

Application for Ken Erickson Award

Project

Granville 710 Catch Points Renewal - Catch point with Guard Rail Arrangement

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Reason for Application

For making the first known innovative use of “four foot” guard rail arrangement instead of standard throw off rail for Catch Point installation in RailCorp's network.

Application Format

The application is presented in two parts:

- Part 1 - Judging Criteria
- Part 2 - Discussion on the process followed and results achieved

Part 1: Judging Criteria

Difficulties Overcome

- Catch point renewal was scheduled to occur in 2006/07 financial year. Given the location/configuration, only two possessions were available with one already predetermined to be used one year in advance.
- Budget, required design and construction staff planned and made available to carry out the renewal as scheduled.
- Possession time for installation of the catch point is 48 hours which does not allow for any unforeseen issues occurring on the site.
- Expectation from the Stakeholders that design solution would be made available to suit planned possession.
- Existing arrangement of 710 Catch Points at Granville was unsuitable:
 - Does not comply with RailCorp's standard ESC 250 requiring clear run off area of minimum 40 metres.
 - If derailment occurred, there is a potentially high risk of train collision, due to proximity of Up Old South Main, causing material damage and possible passenger and train driver injuries or casualties.
- Signal Design requires a method of protection against train collision at Junctions; therefore Catch Points were installed some time ago and cannot be taken out.

Contribution/Impact to Track

Main benefit/impact coming from the innovative system of catch points with guard rail in the four foot, are:

- An alternative solution to standard arrangement of Catch point or derailer and reduces the risk imposed with location and surrounding infrastructure.
- Does not adversely impact on standard construction work procedure for installation of catch points.

Technical Input

In order to effectively address the constraints of the site specific as well as general issue of having a catch point without standard run off area, many stakeholders input was considered in the process:

- Track Services: providing the design for the new arrangement and approval for final design. New design had produced details for modified concrete beams with cast-in shoulder for guard rail attachment, modification to plates and removal of throw off rail.
- Signal Design: providing guidance, support and approval of the design for the new catch point arrangement.
- Renewals: providing feedback on the constructability of the proposal.

- Design Delivery: providing overall project management of the design, supply co-ordination and bringing together all of the stakeholders requirements and approvals.

Degree in innovation in Perway Aspects

Main factor favouring innovation of this product is that risk of having catch points in the rail system, can be addressed from a completely new angle reducing the hazard with modified use of current components arrangement:

- New method of catch point is addressing the train derailment on SPAD occurring, with retaining the essential functionality from signal design point of view.
- Standard components have minimal modifications to incorporate new arrangement: “Flat 1” ties from standard catch point arrangement adapted to “Flat 2” enabling guard rail installation.
- Design innovation had been developed into a Standard which was recently incorporated at Lidcombe and will be installed in near future at Adamstown, Campbelltown and Macarthur.

Contribution to Safety

With current use of catch points within rail system, there is always a risk present of train impacting on any adjacent infrastructure or train, if clear run off area is not present.

This arrangement with guard rail in the “four foot” has the following benefits and contributes to improved safety:

- Reduced risk of impact with adjacent infrastructure like Overhead Wiring Structures, Walls, Signals etc retaining derailed train between tracks and slowing its speed down until rest.
- Provides “clear and even” run off area, as required by the ESC 250 standard. This requirement is important to suppress possible train topple.
- Reduces collision angle to glancing impact rather than possible direct head on crash, if train speed is significantly great causing it to travel long distance.

Amount of Local/Australian Input

During the design process, manufacturing as well as installation, amount of Local Australian input was 100 %:

- Design was solely done by RailCorp
- Concrete manufacturing was completely done by Austrack
- Steelwork manufacturing was entirely carried out by Bathurst Rail Fabrication Centre “BRFC”.
- Installation; was carried out by RailCorp Renewal Division.

Part 2: Discussion on the Process followed and Results Achieved

Background

Granville 710 turnout and catch points were part of the RailCorp's Annual works programme requiring replacement. Infrastructure was approaching to end of its life cycle and was planned for renewal as per RailCorp's "Policy for Turnout/Diamond/Slip & Catchpoint Renewal".

RailCorp's policy for renewal of turnouts, diamonds and catch points provides means to improve reliability issues with points failures due to worn components.

Mentioned 710 catch points were located on Down Main line at around 21.5km between Harris Park and Granville Station.

Catch points had 10600 flexible switch type on compound transition and were built around 1980's.

The design team assigned to this project were RailCorp Track Design with input from Signal Design. Team was lead by Design Delivery Manager coordinating design input and requirements from various stakeholders.

During the project life, innovative design of catch points with guard rail in the "four foot" was developed. This type of the design reduces the risk of catch points being present in the Rail system and not complying with current standard for clear run off area.

Design was later on developed into a standard design and is ready for use at many other similar locations.

Benefits

Factors favouring the guard rail type catch points are as following:

- Solution to the problem where catch points have not got clear runoff area and cannot be removed due to signalling issues or infrastructure in a way of derailed path can be relocated without major funds.
- Use of standard modified rail components which reduces risk of introducing new infrastructure components in the system
- Easy installation thus not changing standard work procedure
- Standard design which can be used throughout the RailCorp system.

Site Challenges

Site investigation and discussion within team members had identified many constraints with the catch point renewal, which had to be considered in the design process for preferred option to be successful.

- Position of catch points throw off rail was pointing towards the Overhead Wiring Structure which was located around 25 metres away. This does not satisfy the RailCorp's Standard Requirement ESC 250, which states that clear run off area for catch point should be minimum 40 metres (2 vehicle lengths) beyond point of derailment.

- Proximity of the Up South Line was an important factor as well being around 28 metres away on the derailed train path.
- Speed of the approaching train is 50 km/h before it's reduced to 35km/h on the catch points. Mentioned speed of 35km/h would allow train to impact the Overhead Wiring Structure possibly affecting Up South Line traffic as well.
- Position of the catch point could not be changed moving it towards Sydney side due to clearance point dictated by Up South Line or towards Country side due to proximity of other Overhead Wiring Structure as well as Signal Hut on the Up Side.
- Construction could happen only in 48 hour track possession which was the driving factor for constructability of the design.



Picture 1: Granville 710 catch points, located on Down West Main showing the proximity of Up South Line, OHWS and Signal Hut/Box.
Picture taken with back to Sydney.



Picture 2: Granville 710 catch points, located on Down West Main showing the proximity of Up South Line and OHWS. Picture taken with back to Country.

Options Considered

In the brainstorming session couple of options were discussed on how this problem, which appeared to be unsolvable, can be approached.

1. Renewing catch point in current location:
This approach would not comply with the RailCorp's Standard ESC 250 and would not address the potential risk of derailed train hitting an infrastructure causing damage to the rolling stock and potential collision with the train located on Up South Line.
2. Removing of the catch points:
This would eliminate the problem of substandard catch points all together. However, purpose of these catch points is to protect the Up South from a timetabled wrong road movement and their removal would necessitate considerable interlocking changes and reduction in operational functionality.
3. Removing throw off rail and installing guard rail in the "four foot":
Purpose of the throw off rail is to direct the derailed train away from the other Main Line train, whose movements are to be protected. When the throw off rail is removed and replaced with guard rail located in the "four foot", derailment path of the train would be following existing track until the vehicle comes to rest.

Solution

Discussing the available options only proposal of removing the throw off rail and installing guard rail was perceived to be worthy of further design investigation.

Same principle is used for bridges or other location where risk of train derailment is assessed to be high and guard rails were installed to control the path of the train.

Other two options would not comply with the RailCorp Standards and would not essentially address the existing risk with the current arrangement.

It was decided to proceed with the design investigation to prove the feasibility of the proposal.

Design Challenges and Process

In the process of design documentation development, there were two main parameters to be considered:

1. Compliance with RailCorp's Standard ESC250 for clear catch point run off of minimum 40 metres.
2. Minimum change to standard catch point arrangement and components if possible

Compliance with RailCorp's Standard ESC 250

As a first step, position of the catch point was considered in reference to the Down Main West, where the catch point was located and Up South as the Main Line, which is to be protected with this catch point.

Clearance point between Down Main West and Up South was determined to provide relationship between these two Lines.

Then, principle of minimum 40 metres run off area beyond point of derailment was applied to Down Main West Line to ascertain likely impact.

Combining these two criteria it was concluded that in this particular situation, clearance point between two tracks is located after required 40 metres of run off. Proving this right, first design parameter was satisfied.

Change to standard catch point arrangement and components

For the proposal to be constructable it was desirable to have least amount of components modified or changed given the already scheduled possession works.

This would enable the use of standard components for installation as well as to ensure uniformity for the spare parts in case component replacement is required.

Dissecting standard catch point on steel and concrete, comparison is made with the new design:

- Steel
 - Starting from the beginning of the points, switch is the same. Throw off rail is removed and guard rail is added on one side of the track for 40 metres.
- Concrete
 - Again starting from the beginning of the points, cant reducing set of ties is the same. Catch point ties and plates CP. 6100.1-30 was

replaced with CP. 6100. G 1-17. Only difference between these two sets for numbers 1-17 is that original CP ties were modified to incorporate cast in Pandrol Shoulder for guard rail.

- Following tie number 17, new set of ties was designed, "Flat 2", which in essence is the "Flat 1" modified tie to incorporate cast in Pandrol shoulder for guard rail. The standard guard rail sleeper was not able to be used due to difference in levels for Flat ties and Guard rail tie.

Proving that modification of the standard catch point arrangement would not be great and that adapted standard components could be used, second design parameter was satisfied as well.

Construction/Implementation

The usual way of catch point renewal/installation is to build the panel off site before the actual possession. This allows any non-compliance to be rectified before actual track possession, being only 48 hours.

Same approach was used for the catch point with guard rail arrangement. Standard work procedure was used and no problems were experienced during the construction.

Same catch point arrangement with guard rail was successfully implemented at Lidcombe recently. Also, installation utilising this type is planned for Campbelltown, Adamstown and Macarthur in the near future.

Conclusion

In the whole of RailCorp's network there are 374 catch points, protecting trains where we have two tracks converging to one.

If catch points were not installed and SPAD incident occurred – "Signal Passed at Danger", there is no other protection and train collision is a likely scenario. This could cause great damage to the rolling stock as well as potential injuries or casualties to the train drivers and passengers.

Due to the complex geometry of the network, junctions, loops or sidings, large number of supporting infrastructure like overhead wiring structures, signal posts, bridges is present as well on the catch points run off area.

The presence of the above mentioned infrastructure in front of the catch points is causing non-compliance of these catch points with ESC250 and is essentially posing risk in case of train derailment on the points.

New proposed arrangement with guard rail in the "four foot" is cost effective, additional way for renewing catch points as well as addressing the risk beside the obvious and expensive removal of the infrastructure.

In case of Granville 710 catch points, location of the clearance point in respect to the position of the points itself was providing more than the required 40 metres of clear run off. Also, low train speed of 35 km/h was deemed to be appropriate for mentioned 40 metres clearance.

In addition to this particular project, standard design for catch points utilising guard rail in the “four foot” had been developed by Track Design with inputs from Signal Design and various other stakeholders.

Standard design has already been used on one other location - Lidcombe, with plans that this design is to be utilised for future projects.

This approach can be used on many other similar locations through the rail network reducing the associated risk in cost effective manner.



Picture 3: Granville 710 catch point with guard rail arrangement
Picture taken with back to country, showing only part of guard rail installed

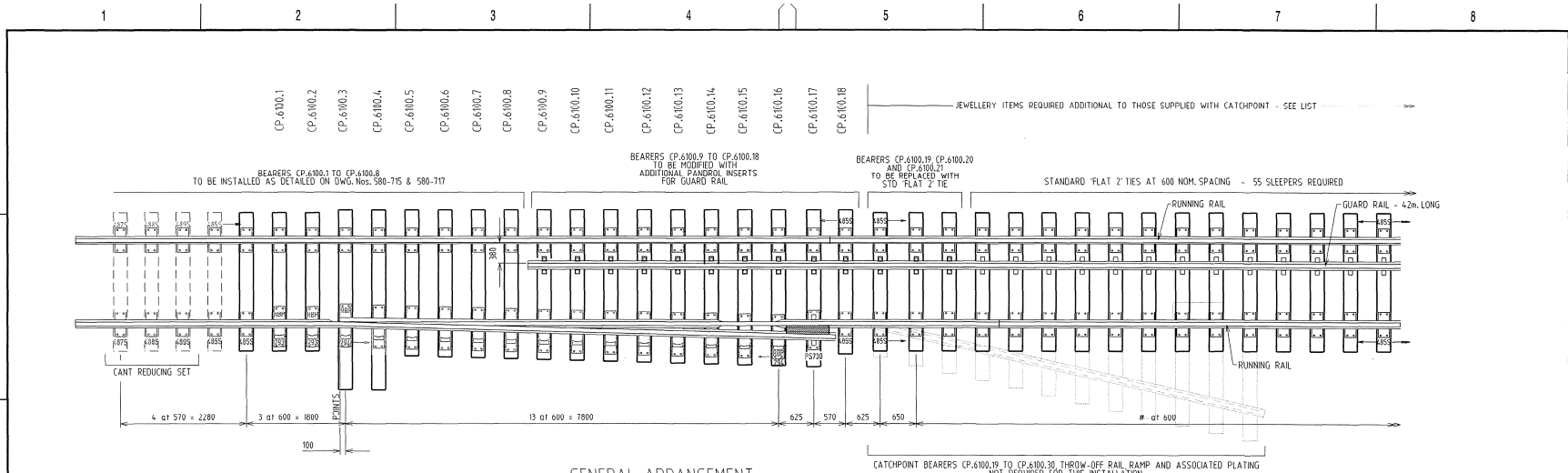
Acknowledgements

Project Sponsor	Phuoc Nguyen
Renewals Team	Nantha Kumaran (Project Manager)
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Design Team	Sunil Joshi (Project Director)
	Sean Sarenac (Design Delivery Manager)
	Graham McGrath (Track Designer)
	Bill Holevas (Track Designer)

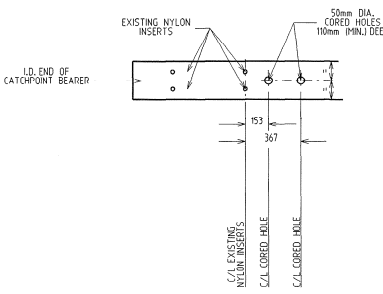
Appendix

Granville; Renewal of 710 Catch Point, Special Modification Details

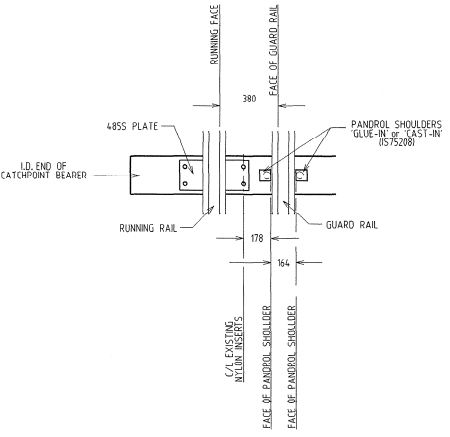
Catch point with Guard Rail- 6100 Flexible Switch – General Arrangement



GENERAL ARRANGEMENT



DETAIL OF CORED HOLE LOCATION FOR "GLUE-IN" PANDROL SHOULDER



DETAIL OF PANDROL SHOULDER LOCATION (GLUE-IN or CAST-IN)

MATERIAL LIST (ADDITIONAL ITEMS ONLY)	
DESCRIPTION	REQ'D
STD. 'FLAT 2' TIES	58
'H' PAD FOR FLAT 2 TIE - 7.5mm THICK	70
PAD FOR 4855 PLATE - 5mm THICK	120
GUARD RAIL - RECLAIMED 53kg/m - 4.2 m.	1
SCREWSPIKES - 24mm DIA.	470
PANDROL INSULATORS	170
PANDROL "GLUE-IN" SHOULDERS *	26 * IF REQ'D

NOTES

1. ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. CATCHPOINT SHOWN STRAIGHT. CATCHPOINT TO BE CURVED TO DETAILS AS SHOWN ON DRAWING No. CV 0041269 & CV 026083Z

REFERENCES

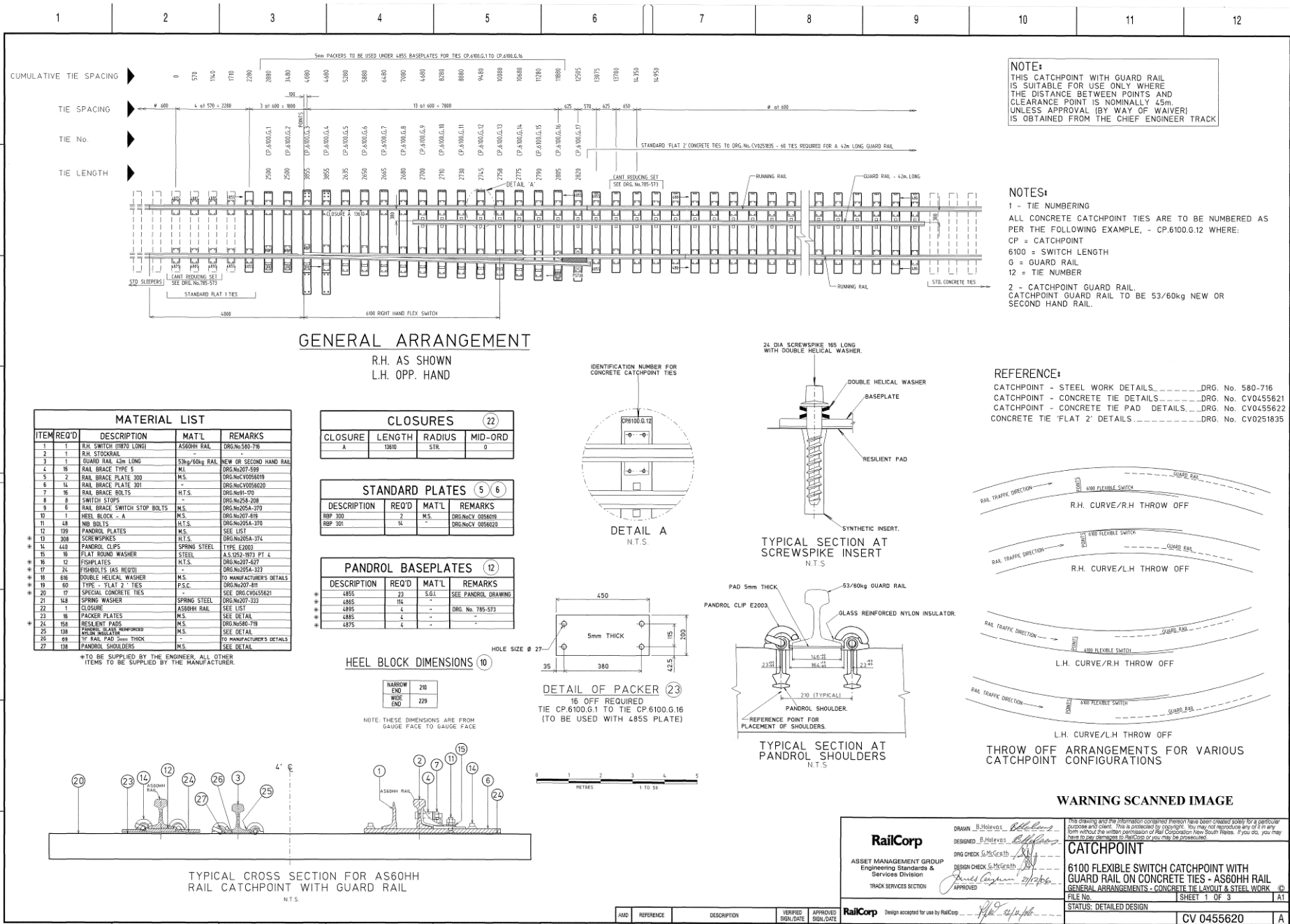
- GRANVILLE - RENEWAL OF 710A Pts, TURNOUT & 710B Pts, CATCHPOINT.....DRG. No. CV026083Z
 710B Pts, CATCHPOINT FIELD LAYOUT DETAILS.....DRG. No. CV0041269
 STD. FLAT 2 TIE & PAD.....DRG. No. CV0251835



WARNING SCANNED IMAGE

RailCorp INFRASTRUCTURE GROUP Engineering Standards & Services Division TRACK SERVICES SECTION	DRAWN - G.L.M. <i>[Signature]</i> DESIGNED - G.L.M. <i>[Signature]</i> DRG CHECK - J.A.C. <i>[Signature]</i> DESIGN CHECK - J.A.C. <i>[Signature]</i> APPROVED - <i>[Signature]</i>	This drawing and the information contained thereon have been created solely for a particular purpose and client. This is protected by copyright. You may not reproduce any of it in any form without the written permission of Rail Corporation New South Wales. If you do, you may have to pay damages to RailCorp or you may be prosecuted.
	GRANVILLE MAIN WEST LINE - 21.600km to 21.650km RENEWAL OF 710B Pts CATCHPOINT	
SPECIAL MODIFICATION DETAILS FILE No. D/04/171		SHEET 1 OF 1
STATUS: DETAILED DESIGN		A2
RailCorp Design accepted for use by RailCorp - <i>[Signature]</i>		CV 0013800

AMD	REFERENCE	DESCRIPTION	VERIFIED SIGN./DATE	APPROVED SIGN./DATE
1				
2				
3				
4				
5				
6				
7				
8				



NOTE:
THIS CATCHPOINT WITH GUARD RAIL IS SUITABLE FOR USE ONLY WHERE THE DISTANCE BETWEEN POINTS AND CLEARANCE POINT IS NOMINALLY 45m. UNLESS APPROVAL (BY WAY OF WAIVER) IS OBTAINED FROM THE CHIEF ENGINEER TRACK

NOTES:
1 - TIE NUMBERING
ALL CONCRETE CATCHPOINT TIES ARE TO BE NUMBERED AS PER THE FOLLOWING EXAMPLE, - CP.6100.G.12 WHERE:
CP = CATCHPOINT
6100 = SWITCH LENGTH
G = GUARD RAIL
12 = TIE NUMBER
2 - CATCHPOINT GUARD RAIL
CATCHPOINT GUARD RAIL TO BE 53/60kg NEW OR SECOND HAND RAIL.

REFERENCE:
CATCHPOINT - STEEL WORK DETAILS.....DRG. No. 580-716
CATCHPOINT - CONCRETE TIE DETAILS.....DRG. No. CV0455621
CATCHPOINT - CONCRETE TIE PAD DETAILS.....DRG. No. CV0455622
CONCRETE TIE 'FLAT 2' DETAILS.....DRG. No. CV0251835

ITEM	REQ'D	DESCRIPTION	MAT'L	REMARKS
1	1	R.H. SWITCH (1870 LONG)	AS60HH RAIL	DRG.No.560-716
2	1	R.H. STOCKRAIL	-	-
3	1	GUARD RAIL 42m LONG	53kg/60kg RAIL	NEW OR SECOND HAND RAIL
4	16	RAIL BRACE TYPE 5	N.L.	DRG.No.207-599
5	2	RAIL BRACE PLATE 300	M.S.	DRG.No.CV0505919
6	14	RAIL BRACE PLATE 301	-	DRG.No.CV0506020
7	16	RAIL BRACE BOLTS	H.T.S.	DRG.No.691-070
8	8	SWITCH STOPS	-	DRG.No.256-208
9	4	RAIL BRACE SWITCH STOP BOLTS	M.S.	DRG.No.205A-270
10	1	HEEL BLOCK - A	M.S.	DRG.No.207-616
11	48	NB BOLTS	H.T.S.	DRG.No.205A-370
12	199	PANDROL PLATES	M.S.	SEE LIST
13	300	SCREWSPICES	H.T.S.	DRG.No.205A-374
14	440	PANDROL CLIPS	SPRING STEEL	TYPE E2003
15	16	FLAT ROUND WASHER	STEEL	A.S.193-1973 PT. 4
16	12	FISHPLATES	H.T.S.	DRG.No.207-427
17	24	FISHBOLTS (AS REQ'D)	-	DRG.No.205A-123
18	616	DOUBLE HELICAL WASHER	M.S.	TO MANUFACTURERS DETAILS
19	60	TYPE - 'FLAT 2' TIES	P.S.C.	DRG.No.207-611
20	17	SPECIAL CONCRETE TIES	-	SEE DRG.CV0455621
21	144	SPRING WASHER	SPRING STEEL	DRG.No.207-333
22	1	CLOSURE	AS60HH RAIL	SEE LIST
23	16	PACKER PLATES	M.S.	SEE DETAIL
24	154	RESILIENT PADS	M.S.	DRG.No.640-719
25	138	NYLON INSULATOR	M.S.	SEE DETAIL
26	61	TY RAIL PAD 5mm THICK	-	TO MANUFACTURERS DETAILS
27	138	PANDROL SHOULDERS	M.S.	SEE DETAIL

CLOSURES (22)				
CLOSURE	LENGTH	RADIUS	MID-ORD	
A	18610	STR.	0	

STANDARD PLATES (5/6)				
DESCRIPTION	REQ'D	MAT'L	REMARKS	
BBP 300	2	M.S.	DRG.No.CV 0506019	
BBP 301	14	-	DRG.No.CV 0506020	

PANDROL BASEPLATES (12)				
DESCRIPTION	REQ'D	MAT'L	REMARKS	
4855	23	S.G.I.	SEE PANDROL DRAWING	
4865	114	-	-	
4865	4	-	DRG. No. 795-573	
4875	4	-	-	

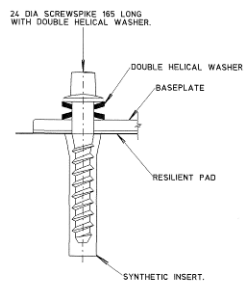
HEEL BLOCK DIMENSIONS (10)

NARROW END	210
WIDE END	229

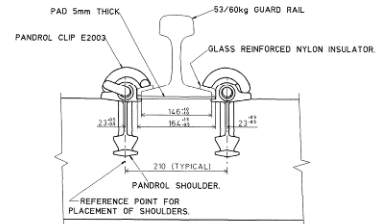
NOTE: THESE DIMENSIONS ARE FROM GAUGE FACE TO GAUGE FACE

DETAIL OF PACKER (23)

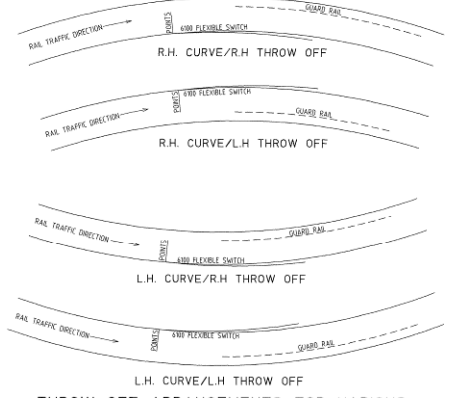
16 OFF REQUIRED
TIE CP.6100.G.1 TO TIE CP.6100.G.16
(TO BE USED WITH 4855 PLATE)



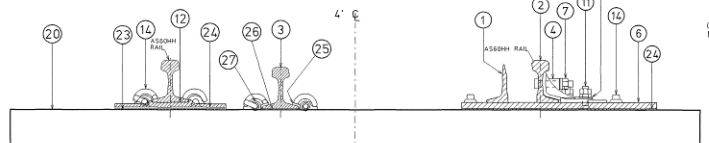
TYPICAL SECTION AT SCREWSPIKE INSERT
N.T.S.



TYPICAL SECTION AT PANDROL SHOULDERS
N.T.S.



THROW OFF ARRANGEMENTS FOR VARIOUS CATCHPOINT CONFIGURATIONS



TYPICAL CROSS SECTION FOR AS60HH RAIL CATCHPOINT WITH GUARD RAIL
N.T.S.

WARNING SCANNED IMAGE

RailCorp ASSET MANAGEMENT GROUP Engineering Standards & Services Division TRACK SERVICES SECTION	DRAWN: B.Holmes DESIGNED: B.Holmes DRG CHECK: G.Holmes DESIGN CHECK: G.Holmes APPROVED: James Coughlin	This drawing and the information contained therein have been created solely for a particular purpose and client. This is protected by copyright. You may not reproduce any part in any form without the written permission of Rail Corporation New South Wales. If you do, you may incur any damages to RailCorp or you may be prosecuted.
	CATCHPOINT 6100 FLEXIBLE SWITCH CATCHPOINT WITH GUARD RAIL ON CONCRETE TIES - AS60HH RAIL GENERAL ARRANGEMENTS - CONCRETE TIE LAYOUT & STEEL WORK	FILE NO. _____ SHEET 1 OF 3 STATUS: DETAILED DESIGN CV 0455620