AS 7725:2022

Australian STANDARD®

Application based work on track authority systems

RISSB
RAIL INDUSTRY SAFETY AND STANDARDS BOARD

Train Control Systems Standard

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This Australian Standard® AS 7725 Application based work on track authority systems was prepared by a Rail Industry Safety and Standards Board (RISSB) Development Group consisting of representatives from the following organisations:

Aurizon	Ergonomie	Queensland Rail
ARTC	UGL Regional Linx	Mott Macdonald
Blue Electronics	Arup	Rail Assurance Consulting
PTA WA	TfNSW	4Tel
Sydney Trains	RGB Assurance	

The Standard was approved by the Development Group and the Train Control Systems Standing Committee in Select SC approval date. On Select Board approval date the RISSB Board approved the Standard for release.

This standard was issued for public consultation and was independently validated before being approved.

Development of the Standard was undertaken in accordance with RISSB's accredited process. As part of the approval process, the Standing Committee verified that proper process was followed in developing the Standard

RISSB wishes to acknowledge the positive contribution of subject matter experts in the development of this Standard. Their efforts ranged from membership of the Development Group through to individuals providing comment on a draft of the Standard during the open review.

I commend this Standard to the Australasian rail industry as it represents industry good practice and has been developed through a rigorous process.

Deb Spring
Chief Executive Officer
Rail Industry Safety and Standards Board

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This Standard was prepared by the Rail Industry Safety and Standards Board (RISSB) Development Group AS 7725 Application based work on track authority systems. Membership of this Development Group consisted of representatives from the organisations listed on the inside cover of this document

Objective

The objective of this Standard is to provide RIMS with the requirements and recommendations for design (including functional and non-functional characteristics), procurement, and implementation of application based work on track authority systems (ABWTAS).

This Standard also provides vendors with a set of minimum requirements and functionality that would be reasonably expected of an ABWTAS.

Compliance

There are four types of provisions contained within Australian Standards developed by RISSB:

1. Requirements.
2. Recommendations.
3. Permissions.
4. Constraints.

Requirements – it is mandatory to follow all requirements to claim full compliance with the Standard. Requirements are identified within the text by the term 'shall'.

Recommendations – do not mention or exclude other possibilities but do offer the one that is preferred. Recommendations are identified within the text by the term 'should'.

Recommendations recognise that there could be limitations to the universal application of the control, i.e. the identified control is not able to be applied or other controls are more appropriate or better.

Permissions – conveys consent by providing an allowable option. Permissions are identified within the text by the term 'may'.

Constraints - provided by an external source such as legislation. Constraints are identified within the text by the term 'must'.

For compliance purposes, where a recommended control is not applied as written in the standard it could be incumbent on the adopter of the standard to demonstrate their actual method of controlling the risk as part of their WHS or Rail Safety National Law obligations. Similarly, it could also be incumbent on an adopter of the standard to demonstrate their method of controlling the risk to contracting entities, or interfacing organisations where the risk may be shared.

RISSB Standards address known hazards within the railway industry. Hazards, and clauses within this Standard that address those hazards, are listed in Appendix A

Contents

Appendix Contents

1 Scope and general

1.1 Scope

This Standard applies to all rail transport operators, including light rail operators, who intend to procure and use an application based work on track authority system (ABWTAS).

This Standard covers the software and hardware used to enable the electronic communication of information relating to the safe occupation of the rail corridor.

The scope includes:

(a) system safety risk management;
(b) system requirements;
(c) system integration;
(d) change management;
(e) test and commissioning;
(f) maintenance;
(g) reliability, availability, maintainability, and safety (RAMS) of an ABWTAS.

1.2 Exclusions

The following is deemed out of scope of this Standard:

(a) Applications used for other purposes than applying for and using work on track authorities.
(b) Train control systems.
(c) Development and maintenance of safeworking systems.
(d) Development and maintenance of communications networks.
(e) Engineering competency.
(f) Systems certification.

1.3 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document:

- AS 7450 Rail systems interoperability
- AS 7470 Human factors integration in engineering design – General requirements
- AS 7722 EMC management

NOTE: Documents for informative purposes are listed in a Bibliography at the back of the Standard.

1.4 Terms, definitions, and abbreviations

For the purposes of this document, the following terms and definitions apply:

1.4.1
application based work on track authority system
ABWTAS
system used to enable the electronic communication of information relating to the safe occupation of the rail corridor

1.4.2
degraded mode
when the ABWTAS falls below a set criteria where the full functionality cannot be met or occurs when part of the system continues to operate in a restricted manner

1.4.3
failure mode
when the whole ABWTAS is unavailable for normal operation

1.4.4
field user
any rail safety worker authorized and competent in the use of the ABWTAS in the field, including track machine operators.

1.4.5
negative transfer
occurs when an end user who is familiar with a procedure or piece of equipment (learned skill) automatically transfers that skill to an alternate system or equipment when it is not appropriate. This can often result in tasks being omitted, operating the wrong controls, or operating the correct controls in the wrong direction

1.4.6
NCO
network control officer

1.4.7
OEM
original equipment manufacturer

1.4.8
RAMS
reliability, availability, maintainability, and safety

1.4.9
RIM
rail infrastructure manager

1.4.10
RSW
rail safety worker

1.4.11
TCS
train control system

1.4.12
WOTA
work on track authority

General rail industry terms and definitions are maintained in the RISSB Glossary: https://www.rissb.com.au/products/glossary/

2 General principles

Application based work on track authority systems are used to assist rail safety workers in the field and network control officers in managing safe occupation of the rail corridor. This can include the process of obtaining, issuing / activating, managing (suspending and reinstating), and releasing / fulfilling work on track authorities, as well as other access types.

These systems do not reduce the requirements for the field user or NCO to carry out their duties safely and in accordance with the defined safeworking rules and procedures.

ABWTAS can be used in all manner of operating environments and environmental conditions.

The ABWTAS should be designed to function reliably in the environments that could be reasonably expected.

3 Risk management

3.1 Assessing risk

Effective use of an ABWTAS can reduce risks such as:

(a) miscommunication (e.g. by providing a digital communication process that eliminates misrepresenting verbal information);

(b) misidentified location;

(c) an RSW obtaining access to the rail corridor when not competent or authorized to do so (e.g. through live links to competency records).

RIMs shall risk assess the ABWTAS prior to implementation. Additional risk assessments should be carried out as required, including pre-design and post-implementation stages.

Risk assessments should consider, as a minimum:

(d) human factors;

(e) training;

(f) data communication links;

(g) technology lifecycle;

(h) cyber security;

(i) software functional failure;

(j) interoperability and integration with other safety systems;

(k) impact of ABWTAS on safeworking rules, procedures, etc.

3.2 Safety integrity level

Safety integrity level (SIL) ratings relate to system specific safety functions and can only be allocated to a function. The SIL rating of a system or piece of equipment is normally listed as being the highest SIL rating of the functions executed by it, i.e., SIL relates to safety functions and their safety integrity requirements.

Part 4 of IEC 61508 defines safety integrity as …'the likelihood of a safety-related system satisfactorily performing the required safety functions under all the stated conditions, within a stated period of time'. A system function SIL rating is derived from an assessment of its safety risk - it is a measure of the intended reliability of a system or function to perform a safety function.

It is important to note that SIL rating relates only to safety-related systems and their safety functions, and that SIL ratings are defined in terms of the reliability of the system in executing its safety or safety-related functions.

A risk assessment should be carried out by the RIM on ABWTAS functions (e.g., functional failure analysis) to determine if a SIL rating is required for the system in the operating environment and environmental condition that it is used.

4 Minimum system requirements

4.1 General principles

ABWTAS should be, as a minimum:

(a) intuitive;
(b) adaptable;
(c) accessible;
(d) scalable;
(e) interoperable with existing safeworking systems.

Adopters of an ABWTAS shall develop a clearly defined concept of operations and change management process that provides detail as to how the above is to be achieved.

Suggested data fields and functionality is provided in Appendix B.

4.2 Communications requirements

The RIM shall define the reliability, availability, security, and coverage requirements of the communication network to be used by the ABWTAS.

4.3 Interoperability

When adopting an ABWTAS interoperability with existing systems shall be assessed in accordance with AS 7450.

The interoperability assessment should consider:

(a) interface with existing train control systems;
(b) different mobile device operating platforms;
(c) interfaces with RIM networks that are using an ABWTAS.

4.4 Human factors & ergonomics

ABWTAS design shall include an evaluation of human factors requirements. These requirements shall be defined by the RIM. The requirements should be based on AS 7470.

Human factors assessments should assess requirements for end users, such as:

(a) field users, which includes:

i. on-track RSW (track workers); and

ii. track vehicle operators (e.g. track machines and road / rail vehicles, etc).

(b) offsite users (e.g. network control officers (NCOs), supervisors, other offsite users);

(c) rail traffic crew (e.g. train drivers operating services near or through worksites).

Human factors assessment should, as a minimum, include:

(d) task analysis;

(e) error analysis;

(f) distraction analysis;

(g) workload assessment;

(h) usability assessment;

(i) comparison between existing (e.g. paper based) systems and proposed systems (i.e. consideration of negative transfer).

Human factors assessments should be integrated into the project and change management plans.

Further information on human factor requirements and guidelines are available in ISO 9241, ISO 11064, AS 7470, RISSB Guideline Integration of HF across project life cycle, and RISSB Guideline Integration of HF in engineering design.

4.5 Location definition and accuracy

4.5.1 General requirements

In general, ABWTAS systems (or associated processes) should ensure a level of accuracy that meets or exceeds that of existing paper-based systems.

The ABWTAS shall reflect network infrastructure at time of system handover to the RIM.

The RIM shall specify the preferred system of identifying and verifying location.

The level of accuracy required should be determined by considering the:

(a) type of work the ABWTAS is to be used for;

(b) area of operation (urban, country, topographical impairments, etc);

(c) adjoining networks and other ABWTAS systems;

(d) infrastructure that is to be located (multiple track locations, signals, limits of authority, single or bidirectional, etc);

(e) overall system requirements, based on what the system is being used for.

4.5.2 Location identification

An ABWTAS shall assist the NCO to identify and verify the field user location. The required accuracy should be assessed based on RIM requirements and available technologies.

4.5.3 Geolocation-denied environments

Locations such as tunnels, underground stations and high-density CBD locations can have reduced geolocation coverage.

The RIM shall identify, and document geolocation denied environments, and put in place controls for managing situations when location cannot be verified by the ABWTAS.

Where geolocation denied environments are identified alternate methods should be used. This could include track shorting cables, standalone geolocation devices, and / or procedures for using an ABWTAS in those locations.

4.6 Reliability

The RIM shall specify reliability requirements for an ABWTAS.

The ABWTAS portable electronic device should have environmental and hardware reliability and / or redundancy (e.g., a tough tablet/phone, or an easy process of logging in to an existing WOTA from a second device).

The ABWTAS shall not impact the normal operation of the TCS in case of fault or failure.

The ABWTAS should have a level of redundancy built into the hardware and / or have a backup system available.

4.7 Maintainability

4.7.1 General

The complete ABWTAS should be configured to optimize maintenance and fault finding, with due regard to the safety of the overall system.

To reduce the risks to personnel working on ABWTAS and the impact to operations, the ABWTAS should:

(a) be capable of having maintenance carried out in non-safety critical locations e.g. away from network control desks or on-track locations;

(b) have easily replaceable equipment.

The ABWTAS should be designed so that the mean time to repair the complete system, including trackside equipment, communication links, and resetting / restoration facility, does not exceed the operational requirements of the RIM.

Test equipment and facilities, including separate indications, shall be made available to system users to enable the system to be interrogated for maintenance or fault-finding purposes without interruption to normal working. This may be provided locally and / or remotely for local or full system analysis.

4.7.2 Infrastructure changes

The ABWTAS shall support updates to reflect changes to RIM infrastructure. This could include changes to limits of authority or track infrastructure changes.

4.7.3 Documentation

To enable RIMs to accurately assess system maintenance requirements the original equipment manufacturer (OEM) shall provide:

(a) product specific user guides;

(b) routine and reactive maintenance guides;

(c) information regarding equipment failure modes and fault finding.

4.7.4 Upgrading

The RIM shall have procedures regarding the deployment of upgrades to the:

(a) host operating system (e.g. iOS, Android, Windows, etc);

(b) ABWTAS application;

(c) associated RIM systems (e.g. TCS).

Deployment procedures shall be based on the OEM requirements and recommendations.

4.7.5 Notification

All ABWTAS users shall be provided with advance notice of any system maintenance that could affect the ABWTAS fully functioning.

The advance notice timeframe shall be determined by the RIM. For example, advance notice may be given:

(a) one week prior to the maintenance date;

(b) one hour prior to the maintenance commencing; and

(c) five minutes prior to the maintenance commencing.

4.7.6 Testing and verification

Prior to the implementation of any upgrade the software shall be tested and verified. This should include:

(a) quality assurance;

(b) server-side checks of client-side software (for authenticity, version, and corruption);

(c) confirmation of patch deployment (checking software version prior to use to ensure current functions unaffected and new/updated functions operate correctly).

4.8 Availability

The availability of ABWTAS to perform its intended functions shall meet the availability target as determined by the RIM.

Additional configurations may be used to improve the availability of the ABWTAS, such as:

(a) built in redundancy;
(b) condition monitoring;
(c) real time monitoring.

4.9 Electromagnetic compatibility

ABWTAS could be affected electromagnetic radiation, such as:

(a) rolling stock;
(b) currents in the rail;
(c) radio frequency antennas mounted close to the rail; and
(d) other sources of electromagnetic radiation.

ABWTAS shall comply with the requirements provided in AS 7722.

4.10 Security and privacy

Cyber security, including privacy, is critical to the safe use of electronic systems. An ABWTAS shall have protocols to prevent unauthorized access to the system.

Further information is provided in AS 7770 and Australian Signals Directorate - Strategies to mitigate cyber security incidents.

4.11 Degraded and failure modes

4.11.1 General

The RIM shall provide procedures for managing an ABWTAS when operating in degraded and failure modes.

Degradation or failure of the ABWTAS shall not result in changes to existing blocking facilities on the TCS.

The RIM shall have procedures for managing WOTAs issued prior to the system failure.

When the ABWTAS is in degraded or failure mode there shall be an alert or message provided to the field user and / or the NCO so that they are aware of the failure. The design of the alert or alarm shall comply with the human factors for alarm management as detailed in AS 7470. Further information on alarm management is also provided in ANSI / ISA 18.2

4.11.2 Hardware failure

Hardware failure could impact the use of the ABWTAS. For example this could include failure of the portable electronic device in the field (battery failure, device failure), or hardware failure at the network control centre.

Management of system failure may include provision of backup hardware at the network control centre (for offsite failures) or backup portable electronic devices (in the field), or the ability to revert to manual (paper-based) WOTAs.

4.11.3 Communications failure

Loss of connection to the primary communications network could impact the use of the ABWTAS system. For example, this could result in the field user being unable to manage or release / fulfill a WOTA.

In case of communications failure the ABWTAS shall permit the field user and NCO to manually manage or release / fulfill any WOTA or other rail corridor access authority and remove any applicable blocking facilities applied to the TCS. This should require supervisor intervention.

4.12 Logging

ABWTAS actions shall be logged. ABWTAS actions to be logged shall be determined by the RIM.

All data records shall be maintained for the period specified by the RIM and in accordance with legal and regulatory obligations. Access to log information should be restricted in accordance with RIM data access policies.

Nominated roles (e.g. supervisors, administrators, and investigators) should be able to download logs for quality assurance and investigation purposes.

5 System integration

5.1 Planning

ABWTAS should, at a minimum, be considered in the planning phase for all WOTA / track closures.

The RIM should incorporate the ABWTAS into planning and pre-start documentation and communication protocols.

5.2 Logic checking and validation

ABWTAS systems should include logic checks or internal validation in support of RIM network rules and procedures.

ABWTAS design shall require both field users and NCOs to confirm data fields (such as protection removal and worksite safety) prior to the WOTA or other rail corridor access authority being issued, suspended or fulfilled. The RIM shall specify which data fields require confirmation, based on the applicable network rules.

All ABWTAS shall incorporate data type validation.

All ABWTAS should include data value validation.

5.3 Competency management systems

All users of the ABWTAS shall have a unique log on, based on RIM cyber security policies.

The user account should be linked to a competency management system which can verify the users:

(a) ABWTAS competencies;

(b) network specific safeworking competencies.

If the field user does not have the necessary authorization to access or use the system the ABWTAS should prevent the field user from applying for a work on track authority. Repeated attempts to access the system should result in a notification to the ABWTAS administrators.

5.4 Train control systems

5.4.1 General

When designing an ABWTAS consideration should be given to emerging TCS technologies such as European Train Control System (ETCS), Communications Based Train Control (CBTC) and other emerging technologies. These systems could provide additional functionality to an ABWTAS in the future.

5.4.2 Levels of interface

ABWTAS currently have different levels of interface with TCS. For example, information provided through the ABWTAS could be manually applied in the TCS, such as the application and removal of blocking facilities.

This introduces the risk of operator error when transferring information manually. The RIM shall have in place procedures, systems of training, checking, and verification to reduce the risk of operator error.

Future technologies could allow full interfacing with the TCS, reducing the risk of data entry errors. RIMs should pursue these technologies when they become available.

5.4.3 Blocking codes

The TCS should be capable of providing a unique code when blocking facilities are applied on the TCS.

The RIM shall provide a method for the field user to capture and store blocking codes.

This may be achieved by providing a manual input field that allows the field user to input and save that code against the WOTA or through electronic transfer of that code from the TCS to the ABWTAS.

The code shall not be visible or retrievable by the NCO once the WOTA is issued.

When the field user fulfills or cancels the WOTA the code shall be transmitted to the NCO to remove the block. The field RSW who holds the WOTA may transmit this code verbally or electronically.

Blocking facilities and their use in a TCS is covered in AS 7711

6 Change management

6.1 General

The RIMs change management process shall be followed in the design, implementation, and modification of an ABWTAS.

It is important that directly affected stakeholders are included and consulted in the change management process. Stakeholders may include, but are not limited to:

(a) end users:
   i. RSWs;
   ii. NCOs;
   iii. Supervisors.
(b) IT personnel;
(c) training personnel.

6.2 Training

Training shall be provided to all end users. Training should be conducted in accordance with RIM policies and procedures.

6.3 Updating relevant rules / policies / procedures

Change management shall include a review of policies, procedures and forms that are affected by the introduction of an ABWTAS.

7 Commissioning

7.1 Testing

Prior to commissioning the OEM and RIM shall agree on a test and trial methodology to evaluate the functionality and suitability of the ABWTAS.

The methodology should include, as a minimum:

(a) required performance standards that need to be achieved;
(b) methodology of conducting factory acceptance testing (FAT), user acceptance testing (UAT), site acceptance testing (SAT), and site integrity acceptance testing (SIAT);
(c) means of recording testing results and feedback;
(d) process to address any shortcomings.

7.2 Post implementation review

A post implementation review (PIR) should be undertaken to evaluate the status of known human factors, hardware, software, and project issues captured during the implementation of the ABWTAS and to ensure that any outstanding issues have been managed successfully.

The PIR also allows for any new issues to be captured and managed, as necessary. Activities would typically include a review of incident data, failure modes, and feedback from all user groups.

Appendix A RISSB Hazard Register

Informative

RIMs maintain their own hazard register that is managed in accordance with their safety management system (SMS). The following list gives some examples of risks and hazardous events that are mitigated by this Standard.

Risk	Hazardous event
Rail traffic approaching workers / equipment in the danger zone	Wrong or no work on track protection established
	Work on track protection failure
	Mismanagement of worksite activity
Authority communication error	Data transmission error
	Voice authority error
Unsafe authority	Manually constructed authority error

Appendix B Data fields and functions for work on track authorities

Informative

Below is a list of possible functions that could be required of an ABWTAS.

(a) Administrator and user log ins.

(b) Data fields on forms that are either:

i. Mandatory; or

ii. Optional.

(c) Blocking codes including:

i. overlapping WOTA blocking codes;

ii. suspension and reinstatement codes;

iii. releasing / fulfillment codes.

(d) Creating, validation, and fulfillment of WOTA.

(e) Electronic, paper-based, and verbal WOTA.

(f) Handover of WOTA from one RSW to another RSW.

(g) Retrieval of existing work sites for each ABWTAS.

(h) Management of multiple work groups.

(i) Management of multiple types of WOTA.

(j) Competency management.

(k) Log on / tag out system compatibility.

(l) Display that provides situational awareness functionality.

Access to these functions should be assessed and based on RIM requirements.

Appendix C Bibliography

The following referenced documents are used by this Standard for information only:

- AS 7711 Signalling principles
- AS 7770 Rail cyber security
- ISO 9241 Ergonomics of human system interaction (series)
- ISO 11064 Ergonomic design of control centres (series)
- IEC 61508-4 Functional safety of electrical / electronic / programmable electronic safety-related systems - Part 4: Definitions and abbreviations
- ANSI / ISA 18.2 Management of alarm systems for the process industries
- RISSB Guideline – Integration of human factors in engineering design
- RISSB Guideline – Integration of human factors across the project lifecycle
- Australian Signals Directorate - Strategies to mitigate cyber security incidents

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Once agreed by the Development Groups, Standing Committees and Validator, the drafts are passed to the RISSB Board for approval.

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