Australian Government
Australian Transport Safety Bureau

Office of Transport Safety Investigations

Train overspeed by run 805K

through BN 318 turnout, Blacktown, New South Wales, on 21 April 2024

ATSB Transport Safety Report
Rail Occurrence Investigation (Defined)
RO-2024-003
Final – 24 March 2026

Cover photo: Transport for NSW

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Acknowledgement of Country and Traditional Owners

The Australian Transport Safety Bureau acknowledges the traditional owners of country throughout Australia, and their continuing connection to land, sea and community. We pay our respects to them and their cultures, and to elders both past and present.

Investigation summary

What happened

At 1421 on 21 April 2024, a Sydney Trains service 805K travelling from Penrith to Sydney Central Station traversed BN 318 turnout near Blacktown Station at a speed of 101 km/h. The turnout speed was sign posted for 25 km/h. The driver was thrown from their driving position but resumed control shortly after a train activated automatic emergency brake application had applied. The driver brought the train to stop at Blacktown Station and had suffered minor injuries. There were no reports of injured passengers.

What the ATSB found

The driver did not operate the train in accordance with signal indications and traversed BN 318 turnout at 101 km/h, 76 km/h over the permitted speed limit.

The driver was not situationally aware as they approached the turnout. They also expected the signal aspects and direction of travel to be the same as they had experienced many times before. So, the driver did not react to the medium signal aspects and slow the train before reaching the turnout.

The investigation also found BN 318 turnout was identified as a high-risk turnout as part of an Automatic Train Protection (ATP) project led by Transport for NSW (TfNSW). The decision to install additional protection for overspeed at this location and others was later revised by TfNSW and overspeed protection was not installed when the ATP project was handed over to Sydney Trains.

As a result, Sydney Trains did not have effective controls for overspeed on parts of the rail network where high-risk turnouts were present. The overspeed of 805K was one of several overspeed events that had occurred on the Sydney Trains Network in previous years.

Shortly after this incident, the Office of the National Rail Safety Regulator (ONRSR) issued Sydney Trains with an improvement notice to address the network-wide risk of overspeed through turnouts on their rail network.

While the track infrastructure was inspected immediately after the overspeed event, the train was permitted to continue in service without being inspected. Sydney Trains identified it did not have a response procedure for overspeed incidents in place at the time.

What has been done as a result

Sydney Trains addressed the immediate risk of overspeed through high-risk turnouts by lowering speed limits at high-risk turnout locations on the rail network. Sydney Trains also developed a plan to implement ATP at these high-risk turnout locations with funding approved and provided by TfNSW.

Sydney Trains also developed and implemented a response procedure for overspeed incidents.

Safety message

Overspeed on the rail network carries a high risk of train rollover and the potential for multiple fatalities as demonstrated by previous incidents in Australia. Risk controls for areas of a rail network where credible safety risks have been identified should be reviewed periodically to determine whether the existing controls remain effective and to establish whether practical means exist to further reduce or eliminate risk.

Near-miss events that occur on Australia's rail networks present an opportunity to reassess the effectiveness of existing controls in real world environments. Rail network managers should have processes in place to capture incident data and to initiate reviews of risk control effectiveness. Risk reviews should assess the risk of known and foreseeable incidents, and establish controls, based on the most critical, credible outcomes.

Post-incident processes should be in place to manage responses consistently and in a manner that reduces the likelihood of further incident escalation.

Contents

The occurrence

Events preceding the incident

On the afternoon of 21 April 2024, an 8-car double-deck suburban train was being operated between Penrith and Sydney Central Station, New South Wales. This train was a scheduled Western Line passenger service, run number 805K, and was crewed and operated by Sydney Trains. Run 805K's crew comprised of one driver, who was seated at the front of the train, and one guard, who was located at the rear of the train.

The driver was scheduled to work an 8.5-hour shift and signed on at Blacktown just after 0900 local time. The driver began their shift by travelling to Lidcombe and operated several passenger services between Lidcombe and Olympic Park. The driver had their scheduled crib break[1] at Lidcombe at around 1215 and then took control of passenger service 805J at around 1300, which they drove from Lidcombe to Penrith.

This service would form run 805K to Central after a short turnaround at Penrith, and both crew members would operate the train to Blacktown where they would be relieved by a new crew. The guard was scheduled to end their shift at Blacktown, while the driver was rostered to take charge of another revenue service at Blacktown, following a short break (Figure 1).

Figure 1: Geographic area of operation

Source: TfNSW ArcGIS, annotated by OTSI

Run 805K's stopping pattern was all stations from Penrith to Blacktown, and the train crew was provided with a crew diagram containing the stopping pattern for reference. These crew diagrams outlined each service a crew member would operate during their shift, as well as crib breaks, turnaround times, and relief information (Figure 2).

Additional information about run 805K was provided to the crew in Special Train Notice[2] (STN) 0574-2024, which detailed all passenger and empty train movements for that weekend, the running times, the running lines and turnouts train services would be operating on (Figure 3).

The STN number was listed on the crew diagram next to each run the crew would operate during their shift.

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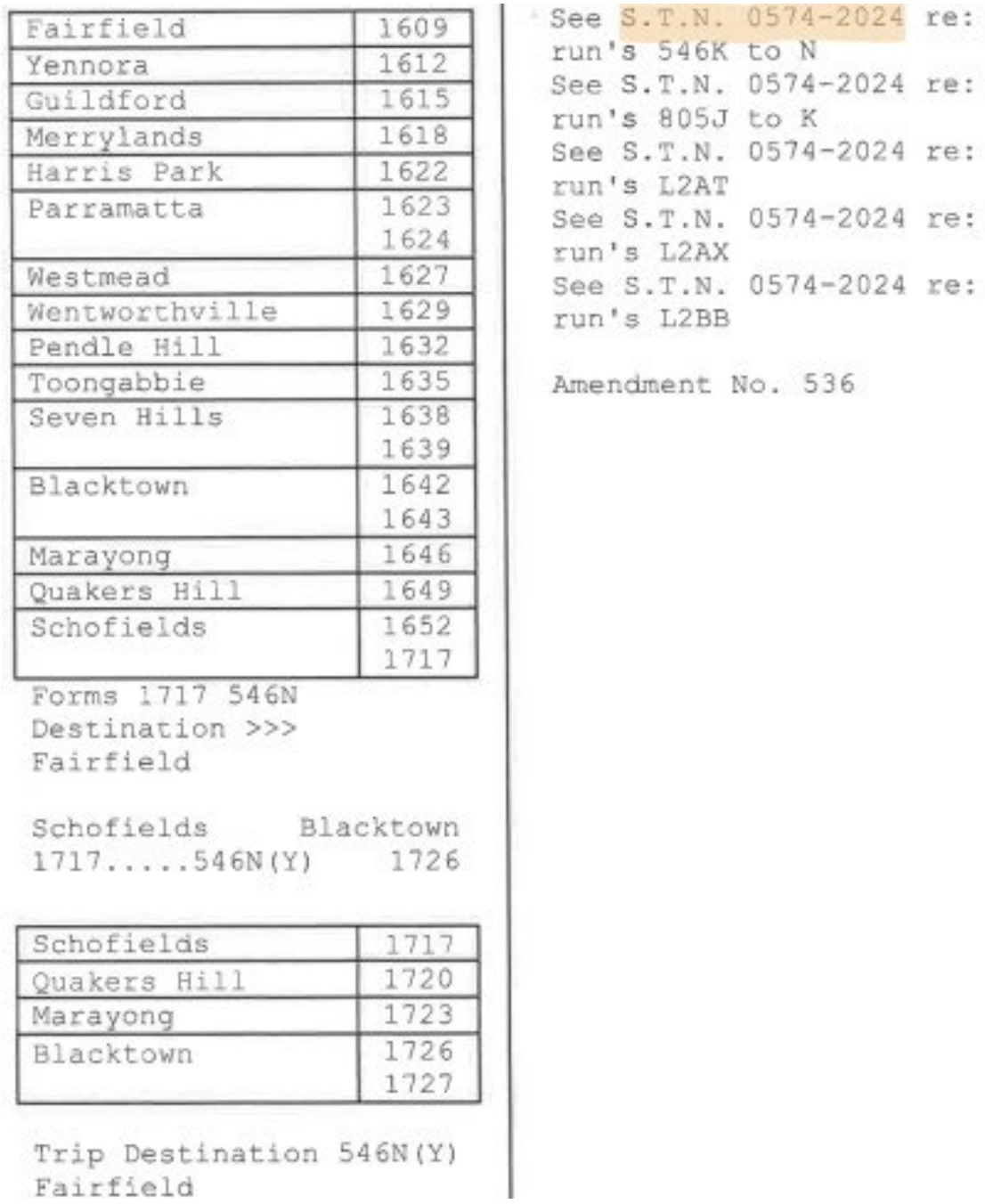
1 A crib break is a rest or meal break.

2 A published notice providing details of train operations or events that might affect train operations.

Figure 2: Extract of crew diagram



Fairfield	1609
Yennora	1612
Guildford	1615
Merrylands	1618
Harris Park	1622
Parramatta	1623 1624
Westmead	1627
Wentworthville	1629
Pendle Hill	1632
Toongabbie	1635
Seven Hills	1638 1639
Blacktown	1642 1643
Marayong	1646
Quakers Hill	1649
Schofields	1652 1717

Forms 1717 546N
Destination >>>
Fairfield

Schofields Blacktown
1717.....546N(Y) 1726

Schofields	1717
Quakers Hill	1720
Marayong	1723
Blacktown	1726 1727

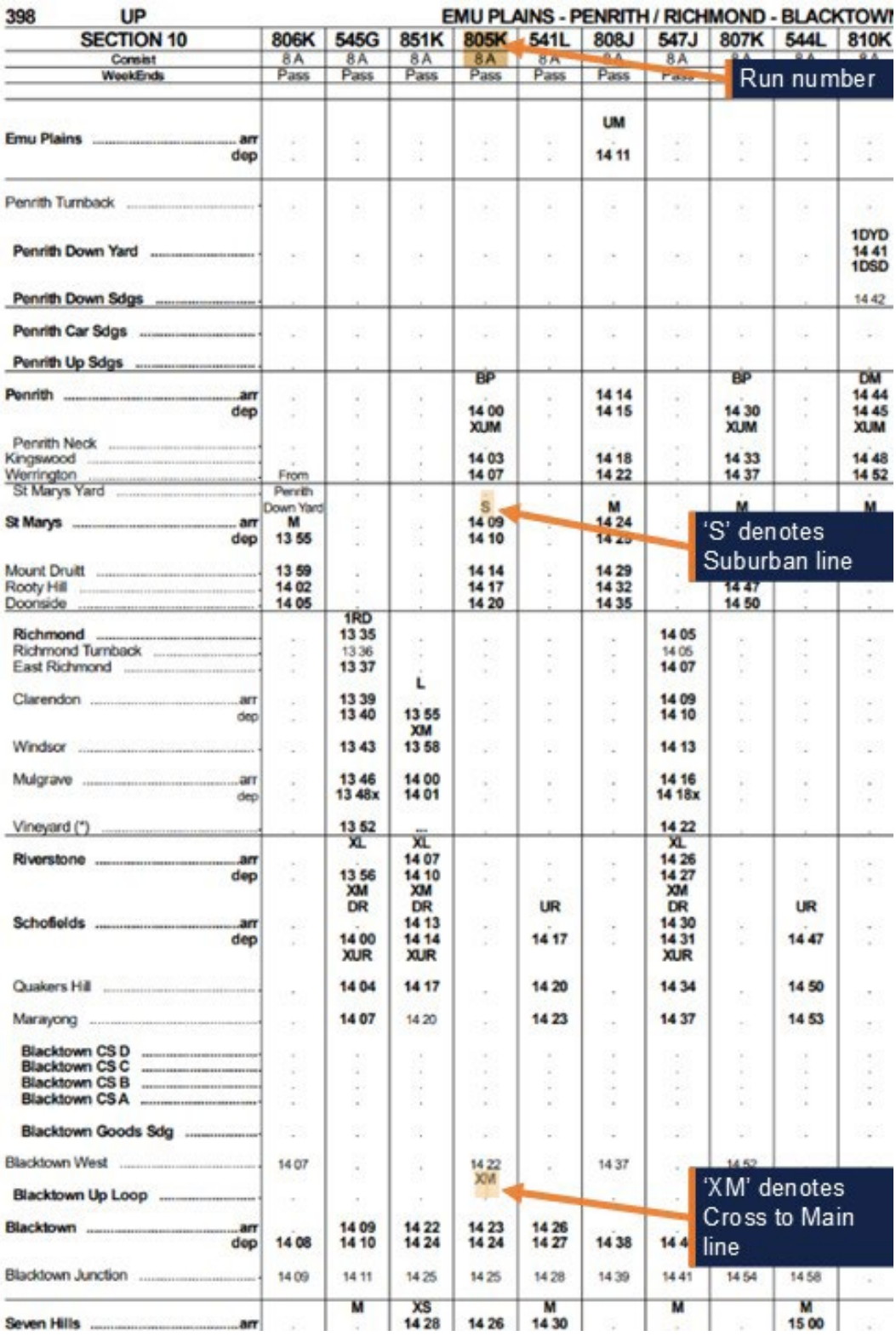
Trip Destination 546N(Y)
Fairfield

See S.T.N. 0574-2024 re:
run's 546K to N
See S.T.N. 0574-2024 re:
run's 805J to K
See S.T.N. 0574-2024 re:
run's L2AT
See S.T.N. 0574-2024 re:
run's L2AX
See S.T.N. 0574-2024 re:
run's L2BB

Amendment No. 536

Source: Sydney Trains

Figure 3: Extract from STN 0574-2024



Source: Sydney Trains, annotated by OTSI

Run 805K was 1 of 8 trains scheduled to operate via the Up Suburban and BN 318 turnout on 21 April. The train departed Penrith on time at 1400 hours and proceeded without incident to Doonside, where the train stopped briefly before departing at 1419:52.

On departure, the train passed automatic signal S 23.8 which was showing a Clear[3] indication, and the driver applied maximum power to accelerate the train (Figure 4).

Figure 4: Signal S 23.8

Image from Doonside platform upgrade VLOG.
Source: Sydney Trains, annotated by OTSI

Around 44 seconds later, at 1420:36, the train had travelled 650 m and reached a speed of 81 km/h as it passed automatic signal S 23.6 (Figure 5). This signal also showed a Clear indication, and the driver maintained the same power setting as they proceeded into the next block[4].

Figure 5: Signal S 23.6

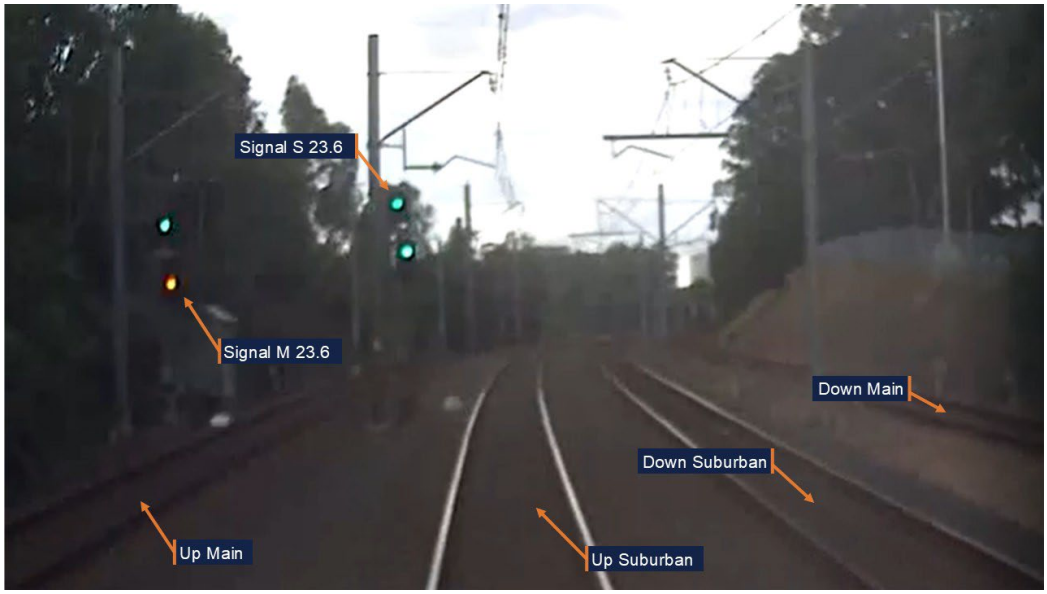


Image from Front of Train CCTV Car D6432 on incident run, approaching signal S 23.6.
Source: Sydney Trains, annotated by OTSI

[3] Clear: a green over green indication indicating proceed, and next signal indication.

[4] Block: a portion of track with defined limits, usually denoted by fixed lineside signals, between which only one rail traffic movement is permitted at any one time.

The train travelled another 624 m in the next 24 seconds, passing automatic signal S 23.2 at 1421:00 at a speed of 106 km/h (Figure 6). This signal was displaying a Preliminary Medium[5] indication, which warned the driver that the next signal would be displaying at least a Medium[6] indication. The driver maintained maximum power as they passed signal S 23.2 and only moved the power handle to OFF to coast the train when the speed reached 110 km/h around 11 seconds later.

Figure 6: Signal S 23.2

Image from Front of Train CCTV Car D6432 on incident run, approaching signal S 23.2.
Source: Sydney Trains, annotated by OTSI

The train's speed dropped back to 106 km/h by 1421:21 as the train reached Blacktown West, which was marked by a yard limit[7] sign and controlled Accept signal BN 102 S (Figure 7). This signal was displaying a Medium indication, which warned the driver that the next signal would be displaying a Caution[8], Caution Turnout[9] or Medium Turnout[10] indication. However, the driver continued to coast at 106 km/h with no braking action applied.

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5 Preliminary medium: a green over pulsating yellow indication. Indicates proceed, and next signal indication is at least a medium.

6 Medium: a green over yellow indication, indicating proceed, and that next signal is at least a caution or turnout.

7 Yard Limits: a defined area of track where rail traffic movements are authorised and managed by a nominated network control officer or other suitably qualified employee, and whose boundaries are marked by trackside signage and, where relevant, labelling on signal panel displays. Train movements in these areas can be coordinated through fixed signal routes, hand signals, or verbal/written authorities.

8 Caution: a green over red indication, indicating proceed and next signal may be a stop.

9 Caution turnout: a yellow over red indication, indication proceed on turnout route, next signal may be a stop.

10 Medium turnout: a yellow over yellow indication, indicating proceed on turnout route and next indication is at least a caution.

Figure 7: Signal BN 102 S

Image from Front of Train CCTV Car D6432 on incident run, approaching signal BN 102 S.
Source: Sydney Trains, annotated by OTSI

At 1421:42, around 21 seconds and 635 m after passing signal BN 102 S, the train reached controlled Home signal[11] BN 94 S at a speed of 106 km/h. This signal was displaying a Medium Turnout indication with a corresponding route indication of 'M'. This warned the driver that the points beyond the signal were set for the route from the Up Suburban to the Up Main, which had a posted speed limit of 25 km/h (Figure 8).

[11] A Home signal is a stop signal that controls the entrance to a block section, station limits, or controlled area such as a turnout or junction.

Figure 8: Signal BN 94 S

Image from Front of Train CCTV Car D6432 on incident run, approaching signal BN 94 S.
Source: Sydney Trains, annotated by OTSI

At this point, the train had travelled past 2 medium signals in 42.5 seconds at a consistent speed of 106 km/h, with idle throttle and no braking action applied. As the train passed signal BN 94 S, the driver acknowledged a visual alert from the onboard task-linked vigilance device via a pushbutton, which reset the timing cycle. The driver then moved the power handle to the Brake position when run 805K was less than one train length from BN 318 turnout.

The train decelerated to 103 km/h before the lead car entered BN 318 turnout at 1421:49 and at a speed of 101 km/h. Although the train went through the leading points at more than 4 times the posted speed limit, the train remained upright and did not derail. A 4-car Millennium set was stabled at the country end of Blacktown Up Loop, which was adjacent to the Up Main, but it was not impacted as run 805K stayed on the tracks (Figure 9).

Figure 9: Dashcam of train mid turnout

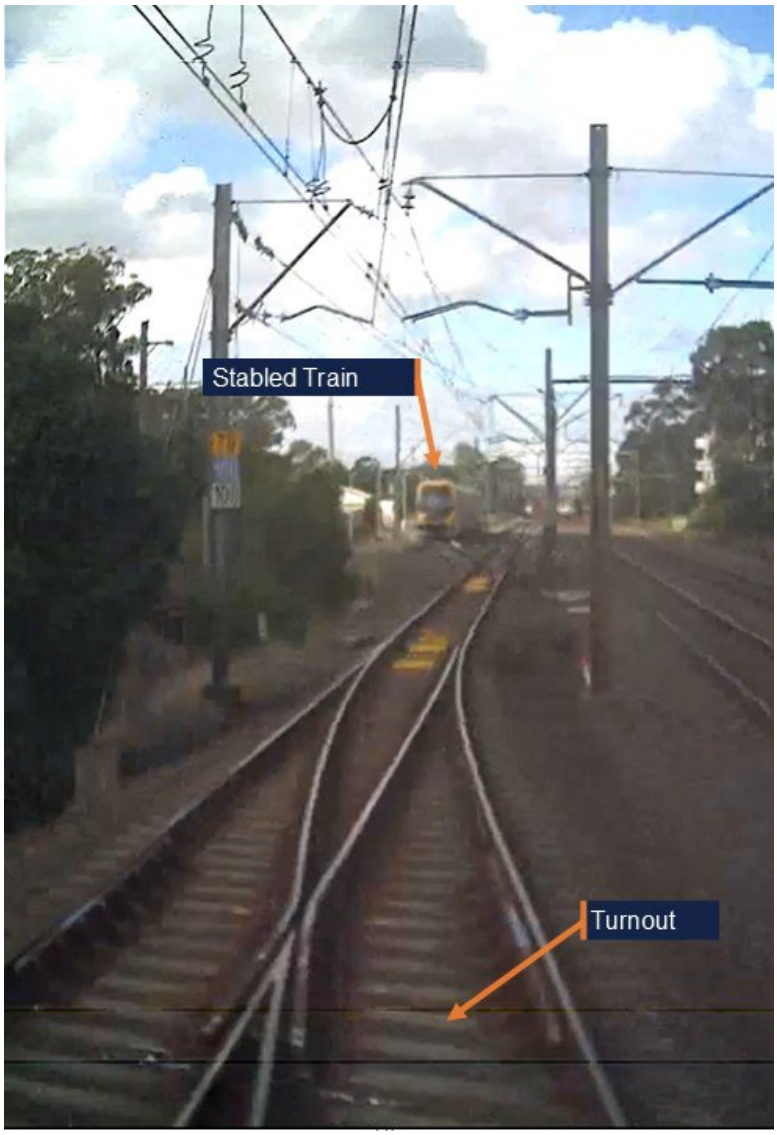

Image from Front of Train CCTV Car D6432 on incident run, mid turnout with stabled train ahead.
Source: Sydney Trains, annotated by OTSI

The driver was thrown from their seat by the force of the train's movement through the turnout. This caused the driver to relinquish control of both the train controls and the Operator Enabled Pedal (OEP), a safety device which is activated when the driver becomes incapacitated. This action triggered an emergency brake application[12] which slowed the train down and the driver was able to return to their seat and reset the OEP, 6 seconds later.

As the train continued to slow, the driver contacted the guard to check if they were okay, and the guard and driver confirmed to each other that they were fine. The guard also enquired as to what had happened, and the driver said they had missed the signal and gone through the points too quickly. The driver released the brakes and slowly accelerated the train from 15 km/h back up to 50 km/h over the next minute.

[12] An automatic emergency brake application in response to certain pre-determined conditions.

The train then continued uneventfully to Blacktown Station (Figure 10), where the driver brought the train to a controlled stop at the scheduled arrival time of 1423.

Figure 10: Approach to Blacktown Station

The Operator enabled pedal (OEP) was released by the driver passing through BN 318 points and turnout at approximately 101 km/h.
Source: Google Earth, annotated by OTSI

Events after the incident

After the train arrived at Blacktown, the guard was unsure as to whether the incident needed to be reported and called the Train Crew Liaison Officer (TCLO) at 1429 to seek clarification. The TCLO confirmed that the guard was okay and said that they would progress the incident report to other parties, and then they called the driver at 1433.

The driver told the TCLO that they were not feeling well and that they had been thrown out of their seat during the incident. The TCLO advised the driver to go to the Blacktown sign-on area for post-incident testing and arranged a replacement driver for their roster. After speaking with the driver, the TCLO contacted the Network Incident Manager (NIM) at 1435 to report the incident.

The NIM then took the following actions:

- At 1438, instructed the Blacktown Area Controller (AC) to book out BN 318 turnout pending inspection.
- At 1443, asked Civil and Signals to check BN 318 turnout points for damage.
- At 1445, requested a data logger download for run 805K from Defects [13].
- At 1450, requested an Incident Response Commander (IRC) to attend Blacktown Station to interview the driver.
- At 1457, arranged for drug and alcohol testing to be conducted on the driver.

[13] Defects – a team within Sydney Trains responsible for identifying, logging and managing rolling stock faults.

- At 1501, reported the incident to the on-call investigator.
- At 1517, spoke with Defects to confirm the set number, which was A32, for run 805K and repeated their request for a data logger download.
- At 1540, confirmed with Infrastructure Control (ICON)[14] that BN 318 turnout had been inspected and certified.
- At 1541, told the Train Service Delivery Manager (TSDM) that BN 318 turnout was available for traffic.
- At 1601, confirmed the speed of the train and incident categorisation with the IRC.

Set A32 was not removed from service during this time and continued to convey passengers for several hours after the incident. At 1800, there was a shift changeover and the NIM on duty at the time of the incident handed over to the NIM of the next shift.

Set A32 continued in service for another hour until Defects contacted the new NIM to check on the condition of the train. At 1902, the NIM instructed the TSDM and Defects to stop the train and remove it from service immediately pending an inspection. The train was then transferred to Auburn Maintenance Centre (AMC), where it was inspected the following day.

No damage or problems were reported with set A32 while it was in service, and no issues were found during the inspection at AMC. No infrastructure damage was found at Blacktown West following the overspeed, and no injuries were reported by the guard or passengers on board the train.

[14] ICON – Integrated Control Operations Network, encompasses the management, maintenance and coordination of all assets and systems that support train operations.

Context

Driver information

Training and competencies

The driver joined RailCorp[15] in 2005 and had extensive experience driving suburban trains in the Sydney metropolitan area. The driver had transferred to Blacktown Crew Depot around 7 years prior to the incident, but in that time, they could only recall driving a train through BN 318 turnout ‘‘maybe two or three times’’. However, the driver held the required route knowledge and operational competencies for the tasks undertaken and had passed their most recent competence assessment in August 2023.

Roster

The driver was working an altered diagram[16] on 21 April between 0922 and 1751 hours, with a total shift time of 8 hours and 29 minutes. This diagram required the driver to operate Olympic Park services in the morning, a Penrith service in the middle of the day, and Y-Link services[17] in the late afternoon. This was the driver’s third shift following 2 days off, and the FAID[18] score for their roster was calculated to be 35.

Awareness of train running

Most city-bound Western Line suburban services travelled on the Up Main between St Marys and Blacktown. However, a handful of services each day were timetabled to operate on the Up Suburban between St Marys and Blacktown West, then cross back to the Up Main via turnout BN 318. This occurred for operational reasons such as rail cleans, crew route knowledge, line closures for track inspections, or to pass freight trains.

This planned route information was not specified in crew diagrams, but was shown in STNs, Standard Working Timetable books, and the Digital Timetable Information Portal. These resources were made available for crews to review online via a mobile device but were principally designed to provide train operating information to rostering staff, signallers, customers and the rail operations centre. The STN’s provided details of any alterations from the standard working timetable due to planned track works or other special events and did not expressly advise of conditions with the potential to affect safety on the rail network.

The STN’s were large documents. For services on 21 April 2024 the relevant STN was 420 pages in length. Crews were prohibited from using mobile devices while operating a

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15 RailCorp (Rail Corporation New South Wales) was a government agency responsible for rail infrastructure and operations. It was established 1 January 2004 and dissolved 30 June 2020. Its parent agency was Transport for NSW.

16 Altered diagram: temporary or updated version of the crew diagram reflecting changes to signalling track layout or operational conditions.

17 Y-link services utilize the Y shaped junction between the T1 Western line and T2/T5 Inner West and Leppington line, and Cumberland line.

18 FAID: the Fatigue Audit InterDyne score is a measure used to estimate the fatigue exposure of a worker based on their work schedule. Generally, a FAID score above 80 is considered to indicate a high level of fatigue. A typical 9am to 5pm work schedule produces a peak FAID score of around 40. Sydney Trains used OpCrew software to calculate FAID scores.

service, therefore there was an expectation that they were to review any relevant train running information provided ahead of operating services.

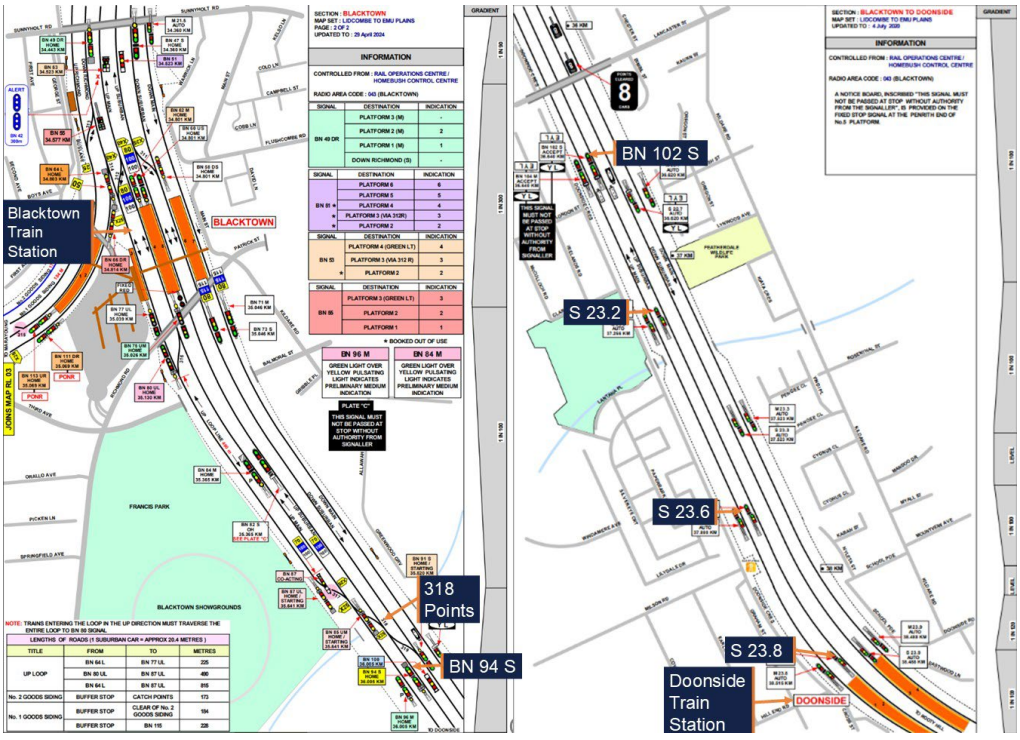
Crews were not required to confirm that they had read each STN for every service they operated. General network rule 'NGE 212 Network Information publications' required that 'Qualified Workers must read and use the information in relevant publications to do their work'. The specific use of the word 'relevant' in the procedure appeared to leave the determination of what is relevant to the discretion of the driver.

The driver in this event did not read the STN, and the procedure implies that they are not required to if they did not consider them relevant. The driver also reported that crews don't have much time to read all the documents and that it took a long time to find and read these documents using the iPad prior to their shifts. It is therefore unclear whether drivers were required to read the STN, or had been provided with sufficient time, resources and training to review them prior to operating services.

However, safeworking rule 'NSG 606 Responding to signals and signs' states when operating a service drivers must be qualified in the route, use their route knowledge to navigate the section and above all they must obey lineside signals, and route/turnout indications to know the specific route their train will be taking. In addition to published alterations to the timetable, network conditions may require the train to be diverted to another line at any time to meet immediate operational requirements.

While crews operating Up services on the Western Line generally expect to run via the Up Main, they are qualified for both tracks as part of their route knowledge requirements. Driver route knowledge diagrams document the information crews are required to know and support familiarisation and retention (Figure 11).

Figure 11: Driver route knowledge diagrams – Doonside and Blacktown



The track between Doonside and Blacktown, indicates a slight right hand curve leaving Doonside then straight track to BN 318 turnout.
Source: Sydney Trains, annotated by OTSI

The driver confirmed that they had not seen STN 0574-2024 on the day of the incident, and that they had not used their company-issued iPad during sign-on time to view it. The driver added that they had used the iPad to swap a shift that morning but did not use it for anything else.

Recollection

The driver stated during interview that their usual routine was to start packing their items prior to the station where they were being relieved. On the day of the incident, the driver said that they started packing at Doonside because they were leaving run 805K at the next station, which was Blacktown.

The driver stated that when the guard gave the 'all right' bell signal confirming it was safe to depart, they checked signal S 23.8 and saw it was showing 'full green'. They also confirmed that they could see the next three signals from a distance, stating that signal S 23.6 also indicated 'full green', and that the two signals beyond that were at medium.

The driver recalled that they powered the train 'up to around 100' past the green signals, and then 'shut off' the power to coast towards the next signal which was at Medium. However, the driver continued coasting, expecting the next signal to be at Caution. Although the driver knew they were on the Up Suburban as they departed Doonside, they said they began to think of the signalling sequence on the Up Main instead.

The driver stated that when driving on the Up Main from Doonside, the usual sequence of signalling would be 'three green signals, and then medium, caution, and stop'. They explained that as a train approached the Lancaster Street bridge on the Up Main, the Stop signal would clear first, which would then change the Caution to Clear. The driver added that, if the Stop signal did not clear, they would usually begin braking from the Lancaster Street bridge on the Up Main.

However, on the day of the incident, the driver said that as they approached the bridge, they read-through[19] to 2 signals at Stop on the Up Suburban. The driver said they did not see the Medium Turnout or Route indications on signal BN 94 S, even though they had expected to see this signal at Caution. The driver recalled that, because they had missed the signal, they began to apply the brakes, but there was insufficient time to reduce the train speed to 25 km/hr as required. The train then continued through the turnout at 101 km/hr, and the driver was thrown from the chair.

Train information

The train involved in the incident was an 8-car double-deck Waratah, set number A32 (Figure 12). These trains entered service between July 2011 and July 2014 and were maintained at Downer Group's[20] Auburn Maintenance Facility. All Waratah sets were fitted with Automatic Train Protection (ATP)[21] technology, which provided a risk control against driver error or system failures through automatic brake interventions in some locations. Further details of the ATP system are described in Appendix A.

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[19] A read-through refers to the driver looking past the closest signal(s) to the next one(s), overlooking the closest signal.

[20] Downer Group was Sydney Trains' contract maintenance provider for Waratah sets.

[21] Automatic Train Protection: a system that supervises train speed and target speed, it can alert the driver of braking requirements and enforces braking when necessary. The system may be intermittent, semi-continuous or continuous according to its track-to-train transmission updating characteristics.

Figure 12: Waratah set – A32

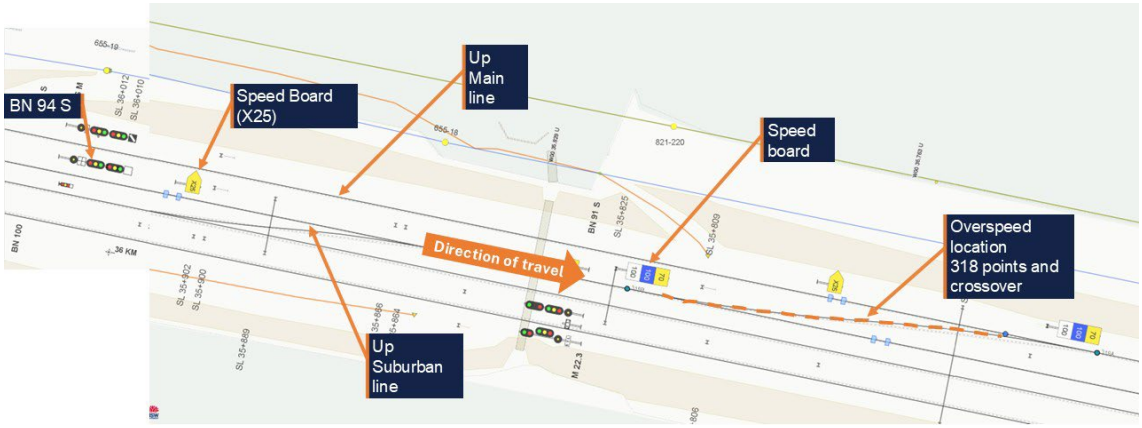
Train set involved in the overspeed, A32.
Source: Pinterest

Track information

The Western Line at Blacktown West consisted of 4 standard-gauge tracks, arranged in parallel with 2 Up lines and 2 Down lines. The Up Main and Up Suburban had a speed limit of 115 km/h from Doonside to Blacktown West, which decreased to 100 km/h at Blacktown West.

A ladder of bi-directional points connected the country-end of Blacktown Up Loop to the Down Suburban, and each turnout had a speed limit of 25 km/h. This included BN 318 turnout, which facilitated movements between the Up Main and Up Suburban (Figure 13).

Figure 13: Track and signal layout at Blacktown West



Map (not to scale) – BN 94 S route indicator and signal, X25 speed board and BN 318 turnout.
Source: WebGISME, annotated by OTSI

Signalling design

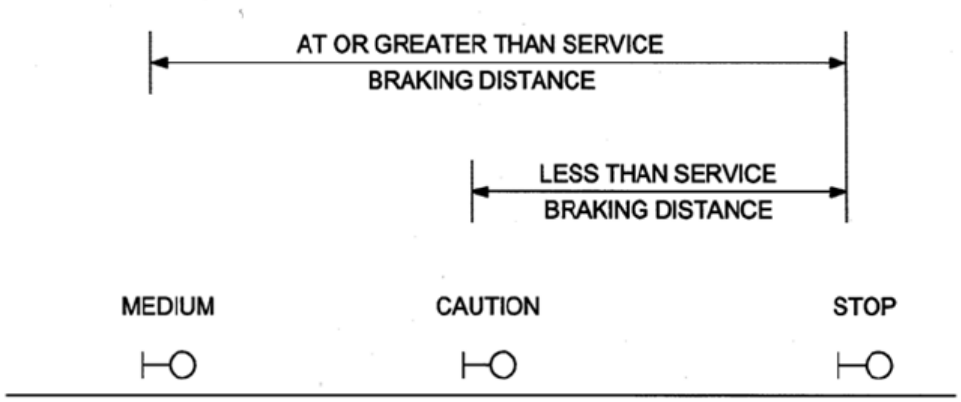
Signalling systems provide a critical risk control to protect infrastructure and other trains. The signalling system on the Sydney Trains network was designed to the Transport for NSW (TfNSW) signalling design principles standard[22]. Within the metropolitan area bounded by Emu Plains, Waterfall, Macarthur and Berowra, double-light colour light[23] signalling controlled train movements. Sydney Trains confirmed that the signals between Doonside and Blacktown West were compliant with signal design requirements.

Signal layout

In double-light colour light signal territory, the default indication for automatic signals is a proceed indication, e.g. Clear, Medium or Caution and the default indication for Home signals is 'Stop', or Red over Red. This is because automatic signals are controlled exclusively by track circuits and show the occupation of the track ahead, whereas Home signals are controlled by signallers and directly protect points, level crossings, and other risks.

Home[24] signals can be preceded by an Outer Home[25] or an Accept[26] signal, depending on the location and the nature of the risk requiring protection. In a location where a Home signal at 'Stop' was immediately preceded by an Accept signal, the Accept signal would show a Caution indication by default. Additionally, the automatic signal prior to the Accept would show a Medium indication (Figure 14), until such time as the Home signal beyond was cleared. This was the arrangement of the signals on approach to Blacktown West.

Figure 14: Basic signal layout – plain track



Source: TfNSW standard T HR SC 10001 ST Signalling Design Principles - Signals

[22] T HR SC 10001 ST 'Signalling Design Principle – Signals'.
[23] Where signals comprise of coloured lights mounted on a signal post, of which two colours indicate the aspect.
[24] Home signal: controlled signal that protects a risk e.g. a turnout, a station platform, an interlocking area.
[25] Outer home signal: a controlled signal that protects the home signal and gives the driver early notice of signal aspect ahead.
[26] Accept signal: controlled signal at the start of a network control boundary.

A total of 5 signals controlled train movements between Doonside and Blacktown West on both the Up Main and Up Suburban. Table 1 shows the signals that a train would pass in order on the Up Suburban after departing Doonside:

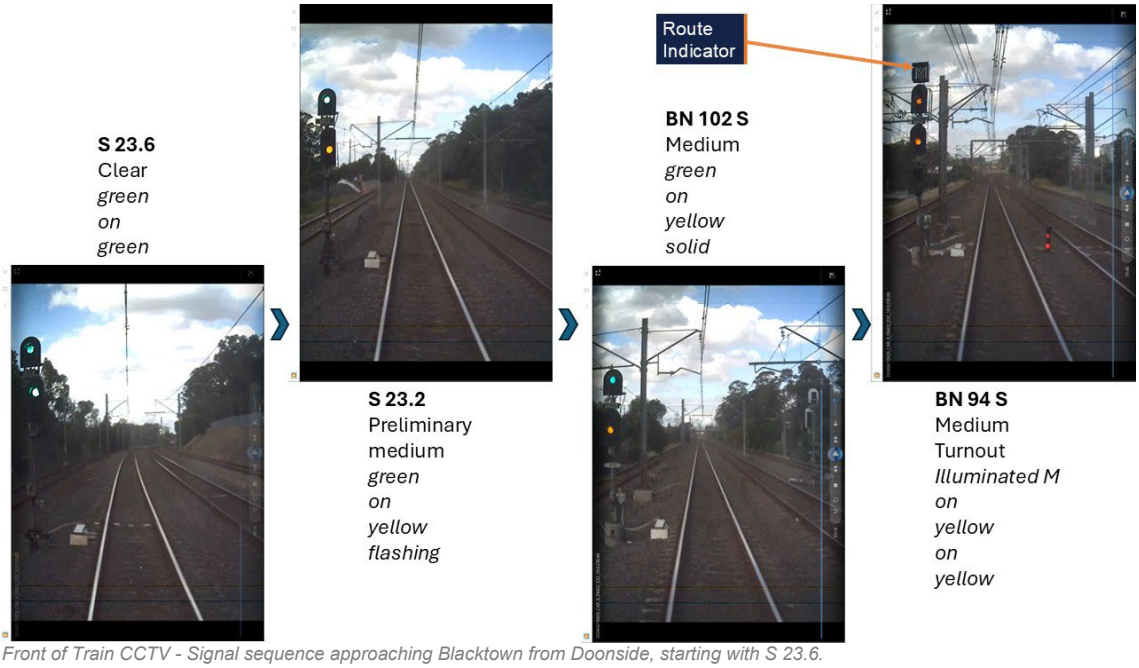
Table 1: Signals on the Up Suburban from Doonside to Blacktown West

Signal name	Controlled / Automatic	Purpose of signal	Kilometrage (km)
S 23.8	Automatic	Occupation block	38.515
S 23.6	Automatic	Occupation block	37.880
S 23.2	Automatic	Occupation block	37.256
BN 102 S	Controlled – Accept	Approach control	36.640
BN 94 S[27]	Controlled – Home	Protection of risk	36.005

Set A32 was equipped with a front-of-train camera which recorded run 805K's journey between Doonside and Blacktown West on 21 April. This camera showed the signalling sequence as the train approached BN 318 turnout, showing the progression from a Clear indication to Preliminary Medium, Medium, and then Medium Turnout.

There was a slight right-hand curve between signals S 23.8 and S 23.6, but the corridor was straight with unobstructed sightlines from signal S 23.6 to Blacktown West. In clear weather conditions, signal BN 94 S had a sighting distance of around 1.5 km (Figure 15).

Figure 15: Signal aspects from S 23.6 to Blacktown West and BN 318 turnout



Front of Train CCTV - Signal sequence approaching Blacktown from Doonside, starting with S 23.6.
Source: Sydney Trains, annotated by OTSI

The automatic signals on the Up Main were placed parallel to those on the Up Suburban at the same kilometrages and were only differentiated by the 'M' for Main in the signal name (see Figure 5 and Figure 6). The controlled signals, Accept and Home, on the Up Main were BN 104 M and BN 96 M respectively (see Figure 7 and Figure 8).

[27] BN 94 S: located in Figure 8.

Route indicators

Route indicators provide a supplement to proceed indications by displaying an indication to the driver of the route destination.

Section 1.4.2 of the TfNSW signalling design principles standard stated that:

> If a double light colour light signal applies to more than one diverging route, then it shall be fitted with a main line route indicator to supplement the turnout indication.

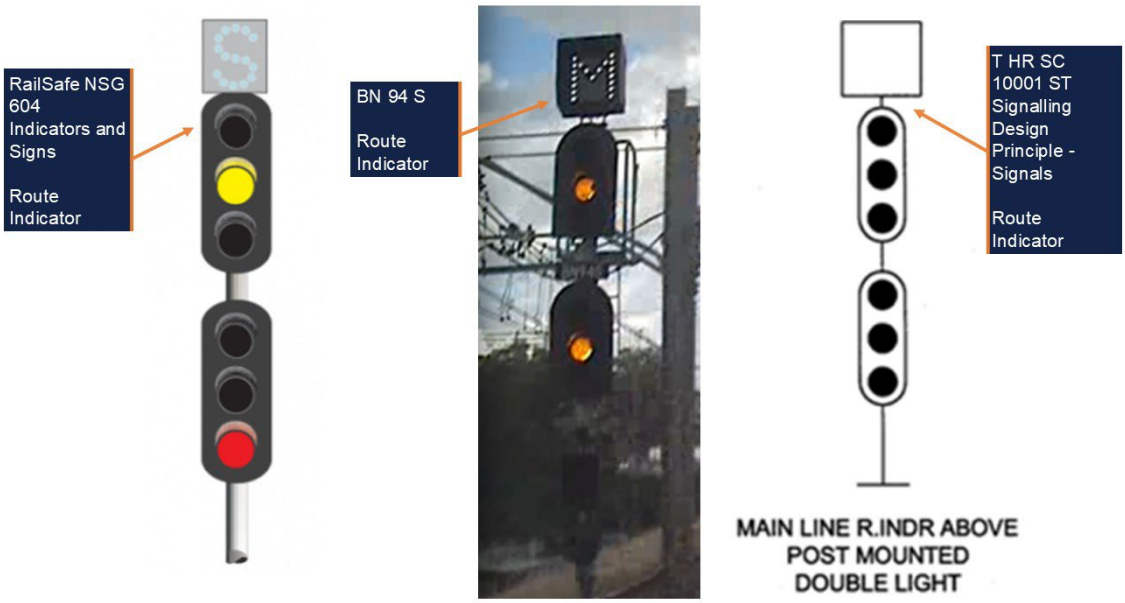
Additionally, Network Rule NSG 604 *Indicators and Signs* also stated that:

> In single and double light colour light signalled territory, route indicators on running signals indicate, in most cases, the turnout route.
>
> If the signal displays a PROCEED indication, the route indicator shows, letters, usually related to the name of the line, as in S for Suburban, and M for Main.

The signal protecting BN 318 turnout was BN 94 S, and this signal was a double-light colour light signal which controlled more than one diverging route. Signal BN 94 S had a route indicator which only illuminated for routes which deviated from the Up Suburban.

If a route was set for the Up Main or Up Loop via BN 318 turnout, the route indicator would show an 'M' or an 'L' respectively. At the time of the incident, signal BN 94 S was displaying a Medium Turnout indication with a corresponding 'M' route indication. This was compliant with the TfNSW standard and the Network Rules (Figure 16).

Figure 16: Route indicators



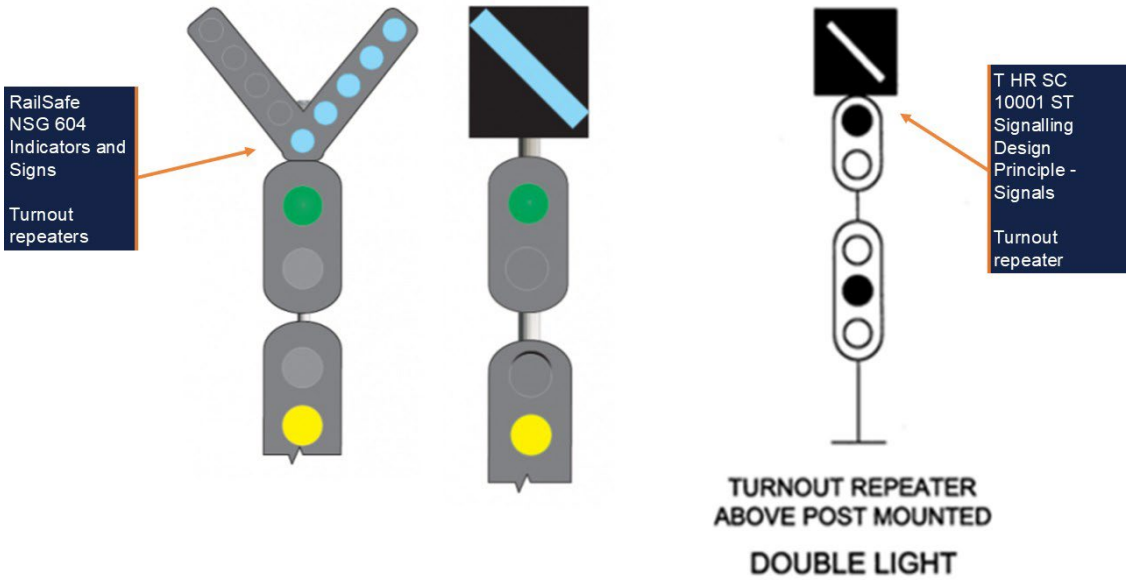
Left: NSG 604 Route Indicator; Middle: BN 94 S; Right: T HR SC 10001 ST Route Indicator.
Source: Transport for NSW and RailSafe, annotated by OTSI

Turnout repeaters

Following the incident, Sydney Trains identified that there was no turnout repeater[28] for signal BN 94 S as an advanced warning mechanism for BN 318 turnout (Figure 17).

[28] Turnout repeater: turnout repeaters provide drivers of trains an early warning that a turnout route through the junction is set for the train and enables train speed to be more readily controlled to the turnout speed.

Figure 17: Turnout repeaters



Left: NSG 604 Examples of Turnout repeaters; Right: T HR SC 10001 ST Turnout repeater.
Source: Transport for NSW and RailSafe, annotated by OTSI

Section 1.4.9 of the TfNSW engineering standard stated:

> Where it is required to provide advance warning that the turnout route is set at a junction, a turnout repeater shall be fitted on the first warning signal in the rear of the turnout signal.

Additionally, Network Rule NSG 604 *Indicators and Signs* stated:

> Turnout repeaters are placed at braking distance from points to give advance warning that a turnout route is set. They have one or more diagonal bars of white lights, in a separate unit fixed to the signal. The lights are angled up towards the turnout route.

Sydney Trains advised that a turnout repeater was not required for BN 318 turnout. However, if a turnout repeater had been installed for BN 94 S, this warning likely would have been placed on controlled signal BN 102 S. At line speed, this would have provided the driver of run 805K an extra 20 seconds of response time and 635 m of additional braking distance ahead of BN 318 turnout.

In its investigation, Sydney Trains confirmed that turnout repeater signals enhanced overall visibility and signal recognition for drivers and provided additional confirmation of primary signal indications. Sydney Trains also noted that turnout repeaters could improve a crew's situational awareness, but that they did not eliminate the risk or prevent the consequences of an overspeed.

Fixed balises

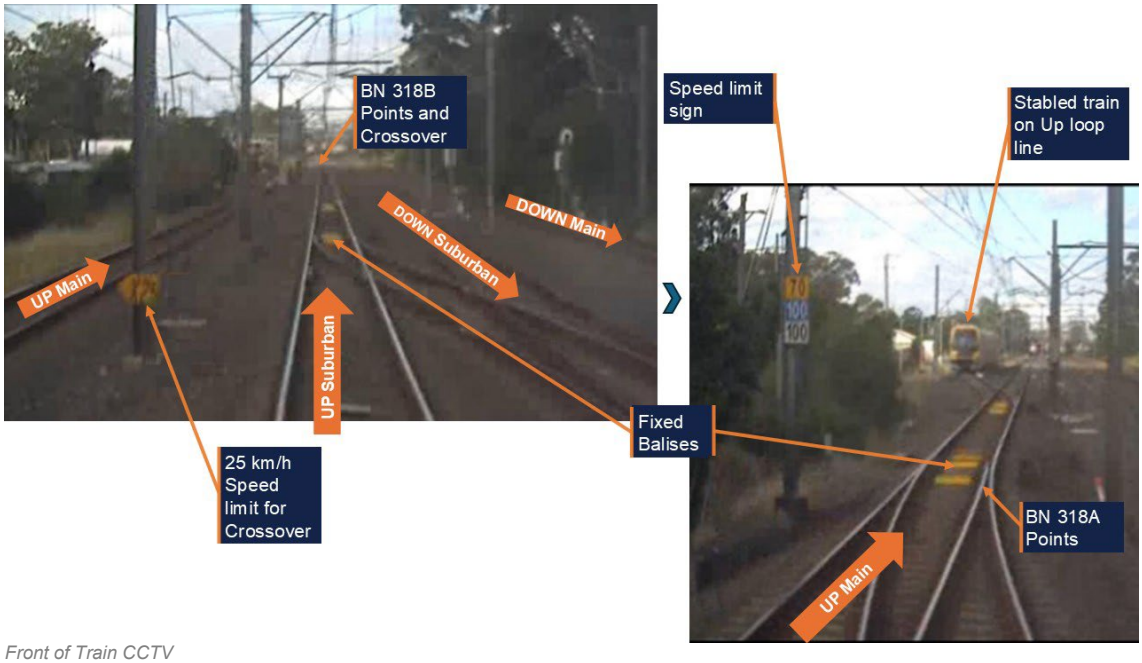
Automatic Train Protection (ATP) was installed on the Sydney Trains network as a risk control to monitor a train's operation in relation to speed limits and signal indications. To support the ATP system, electronic beacons in the form of balises were placed between the rails, which sent static or dynamic data to receivers on passing trains.

Fixed balises provided static, pre-programmed data, such as maximum line speed for the location or position data. While controlled balises are connected to a Line side Electronic

Unit that reads current signalling conditions and provides dynamic, real-time data to the train via the balise.

Fixed balises were used in some parts of the Sydney Trains network, including at BN 318 turnout (Figure 18).

Figure 18: BN 318 points and crossover (turnout)



Front of Train CCTV
Top left: view after passing BN 94 S, crossover speed sign X25;
Bottom right: passing over the crossover, main line speed sign 70/100/100. Fixed balises in four-foot.
Source: Sydney Trains, annotated by OTSI

Each fixed balise provided a package of pre-programmed data, depending on its purpose and where it was placed on the network. For example, some fixed balises were used for maximum line speed monitoring. These fixed balises provided static, location-specific speed sign information to passing trains to enable the train's onboard equipment to apply an emergency brake intervention if the train exceeded the speed limit for the location. Others were used for repositioning and only communicated odometer information to a train for location readings.

Sydney Trains confirmed the fixed balises beyond the speed limit sign (bottom right picture in Figure 18) were installed for maximum line speed monitoring of the Up Main line and for repositioning of trains travelling in the Up direction. The fixed balises at either end of BN 318 turnout were for repositioning only in both directions (see also High-Risk Turnout Operational risk assessment for balise configuration for the turnouts).

Government plan to implement ATP

Waterfall inquiry recommendations

The implementation of ATP on the Sydney Trains network was directly linked to the findings from the Special Commission of Inquiry (SCOI) into the Waterfall rail disaster on 31 January 2003. The SCOI found that the existing vigilance devices installed on trains had shortcomings such as a lack of overspeed protection.

To address this issue, one of the recommendations from the SCOI stated that:

> RailCorp should progressively implement, within a reasonable time, Level 2 Automatic Train Protection.

The New South Wales Rail Regulator (ITSRR[29]) at the time was tasked with overseeing the implementation of these recommendations, and discovered at the time that:

> Level 2 ATP, using the European Rail Traffic Management System definition, has not been installed on a network comparable to RailCorp. No other comparable rail network has been successful in retrospectively introducing this level of automatic train protection on an existing rail network. The feasibility of retrofitting this type of ATP system to the existing NSW railway network therefore requires further review.

ITSRR also noted a 2004 RailCorp study into the risks associated with train overspeed and potential options to mitigate those risks. The study determined that a system based on the use of track transponders to provide warnings to drivers and apply the brakes in certain conditions would be feasible.

ITSRR continued to monitor the implementation of the SCOI recommendations quarterly until the end of 2012, which coincided with the creation of ONRSR[30]. ONRSR published annual updates on the SCOI recommendations until March 2020, when it stated that 'the implementation of an ETCS Level 2 system remains in TfNSW's future strategies for the electrified railway network'.

Intended ATP rollout

In response to the Special Commission of Inquiry (SCOI) into the Waterfall accident, and the 2004 RailCorp feasibility study, European Train Control System (Level 1) equipment otherwise known as ATP, was planned to be deployed across the Sydney Trains network. This system was designed to overlay the existing signalling system with its primary purpose being to minimise risks from over speeding.

In August 2010, the NSW Government approved a 3-stage rollout of ATP on the rail network, beginning with Stage 1 in 2011 and an expected finish date for Stage 3 in 2021. Stage 1 involved the installation of ATP equipment on portions of the electrified rail network and on the entire OSCAR and Tangara train fleets between 2011 and 2017.

Stages 2 and 3 involved the installation of ATP equipment on the remainder of the electrified rail network, as well as extending ATP technology to the Waratah and Millennium train fleets. Stage 2 was expected to run between 2013 and 2018, with Stage 3 running concurrently from 2015 to 2021.

In January 2011, RailCorp engaged a supplier to provide equipment and engineering services for the first approved package of works.

The program became known as the ATP Project and was vested to Transport for NSW (TfNSW) in 2013.

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[29] ITSRR, the Independent Transport Safety and Reliability Regulator was established in 2004 as a statutory authority in New South Wales with the primary roles of regulating rail safety, providing independent advice to the government on transport sustainability and ensuring safe operation of transport services.

[30] ONRSR, the Office of the National Rail Safety Regulator, was established in July 2012 and commenced operations in January 2013 to create a unified, national approach to rail safety regulation in Australia. ONRSR enforces the Rail Safety National Law (RSNL) across all Australian states and territories.

Safety roles and responsibilities

Rail Safety National Law (RSNL) describes that rail infrastructure managers, rolling stock operators and designers, manufacturers and suppliers of rail infrastructure or rolling stock assets each have a duty to ensure so far as is reasonably practicable (SFAIRP) the safety of railway operations[31].

This includes, but is not limited to, ensuring that assets are designed, constructed, commissioned, used and maintained in a way that ensures the safety of railway operations.

ONRSR Guideline 'Meaning of duty to ensure safety so far as is reasonably practicable' provides guidance, references and a broad framework for making SFAIRP determinations[32]. Risk management principles such as likelihood and severity are to be applied, with the guideline also providing guidance on reversing previously determined SFAIRP decisions. In such circumstances, ONRSR acknowledges there may be very specific, albeit limited, occasions when it may be shown that an existing control is no longer necessary to ensure safety SFAIRP.

It can also be interpreted from the ONRSR Guideline 'Major Projects'[33] that everyone involved from the project conception through to operations and maintenance to decommissioning, has a shared safety responsibility, and that each party has a duty to work with others to ensure that everything reasonably practicable is done to ensure the safety of assets throughout their lifecycle.

The guideline also describes that safety roles and responsibilities be well defined for each involved party, and that there is merit in supporting a project delivery model that has the operator and maintainer as the accredited entity during the project delivery phases to support the management of safety risks in a manner consistent with how the assets will be used throughout their service life. In particular, the guideline specifically requires that the operator and maintainer will need to demonstrate how it will be assured that the delivered assets manage safety risk SFAIRP.

The TfNSW Safety Assurance Report (SAR) for Area 6.1 and 6.2, dated 9 Nov 2021, outlines the key roles and responsibilities for engineering safety assurance for the ATP project as being exclusively TfNSW employees or external contractors. Sydney Trains is not nominated to play a role, other than to conduct technical diligence reviews during the Design Safety Review and approval process.

Sydney Trains in its SAR for Area 6.1, dated 27 Oct 2021, outlines its own principal responsibilities as being the operation and maintenance of the ATP trackside assets and its fleet after handover, and operational readiness activities leading to passenger service operations.

Sydney Trains also outlines key roles and responsibilities which focus principally on operational readiness based on its defined role, but some roles did include responsibilities such as formally liaising with the TfNSW to obtain the required evidence for a safety assurance demonstration from TfNSW.

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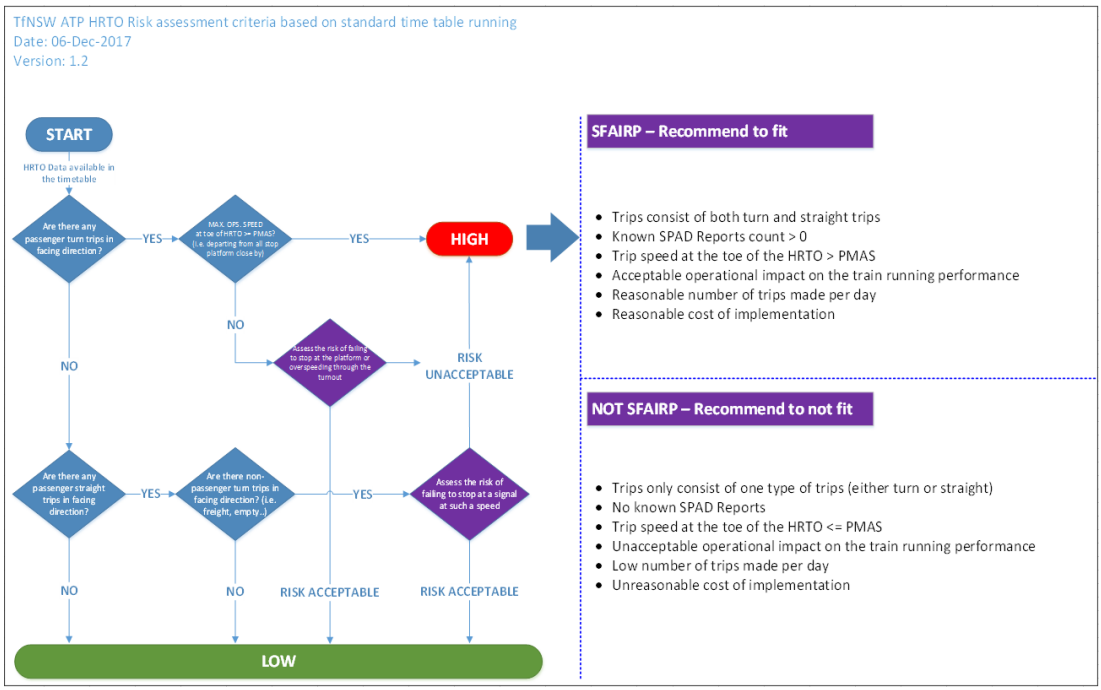
[31] Rail Safety National Law (NSW) No 82a of 2012 - NSW Legislation Division 3 Rail safety duties.
[32] ONRSR Guideline Meaning of duty to ensure safety so far as is reasonably practicable.
[33] ONRSR - Guideline - Major Projects.

High-Risk Turnout Operational risk assessment

Where a low-speed turnout exists on a high-speed line, the risk of derailment and/or rollover in the event of an overspeed through the turnout exists, as observed at Wallan in February 2020 (*reference Appendix C – Similar related Incidents*).

Following the introduction of the 2017 Standard Working Timetable (SWTT), TfNSW initiated a High-Risk Turnout Operational (HRTO) risk assessment to review commonly used turnouts in the timetable. This assessment was conducted between December 2017 and September 2019, and established which points and turnouts were high risk based on specific criteria (Figure 19).

Figure 19: High risk turnout risk assessment criteria



Source: Transport for NSW

Where a turnout was identified as high risk, TfNSW standard *Signalling Design Principle – ETCS Level 1TS 05333.31:2.0*, current at the time of the incident, required, on approach to the turnout, 'target speed monitoring' to minimise 'the risk of derailment resulting from excessive speed'. This means that turnouts on divergent routes would require communication with the signalling system to determine the real time target speed based on the set route, via the installation of line side electronic units and controlled balises.

Several points and turnouts across the network in regular timetable use were identified as being high risk, including BN 317 turnout and BN 318 turnout at Blacktown West.

BN 317 turnout – Up Main to Up Loop

The HRTO risk assessment stated there were 7 passenger trips timetabled to use BN 317 turnout from the Up Main to the Up Loop, and this was used as the basis for the risk calculation. However, in the SWTT, 3 empty trips on weekdays, and none on weekends, were scheduled to use this turnout. No passenger trips were timetabled through BN 317 turnout across the week, and turning out from the Up Main to the Up Loop was an uncommon move for passenger trains in normal operations.

There were also no reported safety incidents at BN 317 turnout in the 5 years to September 2019, and the estimated cost to install ATP protection to the turnout was over $1 million.

Nevertheless, it was determined that the risk of overspeed and derailment was not tolerable at BN 317 turnout, and that ATP speed protection should be installed at BN 317 turnout in the Up direction.

BN 318 turnout – Up Suburban to Up Main

A similar decision was made for BN 318 turnout from the Up Suburban to the Up Main.

5 passenger trips were timetabled on weekdays and 3 on weekends to use BN 318 turnout in the Up direction, and there were also 2 reported safety incidents at BN 318 turnout in the 5 years to September 2019. The estimated cost to install ATP protection was just over $500,000.

It was determined that:

> The risk associated with this turnout is not tolerable and it is reasonably practicable to reduce the risk further with ATP and ATP would provide significant benefits. The turnout will be protected SFAIRP[34] with ATP protection.

As a result, the risk assessment recommended that ATP turnout protection be provided at BN 318 turnout to prevent overspeed through the turnout and reduce the risk of a derailment (Figure 20).

The risk assessment calculated a low likelihood of a derailment through BN 318 turnout due to overspeed but added that a derailment could occur in specific circumstances such as a driver's loss of situational awareness.

For 805K to derail through BN 318 turnout due to overspeed, the speed required of the train was calculated to be just over 115 km/hr. With the maximum permitted line speed of 115km/hr, it remained within the realm of possibility for 805K to have entered BN 318 turnout over this critical derailment speed.

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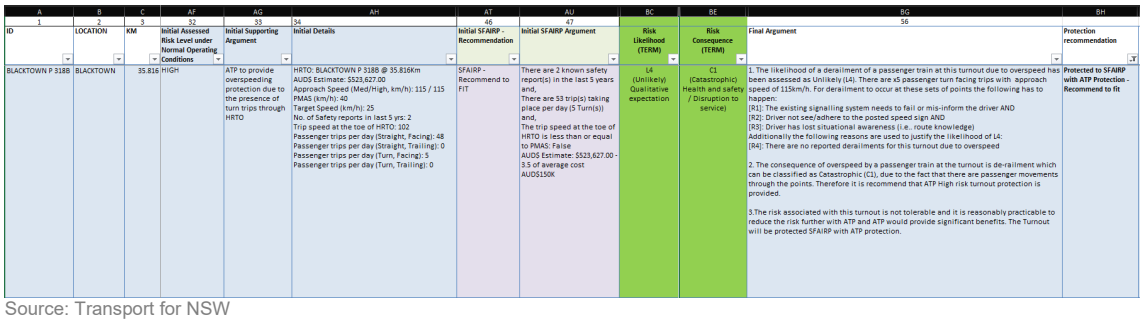
[34] SFAIRP: or So Far As Is Reasonably Practical, is a concept under the Rail National Safety Law (s47), to describe that which is, or was at a particular time, reasonably able to be done to ensure safety, taking into account and weighing up all relevant matters including:
a) the likelihood of the hazard or the risk concerned occurring; and
b) the degree of harm that might result from the hazard or the risk; and
c) what the person concerned knows, or ought reasonably to know, about the hazard or risk, and ways of eliminating or minimising the risk;
d) the availability and suitability of ways to eliminate or minimise the risk; and
e) after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk.

Figure 20: TfNSW risk assessment of 318 points



A	B	C	AF	AG	AH	AT	AU	BC	BE	BG	BH
1	2	3	32	33	34	46	47			56	
ID	LOCATION	KM	Initial Assessed Risk Level under Normal Operating Conditions	Initial Supporting Argument	Initial Details	Initial SFAIRP - Recommendation	Initial SFAIRP Argument	Risk Likelihood (TERM)	Risk Consequence (TERM)	Final Argument	Protection recommendation
BLACKTOWN P 318B	BLACKTOWN	35.816	HIGH	ATP to provide overspeeding protection due to the presence of turn trips through HRTO	HRTO: BLACKTOWN P 318B @ 35.816Km AUDS Estimate: $523,627.00 Approach Speed (Med/High, km/h): 115 / 115 PMAS (km/h): 40 Target Speed (km/h): 25 No. of Safety reports in last 5 yrs: 2 Trip speed at the toe of HRTO: 102 Passenger trips per day (Straight, Facing): 48 Passenger trips per day (Straight, Trailing): 0 Passenger trips per day (Turn, Facing): 5 Passenger trips per day (Turn, Trailing): 0	SFAIRP - Recommend to FIT	There are 2 known safety report(s) in the last 5 years and, There are 53 trip(s) taking place per day (5 Turn(s)) and, The trip speed at the toe of HRTO is less than or equal to PMAS: False AUDS Estimate: $523,627.00 - 3.5 of average cost AUDS150K	L4 (Unlikely) Qualitative expectation	C1 (Catastrophic) Health and safety / Disruption to service)	1. The likelihood of a derailment of a passenger train at this turnout due to overspeed has been assessed as Unlikely (L4). There are x5 passenger turn facing trips with approach speed of 115km/h. For derailment to occur at these sets of points the following has to happen: [R1]: The existing signalling system needs to fail or mis-inform the driver AND [R2]: Driver not see/adhere to the posted speed sign AND [R3]: Driver has lost situational awareness (i.e., route knowledge) Additionally the following reasons are used to justify the likelihood of L4: [R4]: There are no reported derailments for this turnout due to overspeed 2. The consequence of overspeed by a passenger train at the turnout is de-railment which can be classified as Catastrophic (C1), due to the fact that there are passenger movements through the points. Therefore it is recommend that ATP High risk turnout protection is provided. 3.The risk associated with this turnout is not tolerable and it is reasonably practicable to reduce the risk further with ATP and ATP would provide significant benefits. The Turnout will be protected SFAIRP with ATP protection.	Protected to SFAIRP with ATP Protection - Recommend to fit

Source: Transport for NSW

While fixed balises were installed on BN 317 and BN 318 turnouts, it was found during the investigation that the balises had different functions on each turnout and in the Up and Down directions.

On the Up Main at BN 317, fixed balises were installed for maximum line speed of the Up Main and for repositioning in the Up direction. In the Down direction, there were fixed balises installed for repositioning and for maximum speed monitoring through the turnout from the end of the Up Loop Line onto the Up Main only.

On the Up Suburban at BN 318, fixed balises were installed for maximum line speed monitoring of the Up Suburban and for repositioning in the Up direction. In the Down direction fixed balises were installed for repositioning only.

Sydney Trains confirmed the fixed balise for BN 318 turnout could not be used for turnout speed protection as there were 2 routes, a mainline speed 115 km/h on approach and 25 km/h for the turnout and a fixed balise can only provide static information. A controlled balise (one that is integrated with the signalling) would be required to provide the 2 different speed profiles for the routes set by the Signalling system, which would then be sent to the onboard ATP system.

Changes to ATP scope

TfNSW conducted a review of the ATP program in August 2019, and identified several issues impacting its rollout, including:

- Capacity constraints caused by ATP slowing down trains..
- Redundant equipment as ATP was slowly replaced by European Train Control System (ETCS) Level 2 digital in-cab train control
- Budget and delivery constraints due to track access and resource allocation across concurrent projects.

A strategic review of the ATP scope recommended that the following changes be made to the ATP rollout:

- Deploy ATP with fixed Balise only in Areas 6 and 8 (Figure 21)
- Cancel ATP deployment in Areas 7.2 and 9, and focus on ETCS 2 introduction
- Realign fleet deployment to provide priority in safety benefits.

The revised functional specification for areas 6 and 8 released in October 2019 removed, amongst other protections, the following functionalities from the ATP baseline specification:

- High risk turnout protection
- High risk converging movements protection

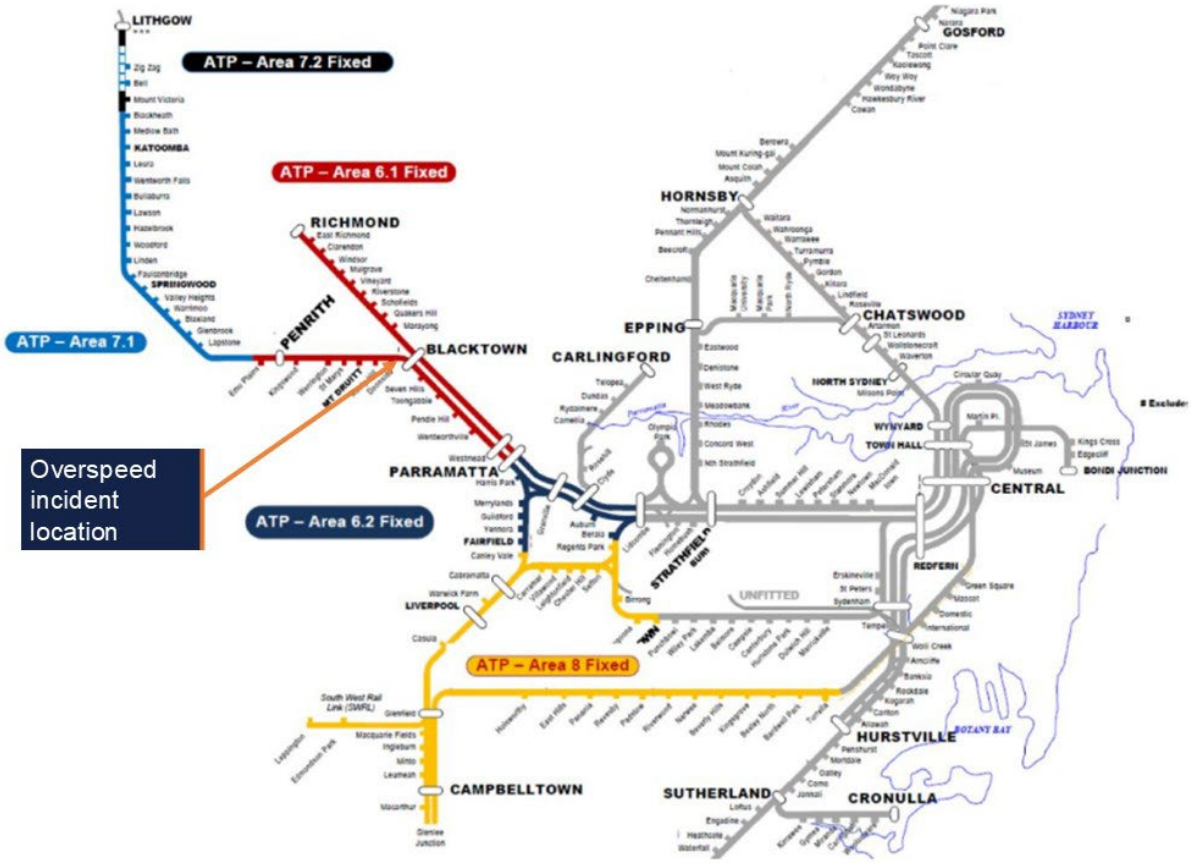
This represented a downgrade in the original scope and implementation of ATP, with the known risk of HRTO remaining post-project implementation. The proposed changes were presented to ONRSR in November 2019, and feedback was provided resulting in a review by TfNSW. This resulted in additional fixed balises being installed in Area 7.2 Area 9 to protect essential functions.

Sydney Trains' SAR documents that all residual safety risks transferred by TfNSW are managed and reduced SFAIRP, and notes that not all High-risk turnouts (HRTO) were to be protected in accordance with the revised design guidelines for ATP. Thus, accepting the residual risk to their operations of the untreated turnouts.

Subsequently, post this incident and a related occurrence, ONRSR issued an improvement notice to Sydney Trains to address the risk of overspeed through crossovers and turnouts. This notice identified that the current configuration of ATP provided overspeed protection for only some of the highest risk turnouts and crossovers. And acknowledged that the risk assessment to identify these turnouts was carried out by TfNSW.

As the accredited operator ONRSR placed the action on Sydney Trains to minimise the network risk of overspeed through turnouts SFAIRP.

Figure 21: Area 6, 7 and 8 geographic location and sub-area breakdown



Source: Transport for NSW

Management of overspeed risk

Sydney Trains maintained a risk register of network-wide safety risks. Overspeed was not contained in the safety risk register as its own risk but had been considered as a contributor to the higher-level network hazard of *'Loss of control passenger train'*.

Sydney Trains had assessed this network hazard as 'well controlled' in its Bow Tie SFAIRP determination[35], Nov 2018.

Despite known incidents occurring on the network, including this incident, a review of the Bow Tie SFAIRP Determination in May 2024 post-incident, maintained the assessment as '*well controlled'*.

Following the issue of an improvement notice from the ONRSR in late May 2024, Sydney Trains reviewed the network hazard of Loss of Control again and subsequently determined the control rating as '*Requires Some Improvement'*.

It was observed by OTSI that most risk controls identified in the Bow Tie SFAIRP determination under the direct control of Sydney Trains were administrative. Other existing preventative controls of driver vigilance systems, rolling stock design, speed monitoring and Level 1 ATP, identified as engineering controls, were delivered by

[35] Bow-tie SFAIRP determinations were part of the risk management tools used by Sydney Trains to manage operational safety risks so far as is reasonably practicable (SFAIRP).

TfNSW. Speed monitoring and Level 1 ATP were considered only partially effective, at the time, as these controls were not installed across the entire network.

ONRSR Case Study – ATP and Sydney Trains

In September 2025, ONRSR released a safety case study, *Automatic Train Protection – ONRSR and Sydney Trains – Case Study* advocating for funding approval on behalf of Sydney Trains to address the risk of high-risk turnouts as a priority.

ONRSR became increasingly concerned by a series of overspeed events through 25 km/h turnouts that occurred on the Sydney Trains network over a period of 20 months between October 2023 and March 2025.

Considering these overspeed events and citing 2 specific events at Blacktown Junction on 4 October 2023, and Blacktown West on 21 April 2024, ONRSR issued an Improvement Notice to Sydney Trains on 23 May 2024. While acknowledging a longer-term strategy to manage overspeed risk was in place, ONRSR's focus was necessarily on the 'here and now' of managing risks to safety SFAIRP.

In response to the Improvement Notice, Sydney Trains identified areas on the rail network with potential for overspeed events and prioritised these based on risk. It was found as part of the review that only a fraction of the turnouts on the Sydney Trains network were overspeed protected by ATP.

Sydney Trains introduced interim measures to control overspeed risk by slowing trains with speed restrictions in high-risk areas until an ATP or similar technological solution could be implemented. Sydney Trains additionally presented to TfNSW a business case to seek funding and support for the implementation of engineering controls to reduce the risk of overspeed through turnouts at high-risk locations on its network.

These actions and the continued advocacy by ONRSR at senior government levels resulted in a High-Risk Turnout (HRTO) Program being agreed to and funded by TfNSW, as a short-term solution, to ensure engineered controls for high-risk turnouts were in place. The longer-term solution of upgrading the Sydney Trains Network to European Train Control System Level 2 technology and introducing a Traffic Management System remained the future end state.

Overspeed response

Sydney Trains did not have a formalised procedure for responding to an overspeed event, but the Network Rules provided general guidelines for operational staff to follow.

Train Crews and Track Vehicle Crews

General Network Rule NGE 232, 'Responsibilities of Train Crews and Track Vehicle Crews', prescribed the responsibilities of Train Crews and Track Vehicle Crews on the network. It stipulated that the primary responsibility of Train Crews and Track Vehicle Crews was 'to operate trains and track vehicles for the safe and efficient transit of rail traffic through the Network'.

NGE 232 stated that Train Crews and Track Vehicle Crews must:

- be responsible for the safe operation of rail traffic and the safety of other crew and passengers, and
- tell a Signaller[36] about breaches of Network Rules and Network Procedures, and
- promptly report delays to the Signaller.

The rule also stated that drivers 'must tell a relieving crew about any conditions that could affect the operation of the rail traffic'.

Additionally, Sydney Trains' Operator Specific Procedure OSP 12 *Responding to an incident* stated:

- Workers who become aware of or are involved in an incident must make every endeavour to ensure it is immediately reported to a Signaller.

Following the incident, when the driver returned to their seat and regained control of the train, they called the guard to check on their welfare and to explain they had misread the signals and went through the turnout too quickly. They had this conversation as the driver continued driving the train to Blacktown.

The driver did not report the incident to the Area Controller as required under NGE 232 but discussed the incident when they were contacted by the TCLO. The driver explained at interview that they did not provide the relieving driver at Blacktown with any details about the incident or condition of the train because at the time they were in a state of shock. The driver further explained they felt relieved when they were contacted by the TCLO because it meant that someone knew what happened and they could provide details about the incident.

The guard said at interview that as the train approached Blacktown, they noticed the train shake a little bit like a rough ride and thought it was a bit unusual. It was at this time the guard received the call from the driver.

The guard stated at the end of the communication with the driver, that they did not consider a major incident had occurred. They had not felt the train jolt so significantly from the rear of the train as the train had slowed by the time the rear carriage passed over the turnout. Further no Passenger Emergency Intercom[37] calls were made between the turnout and Blacktown Station where they were relieved, which led the guard to conclude passengers were okay.

On arrival at Blacktown the guard decided to call the TCLO to report and confirm what they now thought was an incident due to the train shaking and the driver stating they had misread a signal. The TCLO confirmed the details and contacted the driver for further information and subsequently made an incident report to the NIM.

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[36] Signaller: a competent worker who issues proceed authorities, and works points, signals and other signalling equipment usually located in a signal box, to manage routes for safe and efficient transit of rail traffic. On the Sydney Trains network, signallers are also known as Area Controllers.

[37] The Passenger Emergency Intercom (PEI) is a device installed in passenger carriages allowing passengers to communicate with the train crew in case of emergency or if urgent assistance is needed.

Network Controllers

General Network Rule NGE 236, 'Responsibilities of Network Controllers', prescribed the primary responsibility of a Network Controller[38] was 'to manage train paths for the safe and efficient transit of rail traffic through the Network'. The rule also stated that Network Controllers must plan, set priorities for, and manage liaison with relevant Operators and Maintenance Representatives and external services during incident management and manage available facilities to restore train services safely and promptly.

Additionally, Network Controllers must, as necessary, provide rail traffic details to affected Network Controllers and Signallers; promptly report breaches of Network Rules and Network Procedures to the controlling officer and affected Operator's Representatives and compile and maintain, in permanent form, relevant records and reports about conditions and movements in the Network.

After arriving at Blacktown, the train crew discussed the incident with the TCLO who then reported the incident on their behalf to the NIM. Although the TCLO was not specifically covered by either NGE 232 or NGE 236, their responsibilities included assisting crews with Network and Operator-specific rules and procedures.

Upon receiving the incident report, the NIM undertook a series of actions to inspect the affected infrastructure, obtain train information, and begin an internal investigation. The NIM also had a verbal discussion with Defects and the Duty Control Manager (DCM) about whether the train needed to be withdrawn from service and inspected. There was no specific instruction on how to respond to an overspeed event, which meant that decisions on whether to inspect infrastructure and trains were at the discretion of the NIM on duty. After the discussion with Defects and the DCM, a collective decision was taken that the train could remain in service without inspection. However, after a shift changeover several hours later, the replacement NIM had a follow-up discussion with a different representative from Defects, and a decision was made to immediately remove the train from service.

Similar related incidents

ONRSR's reporting requirements classify 'trains significantly exceeding the permitted speed limit' as an Incident Directly Threatening Safety. This falls under Category A – Report Immediately. Trains exceeding the speed limit but to a lesser extent, may be reported by the Operator as an Occurrence Type 7, Network Rule or Procedure Breach.

The incident at Blacktown West on 21 April 2024 was one of 16 reported overspeed incidents through turnouts on the Sydney Trains network between January 2019 and March 2025, and one overspeed incident involving a NSW TrainLink service that derailed and overturned, resulting in multiple fatalities. Each of these incidents is outlined in Appendix C.

[38] Network Controller (NC): Qualified Workers who manage the safe and efficient operation of the Network: for train paths, on time running and possession management, the NC is the Train Service Delivery Manager (TSDM); for network incidents, special working, and the authorisation of work on track authorities the NC is the Network Incident Manager (NIM).

Safety analysis

The contributing factors that led to the incident are discussed below.

Loss of situational awareness

Prior to departing Doonside, the driver of run 805K began to pack their belongings in anticipation of being relieved at Blacktown. They were also aware that the train was travelling on the Up Suburban as they passed the automatic signal off the departure end of Doonside Station. As the train accelerated, the driver recalled that they could see the next 3 signals from a distance and began to recall the usual signalling sequence they would encounter in this section.

However, this sequence was for trains on the Up Main, where they would continue in a straight line rather than turnout, and was the standard routing for suburban services in this section, rather than for the Up Suburban. As a result, it is likely that the driver of run 805K whilst preparing to depart the train at Blacktown, lost their situational awareness of which track the train was operating on, which influenced how they read and responded to each signal, and how they operated the train, as they approached Blacktown West.

Expectation bias

Expectation bias is a phenomenon in which people's expectations about a situation or event can influence their interpretation of and/or reaction to that situation or event.

In the rail context, a high frequency of train movements on a specific track in a specific area allows train drivers to habituate to the signals, speed limits, and gradients unique to that location, and handle their train accordingly. As the frequency of train movements on an alternate track or route decreases, so does the ability for drivers to maintain the requisite route knowledge or memory recall.

Train drivers are expected to maintain their route knowledge and awareness of their area of operations, but the opportunity to do so may be limited by operational considerations. Accordingly, if a driver does not operate a train on a particular route or track on a regular basis, it is possible for drivers to assume that route is no longer used or expect that their train will not traverse that track in regular operations.

The altered train running information for 805K was contained within the daily STN which was issued to crew. However, the driver did not read the STN and Sydney Trains did not have processes in place to ensure the crew reviewed each STN. It was also unclear from the word 'relevant' in the procedures whether the driver was required to read the STN if they had assessed by other means that there were no 'relevant' changes to their services.

Had the driver reviewed the STN they may have recalled the information as they approached BN 318, but it is not possible to conclude that the STN would have provided an effective control based on the size of the document, and a reliance on memory recall due to potential distractions and passage of time. In this incident, the train driver had been based at Blacktown Depot for around 7 years but stated that they had only driven a train over BN 318 turnout 2 or 3 times in this period. This was a consequence of

timetable design, with only 5 trains scheduled daily, to use BN 318 turnout in the Up direction in the Standard Working Timetable (SWTT).

The High-Risk Turnout Risk Assessment found that this equated to fewer than 1 in 10 suburban trips being operated via the Up Suburban and BN 318 turnout. Thus, opportunities for drivers to learn and remember the signalling sequence and maintain route knowledge were wholly dependent upon a driver's shift time and allocated crew diagram, or changes to a train's pathing for operational reasons.

With limited opportunities to traverse BN 318 turnout over the preceding 7 years, the driver became habituated to the signal sequencing and characteristics of the Up Main and handled their train accordingly. The driver explained the usual signal sequence they would observe approaching Blacktown West, and that they would drive the train in accordance with their expectations – that the preceding signals would be cleared once the Home signal was cleared, and they would continue on straight track.

Because the Home signal at Blacktown West would almost always switch from Stop to Clear as the train approached the Lancaster Street bridge, the train driver would maintain their speed and wait for the Home signal to show Green on Green instead of responding to the preceding two signals at Medium.

On the day of the incident, the key difference was that, instead of the Home signal clearing to Green over Green, the signal showed Yellow on Yellow with a corresponding route indication. The driver recalled that, as they approached the Lancaster Street bridge, they were driving the train in their routine manner and 'read through' past the nearest signal to the signals further down the line.

The driver continued to do this as they approached Signal BN 94 S, even though this signal was showing a different indication. As they had rarely traversed BN 318 turnout, and almost always went through Blacktown West at track speed, the driver did not believe this trip would be different to previous journeys in the Up direction. This was further exacerbated by the driver's loss of situational awareness, which caused them to believe they were on the Up Main instead of the Up Suburban.

Therefore, the driver of run 805K did not drive their train in accordance with the prevailing signal indications and was not aware that the train would take a diverging route. This was due to an expectation that the signal sequencing and route setting would be the same as previous journeys, leading to an overspeed through BN 318 turnout at Blacktown West.

Contributing factor

The driver of train 805K did not operate the train in accordance with signal indications.

Contributing factor

The driver was not situationally aware as they approached BN 318 turnout. They expected the signal aspects and direction of travel to be the same as they had experienced many times before. So, the driver did not react to the actual signal aspects which resulted in the train travelling over speed through the turnout.

Ineffective controls for the risk of overspeed

Technology-based risk controls such as ATP and mechanical risk controls such as speed-based train stops, are key mitigations against train driver error and loss of situational awareness. However, Sydney Trains had no such mitigations available at BN 318 turnout to protect against the risk of an overspeed, or to intervene in the event a driver did not respond appropriately to the signals or speed signs.

Responsibility for the ATP rollout was assigned to TfNSW. During the HRTO risk assessment, TfNSW had identified in September 2019 that BN 318 turnout at Blacktown West had a high risk of overspeed and derailment and calculated that this risk was not tolerable. TfNSW also determined that ATP would provide SFAIRP protection – but that protection had not been installed at BN 318 turnout by April 2024, likely due to changes in the ATP project scope and implementation.

TfNSW's decision to downgrade the ATP Project and install fixed balises only in areas of the network where high risk turnouts had been identified (including BN 318 turnout) decreased the opportunity of effectively controlling the high-speed turnout risk.

Fixed balises could only provide static data which made configuring speed protection on a line that offered more than one route unachievable. In the case of BN 318 turnout, an approaching train could be pathed straight on the Up Suburban or pathed through the turnout. With a fixed balise, only one speed limit could be provided, which was the 115 km/h limit on the Up Suburban line.

The history of incidents (*reference Appendix C – Similar related Incidents*) meant that overspeed through turnouts was a well-known hazard on the Sydney Trains network.

As the rolling stock operator and infrastructure maintainer, Sydney Trains was responsible for managing the risk SFAIRP to their operations posed by high-risk turnouts in the absence of engineered controls from TfNSW who controlled the capital budget and project management capability for major works such as the TfNSW ATP Project.

Sydney Trains, whilst identifying the risk of derailment due to overspeed in its Loss of Control passenger train SFAIRP determination, assessed the risk to its operations as controlled SFAIRP citing primarily administrative controls. The engineering controls noted for overspeed, such as speed monitoring and Level 1 ATP were documented as only partially effective, acknowledging the limitations of the TfNSW ATP rollout.

Sydney Trains identified the risk of rollover in its derailment SFAIRP determination, which was determined as well controlled. However, like the loss of control determination the identified controls on which the determination was made were predominately administrative. The only control that directly related to the risk of overspeed was driver compliance with speed boards which was documented as partially effective. Neither determination specifically identified high speed entry into low-speed turnouts as representing a unique risk of derailment and rollover with customised controls.

The administrative nature of the controls in the Sydney Trains SFAIRP determinations were likely reflective of Sydney Trains' funding and capability/resources within the broader TfNSW portfolio, and the controls made available to them. These were specifically identified by Sydney Trains as constraints during works to address the ONRSR improvement notice.

As an alternative to ATP speed protection, turnout repeaters on the preceding signals may have provided an additional control to inform drivers of an upcoming route change. Sydney Trains confirmed that there was no turnout repeater for signal BN 94 S for BN 318 turnout, which could have provided the driver of run 805K an extra 20 seconds and 635 m to slow their train. However, this was reliant upon the driver seeing and responding to the turnout repeater, and much like other signal indications, could be easily overlooked by a driver who had lost their situational awareness.

When trains are routed to use turnouts, the risks associated with overspeed increase with line speed as trains will usually be travelling at line speed approaching a set of points and its controlling signal. Across the rail network, the primary control in place to ensure a train slowed down sufficiently to traverse points safely was the train driver. In the absence of ATP speed protection, there was no other means of controlling the speed of a train prior to it taking a diverging route.

With no mitigation against a driver losing their situational awareness and driving a train at or near line speed through a turnout, the risk of overspeed at high-risk turnouts such as BN 318 turnout – which TfNSW had originally deemed as ‘not tolerable’ – was significantly increased. In this incident, if ATP speed protection had been installed at BN 318 turnout, it is likely that the train would have been automatically slowed down by the onboard ATP system before the train reached the points, and the severity of the overspeed of 805K through BN 318 turnout would have been significantly reduced, if not eliminated entirely.

Other factor that increased risk

TfNSW downgraded the ATP project scope and did not install speed protection at high-speed turnout BN 318, despite the initial risk assessment assessing the risk as not tolerable.

Contributing factor

Sydney Trains did not have effective controls for overspeed where high risk turnouts were present. (Safety issue)

No response process for overspeed incidents

During the investigation, it was established that the crew of run 805K did not know or follow the correct process for reporting an overspeed event. According to the Network Rules, the crew should have reported the incident immediately to the Area Controller, but the train continued in service to Blacktown where the guard then informed the TCLO.

Although the TCLO was able to inform the NIM and commence post-incident activities, crews cannot rely on the TCLO to assist in incident reporting. This uncertainty around reporting processes increased the risk that a serious incident might not be reported by crews, delaying inspections of fleet and infrastructure and potentially delaying medical treatment in the event of injuries.

Sydney Trains also confirmed that there was no formalised process for Control Room staff to manage and respond to an overspeed event. When the NIM on shift became aware of the incident, they undertook a series of actions to obtain train information, inspect the affected infrastructure, and commence an internal investigation.

However, there was no written instruction specifying what actions needed to be taken following an overspeed event. As a result, the NIM spoke with the DCM and Defects to discuss what should be done with set A32. During this conversation, it was collectively agreed that set A32 could remain in service for the rest of its roster, even though the train had not been inspected for damage or defects.

Other factor that increased risk

The train continued in service after the overspeed event without being inspected.

However, the NIM on the following shift several hours later did not agree. Upon learning that set A32 was still in revenue service, the NIM requested that the set be taken out of service and inspected immediately. At that point, set A32 had continued for several hours in revenue service, albeit with no observed damage or defects.

As there was no procedure in place regarding overspeed incidents, it was left to NIMs and other Control Room staff to collectively determine an appropriate course of action after each overspeed incident. This increased the risk that fleet and infrastructure could remain in revenue service without any assessment of whether it was safe to do so.

Other factor that increased risk

Sydney Trains did not have a response process for overspeed incidents. (Safety issue)

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition, 'other findings' may be included to provide important information about topics other than safety factors.

Safety issues are highlighted in bold to emphasise their importance. A safety issue is a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the train overspeed by run 805K, through BN 318 turnout, Blacktown, New South Wales, on 21 April 2024.

Contributing factors

- The driver of train 805K did not operate the train in accordance with signal indications.
- The driver was not situationally aware as they approached BN 318 turnout. They expected the signal aspects and direction of travel to be the same as they had experienced many times before. So, the driver did not react to the actual signal aspects which resulted in the train travelling over speed through the turnout.
- **Sydney Trains did not have effective controls for overspeed where high risk turnouts were present** (Safety issue).

Other factors that increased risk

- TfNSW downgraded the ATP project scope and did not install speed protection at high-speed turnout BN 318, despite the initial risk assessment assessing the risk as not tolerable.
- The train continued in service after the overspeed event without being inspected.
- **Sydney Trains did not have a response process for overspeed incidents.** (Safety issue)

Safety issues and actions

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues. The ATSB expects relevant organisations will address all safety issues an investigation identifies.

Depending on the level of risk of a safety issue, the extent of corrective action taken by the relevant organisation(s), or the desirability of directing a broad safety message to the Rail industry, the ATSB may issue a formal safety recommendation or safety advisory notice as part of the final report.

All of the directly involved parties are invited to provide submissions to this draft report. As part of that process, each organisation is asked to communicate what safety actions, if any, they have carried out or are planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions will be provided separately on the ATSB website on release of the final investigation report, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website after the release of the final report as further information about safety action comes to hand.

Ineffective controls for overspeed

Safety issue description

Sydney Trains did not have effective controls for overspeed where high risk turnouts were present.

Issue number:	RO-2024-003-SI-01
Issue owner:	Sydney Trains
Transport function:	Rail: Passenger - metropolitan
Current issue status:	Monitor
Issue status justification:	Sydney Trains did not have effective controls for overspeed where high risk turnouts were present

Response by Sydney Trains

Since this incident Sydney Trains has undertaken several actions:

Sydney Trains has initiated a project titled: ATP High Risk Turnout Project. The concept phase of this project is under way with the following works currently funded to $5M.

- Signalling and Track Turnout Data collection, collation and verification of all turnouts across the network

- Full re-assessment to determine all High-Risk Turnouts for ETCS L1 fitment

- Prioritisation of turnouts into identified Priority Zones across the network

- Signalling Functional Specification (SFS) and preliminary scopes/design for Priority Zone 1a Blacktown – Seven Hills

- Development of a Business Case to support the rollout of the entire program of works

A temporary Speed Restriction in place on 318 points until engineering works (ATP and Turnout repeater) are completed.

A turnout repeater for BN 318 turnout will be designed and commissioned with works planned for FY 26/27.

The Advanced Train Running Information Control Systems (ATRICS) data monitoring for overspeed analysis at selected turnouts in the Blacktown area.

In August 2024 a General Instruction was issued to train drivers to create awareness of recent incidents and reinforcing the requirements to not exceed track speed.

The Train Crew Compliance team have increased their speed monitoring program.

ATSB comment

A series of interim measures have been undertaken by Sydney Trains, as detailed in Sydney Trains' response.

Short term measures such as, awareness, lower speed limits, and increased speed compliance monitoring, decreases the likelihood of recurrence and decreases the potential consequences. However, the decreased likelihood of recurrence may change over time if higher order controls (engineering controls) are not implemented.

The speed limit at Blacktown was reduced to 80 km/h until engineered controls for high-risk turnouts can be implemented.

In this regard, the longer-term completion of the ATP High Risk Turnout Project is essential for maintaining effective risk control.

Sydney Trains did not have a response process for overspeed incidents

Safety issue description

Sydney Trains did not have a response process for overspeed incidents.

Issue number:	RO-2024-003-SI-02
Issue owner:	Sydney Trains
Transport function:	Rail: Passenger - metropolitan
Current issue status:	Closed – Adequately addressed
Issue status justification:	Sydney Trains did not have a response process for overspeed incidents

Response by Sydney Trains

Sydney Trains has existing processes to respond to incidents involving trains / track infrastructure. Following this incident when it was identified that the involved train was allowed back into revenue service without being 'certified', a review was undertaken of PR R 90427 Fleet Assurance – Post Incident.

The review resulted in the procedure being updated to ensure trains are certified following incidents and was re-issued.

ATSB comment

Sydney Trains system has been updated to ensure trains are certified after involvement in an overspeed incident.

Specifically, significant train overspeed incidents require an Assurance Statement the train is fit to be moved when the speed limit has been exceeded by a specified percentage.

Sydney Trains system has existing processes (such as audits) for ensuring system compliance.

General details

Occurrence details

Date and time:	21 April 2024 – 1436 EST	
Occurrence class:	Serious incident	
Occurrence categories:	Network Rule or Procedure Breach, Overspeed	
Location:	Near Blacktown, New South Wales	
	Latitude: 33º 46' 0.6348' S	Longitude: 150º 53' 53.0664' E

Train details

Track operator:	Sydney Trains	
Train operator:	Sydney Trains	
Train number:	805K	
Type of operation:	Passenger	
Consist:	D6432, N5432, N5632, T6632, T6532, N5532, N5332, D6332	
Departure:	Penrith, New South Wales	
Destination:	Central, New South Wales	
Persons on board:	Crew – 2	Passengers – Unknown
Injuries:	Crew – 1 minor	Passengers – nil
Damage:	None	

Glossary

ATP	Automatic Train Protection (ATP) is a train safety system used across the Australian rail industry to monitor a train's speed, distance and direction, providing warnings to the driver and automatically applying brakes when required to prevent overspeed, signal overruns. Or other unsafe conditions
ITSRR	The Independent Transport Safety and Reliability Regulator (ITSRR) was a statutory authority in New South Wales, responsible for overseeing the safety and reliability of transport services. Established in 2004, ITSRR's primary roles included regulating rail safety, providing independent advice to the government on transport sustainability, and ensuring the safe operation of transport services.
OEP	The Operator Enable Pedal (OEP) is a foot operated vigilance device installed in cabs to ensure the driver remains alert and actively engaged in train operation. The driver must keep the pedal depressed when operating the train. Releasing it can trigger vigilance alerts or safety interventions depending on the train's safety system design.
ONRSR	The Office of the National Rail Safety Regulator (ONRSR) is the regulatory body responsible for overseeing rail safety in Australia. Established in July 2012 and commencing operation in January 2013, to promote and improve national rail safety and ensure the safety of the community by enforcing the Rail Safety National Law (RSNL) across all Australian states and territories.
RailCorp	RailCorp, or Rail Corporation New South Wales, was an agency of the State of New South Wales. It was established on 1 January 2004, under the Transport Administration Act 1988. RailCorp was responsible for holding rail property assets, rolling stock, and rail infrastructure in the Sydney metropolitan area and some country locations. In 2013, RailCorp's operational and maintenance functions were transferred to Sydney Trains and NSW TrainLink, leaving RailCorp as the legal owner of a significant portfolio of railway property. On 1 July 2020, RailCorp was converted into a state-owned corporation and renamed the Transport Asset Holding Entity (TAHE).
RailSafe	RailSafe is a platform managed by Transport for NSW. It serves as a comprehensive resource for safeworking rules, procedures, and updates specifically for the Sydney Trains Network.

SFAIRP	So Far As Is Reasonably Practicable, is a requirement to eliminate or minimise safety-related risks, so far as is reasonably practicable, associated with the planning, design, build, installation, testing and commissioning, operation, maintenance and disposal of rail assets.
Sydney Trains	Sydney Trains is the operator of suburban and intercity rail services in and around Greater Sydney, New South Wales. Established on 1 July 2013, Sydney Trains took over the suburban services previously managed by RailCorp's CityRail division. The network covers a significant area, bounded by Berowra, Emu Plains, Macarthur, and Waterfall, and includes 168 stations across nine lines. Sydney Trains is responsible for the operation, maintenance, and management of rail services, tracks, trains, signals, overhead wiring, stations, and facilities within this area.
TCLO	The Train Crew Liaison Officer (TCLO) is a role in Sydney Trains involved in the Day of Operations Management team. The role provides oversight and support across the rail network to achieve operational objectives.
TfNSW	Transport for NSW (TfNSW) is a statutory authority established on 1 November 2011. It is responsible for managing and coordinating transport services and infrastructure across New South Wales. This includes roads, rail, buses, ferries, light rail, and point-to-point transport.

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the driver of 805K
- the guard of 805K
- Office of the National Rail Safety Regulator (ONRSR)
- Sydney Trains CCTV cameras
- Sydney Trains audio communication systems
- Sydney Trains documented management systems
- Transport for NSW.

References

- Australian Transport Safety Bureau. Derailment of passenger train ST23, Wallan, Victoria on 20 February 2020 (Report No. RO-2020-002). https://www.atsb.gov.au/publications/investigation_reports/2020/rair/ro-2020-002
- Hon. McInerney, P.A. (2005). Special Commission of Inquiry into the Waterfall Rail Accident. Final Report Volume 1 January 2005. https://nraspricms01.blob.core.windows.net/assets/documents/Waterfall-Rail-Accident/Waterfall-final-report-Volume-1.pdf
- OSHA Practice (2023) What is Situational Awareness. https://www.oshapractice.com/blog/what-is-situational-awareness/
- Rail Industry and Safety Standards Board (RISSB) Glossary of Terms
- Psychology (2024) Definition of Expectation Bias. https://psychology.tips/expectation-bias/
- Transport for NSW (2025) https://standards.transport.nsw.gov.au/
- Transport for NSW (2025) https://railsafe.org.au/rules-and-procedures

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the following directly involved parties:

- Crew of 805K
- Sydney Trains
- Transport for NSW
- ONRSR.

Submissions were received from:

- Sydney Trains
- Transport for NSW
- ONRSR.

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Appendices

Appendix A – Automatic Train Protection (ATP)

ATP is a system designed to enhance train safety by monitoring and ensuring that a train's speed is within the permitted limits set by the signalling system. ATP can be configured to prevent incidents such as signals passed and danger (SPAD) and over-speeding, thereby significantly reducing the risk of collisions and derailments.

At the time of writing, there were 4 active levels of ATP, based on European Train Control Standards (ETCS)[39].

Level 0 – No ATP

- Basic operation with traditional signals.
- No onboard ATP functionality: driver relies entirely on visual signals.

Level NTC – Legacy National Train Control systems

- ATP onboard equipment interfacing with legacy train control systems.
- Used during transition or on mixed infrastructure

Level 1 – Limited Supervision

- ATP overlays existing trackside signalling.
- Uses balises (track-mounted transponders) to transmit speed and signal data to the train.
- Can automatically apply brakes if the train exceeds speed limits or passes a signal at danger.
- This is the level rolled out across the Sydney Trains rail network.

Level 2 – Full Supervision

- Removes reliance on trackside signals.
- Continuous communication between train and control centre via radio, provides real-time movement authority
- Speed profiles, and braking curves to apply brakes if train exceeds speed limits
- Train positioning via balises
- Enhances safety and allows for higher network capacity.

Onboard equipment

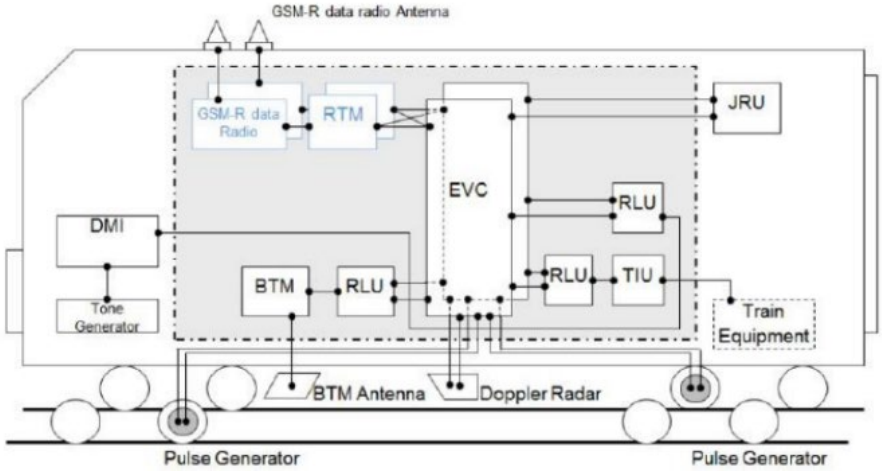
TfNSW publication T HR SC 01650 SP - ETCS On-board Equipment defined the requirements for ETCS onboard equipment, its configuration and installation for TfNSW. Onboard equipment included the following (Figure 22):

- Vital Processing Unit, known as the European Vital Computer (EVC)
- Train equipment (wheel sensors, radar, accelerometer, speakers)
- Driver-Machine Interface (DMI)

[39] ERTMS (https://www.ertms.net/facts-figures/ertms-factsheets/).

- Track to Train interface via air gap (Balise Antenna)
- Radio Transmission Module (RTM)
- GSM-R data radio
- GSM-R data radio antenna
- Balise Transmission Module (BTM)
- BTM antenna
- Relay Logic Unit (RLU)
- Driver Man-Machine Interface (DMI) Tone Generator
- Pulse Generator
- Doppler Radar
- Juridical Recording Unit (JRU)
- Train interface Unit (TIU)

Figure 22: Waratah ATP architecture overview



Source: Downer

By November 2020 the installation of all physical ATP equipment was completed on all A-sets.

Track side infrastructure

The ATP track side infrastructure provided network control information to the ATP onboard equipment allowing the vehicle to be operated on the network with improved levels of safety and vehicle protection. During train operation, ATP would function in a number of states depending on the ATP level of track infrastructure. If ATP failed, manual isolation was possible with additional safety controls to allow the rolling stock to be removed from the network if required.

The trackside equipment included:

- Transponders, known as Balises (Figure 23) – these transponders are used to transmit information such as location, speed limits and signal aspects to trains. The exact functionality can vary depending on the railway system.

- Lineside Electronic Units (LEU's) – an electronic device that acts as the interface between the balise and the railway signalling system. It collects information from the interlocking system (which controls signals and points) and sends appropriate data to the balise. The LEU generates telegrams to be sent by balises, on the basis of information received from external trackside systems.

Figure 23: Transponder (balise)

Source: Transport for NSW

Appendix B – Rail Regulator yearly summary of progress – Rec 32

December 2005	Identified national standards required for fitment of ATP to rollingstock. Australasian Railway Association (ARA) invited to develop standard.
2006	RailCorp gained funding to pilot trial ATP technology on part of its network. The Regulator agreed in principle
2007	RailCorp tested three (3) types of ATP technology on sections of the Blue Mountains line. One manufacturer has fitted a trial train and performed tests.
2008	RailCorp developed a business case outlining an implementation strategy and funding requirements based on successful trial in early 2008. RailCorp's Board had approved funding for the design and planning phase and was prepared to continue following Government approval for full funding of ATP. The Regulator set an interim target date for completion of the recommendation of 30 June 2009
2009	The Regulator had changed the interim target date to 31 July 2010 based on completion of NSW Treasury Gateway Review of the business case. RailCorp required to review the technical feasibility and cost benefit of introducing Level 1 ATP as well as Level 2 ATP. Level 1 ETCS involves the overlay of ATP on the coloured light signalling system to transmit authorities for trains to proceed on the network via the track mounted balises. Level 2 ETCS involves the connection of ATP to the signalling interlockings to transmit authorities for trains to proceed via GSMR radio.
2010	In August 2010, Cabinet gave in-principle funding approval for the rollout of the three stages of the ATP program and full funding approval for the implementation of Stage 1 of the program. Stage 1 involves the supply of ATP equipment for RailCorp's OSCAR and Tangara train fleets and the installation of ATP equipment to 600 kilometres of the CityRail network. Stages 2 and 3 will involve the installation of ATP equipment across the rest of RailCorp's electrified network and onboard the Waratah and Millennium train fleets. Expected completion dates for the three stages are: Stage 1 – 2011 to 2017 Stage 2 – 2013 to 2018 Stage 3 – 2015 to 2021 The first of RailCorp's trains to be fitted with ATP equipment and introduced into service between Wyong and Berowra is expected to be in 2013.
2011	RailCorp awarded four separate supply contracts including ETCS supply and engineering services for trackside and onboard, and through life support for trackside and onboard. RailCorp engaged consultants to risk assess and evaluate implementation of additional ATP systems on RailCorp network.
2012	ATP system testing commenced using the ATP V set test train and the newly commissioned ATP trackside equipment between Gosford and Wyong. This allowed configuration of the ATP system to be fine-tuned prior to the second phase of testing using an OSCAR train and a more extensive area of the track in 2013. ATP installation on the first two OSCAR prototype trains is almost complete, with installation underway on the second train during the fourth quarter 2012. The two trains will be commissioned in the second quarter of 2013.

2013	Trackside construction from Berowra to Wyong was completed with the exception of the installation of compliant, Type Approved lineside electronic units (a key component of the trackside equipment which acts as the interface between the existing signalling system and the ATP system). The installation of ATP equipment on the first two OSCAR prototype trains was almost complete.
2014	Installation of compliant Type Approved lineside electronic units not complete. The issue preventing full Type Approval from being achieved for the lineside electronic units (version 5.1) is related to its use with signals that have flashing aspects. The delays in achieving full Type Approval for the installation of the lineside electronic units means that the first OSCAR train fitted with ATP equipment will not be commissioned into passenger service and operate between Berowra and Wyong until September 2015
2015	In December 2014, Transport for NSW's (TfNSW) Transport Executive Committee approved an alternate strategy known as the 'Advanced Train Control Migration System' (AMS) to proceed under the existing funding arrangements of stage 1. TfNSW's alternate strategy involves fitting all suburban trains with equipment that supports European Train Control System (ETCS) Level 2 systems, but reducing the infrastructure works required (e.g. signalling interlocking modifications – i.e. fewer balises). The result is an ATP system that provides limited supervision including speed control, together with the continued use of train stops and ETCS Level 1 full supervision at high risk locations. To ensure that the alternate strategy satisfies the intent of the Special Commission of Inquiry's recommendation for ATP as an 'acceptable alternative response', ITSR has requested TfNSW to provide formal advice and the safety argument to support this decision.
2016	ITSR accepted TfNSW's proposal for the Advanced Train Control Migration System (AMS) to be considered as an 'acceptable alternative response' to the Special Commission of Inquiry's recommendation for ATP. ITSR's acceptance of TfNSW's proposed alternate response was based on the quantitative risk assessment report; the AMS strategy being completed by December 2019 and the inclusion of an 'Early Deployment Scheme' which will deliver in the Berowra to Newcastle area, controlled trialling of AMS protection for passenger trains in October 2018. This will be in preparation for the scheduled milestone of March 2019. The implementation of an ETCS Level 2 system remains in TfNSW's future strategies for the electrified rail network On 22 March 2016, the NSW Government approved TfNSW's Business Case to proceed with its AMS scope of works comprising: • AMS fitment to 100% of the electrified network (excluding stabling yards). • AMS fitment to Sydney Trains' electrified fleet: OSCAR, Tangara, Millennium, V sets (excluding some that will be replaced by New Intercity Fleet within the project's timeframe), C sets, K sets, S sets and Waratahs. • Extend AMS to provide the cumulative equivalent level of safety as the original ATP strategy through the addition of controls to mitigate for those locations where the risk is high (turnouts, deficient overlaps, level crossings with interlocked signals and catchpoints protecting signals). • Provide ETCS Level 2 compliant onboard equipment which supports the interface between the Digital Train Radio System and a future ETCS Level 2 system.
2017	NSW Government approved full funding for TfNSW's ATP projects final business case in April 2016. The scope of works for the ATP project includes ATP fitment to 100% of the electrified network (excluding stabling yards), and ATP fitment to Sydney Trains' electrified fleet (OSCAR, Tangara, Millennium, V sets (excluding those that will be replaced by new rollingstock), C sets, K sets and Waratahs)

2018	Fitment of ATP equipment to the OSCAR train fleet is complete, subject to a configuration upgrade to be concluded in September 2019. Dynamic testing of the Tangara prototype (fitted with ATP) on the network was successfully completed in July 2016 and the approvals process commenced with installation part of the Tangara Technical Upgrade (TTU) project. The Waratah ATP system design works have been completed and prototype installation commenced in March 2018. The C set and K set fleets have completed system and installation design. The M Set design and prototype is complete and the V set fleet is currently in the design phase. ATP trackside equipment network surveys have been completed and current progress includes • System integration testing • Detailed design • Installation and testing
2019	As of 31 March 2019, the following progress has been achieved: - ATP enabled H-set trains carrying passengers between Cockle Creek and Newcastle - ATP prototype installation completed on A/C/K/T/V sets - ATP installation completed on H sets - ATP infrastructure commissioned between Cockle Creek and Newcastle
2020	TfNSW's introduction of ATP involves fitting electric passenger trains with equipment that supports European Train Control Systems (ETCS) Level 2 technology and uses ETCS Level 1 Limited Supervision to reduce the infrastructure works required (e.g. signalling interlocking modifications). The implementation provides an accelerated safety benefit by enabling all of the Sydney electrified network to be fitted with ATP equipment in a shorter timescale. The result is an ATP system that prevents trains exceeding their maximum allowable speed; prevents trains speeding at high-risk locations; and provides a modern train stop function at unprotected locations. The implementation of an ETCS Level 2 system remains in TfNSW's future strategies for the electrified railway network. As of 31 March 2020, the following progress has been achieved: - ATP enabled H-set trains carrying passengers between Newcastle and Berowra (excluding Warnervale to Point Clare) - ATP prototype installation completed on M sets - ATP installation for T sets resolved and contracted to the Tangara Technology Upgrade project - ATP installation completed on H sets - ATP infrastructure commissioned between Newcastle and Berowra (excluding Warnervale to Point Clare) - Delivery rescheduled to align with major fleet replacement and the digital systems program.
2021	The Rail Regulator ceased publication of implementation progress reports

Appendix C – Similar related incidents

2019

19 January 2019 – 8 car Tangara at Illawarra Junction

At around 2137 hours, Tangara set T57 was leading an 8-car consist[40] on the Down Suburban at Redfern. This train was operating run 101S and was scheduled to cross from the Down Suburban to the Down Main at Illawarra Junction via 668 points.

These points had a speed limit of 25 km/h, but the train went through the points at 78 km/h. The maximum track speed on the Down Suburban approaching the points was 80 km/h. The ATP system was not installed at the time of the incident, so an automatic emergency brake intervention could not be initiated as a protective measure.

The train remained upright and did not derail, but several passengers in the lead carriage were thrown from their seats in the vestibule area onto the floor. The driver did not report the incident, but several passengers approached the driver at the next stop, Burwood, to discuss what had occurred. The driver stated that there was rough riding between Redfern and Macdonaldtown, which was the section in which 668 points were located.

The driver was then approached by the Station Duty Manager at Burwood, who reported the incident to the NIM. Following this report, Sydney Trains reviewed the train's data logger and inspected the points for damage. One passenger reported minor injuries, but no damage was reported and the points were cleared for service.

2020

20 February 2020 – XPT at Wallan

A NSW TrainLink XPT service to Melbourne derailed at high speed at a low speed turnout near Wallan Victoria, with the leading locomotive overturning in the derailment, resulting in fatal injuries to the driver and a qualified worker in the cab.

The Australian Transport Safety Bureau released its investigation into the Wallan derailment on 9 August 2023, with some key findings relevant to the findings in this investigation.

The report found:

> On the balance of evidence, it was concluded that the driver of ST23 probably expected to remain on the straight track through Wallan and was operating the train with that expectation. The driver of ST23 had operated the XPT service through the location 8 times in the 12 days prior, and on all occasions the loop track at Wallan was locked out of service consistent with the arrangements not to use the crossing loop at Wallan while signalling was non-operational.
>
> Information on the routing of ST23 through Wallan Loop on the evening of 20 February was provided to the driver in a modified train authority document given to them at Kilmore East. However, the train working arrangements that were established by ARTC on 6 February did not include protocols that would confirm the driver's understanding of the authority and excluded the requirement for the driver to read back the train authority to the network control officer.

[40] The consist is the list of vehicles that make up the train in the order they are arranged.

Expectations based on experience influence the perception of information and it is probable that the driver did not recognise the text changes made to the train authority from those issued to them on their 8 previous trips.

2021

20 January 2021 – 8 car Tangara at Erskineville

At around 1249 hours, Tangara sets T108 and T110 were travelling on the Up Illawarra at Erskineville. This train was operating run 619G and was scheduled to cross from the Up Illawarra to the Up Illawarra Relief at Erskineville Junction via 679 points.

These points had a speed limit of 25 km/h, but the train reportedly went through the points at 35 km/h. The maximum track speed on the Up Illawarra approaching the points was 65 km/h. The ATP system did not make an emergency brake intervention, and the train remained upright and did not derail.

The driver did not report the incident, but a Standards Officer located in the guard's cab notified the driver and reported the incident. No damage or injuries were reported.

2022

3 October 2022 – 8 car Waratah B-series at Homebush

At around 1435 hours, Waratah B-series set B13 was travelling on the Up Suburban at Homebush. This train was operating run 817L and was scheduled to cross from the Up Suburban to the Local Terminating Road at Homebush via 619, 618, and 617 points.

619 points was the first turnout on the approach and had a speed limit of 25 km/h, but the train went through the points at approximately 50 km/h. The maximum track speed on the Up Suburban approaching the points was 80 km/h. The ATP system made an emergency brake intervention, and train remained upright and did not derail.

The driver reported the incident and stated that they were not aware of pre-planned altered working and therefore did not notice the signal indication and did not expect to traverse 619 points. Following this report, Sydney Trains reviewed the train's data logger and inspected the points for damage. No damage or injuries were reported, and the points were cleared for service.

2023

27 June 2023 – 8 car Waratah at Hornsby

At around 1215 hours, Waratah set A52 was arriving at Platform 1 at Hornsby. This train was operating run 121H and was required to cross from the Down Shore to the Up Shore via 515 points.

These points had a speed limit of 15 km/h, but the train went through the points at approximately 38 km/h. The ATP system did not make an emergency brake intervention, and the overspeed was not reported by the driver until the following day.

Following this report, Sydney Trains reviewed the train's data logger and inspected the points for damage. The train remained upright and did not derail whilst traversing the points, and no damage or injuries were reported.

17 July 2023 – 8 car Waratah B-series at Emu Plains

At around midday, Waratah B-series set B26 was travelling on the Down Main at Emu Plains, where the train would terminate. This train was operating run 193H and was scheduled to cross from the Down Main to the Up Main at this location via 54 points.

These points had a speed limit of 25 km/h, but the train entered the points at 46 km/h and exited the points at 32 km/h. The maximum track speed on the Down Main approaching the points was 80 km/h. The ATP system did not make an emergency brake intervention.

The train remained upright and did not derail, and the driver attempted to report the incident immediately. The driver stated that they were not certain as to whom they needed to report the incident, so they contacted their Shift Manager who then relayed the information to the Train Crew Liaison Officer (TCLO). Following this report, Sydney Trains inspected the points for damage. No damage or injuries were reported, and the points were cleared for service.

4 October 2023 – 8 car Tangara at Blacktown Junction

At around 1217 hours, Tangara set T74 was leading an 8 car consist on the Up Main at Blacktown Junction. This train was operating run 108F and was scheduled to cross from the Up Main to the Up Suburban at this location via 308 points.

These points had a speed limit of 25 km/h, but the train entered the points at 86 km/h and exited them at 62 km/h. The maximum track speed on the Up Main through Blacktown Junction was 105 km/h. The ATP system did not make an emergency brake intervention, and the driver applied low to moderate braking to slow the train and come to a stand at Seven Hills Station. The train remained upright and did not derail.

The driver stated that they had not expected the signal to show a caution or that they would traverse the points, although they knew it was possible the route could be set. The driver also stated that the controlling signal was around a slight bend, and that they were looking at their dashboard and learning the cab layout as they approached the signal.

The dashboard of set T74 had been changed as part of the Tangara Technology Upgrade program, and this was the driver's first time driving in a modified cab since graduating the driver training program several months earlier. The only training the driver received on the altered layout was watching an online video 3 months prior to the incident. As a result, the driver was unfamiliar with the dashboard and had to spend extra time reading their screen and gauges whilst the train was in service.

Although the driver lost situational awareness as they approached 308 points, they brought the train to a controlled stop at Seven Hills and reported the incident immediately to the Signaller. Following this report, Sydney Trains reviewed the train's data logger and recommended that ATP overspeed protection be installed on 308 points to prevent future incidents at the same location. No damage or injuries were reported.

5 November 2023 – 8 car Waratah at Lindfield

At around 1233 hours, Waratah set A76 was travelling on the Down Shore approaching Lindfield. This train was operating run 726S and was scheduled to cross from the Down Shore to the Lindfield terminating road via 20 points.

These points had a speed limit of 25 km/h, but the train entered the points faster than the signposted limit. The maximum track speed in this section approaching the points was 50 km/h. The ATP system made an emergency brake intervention before the train went through the points, and the train came to a stand.

The train remained upright and did not derail, and the driver reported the incident immediately. No damage or injuries were reported.

2024

28 January 2024 – 8 car Waratah at Blacktown West

At around 2054 hours, Waratah set A73 was travelling on the Up Main at Blacktown West. This train was operating run 826T and was scheduled to cross from the Up Main to the Up Loop at this location via 317 points.

These points had a speed limit of 25 km/h, but the train entered the points at 45 km/h. The maximum track speed in this section approaching the points was 115 km/h. The ATP system made an emergency brake intervention as the train went through the points.

The train remained upright and did not derail, and the driver reported the incident immediately. No damage or injuries were reported.

9 February 2024 – 8 car Waratah at Hornsby

At around 1749 hours, Waratah set A7 was arriving at Platform 1 at Hornsby. This train was operating run 158K and was required to cross from the Down Shore to the Up Shore via 515 points.

These points had a speed limit of 15 km/h, but the train went through the points at 29 km/h. The ATP system did not make an emergency brake intervention, and the overspeed was not reported by the driver. However, the Hornsby Shift Manager observed the train overspeed through the points and immediately reported the incident. The train remained upright and did not derail.

Following this report, Sydney Trains reviewed the CCTV footage and the train's data logger. No damage or injuries were reported.

16 February 2024 – 8 car Millennium at Parramatta

At around 1006 hours, Millennium set M33 was departing from Platform 4 at Parramatta. This train was operating run 826T and was required to cross from the Down Main West to the Up Main West via 722 points.

These points had a speed limit of 25 km/h, but the train reportedly reached a speed of around 30 km/h while travelling through the points. The ATP system made an emergency brake intervention before the train went through the points, and the train remained upright and did not derail.

The driver reported the incident and stated that they were feeling fatigued at the time of the overspeed. Following this report, Sydney Trains reviewed the train's data logger and inspected the points for damage. No damage or injuries were reported, and the points were cleared for service.

18 March 2024 – 8 car Waratah at Lindfield

At around 1328 hours, Waratah set A18 was travelling on the Down Shore approaching Lindfield. This train was operating run 168H and was scheduled to cross from the Down Shore to the Lindfield terminating road via 20 points.

These points had a speed limit of 25 km/h, but the train entered the points at 38 km/h. The maximum track speed in this section approaching the points was 50 km/h. The ATP system made an emergency brake intervention before the train went through the points, and the train remained upright and did not derail.

The driver did not report the incident, but the TSDM advised Fleet Operations of the ATP activation. No damage or injuries were reported.

4 April 2024 – 8 car Waratah at Mulgrave

At around 0639 hours, Waratah set A77 was travelling in the Down direction on the Richmond Branch line departing Mulgrave. This train was operating run 142C and was scheduled to turnout from the Loop Line back to the Branch line via 53 points.

These points had a speed limit of 25 km/h, but the train entered the points at 35 km/h. The maximum track speed in the section past the points was 115 km/h. The ATP system made an emergency brake intervention as the train went through the points, but the overspeed and brake intervention were not reported at the time. The train remained upright and did not derail.

The driver did not report the incident until around 0710, as the train was due to depart Richmond in the Up direction with an AM peak service. Following this report, Sydney Trains reviewed the train's data logger and inspected the points for damage. No damage or injuries were reported, and the points were cleared for service.

2 May 2024 – 8 car Waratah B-series at North Strathfield

At around 2157 hours, Waratah B-series set B36 was travelling on the Up North Main at North Strathfield Junction. This train was operating run 192U and was scheduled to cross from the Up North Main to the Up North Suburban at this location via 550 points.

These points had a speed limit of 25 km/h, but the train entered the points at 40 km/h. The maximum track speed on the Up North Main approaching the points was 70 km/h, and on the Up North Suburban after the points was 35 km/h. The ATP system made an emergency brake intervention before the train went through the points, and the train remained upright and did not derail.

The driver reported the incident after the train came to a stand, and the NIM and Defects were advised. No damage or injuries were reported.

9 May 2024 – 8 car Waratah at Lindfield

At around 1457 hours, Waratah set A23 was travelling on the Down Shore approaching Lindfield. This train was operating run 192L and was scheduled to cross from the Down Shore to the Lindfield terminating road via 20 points.

These points had a speed limit of 25 km/h, but the train entered the points at 42 km/h. The maximum track speed in this section approaching the points was 50 km/h. The ATP system made an emergency brake intervention before the train went through the points, and the train remained upright and did not derail.

The driver reported the incident after the train came to a stand. Following this report, Sydney Trains reviewed the train's data logger and inspected the points for damage. No damage or injuries were reported, and the points were cleared for service.

18 August 2024 – 8 car Waratah at Blacktown West

At around 2142 hours, Waratah set A18 was travelling on the Up Suburban at Blacktown West. This train was operating run 811M and was scheduled to cross from the Up Suburban to the Up Main at this location via 318 points.

These points had a speed limit of 25 km/h, but the train entered the points at 65 km/h. The maximum track speed in this section approaching the points was 115 km/h. Although this incident occurred 4 months after the overspeed involving run 805K in the same location, there was still no protection in place to mitigate against future overspeed events. As a result, the ATP system did not make an emergency brake intervention.

The train remained upright and did not derail, and the driver reported that they slowed the train to a stand and contacted the signaller after clearing the points. Following this report, Sydney Trains reviewed the train's data logger and inspected the points for damage. No damage or injuries were reported, and the points were cleared for service.

2025

23 March 2025 – 8 car Waratah at Flemington

At around 1916 hours, Waratah set A46 was travelling on the Down Suburban at Flemington Car Sidings Junction. This train was operating run 714S and was scheduled to go from the Down Suburban to the Down Main at this location via 631 and 633 points.

These points had a speed limit of 25 km/h, but the train entered the points at 59 km/h. The maximum track speed in this section approaching the points was 80 km/h. The ATP system made an emergency brake intervention before the train went through the points, and the train remained upright and did not derail.

The overspeed and brake intervention were not reported by the driver at the time. Another train was crossing parallel to 714S in the Up direction, and the driver of this service heard the emergency brakes apply on 714S as the two trains passed each other. This driver reported the incident three days later on 26 March.

Following this report, Sydney Trains reviewed the train's data logger and inspected the points for damage. No damage or injuries were reported, and the points were cleared for service.

About the ATSB

The **Australian Transport Safety Bureau** is the national transport safety investigator. Established by the *Transport Safety Investigation Act 2003* (TSI Act), the ATSB is an independent statutory agency of the Australian Government and is governed by a Commission. The ATSB is entirely separate from transport regulators, policy makers and service providers.

The ATSB's function is to improve transport safety in aviation, rail and shipping through:

- the independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis, and research
- influencing safety action.

The ATSB prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, international agreements.

Rail safety investigations in New South Wales

Most transport safety investigations into rail accidents and incidents in New South Wales (NSW) and Victoria are conducted in accordance with the Collaboration Agreement for Rail Safety Investigations and Other Matters between the Commonwealth Government of Australia, the State Government of NSW and the State Government of Victoria. Under the Collaboration Agreement, rail safety investigations are conducted and resourced in NSW by the Office of Transport Safety Investigations (OTSI) and in Victoria by the Chief Investigator, Transport Safety (OCI), on behalf of the ATSB, under the provisions of the *Transport Safety Investigation Act 2003*.

The Office of Transport Safety Investigations (OTSI) is an independent statutory body which contributes to improvements in the safety of bus, ferry and rail passenger and rail freight services in NSW by investigating safety incidents and accidents, identifying system-wide safety issues and sharing lessons with transport operators, regulators and other key stakeholders. Visit otsi.nsw.gov.au for more information.

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings.

At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

About ATSB reports

ATSB investigation final reports are organised with regard to international standards or instruments, as applicable, and with ATSB procedures and guidelines.

Reports must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner

An explanation of ATSB terminology used in this report is available on the ATSB website.