecutive for each different bar diameter.
- Bill of Reinforcing Steel for piers, on the drawings with the pier reinforcing details.
- See typical Bill of Reinforcing located on our website.

### 5.3.10 GIRDER CONCRETE DETAILS

Shall at minimum show the following:

- Detail girders thoroughly so that these drawings could be used for fabrication, as no shop drawings will be included in the contract drawing package.
- Detail all girder dimensions for length, height, and width, layout of lateral stressing ducts, layout of drains if applicable, center to center of bearings, any anchorage details for fixed bearings or lateral restraint.
- Detail girder with bottom of girder level as cast in the form.

### 5.3.11 GIRDER DETAILS

Shall at minimum show the following:

- Elevation and Plan of girder showing layout of prestressing strands. Include length of girder and location of hold down points for prestressing strands.
- End View and Section showing layout of prestressing strands at the ends of girder and at the hold down points.
- Indicate lifting devices and show note:
  - The Girder Fabricator shall be responsible for the design, supply and installation of adequate lifting devices c/w 50 mm deep pockets (cut off lifting devices min. 25 mm below top surface and grout after installation).
- Standard details of lateral stressing ducts and blockouts required for concrete patching.
- Outline of girder concrete in plan and side elevation showing variable depth of girder to eliminate camber on top surface after destressing.
- Bill of Material for Girders with details of fabrication (supplied by the girder contractor). Include all material cast in or attached to girder or used for lateral stressing.
- For structural steel girders, shop drawings shall be produced and incorporated into As-built drawings.

### 5.3.12 GIRDER DRAIN DETAILS

Shall at minimum show the following:

- Details all fabrication to make up complete drain assembly.
- Assembly and installation of drains in girder.
- Bill of Miscellaneous Metal for drains (supplied by the girder contractor).
- Any required notes such as:
  - All angles and plates shall conform to the requirements of CAN/CSA-G40.21 Grade 300W.
  - Welding shall meet the current requirements of the American Welding Society, Bridge Welding Code ANSI/AASHTO/AWS D1.5.
  - All material in the above Bill shall be galvanized in accordance with CAN/CSA-G164. No punching, drilling, cutting, or welding will be permitted after galvanizing.

- Pre-assemble drain grate to drain unit prior to delivery to site.
- Drain grate to be tack welded (using spacer bars as required) at each corner of drain unit. Weld length 25 min. each direction.
- Shims, if required, to be tack welded to drain unit and to each other when more than one shim is used.
- Drain grate unit to be field welded to shims or unit with location and elevation to be controlled by the inside face of curb and surface of overlay as shown in details.
- Field welding of shims, drain and HSS tubing to be done by the General Contractor.
- Apply Galvalloy to all field welds and areas where galvanizing has been damaged.
- See sheet No. \_\_\_\_ for drain locations.

### 5.3.13 GIRDER REINFORCING DETAILS

Shall at minimum show the following:

- Ensure that all bars cast into the girder are identified, located either by clearance or dimension, and no. of spaces given.
- No. of spaces can be used for quantity take off of reinforcing bars.
- Ensure enough views or sections are included to locate, and show the shape of every different reinforcing bar.
- Each reinforcing bar shown shall be identified with a bubble containing the appropriate Mark No. or range of No's. if need be.
- Each set of spacing's shall be identified as to what bar Marks they apply to.
- Only bars in near face or cut face for clarity. Take another section to show bars in another layer. Choose the best view to show and space the particular bar. Do not cut corners and try and overlap information.
- Do not identify or space dots for bars. Take a section or view where the bar would be shown as a line, or true shape.
- Bar Mk. No's. for girders shall usually use prefix "G" or suffix, next 2 digits indicate bar diameter, and next 2 digits indicate unique no. (G1501 or 1501G).
- Numbering of bars shall start from 1 and be consecutive for each different bar diameter.
- Any required notes such as;
  - Concrete cover over reinforcing steel shall be 25 mm unless noted otherwise.
- Bill of Reinforcing Steel for girders, on the drawings with the girder reinforcing details.

### 5.3.14 BEARING DETAILS

Shall at minimum show the following:

- Plan view of substructure units locating centerline of bearings with respect to the centerline of piers or inside face of abutment backwalls and centerline of bearings with respect to the centerline of girders.
- Dimensions center to center of bearings.
- Directions.
- Label different types of bearings.
- Section through substructure unit, bearing and girder, to show orientation of bearing with respect to the girder and substructure unit.
- Any required notes such as;
  - Gaps between channel girders may vary and bearings should be centered under channel girder. An allowance for movement due to lateral stressing may be required.

### 5.3.15 GIRDER ERECTION DETAILS

Shall at minimum show the following:

- Plan view of all girders, identifying all girders, and showing orientation with respect to the fixed and expansion ends.
- The girders that will receive anchor rods for fixing girders at fixed ends.
- Any lateral restraints that are required to be erected.
- The location of all lateral stressing ducts.
- Directions.
- Section through fixed ends of girders and dimension to fixed end of girders from control line such as centerline of pier or inside face of abutment backwall as this is the only fixed dimension for girder erection.
- Transverse cross section through superstructure showing layout of girders with respect to the control line, such as centerline of roadway, and indicate any special instructions concerning grouting of shear keys, such as before lateral stressing or after lateral stressing.
- A transverse cross section through superstructure at a diaphragm showing the layout of the lateral stressing ducts.
- A section through the fixed ends of girders showing the anchor details for the fixed ends of girders.
- Any required notes such as;
  - The channel girders shall be erected such their ends at the fixed bearings must be in a straight line maintaining a 50 mm gap between end of girder and centerline of pier.
  - All fixed ends of interior girders are fabricated with anchor rod holes and all unused holes shall be grouted.
  - Sequence of Operations:
  - Grouting of continuous key as shown in Section X-X.
- Placing and grouting of anchor rods on girders Mk. "G1a" only. (For location of anchor rods see Girder Layout ).
- Lateral Stressing (Final force in 12.7 dia. Strand = 93.45KN,  $f_{pu} = 1\ 860\ \text{MPa}$ )
- Grouting of lateral stressing ducts.
- Placing and grouting remaining anchor rods (For location of anchor rods see Girder Layout).
- Grouting of remaining keys and unused anchor rod holes. The areas between the girders and the substructure units shall be kept free of grout.
- Bill of Miscellaneous Metal.
- Bill all material detailed with girder erection and show any fabrication details required for material listed in the Bill.

### 5.3.16 CURB CONCRETE DETAILS

Shall at minimum show the following:

- Plan of curbs (length of curb is not shown as one end is governed by the expansion joint).
- Layout and identify railpost anchor units using a control point such as centerline of pier at fixed end and in other direction to centerline of front railpost anchor bolts with respect to the a previously identified control line such as centerline of roadway.
- Layout and identify contraction joints in the curbs.
- Identify and locate the inside face of curb with respect to the previously identified control line such as centerline of roadway.
- Directions (keep the orientation the same as used throughout the drawing package).
- Cross section through curb giving all the fixed curb dimensions such as height and width etc. and cross fall on top. Locate the railpost anchor unit with respect to the inside face of curb.
- Enlarged view of chamfer and water drip in bottom of curb overhang.
- Elevation, section, and detail of typical curb contraction joint.
- Any required notes such as;
  - Concrete cover shall be 50 mm unless noted otherwise.
  - All exposed edges shall be chamfered 20 mm unless noted otherwise.
  - Areas to receive permeable formwork liner finish:

- All inside faces of curbs.
- All outside faces of curbs.
- For Bill of Railpost anchors see sheet No. \_\_\_\_\_

### 5.3.17 CURB REINFORCING DETAILS

- Enough plan view of curbs to be able to identify all longitudinal bars used in curb and space these bars from inside face of curb.
- Identify transverse curb bars placed in the curb (For clarity do not show curb bars projecting from girder). Space and identify these bars as a typical set of spacing's between center to center of railpost anchor. Show any non typical spaces at ends of spans.
- Directions (keep the orientation the same as used throughout the drawing package).
- A cross section of curb, locating curb bars from inside face of curb.
- Enlarged plan view of curb steel around railpost anchor with any special instruction for placing of bars in this area as space is limited.
- Section through lower portion of curb showing and spacing extra bars through lower part of railpost anchors.
- Any required notes such as:
  - Railpost anchor units shall be positioned accurately before placing longitudinal steel in curb.
  - All exposed edges shall be chamfered 20 mm unless noted otherwise.
  - Concrete cover shall be 50 mm unless noted otherwise.
  - For expansion joint details see sheet No. \_\_\_\_\_
  - For fixed joint details see sheet No. \_\_\_\_\_
- Bill of Reinforcing Steel.

### 5.3.18 EXPANSION JOINT DETAILS

Shall at minimum show the following:

- Plan view of every different edge angle and on each plan show length from previously established control line such as centerline of roadway. On the plan view, layout all different types of anchor bars and all bleeder holes.
- Plan view of every different expansion units and on each plan show length and layout all different types of anchor bars and erection holes.
- Sections through expansion units and edge angles locating anchor rods, any fabrication details required and any welding details for anchors or splice at centerline of roadway or curb.
- Fabrication details and erection details of curb expansion units and curb cover plates.
- Plan of assembly details of roadway expansion units and curb expansion units with layout tied to control line.
- Directions.
- All necessary sections through roadway and curb assemblies to clearly show assembly procedure and ability to adjust gap for temperature at time of placing concrete.
- Table of installation temperatures and corresponding installation gap width.
- Cross fall. This can be shown either by slope or vertical offsets if structure is skewed as well as on a slope.
- Fabrication details of erection angles.
- Bill of Reinforcing Steel for fixed and expansion blockouts.
- Any required notes such as:
  - Installation temperature shall be taken as the mean ambient shade temperature under the bridge for the 48 hours prior to casting the joints into the deck.
  - Contact the design Engineer for instructions regarding installation temperatures in excess of +25 degrees C.
  - Apply Galvalloy to all field welds or areas where galvanizing has been damaged.
  - Prior to placing concrete the installation shall be approved by the Engineer.
  - All surfaces in contact with joint seal shall be cleaned prior to installation of the seal.

- All material shall be installed in accordance with respective manufacturer's recommendations.
- Loosen off erection bolts within 24 hrs. of expansion area pour to allow for movement due to temperature change.
- After removal of erection angles, bleeder holes and voids shall be filled under pressure with approved grout.
- For Bill of Preformed Joint Seal see sheet No. \_\_\_\_\_.
- Bill of Expansion Units

### 5.3.19 FIXED JOINT DETAILS

Shall at a minimum show the same or similar details of the Expansion joint details except no need for temperature/gap variation as it is fixed.

### 5.3.20 GUARDRAIL LAYOUT

Shall at minimum show the following:

- Line diagram for each typical span showing layout of rails with Mk. No's. With each span diagram list total No. of each type of rail, each type of sleeve, and each type of railposts per span.
- A line diagram for piers and list the total No. of each type of rail, each type of sleeve per pier.
- A line diagram for abutments and list the total No. of each type of rail, each type of sleeve, and each type of railpost per abutment.
- Any required notes such as;
  - All railposts shall be Mk. "RP1" unless noted otherwise.
  - Maximum allowable space between railposts shall be 3 000 mm.
  - Spacing between railposts shall be rounded to nearest 20 mm.
  - Minimum distance from end of span to first railpost shall be 450 mm approximately.
  - Approximate distance from far end of abutment to first railpost shall be 400 mm. (to accommodate approach guardrail connection)
  - All layouts of rails are per span, per abutment or per pier.
  - This standard is to be read in conjunction with sht No. to sht. No.

### 5.3.21 RAILING DETAILS

Shall at minimum show the following:

- All fabrication details required for all rails and sleeves.
- Any required notes such as;
  - It is imperative that all rail and sleeve holes in each pair of holes be opposite from each other.
  - The length of slotted holes shall be not less than shown.
  - The width and height of the sleeves shall not exceed the dimensions shown.

### 5.3.22 RAILPOST DETAILS

Shall at minimum show the following:

- All fabrication details (including welding) required for all posts and connection plates and connection angles for approach guardrail, and shims for under railposts.
- Bill of Miscellaneous Metal for all railing material and shall also show details of the railpost anchor units.
- Any required notes such as:
  - HSS Rail shall conform to CAN/CSA- G40.21-M92 Grade 350W
  - All steel plates shall conform to the requirements of CAN/CSA- G40.21-M92 Grade 300W.
  - W150x37 railposts shall conform to CAN/CSA- G40.21-M92 Grade 300W.
  - All bolts shall conform to the requirements of ASTM A307 except where noted otherwise.
  - All posts and rail sections shall be galvanized after fabrication.

- All material in the above Bill shall be galvanized in accordance with CAN/CSA–G164-M92.
- Welding shall meet the current requirements of the American Welding Society, Structural Welding Code ANSI/AASHTO/AWS D.1.5.

### 5.3.23 RAILING ASSEMBLY DETAILS

Shall at minimum show the following:

- All assembly details required for railpost to anchor, rail to sleeves and posts, and approach guardrail connection.
- Standard gap between rail ends and expansion gap between rail ends.
- Any required notes such as:
  - All approach guardrail including timber, miscellaneous metal, and guardrail hardware to be placed by others.

### 5.3.24 APPROACH SLAB DETAILS

Shall at minimum show the following:

- Plan view showing concrete dimensions as well as spacing of all reinforcing steel in top of approach slab. (slab usually 7 m long along centerline of roadway).
- Plan view showing spacing of all reinforcing steel in bottom of approach slab.
- Longitudinal section through approach slab showing slab concrete details, reinforcing steel details, elevations at each end of slab and asphalt details.
- Staggered transverse cross section through slab showing different edge conditions along slab, show concrete details, reinforcing details, and cross fall.
- Section through abutment showing joint details between approach slab and abutment.
- Detail of joint between slab and curb alongside.
- Detail of joint along centerline of roadway.
- Bill of Reinforcing Steel.

## 5.4 LETTERING STANDARDS

- All lettering is done in lower case letters except for starting a sentence, or for proper nouns, such as names, or directions, or if some emphasis is to be applied.
- Uppercase lettering is used for all titles.
- When possible, annotations will be in full and in a position that is readable from the bottom of the plan.
- River and stream names shall follow the shape of the feature.
- Abbreviations should be avoided if possible.
- When a decimal fraction is used, a “0” shall always be placed before the decimal marker (i.e. 0.232 m).
- A space is required for four digit numbers (e.g. 5 634 not 5634).
- Unit symbols (m, kg, ... etc.) represent the unit. They are not abbreviations

## 5.5 DIMENSIONING STYLE

- The starting point of all dimensions shall be a control line or face, with a breakdown of all dimensions to each element and then a summation dimension given on top.
- Dimension text shall be centered and on top of dimension line.
- Dimension text shall be read from the bottom or right side of plan.
- Arrow head terminators shall be inside extension lines if possible.
- Reinforcing dimensions shall be a different dimension each time the spacing changes or a number of same spacing's with a total.



- Accuracy: no decimals, dimensions shall be rounded to the nearest mm. Angle dimensions shall be displayed as degrees, minutes and seconds

## 5.6 REINFORCING DETAILING STYLE

- Reinforcing details shall be separated from concrete details.
- Most reinforcing steel shall be shown with a single line unless using a very large scale.
- Legs of bars shall be shown alongside other bars for clarity.
- Hooks and leg lengths shall be shown to scale.
- Show at least one bar on each side of a space change.
- If bars are staggered in a pattern show enough bars to show the typical pattern repeat.
- Show dots of bars in proper locations.
- Show enough longitudinal bars to show stagger of laps.
- When detailing bars use standard lengths of 6 m, 12 m, or 18 m if possible.
- Usually 12 m max. length is used for ease of transporting to site or handling inside hoarding.
- Every bar detailed shall be identified by a Mark No. inside a bubble.
- Each bridge component shall have a unique letter prefix for the bars within this component
- Incremented bars shall each have their own Mark No.
- Bars are laid out by No. of spaces not No. of bars.
- Total number of spaces plus end spaces should add up to concrete dimension, as a check.
- The ESP shall ensure that all structure components include complete Bills of Reinforcing. Bills of Reinforcing include the following;
  - Cast-In-Place structure components;
    - Mark Number
    - Type (bent or straight bar)
    - Pin Diameter
    - Length
    - Total No.
    - Mass.
  - Precast structure components;
    - Mark number
    - Type (bent or straight bar)
    - Pin diameter
    - Length
    - Unit type
    - Number of units (per unit type)
    - Number of bars per unit
    - Total number of bars per unit type
- All bent bars are to be completely detailed in the bending diagram. All bends shall be in accordance with standard bill of reinforcing located on website (see Section 4.9).

## 5.7 BORING LOGS

- Location of test holes must be shown on the site plan as accurately as possible. Identification of test holes should be shown as "BH 1, BH 2, etc".
- Location is relative to the Plan view location points of bore holes starting from left to right.
- There shall be a maximum of 4 boring logs per sheet.
- Field notes are not required to be shown in boring logs.
- All text must be legible on Arch D (24" x 36") size and/or Ledger (11" x 17") size sheets.
- Present soils information in test hole logs format. Use a separate drawing if the number of logs so require.
- Show on each test hole, the test hole number, station to the nearest 0.1 m, elevation at least to the nearest 0.01 m and date of drilling. E.g. BH 5, Sta. 3+59.4, 4.0m left of centerline, Elevation 101.14, 07/16/02 (MM/DD/YY).

- Classify soils on boring logs according to the Unified Soil Classification System as modified as by the Prairie Farm Rehabilitation Administration (PFRA)
- Soil description should be in accordance with the following rules: Main soil component, followed by the minor components in descending order; density/consistency, and soil structure (e.g. laminated, weathered, friable, etc.). If space permits and drawing won't appear cluttered, add one or more of the following: Moisture, color, and odors.
  - e.g.: a) Sand, silty, dense, presence of boulders.
  - b) Sand, medium dense, above optimum, dark brown
- When a Rock Quality Designation (RQD) value is given, density is not required.
- All RQD values and associated depths must be shown, to the nearest 0.1 m.
- Water table elevation, when available, must be shown on the test hole logs. Also installation of slope indicators, piezometers, etc., should be noted.
- All Standard Penetration Tests (N-values) and associated depths must be shown, to the nearest 0.1m. Where full penetration was not achieved, show N-value and associated penetration as well as the depth.
  - For e.g. N 120/56 mm, 18.10.
- Show depth of bottom of the hole, to the nearest 0.1 m.
- The following abbreviations are permitted:
  - $q_u$  Laboratory Unconfined Compressive Strength in kPa
  - SPT(N) Number of blows per 300mm penetration, Standard Penetration Test
  - U.S.C. Unified Soil Classification
  - M.C. Moisture content
- Keep N-values and RQD-values on one side of the logs and soil description on the other. In general, the presentation chosen should be consistent for all test holes.
- The depth of each stratigraphy should be shown to the nearest 0.1 m.

### 5.7.1 UNIFIED SOIL CLASSIFICATION SYSTEM (WITH 1 PFRA MODIFICATION)

Unified Soil Classification (USC) System (from ASTM D2487) (with PFRA CI Classification added)					
MAJOR DIVISIONS			GROUP SYM.	LOG SYM.	TYPICAL NAMES
<b>Coarse-Grained Soils</b> More than 50% retained on the No. 200 sieve	<b>Gravels</b> More than 50% of coarse fraction retained on the No.4 sieve	Clean gravels	GW		Well-graded gravels and gravel-sand mixtures, little or no fines
			GP		Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM		Silty gravels, gravel-sand-silt mixtures
			GC		Clayey gravels, gravel-sand-clay mixtures
	<b>Sands</b> 50% or more of coarse fraction passes the No.4 sieve	Clean Sands	SW		Well-graded sands and gravelly sands, little or no fines
			SP		Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures
<b>Fine-Grained Soils</b> More than 50% passes on the No. 200 sieve	<b>Silts and Clays</b> Liquid Limit 50% or less	ML		Inorganic silts of low plasticity, rock flour, gravelly silt, sandy silt, clayey silt	
		CL		Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		CI		Inorganic clays of medium plasticity, gravelly clays, sandy clays, silty clays	
		OL		Organic silts and organic clays of low plasticity	
	<b>Silts and Clays</b> Liquid Limit greater than 50%	MH		Inorganic silts of high plasticity, micaceous or diatomaceous silts, elastic silts	
		CH		Inorganic clays of high plasticity, fat clays	
		OH		Organic clays of high plasticity	
<b>Highly Organic Soils</b>			PT		Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic  
 Suffix: W = Well Graded, P = Poorly Graded, M = Silty, C = Clayey, L = Low Plasticity (Clay, LL<30%; Silt and Organic, LL<50%)  
 I = Intermediate Plasticity (Clay, 30% < LL < 50%), H = High Plasticity (Clay, Silt and Organic, LL > 50%)

**OTHER SYMBOLS**

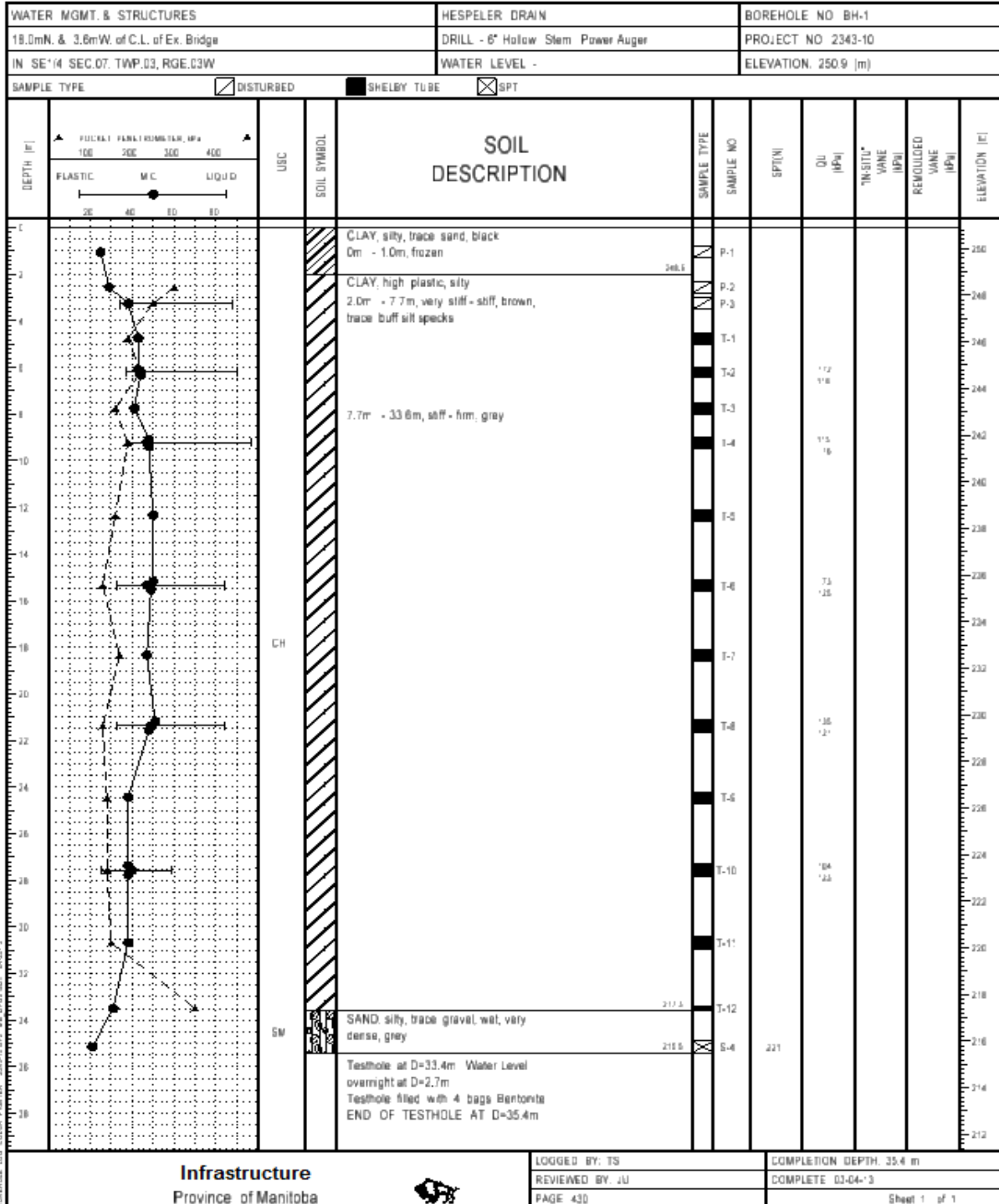
	Bedrock (unclassified)		Limestone
	Sandstone		Overburden
	Shale		Topsoil

5.7.2 FINALIZED LOG (Sample)

The following template is a product produced from a file called MB\_DHGS.GDT which is available on the website along with instructions on necessary software.

MTI takes no responsibility for the performance of the template and the ESP is responsible to verify that the template generates an accurate report from the information inputted by the ESP.

No Engineering firm logos shall appear in the final boring logs.



## **SECTION 6 – DELIVERABLES**

### **6.1 ELECTRONIC FILES**

#### **6.1.1 PDF FORMAT**

- Portable Document Format (pdf) is an accepted static electronic format. The paper size format for the pdf must match requirements for paper delivery (example, plan sheet intended to be printed on 610mm x 914mm paper should be formatted to be printed on 610mm x 914mm paper). PDF's should be created at 600 dpi.
- Submissions that involve drawings or details prepared in a CADD format shall also be submitted in .pdf file format (portable document file).

#### **6.1.2 MICROSTATION FORMAT**

- An electronic copy of all submitted drawings to be provided on USB flash drive or other acceptable format.
- Electronic CADD files shall be Microstation format (.dgn), compatible with versions used by MTI.

### **6.2 DRAWING SUBMISSIONS**

This shall include: INTERIM REVIEW DRAWINGS, ORIGINAL DRAWINGS, REVISIONS, RECORD DRAWINGS, and SHOP DRAWINGS.

#### **6.2.1 INTERIM REVIEW DRAWINGS**

This shall be the drawing package for MTI review.

- Drawings submitted to the B&HS for review shall consist of one full size paper hard copy, 4 - 11 x 17 size paper hard copies and an electronic copy in \*.PDF format (Adobe Portable Document Format).
- B&HS staff will undertake quality assurance reviews of the deliverables. Any review of the ESP's work, signing of drawings and the acceptance of documents by MTI staff does not relieve the ESP from any responsibility for the work.
- Submissions to B&HS shall be submitted in a timely manner and in the format specified in this manual. The submissions shall allow sufficient time for MTI to undertake a level of review appropriate for the work involved.
- MTI staff will not check drawings for errors or omissions but simply review drawings for compliance with this CADD manual and project requirements.
- If after a review there are any errors in concept or the drawings are not in compliance with this CADD manual, the ESP shall make the necessary changes and resubmit drawings for another cursory review and project requirements.
- All structure drawings and reports submitted to MTI must reference the unique structure site number that has been assigned by MTI.

#### **6.2.2 ORIGINAL DRAWINGS**



This shall be the drawing package for project tendering.

- The drawings for this stage shall be contract drawings 100% complete.
- All components shall be thoroughly detailed ready for construction or fabrication. Copies of these authenticated (signed and sealed) drawings will be used for tendering and construction contract award purposes.
- Submissions shall be 1 set of full size mylar hard copies (see Section 4.1) and 1 matching set of pdf files. Pdf submission shall match the mylar submission for size and material content.
- This drawing package is referred to as "Issued for Construction" or "As-tendered"

- The Cover sheet shall show “Issued for Construction” or “As-tendered” label at the bottom Left corner of the sheet



- The remaining sheets shall have the Author’s seal placed in the Design seal area of the title block.
- The date, Engineer’s initials and Issued for Construction text shall be filled in the bottom line of the revision box within the title block.

REVISIONS				
2016/05/04	A.H.P.	ISSUED FOR CONSTRUCTION		
DATE	BY	DESCRIPTION	RELEASED FOR CONSTRUCTION BY:	
DESIGN SEAL		RECORD SEAL	 Infrastructure Water Management and Structures	
				
DESIGN		BY: _____	EXECUTIVE DIRECTOR OF STRUCTURES DATE	
		CHECKED: _____	SCALE: _____	
DETAILS		BY: _____	SHEET No. _____	
		CHECKED: _____	SITE No. _____	

6.2.3 REVISIONS

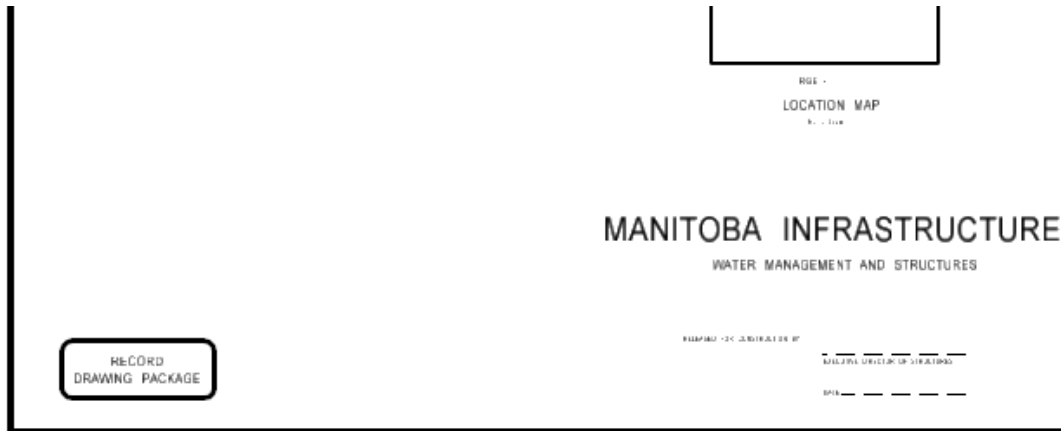
If required these drawings provide direction during tendering and construction. The revisions process includes the periods of time after MTI has officially tendered the project until completion of construction.

- If revisions are required to be made to the drawings, **after tendering the drawings but before awarding the contract**, the ESP will have to submit full size mylar drawings signed and sealed, so copies can be forwarded to all prospective bidders before closing of the tendering period. This process is called an addendum. The revised mylar shall replace the original drawing. It will then be the ESP’s responsibility to remove and dispose of the original mylar drawing.
- If revisions are required to be made to the drawings **after awarding the contract**, the ESP shall submit, throughout the construction period, revised sheet/s in pdf format as identified in Section 6.1.1. These files shall be clearly dated and retained as a history of revisions.
- All revisions, where possible, shall show original data, crossed out, as well as new data flagged or identified.

### 6.2.4 RECORD DRAWINGS

This shall be the completed drawing package for record and filing purposes.

- These drawings shall include any modifications or alterations made to the ORIGINAL DRAWINGS after their submission.
- Submissions shall be 1 set of **full size mylar** hard copies (see Section 4.1) and 1 matching set of **Microstation .dgn** files (see Section 6.1.2).
- The Cover sheet shall show "Record Drawing" label at the bottom left corner of the sheet.



- The remaining sheets shall have the original Author's seal placed in the Design seal area with the original date sealed within the seal.
- Place the authenticating Engineer's seal in the Record Seal area.
- The date, authenticating Engineer's initials and Record Drawing text shall be filled in the bottom line of the revision box within the title block.

REVISIONS				
2016/02/08	R.D.A.	RECORD DRAWING		
DATE	BY	DESCRIPTION	RELEASED FOR CONSTRUCTION BY:	
DESIGN SEAL		RECORD SEAL	EXECUTIVE DIRECTOR OF STRUCTURES DATE	
			DESIGN	BY: _____
				CHECKED: _____
			DETAILS	BY: _____
				CHECKED: _____
			SCALE:	SHEET No. _____
				SITE No. _____

### 6.2.5 SHOP DRAWINGS

- As indicated previously, the ESP shall ensure that all components are detailed with enough information for complete construction. Full detailed drawings incorporated into the drawing package shall show details of how all components interact with adjacent components.

- If Shop Drawings are produced by the Contractor, Supplier, Manufacturer, Sub-Contractor or Fabricator, these shall be submitted to MTI. MTI will submit to the ESP for review and acceptance and ensure that the drawings meet the designer's original intent.
- If shop drawings in any way modify the "Issued for construction" or "As tendered" details (for example Supplier & product selected during design process changes during tendering process) the ESP shall be responsible for incorporating these changes into the Record drawings.