

SECTION 13 - SIGNS, FURNITURE, FENCING, GUIDE POSTS AND STEEL BEAM GUARD FENCE.

| | |
|---|----|
| 13.1 SIGNS | 1 |
| 13.1.1 Supply of Materials | 1 |
| 13.1.2 Handling and Storage of Signs | 1 |
| 13.1.3 Conformity with Drawings | 1 |
| 13.1.4 Erection Of Posts..... | 1 |
| 13.1.5 Steel and Timber Posts | 2 |
| 13.1.6 Foundations | 2 |
| 13.1.7 Backfilling of Post Holes | 2 |
| 13.1.8 Erection Of Signs | 3 |
| 13.1.9 Masking Of Signs..... | 4 |
| 13.1.10 Manufacture Of Road Signs | 4 |
| 13.1.11 Inspection And Testing..... | 4 |
| 13.1.12 Approval By The Superintendent..... | 4 |
| 13.2 FURNITURE | 5 |
| 13.2.1 Supply of Materials | 5 |
| 13.2.2 Quality Assurance | 5 |
| 13.2.3 Substrates..... | 5 |
| 13.2.4 Certification..... | 5 |
| 13.2.5 Inspections | 5 |
| 13.2.6 Fabrication And Approval Of Prototype | 5 |
| 13.2.7 Computations | 5 |
| 13.2.8 Shop Drawings..... | 6 |
| 13.2.9 Installation Procedures Manual: | 6 |
| 13.2.10 Maintenance (And Operating) Manuals:..... | 6 |
| 13.2.11 Long Term Supply Of Spare Parts: | 6 |
| 13.2.12 Warranties..... | 6 |
| 13.2.13 Performance And Functional Requirements..... | 7 |
| 13.2.14 Street Furniture - Materials | 8 |
| 13.2.15 Street Furniture – Prototype Manufacture..... | 9 |
| 13.3 FENCING..... | 13 |
| 13.3.1 General..... | 13 |
| 13.3.2 Materials..... | 13 |
| 13.3.3 Construction | 14 |
| 13.3.4 Timber Finishes | 16 |
| 13.3.5 Gates | 16 |
| 13.3.6 Junctions | 16 |
| 13.3.7 Removal of Existing Fences | 16 |
| 13.4 GUIDE POSTS | 17 |
| 13.4.1 General..... | 17 |
| 13.4.2 Durability..... | 17 |
| 13.4.3 Posts..... | 17 |
| 13.4.4 Colour And Surface Finish | 17 |
| 13.4.5 Installation Of Posts | 17 |
| 13.4.6 Delineators..... | 17 |
| 13.4.7 Warranty..... | 17 |
| 13.5 STEEL BEAM GUARD FENCE | 18 |
| 13.5.1 General..... | 18 |
| 13.5.2 Standards..... | 18 |
| 13.5.3 Material Compliance | 18 |

13.5.4 Guard Fence Components..... 18
13.5.5 Installation..... 19

SECTION 13 - SIGNS, FURNITURE, FENCING, GUIDE POSTS AND STEEL BEAM GUARD FENCE

13.1 SIGNS

This section covers the requirements for the handling, storage and erection of signs and sign supports.

13.1.1 Supply of Materials

Unless otherwise specified, all materials shall be supplied by the Contractor.

13.1.2 Handling and Storage of Signs

The Contractor shall be responsible for loading and transporting the signs, posts and fittings to the sign locations as specified and shall be responsible for any damage to the signs from any cause after taking delivery and up to completion of installation.

Where a Contractor stores signs prior to installation they shall be stored in the following manner:

- (i) Face to face with a layer of protective material between faces to prevent damage.
- (ii) Vertically and clear of the ground with adequate care to protect the edges of the signs.
- (iii) Stacked in numbers small enough to prevent damage to any sign due to the combined weight of the signs.
- (iv) Adequately protected from ingress of moisture between sign face and packing or other protective material.

13.1.3 Conformity with Drawings

(a) Foundations

Concrete foundations shall be poured such that the finished surface of foundation is flush with the finished surface at the base of the sign.

(b) Posts

- (i) Posts are to be straight and plumb to within a tolerance of 1 in 100.
- (ii) Post tops are to be 50± 10 mm below the top edge of the signboard.

(c) Signs

- (i) Signs are to be mounted level to within a tolerance of 1 in 100.
- (ii) Signs shall be mounted symmetrically on their posts unless shown as offset in the assembly drawings or directed by the Superintendent.
- (iii) Where an assembly consists of two or more signs above each other, the signs shall be mounted with the adjacent edges touching unless otherwise shown on the sign assembly drawings.
- (iv) The faces of the signs shall present an even surface free from twists, cracks, indentations or any other faults after erection.

13.1.4 Erection Of Posts

Details of post erection are shown on the Sign and Post Schedule.

HP Before the erection of posts proceeds, the Superintendent will review and confirm the required positions of all posts and signs.

13.1.5 Steel and Timber Posts

Timber and steel posts supplied by Council will generally be in the standard lengths listed below.

| | |
|-------------------------------------|-----------|
| For 32 mm Nominal Bore steel posts | - 1625 mm |
| | - 2165 mm |
| For 50 mm Nominal Bore steel posts | - 2800 mm |
| | - 3250 mm |
| | - 3700 mm |
| | - 4600 mm |
| For 180 x 100 mm Frangible Hardwood | - 4800 mm |
| | - 5400 mm |
| | - 6000 mm |
| | - 6600 mm |

The Contractor shall cut posts to the length required so as to minimise wastage and to conform with the requirements of Clause 13.1.4 and the Sign and Post Schedule.

Where posts are to be mounted in sockets, the Contractor shall drill a hole in the post and bolt the post to the socket to prevent movement or rotation of the post in the socket.

Signs to be mounted on two or more posts shall have posts positioned such that the sign face is rotated away from the approaching traffic to avoid specular reflection. Unless otherwise shown on the drawings, posts shall be positioned such that the sign is rotated away from the normal cross section by an amount equal to one tenth of the width of the sign.

Hardwood posts specified as frangible shall be set such that the centre of the lower hole of each post is between 50 mm and 125 mm above the finished surface at the base of the post.

13.1.6 Foundations

All posts shall be set in footings to the depths shown in the Sign and Post Schedule. Foundation hole diameters shall be as follows:

| | |
|--|-------------------|
| For 32 mm and 50 mm Nominal Bore steel posts | - 225 mm diameter |
| For 80 mm to 150 mm Nominal Bore steel posts | - 300 mm diameter |
| For 180 mm x 100 mm Frangible Hardwood posts | - 300 mm diameter |

Concrete used in foundations shall be 20 Mpa strength grade complying with the requirements of AS 3600 - Concrete Structures.

Where posts are required to be mounted in sockets, the sockets shall be installed to the same depth, as indicated for the parent post with socket sizes as follows:

| <u>Post Size</u> | <u>Socket Size</u> |
|-------------------------|-------------------------|
| 32 mm Nominal Bore pipe | 50 mm Nominal Bore pipe |
| 50 mm Nominal Bore pipe | 65 mm Nominal Bore pipe |

The sockets shall be plugged at the bottom and shall protrude between 20 mm and 30 mm above the finished surface of the concrete foundation.

13.1.7 Backfilling of Post Holes

Posts shall be installed to the depths shown in the Sign and Post Schedule.

(i) For 32 and 50 mm Nominal Bore Steel Posts, the following shall apply:

- * Concrete collars are to be placed at the top and bottom of the post hole.
- * Posts carrying up to 0.6 m² of signs area each are to have two concrete collars 100 mm deep.
- * Posts carrying more than 0.6 m² of sign area each are to have two concrete collars each 150 mm deep.

- (ii) For 180 mm x 100 mm Frangible Hardwood Timber Posts, the following shall apply:

* Frangible Hardwood Posts shall be erected in accordance with the drawings.

* Select backfill with 4% cement added shall be used. If the post is erected in a concrete paved surface, an upper concrete collar 250 mm deep shall be provided.

- (iii) Slip Base Strutted Aluminium Posts

All foundations shall be 400 mm diameter x 1200 mm deep.

Slip base strutted aluminium sign posts shall be erected in accordance with the drawings.

Footing plates shall be set in concrete such that the top of the footing plate is between 50 mm and 125 mm above the finished surface at the base of the post or strut as appropriate.

The vertical posts will be supplied cut to correct length and with post base and cap installed. The struts will be supplied overlength with the adjustable base only installed.

The Contractor shall cut the strut to correct length and install the strut to post clamp.

13.1.8 Erection Of Signs

Details of sign erection are shown on the Sign and Post Schedule.

- (a) Signs shall be attached to the post(s) or structures using the type and number of fittings as specified in the schedule. When a sign is braced it should be attached to the post at every intersection point between a post and a sign bracing member.
- (b) Where a sign assembly consists of two or more signs, the signs shall be mounted in accordance with the sign assembly drawings.
- (c) Signs shall be mounted to:
- (i) Within a tolerance of ± 40 mm of the height specified in the Sign and Post Schedule measured from the bottom of the sign or sign assembly to the lip of the kerb or edge of shoulder nearest the sign unless otherwise indicated in the drawings.
 - (ii) Within a tolerance of ± 100 mm of the pegged sign location or specified location unless otherwise indicated in the drawings.
- (d) When a sign is to be mounted on frangible posts on a cut batter having a slope steeper than or equal to 2:1, the mounting height at the shorter post may be reduced providing that:
- (i) the uphill corner of the sign is a minimum of 800 mm above the ground at that point;
 - (ii) the sign at the longer post is 2200 mm minimum above the ground at that point.
- (e) Where a sign is to be mounted on a utility pole with stainless steel straps, the brackets shall be attached to the pole using stainless steel strapping having a minimum width of 12 mm and a minimum breaking strain of 6.5 kN.
- (f) Where the drawings indicate that a sign is to be erected so as to face oncoming traffic directly, it shall be mounted on posts which have been rotated in accordance with the requirements of clause 13.1.5, with the exception of signs mounted on structures over traffic lanes.
- (g) Where signs are to be removed or relocated, as specified in the Schedule, the Contractor shall dismantle the assembly and transport the signs, posts and fittings to the specified new location or to the VicRoads Site Compound as appropriate. Post holes shall be backfilled and compacted to the finished surface. Relocated signs shall be erected in their new position as specified.
- (h) After erection of each sign all stiffening bars are to be removed.

13.1.9 Masking Of Signs

Where indicated in the Schedule the Contractor shall arrange to mask the nominated sign(s) by placing a black plastic sheet over the face of the sign which shall be held in position by wire mesh over the sign.

Adhesive material shall only be applied to the plastic and not be applied to either the front or rear face of the signboard.

Signs to be masked are marked "m" in the Sign and Post Schedule.

The size of the masking material and its method of attachment shall be such that the sign is effectively and securely covered, either in whole or in part, as required, at all times and under all conditions.

13.1.10 Manufacture Of Road Signs

The manufacture and packaging of all road signs, both permanent and temporary, which are made with steel or aluminium substrates, shall comply with Section 860 – Manufacture of Road Signs of the VicRoads specification.

13.1.11 Inspection And Testing

- (1) The Superintendent reserves the right to inspect any phase of the manufacturing process.
- (2) On request at any time during the currency of the Contract, the Contractor shall provide a test panel 200 mm square, typical of any stage of production including unapplied retro-reflective, fluorescent or non-reflective material. For testing silk screened work the Contractor shall supply a testing screen which will print his trade mark or other identification on portion of the panel together with a strip at least 70 mm wide across the panel. The Superintendent may require proofs to be taken from any silk screen before production commences.
- (3) All tests shall be conducted in accordance with the current test methods used by VicRoads.

13.1.12 Approval By The Superintendent

In considering any request for an approval required by this Section, the Superintendent will take into account:

- (a) evidence of use in maintenance of similar signs;
- (b) performance under similar service conditions;
- (c) manufacturers specifications and other product details;
- (d) conformance with relevant Australian Standard requirements;

The Superintendent's approval may be conditional and require the Contractor to use materials in a specified manner.

13.2 FURNITURE

This section covers the requirements for the supply, handling, storage and installation of furniture for streetscape, landscape and parks works.

13.2.1 Supply of Materials

Unless otherwise specified, all materials shall be supplied by the Contractor.

13.2.2 Quality Assurance

Products shall be reputable proprietary products, factory manufactured under ISO 9002.

All performance design shall comply with the BCA.

Samples: Submit representative samples of products and materials, including finishes and representative factory fabrications and site-installed assemblies.

Include samples for:

- All products and materials visible in the completed work.
- Metal sheet, sections and extrusions, and finishes.
- Fixings, hardware, trim, sealants and accessories.
- Protective and decorative coatings.

13.2.3 Substrates

Commencing installation will be construed as complete acceptance of substrates, base-structure and site conditions, including acceptance of reference lines and marks, and embedments in base structure.

13.2.4 Certification

The contractor shall be required to inspect the Contract Documents, and certify that suitability of proposed materials and products for the relevant substrates and conditions, during the tender period.

13.2.5 Inspections

The contractor is to give 3 days notice to the superintendent so that they may inspect the following stages of work:

- Fabricated assemblies at the factory ready for delivery.
- Substrates, including sub-framing, prepared and ready for the installation, with anchor brackets and other attachments fixed in place.
- All work to be covered over, before delivery.
- First installed occurrence of each type of work.
- The superintendent may require fabricated and finished work to be inspected and accepted on an interim basis prior to delivery to site.

13.2.6 Fabrication And Approval Of Prototype

The contractor shall allow for the complete fabrication of prototype street furniture for approval by the Superintendent in accordance with the provisions of clause 13.2.15.

The approved prototype will be the standard and all remaining furniture shall conform to this standard. Furniture which does not meet the standard of the approved prototype shall be rejected.

13.2.7 Computations

Submit computations for all dead and live loads (including human impact, maintenance and service loads) and safety factors in accordance with the relevant Standards.

Submit manufacturer's standard (load and span) tables. Submit additional computations to demonstrate compliance with requirements if not indicated in standard tables.

Prepare the required computations.

Submit certification of all computations by an approved independent qualified experienced engineer in accordance with the requirements of the BCA Form 13. Submit name and details of certifying engineer.

Refer to relevant Standards, including:

- ? AS 1170 Minimum design loads on structures (SAA Loading Code).
- ? AS 1170.1 Dead and live loads and load combinations.
- ? AS 1170.2 Wind loads.
- ? AS 1657 Fixed platforms, walkways, stairways, and ladders - Design, construction & installation.
- ? AS 4100 Steel structures.

Include computations for:

- Framing, anchorages and fixings supported from base-structure.
- Sizes of members and sections.
- Reinforcement of connections.
- Types and magnitudes of the design loads on the fixing anchors or attachments.
- Confirmation of all performance criteria, in particular, all movement allowances.

If computations for fixings and connections are not included, carry out tests and submit test results to demonstrate adequate structural capability.

13.2.8 Shop Drawings

Submit comprehensive, detailed and dimensioned shop drawings to indicate all set out and construction details where proto-type furniture is required.

Comply with relevant Standards.

Do not commence manufacture until approval to use the relevant shop drawings has been obtained from the Superintendent.

Include shop drawings for and indicate:

- i) Components:
 - Full size profiles of all members, including descriptions of structural properties and specifications of materials. Framing, anchorages and fixings supported from base-structure, and embedments in the base-structure, if required.
- ii) Installation and assembly:
 - Indicate methods of installation and assembly at all junctions, including sealing and fixing, indicated by three-dimensional and exploded views if requested.
- iii) Installation tolerances.
- iv) Hardware, fittings, trim and accessories.
- v) Control of moisture, location, number and size of weepholes.

13.2.9 Installation Procedures Manual:

Submit an installation manual containing comprehensive descriptions of procedures, equipment and personnel required. Include any special training required. Include manufacturer's installation manuals and recommendations.

13.2.10 Maintenance (And Operating) Manuals:

Submit a comprehensive manual containing recommendations for operating, and routine cleaning and maintenance, and all information required to ensure the full service capability of the work, including source of replacement components, and methods of replacement of damaged components, for a period not less than the warranty period.

13.2.11 Long Term Supply Of Spare Parts:

Include with the warranty, a certified undertaking from the manufacturers and/or suppliers that all spare parts and replacement items will be available off-the-shelf, or with a lead time not exceeding 4 weeks, for a period of 8 years from date of Practical Completion.

13.2.12 Warranties

Provide an approved warranty from Date of Practical Completion for a period of 10 years. (the "warranty period"). Include all manufacturers' product warranties.

13.2.13 Performance And Functional Requirements

Service life: The nominal service life of the system shall be 20 years.

i) Corrosion Protection

Provide protective coatings to prevent corrosion of metal components, including concealed and structural components.

All fixings required for the attachment and support of the system to the base-structure shall be permanently resistant to corrosion and completely protected from the weather.

ii) Compatibility of Adjacent Materials

Adjacent materials and products shall be electrolytically and chemically compatible with each other and with relevant substrates, including adjacent work by other subcontractors.

a) Electrolytic compatibility

Metals shall be isolated from adjacent dissimilar metals by approved separation coatings or spacers to prevent corrosion, perforation of protective coatings, or other damage due to electrolytic action. Separation coatings or spacers shall not be visible in the finished work.

Submit details of separation coatings, spacers and other means of isolation between dissimilar or incompatible materials

b) Chemical compatibility

Chemical compounds including adhesives and sealants, and all chemical additives shall be non-staining and non-bleeding to adjacent materials.

iii) Services reticulation

Make provision for concealed reticulation of required services. Provide suitable openings and passages for the unrestricted installation of service pipes and wires by the relevant services subcontractors. Coordinate as required.

Provide approved removable covers where required for maintenance or replacement.

iv) Dimensional stability:

Metal work shall have adequate dimensional stability to function properly and prevent damage to adjacent or applied work by others.

v) Load Requirements

Design and install all components, including anchorages and fixings, to carry all temporary and permanent loads, individually and in combination without causing failure, including cracking, bowing, distortion and looseness, lack of rigidity, dislodgement by wind forces, seismic activity, excessive deflection, or defects which would cause damage to adjacent or applied work by others. Comply with the relevant Standards.

vi) Connection Requirements

Design and provide complete connection assemblies including anchors, brackets and fixings to install the work in its correct position so that all loads can be transferred from the work to the base structure in accordance with the design requirements in a manner which prevents excessive joint displacement, slippage or distortion. Connections shall provide for all movement requirements.

vii) Concrete Substrates

Provide contingency procedures for all typical concrete substrate conditions and deficiencies including reinforcement clash, excessive out-of-tolerance concrete, concrete defects, clash with concrete joints and mislocated, and incorrect embedments.

Check all relevant drawings to verify bracket fixing locations.

viii) Metalwork Fixings

Provide all necessary fixings, flanges, brackets and the like so that work can be assembled and installed in a neat, substantial manner. Design of connections not indicated on the Drawings shall be developed and indicated on the shop drawings.

Factory connections for steel fabrications shall be welded and site connections bolted unless otherwise approved.

Thickness of metal and details of assembly and support shall be such as to provide ample strength and stiffness.

Joints and connections shall be formed to exclude water and to enable draining during galvanizing.

13.2.14 Street Furniture - Materials**i) Banner Pole**

Supply and install banner pole(s) as specified on the drawings.

ii) Bicycle Rack

Supply and install bicycle rack(s) as specified on the drawings and in accordance with drawing SD 530.

iii) Bollard

Supply and install bollard(s) as specified on the drawings and in accordance with SD 505 (CBD Area) or SD 506, SD 507, SD 508 as applicable.

iv) Bollard & Chain

Supply and install bollard and chain as specified on the drawings.

v) Bus Shelter

Supply and install bus shelter as specified on the drawings.

vi) Drinking Fountain

Supply and install drinking fountain as specified on the drawings.

vii) Lighting

Supply and install street lighting as specified on the drawings.

viii) Litter Bin Enclosure

Supply and install litter bin enclosure as specified on the drawings and in accordance with SD 510. Steel perforated body with specified powder coat finish.

ix) Picnic Table and Seats

Supply and install picnic table and seats as specified on the drawings and in accordance with SD 700.

x) Recycle Bin

Supply and install recycling bin as specified on the drawings and in accordance with SD 511. Steel perforated body with Blaze Blue powder coat finish.

xi) Seat

Supply and install seat as specified on the drawings and in accordance with SD 500.

xii) Signage

Supply and install signage as specified on the drawings.

xiii) Street Cafe Screen

Supply and install street café screen as specified on the drawings.
Allow for removable advertising logos on panels.

xiv) Street Light (Non Standard)

Supply and install non-standard street light as specified on the drawings.

xv) Tree Grate

Supply and install tree grate as specified on the drawings.

xvi) Tree Guard

Supply and install tree guard as specified on the drawings.

13.2.15 Street Furniture – Prototype Manufacture**13.2.15.1 STEELWORK****i) Materials**

Provide all required steel materials in the profiles, sizes and grades indicated on the Drawings. Relevant Standards for hot rolled products:

| | |
|---------|---|
| AS 1163 | Structural steel hollow sections |
| AS 3678 | Structural steel - Hot-rolled plates, floor plates and slabs. |
| AS 3679 | Structural steel. |
| AS 4100 | Steel structures. |

Cold rolled products:

| | |
|---------|---|
| AS 1397 | Steel sheet and strip - Hot-dipped zinc-coated or aluminum/zinc coated. |
| AS 1538 | Cold-formed steel structures code. |
| AS 1595 | Cold-rolled unalloyed low carbon steel sheet and strip. |
| AS 2551 | Steel sheet and strip - Cold rolled, electrolytic zinc-coated. |

ii) Protective coatings

Provide all protective coatings of the types indicated on the Drawings and as required for corrosion resistance conditions.

iii) Steel Work Fabrication

Fabricate steelwork in accordance with approved shop drawings, prototypes and relevant Standards.

Cut edges, drilled holes, riveted joints and flat sheets shall be clean, neat, free from burrs and indentations. Remove sharp edges without excessive radiusing. Form bends in tubes without unduly deforming the cross section.

Relevant Standards:

| | |
|---------|------------------------------------|
| AS 1538 | Cold-formed steel structures code. |
| AS 4100 | Steel Structures. |

iv) Joints and Junctions

Provide holes and connections for site assembly and to accommodate work of others as required.

Holes shall be drilled, or punched and reamed, perpendicular to the surface.

Holes shall not be made or enlarged by burning or flame cutting. Holes made in this manner may result in rejection of any items or assemblies in which such holes occur.

v) Galvanizing

Provide suitable joints, holes and connections in galvanized work to exclude water and permit draining during galvanizing.

13.2.15.2 STAINLESS STEEL WORK

i) Materials

Provide stainless steel in the required profiles, finishes sizes and grades in accordance with relevant Codes. Stainless steel generally shall be Grade 304 or 316.

Relevant Codes:

| | |
|-----------|---|
| AS 1449 | Wrought alloy steels - Stainless and heat-resisting steel plate, sheet and strip. |
| AS 1769 | Welded stainless steel tubes for plumbing applications. |
| AS 2837 | Wrought alloy steels - Stainless steel bars and semi-finished products. |
| ASTM A480 | Specification for general requirements for flat-rolled stainless and heat resisting steel plate, sheet and strip. |
| AWRA | Australian Welding Research Association (now incorporated into the Welding Technology Industries Association) |
| AWRA 13 | Technical Note 13: Stainless steels for corrosive environments. |
| AWRA 16 | Technical Note 16: Welding of stainless steel. |

Unless otherwise indicated on Drawings the required finish in accordance with ASTM A480 shall be:

"4" General purpose polished finish.

ii) Stainless Steel Fabrication

Fabricate stainless steel in accordance with approved shop drawings and relevant Codes to match approved samples and prototypes. Ensure that stainless steel surfaces are not contaminated by mild steel particles.

Relevant Codes: AWRA Australian Welding Research Association (now incorporated into the Welding Technology Industries Association) - Technical Note 16: Welding of stainless steel.

Stainless Steel fabrication shall be performed in accordance with the following methods:

a) Joints:

Produce smooth unbroken surfaces at joints. Ensure continuity of finish, colour and texture, by grinding, buffing or methods appropriate to the required finish without surface variations. Scribe and **fit** joints accurately. Make end-to-end joints over an internal sleeve.

b) Bends:

Make changes of direction in tube by evenly curved bends. Form bends without unduly deforming the cross section.

c) Free Ends:

Seal the free ends of pipes with fabricated or purpose made end caps.

d) Holes:

Provide holes and connections for site assembly and to accommodate the work of others as required. Holes to stainless steel shall be drilled. Holes formed by other methods may result in rejection of any items or assemblies in which such holes occur.

13.2.15.3 WELDING

Carry out all welding, including detailing to all joints, welding procedures, appearance and quality of welds, and correction of defective work in accordance with approved samples and AS 1554 for steel welding and AS 1665 for aluminum welding.

Welded parts shall be accurately fabricated to ensure proper fit. All welding equipment shall be of suitable type and in good condition.

Relevant Standards

| | |
|---------------|--|
| AS 1553 | Covered electrodes for welding. |
| AS/NZS 1554 | Structural steel welding. (SAA Structural Steel Welding Code). |
| AS/NZS 1554.1 | Welding of steel structures. |
| AS 1665 | Welding of aluminum structures. |
| AS 1796 | Certification of welders and welding supervisors. |

All welding shall be continuous unless otherwise approved. Tack welding or skip welding will not be approved where items are to be galvanized. Finished welds shall be descaled and free of surface and internal cracks, slag inclusion, and porosity. Visible welds shall ground smooth. Non-visible welds shall be ground smooth to ensure uniform galvanizing if uneven or rough.

13.2.15.4 HOT DIP GALVANISING

Where required, provide hot dip galvanizing in accordance with AS 1650 by approved applicators. If required, submit a certificate that the galvanizing complies with AS 1650.

Include all framing and bracket fixings. Prepare work to be galvanized in accordance with AS 1627 and AS 2312 after completion of fabrication.

Relevant Standards:

| | |
|---------|--|
| AS 1214 | Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series). |
| AS 1397 | Steel sheet and strip - Hot-dipped zinc-coated or aluminum/zinc coated. |
| AS 1627 | Metal finishing - Preparation and pretreatment of surface. |
| AS 1650 | Hot-dipped galvanized coatings on ferrous articles. |
| AS 2312 | Guide to the protection of iron and steel against exterior atmospheric corrosion. |
| GAA | Galvanizes Association of Australia: "Hot Dip Galvanizing". |

Prior to galvanizing, surfaces to be galvanized shall be cleaned of all dirt, weld spatter, grease, slag, oil, paint or other deleterious materials in accordance with AS 1627.5, preparation Class to suite galvanizing requirements.

The galvanized coating shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defects including lumps, blisters, gritty areas, uncoated spots, black spots, dross, flux or the like, detrimental to the function of the article.

Passivate galvanized surfaces to be cast into or in contact with concrete by dipping in 0.1% sodium dichromate solution.

13.2.15.5 ANCHORS

Provide all required anchors and fixings to assemble and install work in a neat, secure manner, including bolts, washers, screws, rivets, welds, proprietary fasteners, and the like, templates and other accessories of approved types for a complete installation.

Fixings shall be of the type and size appropriate for the purpose and location in accordance with manufacturer's instructions, be sufficient to transmit the imposed loads and stresses and ensure the rigidity of the assembly. All fixings shall be new and undamaged.

Fixings shall be corrosion resistant, and non-staining to adjacent work. Fixings shall be concealed unless otherwise approved or indicated on the Drawings.

Co-ordinate with others if required to ensure anchorages are provided and accurately built-into base structure. Ensure that all bolts and similar fixings are tight at completion of installation.

Installation of anchorages in concrete shall comply with AS 3600, Section 14.

All items shall (be):

- ? Appropriate to the substrates and members to be fixed or assembled.
- ? Ensure the rigidity of the assembly.
- ? Corrosion resistant equal to or exceeding the members to be fixed or assembled.
- ? Be capable of transmitting the structural loads and stresses imposed.
- ? Installed to prevent galvanic corrosion.
- ? Allow generous on-site adjustment in accordance with approved shop drawings.
- ? Installed to accommodate all substrate movements and thermal movement of the members to be fixed or assembled.

Fixings for internal work shall be not less than cadmium plated steel, electroplated in accordance with AS 1897.

Fixings for external work or where exposed to moisture shall be or hot-dip galvanized to AS B 193, AS1650 or AS 1214. Nickel plated steel shall not be used.

13.2.15.6 EXPANSION AND CHEMICAL ANCHORS

Provide approved proprietary expansion or chemical anchorages, with corrosion-resistant finish, suitable for the substrates and conditions, with holding power in accordance with manufacturer's recommendations.

Products which may be approved include those manufactured by Hilti or Ramset Fasteners, or approved equivalent.

13.2.15.7 PACKERS, SPACERS AND SHIMS

Provide spacers and shims as required to ensure proper installation in correct locations and to requirements as follows:

- ? Shims shall be stainless steel.
- ? Spacers shall be high density polyethylene or hard neoprene

13.3 FENCING

13.3.1 General

This section covers the requirements for the construction of fencing at the locations shown on the drawings or described in this specification.

All materials shall be supplied by the Contractor.

Unless otherwise indicated on drawings, the outside face of fences on the property boundaries shall be on the title boundary.

Length measurements shall be made parallel to the ground slope, and all grading irregularities shall be evened out to a straight line.

Fences that are to remain in place but have been damaged by the Contractor shall be repaired or replaced to the satisfaction of the Superintendent at the Contractor's expense.

13.3.2 Materials

Material for fencing shall conform with the following:

(a) Untreated Timber Posts and Stays

Untreated timber posts and stays shall be Class 1 or 2 durability, or as specified on the detailed drawings, and shall be cut from sound timber, stripped of all bark and backed off with ends sawn square and dried to equilibrium moisture content. Posts and stays shall be straight and of dimensions not less than shown on the detailed drawings.

(b) Treated Timber Posts and Stays

Treated timber posts and stays shall be hardwood or pine and be of sound timber treated to comply with the requirements for Hazard Level 4 protection specified in AS 1604 - Timber, Preservative Treated, Sawn and Round. Treated timber posts and stays shall be of round or sawn rectangular shape and be free of any defect making them unsuitable for the purpose intended.

Round posts and stays shall be peeled to remove all bark, except that strips of inner bark may remain if not over 15 mm wide or over 75 mm long. All knots shall be trimmed flush with the sides, spurs and splinters removed and ends cut square.

The slope of grain in sawn rectangular posts, for the full length, shall not exceed 1 in 10; and knots shall be sound, tight, well spaced, and shall not exceed 40 mm in size in any face.

Treated timber posts and stays shall be straight and of dimensions not less than shown on the detailed drawings. Posts to be driven shall be square ended, or shall be blunt pointed prior to treatment to a bevel angle not exceeding 30 degrees.

(c) Tubular Steel Posts, Rails and Stays

Tubular steel posts, rails and stays shall be of commercial quality hot dipped galvanised steel pipe conforming to the following Australian Standards: AS 1074, AS 1163 C250L0 and AS/NZS 4792 (galvanised pipe), free from distortion and with the galvanising intact.

Posts shall be properly adapted, before galvanising, to provide means for attaching the fencing to the posts in a manner that will not damage the posts or fencing material, and shall be fitted with watertight galvanised tops.

Tubular steel posts, rails and stays shall be of the dimensions shown on the detailed drawings, and shall be medium (blue band) unless specified otherwise.

(d) Steel Posts other than Tubular Steel Posts

Non-tubular steel posts shall be of "Star" or other specified cross section and shall be of commercial quality of the lengths shown on the detailed drawings.

(e) Concrete Posts

Concrete posts shall be steel reinforced and of good commercial quality of the lengths shown on the drawings.

(f) Droppers

Timber droppers shall be sawn hardwood or pine free from cross grain and large knots and of the length shown on the detailed drawings.

Bored hardwood droppers shall be of 50 mm x 38 mm nominal size timber. Treated hardwood droppers attached without boring shall be not less than 35 mm x 19 mm section.

Pine droppers shall be 42 mm x 35 mm minimum size timber and be pressure treated with preservative.

Metal droppers shall be of commercial quality of the lengths shown on the drawings.

(g) Wire

Wire shall be galvanised and conform with the appropriate Australian Standards and be of the gauge and type specified in the detailed drawings.

Fabricated wire fencing shall be of a commercial type. The width, mesh and gauge shall be as specified or as shown on the detailed drawings.

(h) Gates

Gates shall be good commercial quality of the type and dimensions specified or shown on the detailed drawings.

(i) Miscellaneous Materials

All ferrous bolts, nuts, ties, staples and fittings for fences and gates shall be galvanised and of commercial quality and design.

Portland cement concrete shall be produced from commercially available aggregates and cement and shall contain not less than 240 kg of cement per cubic metre.

(j) Electrical Insulation Materials

All fittings shall be good commercial quality of the type and dimensions specified or shown on the drawings.

13.3.3 Construction

Fences shall be constructed true to the lines pegged on the ground. All logs, stumps, saplings and undergrowth within 1 m of the fence line, and all trees which will interfere with proper construction of the fence shall be removed and disposed of by the Contractor. Any high points which interfere with the placing of wire or wire netting shall be cut down to provide the clearance shown on the detailed drawings, and any low spots shall be filled.

Fences shall be constructed in accordance with the drawings. All posts shall be set in line so that the tops be uniform without sudden dips or irregularities.

Unless otherwise specified, surplus earth from holes and trimming shall be spread within the road reserve. All offcut material to be removed by the Contractor and the area shall be left clean and tidy on completion of the work.

(a) Post and Wire Fences

Timber and concrete posts shall be set in dug or drilled holes, except that posts of treated round timber may be driven provided the method of driving does not damage the post. Posts shall be set solidly and any space left around the posts shall be backfilled and the backfilling compacted. Posts to be driven shall be driven small end down. Other posts shall be placed butt end down.

Steel posts shall be set by driving by a method that does not damage the post.

At all grade changes where posts are liable to be lifted by strained wires, posts shall be at least 2.1 m long, set at least 0.9 m into the ground and tied down.

Strainer assemblies as shown on the detailed drawings shall be provided at all ends, angles, abrupt changes of grade, and intersections of cross fences. Intermediate strainer assemblies shall be provided on straights at intervals not exceeding 200 m, and spaced to the best advantage in the circumstances.

Strainer assemblies at ends and gates shall be single strainer except where provision of double strainer assemblies is specified. Intermediate strainer assemblies shall be single strainer assemblies with both diagonals braced. Corner posts shall be braced in two directions and gate posts shall be braced in one direction.

Plain wires shall be reeved through holes drilled in the posts except that where treated round posts are used wires may be attached with staples after straining. The length of staples shall be 50 mm for pine posts and 40 mm for hardwood posts. Barbed wire shall be secured with galvanised tie wire of not less than 2.5 mm diameter passed through holes bored in the posts, and twisted to the barbed wire on each side of the post, or shall be stapled to treated posts with staples.

Top and bottom wires shall be firmly attached to droppers by preformed ties or twisted galvanised tie wire of not less than 2.5 mm diameter. Intermediate wires shall be similarly attached or shall be threaded through holes bored in the droppers.

(b) Wire Netting Fences

Posts and wire shall be erected as for post and wire fences. Netting shall be correctly tightened between posts, and shall be fastened to timber posts with 25 mm staples at 150 mm intervals and to each wire with 2.5 mm diameter galvanised wire or clips at intervals not exceeding 1 m.

(c) Wire Mesh Fences

Posts and wire shall be erected as for post and wire fences.

Wire mesh shall be attached to posts and droppers by stapling or tying the top and bottom line wires and at least every alternate intermediate wire to each post after straining.

(d) Chain Mesh Fences (oval fencing)

Posts shall be set in concrete footings of the dimensions shown on the detailed drawings, with the top of the concrete crowned to shed water. End, corner and gate posts shall be braced as shown on the detailed drawings. Line posts shall be braced as shown on the detailed drawings at not more than 120 m intervals.

Chainwire to fence and gates shall be black PVC coated 315 mm diameter heavy galvanised wire to AS1650 (Type A) by 45mm mesh, 1200 mm high. Posts and rails to be light (yellow band) galvanised pipe with posts spaced at 3.0m centres and black painted or powder coated.

Chain wire shall be tightened and securely fastened to posts and top and bottom rails on the side shown on the drawings.

Fastening to end, corner and gate posts shall be by lacing through each outer mesh with black PVC coated 2.5 mm diameter galvanised tie wire. Chain wire shall be fastened to line posts and rails with black PVC coated 25 mm diameter galvanised tie wire or clips. The fastenings shall be spaced at not more than 400 mm intervals on line posts and at not more than 500 mm intervals on rails.

(e) Chain Mesh Fences (security fences)

Posts shall be set in concrete footings of the dimensions shown on the detailed drawings, with the top of the concrete crowned to shed water. End, corner and gate posts shall be braced as shown on the detailed drawings. Line posts shall be braced as shown on the detailed drawings at not more than 120 m intervals.

Chainwire to fence and gates shall be black PVC coated 2.5 mm diameter heavy galvanised wire to AS1650 (Type A) by 45mm mesh, 1800 mm high. Posts to be medium (blue band) galvanised pipe with posts spaced at 3.0m centres and black painted or powder coated.

Chain wire shall be tightened and securely fastened to posts and line wires on the side shown on the drawings. Black PVC coated 3 strand double galvanised wire to be tensioned between posts for mesh support and tied with galvanised clips at 100mm centres and two strands of double galvanised barbed wire tensioned at top of fence.

Fastening to end, corner and gate posts shall be by lacing through each outer mesh with black PVC coated 2.5 mm diameter galvanised tie wire. Chain wire shall be fastened to line posts and line wires with black PVC coated 2.5 mm diameter galvanised tie wire or clips. The fastenings shall be spaced at not more than 400 mm intervals on line posts and at not more than 500 mm intervals on line wires.

(f) Steel Post and Welded Mesh Fences

Supply and install weld-mesh fence and gates to the manufacturer's recommendations. Posts shall be set in concrete footings of the dimensions shown in the detailed drawings, with the top of the concrete crowned to shed water.

Welded mesh panels shall be attached to posts with good commercial quality galvanised fittings.

(g) Paling Fences

Supply and install timber paling fence as detailed. Posts shall be set in concrete and the fence constructed as shown on the detailed drawings. No overcutting of posts shall be permitted.

Fix rails using 65mmx28mm galvanised flat head nails, stagger alternatively fixing of rails to post.

Palings shall be straight and clean, and free from splits and major defects. Lap palings to allow 30mm overlap over each edge. Nail each overlap and base paling using 50x2.8mm galvanised flat head nail.

(h) Picket Fence

Supply and install picket fences as detailed. No overcutting of posts shall be permitted. Fix rails using 100 x 4.75mm galvanised broad head nails, pre-drill nail holes with drill bit 50% of nail width. Set rails so joints are on alternative posts. Fix pickets using two galvanised 50 x 2.8mm broad head nails Pre-drill holes on all pickets with drill bit 50% of nail width.

13.3.4 Timber Finishes

Timber finishes shall be in accordance with the drawings. Staining shall be as specified or an approved equivalent. All fencing shall be stained on all external surfaces, and shall include all members. Any parts that will be covered or otherwise inaccessible to stain upon completion, shall be stained during the erection of the fence.

13.3.5 Gates

The Contractor shall install gates of the types and sizes specified, or shown on the drawings. Gate posts shall be of the dimensions shown on the detailed drawings and be firmly set into the ground to the depth specified.

Each post shall be fitted with a strut as shown on the detailed drawings. Tubular metal posts shall be set in concrete as detailed. At gateways in wire netting fences, a timber sill shall be set tightly between the posts and flush with the ground.

All gates shall be hung with hinges securely attached to the gate posts. Each gate shall be fitted with a catch. For wire netting fences, gates shall be finished so as to be rabbitproof when closed.

13.3.6 Junctions

Existing cross fences shall be connected to the new fences. Corner posts with braces for every direction of strain shall be placed at the junction with existing fences. The wire in existing fences shall be strained and securely fastened to the posts.

13.3.7 Removal of Existing Fences

Where specified, existing fences shall be removed and re-erected to the pattern existing prior to removal.

Fences no longer required shall be removed. All other materials with the exception of gates become the property of the Contractor and shall be removed from the site. All post holes shall be backfilled and the backfilling compacted.

13.4 GUIDE POSTS

13.4.1 General

This section covers the requirements for the supply and installation of guide posts at the locations shown on the drawings or as directed by the Superintendent.

13.4.2 Durability

All materials used will retain 85% of their original colour, appearance and physical properties and be resistant to ultraviolet radiation for at least five (5) years when exposed to all weather conditions experienced in Victoria.

13.4.3 Posts

(a) Strength

Posts shall be made from material that is no stronger than a 100 mm x 50 mm Class 3 timber post in shear or bending when acting as a cantilever with a length of 1050 mm.

Posts shall be capable of standing vertically when installed, deflecting by no more than 20° when subjected to a wind speed of 35 m/sec and returning to vertical when such wind is removed.

(b) Dimensions

The exposed length above ground shall be 1050 mm and present to traffic for at least the top 300 mm a face that is 90-100 mm wide. The area on which the delineator is to be placed is to be flat and the deviation from straightness across the remainder of the face shall not exceed 20 mm while the deviation from straightness of the centreline of the post shall not exceed 10 mm. The top shall be square to the sides.

13.4.4 Colour And Surface Finish

All surfaces shall be smooth, free from sharp edges and burrs with the top 300 mm of all faces of the post a smooth, colour-fast, opaque white surface capable of being repeatedly cleaned.

13.4.5 Installation Of Posts

Posts shall be installed at the locations specified or shown on the drawings. Posts shall be set into the ground so that the posts are vertical and the tops present a uniform profile.

The Contractor shall determine the depth to which posts are to be set in the ground, but it shall be such as to ensure the stability and alignment of the posts under all conditions. Notwithstanding this provision, depths of embedment shall not be less than 400 mm.

13.4.6 Delineators

The Contractor shall fix retroreflective type delineators to guide posts on both sides of the carriageway to expose to approaching traffic a red delineator on the left and a white delineator on the right.

Delineators shall have a total minimum reflective output equivalent to 100 cm² of Class 1A retroreflective material as defined in AS/NZS 1906.1. Regardless of the type of delineator used the minimum width of reflective material shall be 40 mm. Delineators made from retroreflective sheeting shall be manufactured such that the sheeting manufacturer's preferred orientation for optimum performance is followed.

The delineators shall be placed centrally on the posts, with the top of the delineator 50 mm below the top edge of the post and shall be attached by a vandal-proof and weatherproof means. Fixing of delineators to posts which require a white coating to be applied shall be done by the Contractor after the final white surface coating has been applied.

13.4.7 Warranty

Suppliers of guide posts and delineators shall guarantee full replacement of guide posts and the cost of their installation should they fail on any specified requirement within 5 years of installation.

13.5 STEEL BEAM GUARD FENCE

13.5.1 General

This section covers the requirements for the supply and installation of steel beam guard fence.

13.5.2 Standards

The materials used for fabrication of guard fence components shall comply with the relevant current Australian Standard Specifications as follows:

| | |
|-------------|---|
| AS 1111 | - ISO Metric hexagon commercial bolts and screws |
| AS 1112 | - ISO Metric hexagon nuts |
| AS 1214 | - Hot-dip galvanised coatings on threaded fasteners |
| AS 1554.1 | - Welding of steel structures |
| AS 1594 | - Hot-rolled steel flat products |
| AS/NZS 4680 | - Hot-dip galvanized (zinc) coatings on fabricated ferrous articles |
| AS 1720.2 | - Timber properties |
| AS 2204 | - Zinc-rich organic priming paint |
| AS 3569 | - Steel wire ropes |

13.5.3 Material Compliance

The Contractor shall submit to the Superintendent a Certificate of Compliance and related test certificates.

All tests shall be carried out in accordance with the appropriate Australian Standard, in a laboratory accredited by the National Association of Testing Authorities (NATA) for those test methods. All tests shall be endorsed in accordance with the NATA registration for that laboratory.

13.5.4 Guard Fence Components

(a) Metal Components

Metal components shall conform with the dimensions shown on the drawings.

(i) Rails

The rails shall be manufactured from steel which meets the requirements of AS 1594 Grade HA350.

The mechanical properties of the base metal shall conform to the following requirements when tested in accordance with AS 1391:

| | |
|-----------------------------|---------|
| Minimum yield strength | 350 Mpa |
| Minimum tensile strength | 430 Mpa |
| Minimum elongation in 80 mm | 16% |

The base metal shall be comply with the following tolerances when measured in accordance with AS 1365:

| | |
|---|----------------------|
| Base metal thickness | 2.7 mm \pm 0.21 mm |
| Mill tolerance on strip width | +2.5 mm, -0.0 |
| Mill camber tolerance on 2000 mm length | 4.0 mm maximum |

For guard fence erected as barrier railing on bridges and major culverts the base material shall comply with the following tolerances when measured in accordance with AS 1365:

| | |
|---|----------------------|
| Base metal thickness | 3.0 mm \pm 0.23 mm |
| Mill tolerance on strip width | +2.5 mm, -0.0 |
| Mill camber tolerance on 2000 mm length | 8.0 mm maximum |

(ii) Steel Posts and Blocks

Steel posts and blocks shall be manufactured from steel which meets the requirements of AS 1594 Grade HU250.

The base material thickness shall be 6.0 mm \pm 0.29 mm.

(iii) Bullnoses

Bullnoses shall be manufactured from steel which meets the requirements of AS 1594 Grade HU250.

(iv) Breakaway Cable Terminal

The wire rope shall comply with the requirements of AS 3569.

(b) Galvanising

All steel components shall be hot-dip galvanised after fabrication.

Before galvanising, the components shall be treated in accordance with the requirements of AS 1627 - Parts 1 and 4, "Code of Practice for Preparation and Pretreatment of Metal Surfaces prior to Protective Coating".

Galvanising on all components other than bolts, nuts and washers shall comply with AS/NZS 4680.

The minimum zinc coating shall be 900 g/m² (total both sides) for beams and terminals and 1200 g/m² (total both sides) for steel posts and blocks.

Galvanised coatings shall be smooth, adherent and free from stains, gross surface imperfections, markings, brand names and/or inclusions. Appearance is of prime importance and colour shall be uniform.

Hot dip galvanised coating on bolts, nuts and washers shall comply with AS 1214, Hot-Dip Galvanised Coatings on Threaded Fasteners.

Where the galvanising on guard rail or associated fittings has been damaged, the coating shall be repaired by regalvanising or by painting with a minimum of two coats of a zinc-rich inorganic paint in accordance with AS 2204 and one coat of aluminium paint.

(c) Timber

Timber posts and blocks shall be supplied to the dimensions shown on the drawings.

Timber posts and blocks shall be seasoned timber dried to equilibrium moisture content and sawn from species complying with Class 1 or 2 durability and stress grading as specified on the drawings.

All timber shall be straight and sound, and free from shakes, pipes, cores, flaws and other imperfections. The timber shall be sawn parallel to the grain, and exposed knots shall be sound, tight, well spaced and shall not exceed 25 mm in size in any face.

(d) Concrete

Concrete for guard fence footings shall be 20 Mpa strength grade complying with the requirements of AS 3600 - Concrete Structures.

13.5.5 Installation

HP Prior to installation the Contractor shall confirm with the Superintendent the required location and length of all guard fence.

The guard fence shall be installed at the positions so confirmed and shall be constructed true to line and level.

(a) Posts

Posts shall be installed to a depth not less than that shown on the drawings.

Steel posts shall be orientated to the direction of traffic as shown on the drawings.

Where posts are driven into the ground this shall be by methods that do not result in any damage to the post.

All post holes in rock shall have a 75 mm minimum clearance from the back of the post to the face of the hole.

Except for anchorage posts, post holes in rock shall be backfilled with granular material. Other post holes shall be backfilled with selected earth, free of rock. The backfilling shall be firmly compacted in layers not exceeding 100 mm compacted thickness. Where posts are located in areas to be paved with concrete or premixed bituminous material, the backfilling of the post holes shall be finished 50 mm below the underside of such paving and the remaining depth of the holes shall be filled and compacted with material similar to the surrounding material.

The hollow steel posts adjacent to bridge abutments shall be set in mix concrete (strength grade 15 Mpa) or cement treated crushed rock and filled with concrete as shown in the standard drawings.

Surplus excavated material remaining after the guard fence has been constructed shall be disposed of off site by the Contractor.

(b) Rails

The guard rail sections shall be lapped so that the exposed ends face away from near-side approaching traffic. The edges of the guard rail section or backing plate adjacent to posts shall be fixed in contact with the post or post blocks and all bolts shall be fully tightened. When the radius of curvature is 50 m or less, the guard rail sections shall be curved to shape prior to delivery to the site.

End treatments of the types specified shall be constructed in accordance with the details shown on the drawings.

Posts attached to bridges and culverts shall be bolted to supporting members and/or set on mortar pads as shown on the drawings.

(c) Anchorages

The anchor cable shall be tightened sufficiently to remove slack.

(d) Line and Level

After installation the top of the rail shall be within 25 mm of the specified level and 50 mm of the specified line. Variations from specified line and level shall not occur at a rate exceeding 15 mm in any 5 m length.

Notwithstanding these requirements the line and level of the guard fence shall be adjusted where necessary to provide a smooth and even vertical and horizontal alignment.