DRAFTING GUIDELINES AND PRACTICES MANUAL

STRUCTURES ENGINEERING

Document No: 6702/02/2236
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AUTHORISATION

As Senior Engineer Structures of Structures Engineering of Main Roads Western Australia, I authorise the issue and the use of this Manual.

Senior Engineer Structures

Date: 19/10/2009

Document No. 3912/04

Controlled Copy No: ___
DRAFTING GUIDELINES AND PRACTICES MANUAL

CHAPTER 1.......................................................... BRIDGE NUMBERING SYSTEM
CHAPTER 2.......................................................... DRAWING MANAGEMENT
CHAPTER 3......................................................... DRAWING STANDARDS AND GUIDELINES
CHAPTER 4.......................................................... CONCRETE
CHAPTER 5.......................................................... REINFORCEMENT
CHAPTER 6.......................................................... STRUCTURAL STEEL
CHAPTER 7.......................................................... SITE INVESTIGATIONS

NB. This manual is to be read in conjunction with the manual No 6706/02/2228 Guidelines on Presentation and Format of Drawings.
CHAPTER 1

BRIDGE NUMBERING SYSTEM
# REVISION STATUS RECORD

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<th>Latest Revision Date</th>
<th>Revision Description/ Reference</th>
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Authorised by: .................................................. Date:__/__/____
# TABLE OF CONTENTS

1.0 PURPOSE .................................................................................................................. 4
2.0 SCOPE ....................................................................................................................... 4
3.0 REFERENCE ............................................................................................................... 4
4.0 DEFINITIONS ............................................................................................................. 4
5.0 DOCUMENTATION ................................................................................................... 4
6.0 BRIDGE NUMBERS ................................................................................................. 5
APPENDIX A - BRIDGE NUMBER REGISTER ................................................................... 6
1.0 PURPOSE

The purpose of Chapter 1 is to describe the processes to be followed in the management of the bridge numbering system used in Structures Engineering.

2.0 SCOPE

The instruction shall apply to the management of information associated with previously issued bridge numbers and the issue and management of bridge numbers for new structures.

3.0 REFERENCE

The procedure for the Management of Bridge Data and Information 3912/01/04.

4.0 DEFINITIONS

The following definitions are taken from the ‘Bridge & Culvert Management Policy’.

**BRIDGE:** a structure (with the exception of sign gantries) having a clear opening in any span of greater than 3 metres measured between the faces of piers and/or abutments or structures of a lesser span with a deck supported on timber stringers. Note: A traffic – supporting structure that is a combination of bridge and culvert openings is managed as a ‘Bridge’.

**CULVERT:** a structure under a road having only clear openings of less than or equal to 3 metres measured between the faces of piers and/or abutments or a pipe shaped structure of any diameter.

**SIGN GANTRY:** an overhead structure spanning a road carriageway for the specific purpose of carrying regulatory, advisory, warning or directional signs.

5.0 DOCUMENTATION

5.1 General

The Bridge Numbering Register described in this chapter shall be retained by the Structures Information and Standards Manager and shall not be destroyed.
It consists of an electronic register and a hard copy backup.
6.0 BRIDGE NUMBERS

6.1 Bridge Numbering System

6.1.1 Introduction

The bridge numbering system was developed to identify every structure in the state for which Main Roads Western Australia has any responsibility including all bridges on Highways, Main Roads and Local Authority Roads.

The Bridge Numbering System shall be maintained in Structures Engineering by the Structures Information and Standards Manager.

6.1.2 Allocation of Bridge Numbers

The Bridge Numbering Register is operated in sections, with various types of roads and structures allocated with blocks of numbers as follows:

0001 – 2999: Main Roads bridges, tunnels and rail bridges.

3000 – 5999: Local Authority road bridges and Water Corporation bridges.

6000 – 6999: Culverts


8000 – 8999: Sign gantries.

9000 – 9999: Footbridges and underpasses.

When a new structure is to be built on a site where no previously registered structure exists, a new bridge number shall be issued.

If a replacement bridge structure is to be built on the site of an existing bridge structure that is to be demolished, it shall retain the allocated bridge number but be given an alphabetic suffix, ranging from “A” (for the first replacement) onwards.

A new structure on a realigned road which replaces an existing structure which is not to be demolished shall be allocated a new number and not a suffix.

Any structure on a road which is reclassified shall retain its original number, regardless of non-compliance with the above number system.

6.1.3 Maintenance of Bridge Register Numbers

The issue of new numbers and any alterations to the Bridge Register Number shall always be carried out by the Structures Information and Standards Manager or his/her delegate.
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APPENDIX A - BRIDGE NUMBERING REGISTER
CHAPTER 2

DRAWING MANAGEMENT
## REVISION STATUS RECORD

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Authorised by:  T M Slattery  
Date:  16 /3/10
**TABLE OF CONTENTS**

1.0 PURPOSE ........................................................................................................ 4

2.0 SCOPE ............................................................................................................. 4

3.0 REFERENCES ................................................................................................. 4

4.0 DEFINITIONS ................................................................................................... 4

5.0 DOCUMENTATION .......................................................................................... 4

6.0 JOB INSTRUCTION ........................................................................................ 5

APPENDIX A - PRELIMINARY DRAWING REGISTER ............................................ 10

APPENDIX B - DRAWING MAINTENANCE UTILITY (TRIM) ................................. 11

APPENDIX C - PDF REQUISITION ........................................................................ 12

APPENDIX D - AUTHORISATION TO RETAIN OR DESTROY ORIGINAL DRAWINGS ........................................................................................................... 13
1.0 PURPOSE

The purpose of this Chapter 2 is to describe the processes to be followed in the management of the drawings produced by Structures Engineering and Consultants.

2.0 SCOPE

This shall apply to the hard copy format and microfilm aperture card copy of all Structures Engineering drawings which are allocated a Main Roads Western Australia drawing number.

Processes described are:

- Numbering of drawings
- Registration of drawings
- Portable Document File (PDF)
- Destruction and archiving of drawings
- Storage, packaging and delivery of drawings.

The management of Structures Engineering electronic drawings is described in the Guidelines on Presentation and Format of Drawings. (6706/02/2228)

3.0 REFERENCES

- Structures Engineering Management System (3912/01)
- Guidelines on Presentation Format of Drawings (6706/02/2228)

4.0 DEFINITIONS

The following terms used in this chapter have the following meanings:

- As constructed: a drawing reaches “as constructed” status when it is amended to reflect any site alterations made during the construction phase.
- Registered: the process whereby drawing identification details are recorded in the Drawing Number Allocation and Drawing Register (TRIM).
- PDF: Portable Document File (Digital file)
- Drawing: the original or master copy (i.e. CAD plot) of a drawing.

5.0 DOCUMENTATION

5.1 General

Where specified proforma and registers referred to in this chapter shall be retained by the Structures Information and Standards Manager and shall not be destroyed.
5.2 Drawing Records

The records generated as a consequence of managing drawings in accordance with this chapter are as shown.

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<td>Allocate Preliminary drawing number</td>
<td>Preliminary Drawing Register</td>
</tr>
<tr>
<td>6.3.2</td>
<td>Initial registration</td>
<td>Drawing Number Allocation and Drawing Register (TRIM)</td>
</tr>
<tr>
<td>6.3.3</td>
<td>Final Registration</td>
<td>Drawing Number Allocation and Drawing Register (TRIM)</td>
</tr>
<tr>
<td>6.3.4</td>
<td>Cancelled/Superseded drawing</td>
<td>Drawing Number Allocation and Drawing Register (TRIM)</td>
</tr>
<tr>
<td>6.5.6</td>
<td>Destruction Processing</td>
<td>Drawing Number Allocation and Drawing Register (TRIM)</td>
</tr>
<tr>
<td>6.4.1</td>
<td>Drawings requiring PDF files</td>
<td>Drawing Number Allocation</td>
</tr>
<tr>
<td>6.5.7</td>
<td>Drawing Disposition</td>
<td>Authorisation to retain or destroy Drawing Number Allocation and Drawing Register (TRIM)</td>
</tr>
</tbody>
</table>

6.0 JOB INSTRUCTION

6.1 Introduction

Structures Engineering is primarily concerned with the management of drawings.

The management of these drawings shall be as per this part regardless of who produces the drawing.

It is imperative that this instruction is adhered to at all times to ensure that drawings are always easily accessible and securely stored.

6.2 Numbering of Drawings

6.2.1 Introduction

A Drawing Number is an identification code for a drawing. All drawings that need to be retained as an official record shall be allocated a number from the Drawing Register.
6.2.2 Drawing number Make-up

A drawing number is made up of 4 parts. These parts are; (current calendar) year, section code, sequential number and an amendment designation in that order. Sequential numbers and amendment numbers start from ‘1’.

<table>
<thead>
<tr>
<th>Year</th>
<th>Amendment designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0830</td>
<td>0001 - 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section code</th>
<th>Sequential number (4 digits)</th>
</tr>
</thead>
</table>

The amendment designation shall be as described in the procedure for the Structures Engineering Drawings (3912/01 – 8)

6.2.3 Drawing Number Allocation

Drawing numbers shall be allocated via the electronic Drawing Register on the TRIM system. A hard copy of this register is held by the Structures Information and Standards Manager. For further information refer to the Guidelines on Presentation and Format of Drawings (6706/02/2228)

Should a drawing be produced outside Structures Engineering require a Drawing Number, the same process shall be followed. From then on these drawings shall be subject to all the other processes that a Structures Engineering drawing goes through.

6.2.4 Preliminary Drawing Number Allocation.

Any drawing that is not to be retained as an official record, but is required for preliminary work only, shall be issued a preliminary drawing number. This is available from the Preliminary Drawing Register. (Refer Appendix A)

6.3 Registration of Drawings

6.3.1 Introduction

All drawings produced inside and outside Structures Engineering that have a Main Roads Western Australia Drawing Number shall be registered and microfilmed. This acts as a permanent record of each drawing.
6.3.2 Initial Registration

- Drawings shall be registered on the Drawing Maintenance Utility (TRIM. Refer Appendix B) when the drawing number is allocated (refer 6.2.3)

- At the same time that a drawing is being registered in The Drawing Maintenance Utility (TRIM) the relevant details shall also be recorded in the Drawing Register Book.

- It is not necessary to amend details in any drawing register between initial registration and the “as constructed” stage unless there are major changes to the drawing title block.

6.3.3 Final Registration

- Final registration of a drawing shall be carried out after the drawing has been “as constructed”. This will ensure that the final amendment number is recorded into the Drawing Registers.

- All information entered into the Drawing Registers shall be taken directly from the drawing.

6.3.4 Cancelled/Superseded Drawings

- When a drawing is cancelled or superseded by another drawing, this shall be noted in the Drawing Register. The cancelled drawing number shall not be reused.

- Cancelled or suspended drawings shall be destroyed or archived as described at 6.5.

6.4 Digital PDF Files

6.4.1 Drawings requiring PDF files

- All drawings that receive a Main Roads Western Australia drawing number and reach the approved stage shall have a PDF format file made.

- Approved drawings shall have a PDF file made at both the tender and “as constructed” stages if possible. Standard drawings to have a PDF made after each amendment.

- Unapproved drawings shall only have a PDF made in special circumstances and at the direction of the Structures Information and Standards Manager.

- PDF is carried out inhouse or by a private company and is requested using a PDF Requisition Form. (refer 2.8 and Appendix D)

- One PDF copy is made and the file name is the drawing number (eg. 09300999). No amendment number is to be used in the file number.
6.4.2 **Storage of PDF files**

- The PDF files shall be filed under Bridge Number in an appropriate bridge folder.
- Superseded PDF files will not be retained except for Standard Drawings. Which shall be filed in a Superseded folder.

6.4.3 **Accessing Microfilm Aperture Cards and PDF files**

- Aperture cards and PDF files may be accessed by Main Roads Western Australia staff only.

6.5 **Destruction and Archival of Drawings**

6.5.1 **Introduction**

As a large number of drawings are produced each year, it is impossible to store them in their full size hard copy state. For this reason many drawings are destroyed, or alternatively retained in house to be sent to the Battye Library for historical archival at a later date. This instruction only applies to approved drawings. Unapproved drawings may be destroyed as required.

6.5.2 **As Constructed Drawings**

Before a drawing can be destroyed or archived it shall have “as constructed” status or an approved alternative.

6.5.3 **Recording of As Constructed Information**

Prior to drawings destruction or archival all necessary structural and statistical details shall be taken from it and entered into IRIS.

6.5.4 **Categorisation of Drawings**

After a PDF has been made “as constructed” drawings shall be:

- Processed for destruction
  OR
- Retained in the Structures Engineering Office
  OR
- Forwarded to the Battye Library Service for Archival retention.

The Structures Information and Standards Manager shall decide into which of the above categories particular drawings belong as specified below. Drawings for projects of major importance, projects embodying new technological innovations, unusual designs and projects of a historical nature shall be generally forwarded to the Battye Library.
6.5.5  **Destruction Processing**

The drawing details shall be placed on an Retain or Destroy Drawings (Hard Copy) form (refer Appendix E). Recommendation to retain or destroy is given by the Project Officer and approval is given by Structures Information and Standards Manager.

Following this approval:

- The completed form shall be placed in the Destruction of Original Drawings file.

- The destruction date shall be entered into the appropriate Drawing Number Allocation and Recording Register book.

6.5.6  **Retention of Original Drawings**

Where a drawing is not approved for destruction:

- The master copy shall be retained in Structures Engineering.

- The retention shall be noted in the Drawing Register book in Structures Engineering.

6.5.7  **Archival of original drawings**

The drawings details shall be placed on an Authorisation to Retain or Destroy Original Drawings which shall be passed to the Structures Information and Standards Manager and Section Leader responsible for the project for a quality check and approval to archive.

The drawing shall then be retained until a reply is received from the Battye Library Service when it shall be forwarded to them.

6.6  **Storage, Packaging and Delivery of Drawings**

6.6.1  **Storage of Drawings**

Drawings shall be stored under bridge number and retained until they are replaced by an amendment or updated to “as constructed”.

6.6.2  **Storage of Existing Microfilm Aperture Cards**

- Master aperture cards shall be stored in the appropriate area in the microfilm storage cabinet.

6.6.3  **Delivery**

Copies (both hard and electronic) of drawings shall be delivered as specified in the procedure for the Control of Bridge Branch Drawings 3912/01-8
### APPENDIX A - PRELIMINARY DRAWING REGISTER

<table>
<thead>
<tr>
<th>No</th>
<th>Drawn By</th>
<th>Date</th>
<th>Title</th>
</tr>
</thead>
</table>
| 0730-R001 | C. Fitzgerald | 31-1-07 | Proposed Bare Location 3  
Bridge No 719A over Hyden River  
Brookton Hwy H052 (SLK 239). |
| 0730-R002 | C. Fitzgerald | 31-1-07 | Proposed Bare Location 4  
Bridge No 720A over Hyden River  
Brookton Hwy H052 (SLK 239, 36) |
| 0730-R003 | C. Fitzgerald | 6-7-07 | Daddow Road Bridge No 5339 over Railway and Dundas Road  
General Arrangement - Sheet N°1 |
| 0730-R004 | C. Fitzgerald | 6-7-07 | Daddow Road Bridge No 5339 over Railway and Dundas Road  
General Arrangement - Sheet N°2 |
| 0730-R005 | C. Fitzgerald | 6-7-07 | Daddow Road Bridge No 5339 over Railway and Dundas Road  
Pier Options |
| 0730-R006 | C. Fitzgerald | 6-7-07 | Daddow Road Bridge No 5339 over Railway and Dundas Road  
Abutment Arrangements |
| 0730-R037 | T. Brain | 11-9-07 | Bridge No 719A over Hyden River  
Brookton Hwy H052 (SLK 239, 00)  
General Arrangement  
Rectangular Precast Plank Option |
| 0730-R008 | T. Brain | 11-9-07 | Bridge No 719A over Hyden River  
Brookton Hwy H052 (SLK 239, 00)  
General Arrangement  
Inverted T Precast Plank Option |
| 0730-R009 | T. Brain | 11-9-07 | Bridge No 719A over Hyden River  
Brookton Hwy H052 (SLK 239, 36)  
General Arrangement  
Rectangular Precast Plank Option |
APPENDIX B - DRAWING MAINTENANCE UTILITY (TRIM)
## APPENDIX C - PDF REQUISITION

**PDF REQUISITION**

**STRUCTURES ENGINEERING**

**3rd Floor DAC**

### Company:

MAIN ROADS Officer: 

### Bridge No.:

Phone No.: 

---

**Authorised by**

Date: 

---

Please provide the following from the microfilm cards:

- 1 x PDF file (with drawing No. as file name) scanned 600 DPI
- 1 x A3 hard copy

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Amend.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
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<tr>
<td>2</td>
<td></td>
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<tr>
<td>3</td>
<td></td>
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<td>4</td>
<td></td>
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<tr>
<td>59</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

---

Work Returned and completed

Signed: 

Date: 

---

MAIN ROADS Western Australia

PDF of Microfilm requisition form Informatics.doc
APPENDIX D - AUTHORISATION TO RETAIN OR DESTROY ORIGINAL DRAWINGS

STRUCTURES ENGINEERING

RETAIN OR DESTROY DRAWINGS (Hard Copy)

Bridge No: 4403  Bridge Name: Canning River

The following drawings have been listed for destruction or retention.

<table>
<thead>
<tr>
<th>Drawing Number</th>
<th>Electronic Copy</th>
<th>Microfilm Copy</th>
<th>Entered into TRIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>9630-1083-1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>to</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9630-1086-1</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

☐ Destroy  ☐ Retain  (If drawings are retained they are to be stored in Structures Engineering)

Recommended: ___________________________ Date: 9/6/08

Approved: ___________________________ Date: 9/6/08

Action Complete and Recorded ___________________________ Date: 9/6/08
CHAPTER 3

DRAWING STANDARDS AND GUIDELINES
# REVISION STATUS RECORD

<table>
<thead>
<tr>
<th>Page No</th>
<th>Latest Revision No</th>
<th>Latest Revision Date</th>
<th>Revision Description/ Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
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</tr>
<tr>
<td>6</td>
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<td></td>
</tr>
</tbody>
</table>

Authorised by: ..............................................  
Date: _/__/____
# TABLE OF CONTENTS

1.0 INTRODUCTION ............................................................................................................. 4
2.0 AUSTRALIAN STANDARDS ............................................................................................ 4
3.0 PROJECTION .................................................................................................................. 4
4.0 SCALES ........................................................................................................................ 5
5.0 DRAWING SHEET SIZES .............................................................................................. 5
6.0 LINENWORK ................................................................................................................ 6
7.0 LETTERING .................................................................................................................. 7
8.0 NOTES .......................................................................................................................... 7
9.0 NORTH POINT .............................................................................................................. 7
10.0 KEY PLAN .................................................................................................................. 7
11.0 OVERCROWDING ........................................................................................................ 7
12.0 THREE DIMENSIONAL (3D) VIEWS .......................................................................... 7
13.0 INDEX ......................................................................................................................... 7
14.0 LOCATION MAP ......................................................................................................... 8
15.0 DIMENSIONING .......................................................................................................... 8
16.0 SECTIONS, VIEWS AND DETAILS .......................................................................... 9
17.0 AMENDMENTS .......................................................................................................... 13
18.0 AS CONSTRUCTED .................................................................................................... 14
19.0 HATCHING .................................................................................................................. 15
1.0 INTRODUCTION

Structures Engineering processes a number of drawings from a variety of projects.

To ensure uniformity in detailing style and methods, it is essential that these standards and guidelines are adhered to at all times.

2.0 AUSTRALIAN STANDARDS

Structures Engineering drawings shall conform with AS/NZS 1100 Part 501 (Structural Engineering Drawing) – Technical Drawing unless otherwise specifically stated in this manual.

3.0 PROJECTION

The system of view projection used by Structures Engineering shall be THIRD ANGLE PROJECTION as shown in Figure 1.

Figure 1 - THIRD ANGLE PROJECTION

Third angle projection is the formation of an image of a view upon a plane of projection placed between the object and the viewer.
4.0 SCALES

The scales adopted shall be based on: 1:1, 1:1.25, 1:2.5, 1:5, 1:7.5 and multiples.

Non standard scales shall be used only where necessary.

Indication of the scale shall be given by a proportional scale under each view, and a bar scale at the right hand side of the drawing sheet. (e.g. 1:50)

5.0 DRAWING SHEET SIZES

Only approved drawing sheets shall be used for final drawings. These sheet sizes are A4, A3, A2, A1 & A0, (refer to Table 1 for dimensions).

<table>
<thead>
<tr>
<th>Sheet Size Designation</th>
<th>Sheet Dimensions (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0</td>
<td>841 x 1189</td>
</tr>
<tr>
<td>A1</td>
<td>594 x 841</td>
</tr>
<tr>
<td>A2</td>
<td>420 x 594</td>
</tr>
<tr>
<td>A3</td>
<td>297 x 420</td>
</tr>
<tr>
<td>A4</td>
<td>210 x 297</td>
</tr>
</tbody>
</table>

Table 1 - DRAWING SHEET SIZES

A1 is the preferred drawing sheet size. However refurbishment designs can be drawn on A2 sheets.
6.0 LINEWORK

Figure 2 shows:

- Line styles
- Minimum Line Thickness

<table>
<thead>
<tr>
<th>Designating Letter</th>
<th>Type of Line</th>
<th>Example of Line</th>
<th>Minimum Thickness according to Sheet Size, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>A0</td>
</tr>
<tr>
<td>A</td>
<td>Continuous - thick</td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>B</td>
<td>Continuous - thin</td>
<td></td>
<td>0.35</td>
</tr>
<tr>
<td>C</td>
<td>Continuous-thin, freehand or ruled with zig-zag</td>
<td></td>
<td>0.35</td>
</tr>
<tr>
<td>D</td>
<td>Dashed - medium</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>E</td>
<td>Chain - thin (Centreline)</td>
<td></td>
<td>0.35</td>
</tr>
<tr>
<td>F</td>
<td>Chain - thick at ends and at change of direction. - thin elsewhere</td>
<td></td>
<td>0.7</td>
</tr>
<tr>
<td>G</td>
<td>Chain - thick</td>
<td></td>
<td>0.7</td>
</tr>
</tbody>
</table>

NOTE: Proportions of lines and spaces are as specified for Line E.

Figure 2 - LINE STYLES AND THICKNESS
7.0 LETTERING

Lettering shall be upper case and vertical.

The height is related to the size of the drawing sheet used and shall be as shown in Table 2.

<table>
<thead>
<tr>
<th>Sheet Size Designation</th>
<th>Minimum Height Upper Case Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>A0, A1</td>
<td>3.5mm</td>
</tr>
<tr>
<td>A2, A3, A4</td>
<td>2.5mm</td>
</tr>
</tbody>
</table>

Table 2 – LETTERING HEIGHT

Titles, drawing number, sub-titles, headings, view and section designations etc shall have vertical lettering (refer Figure 3)

8.0 NOTES

Notes are to be located on a separate drawing sheet. They can be placed on the same sheet as the index and locality plan and should be concise and specific.

9.0 NORTH POINT

All drawings with layout plan shall clearly have the north point displayed. It is generally accepted that locality map drawings shall be arranged with the north arrow pointing to the top of the drawing sheet where possible. (Refer Figure 4)

10.0 KEY PLAN

In large structures a key plan may be necessary to illustrate what component is being detailed on the drawing sheet.

11.0 OVERCROWDING

Simplicity is the key note. Avoid unnecessary details and overcrowding and always allow space around the view for dimensioning and titles.

12.0 THREE DIMENSIONAL (3D) VIEWS

Structure Engineering drawings are generally two dimensional but, with complicated details, 3D views (isometric or perspective) are used to allow for easier reading of the drawing.

13.0 INDEX

This is a list of drawings for a structure. The list comprises a set of drawings for a structure. It consists of drawing numbers and drawing titles listed on the first sheet of a book of drawings. If the project consists of only a few drawings then the drawing index is listed on the first drawing of the set. (refer Figure 3)
### 14.0 LOCATION MAP

The location plan is usually located on the Index sheet. It should show the location of the structure and also the name of the closest town if possible. (refer Figure 4)

![Locality Map Diagrammatic](image)

**Figure 4 – LOCATION MAP**

### 15.0 DIMENSIONING

Dimensions shall be shown in millimetres with Chainages, Reduced levels (RL’s) and Coordinates shown as decimals (refer Figure 5)
METHOD OF DIMENSIONING LINEAR MEASUREMENTS

Dimensions are given in millimetres.

960

1960

16960

121960

REDUCED LEVELS - R.L.S

All levels shall be expressed in metres to three decimal places.

R.L. 10.680

R.L. 10.680

10.680

ELEVATION

PLAN

SPOT LEVEL

CO-ORDINATES

N 185353.898
S 69652.014

CHAINAGE

CHA 99150.000

Figure 5 - DIMENSIONING

16.0 SECTIONS, VIEWS AND DETAILS

The positioning of Sections, Views and Details on a drawing shall conform with third angle projection concepts as shown at Figure 1.

Sections, wherever possible and if applicable, shall be drawn looking in the direction of increasing chainage.

Where it is not possible to position all sections, views and details on one drawing sheet they shall be cross referenced and a note added to all relevant drawings.

Details of all the above are shown at Figures 6 to 11
Figure 6 - SECTIONS

Figure 7 - SECTIONS OVER A SHORT DISTANCE
Figure 8 – DETAILS

Figure 9 - VIEWS
Method of referencing a section, view or detail that is not shown on the drawing where it is taken.
(shown for section)

**Figure 10** – CROSS REFERENCING
(Sections, Views and Details)

6. **Earthquake Data** -
   - Acceleration Coefficient $a = 0.09$
   - Site Factor $S = 0.7$
   - Probability Factor $b = 1.8$
5. **Collision Load on Piers** -
   - 0/0
6. **Wind Speed** -
   - Serviceability L.S. $= 37$ m/s
   - Ultimate L.S. $= 48$ m/s
7. **Flood Data** -
<table>
<thead>
<tr>
<th>L.F.D.</th>
<th>Level</th>
<th>Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>35.50</td>
<td>4.20 m/s</td>
</tr>
<tr>
<td>210</td>
<td>32.65</td>
<td>3.46 m/s</td>
</tr>
<tr>
<td>230</td>
<td>29.55</td>
<td>2.60 m/s</td>
</tr>
</tbody>
</table>
8. **Differential Settlement Allowance** -
   - Abutment & Piers: 5mm
9. **Pier Lift Coefficient** -
   - $C_L = 0.5$
   - $F_B = 2.4$ (1st Skew)
   - $F_B = 1.7$
10. **Barrier Design** - In accordance with AS 5103-2004
    - Regular Performance Level Barrier.
**Notes**
1. For General Notes refer to DRG N° 1533-1908

**Figure 11** – CROSS REFERENCING
(Drawing Sheets)
17.0 AMENDMENTS

Should an approved or unapproved drawing require alterations it shall be amended in accordance with the Procedure for the Control of Structures Engineering Drawings 3912/01-8

Details of the various amendment highlights and descriptions are shown at Figure 12.

Figure 12 - AMENDMENT
18.0 AS CONSTRUCTED

Any changes identified during construction, shall be incorporated into the original drawing. All changes shall be treated as a single amendment as per Figure 13.

Figure 13 – AS CONSTRUCTED
19.0 HATCHING

The cut or broken surface of sections shall be indicated by hatching as designated in AS 1100.

Some typical examples are shown at Figure 14 to 17

Figure 14 - HATCHING OF ADJACENT PARTS

Figure 15 - HATCHING OF LARGE AREAS

Fig 16 - INTERRUPTION OF HATCHING
Figure 17 – HATCHING OF SOLID AREAS

NOTE: Gap between elements (as shown) optional
CHAPTER 4

CONCRETE
## REVISION STATUS RECORD

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<tr>
<th>Page No</th>
<th>Latest Revision No</th>
<th>Latest Revision Date</th>
<th>Revision Description/Reference</th>
</tr>
</thead>
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<tr>
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</table>

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# TABLE OF CONTENTS

1.0 CONCRETE .................................................................................................................. 4
2.0 FORMED AND UNFORMED CONCRETE FINISHES ................................................. 4
3.0 PRESTRESS DUCT CLEARANCES .............................................................................. 6
4.0 STANDARD NOTES .................................................................................................... 7
APPENDIX A - SAMPLE DRAWINGS ............................................................................ 9
1.0 CONCRETE

The bridges whether of timber, concrete or steel have a component of concrete detailing.

This information chapter aims to provide some standard details and information on concrete and should be read in conjunction with the reinforcement chapter (3912/04-5)

2.0 FORMED AND UNFORMED CONCRETE FINISHES

To ensure the final concrete surface is as required by the designer a series of symbols are used (refer to Figure 1 and Tables 1 & 2)

Figure 1 - EXAMPLES OF SURFACE FINISHES FOR CONCRETE
# Applicability of Surface Classes

<table>
<thead>
<tr>
<th></th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Class 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visual characteristics</strong></td>
<td><img src="image" alt="Image" /></td>
<td><img src="image" alt="Image" /></td>
<td><img src="image" alt="Image" /></td>
<td><img src="image" alt="Image" /></td>
<td><img src="image" alt="Image" /></td>
</tr>
<tr>
<td></td>
<td>Highest quality attainable. Best possible uniformity of texture. Excellent quality of edge and joint details</td>
<td>Uniform quality and texture over large areas. Built to close tolerances. Consistently good quality of edge and joint detail</td>
<td>Good visual quality when viewed as a whole</td>
<td>Texture not important.</td>
<td>Alignment and texture not important</td>
</tr>
<tr>
<td><strong>Suitable uses</strong></td>
<td>Select small elements. Areas of special importance in limited quantities. Elements contained in a single pour.</td>
<td>General external and internal facades intended to be viewed in detail</td>
<td>General external and internal intended to be viewed as a whole</td>
<td>Surfaces concealed from general view. Surface to have thick applied finishes after preparation</td>
<td>Totally concealed areas</td>
</tr>
<tr>
<td><strong>Applied finish</strong></td>
<td>Not applicable</td>
<td>Reference should be made to permitted tolerances prior to selection of applied material</td>
<td>Not suitable</td>
<td>Not suitable</td>
<td>Not suitable</td>
</tr>
<tr>
<td><strong>Situations where not to be used</strong></td>
<td>Trafficable slopes, softs, formed tops of slopes except where means to dissipate entrapped air are employed</td>
<td>Formed tops of slopes except where means to dissipate entrapped air are employed</td>
<td>No restriction</td>
<td>No restriction</td>
<td>No restriction</td>
</tr>
<tr>
<td><strong>Colour control</strong></td>
<td>May be specified. Refer to Clause 3.8.3 (b) for the limits of the best colour consistency that can be expected</td>
<td><img src="image" alt="Image" /></td>
<td>Excluded</td>
<td><img src="image" alt="Image" /></td>
<td><img src="image" alt="Image" /></td>
</tr>
<tr>
<td><strong>General</strong></td>
<td>If these classes are required they must be specified in the documentation</td>
<td><img src="image" alt="Image" /></td>
<td>If these classes are not specified in the project documentation, selection of appropriate class is by the visual characteristics and suitable uses set out above</td>
<td><img src="image" alt="Image" /></td>
<td><img src="image" alt="Image" /></td>
</tr>
</tbody>
</table>

NOTE: Class 1 is the highest standard with the most rigorous specification and is only recommended for use in very special features of buildings of a monumental nature. Extracted from AS – 3610 – 1995 (Table – 3.3.1)

---

**Table 1 - Formed Surface Finishes for Concrete**
<table>
<thead>
<tr>
<th>Designated Finish</th>
<th>Type of Concrete Finish</th>
<th>Maximum Allowable Surface Irregularities</th>
</tr>
</thead>
<tbody>
<tr>
<td>U1</td>
<td>A wood floated finish to produce a uniform surface without surface pitting or cavities.</td>
<td>5mm abrupt or 15mm in a 3m template.</td>
</tr>
<tr>
<td>U2</td>
<td>A high quality steel trowelled finish having a dense smooth impervious finish without surface pitting or cavities.</td>
<td>Nil abrupt or 5mm in a 3m template.</td>
</tr>
<tr>
<td>U3</td>
<td>A high quality mechanical steel trowelled finish having a dense impervious finish without surface pitting or cavities.</td>
<td>2mm abrupt or 5mm in a 3m template.</td>
</tr>
<tr>
<td>U4</td>
<td>A wood floated surface with a broomed finish.</td>
<td>2mm abrupt or 5mm in a 3m template.</td>
</tr>
</tbody>
</table>

Table 2 - UNIFORMED SURFACE FINISHES FOR CONCRETE

3.0 PRESTRESS DUCT CLEARANCES

When developing a final prestress duct profile from the designer's calculations the draftsperson should ensure that adequate clearances are provided from reinforcing bars.

These clearances allow for construction, reinforcement bending and prestress duct placement tolerances and are illustrated at Figure 2.

Figure 2 – PRESTRESS DUCT PROFILE PEAK CLEARANCE
4.0 STANDARD NOTES

For general notes refer to Practice Notes manual 6706/02/223 miscellaneous details.

GENERAL NOTES

1. GENERAL


1.2 NO CHANGES TO DESIGN DETAILS SHALL BE ADOPTED DURING CONSTRUCTION WITHOUT WRITTEN APPROVAL OF THE DESIGN ENGINEER.

1.3 THE BRIDGE SHALL RECEIVE PREVENTATIVE AND PRESERVATION MAINTENANCE IN ACCORDANCE WITH THE SPECIFICATION.

1.4 DIMENSIONS SHALL NOT BE SCALLED FROM THE DRAWINGS.

2. CONCRETE

2.1 CONCRETE SHALL BE CLASS S40 IN ACCORDANCE WITH THE SPECIFICATION.

2.2 CONCRETE SURFACE FINISHES SHALL BE IN ACCORDANCE WITH THE SPECIFICATION.

2.3 ABBREVIATIONS USED:

\[ N^* \] FORMED FINISH CLASS N*.

\[ UN^* \] UNIFORMED FINISH CLASS N*.

3. REINFORCEMENT

3.1 CLEAR COVER TO REINFORCEMENT SHALL BE 40 mm UNLESS OTHERWISE SHOWN.

3.2 BAR LAP LENGTH SHALL BE A MINIMUM OF 40D AND A MAXIMUM OF 400+150 UNLESS OTHERWISE SHOWN.

3.3 FABRIC OVERLAP SHALL BE A MINIMUM OF TWO CROSS WIRES ON BOTH SHEETS UNLESS OTHERWISE SHOWN.

3.4 ABBREVIATIONS USED:

<table>
<thead>
<tr>
<th>NF</th>
<th>NEAR FACE</th>
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</thead>
<tbody>
<tr>
<td>FF</td>
<td>FAR FACE</td>
</tr>
<tr>
<td>T</td>
<td>TOP</td>
</tr>
<tr>
<td>B</td>
<td>BOTTOM</td>
</tr>
<tr>
<td>ES</td>
<td>EQUALLY SPACED</td>
</tr>
</tbody>
</table>

3.5 REINFORCEMENT SHALL CONFORM TO:

- SL = 500 MPa MESH TO AS/NZS 4671.
- N = 500 MPa REINFORCING BARS TO AS/NZS 4671.
- R = 250 MPa PLAIN BARS TO AS/NZS 4671.

Figure 5 - STANDARD NOTES FOR MAINTENANCE PROJECTS

(Sample only of notes)
GENERAL NOTES

1. GENERAL
   1.2 NO CHANGES TO DESIGN DETAILS SHALL BE ADOPTED DURING CONSTRUCTION WITHOUT WRITTEN APPROVAL OF THE DESIGN ENGINEER.

2. SURVEY
   2.1 CO-ORDINATES ARE BASED ON MAIN ROADS PROJECT ZONE WYNDHAM 94 (MGA 94). FOR SURVEY CONTROL REFER TO ROADWORKS DRAWINGS.
   2.2 DATUM - AUSTRALIAN HEIGHT DATUM.
   2.3 ALL RL’s ARE GIVEN TO FINISHED CONCRETE LEVELS UNLESS OTHERWISE NOTED.

3. CONCRETE
   3.1 CONCRETE CLASS SHALL BE: ABUTMENT - S40
       PIERS - S40
       DECK - S40
       BLINDING CONCRETE - N20
       MAKE UP CONCRETE - S40
       
   3.2 FOR AGGREGATE SIZE AND GRADING REFER TO SPECIFICATION.
   3.3 ALL EXPOSED CORNERS SHALL HAVE A 20 CHAMFER UNLESS OTHERWISE NOTED.
   3.4 CONCRETE SURFACE FINISHES SHALL CONFORM TO THE FOLLOWING:
       √ INDICATES A FORMED CONCRETE SURFACE FINISH AND SHALL BE IN ACCORDANCE WITH AS 3610-1995 (REFER SPECIFICATION)
       UN INDICATES AN UNFORMED CONCRETE SURFACE FINISH (REFER SPECIFICATION)
   3.5 POLYSTYRENE SHALL CONFIRM TO AS 1366 PT 3 - 1992.

4. REINFORCEMENT
   4.1 CLEAR COVER TO REINFORCEMENT SHALL BE 40 mm UNLESS OTHERWISE NOTED.
   4.2 BAR LAP LENGTH SHALL BE A MINIMUM OF 40D AND A MAXIMUM OF 40D+150 UNLESS OTHERWISE SHOWN.
   4.3 FABRIC OVERLAP SHALL BE A MINIMUM OF TWO CROSS WIRES ON BOTH SHEETS UNLESS OTHERWISE SHOWN.
   4.4 WHERE REINFORCEMENT LAPS ARE REQUIRED BUT NOT SHOWN STAGGERED LAPS SHALL BE PROVIDED.
   4.5 FOR DETAILS OF CUTTING AND BENDING OF REINFORCEMENT REFER TO SPECIFICATION.
   4.6 ABBREVIATIONS USED:-
       NF - NEAR FACE  ES - EQUALLY SPACED
       FF - FAR FACE  CJ - CONSTRUCTION JOINT
       T - TOP       T.O.C. - TOP OF CONCRETE
       B - BOTTOM    T.O.S. - TOP OF SEAL

6.7 LEGEND:
       ______ DENOTES NEAR FACE AND TOP REINFORCEMENT
       - - - - DENOTES FAR FACE AND BOTTOM REINFORCEMENT

6.8 REINFORCEMENT SHALL CONFORM TO:-
       SL - 500 MPa MESH TO AS/NZS 4671.
       N - 500 MPa REINFORCING BARS TO AS/NZS 4671.
       R - 250 MPa PLAIN BARS TO AS/NZS 4671.

Figure 6 – STANDARD NOTES FOR PROJECTS OTHER THAN MAINTENANCE PROJECTS
(Sample only of notes)
CHAPTER 5

REINFORCEMENT
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# TABLE OF CONTENTS

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<th>Page</th>
</tr>
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<tr>
<td>1.0</td>
<td>INTRODUCTION</td>
<td>4</td>
</tr>
<tr>
<td>2.0</td>
<td>MATERIALS</td>
<td>4</td>
</tr>
<tr>
<td>3.0</td>
<td>BAR DESCRIPTION</td>
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<td>BAR SHAPES</td>
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<td>STANDARD ABBREVIATIONS</td>
<td>7</td>
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<td>GENERAL INSTRUCTIONS ON DRAWING PROCEDURES</td>
<td>8</td>
</tr>
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<td>STANDARD NOTES</td>
<td>10</td>
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<td>APPENDIX A - SAMPLE DRAWINGS</td>
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</table>
1.0 INTRODUCTION

As a draftsperson your main task is to provide final construction drawings from engineer's sketches. Reinforcement drawings are one of the more difficult engineering phases of drafting to produce. When difficulties are encountered it will require you to have close co-operation with the designer to overcome those problems.

2.0 MATERIALS

Reinforcement shall conform to:

RL - Mesh to AS/NZS 4671. (Rectangle - 500MPa)
SL - Mesh to AS/NZS 4671. (Square - 500MPa)
N - Reinforcing bars to AS/NZS 4671. (500MPa)
R - Plain bars to AS/NZS 4671. (250MPa)
W - Reinforcing wire to AS/NZS 4671.

3.0 BAR DESCRIPTION

Bar description consists of:

- Mark Number
- Number off (can be shown as a No. x No. to indicate the No. of sets x No. of bars in each set, e.g. 6 x 4 = 6 sets of 4 bars)
- Grade
- Diameter
- Centres

e.g.

```
  Mark No.  No. off  Grade  Diameter  Centres
    D5      10       N20     300
```

BAR MARK KEY

The Bar mark Key is a two part number, the first being a letter indicating the location of the bar in the structure. The second part is a sequence number stating from 1, of the number of sets of bars at that part of the structure.
e.g.

\[ \text{Sequence number} \]
\[ \text{Letter indicating location in the structure} \]

Where a set of bars have the same shape but vary proportionally in length then the description shall be as follows:

e.g.

\textbf{D5 to D10 – 6x1 – N20 - 300}

Alphabetical letters that should be used where possible for indicating location of the bar in the structure are:

\begin{align*}
A & \quad - \quad \text{Abutment No.1} \\
B & \quad - \quad \text{Abutment No 2} \\
C & \quad - \quad \text{Cap beam} \\
D & \quad - \quad \text{Deck} \\
E & \quad - \quad \text{Footing} \\
P & \quad - \quad \text{Pier} \\
G, H, K & \quad - \quad \text{Wing walls} \\
Y & \quad - \quad \text{Approach slab} \\
M & \quad - \quad \text{Abutment diaphragm 1.} \\
T & \quad - \quad \text{Abutment diaphragm 2.} \\
F & \quad - \quad \text{Pier Diaphragm}
\end{align*}

Alphabetical letters not to be used in naming reinforcement are S, L, N, R and W. These letters are used for identification of types of reinforcement e.g. W – Reinforcing wire

Letters I and O should also not be used.
4.0 BAR SHAPES

4.1 Critical Radius Bend

Bars required to be bent to a radii exceeding the following need not be pre-bent, but can be sprung into place during placing.

<table>
<thead>
<tr>
<th>BAR BEND</th>
<th>CRITICAL RADIUS OF</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>3500</td>
</tr>
<tr>
<td>12</td>
<td>4250</td>
</tr>
<tr>
<td>16</td>
<td>7500</td>
</tr>
<tr>
<td>20</td>
<td>14000</td>
</tr>
<tr>
<td>24</td>
<td>28000</td>
</tr>
<tr>
<td>28</td>
<td>35700</td>
</tr>
<tr>
<td>32</td>
<td>43300</td>
</tr>
<tr>
<td>36</td>
<td>50700</td>
</tr>
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</table>

4.2 Minimum Bend Diameter

<table>
<thead>
<tr>
<th>Case</th>
<th>Material</th>
<th>Internal Dia.</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Reinforcement, other than that specified in items (b), (c) or (d) below.</td>
<td>All deformed bars</td>
<td>5 d</td>
</tr>
<tr>
<td></td>
<td>Fabric</td>
<td>3 d</td>
</tr>
<tr>
<td>b) Fitments</td>
<td>Wire and Fabric</td>
<td>3 d</td>
</tr>
<tr>
<td></td>
<td>Grade 230R bars</td>
<td>3 d</td>
</tr>
<tr>
<td></td>
<td>All deformed bars</td>
<td>4 d</td>
</tr>
<tr>
<td>c) Reinforcement in which the bend is intended to be subsequently straightened or re-bent.</td>
<td>Size 16mm or less</td>
<td>4 d</td>
</tr>
<tr>
<td></td>
<td>Size 20mm or 24 mm</td>
<td>5 d</td>
</tr>
<tr>
<td></td>
<td>Size 28mm or greater</td>
<td>6 d</td>
</tr>
<tr>
<td>d) Reinforcement which is epoxy-coated or galvanised, either before or after bending.</td>
<td>Size 16mm or less</td>
<td>5 d</td>
</tr>
<tr>
<td></td>
<td>Size 20mm or greater</td>
<td>8 d</td>
</tr>
</tbody>
</table>

Note: d is the diameter of the bar being bent.

5.0 LAPS

The length and location of a lap splice in reinforcing bars may vary depending upon certain factors:

- The level of tensile stress
- Regions of compressive stress
• Regions where the actual amount of reinforcement exceeds the amount dictated by the design calculation.

• The proportion of bars spliced at any one point or the degree of staggering of splices.

• The strength of the steel bar and concrete

• Whether the bars are plain or deformed

• Bars which are bundled

• Bars in footings with main reinforcement in two directions

The draftsperson should check with the designer to ensure that the laps are the required length and are correctly positioned on the drawing.

Bar lap length shall be a minimum of 400 and a maximum of 400 + 150 unless otherwise stated.

6.0 STANDARD ABBREVIATIONS

If the exact location of a set of bars is not clearly defined in the layout, standard abbreviations may be used after the bar description as shown below:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>EW</td>
<td>Each Way</td>
</tr>
<tr>
<td>NF</td>
<td>Near Face</td>
</tr>
<tr>
<td>FF</td>
<td>Far Face</td>
</tr>
<tr>
<td>EF</td>
<td>Each Face</td>
</tr>
<tr>
<td>T</td>
<td>Top</td>
</tr>
<tr>
<td>B</td>
<td>Bottom</td>
</tr>
<tr>
<td>ES</td>
<td>Equally Spaced</td>
</tr>
<tr>
<td>Horiz</td>
<td>Horizontal</td>
</tr>
<tr>
<td>Vert</td>
<td>Vertical</td>
</tr>
<tr>
<td>Alt</td>
<td>Alternate</td>
</tr>
<tr>
<td>ABR</td>
<td>Alternative Bars Reversed</td>
</tr>
</tbody>
</table>

e.g.

D1 - 10 – N20 – 300 B

_____ Standard abbreviation shown after the bar
7.0 GENERAL INSTRUCTIONS ON DRAWING PROCEDURES

- Concrete shape to be accurately drawn

- __ __ Denotes far face and bottom reinforcement

  _______ Denotes near face and top reinforcement

- Bars of similar diameter, length and shape which occur at regular intervals are grouped together and are known as sets

- Each set is labelled with mark number, number off, grade, diameter and centres

- The limit bar system shall be used in showing sets. Only one bar is drawn out at its correct size, while small limit marks show the extent of the set. (see figure 4)

- Bar sets must only be described once. This shall be done where the set can be laid out fully with limit bars. Only the mark number is used to refer to the bars in subsequent views

- Fabric reinforcement shall be shown with the direction of main wire drawn to its full extent with limit lines used to show full width of fabric required (see figure 5)

- Bar mark key shall be placed on all reinforcement drawings.

- Standard notes shall be located at the bottom right hand corner of the drawing

- Where notes generally apply to a number of reinforcement drawings, such notes may be fully detailed on one drawing and this drawing reference on other drawings

- Reinforcement drawings will not include details of spacers, supports unless specifically required.
8.0 STANDARD NOTES

For Reinforcement standard notes refer to Part 4 of this manual titled CONCRETE
APPENDIX A - SAMPLE DRAWINGS

PLAN - COVER SLAB TYPE - T
COVER AND FRAME NOT SHOWN
1:20

SECTIONAL ELEVATION B
COVER AND FRAME NOT SHOWN
1:20

GULLEY TOP RC DETAILS
APPENDIX A - SAMPLE DRAWINGS

ABUTMENT REINFORCEMENT DETAILS SHEET 1
## REVISION STATUS RECORD

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<th>Latest Revision No</th>
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</tbody>
</table>

Authorised by: ..........................................................     Date: / /
1.0 INTRODUCTION

All bridges whether of timber, concrete or steel and most minor projects carried out in the Structures Engineering have a component of structural steel detailing.

This part aims to provide some standard details and notes to assist with detailing steel components.

2.0 DRAWING TYPES

The majority of Structures Engineering structural steel drawings are designed drawings, i.e. they provide the minimum amount of information required in conjunction with other drawings to fabricate and install the steel element of a project (fabrication or workshop details are not shown – the onus for "correctness" is then placed on the fabricator).

Fabrication details should not be shown unless on specific request from the Design Engineer.

3.0 BOLTED CONNECTIONS (REFER CODE: AS / NZS 1554)

3.1 Spacing

**Minimum Pitch:** The distance between centres of fastener holes shall not be less than 2.5 times the nominal diameter of the fastener. However, where the use of a special tensioning tool is required to tighten fasteners the minimum distance between centres of fastener holes shall be appropriate to the type of tool used.

**Maximum Pitch:** The maximum distance between centres of fasteners shall generally be the lesser of 14t and 200mm. However, for an outside line of fasteners in the direction of major force the maximum distance shall be the lesser of (14t + 100) mm and 200mm, t being the thickness in mm of the thinner outer plate or shape.

Where two lines of load carrying fasteners are staggered at equal intervals and the transverse pitch does not exceed 75mm the maximum distance between centres of fasteners along each line shall be 1.5 times the appropriate values given above.

**Minimum edge distances:** The minimum distance from the centre of a fastener to the edge of a plate or the flange of a rolled section shall be as specified in Figure 1.
Figure 1 - BOLT SPACINGS

<table>
<thead>
<tr>
<th>Sheared or hand flame cut edge</th>
<th>Rolled plate, machine flame cut, sawn or planed edge</th>
<th>Rolled edge of rolled section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.75d</td>
<td>1.50d</td>
<td>1.25d</td>
</tr>
</tbody>
</table>

Where d being the nominal diameter of bolt

Table 1 – MINIMUM EDGE DISTANCE

4.0 WELDED CONNECTIONS (REFER CODE: AS1101.3)

4.1 What to show

The degree of detail of welded connections on Structures Engineering Drawings varies between projects.

In some cases no weld symbols are shown and a note specifying all welds as "full strength" is considered adequate.
Generally in this situation workshop fabrication drawings (protocol external to the section) giving full weld details are provided to construction staff for approval.

In other cases it may be necessary to specify weld details on the drawing.

The Design Engineer and/or a Draftsperson are generally able to determine the degree of detail required on individual drawings or projects.

4.2 Symbols

Standard weld notation and symbols are shown at Figures 2, 3, 4 and 5.

![Diagram of welding symbol elements](image)

**Figure 2 – STANDARD LOCATION OF ELEMENTS OF A WELDING SYMBOL**
<table>
<thead>
<tr>
<th>Form of Weld</th>
<th>Sectional Representation</th>
<th>Appropriate Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bead</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Fillet</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>General Butt</td>
<td>Full penetration butt weld by a welding procedure to be agreed</td>
<td>![image]</td>
</tr>
<tr>
<td>Square Butt</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Single V Butt</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Single Bevel Butt</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Single &quot;U&quot; Butt</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Single &quot;J&quot; Butt</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Plug or Slot</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Stud</td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Surfacing</td>
<td>![image]</td>
<td>![image]</td>
</tr>
</tbody>
</table>

Figure 3 - STANDARD WELD SYMBOLS
<table>
<thead>
<tr>
<th>FORM WELD</th>
<th>SECTIONAL REPRESENTATION AND EXAMPLES OF USE</th>
<th>APPROPRIATE SYMBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BACKING STRIP OF BAR</td>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Symbol" /></td>
</tr>
<tr>
<td>WELD ALL AROUND</td>
<td><img src="image3.png" alt="Diagram" /></td>
<td><img src="image4.png" alt="Symbol" /></td>
</tr>
<tr>
<td>SITE OR FIELD WELD</td>
<td><img src="image5.png" alt="Diagram" /></td>
<td><img src="image6.png" alt="Symbol" /></td>
</tr>
<tr>
<td>FLUSH</td>
<td><img src="image7.png" alt="Diagram" /></td>
<td><img src="image8.png" alt="Symbol" /></td>
</tr>
<tr>
<td>CONTOUR</td>
<td><img src="image9.png" alt="Diagram" /></td>
<td><img src="image10.png" alt="Symbol" /></td>
</tr>
<tr>
<td>CONVEX</td>
<td><img src="image11.png" alt="Diagram" /></td>
<td><img src="image12.png" alt="Symbol" /></td>
</tr>
<tr>
<td>CONCAVE</td>
<td><img src="image13.png" alt="Diagram" /></td>
<td><img src="image14.png" alt="Symbol" /></td>
</tr>
</tbody>
</table>

Figure 4 - STANDARD WELD SYMBOLS
ARROW SIDE WELDING SYMBOL

OTHER SIDE WELDING SYMBOL

BOTH SIDES WELDING SYMBOL

Application of welding symbols indicating use of cranked arrow to indicate plate to be prepared

Figure 5 - STANDARD WELD SYMBOLS
5.0 STANDARD NOTES

For structural steel notes refer to Practice Notes Manual 6706/02/223 Miscellaneous details (PN30 – 4203)
CHAPTER 7

SITE INVESTIGATION INFORMATION
# REVISION STATUS RECORD

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<tr>
<th>Page No</th>
<th>Latest Revision No</th>
<th>Latest Revision Date</th>
<th>Revision Description/ Reference</th>
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<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Authorized by: .................................................. Date: __/__/____
# TABLE OF CONTENTS

1.0 INTRODUCTION .................................................................................................................. 4
2.0 BORE DRAWING PROCEDURE .......................................................................................... 4
3.0 LEGEND ............................................................................................................................... 5
4.0 ABBREVIATED USES .......................................................................................................... 6
5.0 BORE INFORMATION SOIL DESCRIPTION AND STANDARD NOTES ......................... 6
6.0 LAYOUT DETAIL FOR BORES .......................................................................................... 8
7.0 LAYOUT DETAILS FOR S.P.T's ...................................................................................... 9
8.0 LAYOUT DETAILS FOR C.P.T's ..................................................................................... 10
9.0 ELECTRIC FRICTION CONE PENETROMETER TEST ................................................... 11
APPENDIX A - SAMPLE DRAWING .................................................................................. 12
1.0 INTRODUCTION

Before the foundation can be designed, an investigation of the site shall be made. An estimate shall be made of the load capacity of the soil by determining the sub-soil profile and the characteristics of these materials.

2.0 BORE DRAWING PROCEDURE

These basic guidelines are to be followed when preparing a bore drawing.

- Elevation
  
The vertical scale is **always 1:50** and the horizontal scale can vary to suit the space available on the drawing having some regard to the proportions of the intended structure.

- Plan
  
A suitable longitudinal/transverse scale may be used to suit the place available.

- Bores (Spade bit and Rock bit)
  
In the elevation these are always drawn directly under their location in the plan.

- Diamond Drill holes (DD)
  
In the elevation these are drawn as close as practical to their location in the plan.

- Standard Penetration Test (S.P.T)
  
These too are drawn as close as practicable to their location in the plan.

- Pile Penetration Test (P.P.T)
  
As per diamond drill holes, S.P.T and P.P.T.

- Cone Penetration test
  
As per diamond drill holes, S.P.T and P.P.T.

- Expressions of Depths
  
Depths of all bores, S.P.T's, DD's, C.P.T's and PPT's are expressed as RL's.

- Levels
  
For simplicity all ground RL's are rounded off, e.g. 251.036 would be 251.040 and 251.035 would be 251.030.

  RL's shall be expressed to 3 decimal places.

- Water Levels
Water levels (WL) when stated in the Drillers Bore Logs must be shown on the drawing as an RL and the date of drilling be noted in the legend alongside the water level.

If no WL is recorded then it must be noted in the legend that water was not encountered.

- Orientation

It is important that the following points be noted (if known), the direction of the road, direction of flow and North. These positions should be shown in the plans.

3.0 LEGEND

LEGEND

〇 BORE
  TYPE: PROBE WITH SPADE BIT - DIA.

▲ BORE
  TYPE: PROBE WITH ROCK BIT - DIA.

〇 DIAMOND DRILL

✘ SPT STANDARD PENETRATION TEST
  WT OF HAMMER: 63.5 kg
  FREEFALL DROP: 762 mm

✘ CPT CONE PENETRATION TEST
  WT OF HAMMER: 63.5 kg
  FREEFALL DROP: 762 mm

✘ PPT PILE PENETRATION TEST
  WT OF HAMMER: 63.5 kg
  FREEFALL DROP: 762 mm

〇 E.F.C.P. ELECTRIC FRICTION
  CONE PENETRATION TEST

W.L. 9.860
14/7/93

WATER LEVEL
4.0 ABBREVIATED USES

P   Pressed
D   Drilled
D/D Diamond Drilling
E.D Easy Drilling
F.D Firm Drilling
S.P Slow penetration
V.S.P Very slow penetration
W.L. Water level – If water is encountered the date should be stated.
      If no water is encountered state “not encountered”.

D Drilled to depth of arrow before continuing test

ETP Estimated Toe of Pile

Refer to bore holes operation at 18.4 in the Bridge Branch CAD manual for computer
processing of bore information.

5.0 BORE INFORMATION SOIL DESCRIPTION AND STANDARD
NOTE

5.1 Soil Description

Bore information as recorded by the drilling team in the field shall be interpreted and
arranged on the drawing sheet in the following format:-

- Primary material
- Secondary material
- Composition
- Plasticity
- Colour
- Probe penetration

Example as recorded by the drilling team:-

- Brown clayey sand
- Medium – sub rounded grains
- Low plasticity
- Brown
- Firm drilling

The above bore log example should be placed on the bore drawing in the following format:-

- Sand clayey
- Medium sub rounded grains
- Low plasticity
5.2 Standard Note

NOTE

1. The information contained on this drawing is furnished for the convenience of bidders and is not part of the contract. The information is not guaranteed and any bids submitted must be based on the bidders' own investigations and determinations.
6.0 LAYOUT DETAIL FOR BORES

PLAN
1:100

BORE N° 1

3500

G BRIDGE

BORE N° 1

R.L. 100.000 — Reduced Level

Ground Level

99.400

ROAD FILL

W.L. 98.700
11/7/93

98.000

CLAY GRAVELLY
RED
FD

Description of strata

96.500

GRANITE
HIGHLY WEATHERED
V.S.P.

95.000

ROCK BIT REFUSED

ELEVATION
1:50

MAIN ROADS Western Australia
Sitra Investigations.doc
Drafting Guidelines and Practices Manual
Doc. No: 5706-02-2236 – Issue 16/2/2009

Page 9 of 14
7.0 LAYOUT DETAILS FOR S.P.T'S

PLAN

SCALE 1:100

2000

S.P.T. No. 1

R.L. 5.330

SILTY FINE SAND

4.180
3.880

8

CLAYEY SANDY GRAVEL.
GRavel is fine grained, angular.
SAND is fine grained, angular.
CLAY has low plasticity, inorganic.
BROWN

Reduced levels

2.680
2.380

14

CLAYEY SANDY GRAVEL.
SAND is fine grained, angular.
CLAY has low plasticity, inorganic.
BROWN

1.180
0.880

34

CLAYEY SANDY GRAVEL. GRAVEL IS
FINE GRAINED, ANGULAR. SAND IS
FINE GRAINED, ANGULAR. CLAY HAS
LOW PLASTICITY, INORGANIC. BROWN.
BROWN

ELEVATION

150

Note: N° of blows to penetrate a certain depth (usually 300)
8.0 LAYOUT DETAILS FOR C.P.T'S

- At CPT No. 1:
  - Ground Level
  - Reduced Level

**Plan 1:100**

**Elevation 1:50**

- **Drill to depth of arrow before continuing test**
- **N° of blows to penetrate a curtain depth (usually 300)**
9.0 ELECTRIC FRICTION CONE PENETROMETER TEST

[Diagram showing friction cone penetration test results with layers labeled as Clay, Sandy Silt, Silty Sand, Clayey Silt/Silty Clay, and Average Friction Ratio.]