INGAL CIVIL PRODUCTS

A valmont COMPANY

Flexbeam Guardrail

Roadside Safety Barrier

Product Manual

Release 08/14

www.ingalcivil.com.au

Flexbeam Guardrail Roadside Safety Barrier

1.0 Introduction

Roadside barriers have been developed over the years to safely redirect vehicles that leave the roadway. Many different rigid, semi-rigid and flexible designs for roadside barriers have evolved. The most common system consists of a steel w-beam rail supported on steel posts with end treatments and transitions of various designs using similar materials.

Ingal Civil Products' Flexbeam guardrail's uniformly high resistance to impacts is assured by its continuous flexible beam action. This prevents dangerous pocketing and minimises the ride down deceleration experienced by the vehicle and its occupants.

The high visibility of Flexbeam guardrail creates driver confidence. This is an intangible but exceedingly important factor. At night or in fog conditions, the excellent visibility of Flexbeam guardrail highlights the limit of safe travel and reduces dangerous centreline crowding.

2.0 Standards

Flexbeam guardrail is manufactured in accordance with the following;

- AS/NZS 3845:1999 Road safety barrier systems
- AS/NZS 4680:2006 Hot-dip galvanized (zinc) coatings

3.0 Specifications

Table 1: Flexbeam Panels - 2.7mm base metal thickness

Nett Laying Length (mm)	Ingal Part No.	Mass (kg)
1000	C1364G	14.1
2000	C1373G	25.0
2500	C1381G	30.5
3000	C1195G	36.0
3810 (12'6")	C1355G	44.6
4000	C1351G	46.7
5000	C1356G	57.6

Table 2: Charlie Posts 150x110x4.3mm

Post Length (mm)	Ingal Part No.	Mass (kg)
700 with Base Plate	C1432G	17.2
750 with Base Plate	C1409G	17.9
1800	C1402G	23.6
1850	C1415G	24.4
2100	C1444G	27.6
2400	C1458G	31.6

Table 3: U Channel Posts 178x76x6.0mm

Post Length (mm)	Ingal Part No.	Mass (kg)
700 with Base Plate	C1135G	17.0
1600	C1095G	23.3
1675	C1090G	24.4
1800	C1100G	26.3

4.0 Barrier Deflection

The expected deflection of the barrier should not exceed the available room to deflect. If the available space between the hazard and the barrier is not adequate, then the barrier can be stiffened in advance of, and alongside the hazard. Commonly used methods to reduce deflection of Flexbeam guardrail include reducing the post spacing, nesting the rail or transitioning to a stiffer barrier such as Thriebeam guardrail.

Table 4: Flexbeam & Thriebeam Deflection Values

System Type	Post Spacing	Dynamic Deflection[1]
AASHTO G4 W Beam	2.0m	1.0m
Type B Guardfence	2.5m	1.0m
AASHTO G9 Thriebeam	2.0m	0.6m

[1] **Sources: AS/NZS 3845:1999 & VicRoads Model Drawing SD3501E**

5.0 Thriebeam Guardrail

An important attribute of Thriebeam guardrail is its high level of performance especially for large vehicles. Due to the greater height of the rail face, Thriebeam guardrail provides reduced deflection and improved resistance to vehicle vaulting or under running. The reduced dynamic deflection and maintenance demand makes Thriebeam guardrail ideally suited for major facilities carrying a high volume of high-speed traffic. Thriebeam guardrail should also be used in transition from Flexbeam guardrail to more rigid barriers. This significantly reduces the deflection of the barrier system at transition to the rigid barrier.

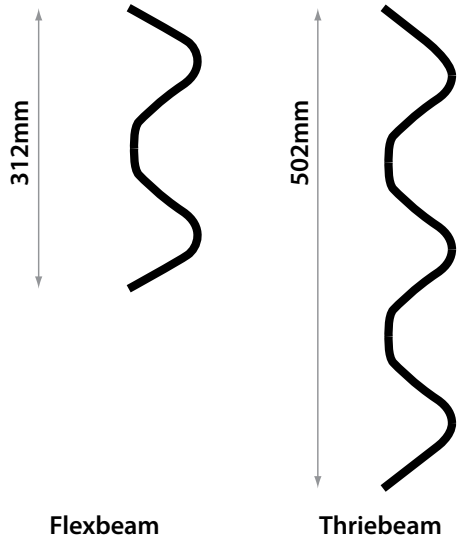


Figure 1: Flexbeam and Thriebeam Comparison

6.0 Installation

6.1 Site Preparation

Flexbeam guardrail should be located at least 600mm (measured from back of post) in front of embankments that require shielding. This distance is required to provide proper post support.

The approach terrain to the barrier must be level. Grading to 1:20 is preferable and 1:10 maximum slope should be present. Steeper slopes can result in the vehicle impacting the barrier at other than the design height.

6.2 Installation Sequence

The following written instructions should be read in conjunction with Ingal Civil Products' drawings:

1. Ensure the area has been inspected for underground hazards and that suitable traffic control is in place.
2. Post locations are marked ensuring the hazard to be protected is located outside the expected dynamic deflection of the barrier.
3. The post is orientated with no post edges presented towards the traffic.
4. Posts are driven directly into the ground and should be vertical. (The post installation process shall not cause damage to the post, such that it reduces the effective operation of the safety barrier or its design life, or introduces sharp tearing edges, nor shall it cause damage to pavement). Alternately, a hole can be augured and the post placed in the hole. The posthole is then backfilled with the material that was excavated. Material should be placed in layers and suitably compacted to not less than the density of the surrounding layers.
5. Blocking pieces are then attached to the posts using M16 hex. head bolts. The function of the blocking piece is to prevent wheel snagging and vehicle vaulting.
6. Rails are attached to the blocking pieces and are spliced using mushroom head bolts. The holes in the rails for attachment to the blocking pieces are slotted to allow for tolerances in post spacing.
7. Rails are spliced together at every second post using M16x32mm mushroom head bolts. Rails are orientated so that no leading edges are presented to the traffic face. At post locations where there is not a rail splice, a stiffener piece is inserted behind the rail. Washers are NOT used.
8. It is recommended that posts be installed only a few metres ahead of rail assembly to ensure correct post spacing and alignment. On curves, the rails can be used as a template and laid on the ground to determine post locations.

Figure 2: Attachment of steel blocking piece

Figure 3: Splice Connection

Figure 4: Delineator

6.3 Curving

FLEXBEAM guardrail may be shop curved to fit any radius from 2.4m to 46m. Curves in excess of 46m radii do not require shop curving as the lap joint accommodates itself to such installations. Rail may be curved either concave or convex to the traffic face and can be part curved along its length to suit your needs.

6.3.1 Measuring Curvature

1. Depending on your length of rail, mark along your arc at 4m or 5m intervals
2. Measure the corresponding chord length (C) – Refer to Figure 5
3. Measure the corresponding centre offset (H) – Refer to Figure 5
4. Use the values for C and H to select the radius from Table 5
5. Determine the curvature orientation from Figure 6

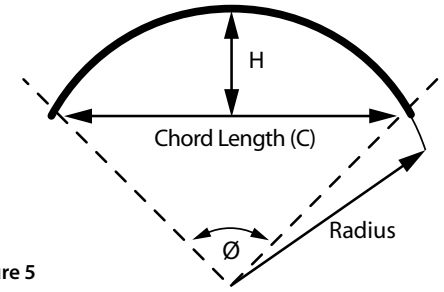


Figure 5

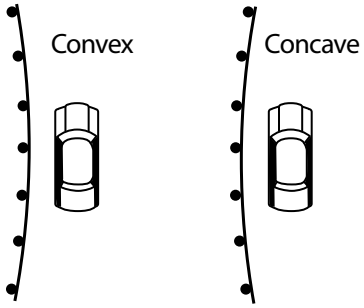


Figure 6

Table 5: Radius of Curvature

	4000mm Rail			5000mm Rail		
Radius m	Ø Degrees	C mm	H mm	Ø Degrees	C mm	H mm
2.4	95.5	3553	786	119.4	4144	1189
3	76.4	3710	642	95.5	4441	983
4	57.3	3835	490	71.6	4681	756
5	45.8	3894	395	57.3	4794	612
6	38.2	3926	330	47.8	4857	513
7	32.7	3946	284	40.9	4894	442
8	28.7	3958	249	35.8	4919	387
9	25.5	3967	221	31.8	4936	345
10	22.9	3973	199	28.7	4948	311
12	19.1	3982	166	23.9	4964	259
14	16.4	3986	143	20.5	4973	223
16	14.7	3990	125	17.9	4980	195
20	11.5	3993	100	14.3	4987	156
24	9.6	3995	83	11.9	4991	130
28	8.2	3997	71	10.2	4993	112
32	7.2	3997	62	8.9	4995	98
35	6.6	3998	57	8.2	4996	89
40	5.7	3998	50	7.2	4997	78
45	5.1	3999	44	6.4	4997	69

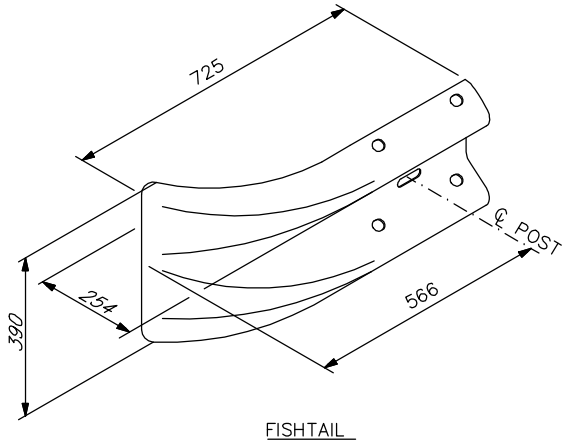
7.0 End Terminals and Transitions

Guardrail end terminals are designed to provide a soft gating impact to prevent the end rail from spearing an impacting vehicle. Terminals also introduce tensile and flexural strength necessary to ensure redirection performance of the length-of-need section.

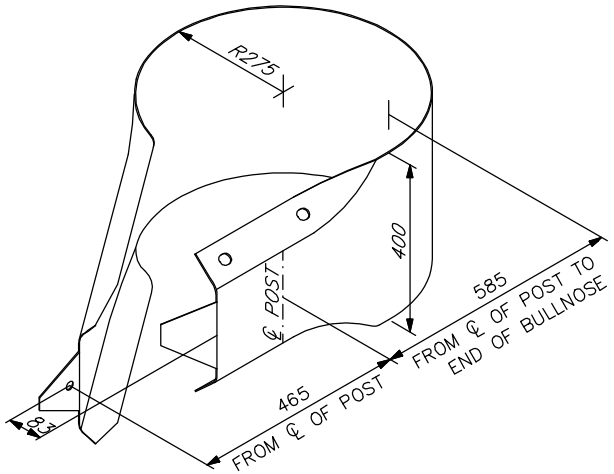
Transitions are required when Flexbeam guardrail is terminated at a bridge abutment or a concrete parapet.

The purpose of a transition is to smoothly increase the stiffness of the approach guardrail from the more flexible to the less flexible system.

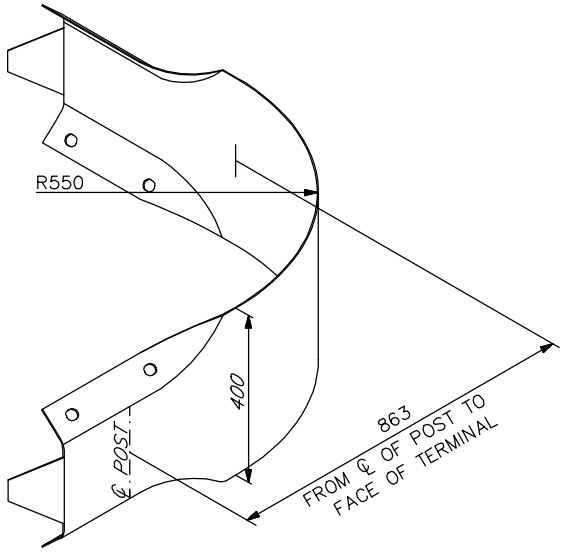
Figure 7: ET2000 Plus



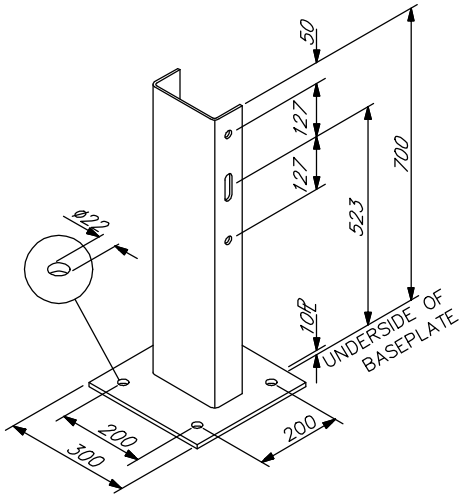
FISHTAIL
Part No. C1050G



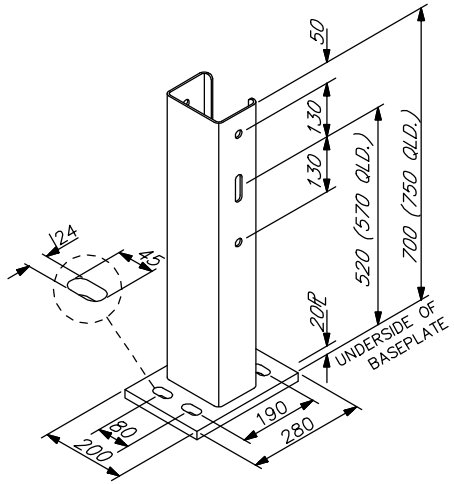
BULLNOSE
Part No. C1060G



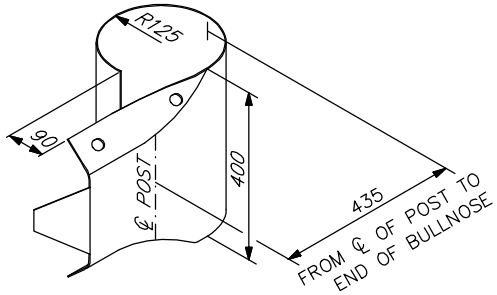
RIGHT ANGLE TERMINAL
Part No. C1068G



'U' POST ON BASE PLATE (VIC.)
Part No. C1135G



'C' POST ON BASE PLATE
Part No. C1432G
Part No. C1409G (QLD.)



SHORT BULLNOSE
Part No. C1064G

Rev.	Description	Chkd	Date
A	TITLE BLOCK UPDATED	MS	17/03/09
0	INITIAL ISSUE	T.C	30/01/06

INGAL Civil Products
57-65 Airds Road, Minto, NSW, 2566 Australia
Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au

PROJECT: FLEXBEAM GUARDRAIL ACCESSORIES

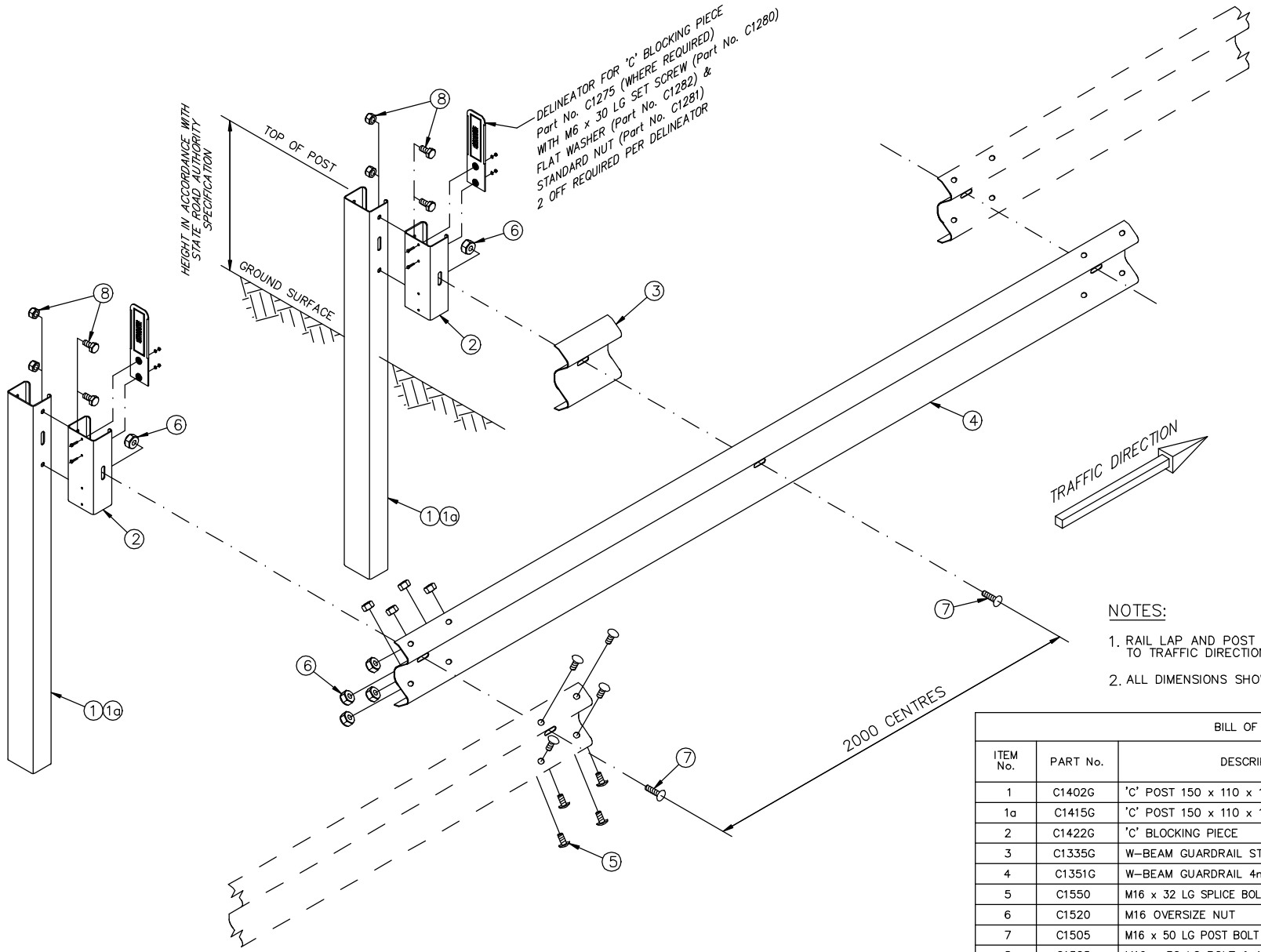
TITLE: COMPONENT DETAILS

DATE	30/01/06
DRAWN	B.F
DESIGNED	
CHECKED	T.C
MATERIAL	
FINISH	H.D GALV
SCALE	N.T.S

INGAL CIVIL PRODUCTS REFERENCE No.

DRAWING No.
GR-STD-049
REV.A

CAD FILE - GR-STD-049.DWG 30/01/06



NOTES:

1. RAIL LAP AND POST ORIENTATION IN RELATION TO TRAFFIC DIRECTION AS SHOWN IS ESSENTIAL.
2. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES.

BILL OF MATERIALS

ITEM No.	PART No.	DESCRIPTION	QTY
1	C1402G	'C' POST 150 x 110 x 1800 LG	2
1a	C1415G	'C' POST 150 x 110 x 1850 LG (QLD. STATE ONLY)	2
2	C1422G	'C' BLOCKING PIECE	2
3	C1335G	W-BEAM GUARDRAIL STIFFENER	1
4	C1351G	W-BEAM GUARDRAIL 4m NET LAYING LENGTH	1
5	C1550	M16 x 32 LG SPLICE BOLT - MUSHROOM HD (GRADE 8.8)	8
6	C1520	M16 OVERSIZE NUT	10
7	C1505	M16 x 50 LG POST BOLT - MUSHROOM HD (GRADE 4.6)	2
8	C1525	M16 x 30 LG BOLT & NUT - HEX. HD	4

Rev.	Description	Chkd	Date
A	TITLE BLOCK UPDATED	MS	17/03/09
0	INITIAL ISSUE	T.C	15/11/05

INGAL Civil Products
57-65 Airds Road, Minto, NSW, 2566 Australia
Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au

PROJECT: AASHTO G4 W-BEAM ASSEMBLY WITH 'C' BLOCKER

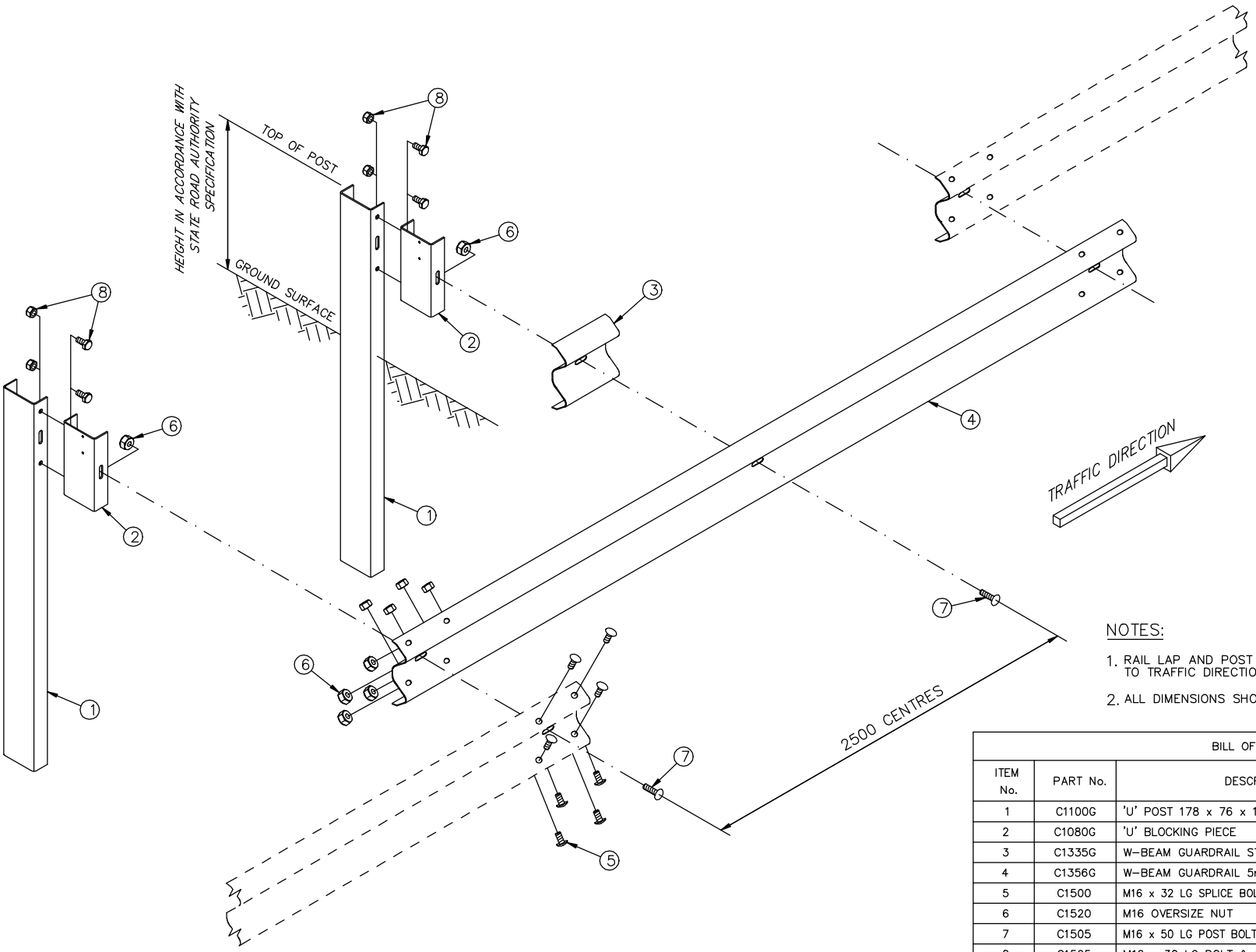
TITLE: GENERAL ARRANGEMENT

DATE	15/11/05
DRAWN	B.F
DESIGNED	I.C.P
CHECKED	T.C
MATERIAL	AS SHOWN
FINISH	H.D GALV
SCALE	NTS

INGAL CIVIL PRODUCTS REFERENCE No.

DRAWING No. CAB-STD-071 REV.A

CAD FILE - CAB-STD-071.DWG 15/11/05



NOTES:

1. RAIL LAP AND POST ORIENTATION IN RELATION TO TRAFFIC DIRECTION AS SHOWN IS ESSENTIAL.
2. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES.

BILL OF MATERIALS

ITEM No.	PART No.	DESCRIPTION	QTY
1	C1100G	'U' POST 178 x 76 x 1800 LG	2
2	C1080G	'U' BLOCKING PIECE	2
3	C1335G	W-BEAM GUARDRAIL STIFFENER	1
4	C1356G	W-BEAM GUARDRAIL 5m NET LAYING LENGTH	1
5	C1500	M16 x 32 LG SPLICE BOLT - MUSHROOM HD (GRADE 4.6)	8
6	C1520	M16 OVERSIZE NUT	10
7	C1505	M16 x 50 LG POST BOLT - MUSHROOM HD (GRADE 4.6)	2
8	C1525	M16 x 30 LG BOLT & NUT - HEX. HD	4

Rev.	Description	Chkd	Date
A	TITLE BLOCK UPDATED	MS	17/03/09
0	INITIAL ISSUE	B.F	15/11/05

INGAL Civil Products
57-65 Airds Road, Minto, NSW, 2566 Australia
Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au

PROJECT: VICTORIAN TYPE B GUARDFENCE

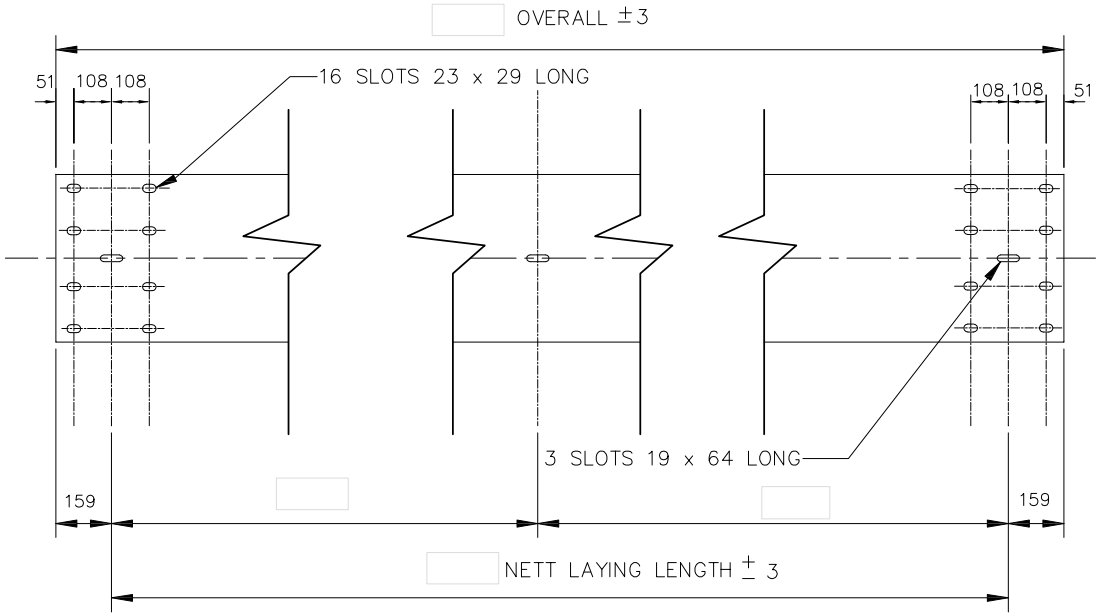
TITLE: GENERAL ARRANGEMENT

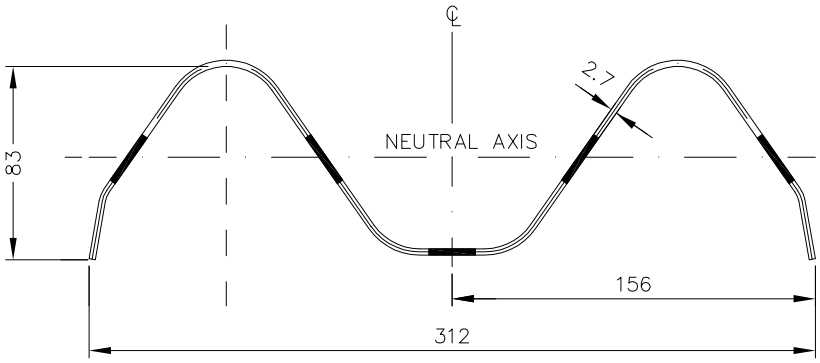
DATE	15/11/05
DRAWN	B.F
DESIGNED	I.C.P
CHECKED	T.C
MATERIAL	AS SHOWN
FINISH	H.D GALV
SCALE	N.T.S

INGAL CIVIL PRODUCTS REFERENCE No.

DRAWING No. CAB-STD-072 REV.A

CAD FILE - CAB-STD-072.DWG 15/11/05





Material Specifications
1. Material shall satisfy the requirements of HA350 in accordance with AS1594
2. Tolerances on thickness, strip width and camber shall comply with AS1365
3. Material to be hot dip galvanized after fabrication in accordance with AS4680
4. Galvanized rails to be dichromate dipped as a final treatment immediately after galvanizing.

Rev.	Description	Chkd	Date
2	TITLE BLOCK UPDATED	M.S	19/04/10
1	GALV. SPEC BORDER CHANGE		
0	INITIAL ISSUE	W.S-B	06/07/95

INGAL Civil Products
57-65 Airds Road, Minto, NSW, 2566 Australia
Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au

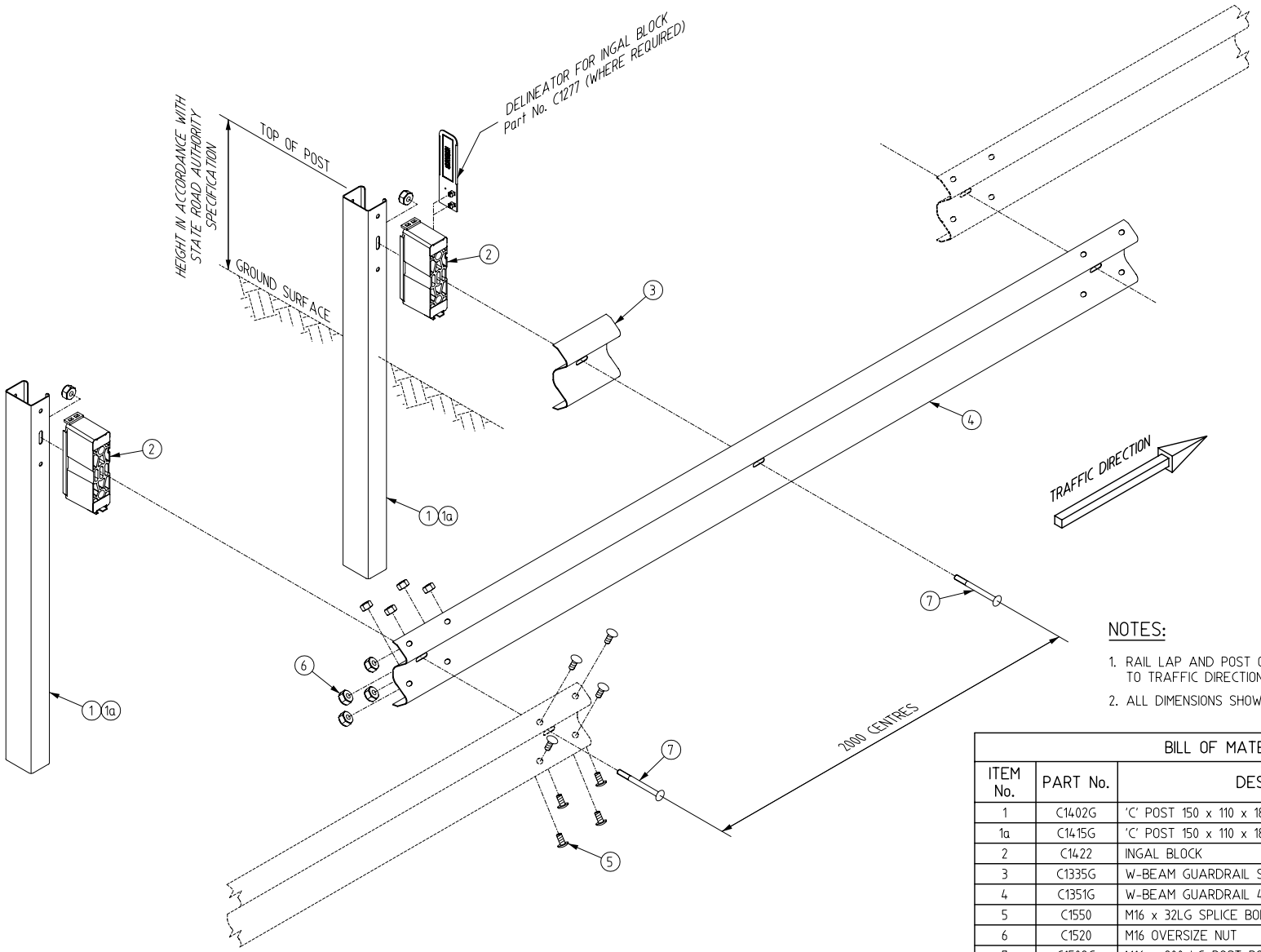
PROJECT: FLEX-BEAM GUARDRAIL SPECIAL RAIL

TITLE: TYPICAL DIMENTIONS AND MATERIAL SPECIFICATIONS

DATE	
DRAWN	
DESIGNED	ICP
CHECKED	T.C.
MATERIAL	AS SHOWN
FINISH	AS SHOWN
SCALE	N.T.S

INGAL CIVIL PRODUCTS REFERENCE No.

DRAWING No. GR-STD-SPEC REV.2



NOTES:

1. RAIL LAP AND POST ORIENTATION IN RELATION TO TRAFFIC DIRECTION AS SHOWN IS ESSENTIAL.
2. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES.

BILL OF MATERIALS

ITEM No.	PART No.	DESCRIPTION	QTY
1	C1402G	'C' POST 150 x 110 x 1800 LG	2
1a	C1415G	'C' POST 150 x 110 x 1850 LG (QLD. STATE ONLY)	2
2	C1422	INGAL BLOCK	2
3	C1335G	W-BEAM GUARDRAIL STIFFENER	1
4	C1351G	W-BEAM GUARDRAIL 4m NET LAYING LENGTH	1
5	C1550	M16 x 32LG SPLICE BOLT - MUSHROOM HD	8
6	C1520	M16 OVERSIZE NUT	10
7	C1508G	M16 x 200 LG POST BOLT - MUSHROOM HD	2

Rev.	Description	Chkd	Date
0	INITIAL ISSUE	T.C.	16/9/05

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☒NSW ☒ACT ☒QLD ☐NT ☐VIC ☐TAS ☐WA ☒SA ☐SNG ☐HK ☐---

PROJECT AASHTO G4 W-BEAM ASSEMBLY WITH INGAL BLOCK

TITLE GENERAL ARRANGEMENT

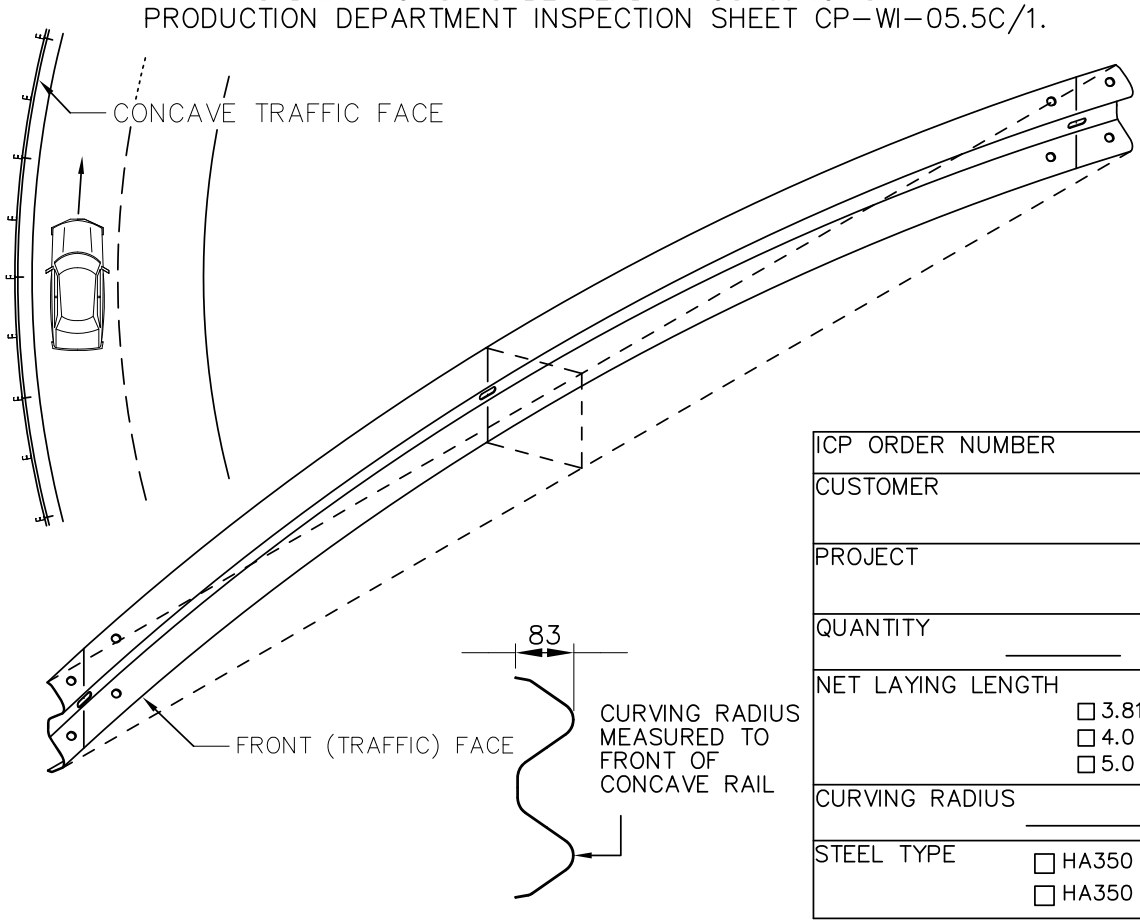
DATE	16/9/05
DRAWN	B.FREEMAN
DESIGNED	I.C.P.
CHECKED	T.C.
MATERIAL	AS SHOWN
FINISH	H.D.GALV.
SCALE	N.T.S. (A3)

INGAL CIVIL PRODUCTS REFERENCE No.

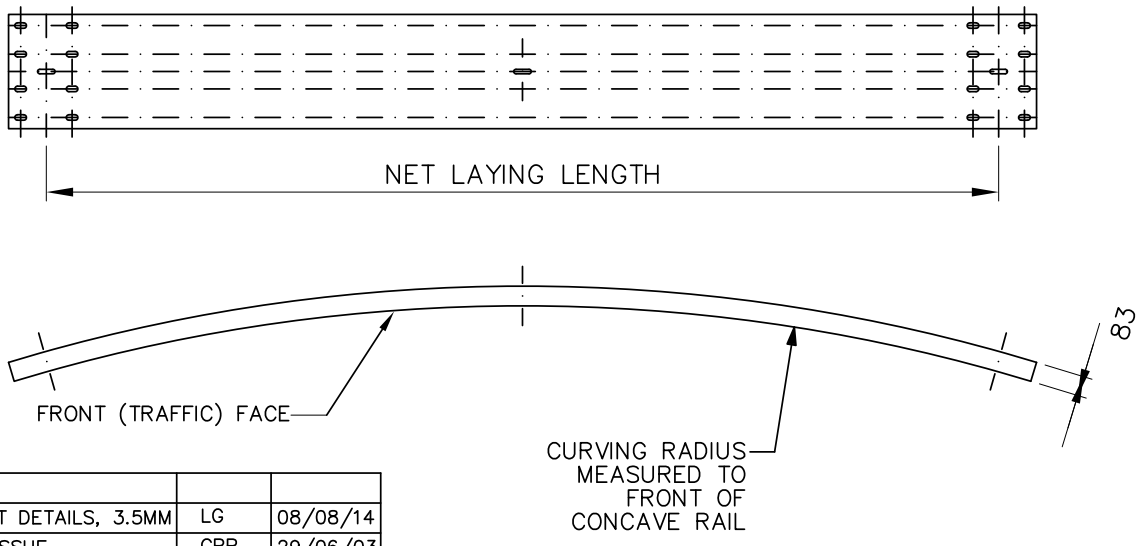
DRAWING No.
CAB-STD-70
REV.0

CAD FILE - CABSTD70.DGN 16/9/05

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH
PRODUCTION DEPARTMENT INSPECTION SHEET CP–WI–05.5C/1.



ICP ORDER NUMBER	
CUSTOMER	
PROJECT	
QUANTITY	_____ PIECES
NET LAYING LENGTH	☐ 3.81 METRES ☐ 4.0 METRES ☐ 5.0 METRES
CURVING RADIUS	_____ METRES
STEEL TYPE	☐ HA350 2.7mm ☐ HA350 3.5mm



ISSUE	Description	Checked	Date
2	CONTACT DETAILS, 3.5MM	LG	08/08/14
1	INITIAL ISSUE	GPP	29/06/03

INGAL
Civil Products
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Australia
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Facsimile 61–2–9542 3667
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PROJECT DETAILS

W–BEAM GUARDRAIL CURVING CONCAVE RAIL SINGLE CURVATURE

DATE 29/06/03	DRAWN GPP	DESIGNED GPP	CHECKED GPP
MAT. HA350	FINISH H.D.GALV.	SCALE NTS	

INGAL CIVIL PRODUCTS
DRAWING No.

GR–STD–30

ISSUE No.

2

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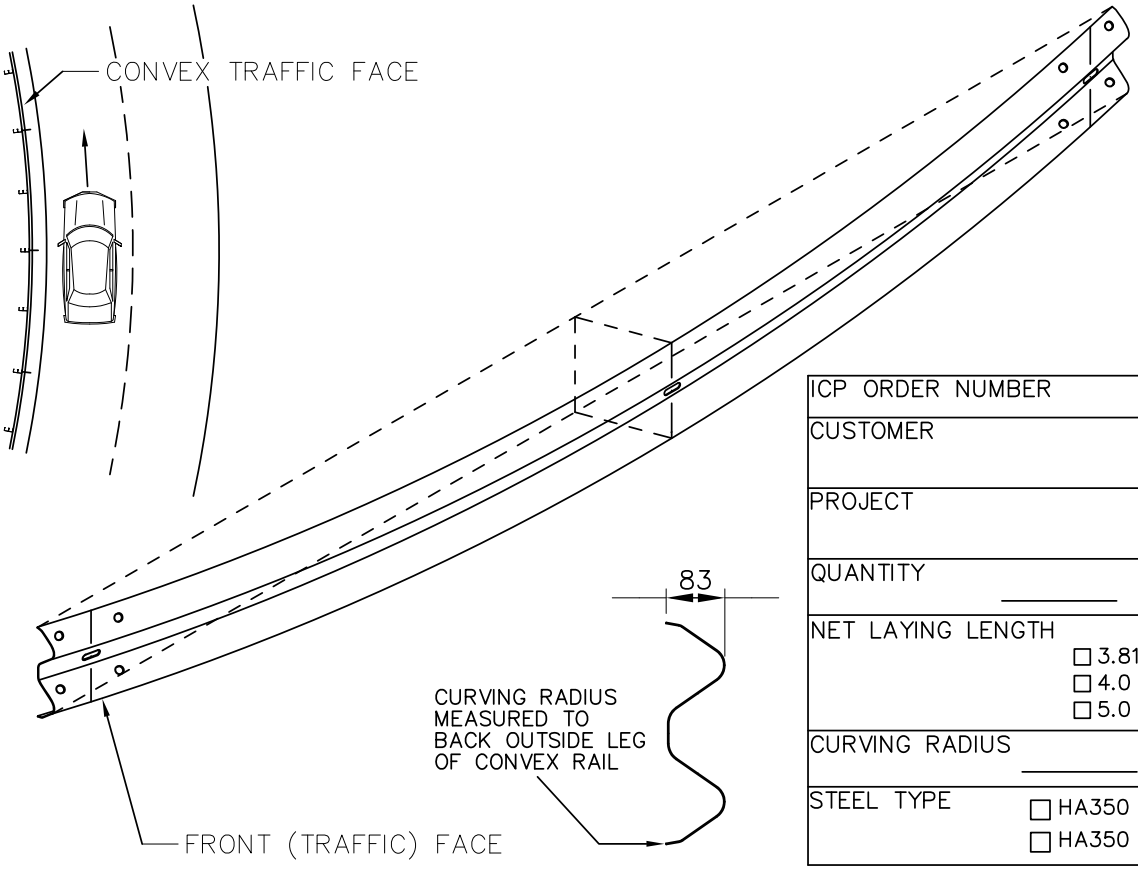
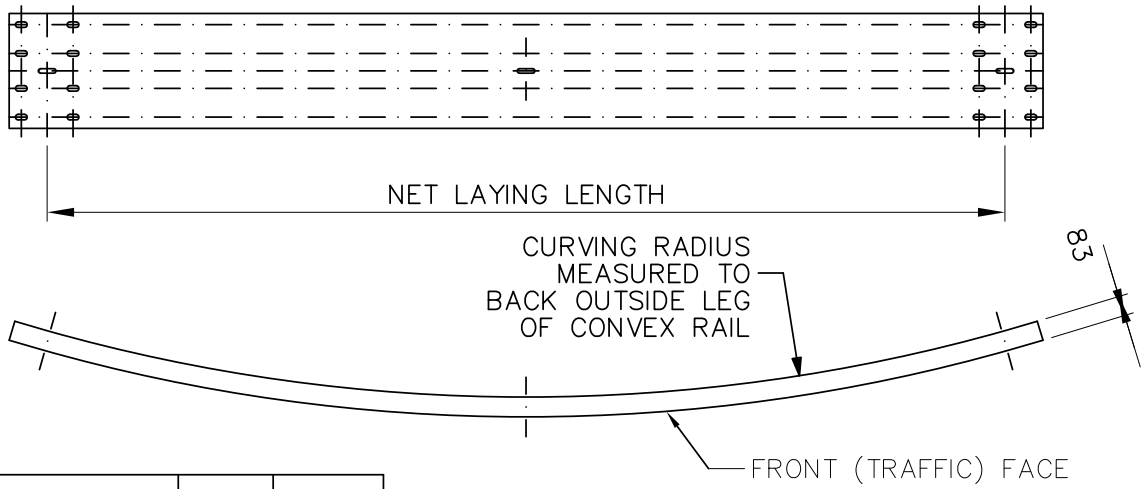
PRODUCTION DEPARTMENT INSPECTION SHEET CP–WI–05.5D/0.



ICP ORDER NUMBER	
CUSTOMER	
PROJECT	
QUANTITY	_____ PIECES
NET LAYING LENGTH	☐ 3.81 METRES ☐ 4.0 METRES ☐ 5.0 METRES
CURVING RADIUS	_____ METRES
STEEL TYPE	☐ HA350 2.7mm ☐ HA350 3.5mm



ISSUE	Description	Checked	Date
2	CONTACT DETAILS, 3.5MM	LG	08/08/14
1	INITIAL ISSUE	GPP	29/06/03

INGAL Civil Products
57–65 Airds Road, Minto, 2566
Australia
Telephone 61–2–9710 5555
Facsimile 61–2–9542 3667
www.ingalcivil.com.au

PROJECT DETAILS

W–BEAM GUARDRAIL CURVING CONVEX RAIL SINGLE CURVATURE

DATE	DRAWN	DESIGNED	CHECKED
29/06/03	GPP	GPP	GPP
MAT. HA350	FINISH H.D.GALV.	SCALE NTS	

INGAL CIVIL PRODUCTS DRAWING No.

GR–STD–31

ISSUE No.

2

For more information

INGAL CIVIL PRODUCTS
A valmont COMPANY

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• Brisbane • Melbourne
• Newcastle • Wagga
• Perth • Sydney