

ET2000 Plus

Guardrail Extruder Terminal

Product Manual



Release 04/15

ET2000™ PLUS is licensed to Ingal Civil Products by Trinity Industries Inc. of the U.S.A.

www.ingalcivil.com.au

ET2000 Plus Guardrail Extruder Terminal

1.0 Introduction

The ET2000 Plus guardrail extruder terminal is engineered to absorb the kinetic energy of an impacting vehicle at a controlled rate, providing a soft ride-down for vehicle occupants.

Unlike traditional flared guardrail terminals, the ET2000 Plus is a tangential end treatment that is installed on a straight alignment. The use of an ET2000 Plus provides an end treatment solution for applications where there is insufficient space for a flared end terminal or when it is cost prohibitive to place an embankment for a flared terminal.

The ET2000 Plus is available in two sizes. The compact 7.62m TL2 terminal is an economical solution where the posted speed is less than or equal to 70km/h. The standard 15.24m TL3 terminal is acceptable for all posted speeds greater than 70km/h.

2.0 Functionality

Upon impact, the extruder head travels horizontally along the guardrail beams, flattening the w profile of the beam and extruding the flattened section away from the traffic face. It is this action that absorbs the kinetic energy of the impacting vehicle.

The guardrail beams are supported by specially engineered Steel Yielding Terminal (SYT) posts that are designed to yield when the terminal is impacted end-on, and provide redirection for side-on impacts.

3.0 Crash Test Details

The ET2000 Plus has been crash tested and assessed in accordance with Test Level 2 (TL2) and Test Level 3 (TL3) of the National Cooperative Highway Research Program (NCHRP) Report 350.

Australian state specific product acceptance details are available upon request from your local Ingal representative.

4.0 Specifications

4.1 Material:

Guardrail Beams:	Grade 350MPa
STY Posts:	Grade 300MPa
Blocking Pieces:	Composite HDPE / crumb rubber
Delineation:	Class 1A reflective sheeting

All steel components are hot dip galvanized in accordance with AS/NZS 4680.

4.2 System Dimensions:

TL2 Terminal:	7.62m overall length
TL3 Terminal:	15.24m overall length
SYT Post Spacing:	1,905mm
Point of Need:	Post 3

4.3 Packaging:

The ET2000 Plus is available packaged as individual units to facilitate rapid installation and minimise disruption to traffic.

TL2 Package Mass:	330kg
TL3 Package Mass:	540kg



5.0 Installation

Only items provided by Ingal are to be used for the installation of the ET2000 Plus. The following written instructions are to be read in conjunction with Ingal's drawings. A generic Safe Work Method Statement is available upon request for installation operations.

5.1 Site Preparation.

The site should be prepared free of obstructing vegetation and other hazards that may interfere with the installation or operational performance of the system. This includes kerbs below the system and other hazards that may hinder the extruder head as it travels horizontally along the guardrail beams. Some sites may require minor grading if installed beyond the edge of the pavement shoulder.

Impacts occurring prior to the location of the 3rd post (point of need) may allow the vehicle to pass behind the barrier system. Therefore, the area immediately behind the terminal should be reasonably traversable and free from fixed object hazards. If a clear run-out is not possible, this area should be similar in character to adjacent unshielded roadside areas.

Since the terminal functions by extruding rail away from the traffic face, a risk assessment is recommended if pedestrians and/or cyclists will be accessing the area behind the terminal.

5.2 Set-Out

When the downstream guardrail system is installed parallel to the edge of the roadway without any offset, a 25:1 or flatter flare over the length of the ET2000 Plus may be used to locate the extruder head away from the roadway.

When the ET2000 Plus is installed at the end of guardrail following a curved alignment, the following should be adopted for the layout of the terminal. For both conditions, the ET2000 Plus must be straight over the length of the system. All offsets are measured to the face of the rail.

Outside of the Curve. The ET2000 Plus is to be installed with a maximum offset of 610mm from the curve.

Inside of the Curve. For a curve radius of 300m or less, the ET2000 Plus is to be installed with a maximum offset of 305mm from the curve. For a curve radius greater than 300m, the ET2000 Plus is to be installed with a maximum offset of 610mm from the curve.

When establishing the post locations of the terminal, take care to note the following;

- The first two posts from the end of the terminal have no offset blocking piece;
- The 200mm offset block used in the terminal is wider than conventional w-beam offset blocking pieces;
- The 1,905mm spacing for the SYT posts is different from the conventional w-beam barrier spacing of 2,000mm (2,500mm in Victoria).



5.3 Installing the HBA Bottom Post

The first post of the ET2000 Plus is a Hinged Breakaway (HBA) post that comprises a top and bottom half. Installation commences by first installing the bottom half of the post as an individual item. This may be achieved by

- Driving the bottom post with an approved driving head to the appropriate depth, approximately 1,800mm

or

- Auguring a 300mm diameter pilot hole approximately 1,800mm deep and force the HBA post to the appropriate depth by impact or vibratory means with an approved driving head after compaction. Backfill material shall be placed in 150mm lifts and compacted with pneumatic equipment or heavy hand tampering equipment for optimal compaction.

If rock is encountered when installing the HBA bottom post, use either of the following procedures unless there is a more restrictive Regulatory Authority specification that should be followed:

- If rock is encountered with less than 500mm required to complete the installation of the HBA bottom post to full depth, drill a 300mm diameter hole in the rock to the depth required to install the HBA bottom post to full depth. Backfill and compact the hole in accordance with Section 5.6.
- If rock is encountered and more than 500mm is required to install the HBA bottom post to full depth, drill a 300mm diameter hole 560mm deep into the rock. Install the HBA bottom post in the hole, cutting off the bottom of the HBA bottom post so that its top is at the correct elevation for proper installation. Backfill and compact the hole in accordance with Section 5.6.

Care must be taken to ensure the HBA bottom post is installed perpendicular to the finished ground level.

Once installed the HBA bottom post should not protrude more than 100mm above the ground line.

5.4 Installing the HBA Top Post

- Install the HBA top post by aligning the holes of the ears on the HBA top and bottom posts. Refer to Figure 1 for the correct orientation
- In the 11mm diameter holes, install $\frac{3}{8}$ " (10mm) diameter x 2" (50mm) hex head bolt (C1625) with a $\frac{3}{8}$ " (10mm) washer (C1620) and secure with a $\frac{3}{8}$ " (10mm) lock washer (C1622) and $\frac{3}{8}$ " (10mm) hex nut (C1626). The bolts should be installed so that the nuts are on the inside of the ears
- In the 21mm diameter holes, install a $\frac{3}{4}$ " (20mm) diameter x 2½" (63mm) hex head high strength bolt (C1619) with a $\frac{3}{4}$ " (20mm) washer (C1617) and secure with a $\frac{3}{4}$ " (20mm) lock washer (C1624) and $\frac{3}{4}$ " (20mm) hex nut (C1618). There is no torque requirement for these bolts. They should be tightened to a snug position. Do not install the bolt on the shoulder side until the strut is ready to be installed.

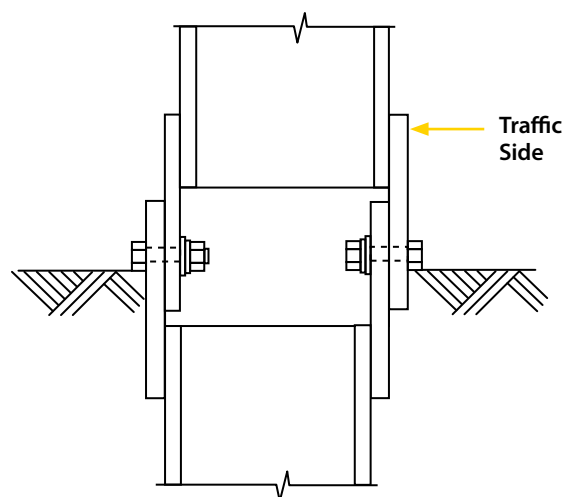


Figure 1: Orientation of HBA Post

The HBA Top Post must be installed perpendicular to the finished ground level. ($\pm 1^\circ$ or 15mm angular displacement at top of post).

5.5 Installing the SYT Posts

The SYT posts may be installed by using any of the following methods:

- Driving the posts with an approved driving head to the appropriate elevation, 730mm \pm 20mm. Note there is little tolerance in relative height of posts to one another. Care in setting the posts to the same height will facilitate a quicker installation.

or

- Auguring a 300mm diameter pilot hole approximately 1,100mm deep. Backfill native material shall be placed in 150mm lifts and compacted with pneumatic equipment or heavy hand tampering equipment for optimal compaction. Force the SYT post into backfilled hole to an appropriate depth by impact or vibratory means with an approved driving head.
- If rock is encountered, drill a 300mm diameter hole in the rock to the depth required to install the SYT post to full depth. Backfill and compact the hole. The material removed from the hole may be used for the backfill.

5.6 Backfill of Posts in Excavated Rock Holes

Native materials may be used for backfilling in overlying soil. Backfill material in excavated rock hole should be compliant to ASTM C33 coarse aggregate size number 57 – reference Table 1

Table 1: Grading Requirements for Course Aggregate					
Size No.	Amounts finer than each laboratory sieve (square – openings), mass percent				
	37.5mm	25.0mm	12.5mm	4.75mm	2.36mm
57	100	95 to 100	25 to 60	0 to 10	0 to 5

Backfill material shall be placed and compacted to 95% maximum dry density in 150mm lifts. When the top of the drilled hole is not at the surface, the soil above the drilled hole should consist of native soil re-compacted to existing specifications. The post should be driven into the backfilled hole after compaction.

5.7 Installing the Angle Strut

- Place the angle iron strut (C1798G) between post 1 (HBA post) and post 2 (first SYT post).
- Attach the strut to post 1 (HBA post) with a $\frac{3}{4}$ " (20mm) diameter x $2\frac{1}{2}$ " (63mm) hex head high strength bolt (C1619) with a $\frac{3}{4}$ " (20mm) washer (C1617) and secure with a $\frac{3}{4}$ " (20mm) lock washer (C1624) and $\frac{3}{4}$ " (20mm) hex nut (C1618). Install so that the nut is on the inside of the ears.
- Attach the strut to post 2 (first SYT post) with 2 off $\frac{7}{16}$ " (11mm) diameter x $1\frac{1}{2}$ " (38mm) hex head bolts (C1629) with 2 off $\frac{7}{16}$ " (11mm) washers (C1628) and secure with 2 off $\frac{7}{16}$ " (11mm) lock washer (C1630) and $\frac{7}{16}$ " (11mm) hex nut (C1627). Install so that the nut is on the inside of the flange

There is no torque requirement for any of these bolts. They should be tightened to a snug position.



5.8 Installing Blocking Pieces and Rails

- Place the 190mm plastic King Block (C1797) on posts 3 through 8.
- Select 3 off 3.81m rail panels (C1355G) and 1 off 3.81m anchor rail (C1811G). The anchor rail should be orientated with the anchor bracket holes closest to the terminal end.
- At posts 3 through 8, bolt rail panels with the correct lap orientation with a $\frac{5}{8}$ " (16mm) diameter x 10" (255mm) long mushroom head post bolt. A $\frac{5}{8}$ " (16mm) diameter round washer (C1631) and a $\frac{5}{8}$ " (16mm) hex

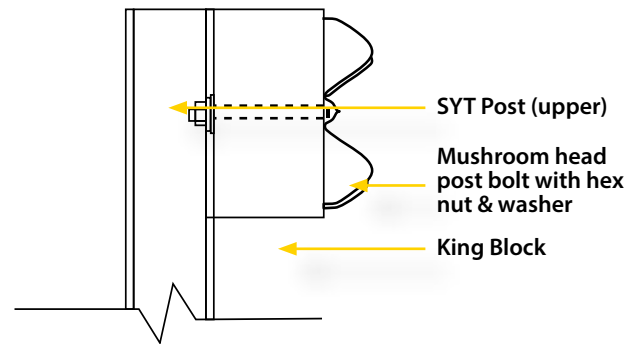


Figure 2: Attachment of King Block

nut (C1632) secures the rail and block to the post. The washer is located between the post and the nut. See Figure 2.

- At post 2, bolt the rail panel directly to the SYT post with a 16mm diameter x 32mm long mushroom head post bolt (C1550) and a 16mm washer (C1631) and hex nut (C1520). The washer is located between the post and the nut. No post bolt is used at post 1
- Splice the 3.81m rail panels together with eight 16mm diameter x 32mm long mushroom head splice bolts (C1550) and hex nuts (C1520).



5.9 Installing the Cable Anchor Assembly

- The cable anchor fitting (C1813G) is secured to the anchor rail panel (C1811G) by inserting the protruding hooks into the slots in the rail. It is locked into place by pulling the bracket towards the terminal end.
- Slide one end of the cable (C1162) into the cable anchor fitting (C1813G) and the other end through post 1 (HBA post). Secure the cable to the anchor fitting with a 1" (25mm) washer and 1" (25mm) hex nuts.
- Place the bearing plate (C1479G) with the 125mm dimension up and the 75mm dimension down. Secure the cable with a 1" (25mm) washer and 1" (25mm) hex nut
- Restrain the cable with vice grips at the end being tightened to avoid twisting the cable. Make sure the nuts are tight and the cable is tightened to a tension of 50Nm.



5.10 Installing the Extruder Head

The final piece to attach is the extruder head:

- Place the extruder head (C1812G) over the end of the anchor rail panel (C1811G). The extruder head can be used on the left hand or right hand shoulder. Be sure

that the extruder is orientated with the exit slot on the rear side of the guardrail system, so that the guardrail is extruded away from traffic.

- The extruder head should be pushed along the anchor rail panel as far as it will go. Centre the rail in the tail of the extruder.
- The top and bottom attachment brackets of the extruder head each have three holes to provide tolerance in the installation. Choose the hole in the attachment bracket that is closest to the predrilled hole in the post to allow the extruder head be parallel with the W-Beam rail. Secure the extruder head with a 3/8" (10mm) diameter x 1 1/2 (38mm) hex head bolt (C1623) and a 3/8" (10mm) washer (C1620) and lock washer (C1621) between the 3/8" (10mm) nut (C1626) and the post at the top and bottom attachment brackets
- If not already fixed, attach regulatory authority approved reflective/chevron sheeting (specifications differ in each state) to the face of the extruder head. Note the orientation of the reflective/chevron sheeting may depend on what side of the road the terminal is installed relative to.



5.11 Installation of the TL2 ET2000 Plus

The installation of the TL2 system follows that of the longer TL3 system however, the following needs to be observed:

- The system comprises of 1 off HBA post assembly and 3 off SYT posts

ET2000 Plus Installation Checklist

Customer:

Project:

Barrier ID:

Terminal Type: ☐ TL2 ☐ TL3

Checked By:

Signed:

Date:

Have the SYT posts been positioned every 1,905mm	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Does the bottom half of post 1 (HBA) protrude not more than 100mm above ground level	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Are all bolts securing the top to the bottom of the HBA post tight	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Are the SYT posts at the correct height of 730mm \pm 20mm above ground level	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the extruder head pushed to its maximum along the anchor rail	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the extruder head correctly orientated with the exit slot facing the rear of the guardrail system	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the area below the guardrails free from hazards so that the extruder head can travel freely upon impact	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the extruder head properly secured to post 1 through the attachment brackets	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Has delineation been attached to the extruder head	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Have the rails been secured to posts 2 through 8 (posts 2 through 4 for the TL2 system)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Have the rails been spliced with M16x32mm mushroom head bolts	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Are all splice bolts and post bolts snug tight	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the fill material around each post suitably compacted	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the anchor cable secured between the anchor rail and post 1	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the bearing plate correctly orientated	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Is the cable tensioned to 50Nm	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Has any minor damage been repaired using two coats of an organic zinc rich paint	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Does the terminal form a smooth line vertically and horizontally when viewed along the system	<input type="checkbox"/> Yes	<input type="checkbox"/> No

6.0 Attachments

The ET2000 Plus has been assessed through full scale crash testing. The attachment of items, such as motorcycle rub rails or handrails may alter the functionality of the terminal as a guardrail end treatment. Only items sanctioned by Ingal are to be attached to the ET2000 Plus.

6.1 Extruder Head Cover.

Manufactured from UV stabilised Polyethylene, the extruder cover provides protection for vulnerable road users. The cover slides over the extruder head and can be secured with tek screws along the sides. Retroreflective/ Chevron sheeting is attached directly to the face of the cover.



Extruder Head with Cover - Rear View



Extruder Head with Cover - Front View

7.0 Maintenance

Except for repairs due to impacts, there is virtually no maintenance required for the system. It is recommended that annual inspections be performed to ensure the following;

- The terminal is appropriately delineated.
- Debris has not accumulated around the terminal that may impede the travel of the extruder head.
- The anchor cable is taut and the nuts have not been removed from the cable.
- The blocking pieces have not rotated.

7.1 Bush Fire Damage

All steel items used for the assembly of the ET2000 Plus are hot dip galvanized. The performance of galvanized coatings when subjected to fires depends upon a number of factors, such as flame duration, intensity and the characteristics of the galvanized coating.

Typical bushfire conditions may expose steel structures to an air temperature of 800°C for periods of up to 120 seconds, however zinc coatings are generally reflective and will not absorb heat at the same rate as an uncoated steel surface. Depending on the section thickness of the steel, the actual steel surface temperature may not exceed 350°C.

Typically, the bushfire flame duration and intensity are not high enough to compromise the structural strength of the steel. The hot dip galvanized coating will also typically remain unaffected through a bushfire event. If the bushfire causes damage to the galvanized surface, then the item(s) shall be replaced.

If an item to be replaced is a post or rail, it is recommended that the blocking pieces be replaced at these locations.

7.2 Damage Assessment

In the event of a vehicle impact, damage to the terminal is to be assessed in accordance with Table 2.

A Safe Work Method Statement is available upon request to assist in the safe repair of the ET2000 Plus.

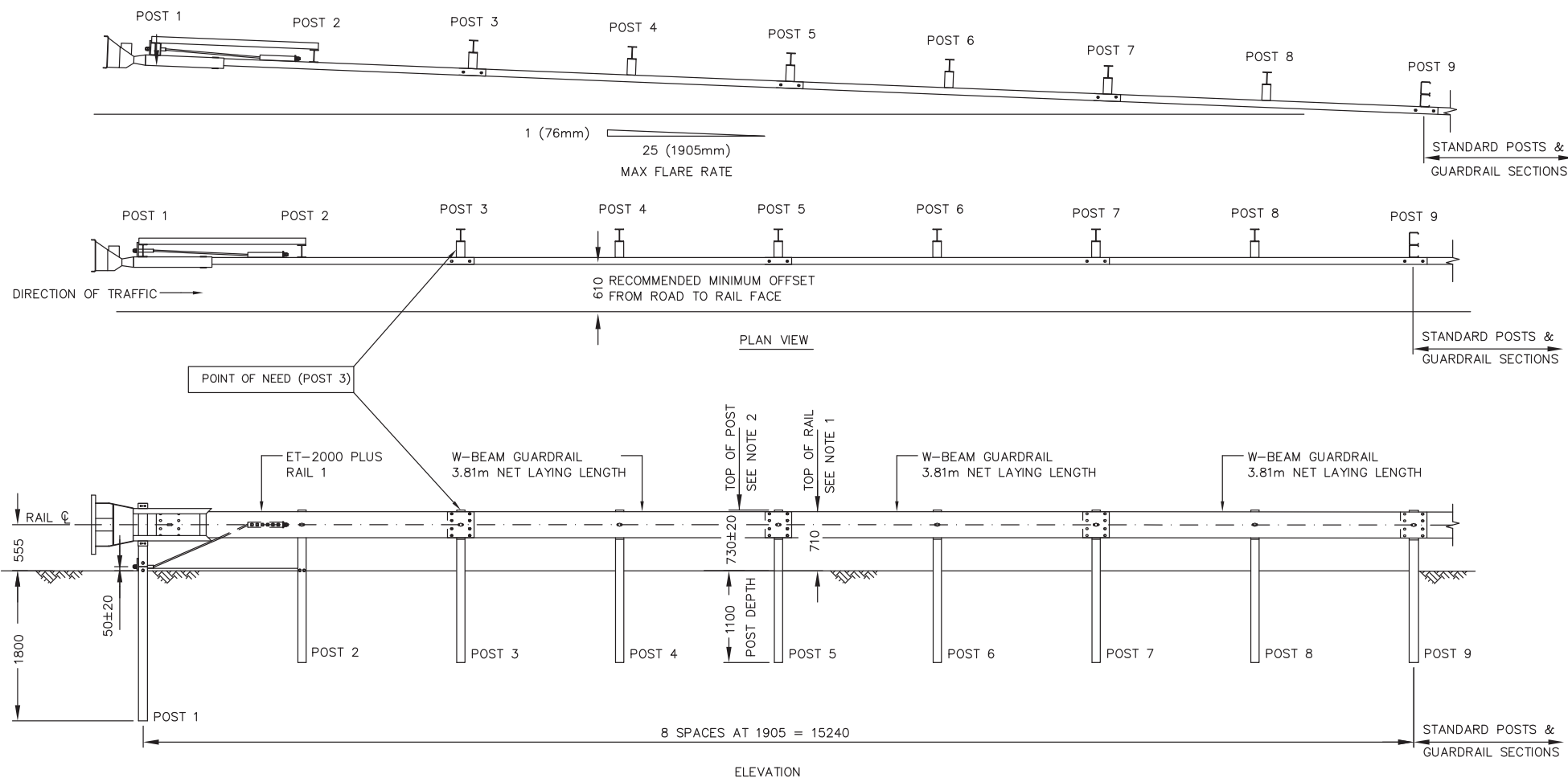
Only items purchased from Ingal shall be used for the repair of the ET2000 Plus.

When replacing posts, ensure that the disturbed foundation material is suitably compacted prior to the installation of replacement posts.



Table 2: Damage Assessment of ET2000

Type of Defect	Description of the Defect	Action to be Taken
Galvanizing damage on posts.	The sum total of the damaged area does not exceed 45cm ² (0.5% of the total surface area) and no individual damaged area exceeds 40cm ² . The sum total of the damaged area exceeds 45cm ² (0.5% of the total surface area) or an individual damaged area exceeds 40cm ² .	An organic zinc rich epoxy paint is to be applied to the repair area in two coats. The post is to be replaced.
Galvanizing damage on rails.	The sum total of the damaged area does not exceed 200cm ² (0.5% of the total surface area) and no individual damaged area exceeds 40cm ² . The sum total of the damaged area exceeds 200cm ² (0.5% of the total surface area) or an individual damaged area exceeds 40cm ² .	An organic zinc rich epoxy paint is to be applied to the repair area in two coats. The rail is to be replaced.
Mechanical damage on blocking pieces	The blocking piece has chips or cracks.	The blocking piece is to be replaced.
Mechanical damage on SYT posts.	The post is bent.	The post is to be replaced.
Mechanical damage on extruder head	The extruder head has minor damage that will not prevent its travel along the rail. The extruder head is bent which will prevent its travel along the rail. The delineation tape is damaged.	The extruder head may be reused. The extruder head is to be replaced. The delineation tape is to be replaced.
Mechanical damage on rail.	The rail is dented, twisted or flattened. There are nicks in any part of the rail. The slots in the rail are distorted.	The rail is to be replaced. The rail is to be replaced. The rail is to be replaced.
Mechanical damage on bolts.	The body of the bolt is distorted. The thread of the bolt is damaged.	The bolt is to be replaced. The bolt is to be replaced.
Disturbance of material around posts.	The material around the post is loose or uncompacted.	Any disturbed pavement or material around a post shall be left dense, tight and smooth so that resistance to water penetration is similar to that of the adjacent surface.



THE CLEAR ZONE IS DEFINED AS THE AREA BEHIND AN END TERMINAL THAT IS AVAILABLE FOR SAFE USE BY ERRANT VEHICLES.

THE SIZE OF THE CLEAR ZONE IS DEPENDANT UPON DESIGN SPEED, TRAFFIC VOLUME, AND ROADSIDE GEOMETRY (CROSS-SLOPE).

THE ROAD DESIGNER SHALL SPECIFY CLEAR ZONE DIMENSIONS TO COMPLY WITH THE REQUIREMENTS OF THE RELEVANT STATE ROAD AUTHORITY.

NOTES:

1. RAIL HEIGHT DIMENSIONS ARE TYPICAL. IF VARIANCE FROM ROAD CONTROLLING AUTHORITY, ROAD AUTHORITY RAIL HEIGHT SHOULD BE USED.
2. IF RAIL HEIGHT IS TO BE MODIFIED AS PER NOTE 1, NEW POST HEIGHT SHOULD BE RAIL HEIGHT PLUS 20mm.

Rev	Description	Chkd	Date
E	NOTES ADDED	L.G.	12/08/14
D	LAYOUT AMENDED	M.S.	27/10/10
C	AMENDED TITLE BLOCK & DWG CONVERT	M.S.	03/02/09
B	GENERAL AMENDMENTS	B.F.	19/5/04
A	HAZARD FREE ZONE & POST DEPTH ADDED	B.F.	22/3/04
O	INITIAL ISSUE	G.P.P.	4/8/03



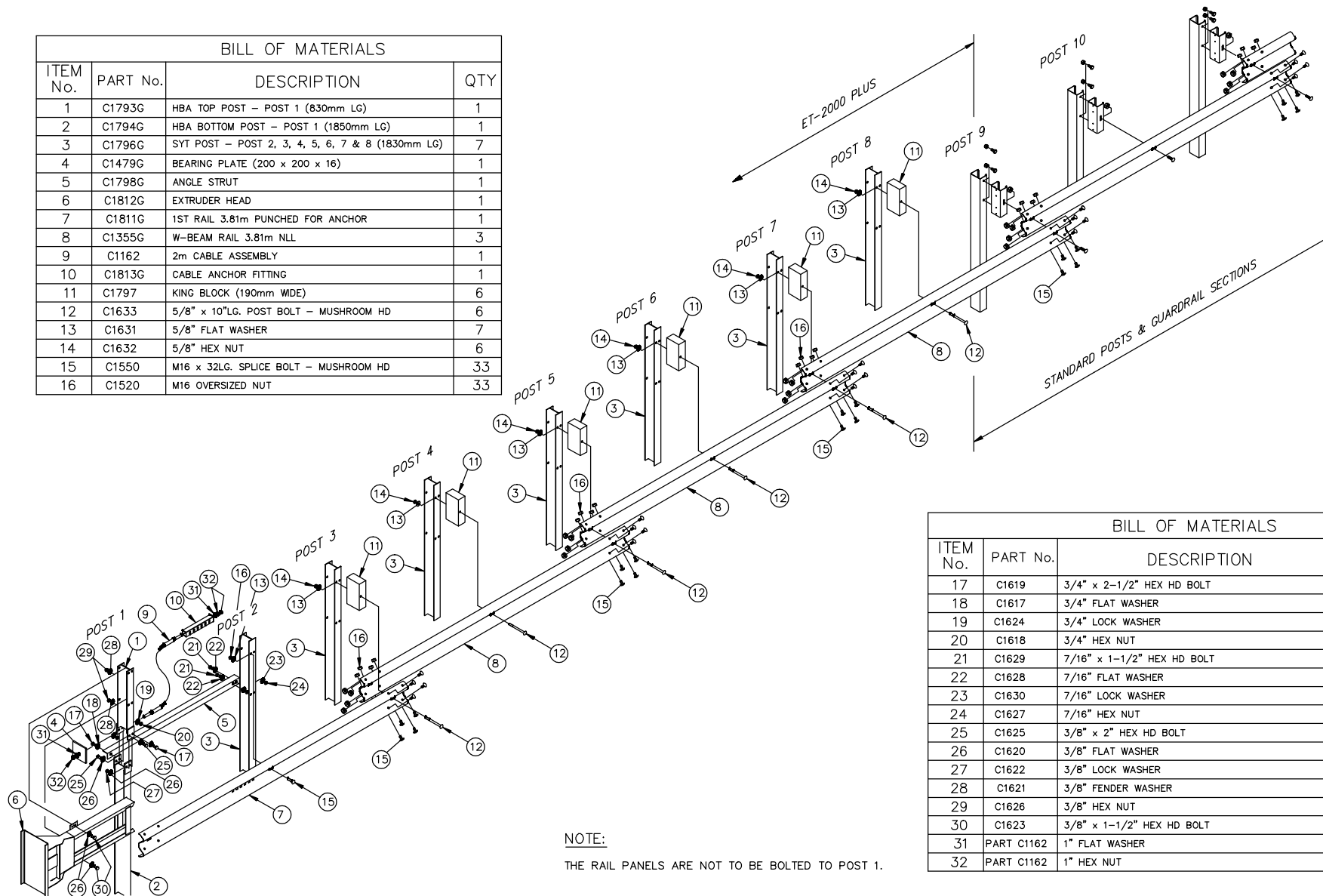
INGAL Civil Products

57-65 Airlds Rd, Minto, NSW, 2566 Australia
Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au
c Industrial Galvanizers Corporation Pty Ltd ACN 000 545 415 (2003)
This drawing is the subject of COPYRIGHT. No part of it may be used, reproduced or copied by any means or in any form without the prior permission of the owner.

PROJECT	ET-2000 PLUS STEEL YIELDING TERMINAL POST SYSTEM NCHRP 350 TEST LEVEL 3
TITLE	GUARDRAIL EXTRUDER TERMINAL SITE PLAN

DATE	27/10/10	INGAL CIVIL PRODUCTS
DRAWN	M.S.	PART No.
DESIGNED	TRINITY IND.	
CHECKED	G.P.P.	ISSUE No.
MATERIALS	AS SHOWN	CAB-STD-61
FINISH	H.D.GALV.	REV.E
SCALE	1:50 (A3)	

BILL OF MATERIALS			
ITEM No.	PART No.	DESCRIPTION	QTY
1	C1793G	HBA TOP POST – POST 1 (830mm LG)	1
2	C1794G	HBA BOTTOM POST – POST 1 (1850mm LG)	1
3	C1796G	SYT POST – POST 2, 3, 4, 5, 6, 7 & 8 (1830mm LG)	7
4	C1479G	BEARING PLATE (200 x 200 x 16)	1
5	C1798G	ANGLE STRUT	1
6	C1812G	EXTRUDER HEAD	1
7	C1811G	1ST RAIL 3.81m PUNCHED FOR ANCHOR	1
8	C1355G	W-BEAM RAIL 3.81m NLL	3
9	C1162	2m CABLE ASSEMBLY	1
10	C1813G	CABLE ANCHOR FITTING	1
11	C1797	KING BLOCK (190mm WDE)	6
12	C1633	5/8" x 10"LG. POST BOLT – MUSHROOM HD	6
13	C1631	5/8" FLAT WASHER	7
14	C1632	5/8" HEX NUT	6
15	C1550	M16 x 32LG. SPLICE BOLT – MUSHROOM HD	33
16	C1520	M16 OVERSIZED NUT	33



NOTE:

THE RAIL PANELS ARE NOT TO BE BOLTED TO POST 1.

BILL OF MATERIALS			
ITEM No.	PART No.	DESCRIPTION	QTY
17	C1619	3/4" x 2-1/2" HEX HD BOLT	2
18	C1617	3/4" FLAT WASHER	2
19	C1624	3/4" LOCK WASHER	2
20	C1618	3/4" HEX NUT	2
21	C1629	7/16" x 1-1/2" HEX HD BOLT	2
22	C1628	7/16" FLAT WASHER	2
23	C1630	7/16" LOCK WASHER	2
24	C1627	7/16" HEX NUT	2
25	C1625	3/8" x 2" HEX HD BOLT	2
26	C1620	3/8" FLAT WASHER	4
27	C1622	3/8" LOCK WASHER	2
28	C1621	3/8" FENDER WASHER	2
29	C1626	3/8" HEX NUT	4
30	C1623	3/8" x 1-1/2" HEX HD BOLT	2
31	PART C1162	1" FLAT WASHER	2
32	PART C1162	1" HEX NUT	3

Rev.	Description	Chkd	Date
C	TITLE BLOCK UPDATED	MS	24/02/09
B	ITEM 11 DESCRIPTION AMENDED	BF	19/05/04
A	ITEM 13 QUANTITY CHANGED	BF	22/03/04
0	INITIAL ISSUE	GPP	04/08/03



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
 c Industrial Galvanizers Corporation Pty Ltd ACN 000 545 415 (2005)
 This drawing is the subject of COPYRIGHT. No part of it may be used, reproduced or copied by any means or in any form without the prior permission of the owner.

PROJECT ET-2000 PLUS NCHRP TEST LEVEL 3
 STEEL YIELDING TERMINAL POST SYSTEM

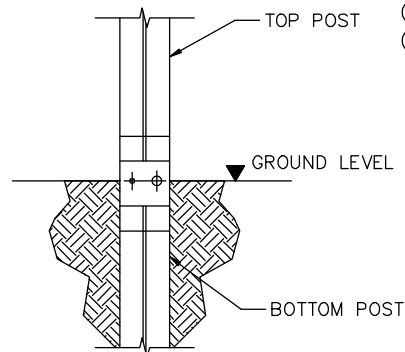
TITLE GUARDRAIL EXTRUDER TERMINAL
 ISOMETRIC ASSEMBLY DETAILS

DATE	04/08/03
DRAWN	B.F
DESIGNED	TRINITY IND.
CHECKED	GPP
MATERIALS SHOWN	
FINISH	H.D GALV
SCALE	1:500 (A3)

INGAL CIVIL PRODUCTS
 REFERENCE No.

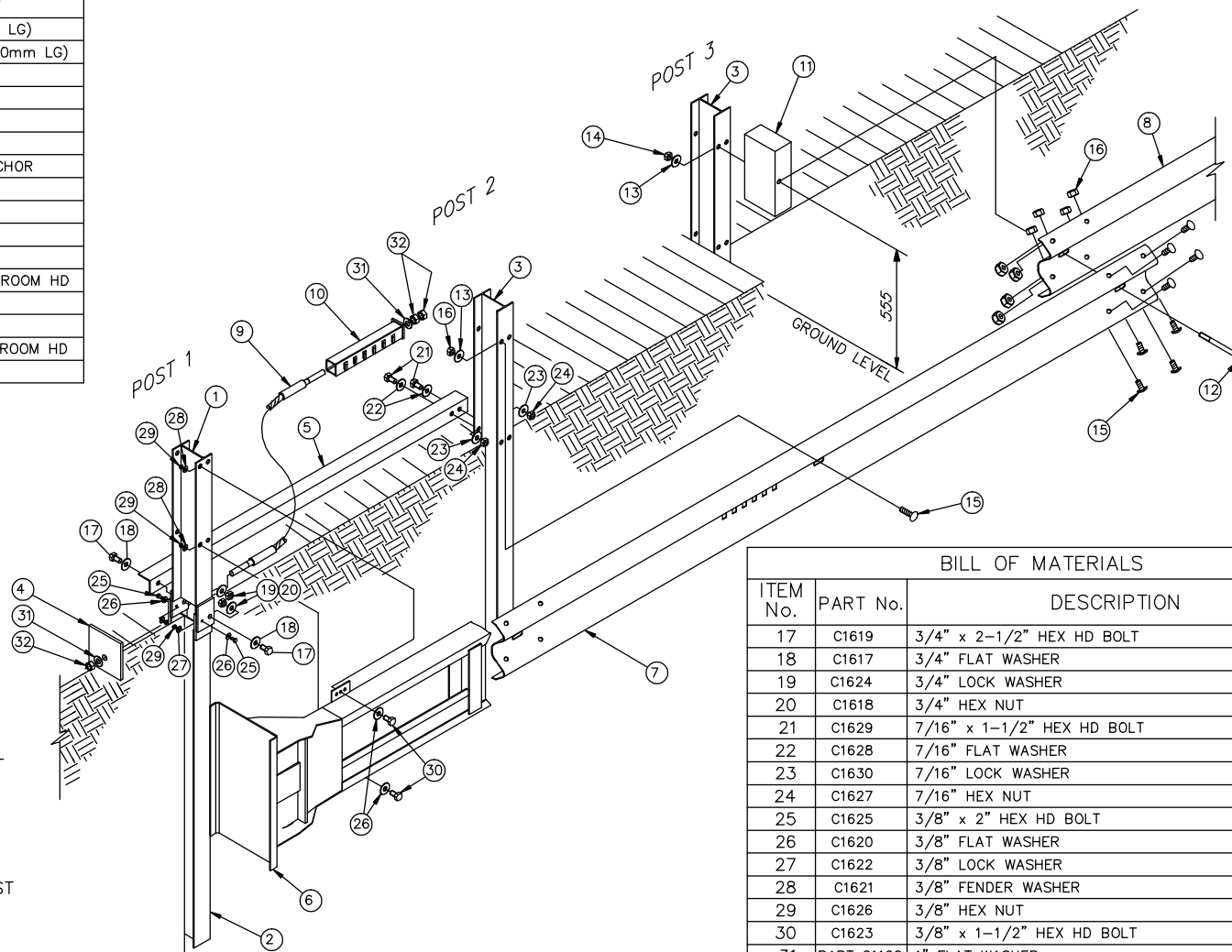
DRAWING No.
 CAB-STD-062
 REV.C

BILL OF MATERIALS		
ITEM No.	PART No.	DESCRIPTION
1	C1793G	HBA TOP POST - POST 1 (830mm LG)
2	C1794G	HBA BOTTOM POST - POST 1 (1850mm LG)
3	C1796G	SYT POST - POST 2 & 3
4	C1479G	BEARING PLATE (200 x 200 x 16)
5	C1798G	ANGLE STRUT
6	C1812G	EXTRUDER HEAD
7	C1811G	1ST RAIL 3.81m PUNCHED FOR ANCHOR
8	C1355G	W-BEAM RAIL 3.81m NLL
9	C1162	2m CABLE ASSEMBLY
10	C1813G	CABLE ANCHOR FITTING
11	C1797	KING BLOCK (190mm WIDE)
12	C1633	5/8" x 10"LG. POST BOLT - MUSHROOM HD
13	C1631	5/8" FLAT WASHER
14	C1632	5/8" HEX NUT
15	C1550	M16 x 32LG. SPLICE BOLT - MUSHROOM HD
16	C1520	M16 OVERSIZED NUT



DRIVING DEPTH DETAIL FOR POST 1

SCALE 1:100



BILL OF MATERIALS		
ITEM No.	PART No.	DESCRIPTION
17	C1619	3/4" x 2-1/2" HEX HD BOLT
18	C1617	3/4" FLAT WASHER
19	C1624	3/4" LOCK WASHER
20	C1618	3/4" HEX NUT
21	C1629	7/16" x 1-1/2" HEX HD BOLT
22	C1628	7/16" FLAT WASHER
23	C1630	7/16" LOCK WASHER
24	C1627	7/16" HEX NUT
25	C1625	3/8" x 2" HEX HD BOLT
26	C1620	3/8" FLAT WASHER
27	C1622	3/8" LOCK WASHER
28	C1621	3/8" FENDER WASHER
29	C1626	3/8" HEX NUT
30	C1623	3/8" x 1-1/2" HEX HD BOLT
31	PART C1162	1" FLAT WASHER
32	PART C1162	1" HEX NUT

Rev	Description	Chkd	Date
C	TITLE BLOCK UPDATED	MS	24/02/09
B	ITEM 11 DESCRIPTION AMENDED	BF	19/05/04
A	LENGTHS ADDED TO BILL OF MATERIALS	BF	22/03/04
0	INITIAL ISSUE	IJ	10/02/04



INGAL Civil Products

57-65 Airids Road, Minto, NSW, 2566 Australia

Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au

c Industrial Galvanizers Corporation Pty Ltd ACN 000 545 415 (2005)

This drawing is the subject of COPYRIGHT. No part of it may be used, reproduced or copied by any means or in any form without the prior permission of the owner.

PROJECT	ET-2000 PLUS NCHRP TEST LEVEL 3 STEEL YIELDING TERMINAL POST SYSTEM
TITLE	GUARDRAIL EXTRUDER TERMINAL POSTS 1, 2 & 3 ASSEMBLY DRAWING

DATE	10/02/04
DRAWN	B.F
DESIGNED	TRINITY IND.
CHECKED	IJ
MATERIALS SHOWN	
FINISH	H.D GALV
SCALE	1:250 (A3)

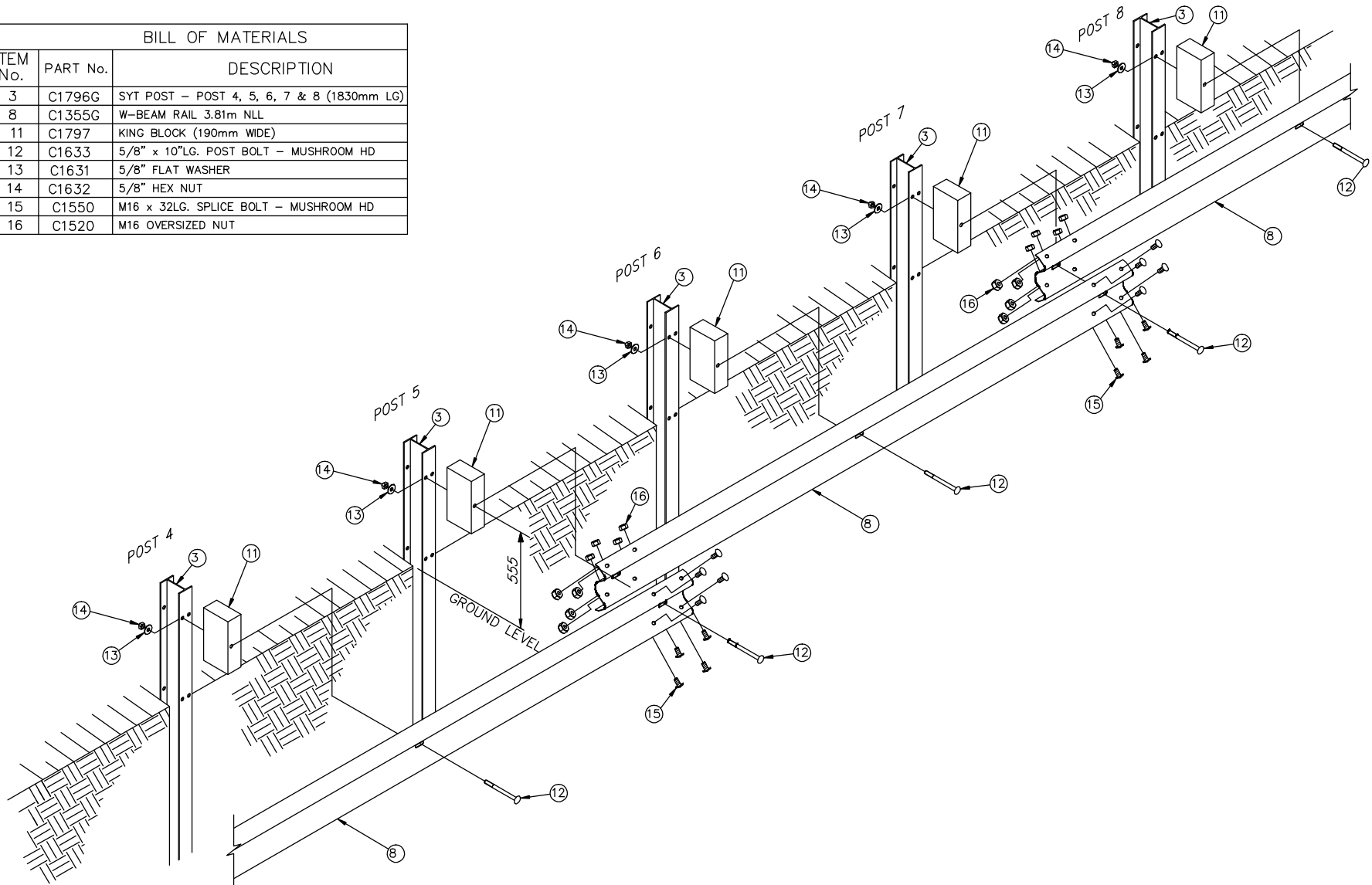
INGAL CIVIL PRODUCTS
REFERENCE No.

DRAWING No.

CAB-STD-063

REV.C

BILL OF MATERIALS		
ITEM No.	PART No.	DESCRIPTION
3	C1796G	SYT POST - POST 4, 5, 6, 7 & 8 (1830mm LG)
8	C1355G	W-BEAM RAIL 3.81m NLL
11	C1797	KING BLOCK (190mm WIDE)
12	C1633	5/8" x 10" LG. POST BOLT - MUSHROOM HD
13	C1631	5/8" FLAT WASHER
14	C1632	5/8" HEX NUT
15	C1550	M16 x 32LG. SPLICE BOLT - MUSHROOM HD
16	C1520	M16 OVERSIZED NUT



Rev	Description	Chkd	Date
C	TITLE BLOCK UPDATED	MS	24/02/09
B	ITEM 11 DESCRIPTION AMENDED	BF	19/05/04
A	LENGTHS ADDED TO BILL OF MATERIALS	BF	22/03/04
0	INITIAL ISSUE	IJ	10/02/04

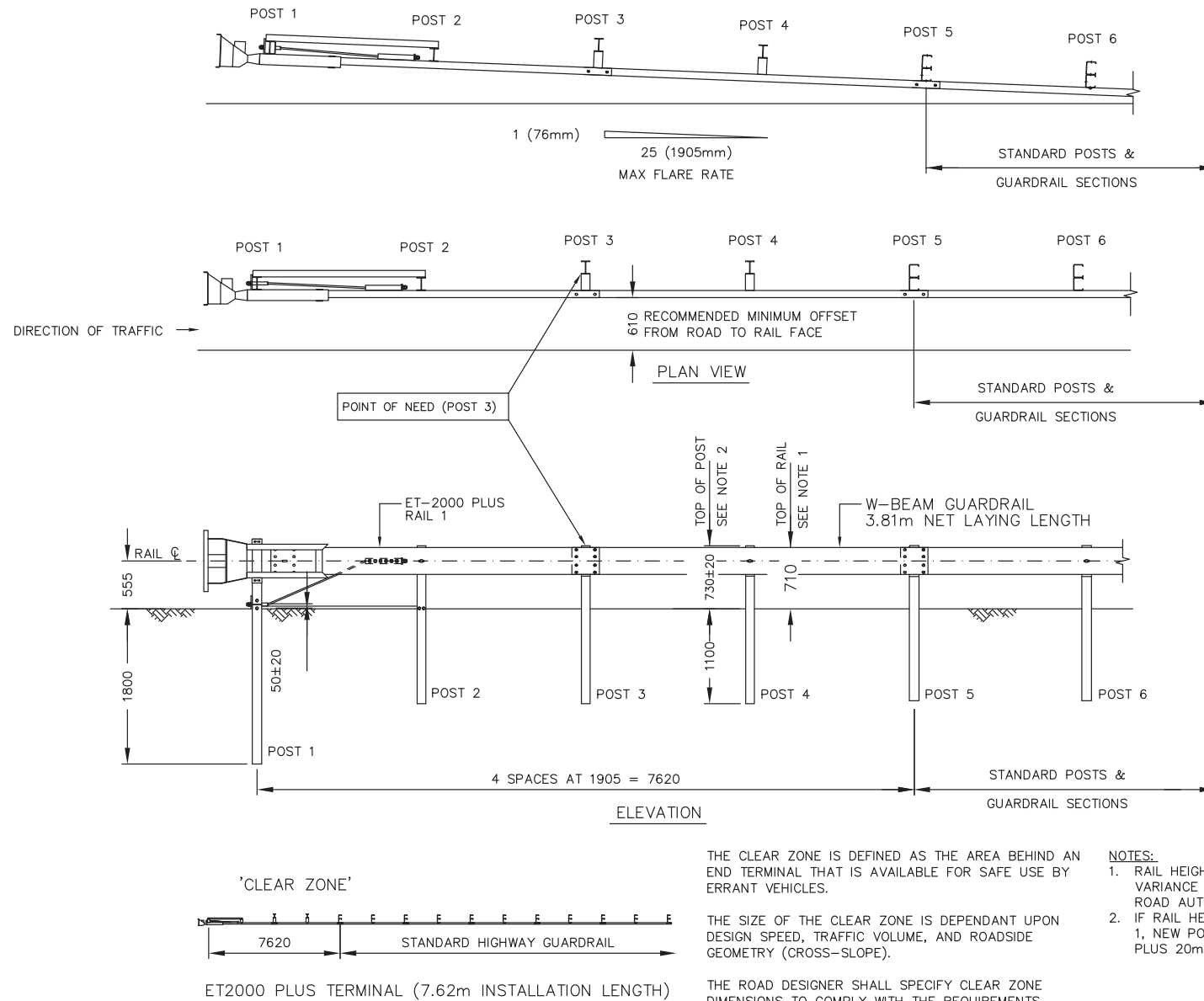


INGAL Civil Products

57-65 Airids Road, Minto, NSW, 2566 Australia
 Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au
 c Industrial Galvanizers Corporation Pty Ltd ACN 000 545 415 (2005)
 This drawing is the subject of COPYRIGHT. No part of it may be used, reproduced or copied by any means or in any form without the prior permission of the owner.

PROJECT	ET-2000 PLUS NCHRP TEST LEVEL 3 STEEL YIELDING TERMINAL POST SYSTEM
TITLE	GUARDRAIL EXTRUDER TERMINAL POSTS 4,5,6,7 & 8 ASSEMBLY DRAWING

DATE	10/02/04	INGAL CIVIL PRODUCTS REFERENCE No.
DRAWN	B.F	
DESIGNED	TRINITY IND.	
CHECKED	IJ	
MATERIALS SHOWN		DRAWING No.
FINISH	H.D GALV	CAB-STD-064
SCALE	1:250 (A3)	REV.C



Rev	Description	Chkd	Date
C	NOTES ADDED	L.G.	12/08/14
B	LAYOUT AMENDED	M.S.	27/10/10
A	TITLE BLOCK AMENDED	M.S.	03/02/09
0	INITIAL ISSUE	I.J.	12/5/05



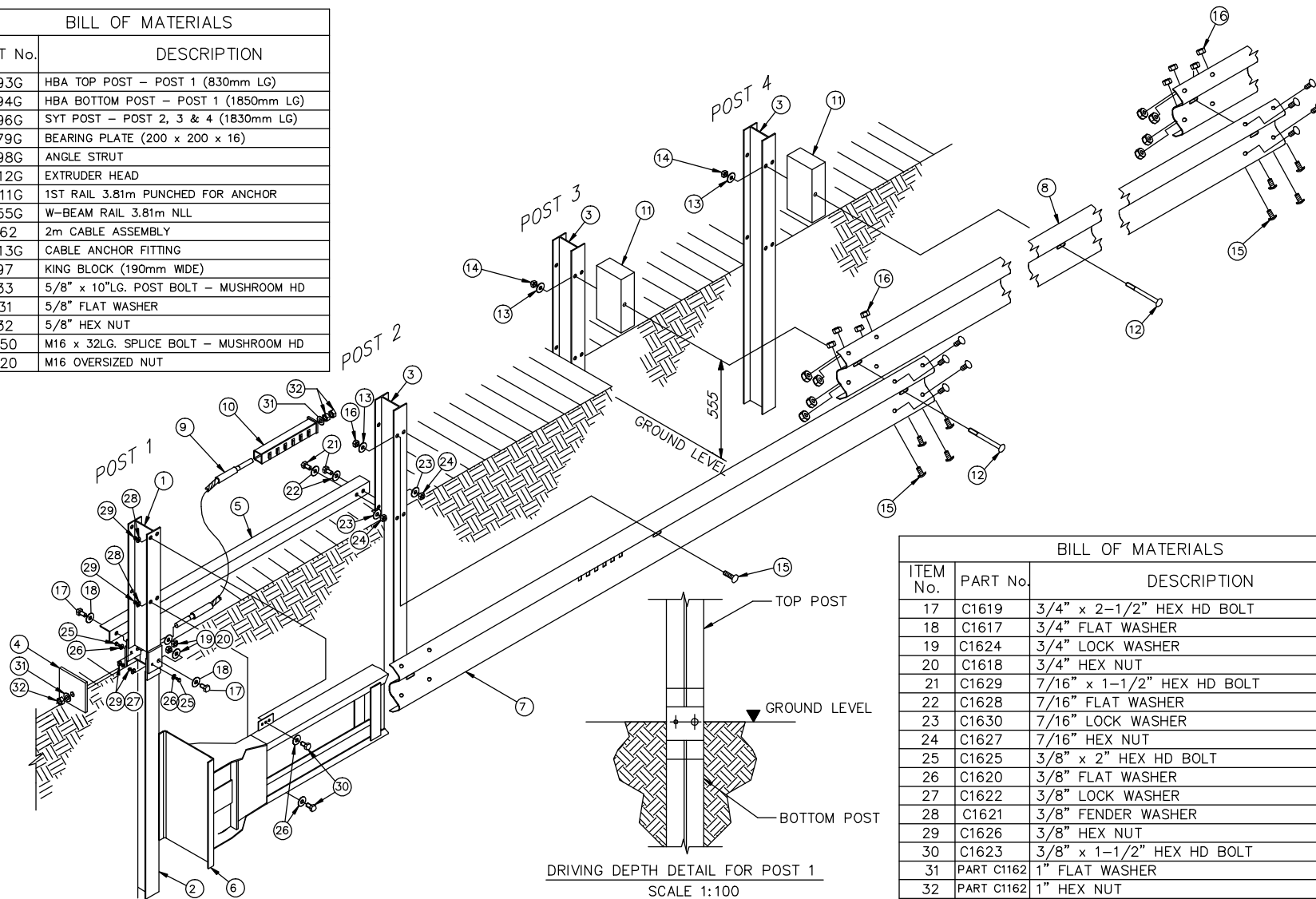
INGAL Civil Products

57-65 Alrds Rd, Minto, NSW, 2566 Australia
 Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au
 c Industrial Galvanizers Corporation Pty Ltd ACN 000 545 415 (2003)
 This drawing is the subject of COPYRIGHT. No part of it may be used, reproduced or copied by any means or in any form without the prior permission of the owner.

PROJECT	ET-2000 PLUS STEEL YIELDING TERMINAL POST SYSTEM NCHRP 350 TEST LEVEL 2
TITLE	GUARDRAIL EXTRUDER TERMINAL SITE PLAN

DATE	27/10/10	INGAL CIVIL PRODUCTS REFERENCE No.
DRAWN	M.S.	
DESIGNED	TRINITY IND.	
CHECKED	I.J.	DRAWING No.
MATERIALS SHOWN		CAB-STD-65
FINISH	H.D.GALV.	REV.C
SCALE	1:50 (A3)	

BILL OF MATERIALS		
ITEM No.	PART No.	DESCRIPTION
1	C1793G	HBA TOP POST – POST 1 (830mm LG)
2	C1794G	HBA BOTTOM POST – POST 1 (1850mm LG)
3	C1796G	SYT POST – POST 2, 3 & 4 (1830mm LG)
4	C1479G	BEARING PLATE (200 x 200 x 16)
5	C1798G	ANGLE STRUT
6	C1812G	EXTRUDER HEAD
7	C1811G	1ST RAIL 3.81m PUNCHED FOR ANCHOR
8	C1355G	W-BEAM RAIL 3.81m NLL
9	C1162	2m CABLE ASSEMBLY
10	C1813G	CABLE ANCHOR FITTING
11	C1797	KING BLOCK (190mm WIDE)
12	C1633	5/8" x 10"LG. POST BOLT – MUSHROOM HD
13	C1631	5/8" FLAT WASHER
14	C1632	5/8" HEX NUT
15	C1550	M16 x 32LG. SPLICE BOLT – MUSHROOM HD
16	C1520	M16 OVERSIZED NUT



BILL OF MATERIALS		
ITEM No.	PART No.	DESCRIPTION
17	C1619	3/4" x 2-1/2" HEX HD BOLT
18	C1617	3/4" FLAT WASHER
19	C1624	3/4" LOCK WASHER
20	C1618	3/4" HEX NUT
21	C1629	7/16" x 1-1/2" HEX HD BOLT
22	C1628	7/16" FLAT WASHER
23	C1630	7/16" LOCK WASHER
24	C1627	7/16" HEX NUT
25	C1625	3/8" x 2" HEX HD BOLT
26	C1620	3/8" FLAT WASHER
27	C1622	3/8" LOCK WASHER
28	C1621	3/8" FENDER WASHER
29	C1626	3/8" HEX NUT
30	C1623	3/8" x 1-1/2" HEX HD BOLT
31	PART C1162	1" FLAT WASHER
32	PART C1162	1" HEX NUT

Rev	Description	Chkd	Date
A	TITLE BLOCK UPDATED	MS	24/02/09
0	INITIAL ISSUE	IJ	10/02/04



INGAL Civil Products

57-65 Alrds Road, Minto, NSW, 2566 Australia
 Telephone 61-2-9827 3333, Facsimile 61-2-9827 3300, Internet www.ingalcivil.com.au
 c Industrial Galvanizers Corporation Pty Ltd ACN 000 545 415 (2005)
 This drawing is the subject of COPYRIGHT. No part of it may be used, reproduced or copied by any means or in any form without the prior permission of the owner.

PROJECT	ET-2000 PLUS NCHRP TEST LEVEL 2 STEEL YIELDING TERMINAL POST SYSTEM
TITLE	GUARDRAIL EXTRUDER TERMINAL POSTS 1, 2, 3 & 4 ASSEMBLY DRAWING

DATE	12/05/05	INGAL CIVIL PRODUCTS REFERENCE No.
DRAWN	B.F	
DESIGNED	TRINITY IND.	DRAWING No. CAB-STD-067 REV.A
CHECKED	IJ	
MATERIALS SHOWN		
FINISH	H.D GALV	
SCALE	1:250 (A3)	



For more information



contact us on the web
www.ingalcivil.com.au

Head Office: Sydney

57-65 Airs Road, Minto, NSW 2566

Ph: +61 2 9827 3333

Fax: +61 2 9827 3300

Free call (within Australia):

1800 803 795

Email: sales@ingalcivil.com.au

Our Locations:

- Adelaide • Auckland
- Brisbane • Kuala Lumpur
- Melbourne • Newcastle
- Perth • Sydney • Wagga