Section 3 Organisation and Presentation Guidelines

3.1. Bridge Engineering

3.1.1. Approval Sheet

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3.1.2. Table of Contents

3.1.3. Overview

3.1.3.1. Scope

This Guide sets out the requirements of the RTA for the production, presentation and/or electronic transfer of CADD sketches and drawings for Concept, Design, Rehabilitation and widening works for bridges and related structures.

3.1.3.2. Objective

The objective of this Guide is to provide sketches for Concepts and final approved drawings for new design and rehabilitation works, on bridges and bridge related structures in a format that can be readily read and stored by the RTA on its equipment.

It defines the way in which data is to be organised and how it shall be presented to the RTA.

3.1.3.3. Audience

This Guide has been prepared to assist persons and/or organisations that use CADD for the preparation of drawings associated with bridgeworks, for the RTA or for structures that will become the property of the RTA in the future.

3.1.3.4. Usage

The use of this Guide is limited to the production of the various drawings required to convey information for bridge concepts, final approved drawings for both major and minor construction, plus drawings associated with rehabilitation works and bridge widenings. This document is complemented by the design brief for the work.

3.1.3.5. DATA Transfer

Data transfer is to be in accordance with Section 2.1 of this document - CADD Data Exchange Policy. These are to be read in conjunction with this section.

3.1.4. Organisation of CADD Data

3.1.4.1. Use of Levels

3.1.4.1.1. *Drawing Levels*

The information provided in the presentation of bridge construction drawings shall be provided on separate levels within each drawing as appropriate. The following is provided as a guide to the type of information that should be supplied:

Dimensions and text

Construction lines

Concrete details

Concrete details – hidden

Reinforcement details

Steel Items – Major (Steel girders etc)

Steel Items – Minor (Bolts, nuts, washers, protection angles etc)

Hatching

Existing structure (as appropriate)

Centrelines

Existing surface, contours

Sheet Border and Title Block

Contours, boundaries and utility information etc shall be placed on a respective level other than those shown above.

3.1.4.2. Presentation

3.1.4.2.1. *Plan Size*

Transparent film/tracing paper, A1 in size and plain paper plan sheets, A3 in size are to be provided as nominated in the Design Brief.

3.1.4.2.2. *Plan Borders*

Plan borders shall be in accordance with Australian Standard AS 1100, or as supplied by the RTA, and must be adopted.

3.1.4.2.3. *CADD Filename*

Each drawing shall have a CADD filename placed beneath the bottom left hand corner of the title block with the filename being in the following format: -

eg D12 P RA maximum 8 characters where

*** ** *

*** = CAD registration number (D12 as supplied by Bridge Branch)

** = Major sheet heading (PIER from Table 3.1)

* = Minor sheet heading (REINFORCEMENT - SHEET A from Table 3.1)

TABLE 3.1

MAJOR SHEET HEADINGS		MINOR SHEET HEADINGS	
DES	- Design Sketch	C	- Concrete
CON	- Concept Sketch	R	- Reinforcement
PROP	- Proposal Sketch	A	- Sheet A
CS	- Cover Sheet	B	- Sheet B
GA	- General Arrangement	D	- Details
FP	- Foundation Plan		
BI	- Bore Information		
PL	- Piles & Pile Layout		
AA	- Abutment A		
AB	- Abutment B		
P	- Pier		
RW	- Retaining Walls		
BEA	- Bearings		
GR	- Girders		
PL'n'	- 'n' m Span PSC Plank		
D	- Deck		
DSO	- Deck Setting Out		
EJ	- Expansion Joint		
CP	- Cover Plates		
TRP	- Traffic Barrier Railing - Panels		
TRS	- Steel TBR - Details		
PRP	- Pedestrian Railing - Panels		
PRS	- Steel Ped. Railing - Details		
PRA	- Alum. Ped. Railing - Details		
BCS	- Construction Sequence		
AS	- Approach Slabs		
BS	- Bar Shapes Diagram		

3.1.4.2.3.1. For Sketches

The file names for official sketches shall be similar to drawings except that the prefix *K* shall be added to a file name.

eg Concept Sketch shall have a file name *KD12CON*

3.1.4.2.3.2. For Bridges with Two or More Contracts

Where a design is divided into two or more separate contracts, the appropriate contract description (A, B, C, etc) shall be included in the filename immediately following the CADD registration number.

eg D12AGA - for Contract A
D12BGA - for Contract B
D12CGA - for Contract C

3.1.4.2.3.3. For Amended Drawings or Sketches

All drawings which require amendments AFTER APPROVAL shall be copied and the new file names given a suffix "*_A*" (Amendment A), "*_B*" (Amendment B), "*_C*" etc and Bridge Branch shall be informed so that the CADD registers can be updated.

If CADD produced drawings/ink plots are amended by hand either before or after approval, the electronic version must also be updated as soon as possible.

3.1.4.2.4. *Drawing Composition*

Each drawing shall contain one Level in which a numerical and textual listing of levels used together with a brief description of the contents and the scale used to draw the details within the level.

Each drawing shall contain a separate level for information, which has been drawn to a specific scale.

Each drawing shall contain levels with necessary information only.

ie all unnecessary information shall be deleted.

3.1.4.2.5. *Scales*

Scales used on drawings may vary in accordance with the size and character of the feature being detailed or the degree of detailing required.

All drawings should be to a defined natural scale with the scale being selected so that the drawing may be easily read when reduced to half of its original size.

Distorted scales must not be used except where special circumstances require distortion for clarity of presentation eg Borehole Information drawings.

Proposals to use distorted scales must be approved by the Project Leader prior to use.

Scales shall be shown on all drawings, they shall be represented in accordance with AS 1101 Part 101 and shall be shown in the following manner:

The following scales are recommended for use:

Detail Drawings

1:1, 1:2, 1:2.5, and 1:5 and their decimal multiples.

General Arrangement Drawings

1:1, 1:2, 1:2.5, 1:3*, 1:4*, 1:5, 1:7.5* and 1:12.5* and their decimal multiples

(*Indicates scales may be used for the Plan and Elevation on General Arrangement drawings if required however their use should be kept to an absolute minimum)

Locality Plans

1:1,000,000, 1:500,000, 1:250,000, 1:100,000, 1:50,000, and 1:25,000.

Site Plans

1:500, 1:1000, 1:2000 and 1:2500.

Drawings shall not contain two scales which are similar, eg a scale of 1:2 shall not be used on the same drawing as a scale of 1:2.5.

Where drawings contain several levels, each level shall contain information drawn to one scale only.

3.1.4.2.6. *Line Thickness And Type*

Refer to Section 2.1 - CADD Data Exchange Policy and 3.1.6 Appendix A of this Guide.

3.1.4.2.7. *Symbols*

Symbols shall conform to an Australian or a joint Australian/New Zealand Standard appropriate to the type and class of the work.

3.1.4.2.7.1. Welding

The necessary information concerning the location, type, size, category and length of welds in welded joints and whether the welds are to be made in the shop or at the site shall be given on the drawings with the use of standard symbols.

All symbols shall be in accordance with AS 1101.3.

3.1.4.2.8. *Surface Texture Of Metals*

Where surface texture for metal work must be specified to ensure an acceptable surface finish, the necessary information shall be given by the use of standard symbols and roughness grade numbers.

The symbols used shall be in accordance with AS 1100.1 Part 201.

The roughness grade numbers shall be in accordance with Table 4.4 of that standard.

3.1.4.2.9. *Materials*

Where it is necessary to show materials in section by symbols, the symbols shall be in accordance with 3.1.7 Appendix B of this Guide.

Where new work and existing work are shown side by side on a drawing the new work shall be identified with appropriate hatching and the existing work shall be left unhatched and shown in outline only using the 'existing work' line type as shown in 3.1.7 Appendix B of this Guide.

3.1.4.2.10. *Use Of Asterisks And Similar Symbols*

Asterisks, filled in dots and triangles, or other like symbols used as a reference to a note, dimension, reduced level, etc, on a drawing should be used as sparingly as possible. They can be used to avoid repetition of a note or where space precludes the use of a direct note. However, where it is necessary to have references to different items on the same drawing separate symbols shall be used.

Standard symbols (in accordance with AS 1100 Part 5) to represent section cutting planes, details and titles of sections and details shall be used on all relevant drawings.

Standard symbols shall be used on all relevant drawings to identify utilities, drainage pits, survey marks, etc. Standard Symbols for roadwork applications are given in 3.5.10 Appendix C of this Manual – Road Design.

3.1.4.2.11. *Notes On Drawings*

Standard notes are to be selected, where applicable, from RTA Standard Bridge Drawing No RTAB029 with the missing information to be completed. Where appropriate, notes shall be shown on one sheet only where they apply to a group of sheets ie Concrete - Sheet A and Concrete - Sheet B etc and cross references shall be made to the sheet containing the notes in the form of

"For other general notes relating to this sheet, see Sheet No ".

Any project specific additions to the listed notes are to be included and brought to the attention of the RTA.

The lettering on all A1 size drawings shall be in upper case with the size and application being in accordance with the following:

- 3.5mm HIGH - General text, dimensions and General Notes as shown in Appendix D1
- 5mm HIGH - Titles of sections, views etc and title block information as shown in Appendix D1
- 7mm HIGH - Titles as appropriate, bridge name and registration number of plans or sketch numbers in title blocks as shown in Appendix D1

3.1.4.2.12. *Abbreviations*

A list of Standard Abbreviations for metric units is shown in Table 1 of 3.1.10 Appendix E.

A list of commonly used, acceptable abbreviations for bridge drawings is shown in Table 2 of 3.1.11 Appendix E.

The arrangement of upper case and lower case letters for each of the abbreviations as shown in each table shall be followed; abbreviations shall not contain a full stop.

3.1.4.2.13. *Dimensioning*

In all cases, dimensions shown on drawings shall be in millimetres and they shall be shown in accordance with AS 1100 Part 101. The use of a space between the third and fourth digit in a four digit number is optional but is mandatory in a five digit number.

Dimensions shall be placed on drawings using the 'aligned' method with each dimension being placed parallel to its dimension line in order that it may be read from either the bottom or the right hand side of the drawing.

A chain of dimensions shall be covered by an overall dimension except where dimensional tolerances are of critical importance.

Where several dimensions are to be given to a common datum surface, either the line method or the point method may be used.

Dimensions and notes shown with leaders shall be inscribed using the unidirectional method.

Where it is necessary to indicate that a particular dimension on a drawing is not shown to the same scale as the view or detail in which it appears, the dimension shall be underlined with a full thick line. This method of representing details drawn out of scale shall not be applied to entire details that are shown 'NOT TO SCALE'.

Radii shall be dimensioned by the use of a dimension line which passes (or is in line with) the centre of the arc and terminates at the lead end with a single arrowhead. However, radii of arcs which need not have their centres located shall be dimensioned using one of the methods shown in AS 1100 Part 101.

Dimensions for radii shall be preceded by the conventional abbreviation 'R'.

Dimensions of concrete elements whose details appear on a separate sheet shall not be given. For example, the dimensions for the positioning of piles relative to pilecap/pier extremities shall not be shown on the pilecap/pier drawing.

3.1.4.2.13.1. Orders of Accuracy for Dimensions

The following order of accuracy shall be used on all drawings:

- Concrete dimensions 1mm
- Reinforcing bar spacing 5mm
- Steel plate widths 1mm
- Steel plate lengths 1mm (as necessary for cambered plates etc)
- Steel sections 0.1mm (or as shown in manufacturer's catalogues)

3.1.4.2.13.2. Orders of Accuracy For Reduced Levels and Chainages

Reduced levels and Chainages shall be shown in metres on all drawings with the following order of accuracy being used:

- Designed Surface Levels 0.001 metres
- Contract Levels 0.100 metres
- Existing surface levels 0.1 metres
- Contours 0.5 metres
- Chainages 0.001 metres
- Flood and water levels 0.1 metres

3.1.4.2.14. *Plan Orientation*

Chainages must be shown in ascending order from left to right across the sheet except in the case of a bridge widening where the structure is widened on one side only and in this case the widening shall be shown on the elevation face which will in some cases require reversing the conventional rules of orientation.

3.1.4.2.15. *Title Blocks*

Title blocks shall be in accordance with details as shown in Appendices 3.1.9 D1, 3.1.9 D2 and 3.1.9 D3 of this Guide.

The RTA can provide a typical A1 sheet containing a title block with a layout that allows for the addition of Consultant details electronically.

3.1.4.2.16. *Plan Registration*

The RTA will supply the Plan registration number specific to each individual project.

3.1.4.2.17. *RTA Bridge Number*

The RTA will supply the RTA Bridge Number which must be included on each drawing sheet as well as the Cover Sheet.

3.1.4.2.18. *Hatching And Shading Standards*

See 3.1.7 Appendix B of this Guide for acceptable hatching and shading standards for items commonly represented on bridge construction drawings prepared for the RTA.

3.1.4.3. COMPILATION

3.1.4.3.1. *Order of Drawings*

The order of the sheets in a set of drawings should follow the logical order of the construction procedure of the structure itself. The numbering sequence shall be as follows:

Cover Sheet

General Arrangement

Foundations ie Piles, Pile / Pilecap combinations, Rock Anchors, etc

Substructure ie Abutments Concrete

Reinforcement

Piers Concrete

Reinforcement

Bearings

Superstructure units ie Girders, Planks etc

Deck Setting Out (if necessary)

Concrete

Reinforcement

Barriers (if applicable)

Approach Slabs (if INCLUDED in the Bridge Contract)

Bar Shapes Diagram

Approach Slabs (if NOT INCLUDED in the Bridge Contract)

3.1.5. SHEET COMPOSITION

Sheet composition considers the overall presentation of detail and associated support documentation in accordance with the design brief. Drawings must not appear to be cluttered, but should clearly present the information required in an orderly format. The final product must be fully prepared using electronic means without manual enhancement.

3.1.5.1. COVER SHEET

A Cover Sheet shall be prepared for all sets of final drawings and it shall be shall be numbered 1. Where drawings are prepared for the RTA by an external consultant, the Cover Sheet and be in accordance with 3.1.9 Appendix D of this Guide and the consultant's reference number shall not be shown as part of the sheet number.

3.1.5.2. GENERAL ARRANGEMENT

3.1.5.2.1. *General*

The General Arrangement shall give an overall picture of the bridge as it will appear once constructed and shall include a plan, elevation, typical cross section, site plan and a list of "General Notes" which apply to the entire set of drawings. A suitable skew diagram and/or vertical alignment diagram shall be shown where appropriate.

3.1.5.2.2. *Plan View*

This shall contain the following information:

- An outline of the structure;
- The watercourse, railway line or road under the structure;
- Any existing structures including the Reduced Level of the deck;
- The location of any public utilities;
- The Control Line and Carriageway centreline (as appropriate);
- Chainages on the Control Line at the ends of deck and at each pier centreline together with the reduced level at each location;
- The bearing (or radius) of the Control Line (as appropriate);
- An outline of concrete safety barriers, footways and railings (as appropriate);
- Joints in the deck surface;
- The position of name plates;
- Outlines of the structural elements ie abutments, piers, piles, footings and columns etc where the scale of the drawing permits;
- Relevant horizontal clearances;
- The location of any vertical clearance referenced from the Elevation;
- Contours of the existing surface;
- Shapes and slopes of any embankments or cuttings;
- Extent of any embankment protection required;
- Extent of any channel excavation required;
- The direction of flow of the watercourse or conventional tidal representation;
- The compass direction of True North indicated by a northpoint;

- The outline of concrete safety barrier extensions, approach slabs and approach safety barriers:

3.1.5.2.3. *Elevation*

This shall contain the following information as appropriate:

- An outline of the elevation face of the structure projected from the Plan view showing foundation type, abutments, piers, superstructure and railings;
- The overall length of deck;
- The number and length of spans;
- The normal water level or stream condition ie normally dry etc;
- Mean High Water Springs and Mean Low Water Springs for tidal waters;
- Navigational clearances above Mean High Water Springs for navigable waterways;
- High flood level both calculated and reported with date for reported high flood level;
- Vertical and horizontal clearances for structures over roads and/or railways including the approximate design surface level of any road or railway line under the structure at the Control Line;
- Vertical and horizontal clearances for opening span bridges both open and closed;
- The Existing Natural Surface on the Control Line projected from contour lines;
- Proposed cross section for channel excavation;
- Form and extent of any embankments and any required embankment protection whether above or below the Existing Surface, Parapet extensions, approach slabs and approach safety barriers;
- Contract levels of foundation elements;
- Joint types represented by the letters 'F' for fixed, 'E' for expansion and "R" for restrained;
- Joints in the superstructure represented by a single heavy line;
- Statement regarding the type of foundation material present under the structure;
- Chainages, existing surface levels and design surface levels at the ends of deck and at each pier on the Control Line given in a Datum block below the Elevation;
- Structure location with respect to nearest major towns or cities ie FROM/TO

3.1.5.2.4. *Typical Cross Section*

These shall contain the following information:

- General form of the piers or abutments including foundation elements;
- Outline of the superstructure elements;
- Overall width of the superstructure;
- Width between concrete safety barriers;
- Widths of concrete safety barriers and/or footways;
- Clear width of footways;
- Control Line location;
- Crossfall or superelevation down the slope represented by an arrow and % sign;
- Type of wearing surface;

- Indication of orientation with respect to stream flow or compass point ie UPSTREAM or DOWNSTREAM, NORTH or SOUTH;

3.1.5.2.5. *Skew Diagram*

These shall be in the following format:

- A right angle triangle with the base parallel to the setting out line or Control Line, the hypotenuse parallel to the abutment and pier centrelines and with the skew angle designated at the apex of the triangle;

These shall contain the following information:

- A dimension for the vertical side of the triangle (normally 10 000). A dimension for the base and hypotenuse of the triangle calculated from the vertical dimension and the skew angle;

3.1.5.2.6. *Vertical Alignment Diagram*

This shall contain the following information:

- The length of the curve;
- The grade on the road at each end of the curve;
- The chainage and reduced level at each end of the curve;
- The chainage and reduced level of the intersection point of the approach grades on the Control Line;
- The chainage and reduced level at each end of the deck with the bridge being represented by a thick line between these two points;

3.1.5.2.7. *Horizontal Alignment Diagram (For Curved Structures)*

This shall contain the following information:

- The bearing in;
- The bearing out;
- The coordinates of the centre of the circle;
- The radius of the Control Line;
- The tangent points at each end of the Control Line where curved.

Horizontal Alignment Data for the Control Line shall be provided in a table format.

3.1.5.2.8. *Site Plan*

This shall contain the following information:

- Control Line, including the position of any Tangent Points etc;
- The position and chainage of each end of the bridge;
- The existing bridge (if applicable) including the RL of the existing deck;
- Survey Marks and Bench Marks (including RL);
- Road boundaries;
- The location of any existing public utilities;

- The location and description of any nearby features that are likely to affect the construction of the new bridge
- Northpoint

3.1.5.2.9. *General Notes*

The General Notes on the General Arrangement Drawing shall be in the format shown in 3.1.8 Appendix C of this Guide.

3.1.5.3. FOUNDATIONS

3.1.5.3.1. *Piles*

The setting out of the piles shall be shown on a 'Pile Layout'. This drawing is not necessarily to scale but should have reasonable proportions. On curved bridges the curvature may be exaggerated to show dimensions more clearly.

The pile layout should be shown on the Pile Detail Sheet where possible and include all information necessary for the positioning of pile.

Generally piles are in groups or a straight line.

Piles in one line: The centreline of the pile group shall be defined by chainage and bearing to the Control Line with the location of each individual pile being dimensioned from the intersection of the control line and the centreline of piles, parallel / normal to the centreline of the piles.

Piles in a group: The centre of the pile group shall be defined by a chainage and bearing to the Control Line together with a dimension from the Control Line or alternatively by a set of coordinates with the location of each individual pile being dimensioned from centre of the pile group parallel / normal to the centreline of the piles.

Raked piles: Where raked piles are used, a note shall be added to the drawing to indicate that the location shown is at a nominated RL (usually the top of pile).

Raked piles shall also have the degree of rake shown together with an arrow to indicate the direction of the rake in relation to the centreline of piles.

Where raked piles are in two or more rows beneath a pilecap, a dimension between the design location of pile centrelines at the top of the finished pile shall be provided.

3.1.5.3.2. *Footings*

The setting out of footings on structures with complicated geometry shall generally be shown on a 'Footing Layout'. However, on straight, square bridges, the location of footings may be shown on the plan of piers or abutments.

The 'Footing Layout' shall indicate plan dimensions of individual footings and relative position in relation to a known point. Where a layout is a combination of piles and footings it shall be known as a 'Foundation Plan'.

The Footing Layout is not necessarily to scale but should be reasonably proportioned.

Where geometry is very complex, the preferred method for setting out is the use of co-ordinates at each corner of the footings.

3.1.5.4. Abutments - Concrete

3.1.5.4.1. *General*

Concrete detail drawings should show the physical dimensions and levels of a concrete structure. Sufficient information shall be shown to enable formwork to be built and erected and concrete quantities to be easily calculated.

Formed holes, cast-in metal work, construction joints and any necessary layers of mass concrete shall be shown.

The location of formed holes and cast-in metal work shall be sufficiently dimensioned to enable their correct positioning inside the formwork.

Cast-in items (where applicable) shall be cross-referenced to the particular sheet where respective details are shown.

The detailing of standard chamfers and fillets ie 20 x 20 mm, should not be shown on small scale levels or sections. However, chamfers and fillets shall be detailed to their correct size on any view or section where the scale is 1:10 or larger (ie. 1:10, 1:5, 1:2 etc.).

Non-standard fillets ie greater than 20 x 20 mm, shall be shown and dimensioned in all instances.

'General Notes' applicable to concrete detail sheets are shown in 3.1.8 Appendix C of this Guide and those notes shall be used as the basis for all 'concrete' notes with any other required notes being added thereto.

3.1.5.4.2. *Plan Views*

Plan views, used to show the location of such elements as footings, columns, headstocks, bearings etc may also be used to show reference markings, co-ordinates and chainages.

Plan views shall be drawn as a horizontal view taken immediately above the element under consideration.

Hidden details such as piles, columns and footings shall be shown as broken lines where appropriate in accordance with the line types shown in 3.1.6 Appendix A of this Guide.

3.1.5.4.3. *Elevations*

Elevations shall be drawn as a view seen from a vertical plane immediately in front of the element under consideration and shall be projected from that elements 'PLAN' view.

Hidden details, such as abutment wing walls and associated fillets shall be shown as broken lines in accordance with the line types shown in 3.1.6 Appendix A of this Guide.

3.1.5.4.4. *Sections*

Sections shall be drawn as a view from a cutting plane located through an element previously drawn as an Elevation or a Plan.

Generally, only the details at the cutting plane of the section should be shown, however, details beyond the cutting plane may be included provided that the included details are not confusing to the main details being shown.

Where possible, sections are to be drawn adjacent to the plan (or elevation) to which they relate. Where section details cannot be shown on the sheet of origin, they shall be cross referenced in accordance with AS 1100 Part 501.

Linework shall be in accordance with 3.1.6 Appendix A of this Guide.

If a series of cutting planes are used to define section details, 0.7mm thick lines shall show any change in direction of the cutting plane.

Each part of an abutment shall be set out from a known point, such as the Control Line. Dimensions given when setting out columns etc shall not be given from footings or piles.

3.1.5.4.5. *Dimensioning*

Dimensioning of concrete items shall be in accordance with Clause 3.1.12 of this Guide

Dimensioning of concrete elements (whose details appear on a separate sheet) shall not be given.

3.1.5.5. Abutments - Reinforcement

3.1.5.5.1. *Layout*

The layout of a reinforcement drawing shall be in accordance with the principles outlined in Section 4.4 of this Guide.

Elevations, Plans and Views shall be treated as being transparent with the applicable reinforcement details being added.

The prefix 'Sectional' SHALL NOT be used with any sub-title.

3.1.5.5.2. *Bar And Fabric Detailing*

This shall be in accordance with Section 23 and Section 23 Appendix A ("Steel Reinforcement Detailing") of the RTA's Structural Drafting and Detailing Manual.

The numbering of reinforcement, whether bars or fabric, shall be in sequential order and shall proceed from the bottom to the top of the element under consideration wherever possible and/or practical.

The locating of reinforcing bars in relation to each other, particularly in connection details such as column to headstock, pile to pilecap and footing to column, should be closely examined to ensure that bars may be easily placed and that concrete compaction in that area can be achieved.

The location of cast-in metal work ie. dowels, anchor bolts etc. and the location of formed holes shall also be checked to ensure interference is minimised. Where the location of the cast-in item is critical, reinforcement shall be detailed to suit the particular application.

Where interference is of a minor nature only and is not critical eg. the placing of shear reinforcement , a suitable note to be added to the drawing would be;

> "the spacing of . . . . . bars may be adjusted slightly where necessary to clear formed holes and dowels".

'General Notes' applicable to reinforcement detail sheets are shown on RTA Standard Bridge Drawing No RTAB029 and those notes shall be used as the basis for all 'reinforcement' notes with any other required notes being added thereto.

3.1.5.6. Piers - Concrete

3.1.5.6.1. *General*

Concrete detail drawings should show the physical dimensions and levels of a concrete structure. Sufficient information shall be shown to enable formwork to be built and erected and concrete quantities to be easily calculated.

The location of formed holes and cast-in metal work shall be sufficiently dimensioned to enable their correct positioning inside the formwork.

Cast-in items (where applicable) shall be cross-referenced to the particular sheet where respective details are shown.

The detailing of standard chamfers ie. 20 x 20 mm should not be shown on small-scale views or sections. However, chamfers shall be detailed to their correct size on any view or section where the scale is 1:10 or larger (ie. 1:10, 1:5, 1:2 etc).

Non-standard fillets ie greater than 20x20 mm shall be shown and dimensioned in all instances.

'General Notes' applicable to concrete detail sheets are shown in 3.1.8 Appendix C of this Guide and those notes shall be used as the basis for all 'concrete' notes with any other required notes being added thereto.

3.1.5.6.2. *Plan Views*

Plan views, used to show the location of elements such as footings, columns, headstocks etc. may also be used to show reference markings, co-ordinates and chainages.

Plan views shall be drawn as a horizontal view taken immediately above the element under consideration.

Hidden details such as piles, columns and footings shall be shown as broken lines where appropriate in accordance with the line types shown in 3.1.6 Appendix A of this Guide.

3.1.5.6.3. *Elevations*

Elevations shall be drawn as a view seen from a vertical plane immediately in front of the element under consideration and shall be projected from that elements 'PLAN' view.

Linework shall be in accordance with 3.1.6 Appendix A of this Guide.

3.1.5.6.4. *Sections*

Sections shall be drawn as a view from a cutting plane located through an element previously drawn as an Elevation or Plan.

Generally, only the details at the cutting plane of the section should be shown, however, details beyond the cutting plane may be included provided that the included details are not confusing to the main details being shown.

Sections, where possible, shall be drawn adjacent to the plan or elevation to which they relate. Where section details cannot be shown on the sheet of origin, they shall be cross referenced in accordance with AS 1100 Part 501.

Linework shall be in accordance with 3.1.6 Appendix A of this Guide.

If a series of cutting planes are used to define section details, 0.7mm thick lines shall show any change in direction of the cutting plane.

Each part of a pier shall be set out from a known point such as the Control Line. Dimensions given when setting out columns etc shall not be given from footings or piles.

3.1.5.6.5. *Dimensioning*

Dimensioning of concrete items shall be in accordance with Clause 3.1.12 of this Guide.

Dimensioning of concrete elements (whose details appear on a separate sheet) shall not be given.

3.1.5.7. Piers - Reinforcement

3.1.5.7.1. *Layout*

The layout of a reinforcement drawing shall be in accordance with the principles outlined in Section 4.4 of this Guide.

Elevations, Plans and Views shall be treated as being transparent with the applicable reinforcement details being added.

The prefix 'Sectional' SHALL NOT be used with any sub-title.

3.1.5.7.2. *Bar and Fabric Detailing*

This shall be in accordance with Section 23 and Section 23 Appendix A ("Steel Reinforcement Detailing") of the RTA's Structural Drafting and Detailing Manual.

The numbering of reinforcement, whether bars or fabric, shall be in sequential order and shall proceed from the bottom to the top of the element under consideration wherever possible and/or practical.

The locating of reinforcing bars in relation to each other, particularly in connection details such as column to headstock, pile to pilecap and footing to column, should be closely examined to ensure that bars may be easily placed and that concrete compaction in that area can be achieved.

The location of cast-in metal work ie. dowels, anchor bolts etc. and the location of formed holes shall also be checked to ensure interference is minimised. Where the location of the cast-in item is critical, reinforcement shall be detailed to suit the particular application.

Where interference is of a minor nature only and is not critical eg. the placing of shear reinforcement, a suitable note to be added to the drawing would be:

> "the spacing of . . . . . bars may be adjusted slightly where necessary to clear formed holes and dowels".

'General Notes' applicable to reinforcement detail sheets are shown ON RTA Standard Bridge Drawing No RTAB029 and those notes shall be used as the basis for all 'reinforcement' notes with any other required notes being added thereto.

3.1.5.8. Bearings

Bearings, other than elastomeric strip types, shall be sufficiently detailed to allow for inspection and possible future replacement.

3.1.5.8.1. *Reduced Levels of Bearings*

Where bearings are to be set on nominal thickness mortar pads, the reduced level for the top of the bearing shall be given so that any variation of design levels may be "taken out" in the thickness of the mortar pad.

Where bearings are to be set on concrete plinths or where elastomeric pad/strip bearings are used and are set directly on the concrete surface, the reduced level for the concrete surface shall be given.

3.1.5.8.2. *Bearing Types*

3.1.5.8.2.1. Elastomeric Bearing Strips and Elastomeric Bearing Pads

Sizes of these types of bearings shall conform to details given in AS 5100.4 – Bridge Design.

Elastomeric Bearing Strips shall be detailed complete with width, thickness, length, hole size and spacing for dowels where applicable.

Elastomeric Bearing Pads do not normally require detailing, however, width and thickness shall be given and bearings should be shown in detail to enable correct orientation and placement within the structure.

3.1.5.8.2.2. Laminated Elastomeric Bearings

Laminated Elastomeric Bearings shall conform to AS 5100.4 – Bridge Design with Part Numbers from AS 5100.4 being quoted on the drawings. 'Standard' bearings require no specific detail except where holes are required for dowel pins etc. Any modifications to 'standard' bearings shall be sufficiently detailed to enable manufacture, ie. size, location and depth of required holes.

Non-Standard Bearings, where used shall be sufficiently detailed to enable manufacture. The following information shall be given:

- Overall physical dimensions
- Number and thickness of internal rubber layers
- Number, size and thickness of steel plates
- Cover thickness to steel plates
- Hole details (including location and depth)
- Cover thickness to holes for steel plates (where hole detailed)
- Table of bearing performance requirements.

3.1.5.8.2.3. Proprietary Bearing Types

Brand names for proprietary bearings shall not be shown on the drawings and proprietary bearings shall not be fully detailed. However, it is necessary to draw the outline of the bearing based on the dimension shown in the manufacturer's catalogue.

The only dimension given on the drawings shall be: -

- bearing height (excluding additional attachment plates)
- overall height of the bearing assembly including necessary attachment plates.
- plan dimensions of the upper and lower surfaces in contact with the attachment plates, or with the bridge structure where attachment plates are unnecessary.
- spacing of bearing anchor bolts.

Where attachment plates are provided to allow for the future removal or replacement of the bearings, they shall be shown as separate items and shall be fully detailed to enable fabrication.

All necessary bolts, nuts, washers, screws, dowels and other attachment devices for fastening bearings to attachment plates and for anchoring the bearings or attachment plates to the bridge structure shall be called up in detail. Standard bolts, screws etc. need not be detailed separately but must be fully described. Non-standard fasteners shall be drawn in detail with all necessary dimensions to enable fabrication.

In addition to the above, bearing performance requirements for each size and type of bearing used in the bridge structure shall be provided in a table format.

General notes relating specifically to bearing drawings are shown on RTA Standard Bridge Drawing No RTAB029 and where applicable, shall be used.

3.1.5.9. Superstructure Units

3.1.5.9.1. *Prestressed Concrete Planks*

In simple cases, such as in PSC plank deck designs, the detailing of tendons etc. is not required. The use of RTA Standard Bridge Drawings No RTAB050 to RTAB062 inclusive is recommended as these drawings are sufficiently detailed for standard applications and may be purchased from the RTA in either hard copy or soft copy versions. The PSC planks detailed in the nominated drawings have been designed for the SM1600 Loading.

Where RTA Standard Bridge Drawings are used for "non-standard" applications, any modifications to the drawings, such as the inclusion of cast-in items must be carefully considered with respect to strand and/or void locations.

If the "Standard Drawing" is altered or added to in any way, except for title block information, the text adjacent to the title block shall be amended to read "MODIFIED RTA DRAWING No. ...."

3.1.5.9.2. *Precast Prestressed Concrete Girders*

Cross sections of Precast Prestressed Concrete I-Girders and Precast Prestressed Concrete Trough Girders shall conform to details as shown in the AS 5100 –Bridge Design.

The cross section dimensions for Precast Prestressed "Super T" concrete girders shall conform to RTA Standard Bridge Drawing No RTAB033.

3.1.5.9.3. *Fabricated Steel Girders*

3.1.5.9.3.1. General

In all cases where structural steel elements are specified, the material used shall be in accordance with the relevant Australian Standard and this shall be stated on the drawings in the following manner:

"Steel plate shall be to AS/NZS 3678-250".

"Steel sections shall be to AS/NZS 3679.1-350LO".

Structural steelwork drawings shall show sufficient detail for the complete fabrication of a particular item or sufficient detail to enable the fabricator to prepare detailed shop drawings for the particular item.

For simple fabrication work, such as bridge girders that are made from rolled steel sections, universal beams and built-up plate girders, shop drawings are not usually prepared.

Each item of fabricated steelwork shall be detailed in the form that the item is released from the fabrication shop with each and every part that is attached in the fabrication shop shown as part of the total assembly. Fabricated items that form part of the total assembly need not be detailed as separate items nor shall the quantity of those items be shown separately unless unduly complicated and in such a case, the quantity of those items be shown separately with the detail of the item.

In the majority of cases, it is sufficient to detail a fabricated item in one or two views, with enlarged details of the more complex portions as necessary

Eg A normal plate with holes in it would require a plan view only.

A tapered plate would require a plan and a section.

A universal beam type girder would require an elevation and cross section.

A fabricated item with a longitudinal axis of symmetry, such as a built-up plate girder, steel trough girder or steel box girder, would require an elevation and sections to depict different plate sizes and part plans to show all relevant details.

Where items are to be bolted or welded together in the field, eg where steel cross girders are to be attached to the main girders, an assembly drawing showing all components in their final position in the structure shall be provided.

Where girders are bolted in the field, the individual splice plates are supplied separately to the girders. Conventional practice is such that the holes in these plates are match drilled with the hole locations provided at the ends of each girder and in this case the detailing of each splice plate is not required as the assembly of the bolted splice is drawn in elevation, plan and cross section. The spacing of bolt holes and the edge distances to all plates shall be provided on these assembly drawings.

3.1.5.9.3.2. Closing Dimensions

In accordance with industry practice, overall dimensions of steel items shall be provided to enable the correct manufacture of the items.

Dimensions required for the correct positioning of holes etc in items shall be provided from one end only and as such no closing dimensions shall be given on the drawings.

3.1.5.9.3.3. Web Diagrams

Web diagrams shall be fully detailed to incorporate any camber requirements. Vertical dimensions may be related to a horizontal datum or alternatively, the web diagram may be detailed with the chord horizontal.

Where the appearance of the girder is of aesthetic importance, the top and bottom edges of the web plates shall be cut to form smooth curves to provide for the required camber.

3.1.5.9.3.4. Stud Welded Shear Connectors

The detailing of each and every shear connector in the plan and elevation of a girder is not necessary.

In elevations, shear connectors need only be shown where a change in pitch occurs.

In cross sections and enlarged details, all shear connectors shall be shown.

3.1.5.9.3.5. Web Stiffeners

Where web stiffeners are provided and are not required to be welded to a flange, suitable clearance shall be provided between the web stiffener and the flange to allow for maintenance and painting requirements.

3.1.5.9.3.6. Corner Cuts and Cutouts

When detailing the fabrication and assembly of steel members, R40 radial corner cuts shall be provided to enhance weld clearance.

Where cutouts are required in steel plates to provide clearance to existing members, the drawing shall clearly detail where the cutouts are required and shall also include any relevant welding requirements.

3.1.5.9.3.7. Lifting Lugs

Steel girders and any other large fabricated steel items shall be detailed to include the provision of lifting lugs at suitable locations to facilitate the erection of the item.

Drawings shall also contain the following note as appropriate:

> "All lifting lugs shall be cut off by a suitable method after final positioning of the girder and the remaining stub shall be ground flush with the top flange."

3.1.5.9.3.8. Protective Treatment

The protective treatment specified on the drawings shall be appropriate for the item under consideration.

In all cases where protective treatment of steelwork is required, the following note shall be included in the General Notes on the drawing:

> "Edges to protective treated shall be rounded to a radius of 1.5mm unless noted otherwise".

Where fabricated steel items have been hot-dip galvanized and the surface of the protective coating has been disturbed for any reason, the following note shall be included on the drawing:

> "Damaged galvanized surfaces shall be renovated in accordance with RTA Specification B204".

Drain holes and/or air escape holes shall be provided in appropriate locations.

3.1.5.10. Superstructure - Setting Out

3.1.5.10.1. *General*

Generally setting out shall be carried out by one of two methods;

a) Alignment Method (chainages and offsets)

b) A coordinate system.

For structures that are on a straight alignment, setting out shall be carried out using the control line. The use of chainage and offsets is the preferred method, however, coordinates may be used.

Where there are multiple alignments, including spiral curves, the use of co-ordinates shall be adopted. Co-ordinates of points on the control line shall be given with a bearing and offset to other points required.

3.1.5.10.2. *Chainages*

Chainages, given on the Control Line, should be adopted from the road design and/or site survey information provided.

Where possible and practical, chainages for the centrelines of piers, bearings etc shall be given in metres to the nearest 0.005 metre, eg. 320.605. Chainages being used for calculating purposes shall not be rounded off.

3.1.5.10.3. *Co-ordinates*

The coordinate system adopted for a project may be an arbitrary local one, ISG (Integrated Survey Grid) or GDA (Geocentric Datum of Australia).

The coordinates are normally quoted in metres to the nearest 0.001 metre. In recording both GDA and ISG coordinates, the Easting is always placed before the Northing.

3.1.5.10.4. *Setting Out*

Straight bridges shall be out from Control Line (or shift centreline).

Horizontally Curved bridges shall be set out in accordance with the following.

Determination

For a bridge of length 30 m or less with a mid-ordinate of 50 mm or less, the horizontal alignment of the bridge shall be straight, ie. the chord of the arc between the ends of the deck.

For a bridge over 30 m long with a horizontal mid-ordinate of 75 mm or less, the horizontal alignment of the bridge shall also be straight.

No increase in road width is necessary in such cases (other than that required by the RTA Road Design Guide).

For any other bridge the horizontal alignment of the deck is to be set out on the curve or in chords of such length that the mid-ordinate between the chord and the curve does not exceed 5 mm.

However, for a simply-supported bridge when the length of the span is less than this chord, the horizontal alignment shall be set out from pier to pier.

For spans up to and including 12 metres, where the mid-ordinate of individual spans is 10mm or less and the angular deviation from one span to the next is less than one degree (1^0), consideration shall be given to making individual spans straight.

Final details of deck setting out shall include a Plan, Cross Section and Table(s).

On curved structures, where the piers, abutments and ends of superstructure are skewed to the Control Line, the setting out information at supports shall be given along the skew.

The setting out data for all other chainage increments shall be given radially as shown in Figure 5.1, Sheets 1 and 2 of the RTA Structural Drafting and Detailing Manual.

Skew angles for curved structures shall be defined in a Skew Diagram as shown on as shown on Sheet 2 of Figure 5.1 of the RTA Structural Drafting and Detailing Manual.

Reduced levels for selected points on the cross section shall be given to the top of the finished concrete surface, not the top of the asphalt wearing surface.

The Plan view shall show the outline of the deck, the Control Line, the ends of deck, the pier centrelines, the location of any cross sections and the bearing of skew angles as appropriate. Locations of the deck accessories may be shown, however it is preferable that they be shown on separate deck layout plan. The Plan view is generally not to scale and the curvature shall, in most cases be exaggerated for clarity.

Setting Out Tables shall show the values of offsets and levels at selected chainages along the bridge and the bearing of any skew angles as appropriate.

Suggested increments for cross sections taken along bridge.

Radius	Increment
50	1.5
100	2.0
150	2.5
200	3.0
300	3.5
400	4.0
500	4.5
1000	5.0
2000 and over	10.0

These increments are guides only and should be adjusted to suit span lengths etc.

iii. *Bridge on a Curved Vertical Alignment*

For a bridge of length 30 m or less on a sag vertical curve with a mid-ordinate over the length of the bridge of 50 mm or less, the vertical alignment of the bridge shall be straight.

3.1.5.11. Superstructure - Concrete

3.1.5.11.1. *General*

Concrete detail drawings should show the physical dimensions and levels of a concrete structure with sufficient information shown to enable formwork to be built and erected and concrete quantities to be easily calculated.

Formed holes, cast-in metal work and construction joints shall be shown.

The location of formed holes and cast-in metal work shall be sufficiently dimensioned to enable their correct positioning inside the formwork.

Cast-in items (where applicable) shall be cross-referenced to the particular sheet where respective details are shown.

The detailing of standard chamfers and fillets ie 20 x 20 mm should not be shown on small-scale views or sections. However, chamfers and fillets shall be detailed to their correct size on any view or section where the scale is 1:10 or larger (ie. 1:10, 1:5, 1:2 etc).

Non-standard fillets ie greater than 20x20mm shall be shown and dimensioned in all instances.

'General Notes' applicable to concrete detail sheets are shown in 3.1.8 Appendix C of this Guide and those notes shall be used as the basis for all 'concrete' notes with any other required notes being added thereto.

3.1.5.11.2. *Dimensioning*

Dimensioning of concrete items shall be in accordance with Clause 3.1.12 of this Guide

Dimensioning of concrete elements (whose details appear on a separate sheet) shall not be given.

3.1.5.11.3. *Plan Views*

Plan views shall be used to show reference markings, co-ordinates and chainages.

Plan views shall be drawn as a horizontal view taken immediately above the superstructure.

Hidden details shall be shown in broken lines where appropriate in accordance with 3.1.6 Appendix A of this Guide.

3.1.5.11.4. *Sections*

Sections shall be drawn as a view from a cutting plane located through an element previously drawn as a Plan.

Generally, only the details at the cutting plane of the section should be shown, however, details beyond the cutting plane may be included provided that the included details are not confusing to the main details being shown.

Sections, where possible, shall be drawn adjacent to the plan or elevation to which they relate. Where section details cannot be shown on the sheet of origin, they shall be cross referenced in accordance with AS 1100 Part 501.

If a series of cutting planes are used to define section details, 0.7mm thick lines shall show any change in direction of the cutting plane.

Line work shall be in accordance with 3.1.6 Appendix A of this Guide.

3.1.5.11.5. *Construction Joints*

Construction joints in prestressed concrete are not permitted except where specifically required and detailed on the drawings.

Construction joints, where critical for design purposes eg. continuous deck slabs and continuity connections, shall be adequately located by dimensions on the drawings.

Construction joints in void formers in voided slab decks, whilst possible by sealing the end of the void former, shall be avoided.

Where it may be possible to cast the whole of an element in one continuous operation but the quantity of concrete involved is large, possible construction joints may be shown and marked 'OPTIONAL'.

3.1.5.11.6. *Post-Tensioned Prestressed Concrete*

3.1.5.11.6.1. General

Bridge decks shall be detailed for a typical "size" strand prestressing system and any variation to the details as shown shall be covered by an appropriate "PRESTRESSING SYSTEM" note. (Refer to 3.1.8 Appendix C of this Guide).

When detailing prestressed concrete, particular attention must be given to:-

- Physical dimensions of anchorages;
- Spacing between anchorages;
- Sufficient space allowed for use of tendon jacks;
- Arrangement of end block/diaphragm reinforcement with respect to anchorages and tendons to facilitate the placement and vibration of concrete, large scale details are appropriate in most cases.

3.1.5.11.6.2. Tendon Profiles

Tendon profiles shall be sufficiently detailed to enable correct stressing duct placement and careful attention must be given to minimum bend radii recommendations from post-tensioning manufacturers.

Comprehensive detailing in both Plan and Elevation/Section shall be provided to ensure correct placement can be achieved and that required clearances for anchorages are maintained.

3.1.5.11.6.3. Ducts

Ducting detailed on drawings shall be in accordance with stressing system manufacturer's recommendations for the system used.

3.1.5.12. Superstructure - Reinforcement

The detailing of reinforcement shall be in accordance with Section 23 and Section 23 Appendix A of the RTA Structural Drafting and Detailing Manual ("Steel Reinforcement Detailing").

The numbering of reinforcement, whether bars or fabric, shall be in sequential order and shall proceed from the bottom to the top of the element under consideration wherever possible and/or practical.

'General Notes' applicable to reinforcement detail sheets are shown on RTA Standard Bridge Drawing No RTAB029 and those notes shall be used as the basis for all 'reinforcement' notes with any other required notes being added thereto.

3.1.5.13. Barrier Railings

3.1.5.13.1. *Dimensions*

3.1.5.13.1.1. Traffic Barrier Railings

RTA Standard Bridge Drawings RTAB051 - RTAB054 inclusive show details of the cross sections of Traffic Barrier Railings and joint details

3.1.5.13.1.2. Pedestrian Barrier Railings

RTA Standard Bridge Drawings RTAB018 and RTAB019 show details of Steel and Aluminium Pedestrian Barrier Railings currently used by the RTA.

Blank spaces are provided on these detail sheets for the addition of relevant information, ie numbers of items required.

3.1.5.13.2. *Geometry*

3.1.5.13.2.1. Grades and Vertical Curves

Posts for all types of traffic barrier railings shall be perpendicular to the top of the concrete barrier or footway surface on which they are located in all cases where the grade of the structure does not exceed 4%.

Posts for traffic barrier railings that are located on a structure where the grade of the structure exceeds 4% at any point, shall be detailed to be truly vertical for the full length of the structure. Detailing of traffic barrier railings in this instance will entail the calculation of vertical offsets from a given datum for each panel type.

Anchor bolts for steel pedestrian railings shall be cast-in normal to the concrete surface in all cases.

Anchor bolts for aluminium pedestrian railings shall be cast-in truly vertical in all cases.

End posts and balusters for pedestrian barrier railings shall be detailed to be truly vertical in all instances.

3.1.5.13.2.2. Horizontal Curves

All types of barriers on structures which are set out on a curved horizontal alignment need careful examination to ensure that the angular variation between panels can be accommodated at rail splices.

Straight panels shall be used for structures set out on horizontal curves where the radius of curvature is greater than or equal to 150 x the panel length for the longest panel used.

Where the radius of curvature of the structure is less than 150 x the panel length for the longest panel used, the panels shall be detailed to suit the radius as appropriate, however, where the mid-ordinate offset for any panel is calculated to be less than 5mm, the panel shall be detailed as being straight.

3.1.5.13.3. *Joints*

On continuous bridges, joints between panels in traffic barrier railings may be placed at the most convenient locations, however as a general rule, joints between adjacent panels shall occur at approximately the quarter point of the span between adjacent posts. The quarter point used shall be immediately past the post in the direction of traffic.

On simply supported bridges and continuous bridges where expansion and or contraction joints are detailed, a joint in the railing (all types) shall be provided between the posts located either side of the joint in the deck. Joints provided at these locations shall be detailed with a rail splice that is sufficient in length to accommodate the expected range of movement of the joint in the deck.

3.1.5.13.4. *Post Spacing*

3.1.5.13.4.1. Traffic Barrier Railings

The post spacing in traffic barrier railings shall conform to the requirements of AS 5100.1 – Bridge Design.

For aesthetic considerations, post spacing in barrier railings shall be as even as is practical to suit the particular application and to reduce the number of different panel types to be used.

Where post spacing at the ends of structures is different to that adopted for the majority of the structure, the post spacing shall be reduced rather than increased and if necessary intermediate post spacing shall be used to reduce the visual impact of the change in spacing.

Where a reduction in post spacing is required, the post spacing adopted should, in most cases, not be less than two-thirds of the post spacing used for the remainder of the structure.

3.1.5.13.4.2. Pedestrian Barrier Railings

The maximum centre-to-centre spacing for supports in pedestrian barrier railings shall be 1500mm.

The maximum clear spacing between balusters in pedestrian barrier railings shall be 130mm.

3.1.5.13.5. *Panel Lengths*

3.1.5.13.5.1. Traffic Barrier Railings

For ease of manufacture, protective treatment, handling and erection, panel lengths shall not exceed 5500mm and shall not contain more than two railing posts.

3.1.5.13.5.2. Pedestrian Barrier Railings

Panel lengths for pedestrian barrier railings shall not exceed 2990mm.

3.1.5.13.6. *Connection Of Railings At End Of Structure*

Where steel safety barriers in bridge approaches are required to be connected to the bridge, connection shall be to a concrete termination block and shall be facilitated using a cast-in anchor assembly as detailed on Branch Standard Drawing Number RTAB032.

3.1.5.14. Approach Slabs

3.1.5.14.1. *Concrete Details*

The layout of a concrete drawing shall be in accordance with the principles outlined in section 4.4 of this Guide.

3.1.5.14.2. *Bar And Fabric Detailing*

The detailing of reinforcement shall be in accordance with Section 23 and Section 23 Appendix A of the RTA Structural Drafting and Detailing Manual ("Steel Reinforcement Detailing").

The numbering of reinforcement, whether bars or fabric, shall be in sequential order and shall proceed from the bottom to the top of the approach slab wherever possible and/or practical.

3.1.5.15. Bar Shapes Diagram

An RTA Standard Bar Shapes Diagram (RTA Standard Bridge Drawing No RTAB031) complete with bend, cog, hook and fitment hook details shall be provided for each set of bridge drawings and shall be used so that bending of the reinforcement to the correct size and shape can be achieved.

Where the shape of a particular bar does not conform to the "Standard" bar shapes a "Z" suffix shall be added to the bar shape code with the first non-standard shape being "AZ". Variations within a particular non-standard bar shape, ie same general shape with different leg lengths, shall be identified by the use of the next available numerical suffix within that particular bar shape, eg "AZ1", "AZ2".

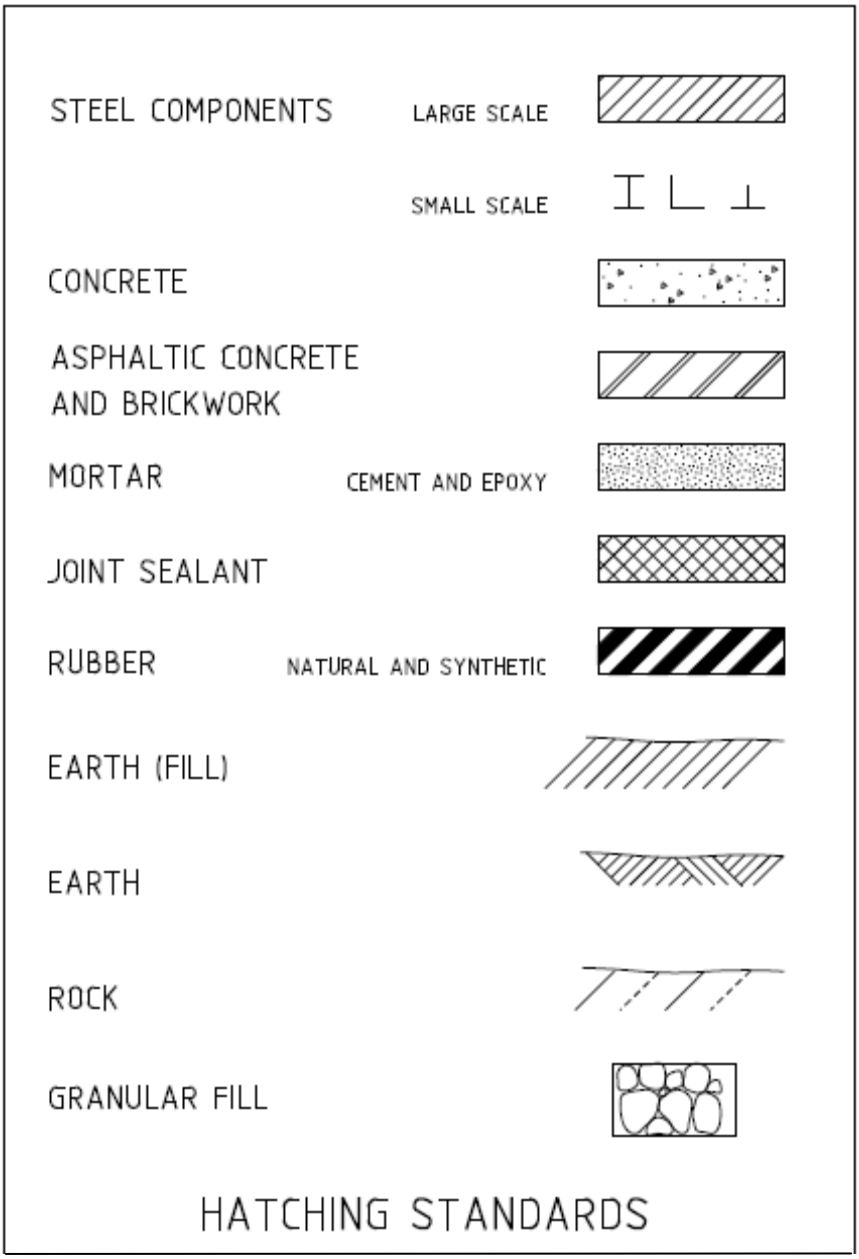
Any subsequent non-standard bar shapes shall be numbered 'BZ', 'CZ' etc. and all non-standard shapes shall be clearly defined in the "BAR SHAPES DIAGRAM" so that bending to the correct size and shape can be achieved.

3.1.6. Appendix A Table Of Line Types

TABLE OF LINE TYPES

TYPE OF LINE	EXAMPLE OF LINE	APPLICATION
CONTINUOUS	0.25mm THICK WHITE IN COLOUR	DIMENSION LINES NOTE LEADERS
	0.35mm THICK RED IN COLOUR	CONCRETE OUTLINES (SCALES BELOW 1:20) STEELWORK IN SECTION (SCALES BELOW 1:10)
	0.5mm THICK GREEN IN COLOUR	CONCRETE OUTLINES (SCALES ABOVE 1:20) REINFORCEMENT AND LIMIT LINES (SCALES BELOW 1:20) STEELWORK IN SECTION (SCALES ABOVE 1:20)
	0.7mm THICK BLUE IN COLOUR	REINFORCEMENT AND LIMIT LINES (SCALES ABOVE 1:20)
DASHED – LONG	0.25mm THICK WHITE IN COLOUR	CONSTRUCTION JOINTS (SCALES BELOW 1:20)
	0.5mm THICK GREEN IN COLOUR	CONSTRUCTION JOINTS (SCALES ABOVE 1:20)
DASHED – SHORT	0.35mm THICK RED IN COLOUR	HIDDEN DETAILS
CHAIN – THIN	0.25mm THICK WHITE IN COLOUR	CENTRELINES
CONTINUOUS ZIG ZAG	0.25mm THICK WHITE IN COLOUR	BREAK LINES
CHAIN – THIN DOUBLE DASHED	0.35mm THICK RED IN COLOUR	EXISTING WORK
CONTINUOUS WAVY	0.25mm THICK WHITE IN COLOUR	DENOTATION OF AMENDMENTS

3.1.7. Appendix B Hatching Standards



3.1.8. Appendix C Abbreviations

Table 1 - Standard Metric Abbreviations

UNIT	*SYMBOL*
Degree (angular)	...o
Degree (Celsius)	^{o}C
Kilogram	kg
Kilometre	km
Kilopascal	kPa
Megapascal	MPa
Metre	m
Millimetre	mm
Minute (angular)	...'
Newton	N
Pascal	Pa
Radian	RAD
Second (angular)	..."
Tonne	t

The arrangement of upper and lower case letters for each of the abbreviations shall be strictly adhered to.

TABLE 2 - ACCEPTABLE ABBREVIATIONS

GENERAL ABBREVIATIONS

WORD(S)	*ABBREVIATION/ SYMBOL*	*WORD(S)*	*ABBREVIATION/ SYMBOL*
Approximate	APPROX	International System of Units (Systems International d'Unites)	SI
Australian Height Datum	AHD		
Average	AV		
Bench Mark	BM	Intersection Point	IP
Calculated High Flood Level	CALC HFL	Maximum	MAX
		Minimum	MIN
Centre-to-Centre,	C/C	Modulus of	
Centres	CTRS	Elasticity	E
Centreline	℄	Near Face	NF
Construction Joint	CJ	No Chamfer or	
Countersink	CSK	Fillet	NCF
Diameter	DIA or Ø	Nominal	NOM
- inside	ID	Number	No
- outside	OD	Pitch Circle Diameter	PCD
		Parallel Flange	
Downstream	DS	Channel	PFC
Drawing Number	DRG NO	Percentage	%
Each Face	EF	Plate	ℙ
Far Face	FF	Polytetraflour-	
Flat	FL	ethylene	PTFE
Head	HD	Polyvinylchloride	PVC
- Cheese	CH HD	Radius	R
- Countersunk	CSK HD	Recovery Peg	RP
- Cup	CUP HD	Reduced Level	RL
- Hexagon	HEX HD	Reinforced Concrete	RC
- Hexagon Socket	HEX SOC HD	Required	REQD
- Mushroom	MUSH HD		
High Flood Level	HFL	Reported High	
Hollow Section		Flood Level	REPORTED HFL
- Circular	CHS	Road	RD
- Rectangular	RHS	Tangent Point	TP
Internal Diameter	ID	Street	ST

TABLE 2 (Cont/d)

WORD(S)	*ABBREVIATION/ SYMBOL*	*WORD(S)*	*ABBREVIATION/ SYMBOL*
Taper Flange Beam	TFB	Vertical Curve	VC
Taper Flange Channel	TFC	Observed High Flood Level	OBSERVED HFL
Typical	TYP	Water Level	
Ultimate Tensile Strength	UTS	- normal water level	NWL
Universal Beam	UB	- mean high water springs	MHWS
Universal Bearing Pile	UBP	- mean high water	MHW
Universal Column	UC	- mean low water	MLW
Unplasticised poly-vinylchloride	UPVC	- mean low water springs	MLWS
Upstream	US		
Ultimate Limit State	ULS		
Ultimate	ULT		

Abbreviations shall not contain a full stop.