Appendix – Coronado Global – Curragh Mine Incident Data Analysis

CG CNOC provided a set of over 3,500 incident reports during the preparation phase of the review. This data has been reviewed by Risk Mentor as detailed below.

The data were sampled and filtered to Vehicle Interaction related incidents. These incidents were mapped to the Vehicle Interaction Control Framework to identify:

1. Which Required Operating State or States (ROS) was compromised
2. The Credible Failure Mode or Modes (CFM) dominantly involved in compromising the ROS, and
3. Which Business Inputs (BI) that could have constrained the CFM that was either not present or not effective.

Some general observations on the analysis are:

- There is a difference to the data sets from other open cut mining operations reviewed by Risk Mentor. The main differences are:
    - The total number of reported incidents is higher than other, similar sized, mining operations - which is a positive indication of a strong reporting culture on site (or indications of a site that suffers from more incidents than other, similar sites),
    - The proportion of ROS 01 - Vehicle Operators Maintain Adequate Clearance is similar to other operations but the higher frequency of ROS 12 - Cabin Protection may be an indicator of worse road conditions or operating practices (operators injured due to high accelerations in the cabin, and impacts during loading)
    - Failure modes that were noted to be different include a lower than usual (although still the single most significant) frequency of CFM-CPA.11.01 Clearance Distance estimation errors, and higher than typical frequency of CFM-EPV.27.20 Mobile Equipment not meeting site standards,
    - No unique failure modes were identified for Curragh North Open Cut Mine - which indicates the control framework model is applicable for the site,
    - In terms of Business Inputs - most are in line with similar analyses at other sites - but the frequency of BI-ERA.32.01 Operator pre-starts is higher - due to failed components identified as causal and failure to adequately inspect work environments before commencing work being more common in the incident data set.

The following tree-charts show these data which are presented as data tables at the end of this appendix.

Figure 1 – Required Operating States Compromised in Incident Data for ROS types connected to more than 3 incidents

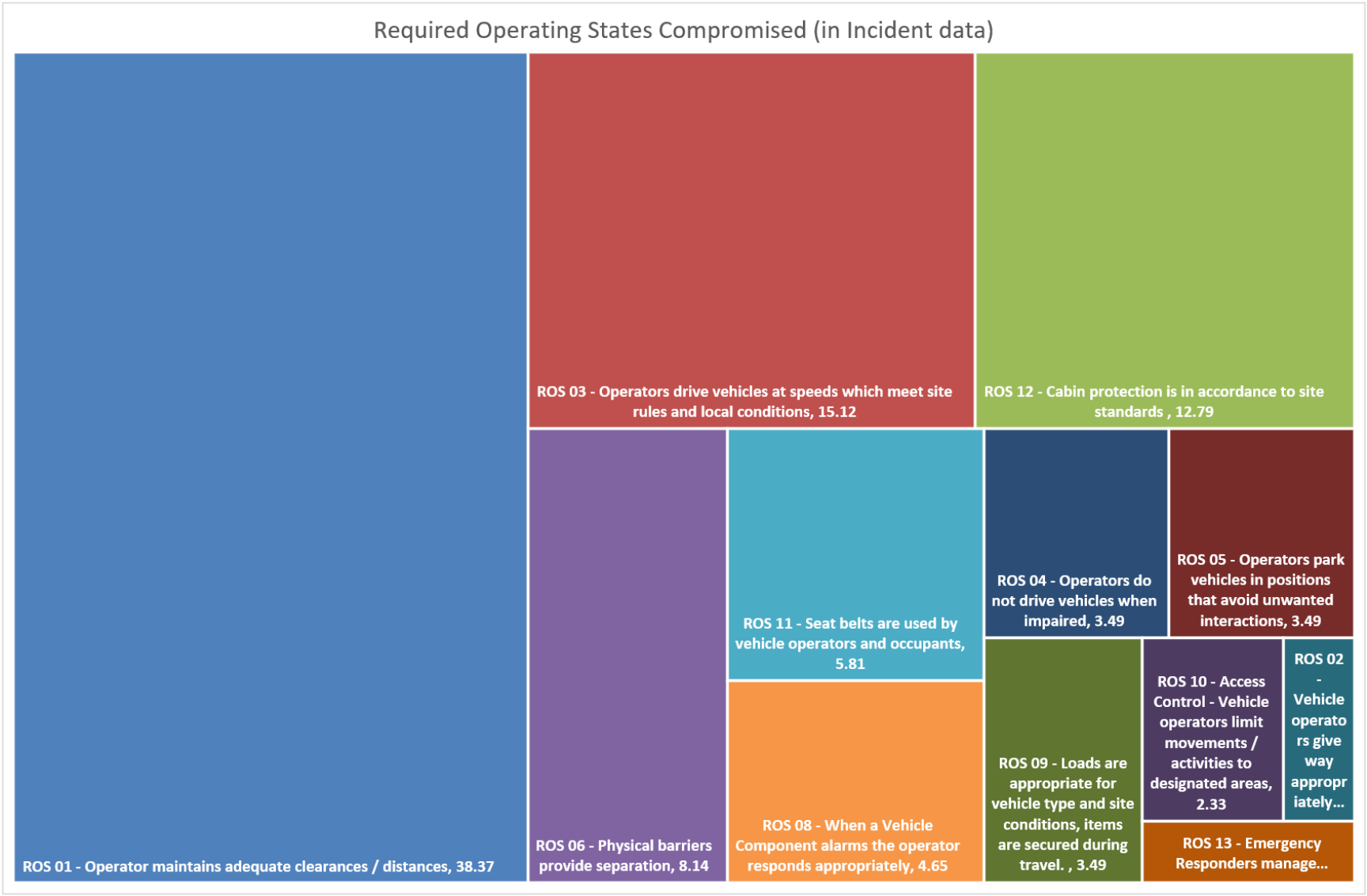

Figure 2 – Credible Failure Modes dominantly implicated in the Incident Data for CFM

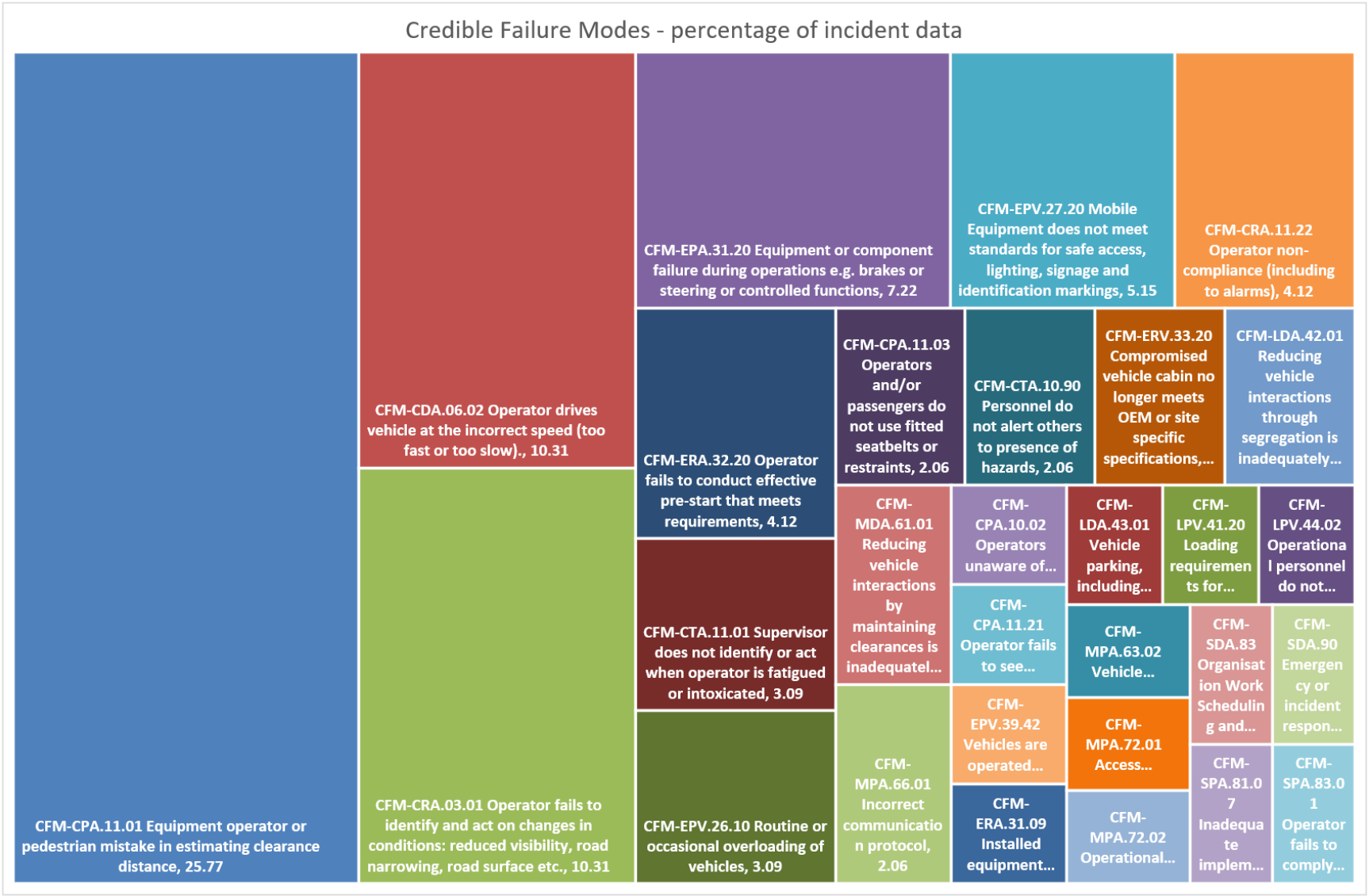

Figure 3 – Business Inputs which did not constrain the CFMs implicated in the Incident Data for BI

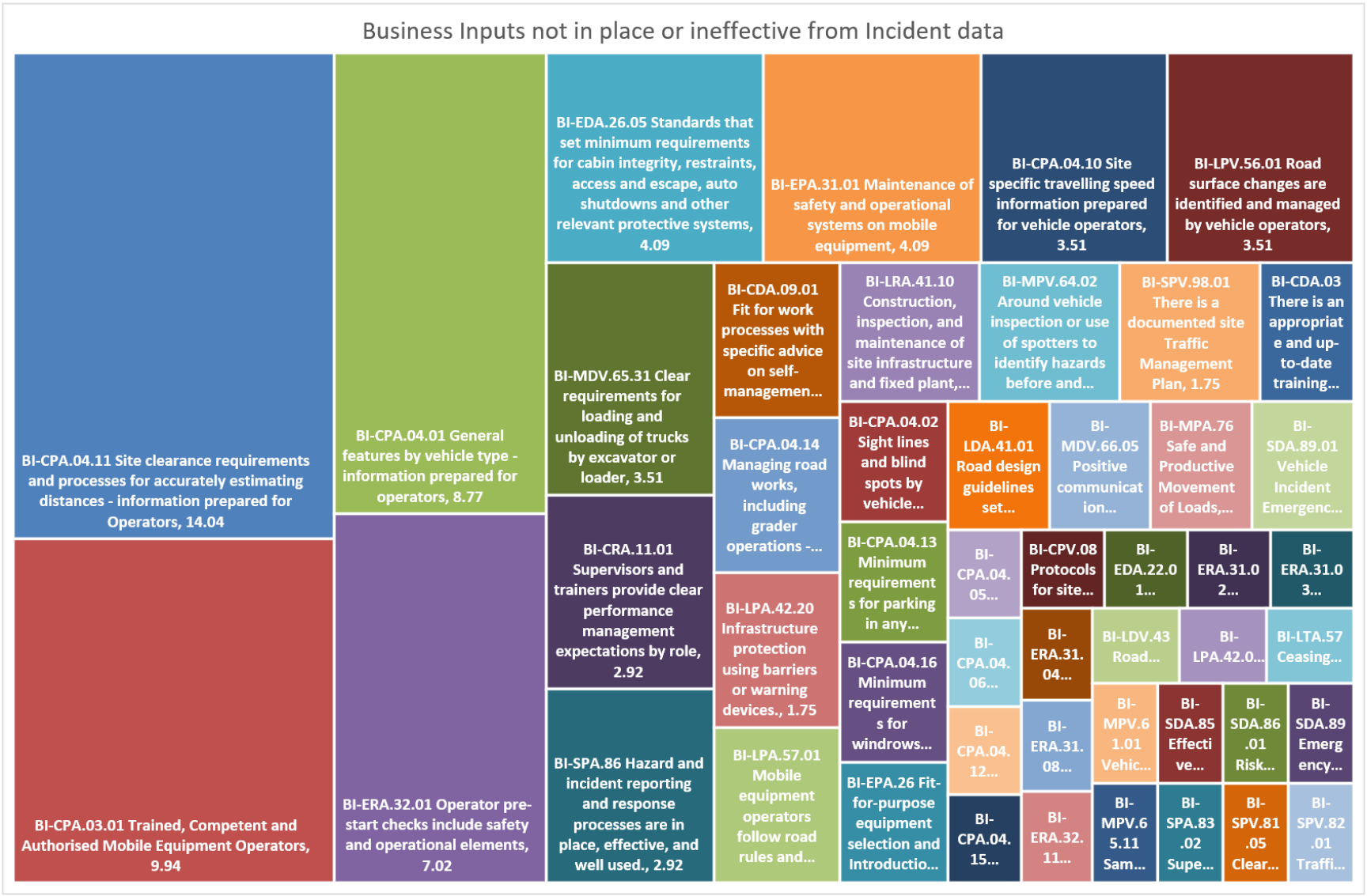

Table - 1 – Percentage of Incidents for compromised Required Operating States

Required Operating State	Percentage of Incidents
ROS 01 - Operator maintains adequate clearances / distances	38.37
ROS 03 - Operators drive vehicles at speeds which meet site rules and local conditions	15.12
ROS 12 - Cabin protection is in accordance to site standards	12.79
ROS 06 - Physical barriers provide separation	8.14
ROS 11 - Seat belts are used by vehicle operators and occupants	5.81
ROS 08 - When a Vehicle Component alarms the operator responds appropriately	4.65
ROS 04 - Operators do not drive vehicles when impaired	3.49
ROS 05 - Operators park vehicles in positions that avoid unwanted interactions	3.49
ROS 09 - Loads are appropriate for vehicle type and site conditions, items are secured during travel.	3.49
ROS 10 - Access Control - Vehicle operators limit movements / activities to designated areas	2.33
ROS 02 - Vehicle operators give way appropriately to mobile plant and pedestrians	1.16
ROS 13 - Emergency Responders manage injuries at the scene	1.16

Table - 2 – Percentage of Incidents for implicated Credible Failure Modes

Credible Failure Mode	Percentage of Incidents
CFM-CPA.11.01 Equipment operator or pedestrian mistake in estimating clearance distance	25.77
CFM-CDA.06.02 Operator drives vehicle at the incorrect speed (too fast or too slow).	10.31
CFM-CRA.03.01 Operator fails to identify and act on changes in conditions: reduced visibility, road narrowing, road surface etc.	10.31
CFM-EPA.31.20 Equipment or component failure during operations e.g. brakes or steering or controlled functions	7.22
CFM-EPV.27.20 Mobile Equipment does not meet standards for safe access, lighting, signage and identification markings	5.15
CFM-CRA.11.22 Operator non-compliance (including to alarms)	4.12
CFM-ERA.32.20 Operator fails to conduct effective pre-start that meets requirements	4.12
CFM-CTA.11.01 Supervisor does not identify or act when operator is fatigued or intoxicated	3.09
CFM-EPV.26.10 Routine or occasional overloading of vehicles	3.09
CFM-CPA.11.03 Operators and/or passengers do not use fitted seatbelts or restraints	2.06
CFM-CTA.10.90 Personnel do not alert others to presence of hazards	2.06
CFM-ERV.33.20 Compromised vehicle cabin no longer meets OEM or site specific specifications	2.06
CFM-LDA.42.01 Reducing vehicle interactions through segregation is inadequately considered in mine design and work planning	2.06
CFM-MDA.61.01 Reducing vehicle interactions by maintaining clearances is inadequately considered routine work planning	2.06
CFM-MPA.66.01 Incorrect communication protocol	2.06
CFM-CPA.10.02 Operators unaware of give way requirements for light vehicles	1.03
CFM-CPA.11.21 Operator fails to see signage installed to standard	1.03
CFM-EPV.39.42 Vehicles are operated outside specified tyre conditions	1.03
CFM-ERA.31.09 Installed equipment system status alarms do not operate	1.03
CFM-LDA.43.01 Vehicle parking, including emergency parking is inadequately considered in mine design and routine work planning	1.03
CFM-LPV.41.20 Loading requirements for vehicles inadequately considered in mine design, equipment selection and work planning	1.03
CFM-LPV.44.02 Operational personnel do not maintain minimum standards for berms, windrows and other zone protection.	1.03
CFM-MPA.63.02 Vehicle operator does not check pathway after being parked	1.03
CFM-MPA.72.01 Access control infrastructure is inadequate	1.03
CFM-MPA.72.02 Operational access control (pedestrian and vehicle) is inadequate	1.03
CFM-SDA.83 Organisation Work Scheduling and Planning is inadequate	1.03
CFM-SDA.90 Emergency or incident response is inadequate	1.03
CFM-SPA.81.07 Inadequate implementation of site traffic management plan	1.03
CFM-SPA.83.01 Operator fails to comply with site requirements	1.03

Table - 3 – Percentage of Incidents for missing or ineffective Business Inputs

Business Input	Percentage of Incidents
BI-CPA.04.11 Site clearance requirements and processes for accurately estimating distances - information prepared for Operators	14.04
BI-CPA.03.01 Trained, Competent and Authorised Mobile Equipment Operators	9.94
BI-CPA.04.01 General features by vehicle type - information prepared for operators	8.77
BI-ERA.32.01 Operator pre-start checks include safety and operational elements	7.02
BI-EDA.26.05 Standards that set minimum requirements for cabin integrity, restraints, access and escape, auto shutdowns and other relevant protective systems	4.09
BI-EPA.31.01 Maintenance of safety and operational systems on mobile equipment	4.09
BI-CPA.04.10 Site specific travelling speed information prepared for vehicle operators	3.51
BI-LPV.56.01 Road surface changes are identified and managed by vehicle operators	3.51
BI-MDV.65.31 Clear requirements for loading and unloading of trucks by excavator or loader	3.51
BI-CRA.11.01 Supervisors and trainers provide clear performance management expectations by role	2.92
BI-SPA.86 Hazard and incident reporting and response processes are in place, effective, and well used.	2.92
BI-CDA.09.01 Fit for work processes with specific advice on self-management	1.75
BI-CPA.04.14 Managing road works, including grader operations - information prepared for operators	1.75
BI-LPA.42.20 Infrastructure protection using barriers or warning devices.	1.75
BI-LPA.57.01 Mobile equipment operators follow road rules and adjust based on conditions and circumstances.	1.75
BI-LRA.41.10 Construction, inspection, and maintenance of site infrastructure and fixed plant	1.75
BI-MPV.64.02 Around vehicle inspection or use of spotters to identify hazards before and during movement	1.75
BI-SPV.98.01 There is a documented site Traffic Management Plan	1.75
BI-CDA.03 There is an appropriate and up-to-date training management system	1.17
BI-CPA.04.02 Sight lines and blind spots by vehicle type - information prepared for vehicle operators	1.17
BI-CPA.04.13 Minimum requirements for parking in any situation - information prepared for operators	1.17
BI-CPA.04.16 Minimum requirements for windrows (bunds) - information prepared for operators	1.17
BI-EPA.26 Fit-for-purpose equipment selection and Introduction to Site processes	1.17
BI-LDA.41.01 Road design guidelines set minimum standards for the construction and maintenance of the road network	1.17
BI-MDV.66.05 Positive communication protocol for passing or moving close to a vehicle	1.17
BI-MPA.76 Safe and Productive Movement of Loads	1.17
BI-SDA.89.01 Vehicle Incident Emergency Preparedness	1.17
BI-CPA.04.05 Alarm and vehicle information panel expected response - information prepared for Operators	0.58

Business Input	Percentage of Incidents
BI-CPA.04.06 Tyre hazard awareness for all personnel.	0.58
BI-CPA.04.12 Give way requirements information prepared for mobile equipment operators and pedestrians	0.58
BI-CPA.04.15 Minimum requirements for hazard notification and demarcation - information prepared for operators	0.58
BI-CPV.08 Protocols for site induction and operating areas access	0.58
BI-EDA.22.01 Specifications for operator displays	0.58
BI-ERA.31.02 Inspection and maintenance of mobile equipment cabin integrity, restraints, access and escape, auto shutdowns and other relevant protective systems.	0.58
BI-ERA.31.03 Inspection and maintenance of mobile equipment lights and markings	0.58
BI-ERA.31.04 Inspection and Maintenance of Mobile Equipment alarms, monitors, cameras, and other warning devices.	0.58
BI-ERA.31.08 Inspection and maintenance of mobile equipment key systems, brakes, steering, and wheel assemblies	0.58
BI-ERA.32.11 Prestart checks of mobile equipment alarms and monitors	0.58
BI-LDV.43 Road design guidelines specify minimum parking area requirements	0.58
BI-LPA.42.04 Lighting, delineation and signs are installed and maintained to standards that meet minimum site road design requirements.	0.58
BI-LTA.57 Ceasing Operations Procedure - compromised operating environment	0.58
BI-MPV.61.01 Vehicle interactions are considered during short-term planning processes	0.58
BI-MPV.65.11 Same direction travelling and queuing separation protocols	0.58
BI-SDA.85 Effective contractor selection and management processes	0.58
BI-SDA.86.01 Risk and Control Management for Routine Tasks	0.58
BI-SDA.89 Emergency Preparedness	0.58
BI-SPA.83.02 Supervisor performance requirements	0.58
BI-SPV.81.05 Clear accountabilities for managers, superintendents, and supervisors in site relevant road design guidelines and traffic management plans	0.58
BI-SPV.82.01 Traffic Management Plan consultation and communication	0.58