

## CERTIFICATE OF STRUCTURAL ADEQUACY

Project: Standard Certification for Balustrade  
(Occupancy level C3)

Project No.: 14816  
Date: 13<sup>th</sup> October, 2014

For: Knotwood  
Attn: Darren Galway

### SCOPE

This report involves the standard certification of an aluminium balustrade system. Structural calculations were undertaken to assess the adequacy of the proposed member sizes and fixings. Modifications have been designed where necessary.

### DESIGN STANDARDS

The balustrade has been assessed by this office in accordance with the following Australian Standards:

|                    |   |
|--------------------|---|
| AS 1170.0:2002     | Structural design actions<br>Part 0: General Principles                 |
| AS 1170.1:2002     | Structural design actions<br>Part 1: Permanent, imposed & other actions |
| AS/NZS 1170.2:2002 | Structural design actions: Wind actions                                 |
| AS 1664.1:1997     | Aluminium structures – Part 1: Limit state design                       |
| AS 1288–2006       | Glass in buildings – Selection and installation                         |

### GENERAL

The balustrade is 1000mm high and composed of posts and glass panels. Alternatively, slats can be used in lieu of the glass panels. A handrail is fitted to the top of the posts. The posts are spaced at 1500mm maximum and either cast into an existing concrete floor or anchored to the floor with a baseplate.

#### The balustrade was checked for the following guidelines:

- Region A, Terrain Category 2 or above (site wind speed of  $V = 48.6$  m/s), building height  $\leq 20$ m. This is suitable for Australia generally, with the exception of coastal regions north of 30° latitude line including exposed and coastal regions, as well as the inland.
- Region B, Terrain Category 2 or above (site wind speed of  $V = 61.5$  m/s), building height  $\leq 20$ m. This is suitable for exposed and coastal regions north of 30 degrees latitude.

- Region C, Terrain Category 2 or above (site wind speed of  $V = 78.3$  m/s), building height  $\leq 20$ m. This is suitable for cyclonic areas, such as exposed and coastal regions in the Northern Territory and Queensland.
- Importance level 2 (this is suitable for normal structures with medium consequences for loss of human life).
- 50 years design working life.

### Imposed loads:

The balustrade was checked for type C3 occupancy according to Table 3.3 of AS 1170.1:2002 for the following loads:

- Handrail – 0.75 kN per linear metre acting horizontally or vertically on the rail; OR 0.6 kN acting inwards, outwards or downwards at any point on the rail or post.
- Infill – 1.0 kPa uniformly distributed load acting horizontally; OR 0.5 kN acting in any direction at any point of the infill.

### MEMBER SUMMARY

The balustrade members are in detail:

Note: The maximum post centres and glass infill widths listed below refer to balustrade types as follows:

- Type 1: balustrades up to and including 5m long, or balustrades longer than 5m without free end, or balustrades longer than 5m with free end but starting 2m in from the end (net pressure coefficient for wind loading  $C_{p,n} = 1.2$ ).
- Type 2: balustrades longer than 5m with free end, starting from the end of the balustrade to 2m in (net pressure coefficient for wind loading  $C_{p,n} = 2.4$ ).

Refer drawing 14816-2 for schematic diagram illustrating where type A & B balustrades are applicable.

- Post:
  - *Unreinforced 2 Way Post & 90 Degree Corner Post:* 65x65x2mm thick post, alloy 6063-T6, spaced at varying centres as detailed below. Refer drawing no. TS50613/G & TS50614/G by Capral. Note that the unreinforced 2 Way Post is considered unsuitable for region C, type 2. The Corner Post is only to be used where balustrades return and the balustrade extends at least 1 bay or longer.
    - Post spacing 1500mm suitable for
      - Imposed loads
      - Region A & B for type 1
    - Post spacing 1400mm suitable for
      - Imposed loads
      - Region A & B for type 1
      - Region A for type 2

- Post spacing 1300mm suitable for
  - Imposed loads
  - Region A & B for type 1
  - Region A for type 2
- Post spacing 800mm suitable for
  - Imposed loads
  - Region A, B & C for type 1
  - Region A & B for type 2

Base connection:

- Base plate: Use 170mm square x 12 thick base plate, alloy 6060-T5. Connect to floor slab with 4 M12 DynaBolt Plus anchors with effective depth of 50mm and observe 75mm minimum distance to edge of slab. Slab to be 100mm thick minimum and grade N25 or better. Fix 2 Way Post to base plate with 8 no. 10-16x16G steel screws through the underside of the plate. Fix Corner Post to base plate with 2 no. 10-16x16G steel screws (installed diagonally) & 1 M10 grade 4.6 bolt (in centre of post) through the underside of the plate. All fasteners to be galvanised to avoid galvanic reaction between steel and aluminium.
  - Core drilled fixing: Drill  $\varnothing 95$ mm core x 100mm deep and insert post. Grout hole with Emaco Set 45 repair mortar and add MasterLife 2006 corrosion inhibitor. Ensure 75mm clear distance from the post to the edge of the slab. Slab to be 125mm thick minimum and grade N25 or better. 2 N12 bars perimeter reinforcement is required along the edges of the concrete slab, between the inset post and the edge of the slab. This is to be confirmed before construction commences.
- *Reinforced 2 Way Post & 90 Degree Corner Post (unreinforced):* 65x65x2mm thick post, alloy 6063-T6, spaced at varying centres as detailed below. Refer drawing no. TS50613/G & TS50614/G by Capral. Reinforce 2 Way Post with 40x16 solid spigot (alloy 6063-T6) to 750mm above floor level. Refer drawing 14816-2 Rev A. The Corner Post is unreinforced and only to be used where balustrades return and the balustrade extends at least 1 bay or longer, i.e. the Corner Post is braced in both directions by the handrail and 2 Way Posts.
- Post spacing 1200mm suitable for
    - Imposed loads
    - Region A for type 1 & 2
    - Region B & C for type 1
  - Post spacing 1000mm suitable for
    - Imposed loads
    - Region A & B for type 1 & 2

- Region C for type 1
  - Post spacing 600mm suitable for
    - Imposed loads
    - All wind regions and balustrade types

Base connection:

- Core drilled fixing: Drill  $\varnothing 95$ mm core x 100mm deep and insert post. Grout hole with Emaco Set 45 repair mortar and add MasterLife 2006 corrosion inhibitor. Ensure 75mm clear distance from the post to the edge of the slab. Slab to be 125mm thick minimum and grade N25 or better. 2 N12 bars perimeter reinforcement is required along the edges of the concrete slab, between the inset post and the edge of the slab. This is to be confirmed before construction commences.
- Infill:
    - *Slats:* 100x16x1.4 RHS slat, alloy 6060-T5, spanning horizontally between posts. Refer drawing no. TS44499/C by Capral. The maximum span is 1000mm (suitable for imposed loads, all wind regions and balustrade types). Insert slats in post channels at each end and fix with 2 no. 10-16x16G Hex head steel screws (galvanised) each. The allowable clear spacing between the slats is 0 to 100mm. The clear distance from the top of the floor to the lowermost slat & from the uppermost slat to the handrail must not exceed 100mm.
    - *Glass panels:* The glass panels are typically 10mm thick toughened glass and are to be grade A safety glass. They span horizontally between the posts and are supported continuously along the vertical edges. The panels are typically 800mm high, with the clear distance from the top of the floor to the panel & from the handrail to the panel being 100mm.
      - Type 1 balustrades:  
Region A, B, C – 1500mm wide panel maximum
      - Type 2 balustrades:  
Region A – 1400mm wide panel maximum  
Region B – 1300mm wide panel maximum  
Region C – 1000mm wide panel maximum
- Note that all panel widths listed above are suitable for the applicable imposed loads.
- Handrail: 65 wide x 25 deep x 2mm thick handrail, alloy 6063-T6. Refer drawing no. TS50610/D by Capral. The maximum span is 1500mm (suitable for imposed loads, all wind regions and balustrade types) and the handrail is to span continuously. Install on flat and fix to post with 2 no. 10-16x16G Hex head steel screws (galvanised) each through slats inserted in the handrail and post

channels, and connect slats to post with 2 no. 10-16x16G Hex head steel screws (galvanised) each.

Refer to drawing 14816-2 Rev A for further details on the construction of the balustrade.

For Magryn & Associates Pty. Ltd.

A handwritten signature in black ink, appearing to read 'Christiane Husmann', written in a cursive style.

Christiane Husmann  
CP Eng.

Attachments:

- Drawing TS50613/G showing 2 Way Post
- Drawing TS50614/G showing 90 Degree Corner Post
- Drawing TS44499/C showing slat
- Drawing TS50610/D showing handrail
- Drawing 14816-2 Rev A

## CERTIFICATE OF STRUCTURAL ADEQUACY

Project: Standard Certification for Balustrade  
(Occupancy level C1/C2)

Project No.: 14816  
Date: 13<sup>th</sup> October, 2014

For: Knotwood  
Attn: Darren Galway

### SCOPE

This report involves the standard certification of an aluminium balustrade system. Structural calculations were undertaken to assess the adequacy of the proposed member sizes and fixings. Modifications have been designed where necessary.

### DESIGN STANDARDS

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| AS/NZS 1170.2:2002 | Structural design actions: Wind actions                                 |
| AS 1664.1:1997     | Aluminium structures – Part 1: Limit state design                       |
| AS 1288–2006       | Glass in buildings – Selection and installation                         |

### GENERAL

The balustrade is 1000mm high and composed of posts and glass panels. A handrail is fitted to the top of the posts. The posts are spaced at 1000mm maximum and either cast into an existing concrete floor or anchored to the floor with a baseplate.

**The balustrade was checked for the following guidelines:**

- Region A, Terrain Category 2 or above (site wind speed of  $V = 48.6$  m/s), building height  $\leq 20$ m. This is suitable for Australia generally, with the exception of coastal regions north of 30° latitude line including exposed and coastal regions, as well as the inland.
- Region B, Terrain Category 2 or above (site wind speed of  $V = 61.5$  m/s), building height  $\leq 20$ m. This is suitable for exposed and coastal regions north of 30 degrees latitude.

- Region C, Terrain Category 2 or above (site wind speed of  $V = 78.3$  m/s), building height  $\leq 20$ m. This is suitable for cyclonic areas, such as exposed and coastal regions in the Northern Territory and Queensland.
- Importance level 2 (this is suitable for normal structures with medium consequences for loss of human life).
- 50 years design working life.

### Imposed loads:

The balustrade was checked for type C1/C2 occupancy according to Table 3.3 of AS 1170.1:2002 for the following loads:

- Handrail – 1.5 kN per linear metre acting horizontally; OR 0.75 kN per linear metre acting vertically on the rail; OR 0.6 kN acting inwards, outwards or downwards at any point on the rail or post.
- Infill – 1.0 kPa uniformly distributed load acting horizontally; OR 1.5 kN acting in any direction at any point of the infill.

### MEMBER SUMMARY

The balustrade members are in detail:

Note: The maximum post centres and glass infill widths listed below refer to balustrade types as follows:

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- Type 2: balustrades longer than 5m with free end, starting from the end of the balustrade to 2m in (net pressure coefficient for wind loading  $C_{p,n} = 2.4$ ).

Refer drawing 14816-2 for schematic diagram illustrating where type A & B balustrades are applicable.

- Post:
  - *Unreinforced 2 Way Post & 90 Degree Corner Post:* 65x65x2mm thick post, alloy 6063-T6, spaced at 800 mm. Refer drawing no. TS50613/G & TS50614/G by Capral. Note that the unreinforced 2 Way Post is considered unsuitable for region C, type 2. The Corner Post is only to be used where balustrades return and the balustrade extends at least 1 bay or longer.
    - Post spacing 800mm suitable for
      - Imposed loads
      - Region A, B & C for type 1
      - Region A & B for type 2

## Base connection:

- Base plate: Use 170mm square x 12 thick base plate, alloy 6060-T5. Connect to floor slab with 4 M12 DynaBolt Plus anchors with effective depth of 50mm and observe 75mm minimum distance to edge of slab. Slab to be 100mm thick minimum and grade N25 or better. Fix 2 Way Post to base plate with 8 no. 10-16x16G steel screws through the underside of the plate. Fix Corner Post to base plate with 2 no. 10-16x16G steel screws (installed diagonally) & 1 M10 grade 4.6 bolt (in centre of post) through the underside of the plate. All fasteners to be galvanised to avoid galvanic reaction between steel and aluminium.
  - Core drilled fixing: Drill  $\varnothing$ 95mm core x 100mm deep and insert post. Grout hole with Emaco Set 45 repair mortar and add MasterLife 2006 corrosion inhibitor. Ensure 75mm clear distance from the post to the edge of the slab. Slab to be 125mm thick minimum and grade N25 or better. 2 N12 bars perimeter reinforcement is required along the edges of the concrete slab, between the inset post and the edge of the slab. This is to be confirmed before construction commences.
- *Reinforced 2 Way Post & 90 Degree Corner Post (unreinforced):* 65x65x2mm thick post, alloy 6063-T6, spaced at varying centres as detailed below. Refer drawing no. TS50613/G & TS50614/G by Capral. Reinforce 2 Way Post with 40x16 solid spigot (alloy 6063-T6) to 750mm above floor level. Refer drawing 14816-2 Rev A. The Corner Post is unreinforced and only to be used where balustrades return and the balustrade extends at least 1 bay or longer, i.e. the Corner Post is braced in both directions by the handrail and 2 Way Posts.
- Post spacing 1000mm suitable for
    - Imposed loads
    - Region A & B for type 1 & 2
    - Region C for type 1
  - Post spacing 600mm suitable for
    - Imposed loads
    - All wind regions and balustrade types

## Base connection:

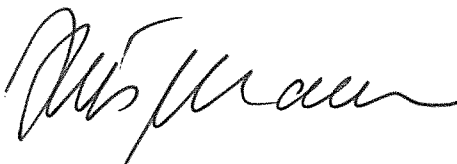
- Core drilled fixing: Drill  $\varnothing$ 95mm core x 100mm deep and insert post. Grout hole with Emaco Set 45 repair mortar and add MasterLife 2006 corrosion inhibitor. Ensure 75mm clear distance from the post to the edge of the slab. Slab to be 125mm thick minimum and grade N25 or better. 2 N12 bars perimeter reinforcement is required along the edges of the concrete slab, between the inset post and the edge of the slab. This is to be confirmed before construction commences.



- Infill:
  - Glass panels: The glass panels are typically 10mm thick toughened glass and are to be grade A safety glass. They span horizontally between the posts and are supported continuously along the vertical edges. The panels are typically 800mm high, with the clear distance from the top of the floor to the panel & from the handrail to the panel being 100mm. The maximum span is 1000mm to suit the maximum post spacing (suitable for the imposed loads, all wind regions and balustrade types).
  
- Handrail: 65 wide x 25 deep x 2mm thick handrail, alloy 6063-T6. Refer drawing no. TS50610/D by Capral. The maximum span is 1000mm to suit the maximum post spacing (suitable for the imposed loads, all wind regions and balustrade types) and the handrail can be single or continuous span. Install on flat and fix to post with 2 no. 10-16x16G Hex head steel screws (galvanised) each through slats inserted in the handrail and post channels, and connect slats to post with 2 no. 10-16x16G Hex head steel screws (galvanised) each.

Refer to drawing 14816-2 Rev A for further details on the construction of the balustrade.

For Magryn & Associates Pty. Ltd.



Christiane Husmann  
CP Eng.

Attachments:

- Drawing TS50613/G showing 2 Way Post
- Drawing TS50614/G showing 90 Degree Corner Post
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