

**National Statement of Competence for a – Please Select a Role**

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| **Concept Design (Scheme Design)** | **Proficiency** |
| Aspect Sequences | Proficiency Level |
| Braking Calculations & Headway Validation | Proficiency Level |
| Signalling Arrangement Plan | Proficiency Level |
| Train Vacancy/Detection Architecture | Proficiency Level |
| Control Tables | Proficiency Level |
| **Detailed Design (Application / Interlocking)** | **Proficiency** |
| Interlocking Design (CBI) | Proficiency Level |
| Interlocking Design (RRI) | Proficiency Level |
| Interlocking Design (Relay/Geo) | Proficiency Level |
| Interlocking Design (Interface, Cross Boundary and Relay) | Proficiency Level |
| Train Vacancy/Detection Design | Proficiency Level |
| Bonding Plan (Train Detection, Signalling Apparatus and Bonding Plan) | Proficiency Level |
| Object Controller Data Design (No Locking) (Design Using ALDS/ICD) | Proficiency Level |
| Power Calculations and Cable Running Plan | Proficiency Level |
| Axle Data Design | Proficiency Level |
| Railway Crossing Circuit Design (Design Using Typical Circuits) | Proficiency Level |
| Trackside Circuit Design (Design Using Typical Circuits) | Proficiency Level |
| **Proficiency Definitions** |
| **P1** – A RIW Cardholder has limited knowledge obtained through either formal training or experience. The RIW Cardholder requires supervision in more complex tasks and activities to allow that person to gain relevant experience. May perform simple tasks unsupervised where previous experience can be demonstrated.  |
| **P2** – A RIW Cardholder who has sufficient knowledge through either formal training and/or experience allowing to work unsupervised in tasks and activities within the relevant experience.  |
| **RIW Cardholder** |
| Name: | RIW Number: |
| Signature:  | Date: |
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| **Certification by Assessor:** |
| Name: | RIW Number: |
| Signature: | RIW Role: |
| Date: |

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| **Concept Design (Scheme Design)** |
| **Design Artifact** | **Definition** |
| **Braking Calculations and Headway Verification** | The purpose of this task is to determine the position a train will stop or slow to specified speed based on train braking characteristics and gradient then verify that the positions provide the required throughput of trains.This task uses the Signalling Arrangement Plan or Concept design to ensure the position of signals, overlaps etc provide adequate braking distances. The calculation of the braking distances uses inputs from:* Rolling Stock parameters,
* Track and Civil Design, and
* Signalling Design.

The Project Requirements will determine the required headway in order to operate the working timetable. Once the SAP has been designed, the signal positioning needs to be used to verify that the headway can be met. |
| **Signalling Arrangement Plan (SAP)** | The purpose of this task is to define the signalling arrangement for the signalling system bounded by the project scope, in the form of a SAP. The SAP is the top-level signalling design document.This task uses the concept design, and considers existing installation, site constraints, rolling stock parameters, etc, to refine the concept SAP to the desired design. The task includes (but is not limited to):* Positions of the signals to allow for optimum signal spacing to achieve the desired headway,
* Positions of air gaps in traction power,
* Position of signalling components that interacts with the signals,
* Position and limits of train detection equipment and systems,
* Position of station platforms,
* Position of signal overlaps,
* Position and types of train protection,
* Position of points, crossings, turnouts,
* Position of railway crossings,
* Identification of railway crossing activation and holding controls,
* Undertake initial signal sighting assessment,
* Additional information signage to accompany the signalling,
* Track grades and curves,
* Line speeds and speed restrictions, and
* Initial Signal Sighting (desktop).
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| **Control Tables** | The purpose of this task is to present the information from the SAP into tabulated functional or locking requirements. The Control Tables shows the requirements for locking and releasing of the signal interlocking including signals, movable infrastructure, train detection, train protection, enforcement and railway crossings conditions to be satisfied in order for a route to be set, locked and subsequently released. The aspect sequencing information is taken from the Control Tables to produce as aspect sequence chart for each direction of travel.The task includes (but is not limited to):* Condition of the route for aspect to clear,
* Condition of the overlap for the aspect to clear,
* Conditions of the track circuit,
* Railway crossing conditions,
* Condition of the tracks for point/other moveable infrastructure movement,
* Conditions of swinging overlaps,
* Aspect Sequence condition for signal in advance,
* Axle Counter reset conditions (if in interlocking),
* Axle Counter supervisory reset if over points,
* Railway Crossing controls,
* Railway Crossing progression controls,
* Timer values for clearing aspects, and
* Timer values for approach locking.

**Note:** Different interlockings or signalling systems may require different types of information or representation. This may result in a variance of Control Table styles. |
| **Aspect Sequences** | A signalling plan that identifies the aspect sequence between signals. The chart shows all signals for a given direction of travel, their aspects, and the interconnection between aspects in following signals that provide the advance signalling. The creation of this is an output from the completion of control tables. |
| **Axle Counter Architecture**  | The purpose of this task is to provide a high-level diagram showing the connections between all Axle Counter systems and communication to the wheel detector. The Axle Counter Architecture must consider how features on axle counters such as double usage head, supervisory section is used. The Axle Counter Architecture is crucial to assist with the resetting of axle counter sections. The Axle Counter Architecture should be a geographical representation in relation to signalling assets. The task includes (but is not limited to):* Wheel detector positions,
* Wheel detector identification,
* Track section number,
* Supervisory section allocation (if applicable),
* Double usage head control (if applicable),
* Identification of which rail it is mounted on,
* What processor is counting which head,
* IP Addresses as required,
* Switch and router connection ports as applicable,
* Communication bearers,
* Communication protocol used,
* System dip switches/Jumpers (if applicable), and
* Controlling CBI (if applicable).

**Note:** The relationship between the Axle Counter Overview / Architecture with the Signalling Network Architecture, Control Tables and Track Circuit, Bonding and SAP is non-linear. The information in these need to be verified against each other prior to design approval. |
| **Detailed Design (Application / Interlocking)** |
| **Design Artifact** | **Competency Definition** |
| **Interlocking Design (Computer Based Interlocking (CBI))** | The purpose of this task is to provide system specific configuration data for Interlocking/Object controllers. The interlocking is classified as SIL 4 systems and provide confidence that the processing of the system reduces the chance of wrong side failure. This requires designer to be aware of the safety related application conditions and design within the parameters. This requires a robust design/check/test process. Where the system is not SIL 4, greater responsibility is held by the RTO/State to ensure that the system operates safely through a site-specific safety case to design the locking that prevents unsafe conditions that could lead to unsafe train movements. The interlocking uses status information from the trackside equipment (Signals, points/Other moveable infrastructure, Tracks and Train Protection) to ensure that any authorised train moves are compliant for the Signalling Principles. The interlocking receives commands from the train control system and determines if it is safe to action the commands. If it is safe, the interlocking sends controls to ‘drive’ output to move points/other moveable infrastructure, train protection and signal aspects. The task includes (but is not limited to): * Locking of signalled routes,
* Locking of signal overlaps,
* Locking of signal approaches,
* Operation of railway crossing protection,
* Operation and suppression of train protection systems,
* Releasing of locking,
* Timed clearing of signal aspects,
* Application of vital signalling timers,
* Application of signal asset blocking,
* Communication of local commands and indication to Object Controllers,
* Clearing of Aspects,
* Locking for Flank Protection,
* Swinging overlaps, and
* Slotting Request and Acceptance.

**Note:** The object controllers may be straight mapping of bits between the interlocking and the trackside equipment or may include some simple data that can be controlled locally. Object Controllers are considered part of the interlocking component and cannot operate without the interlocking. The interlocking/object controller can be mechanical, electro-mechanical or CBI. New and/or updated sites should be CBI. |
| **Interlocking Design (Route Relay Interlocking (RRI))** | The purpose of this task is to provide signalling interlocking design or modification to the signalling system using RRI principles.To design the locking that prevents unsafe conditions that could lead to unsafe train movements. The interlocking uses status information from the trackside equipment (Signals, points/Other moveable infrastructure, Tracks and Train Protection) to ensure that any authorised train moves are compliant for the Signalling Principles. The interlocking receives commands from the train control system and determines if it is safe to action the commands. If it is safe, the interlocking controls equipment to move points/other moveable infrastructure, train protection and signal aspects. The task includes (but is not limited to): * Locking of signalled routes,
* Locking of signal overlaps,
* Locking of signal approaches,
* Operation of railway crossing protection,
* Operation and suppression of train protection systems,
* Releasing of locking,
* Timed clearing of signal aspects, and
* Application of vital signalling timers.
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| **Interlocking Design (Relay/Geographic)** | The purpose of this task is to provide signalling interlocking design or modification to the signalling system using Victorian Geographic principles.To design the locking that prevents unsafe conditions that could lead to unsafe train movements. The interlocking uses status information from the trackside equipment (Signals, points/Other moveable infrastructure, Tracks and Train Protection) to ensure that any authorised train moves are compliant for the Signalling Principles. The interlocking receives commands from the train control system and determines if it is safe to action the commands. If it is safe, the interlocking controls equipment to move points/other moveable infrastructure, train protection and signal aspects. The task includes (but is not limited to): * Locking of signalled routes,
* Locking of signal overlaps,
* Locking of signal approaches,
* Operation of railway crossing protection,
* Operation and suppression of train protection systems,
* Releasing of locking,
* Timed clearing of signal aspects,
* Application of vital signalling timers,
* Clearing of Aspects,
* Locking for Flank Protection,
* Swinging overlaps, and
* Slotting Request and Acceptance.
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| **Interlocking Design (Interface, Cross Boundary and Relay)**  | The purpose of the Interlocking design is to implement the requirements of the Signalling Principles. The Interlocking is the system and conditions that prevent unsafe conditions that may lead to unsafe movement of trains. The Interlocking uses status information provided from trackside equipment (via Object Controllers) and commands from the Signalling Control and Indication System where the request is processed and if deemed safe, executed.At areas where the area of control changes there is a requirement for Interlocking design to interact with different technology, principle and operational requirements.Tasks include (but is not limited to):* Locking of signalled routes across systems,
* Locking of signal overlaps across systems,
* Locking of signal approaches across systems,
* Operation of railway crossing protection across systems,
* Operation and suppression of train protection systems across systems,
* Releasing of locking across systems,
* Timed clearing of signal aspects across systems,
* Clearing of Aspects,
* Locking for Flank Protection cross boundary,
* Swinging overlaps, and
* Slotting Request and Acceptance.

Other consideration should include:* Failure modes of interface systems that are communicating vital functions over a communication bearer,
* Timing consideration for cross boundary functions and impacts, and
* The physical attributes of the existing or interfacing equipment.

**Note:** The object controllers may be straight mapping of bits between the interlocking and the trackside equipment or may include some simple data that can be controlled locally. Object Controllers are considered part of the interlocking component and cannot operate without the interlocking. The interlocking/object controller can be mechanical, electro-mechanical or CBI. New and/or updated sites should be CBI. |
| **Axle Counter Data Design** | The purpose of this task is to configure the system data for axle counter installations in Victoria. Axle Counter Systems are certified as SIL 4 systems and provide confidence that the processing of the system reduces the chance of wrong side failure. This requires designers to be aware of the safety related application conditions and design within the parameters of the safety assessment. This requires a robust design/check/test process.The task includes (but is not limited to):* Identifying which head is assigned to which track,
* Identifying which Axle Counter Evaluation Board is assigned to which head,
* Defining which heads need to communicate with each other to form valid count in/count out,
* Defining the conditions that needs to be met to reset the system,
* Defining the reset methods within the system,
* Defining which track sections can be used for automatic reset,
* Defining counting head control requirements (if applicable),
* Defining communication requirements between other systems, and
* Defining interface file requirements between Axle counters and Interlocking (if applicable).

**Note:** If two or more systems communicate with each other, the designer must ensure that the system configurations are aligned. |
| **Bonding Plan (Train Detection, Signalling Apparatus and Bonding Plan)** | The purpose of this task is to provide a geographical scaled drawing of the railway section showing the signalling apparatus, track circuit bonding and electrical networks interface components for traction return current. This plan also provides details relating to track mounted equipment positions in relation to datum point and track connections. The task includes (but is not limited to):* Insulated Rail Joints,
* Electrical Separation Joints,
* Axle Counter heads,
* Tuning units,
* Matching units,
* Train stops,
* Train Protection and Warning System,
* Point machine,
* Signals,
* Platforms,
* Crossings,
* Signalling bonds,
* Impedance bonds,
* Tie in stations,
* Substation,
* Traction return rail,
* Bonding configuration,
* Transponders,
* Equipment housings, and
* Air gaps.

**Note:** The exact chainage/meterage should be denoted for each piece of equipment. This plan is used by electrical teams to ensure that overhead structures are not within touch of signals, cross bonding positions enable sufficient traction return currents and the position of airgaps do not impact on signalling system. This development of this design should be an iterative process between signalling and electrical design to ensure that both systems can operate safely together. Signalling installation teams use this plan to install all signalling trackside equipment. Cable route designers use this assist with the positions of pits and under track crossings. |
| **Object Controller Data Design (No Locking – using Application Logic Data Structure / Interface Control Document)** | The purpose of the task is to design the data for the object controller. The Object Controller acts as an interface between the Signalling Interlocking and the Trackside equipment. Tasks include (but is not limited to):* Allocation of I/O to align with trackside wiring,
* Allocation of I/O to interface with other Object controller or Interlocking,
* Allocation of I/O to interface with Axle Counter systems,
* Assigning Communication IP and Networking information,
* Assigning system timers (LOC etc),
* System specific configuration settings, and
* Alarm creation.
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| **Power Calculations and Cable Running Plan** | The purpose of this task is to provide power calculations for each individual signalling location / Relocatable Equipment Building / Room etc.The power calculations should consider all signalling equipment which is powered from each busbar within the installation. As some signalling equipment only operates for a short period of time i.e., point drive, trainstop drive, the loads should be split into static and dynamic.Where the busbar is being fed from a power supply or transformer, the losses within the unit should be accounted for. Allowance for future expansion should be provided by a nominal percentage figure. The task includes (but is not limited to):* Busbar name and voltage,
* Equipment being drawn from each,
* Expected load of each piece of equipment,
* Overall load on the 110V Transformer,
* Alternative power source loading requirements (generator),
* Size and recharging of Uninterruptable Power Supplies,
* Protection devices to discriminate faults, and
* Protection coordination - compatibility of settings over multiple protective devices.

The information from the power loading calculation is used with the information from the track circuit bonding and signalling apparatus plan to create a cable running plan. The Cable Running Plan shows the point-to-point installation of signalling communications and power cables with reference to signalling equipment and distances. This includes (but is not limited to):* Cable types to be installed between signalling locations based on functions or power requirements,
* Cable types to be installed between signalling locations and trackside assets based on functions or power requirements,
* Cable types to be installed between signalling locations and power stepdown transformer locations,
* Cable identifier, and
* The plan is used to determine the conduit requirements for the cable route design and the installation of cable by the installation (civil) team.
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| **Railway Crossing Circuit Design (Using Typical Circuits)** | The purpose of this task is to identify the circuit for activating level and pedestrian crossing and subsequently normalising. This task is generally local circuit with an interface to the interlocking for newer installations. The task includes (but is not limited to):* Power supplies and batteries for crossing protection equipment,
* Timers to stage protection activation,
* Indication circuits for status indication,
* Traffic Light Coordination,
* Condition monitoring system,
* Fuse and termination analysis,
* Cable and terminal analysis,
* Relay contact analysis, and
* Equipment housing /rack layouts.
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| **Trackside Circuit Design (Using Typical Circuits)** | The purpose of this task is to identify the connections and wiring relating to the operation of the trackside signalling equipment. The task includes (but is not limited to):* Power supplies and protection for equipment being powered within and external to the location,
* Signal lighting circuit including junction box,
* Train Detection circuits,
* Point/moveable infrastructure control and detection:
	+ Train Protection control and detection, and
	+ Siding gates.
* Network and communications equipment,
* Object Controller system wiring,
* Dip switch or jumper settings for all electronic systems,
* Fuse and termination analysis,
* Cable and terminal analysis,
* Systems I/O analysis,
* Relay contact analysis, and
* Equipment housing/rack layouts.
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