

Work Package 1.2.3
**Credible Failure Modes Review**

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|  Vehicle Interaction Control Improvement Project |
| **WBS Parent** | 1. VI Control Baseline (Phase 1)
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| **WBS Reference** | 1.2 Phase 1 Site VICE Baseline |
| **Work Package** | 1.2.3 Credible Failure Modes Review |
| **Package Owner** | Project Manager |
| **Owner Organisation** | Your Company |
| **Participants** | Project Manager, Project Team, site and divisional HSE personnel, selected operations personnel. |
| **Capability Required** | Systems level knowledge about business mission, company requirements, and site operating processes. |
| **Description** | Consider the list of associated Credible Failure Modes (CFM) listed in Appendix A. For each of these:1. Identify and highlight any CFM that may not be site relevant.
2. If required, add new Credible Failure Modes.

Note: this same information is used to analyse site and company incidents.  |
| **Completion State** | **A site relevant table of Credible Failure Modes.**  |
| **References**  | * **Credible Failure Modes Relevancy Analysis Worksheet**(Appendix A)
* [EMESRT VICI Project Guide](https://emesrt.org/wp-content/uploads/EMESRT-VICI-Project-Guide-2023.pdf)
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| **Notes**...................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................................... |
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**Appendix A**

The five categories of Credible Failure Mode:

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| **People**Operators and those working around mobile equipment are trained, competent, authorised, informed, alert, and situationally aware. |
| **Equipment**Mobile Equipment is fit for use, key systems are functioning. |
| **Operating Environment**The operating environment for mobile equipment is satisfactory, hazards are identified and managed. |
| **Workgroup Interactions**Mobile Equipment interfaces with pedestrians and other vehicles are well managed. |
| **Systems**Vehicle interaction management is well coordinated, practical and integrated with routine operational and business processes. |

**Credible Failure Modes Relevancy Analysis Worksheet**

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| CFM Reference | Credible Failure Mode Details and Examples | Related Business Inputs |
| CFM.1CD-01 Operator unaware of correct speed | *Operator not aware of correct speed, caused by:* 1. *Unaware of maximum operating speed limits for Light/Heavy Vehicles on site by type and travel routes*
2. *Does not recognise change in work environment e.g. not at correct crest speed for the ramp, adverse weather conditions, slippery road etc.*
3. *Towing equipment*
4. *Lack of awareness due to inconsistent or missing signage around prevailing site speed limits*
5. *CAS/PDS geofences or site speeds not set up or maintained*
 | * BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
* BI-01P.07 Site specific travelling speed information prepared for vehicle operators
* BI-02S.05 Protocols for the calibration of key measuring equipment
* BI-03T.10 TARP’s prepared for unwanted conditions
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| CFM.1CD-02 Proximity alarms, area guards do not perform to specification (false negatives)  | *Proximity detection systems do not perform to specification, caused by:* * *Fails to alarm*
* *Fails to disengage at increased speed or nominated distance*
* *System fails to switch to camera that is in direction of sensed item*
* *False negative - fails to detect pedestrian or other vehicle*
 | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-02D.53 Operator display specifications are detailed for mobile equipment
* BI-04S.20 Proximity detection data send
* BI-04T.20 Proximity detection, permission lines, alerts, advice, and intervention
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| CFM.1CD-03 Incorrect action on vehicle system alarm - not understood | *On alarm, operator takes wrong action, caused by:* * *Lack of training*
* *Multiple alarms cause confusion and mistakes*
* *Operating a range of vehicles (or different sites) with different alarms for same issue*
* *Level 8 alerts confusing or hard to hear or understand*
 | * BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
* BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-02D.53 Operator display specifications are detailed for mobile equipment
* BI-02T.30 Component alarm or safety device, alarm and data send on fault
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| CFM.1CP-01 Operators of heavy and light vehicles (or pedestrians) fail to follow the designated travel path | *Operators of heavy and light vehicles fail to follow the designated haul route, caused by:* * *Unaware or does not understand the requirement for operating Light/Heavy Vehicles on site (travel routes, vehicle capabilities, critical systems)*
* *Rules for travelling into the Shop*
* *Inadequate Management of Vehicles (asset management)*
* *Equipment under tow*
* *Geofences and rules for direction of travel not set up or maintained in the CAS/PDS system*
* *Vehicle operator or Pedestrian fails to react to alarms from CAS/PDS (CSX) units*
 | * BI-03P.03 Expected routes by vehicle type are effectively communicated.
* BI-04P.01 Vehicle interactions are considered as part of the short-term planning processes
* BI-04P.08 Pedestrian working in operational area communications protocol
* BI-04P.10 Specification covering escorting requirements
* BI-05P.01 Shift to shift communication
* BI-05P.02 Site change management process apply to changes in equipment, road networks and traffic flows
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| CFM.1CP-02 Equipment operator or pedestrian mistake in estimating clearance distance | *Operator or pedestrian misjudges clearance distance, caused by:* * *Vision / Visibility issues (poor sight lines, glare, dust, etc.)*
* *Delineation not placed as required*
* *Reversing / moving in restricted areas (without assistance - spotter or cameras)*
* *Pedestrian entry into operating area without notification*
* *Operator unaware or does not understand the requirement for operating Light/Heavy Vehicles on site (travel routes, vehicle capabilities, critical systems)*
* *Changes made to roadways/access protocols without notifying all affected employees*
* *Vehicle speed on approach to intersection or destination*
* *Equipment operator mistake in estimating distance to pedestrian when passing*
* *Work planning does not allow adequately for vehicle access e.g. working on fixed infrastructure*
* *CAS/PDS fails to detect the presence of a nearby vehicle*
* *Driving too close to the vehicle in front (due to failure to perceive distance)*
* *Failing to identify permission line from any automated units (if deployed)*
 | * BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
* BI-01P.05 Site clearance requirements and processes for accurately estimating distances - information prepared for Operators
* BI-03P.04 Power line working distance management process
* BI-04D.05 Road design guidelines specify minimum requirements for delineation
* BI-04P.03 Same direction travelling and queuing separation protocols
* BI-04P.06 Protocols for approaching and accessing mobile equipment
* BI-04P.14 Positive communication protocol for passing or moving close to a vehicle
* BI-04T.20 Proximity detection, permission lines, alerts, advice, and intervention
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| CFM.1CP-03 Operators unaware of right of way and other general requirements | *Operators unaware of give way or general requirements for vehicles, caused by:** *Vehicle operators not trained or assessed in site requirements*
* *Training activities to not utilize competency-based training or don't use appropriate trainers*
* *Too many and/or conflicting procedures vehicle operators are required to be trained in*
* *Maintainers competent in move and test skills operate vehicles outside a controlled (e.g. workshop) environment*
* *Inadequate assessment of skills of operators and workers who interact with mobile equipment*
* *Simulators not used or set up in line with site requirements for vehicle movement*
* *Procedures not developed for high consequence vehicle operations (surface and/or underground)*
* *Right of way rules not being understood e.g. not understanding explosives vehicles have right of way*
 | * BI-01D.01 Trained personnel who are supported by an appropriate and up-to-date training management system
* BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
* BI-01P.06 Give way/Right of Way requirements information prepared for mobile equipment operators and pedestrians
* BI-05D.03 Effective contractor management processes
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| CFM.1CP-04 Operators unaware of give way requirements for vehicles | *Operators unaware of give way requirements for light or heavy vehicles, caused by:* * *Vehicle operators not trained or assessed in site requirements*
* *Right of way rules not being understood*
* *Contractors travelling (working) on multiple sites conforming to different rules*
* *LV believe they have right of way and proceeds through the intersection and a HV turns across the path of a LV*
* *LV or HV cannot stop in time*
* *CAS/PDS intersection geofence not established or maintained for an intersection - so no alert provided to (particularly LV) operators*
* *Vehicle operator fails to react to intersection alarms from CAS/PDS*
 | * BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
* BI-01P.06 Give way/Right of Way requirements information prepared for mobile equipment operators and pedestrians
* BI-05D.03 Effective contractor management processes
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| CFM.1CP-05 Impaired or inattentive operator operates mobile equipment | *Operator impairment by:* * *Fatigue - arising from: Sleeping 6 hours or less sleep-in 24-hour period; Poor diet ; Recent illness or injury; Underlying health or substance abuse issue (not picked up in on site testing or off-site medical screening); Family stress - illness to family member, new baby etc.; Additional work commitments (second job); Long commutes; Stress*
* *Prescription medicine*
* *AOD intoxication*
* *Chronic injury or medical condition*
* *Operator Inattention - arising from Use of mobile phone or other personal electronic devices while operating mobile equipment*
 | * BI-01D.03 Fit for work processes with specific advice on self-management
* BI-01S.02 Pre-commencement and periodic medicals for mobile equipment operators
* BI-01S.50 Introduce technology to support existing fatigue management approaches
* BI-01S.51 Fatigue status data send (off vehicle review)
* BI-01T.50 Fatigue alert alarms
* BI-05D.05 Site fatigue management processes are comprehensive and optimise work rosters
* BI-05S.06 Comprehensive fitness for work process includes alcohol and other drugs
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| CFM.1CP-06 Operators or passengers do not use fitted seatbelts or restraints | *Operators and/or passengers do not use seatbelts or restraints, caused by:* * *Operator and/or passenger willful violation*
* *Riding in a position outside the nominated cabin/travelling position*
 | * BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
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| CFM.1CP-07 Operators or passenger has limb outside cabin while travelling | *Worker or passenger has limb or body part protruding outside cabin or travelling location, caused by:* * *Unaware or does not understand the requirement for operating LV/HV Vehicles on site (travel routes, vehicle capabilities, critical systems)*
* *Operator and/or passenger willful violation*
 | * BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
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| CFM.1CP-08 Operator does not drive on available segregated roads or nominated routes/locations | *Operator fails to drive on segregated roads, caused by:* * *Unaware or does not understand the requirement for operating LV/HV Vehicles on site (travel routes, vehicle capabilities, critical systems)*
* *Failure to maintain signage on segregated roads*
* *Maintenance equipment not suitable for the conditions*
* *Travel on wrong road or in wrong direction*
* *Enters a restricted location (e.g. LV into Loading/Production area without clearance)*
* *CAS/PDS geofences for segregated roadways not entered or maintained and breaching vehicle not alerted to their presence on a segregated roadway*
 | * BI-01P.02 Task expectations are well communicated and reinforced over the work shift.
* BI-03P.02 Lighting, delineation and signs are installed and maintained to standards that meet minimum site road design requirements
* BI-03P.03 Expected routes by vehicle type are effectively communicated.
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| CFM.1CS-01 Personnel do not manage heavy vehicle blind spots  | *Operator fails to manage heavy vehicle blind spots, caused by:* 1. *Light vehicles or Co-workers on the ground*
2. *Heavy traffic/congestion not identified and/or related to appropriately (e.g. continuing to operate vehicles at higher speeds)*
3. *Operators (LV, HV or other) not understanding HV limitations (sight lines, stopping, etc)*
4. *Tradesman working on broken down equipment in an operational area*
5. *Pedestrian assumes that operator knows their position (when in a blind-spot)*
6. *Limitations on CAS/PDS not understood by pedestrians or vehicle operators and protection assumed to be in place when none exists*
7. *Blind spots are most significant around the MIA - workshops, fuel bays, etc.*
 | * BI-01P.12 Sight lines and blind spots by vehicle type - information prepared for vehicle operators
* BI-01P.13 Sight lines and blind spots from outside - information prepared for people who work around vehicles
* BI-04D.03 Road design guidelines specify walkway designs considering vehicle sight lines
* BI-04D.05 Road design guidelines specify minimum requirements for delineation
* BI-04P.06 Protocols for approaching and accessing mobile equipment
* BI-04P.11 Protocols for working on equipment in production areas
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| CFM.1CS-02 Operators or co-workers have required communications equipment but are not contactable  | *Operators or co-workers are not contactable (actions of people), caused by:* 1. *Incorrect communications channel*
2. *Equipment turned off or down*
3. *CAS/PDS relied upon to achieve communications and not in an operable state*
4. *Failing to confirm message received (no pos comms)*
 | * BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
* BI-02P.07 Prestart radio checks
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| CFM.1CS-03 No action taken on over speed alarm  | *Operator fails to identify and act on over speed warning alarm, caused by:** *Unaware of alarm meaning*
* *Confusion / misinterpretation from multiple alarms in cab*
* *Unaware of over speed alarm setting*
* *No supervisor follow up based on alarm*
 | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-03S.20 Speed and other operating parameter data send
* BI-05S.03 Hazard and incident reporting processes are effective and well used
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| CFM.1CS-04 Operators change behaviour after fatigue alerting system is fitted  | *Operators change behaviour after fatigue/distraction alerting system is fitted, caused by:** *Operators develop a trust that the alerting system will always wake them from micro sleeps in time to avoid incidents*
* *Previous successful fatigue management actions are no longer applied e.g. ensuring adequate rest between shifts, use of rest facilities during night shift etc.*
* *Distraction/fatigue sensing system not fitted on all vehicles*
* *Critical distraction alerts not escalated by remote monitoring group or not reacted to by site supervisors*
 | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-02D.10 Operator ergonomics are considered for controls and before introducing vehicle alarms and other aids
* BI-05D.05 Site fatigue management processes are comprehensive and optimise work rosters
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| CFM.1CS-05 Proximity and other alarms do not assist operator  | *Operator is overloaded and ignores, has trouble interpreting or is tempted to disable proximity, fatigue or other alarm* | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-02P.04 Regular checking and maintenance of alarms, monitors, cameras and other warning devices
* BI-02P.11 Protocols that detail how the status of vehicle alarms and monitors are checked prior to use
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| CFM.1CS-06 Operator fails to see signage installed to standard | *Operator fails to see acceptable signage, caused by:* * *Inattention to task or operating location*
* *Vision impairment*
* *Fatigue affects performance*
* *Signs covered in mud or dust*
* *Lack of signs (insufficient number or position of signs)*
* *Signs not put in a location that is visible (even though it might comply with the design requirements for where it should be located)*
 | * BI-01S.02 Pre-commencement and periodic medicals for mobile equipment operators
* BI-05S.03 Hazard and incident reporting processes are effective and well used
* BI-05S.06 Comprehensive fitness for work process includes alcohol and other drugs
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| CFM.1CS-07 Operator ignores or bypasses alarm or safety device | *Operator over-rides the alarm device, for example:* * *ignoring the alarm*
* *overriding the speed limiting device*
* *overriding door safety device*
* *seatbelts or any other safety device*
* *high frequency of nuisance alarms (alarms without context) leads to them being ignored*
* *operator doesn't hear alarm, or the alarm priority isn't clear*
 | * BI-02P.11 Protocols that detail how the status of vehicle alarms and monitors are checked prior to use
* BI-02T.30 Component alarm or safety device, alarm and data send on fault
* BI-03S.20 Speed and other operating parameter data send
* BI-04S.20 Proximity detection data send
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| CFM.1CS-08 Operator fails to identify and act on changes in conditions - reduced visibility, road narrowing, road surface etc.  | *Operator fails to identify and act on changes in conditions: reduced visibility, road narrowing, road surface etc., caused by:* 1. *Dust, rain or fog obscuring visibility of roadway, other vehicles or obstructions*
2. *Lighting too bright, too dim, or poorly positioned lights*
3. *Roadworks and grader operations (e.g. creating rough conditions or drop-offs)*
4. *[Where relevant] CAS/PDS constraints for roadwork vehicles not adequately programmed (nuisance alarms) or honoured (fail to react to in-cab alarm when inside roadwork vehicle's zone of influence)*
5. *Change in road surface (conditions or material - including impacts of geotechnical (subsidence, slumps, falls of material onto roadways))*
6. *Lightning storms*
7. *Excess water on road (rain, irregular or overwatering)*
8. *Snow, ice, windblown sand, falls of ground, etc.*
9. *[Where available] CAS/PDS alerts of TARP status not included or not actioned on shift*
 | * BI-03P.01 Road surface changes are identified and managed by vehicle operators
* BI-03T.01 Ceasing Operations Procedure - compromised operating environment
* BI-03T.05 Lightning and Extreme Weather TARP
* BI-03T.10 TARPs prepared for unwanted conditions
* BI-04P.05 Demarcation when changed road conditions arise including commissioning or live testing is being undertaken
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| CFM.1CS-09 Distraction or Fatigue event not validated and communicated | *Event not validated and communicated to site within the specified timeframe, caused by:** *event not communicated to off-vehicle facility which reviews events and helps to escalate responses*
* *event footage not received*
* *event not managed as per agreed TARPs*

*inability of the remote monitoring workers to contact site* | * BI-01S.51 Fatigue status data send (off vehicle review)
* BI-01T.50 Fatigue alert alarms
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| CFM.1CT-01 Supervisor does not identify or act when operator is fatigued or intoxicated | *Supervisor does not identify a fatigued or intoxicated operator, caused by:** *Lack of supervisor performance management training and support*
* *Choosing to avoid difficult performance management issues*
* *Limited interface with operator e.g. supervisor has many reports*
* *Lack of understanding of social factors e.g. religious observations, community norms for alcohol and other drug use*
 | * BI-01D.03 Fit for work processes with specific advice on self-management
* BI-05D.05 Site fatigue management processes are comprehensive and optimise work rosters
* BI-05S.06 Comprehensive fitness for work process includes alcohol and other drugs
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| CFM.1CT-02 Incorrect action taken on proximity alarm  | *Proximity alarm works as designed but vehicle operator takes wrong action for the situation e.g. assumes that alarm applies to distant vehicle and drives over a local unsighted LV, caused by:** *Mistake in comprehension*
* *Incorrect projection*
* *Wrong decision and action for the situation*
 | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-04S.20 Proximity detection data send
* BI-04T.20 Proximity detection, permission lines, alerts, advice, and intervention
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| CFM.2ED-01 Equipment or Component Design is not error tolerant  | *Equipment design causes or amplifies operator mistakes including:** *Turn indicators that are not self-cancelling*
* *Blind spots on haul trucks and other heavy mobile equipment*
* *Operator position on LHDs and digging units*
* *Equipment selected for use is sub-optimal in the operating environment (wrong equipment for task)*
* *Carefully selected equipment has design deficiencies (best available equipment still has design improvement opportunities)*
* *Installed systems conflict with other technology or control systems on the equipment*
* *Operator interfaces (control systems) being inadequate or having poor ergonomics (e.g. multiple screens obscuring windscreen sight lines)*
* *Control system faults lead to unintended equipment operation*
 | * BI-02D.01 Fit-for-purpose equipment selection and site use approval processes
* BI-02D.02 Standards that set minimum requirements for cabin integrity, restraints, access and escape, auto shutdowns and other relevant protective systems
* BI-05P.04 Skilled and experienced personnel are accountable for specifying and selecting mobile equipment and mobile equipment components
* BI-05S.02 Effective incident reporting, investigation with effective corrective actions
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| CFM.2ED-02 Mobile Equipment does not meet standards for lighting, signage and identification markings  | *Vehicle(s) do not comply with site and corporate standards for lighting, signage and markings, caused by:* 1. *Inadequate vehicle identification number design i.e. size and location of numbers*
2. *[Where fitted] Required CAS/PDS hardware not permanently or temporarily fitted to vehicles in work areas*
3. *Uncontrolled introduction of mobile equipment to site e.g. through contractors*
4. *Inadequate pre-operation inspections and/or maintenance*
5. *Sight lines from operator position impeded (dirty windscreens, poorly sited materials/components, etc.)*
6. *Technology selection/design does not consider leading practice from other sectors (e.g. automotive)*
7. *Missing/worn reflective markings and strobe lights*
8. *[Where applicable] Equipment not fitted with appropriate vehicle identification CAS components*
9. *[Where relevant] Access to underground area not restricted by physical controls.*
 | * BI-01P.11 Vehicle lights and markings requirements - information prepared for operators
* BI-02D.04 Processes for confirming that new to site vehicles meet site specifications including vehicle lights, signage and markings (Intro to Site)
* BI-02P.03 Regular checking and maintenance of vehicle lights and markings
* BI-05D.03 Effective contractor management processes
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| CFM.2ED-03 Steering and brake alarms not fitted  | *Vehicles without steering and brake alarms can lead to operators continuing to operate a vehicle that is compromised.* | * BI-02D.01 Fit-for-purpose equipment selection and site use approval processes
* BI-02D.04 Processes for confirming that new to site vehicles meet site specifications including vehicle lights, signage and markings (Intro to Site)
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| CFM.2ED-04 Failing to adequately consider site requirements when specifying technology for mobile equipment | *Equipment selection fails to adequately consider prevailing site requirements, caused by:** *Not considering available data on VI events when selecting equipment*
* *Failing to conduct a baseline study of how vehicles are deployed*
* *Not updating VI baseline after installing technology*
* *Not making allowance for mining front and work environment changes in geofencing capabilities of CAS/PDS*
* *Failing to make an allowance for limits of older equipment/technologies in use on site*
* *Failing to match vehicle selection to mined opening dimensions*
 | * BI-02D.01 Fit-for-purpose equipment selection and site use approval processes
* BI-02D.04 Processes for confirming that new to site vehicles meet site specifications including vehicle lights, signage and markings (Intro to Site)
* BI-05P.04 Skilled and experienced personnel are accountable for specifying and selecting mobile equipment and mobile equipment components
* BI-05P.05 Skilled and experienced personnel are accountable for determining the operating parameters for mobile equipment use
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| CFM.2ED-05 Fatigue alarms not matched to CAS/PDS user requirements | *Selection and installation of fatigue detection and alert system that lead to problems, caused by:** *Conflicting alarms and alerts with onboard systems*
* *Off vehicle alerts not triggered by critical fatigue events*
* *No Level 8 (advisory) messages provided from monitoring system*
 | * BI-01S.51 Fatigue status data send (off vehicle review)
* BI-01T.50 Fatigue alert alarms
* BI-02D.01 Fit-for-purpose equipment selection and site use approval processes
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| CFM.2EP-01 Operator fails to conduct pre-start requirements | *Operators fail to conduct an effective pre-start, caused by:** *Haste in leaving a parked-up position (short-cut taken)*
* *Incomplete checks on communication equipment*
* *Hot seating processes lead to missing required frequency of pre-starts*
* *Identifying an issue but failing to escalate the fault to a "do not operate" response*
* *Lack of understanding of key equipment systems to be checked during pre-start*
* *Format of pre-start and/or an absence of follow up leads to a "tick and flick" approach by vehicle operators*
* *Assumption of checks by earlier vehicle operators on shift*
 | * BI-01T.01 Required emergency checks before vehicle operation - information for operator by vehicle type.
* BI-02P.06 Operator pre-start checks include work area, communication system, safety devices, brakes, steering, tyres and running gear
* BI-02P.11 Protocols that detail how the status of vehicle alarms and monitors are checked prior to use
* BI-02P.20 Tyre hazard awareness for equipment operators
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| CFM.2EP-02 Equipment or component failure during operations e.g. brakes or steering or controlled functions | *Equipment failure / design means that operator cannot maintain separation distance or give way requirements, caused by:* * *Indicators fail to cancel in CAT trucks (not self-cancelling)*
* *Tyres worn and/or lose traction*
* *Poor maintenance of components or systems (particularly brakes, steering, emergency stops, etc.)*
* *Equipment returned to service or not stood down when components are compromised*
* *Loss of power/propulsion leads to loss of braking effort*
* *Compromised operation of remotely controlled vehicle systems (unwanted movement/operation)*
 | * BI-02P.01 All safety and operational systems on mobile equipment are maintained
* BI-02P.06 Operator pre-start checks include work area, communication system, safety devices, brakes, steering, tyres and running gear
* BI-02P.08 Regular checking and maintenance of key systems, brakes, steering, rims and tyres
* BI-02P.20 Tyre hazard awareness for equipment operators
 |
| CFM.2EP-03 Communication equipment absence, failure or poor reception | *Operators and / or co-workers are not contactable because of equipment failure, caused by:* * *Communication equipment is inoperable (e.g. due to poor maintenance or failure to conduct pre-start)*
* *Areas of poor reception*
* *Communication not available*
 | * BI-02P.01 All safety and operational systems on mobile equipment are maintained
* BI-02P.07 Prestart radio checks
* BI-02P.30 Regular and timely maintenance of communications systems equipment
* BI-02S.06 New communications or technology equipment, specification, test and commissioning process
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| CFM.2EP-04 Speed limiting device compromised | *Speed limiters not on equipment to specification, caused by:* * *Component fault/failure*
* *Logic failure (wrong speed set)*
* *False detection of a conflict and hard braking applied when not required (L9)*
* *Operator bypass*
 | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-02D.21 Mobile Equipment is speed limited
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| CFM.2EP-05 Restraints or load securing devices fail causing an incident | *Restraints or load securing devices do not function in or cause an incident, caused by:* * *Incorrect selection of restraint based on application*
* *Failure of anchor points*
* *Change of vehicle centre of gravity due to load shifting*
* *Load (bulk materials) shifts or remains stuck in elevated trays/buckets leading to instability of vehicle(s)*
* *LVs not fit for purpose - toolboxes do not allow use/correct fitment of nets*
* *Supervisors are not enforcing use of nets*
* *lack of roll out for load restraint methods and expectations to all operators*
* *LV's not fitted with correct tow hitch (have not been changed over to site standard system)*
 | * BI-01P.16 Site specific protocols for movement of loads
* BI-02D.01 Fit-for-purpose equipment selection and site use approval processes
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| CFM.2EP-06 Loose objects in cabin remain unsecured  | *Operator unaware of requirements for loading and securing equipment, caused by:* * *Poor housekeeping in the vehicle cabin*
* *Unaware of cabin areas to check*
 | * BI-01T.01 Required emergency checks before vehicle operation - information for operator by vehicle type.
* BI-02P.06 Operator pre-start checks include work area, communication system, safety devices, brakes, steering, tyres and running gear
* BI-05P.04 Skilled and experienced personnel are accountable for specifying and selecting mobile equipment and mobile equipment components
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| CFM.2EP-07 Routine overloading of vehicles  | *Routine overloading of all vehicle types caused by:** *Loaded incorrectly - overloaded and position of heavy objects*
* *Personnel are unaware or do not understand the requirement for operating LV/HV Vehicles on site (travel routes, vehicle capabilities etc.)*
* *Misunderstanding load stability e.g. semi-liquid loads*
 | * BI-05D.04 Position descriptions that specify expected supervisor performance
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| CFM.2EP-08 CAS/PDS alarm failure to operate | *Alarm fails to operate caused by:** *Less than 8 volt (or required) supply*
* *Shorted to ground*
* *Alarm system is not fail to safe*
* *GPS or LIDAR Sensor failure / circuit failure (e.g. arising from physical damage. Will prevent sensing of nearby items or incorrectly determine location, orientation and/or speed)*
* *Software version is incorrect*
* *Backup battery flat (parked vehicle no longer CAS enabled)*
* *Cables or 24 Pin Deutsch connector not in contact (CAS faults, possibly spuriously)*
* *Speaker fault/failure (limits ability to warn operator - screen brightening only)*
* *Failing to detect CAS fault during pre-start*
 | * BI-04P.01 Vehicle interactions are considered as part of the short-term planning processes
* BI-04S.04 Access barrier performance - regular inspection and maintenance of barriers for access - boundary fencing and work area barriers
* BI-05S.05 Appropriate system for scheduled inspections include structured checklists and defect reporting
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| CFM.2EP-09 CAS/PDS fails to notify the operator | *System fails to notify the operator, caused by:** *Hardware sensing, on-board main processor, operator interface fault*
* *Software / configuration version is incorrect*
* *Failure of the screen/screen fault*
* *Prevailing work environment conditions prevent the CAS/PDS from triggering an alert/alarm (dust, conductive/magnetic rock, etc.)*
 | * BI-02D.04 Processes for confirming that new to site vehicles meet site specifications including vehicle lights, signage and markings (Intro to Site)
* BI-02P.01 All safety and operational systems on mobile equipment are maintained
 |
| CFM.2EP-10 Work environment conditions impeded operation of technologies | *Technological systems (fatigue, PDS, CAS, etc.) impaired, caused by:** *Prevailing weather (including sunlight)*
* *Dust (particularly conductive dusts)*
* *Water and humidity conditions*
* *Acidity or chemical attack on sensors*
* *Extremes of heat*
 | * BI-02D.01 Fit-for-purpose equipment selection and site use approval processes
* BI-02P.04 Regular checking and maintenance of alarms, monitors, cameras and other warning devices
* BI-05P.04 Skilled and experienced personnel are accountable for specifying and selecting mobile equipment and mobile equipment components
 |
| CFM.2ES-01 Compromised vehicle cabin no longer meets OEM or site specific specifications  | *Compromised vehicle cabin fails to withstand impact (at, over or below FOPS / ROPS rating), caused by:* * *Corrosion of / damage to structural elements*
* *Excessive load applied*
* *Penetration by "sharp" parts of colliding vehicle / structure*
 | * BI-01P.20 Skilled and experienced personnel are accountable for maintaining mobile equipment
* BI-01T.01 Required emergency checks before vehicle operation - information for operator by vehicle type.
* BI-02D.02 Standards that set minimum requirements for cabin integrity, restraints, access and escape, auto shutdowns and other relevant protective systems
* BI-02P.02 Regular checking and maintenance for cabin integrity, restraints, access and escape, auto shutdowns and other relevant protective systems
* BI-02S.05 Protocols for the calibration of key measuring equipment
 |
| CFM.2ES-02 Installed equipment system status alarms do not operate | *Equipment system status alarms do not operate, caused by:* * *Less than 8 volt supply*
* *Alarm system is not fail-to-safe*
* *Sensor failure / circuit failure*
* *Shorted to ground*
* *Software version is incorrect*
 | * BI-01T.01 Required emergency checks before vehicle operation - information for operator by vehicle type.
* BI-02P.01 All safety and operational systems on mobile equipment are maintained
* BI-02S.30 Equipment systems data send
* BI-02T.30 Component alarm or safety device, alarm and data send on fault
* BI-03S.20 Speed and other operating parameter data send
* BI-04S.20 Proximity detection data send
* BI-05P.04 Skilled and experienced personnel are accountable for specifying and selecting mobile equipment and mobile equipment components
 |
| CFM.2ES-03 Seat belt use indicators disabled or compromised  | *Seat belts non-use not detected, caused by:** *Indicators are disabled*

*Seat belt indicator confirms use, but the belt is fastened behind the vehicle operator* | * BI-02D.02 Standards that set minimum requirements for cabin integrity, restraints, access and escape, auto shutdowns and other relevant protective systems
* BI-02P.04 Regular checking and maintenance of alarms, monitors, cameras and other warning devices
* BI-02P.11 Protocols that detail how the status of vehicle alarms and monitors are checked prior to use
* BI-05P.06 Structured line and functional support for supervisors when applying site performance management processes
 |
| CFM.2ES-04 Overload warning system fails is incorrect or absent | *Equipment to provide load information fails or is incorrect, caused by:** *Overload warning system fails when 20% overloaded*
* *Tare of the load cells/measuring device resets on tip even though carry back remains in the tray/tub*
* *Mismatch between payload and tyre selection/monitoring systems*
 | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-02S.05 Protocols for the calibration of key measuring equipment
 |
| CFM.2ES-05 Over speed warning alarm fails to operate | *Over speed warning alarm fails to operate, caused by:** *Calibration error*
* *Component or safety system not working when required*
* *System or configuration failures*
* *Incorrect geofencing or speed area settings*
* *Sabotage of the speed sensing system*
 | * BI-01P.20 Skilled and experienced personnel are accountable for maintaining mobile equipment
* BI-02D.53 Operator display specifications are detailed for mobile equipment
* BI-02P.05 Regular checking and maintenance of speed measuring systems
* BI-03S.20 Speed and other operating parameter data send
* BI-05S.05 Appropriate system for scheduled inspections include structured checklists and defect reporting
 |
| CFM.2ES-06 Speedometer does not indicate actual speed | *Speedometer does not indicate actual speed, caused by:** *Calibration error*
* *Component or safety system not working when required*
* *Tyre changes (particularly changed type) leads to speed monitoring errors*
* *Changed to miles/hr from km/hr*

*Confusion on dual scale (e.g. Hitachi trucks)* | * BI-02P.05 Regular checking and maintenance of speed measuring systems
* BI-05S.05 Appropriate system for scheduled inspections include structured checklists and defect reporting
 |
| CFM.2ES-07 Multiple vehicles system alarms overwhelm and confuse the operator | *Operator ceases to pay attention to alarms, caused by:** *Alarms providing multiple operational and safety information are constantly sounding*
* *Multiple onboard systems have confusing alarms*
* *Proximate equipment triggers alarms (e.g. during normal loading operations) and obscure specific alarm required from entry of a new person or machine*
 | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-01S.03 Consultation and communication on safety and health
* BI-02D.10 Operator ergonomics are considered for controls and before introducing vehicle alarms and other aids
* BI-02D.53 Operator display specifications are detailed for mobile equipment
 |
| CFM.2ES-99 In vehicle fatigue monitoring and alerting system fails | *In vehicle fatigue monitoring and alerting system fails, caused by:* *False negative or equipment failure*  | * BI-01S.50 Introduce technology to support existing fatigue management approaches
* BI-01S.51 Fatigue status data send (off vehicle review)
* BI-01T.50 Fatigue alert alarms
 |
| CFM.2ET-01 OEM supplied seat belts are disabled or removed  | *Seat belts are affected by:** *Maintainers:*
	+ *Removing key elements*
	+ *Disabling or defeating belt buckle secured devices*
	+ *Damaging restraint connections or materials when repairing nearby elements of the cabin*
* *Operators:*
	+ *Clipping the restraint behind themselves*
	+ *Using an unconnected buckle in the clip (signaling belt on when not)*
 | * BI-02P.01 All safety and operational systems on mobile equipment are maintained
* BI-02P.06 Operator pre-start checks include work area, communication system, safety devices, brakes, steering, tyres and running gear
 |
| CFM.2ET-02 Fitted airbags fail to deploy | *Fitted airbags fail to deploy, caused by:* * *Equipment failure*

*Third party fitted equipment prevents OEM designed triggering sequence e.g. bull bars and rollover protection*  | * BI-02P.02 Regular checking and maintenance for cabin integrity, restraints, access and escape, auto shutdowns and other relevant protective systems
 |
| CFM.2ET-03 Routine false positive alarms  | *Routine false positive alarms result in a true positive (real) alarm being ignored* | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-02D.10 Operator ergonomics are considered for controls and before introducing vehicle alarms and other aids
* BI-02P.04 Regular checking and maintenance of alarms, monitors, cameras and other warning devices
 |
| CFM.3VD-01 Inadequate mine traffic management plan (specification) | *Opportunities to minimise vehicle interactions through good practice mine planning are not applied, caused by:* * *Failure to include road segregation requirements*
* *HV or other vehicles must turn in front of loaded HV’s due to scheduling or road network design*
* *Planners not adopting site/corporate guidelines for road construction or production scheduling (including lack of resources or understanding)*
* *Allowance not made for clearance from fixed/overhead structures (including clearance to drive walls)*
* *Failure to include road segregation in issued plans*
* *Failure to consider orientation of roadways (particularly ramps) with reference to sunset/sunrise or facility lights*
* *Failure to have U/G traffic controls*
* *Not providing and/or updating a surface and U/G map of traffic flows*
 | * BI-04D.21 Road design guidelines specify minimum parking area requirements
* BI-05D.01 Clear accountabilities for managers, superintendents and supervisors are included in comprehensive, site relevant road design guidelines and traffic management plans
* BI-05D.02 Clear accountabilities for planners are included in comprehensive and site relevant road design guidelines and traffic management plans
* BI-05D.99 There is a documented site Traffic Management Plan
* BI-05P.03 Consultation and communication on HSMS and traffic management plan
 |
| CFM.3VD-02 Reducing vehicle interactions through intersection design and traffic rules is inadequately considered in mine design and routine work planning | *Intersection designs compromised, caused by:** *Failing to provide or consider sight lines from vehicle operator positions*
* *Acute angle entries to intersections*
* *Horizontal or vertical radii at intersections not matched to deployed vehicles*
* *Intersections in close proximity to each other (i.e. either not specifying or not honouring required straight run distances between intersections)*
 | * BI-04P.01 Vehicle interactions are considered as part of the short-term planning processes
* BI-05D.99 There is a documented site Traffic Management Plan
 |
| CFM.3VD-03 Speed limits and over-speed management are inadequately considered in mine design and routine work planning | *Over-speed management is inadequately considered in mine design and work planning, caused by:* * *Not setting the speed limit correctly (too high for geometry/traffic or too low and encouraging non-conformance)*
* *Setting cresting speed limits but not delineating the crest*
* *Decline gradient or gradient not considered*
 | * BI-01P.07 Site specific travelling speed information prepared for vehicle operators
* BI-04P.01 Vehicle interactions are considered as part of the short-term planning processes
* BI-05D.99 There is a documented site Traffic Management Plan
* BI-05S.03 Hazard and incident reporting processes are effective and well used
* BI-05S.07 Senior management review, update, and confirm the Traffic Management Plan as being fit-for-purpose
 |
| CFM.3VD-04 Vehicle parking, including emergency parking is inadequately considered in mine design and routine work planning  | *Mine design processes do not allow for parking, including:** *Not providing level areas near high traffic locations*
* *Requiring large vehicles to negotiate tight turns or narrow entries into high traffic parking areas*
* *Limiting the options for run-out's etc. for emergency park up for suspected fire situations etc.*
* *Layouts that do not include dedicated pedestrian walkways from park-up locations to the workshop, lunch-room, etc.*
 | * BI-02P.20 Tyre hazard awareness for equipment operators
* BI-04D.21 Road design guidelines specify minimum parking area requirements
* BI-04P.02 Around vehicle inspection or use of spotters to identify hazard before moving
* BI-04P.12 Established requirements for parking and resting in vehicles
* BI-04P.13 Established requirements for approaching parked mobile equipment in operational areas.
* BI-05D.99 There is a documented site Traffic Management Plan
* BI-05S.02 Effective incident reporting, investigation with effective corrective actions
* BI-05S.07 Senior management review, update, and confirm the Traffic Management Plan as being fit-for-purpose
 |
| CFM.3VD-05 Reducing vehicle interactions through segregation is inadequately considered in mine design and work planning  | *Mine planning process fails to identify opportunities to minimise interaction, caused by:** *planners not adopting site/corporate guidelines*
* *no expectation/allowance for separation and design of parking areas*
* *not allowing for segregation of people and mobile equipment (particularly for high traffic locations U/G)*
* *failure to include road segregation where possible in pit development*
* *HV have to turn in front of loaded HVs*
* *Planners fail to provide sufficient sight lines in designs*
* *Planners fail to consider any CAS/PDS provided heatmap information or geofencing capabilities*
* *Not considering mining front and other work environment factors when plotting/loading geofence information into CAS/PDS*
 | * BI-01P.15 Minimum requirements for demarcation (guard rails, windrows, bunds) and warning devices (chains, cones, flagging) - information prepared for operators
* BI-03S.05 Infrastructure protection - placement of barriers and/or warning devices to prevent unwanted vehicle interactions
* BI-04D.03 Road design guidelines specify walkway designs considering vehicle sight lines
* BI-04P.01 Vehicle interactions are considered as part of the short-term planning processes
* BI-05D.02 Clear accountabilities for planners are included in comprehensive and site relevant road design guidelines and traffic management plans
* BI-05D.99 There is a documented site Traffic Management Plan
* BI-05P.01 Shift to shift communication
* BI-05P.02 Site change management process apply to changes in equipment, road networks and traffic flows
* BI-05S.07 Senior management review, update, and confirm the Traffic Management Plan as being fit-for-purpose
 |
| CFM.3VD-06 Loading requirements for vehicles inadequately considered in mine design, equipment selection and work planning | *Failure to consider loading requirements - can lead to issues such as:* * *Size of vehicle plus load being too large for mine openings*
* *Poor equipment selection - not matched to required loads*
* *High traffic areas (stockpiles, loading areas, workshops) not adequately considered in designs*
* *Clay, carry-back, or other bulk materials properties not adequately considered in equipment selection/design*
 | * BI-05D.99 There is a documented site Traffic Management Plan
* BI-05P.01 Shift to shift communication
* BI-05P.02 Site change management process apply to changes in equipment, road networks and traffic flows
* BI-05P.04 Skilled and experienced personnel are accountable for specifying and selecting mobile equipment and mobile equipment components
* BI-05P.05 Skilled and experienced personnel are accountable for determining the operating parameters for mobile equipment use
* BI-05S.07 Senior management review, update, and confirm the Traffic Management Plan as being fit-for-purpose
 |
| CFM.3VD-07 Poorly designed intersection/break-away  | *Intersections and associated corner pillars pose a hazard to vehicle movements, cause by:** *Designing level break off from ramp/decline at a switch-back or other tight radius turn*
* *Acute angle of entry from a level access to a higher traffic roadway*
* *Ground conditions in the design location of the intersection requiring a smaller span and so tightening up the entry angles at the turning point*
* *Inadequate design guidelines or training for planners in guideline requirements*
* *Intersection standards and layouts vary across the operation*
 | * BI-03D.01 Road design guidelines set minimum standards for the construction and maintenance of the road network
* BI-03P.02 Lighting, delineation and signs are installed and maintained to standards that meet minimum site road design requirements
 |
| CFM.3VP-01 Inadequate implementation of site traffic management plan | *Site management does not consistently implement mine traffic plans to an adequate standard, caused by:* * *Lack of knowledge and operational experience e.g. setting speed limits*
* *Failure to adequately communicate changes*
* *Failure to regularly review and improve operating environment e.g. delineators (presence and spacing), intersection demarcation and/or lighting*
* *Failure to regularly review Traffic Management Plan*
* *Road, intersections and barriers layouts designed, constructed and maintained without referencing Site/Corporate guidelines, standards and external regulation.*
* *Failure to communicate new requirements and update documentation e.g. speed limits on ramps*
* *Failure to factor in CAS/PDS heatmap or operator non-conformance reports into short term traffic flow/traffic management plans*
 | * BI-04P.01 Vehicle interactions are considered as part of the short-term planning processes
* BI-05P.02 Site change management process apply to changes in equipment, road networks and traffic flows
* BI-05P.03 Consultation and communication on HSMS and traffic management plan
* BI-05S.07 Senior management review, update, and confirm the Traffic Management Plan as being fit-for-purpose
 |
| CFM.3VP-03 Operational personnel do not maintain minimum standards for berms, windrows and other zone protection. | *Operational personnel are unaware of requirements for maintaining zone protection structures:** *remote operation stand*
* *bumper blocks*
* *Dumps - poorly protected edges or poor operating at dump edges*
* *Parking areas for HV and LV not designated and protected*
* *Structures not adequately protected*
* *Remote control operating positions not adequate/used*
* *Lack of Monitoring how well pit permit rules followed for shutting down location, Dozer Operator and Supervisor to discuss all Level 2, 3 Jobs,*
* *Lack of skill verification/training,*
* *Supervisor inspections aren't thorough due to workload and number of inspections required to be completed,*

*Operators understanding of 1.8 m is variable* | * BI-02S.04 Regular checking and maintenance of infrastructure and fixed plant
* BI-03S.05 Infrastructure protection - placement of barriers and/or warning devices to prevent unwanted vehicle interactions
* BI-04D.03 Road design guidelines specify walkway designs considering vehicle sight lines
 |
| CFM.3VP-05 Vehicles are operated outside specified tyre conditions | *Vehicles are operated outside specified tyre/tire conditions for pressure, temperature, speed or load limits, caused by:* * *Unaware or does not understand the requirement for operating LV/HV Vehicles on site (travel routes, vehicle capabilities, critical systems)*
* *Incorrect tyre pressure*
* *Personnel choosing to speed*
* *Degraded tyre/tire conditions (tread, side-wall integrity, etc.) not identified or reacted to*
 | * BI-02P.06 Operator pre-start checks include work area, communication system, safety devices, brakes, steering, tyres and running gear
* BI-02P.08 Regular checking and maintenance of key systems, brakes, steering, rims and tyres
* BI-02P.20 Tyre hazard awareness for equipment operators
* BI-02S.05 Protocols for the calibration of key measuring equipment
* BI-05D.04 Position descriptions that specify expected supervisor performance
 |
| CFM.3VP-06 Obscured or missing signage | *Obscured or missing signage, caused by:* * *Dirty/muddy signage*
* *Missing signs*
* *Poor placement of signs*
* *LV Asset numbers - not visible or legible*
* *Missing work area call signs*
 | * BI-03P.02 Lighting, delineation and signs are installed and maintained to standards that meet minimum site road design requirements
* BI-03P.05 Mobile equipment operators follow road rules and adjust based on conditions and circumstances.
* BI-05S.05 Appropriate system for scheduled inspections include structured checklists and defect reporting
 |
| CFM.3VP-07 Appropriate distances from fixed and overhead structures are not maintained  | *Operators in heavy vehicles fail to keep appropriate distances from fixed and overhead structures or dig/loading units, caused by:* * *Vision / visibility issues (poor sight lines)*
* *Not following routine operating instructions e.g. driving with elevated tray*
* *Not following specific directions e.g. signs, supervisor instructions, work orders etc.*
* *Signage not clear on required clearance*
 | * BI-02S.04 Regular checking and maintenance of infrastructure and fixed plant
* BI-03P.04 Power line working distance management process
* BI-03P.11 Clear requirements for loading of trucks by digger/loader
* BI-03S.05 Infrastructure protection - placement of barriers and/or warning devices to prevent unwanted vehicle interactions
* BI-05S.01 Regular and consistent application of performance management processes
* BI-05S.03 Hazard and incident reporting processes are effective and well used
 |
| CFM.3VP-09 Excessive water (Dust Control) is applied to road surface | *Water truck operator or deployed sprays apply excessive water to road surface, caused by:* * *Spray pattern applied e.g. strip vs spot*
* *Manual application based on judgement and experience of water truck operator or worker deploying manual spray system*

*Spray equipment failure*  | * BI-01P.09 General features by vehicle type - information prepared for operators
* BI-01P.14 Managing road works, including grader operations - information prepared for operators
* BI-03D.03 Competent and site experienced water cart operators
* BI-03P.05 Mobile equipment operators follow road rules and adjust based on conditions and circumstances.
* BI-05S.03 Hazard and incident reporting processes are effective and well used
* BI-05S.05 Appropriate system for scheduled inspections include structured checklists and defect reporting
 |
| CFM.3VP-10 Inadequate work planning means that heavy vehicle operators approach fixed structures that are incidental to achieving operational outcomes | *Inadequate work planning means that heavy vehicle operators approach fixed structures that are incidental to achieving operational outcomes, caused by:* * *Buildings or other structures - poorly sited or poorly protected*
* *Reject bins - not fitted with features to limit unwanted vehicle interactions*
 | * BI-03D.01 Road design guidelines set minimum standards for the construction and maintenance of the road network
* BI-03P.03 Expected routes by vehicle type are effectively communicated.
* BI-03P.05 Mobile equipment operators follow road rules and adjust based on conditions and circumstances.
* BI-03P.11 Clear requirements for loading of trucks by digger/loader
* BI-05D.02 Clear accountabilities for planners are included in comprehensive and site relevant road design guidelines and traffic management plans
* BI-05S.03 Hazard and incident reporting processes are effective and well used
 |
| CFM.3VS-01 Inadequate Inspection of Operating Environment | *Site management does not consistently monitor and review how mine traffic plans have implemented and are being maintained, including:** *Failing to complete inspection reports/cards*
* *Not conducting scheduled heading inspections*
* *Changes being made without reference to the Management of Change process*
 | * BI-05D.01 Clear accountabilities for managers, superintendents and supervisors are included in comprehensive, site relevant road design guidelines and traffic management plans
* BI-05D.02 Clear accountabilities for planners are included in comprehensive and site relevant road design guidelines and traffic management plans
* BI-05P.02 Site change management process apply to changes in equipment, road networks and traffic flows
 |
| CFM.3VT-01 Operations continue when operating environment is significantly compromised  | *Compromised operating environment caused by:** *Storms including electrical storms*
* *Failure of roadways e.g. slumps, washouts, sink holes*
* *Actual or potential geotechnical failures (e.g. inability to allow for spans needed for larger equipment)*
* *Ground support or deformed strata/rock mass impinges on roadway*
* *Fires and smoke*
* *Floods*
* *Precipitation: snow, sleet, rain, hail etc.*
* *Dust*
* *Temperature extremes*
* *Infrastructure potential or actual failure*
* *Potentially explosive atmospheres*
* *Falls of ground or slumping of walls*
* *Weakness of dump or roadway edges (at point of slumping/failing)*
* *Seismic events*
* *Loss of ventilation*

*Animals etc.*  | * BI-03T.01 Ceasing Operations Procedure - compromised operating environment
* BI-03T.05 Lightning and Extreme Weather TARP
 |
| CFM.4TD-01 Access control infrastructure is inadequate | *Access control design and/or construction is inadequate - allowing unauthorised entry of vehicles or people, caused by:** *Construction inadequate to prevent entry*
* *Interface failure on the Automated Barrier System (if applicable)*
 | * BI-01D.02 Protocols for site induction and site and operating areas access
* BI-04P.05 Demarcation when changed road conditions arise including commissioning or live testing is being undertaken
* BI-04S.04 Access barrier performance - regular inspection and maintenance of barriers for access - boundary fencing and work area barriers
* BI-05D.99 There is a documented site Traffic Management Plan
 |
| CFM.4TD-02 Blind spots on heavy vehicles are not considered in workplace layout | *Blind spots on Heavy Vehicles are not considered when deciding on workplace layout (during mine or shift planning), caused by:* * *Location of walkways without adequate sight lines*
* *Failure to establish or improve intersection demarcation and/or lighting*
 | * BI-01P.13 Sight lines and blind spots from outside - information prepared for people who work around vehicles
* BI-04D.03 Road design guidelines specify walkway designs considering vehicle sight lines
* BI-05S.05 Appropriate system for scheduled inspections include structured checklists and defect reporting
 |
| CFM.4TP-01 Operational access control (pedestrian and vehicle) is inadequate | *Access control (pedestrian and vehicle) to operational areas is inadequate - there is routine unauthorised entry of mobile equipment and pedestrians into operational areas.* *Personnel in operating areas do not meet site requirements for PPE, high visibility clothing, lights (cap lamps) alerting devices etc.* | * BI-01D.02 Protocols for site induction and site and operating areas access
* BI-01P.21 PPE, high visibility clothing, lights and alerting devices required in operational areas - information prepared for all personnel
* BI-03S.05 Infrastructure protection - placement of barriers and/or warning devices to prevent unwanted vehicle interactions
* BI-04P.10 Specification covering escorting requirements
* BI-04T.01 Ceasing Operations Procedure - significant interaction threats
* BI-05S.01 Regular and consistent application of performance management processes
 |
| CFM.4TP-02 Vehicle operator does not check pathway after being parked | *Heavy or Light vehicle operator fails to ensure that there is a safe pathway after being parked, caused by:* * *Failure to ensure it is safe to proceed after parking and remaining in equipment*
* *Failure to conduct a walk around inspection before operating vehicle*
 | * BI-01D.01 Trained personnel who are supported by an appropriate and up-to-date training management system
* BI-04P.02 Around vehicle inspection or use of spotters to identify hazard before moving
* BI-04P.12 Established requirements for parking and resting in vehicles
* BI-04P.13 Established requirements for approaching parked mobile equipment in operational areas.
 |
| CFM.4TP-03 Light vehicles stop or park in heavy vehicle blind spots  | *Light vehicle operators drive and park too close to heavy vehicles, caused by:* * *Not meeting site requirements i.e. parking within footprint of HV to for ease of access*
* *Failing to communicate correctly when gaining access to heavy vehicles*
* *Fueling / servicing equipment*
* *LV stopping to give way in front of a HV*
* *Travelling too closely behind a vehicle*
* *Poor siting of parking areas (e.g. requiring trades workers to walk extended distances to service HME’s)*
 | * BI-01P.10 Minimum requirements for parking in any situation - information prepared for operators
* BI-01P.13 Sight lines and blind spots from outside - information prepared for people who work around vehicles
* BI-04D.21 Road design guidelines specify minimum parking area requirements
* BI-04P.02 Around vehicle inspection or use of spotters to identify hazard before moving
* BI-04P.04 Vehicle entering a work area positive communications protocol
* BI-04P.07 Refueling Practices - trained personnel follow site refueling procedures
* BI-04P.08 Pedestrian working in operational area communications protocol
* BI-04P.11 Protocols for working on equipment in production areas
* BI-04P.13 Established requirements for approaching parked mobile equipment in operational areas.
 |
| CFM.4TP-04 Mobile equipment operator or pedestrian does not notify when entering a controlled work area | *Operator fails to notify when entering a specific work area, caused by:* * *Entering a controlled area incorrectly - either poor communication or when unauthorised e.g. driving into a live haul circuit*
* *Failing to make positive communication with nearby vehicles/workers*
* *Inadequate indication of a controlled area*
* *Fails to see sign designating a controlled work area*
* *Geofences not maintained or set up for controlled work area and CAS/PDS fails to signal LO/RO*
* *Personnel do not recognise that maintenance works, commissioning and/or live testing is being undertaken.*
 | * BI-01P.15 Minimum requirements for demarcation (guard rails, windrows, bunds) and warning devices (chains, cones, flagging) - information prepared for operators
* BI-04P.04 Vehicle entering a work area positive communications protocol
* BI-04P.08 Pedestrian working in operational area communications protocol
* BI-04P.11 Protocols for working on equipment in production areas
 |
| CFM.4TP-05 Operator does not meet site requirements when parking  | *Operators routinely park vehicles incorrectly, caused by:* * *Unaware or misunderstand site parking requirements by vehicle type and operating location e.g. what is fundamentally stable*
* *No reminders on emergency and equipment breakdown parking*
* *No consequences for failing to park correctly e.g. non-use of chocks, not fundamentally stable when refueling*
 | * BI-01P.10 Minimum requirements for parking in any situation - information prepared for operators
* BI-01P.12 Sight lines and blind spots by vehicle type - information prepared for vehicle operators
* BI-04P.07 Refueling Practices - trained personnel follow site refueling procedures
* BI-04P.11 Protocols for working on equipment in production areas
* BI-04P.13 Established requirements for approaching parked mobile equipment in operational areas.
 |
| CFM.4TP-06 Incorrect communication protocol  | *Vehicle operator or co-worker does not use correct communication protocol (fails to achieve positive communication) when requesting access to a controlled area, caused by:* * *Makes an access request using a name instead of vehicle identification number*
* *The permission for access is by name rather than by vehicle identification number*
* *An access request is made but vehicle enters before any response*
* *An access request is made with no response and vehicle enters anyway*
* *Wrong identification number used for access request*
* *Incorrect or no communication when approaching a parked heavy vehicle*
 | * BI-02P.07 Prestart radio checks
* BI-02P.30 Regular and timely maintenance of communications systems equipment
* BI-04P.04 Vehicle entering a work area positive communications protocol
* BI-04P.08 Pedestrian working in operational area communications protocol
* BI-04P.14 Positive communication protocol for passing or moving close to a vehicle
 |
| CFM.4TP-07 Reducing vehicle interactions by maintaining clearances is inadequately considered routine work planning | *Work planning processes do not adequately consider the interactions between:** *Mobile equipment units that are undertaking the same task i.e. on the same circuit*
* *Mobile equipment unit interaction between different work groups e.g. owner vs contractor, operations vs surveying, operations and transport shift change etc.*
* *Vehicle interactions and personnel working on the ground e.g. operations and infield maintenance, production and charge up crew etc.*
* *Arrangements set up only considering production requirements and ignoring any potential vehicle interactions that will result*
* *Poor queuing practices at dig units*
 | * BI-04P.01 Vehicle interactions are considered as part of the short-term planning processes
* BI-04P.03 Same direction travelling and queuing separation protocols
* BI-04T.20 Proximity detection, permission lines, alerts, advice, and intervention
* BI-05D.99 There is a documented site Traffic Management Plan
 |
| CFM.4TP-08 Vehicle remains in heavy vehicle blind spot due to intersection approach speeds | *Collision at intersection caused by one vehicle not stopping at intersection where the other vehicle has right of way, caused by:** *HV is unaware of the presence of LV*
* *Moving blind spot due to approach speeds/directions of the moving vehicles*
* *Sight lines obscured by windrows or drive geometries*
 | * BI-01P.06 Give way/Right of Way requirements information prepared for mobile equipment operators and pedestrians
* BI-01P.12 Sight lines and blind spots by vehicle type - information prepared for vehicle operators
* BI-03D.01 Road design guidelines set minimum standards for the construction and maintenance of the road network
* BI-03P.03 Expected routes by vehicle type are effectively communicated.
 |
| CFM.4TS-01 Parked vehicles block view for pedestrians and other equipment operators  | *Parking obstructs view, caused by:* * *HV park and create a blind spot for LV (e.g. around intersections / car parks etc.)*
* *Parking in blind spot*
* *No parking space provided i.e. insufficient space for parking and pedestrian and vehicle traffic*
* *Cameras for equipment operators are turned off, screens are not checked, out of service or not fitted*
 | * BI-01P.10 Minimum requirements for parking in any situation - information prepared for operators
* BI-01P.12 Sight lines and blind spots by vehicle type - information prepared for vehicle operators
* BI-03P.02 Lighting, delineation and signs are installed and maintained to standards that meet minimum site road design requirements
 |
| CFM.4TT-01 Operations continue when there are significant interaction threats  | *Operations continue when there are significant interaction threats for example:** *Unauthorised access (pedestrian or vehicles)*
* *Non reversible equipment travelling underground*
* *During emergency response e.g. travelling ambulance*
* *Failing to brake or veer from an impending collision/unwanted interaction*
* *Operation when key controls (e.g. proximity detection, cameras, etc.) are not functional*
* *TARPs not developed or implemented for CAS/PDS and other interaction threats*
* *Inadvertent operation of remotely controlled equipment with people in proximity*
* *Manually controlled vehicle moves into path of remotely/autonomously controlled vehicle*
 | * BI-04T.01 Ceasing Operations Procedure - significant interaction threats
 |
| CFM.4TT-01S Operations continue when there are significant interaction threats | *Operations continue when there are significant interaction threats, for example:** *Unauthorised access into a work area (vehicles or pedestrians)*
* *During an emergency response (e.g. travelling ambulance)*
* *Requirement to brake or veer from an impending collision*
* *Operation when key controls (e.g. PDS, Cameras, Mirrors, etc.) are not functional*
* *TARPs not developed for interaction threats (i.e. no escalation for non-functional CAS/PDS)*
* *Inadvertent operation of remotely controlled equipment with people in proximity*
* *Manually controlled vehicle moves into the path of remotely controlled or autonomous vehicle*
 | * BI-04T.01 Ceasing Operations Procedure - significant interaction threats
 |
| CFM.5SD-01 Emergency response is inadequate through lack of skill or equipment | *Emergency response is compromised through lack of equipment e.g. unable to quickly release a trapped vehicle operator, caused by:** *Inadequate planning for potential emergency scenarios - equipment not purchased*
* *Poor logistics or maintenance - equipment not in service*

*Emergency response is compromised by unavailability of suitably trained and experienced emergency personnel, caused by:** *Inadequate emergency response planning - personnel not hired or trained*
* *ER personnel not available when requested e.g. minimum numbers for shift emergency response team not met.*
* *Concurrent emergencies*
 | * BI-05D.11 Emergency Preparedness
* BI-05T.11 Strategy for testing, reviewing and maintaining the currency of the emergency response plan
 |
| CFM.5SD-02 Organisation Work Scheduling and Planning is inadequate  | *Organisation processes to identify and manage fatigue and other impairment risks are inadequate (specification), caused by:** *Poor Work Scheduling and Planning:*
	+ *Work scheduling - daily work hours 9-12 hours*
	+ *Work scheduling - daily work hours and work related travel including commute of 13+ working hours*
	+ *Work scheduling not considered for staff hours e.g. supervisor attendance for next shift handovers*
	+ *Work Scheduling of greater than 48 hours per week*
	+ *Work scheduling over 624 hours in a three month period*
	+ *Irregular and unpredictable hours, short notice of schedule, extended overtime, on call across shift cycle*
* *Shiftwork and Night Work:*
	+ *Shift length is greater than 10 hours*
	+ *Shift work includes afternoon shifts and night shifts*
	+ *Shift work suboptimal design of speed and direction or shift backward rotation (night/evening/morn) and slow rotation (weekly/3-4 week)*
	+ *Sequential night shifts (6 or more 8 hour shifts high, 5 or more 10 hour shifts or 4 or more 12 hour shifts)*
	+ *Shifts end after 10 PM and before 6 AM*
* *Less than adequate breaks:*
	+ *Infrequent or no breaks during work*
	+ *Non-working period following nightshifts is < 48 hours*
	+ *Split shifts extend over 13 hours*
	+ *Breaks between shifts do not provide adequate sleep opportunity (considering time for eating, washing, personal commitments etc.)*
 | * BI-01S.50 Introduce technology to support existing fatigue management approaches
* BI-01S.51 Fatigue status data send (off vehicle review)
* BI-01T.50 Fatigue alert alarms
* BI-05D.05 Site fatigue management processes are comprehensive and optimise work rosters
* BI-05S.06 Comprehensive fitness for work process includes alcohol and other drugs
 |
| CFM.5SD-03 Work Environment and Work Demands result in Fatigued Mobile Equipment Operators  | *Physical and Mental Demands of Work** *Highly repetitive work*
* *High concentration work, with high demands over an extended period of time*
* *Highly physically demanding work that results in muscle fatigue*
* *Sustained and/or complex physical or mental effort*

*Work Environment* * *Exposure to hazardous substance at close to relevant exposure standard*
* *Exposure to long duration noise levels*
* *Exposure to extreme temperatures*
* *Exposure to vibration for long periods*
 | * BI-01S.50 Introduce technology to support existing fatigue management approaches
* BI-01S.51 Fatigue status data send (off vehicle review)
* BI-01T.50 Fatigue alert alarms
* BI-05D.05 Site fatigue management processes are comprehensive and optimise work rosters
* BI-05S.07 Senior management review, update, and confirm the Traffic Management Plan as being fit-for-purpose
 |
| CFM.5SD-04 Insufficient resources applied to minimise unwanted vehicle interactions | *Insufficient resources are allowed for/applied to minimise unwanted vehicle interactions, including not:** *providing vehicles for workers required to move around U/G workings*
* *allowing for lighting and segregation/delineation devices (including their maintenance)*
* *making provision for segregated roadways (surface and U/G)*
* *failing to provide efficient (e.g. electronic) means of capturing information on the site's vehicle interactions*
 | * BI-05D.99 There is a documented site Traffic Management Plan
* BI-05S.07 Senior management review, update, and confirm the Traffic Management Plan as being fit-for-purpose
 |
| CFM.5SD-05 Failing to adequately communicate changes or consider impacts on site culture | *Introduction of technology leads to conflicts on site, caused by:** *Not communicating across all levels about the implications of the technology being introduced*
* *Actual or perceived breach of individual privacy rights*
* *Not considering site culture when selecting and implementing technology*
 | * BI-02D.01 Fit-for-purpose equipment selection and site use approval processes
* BI-05P.02 Site change management process apply to changes in equipment, road networks and traffic flows
* BI-05P.03 Consultation and communication on HSMS and traffic management plan
 |
| CFM.5SP-01 Inadequate management of change | *Inadequate management of change - caused by:* * *Changes made to engineering of mobile plant not included in process*
* *Operational changes (routes, roads, numbers) not identified as a change and process not applied*
* *Changes to segregation (e.g. removal of berm/centre bund) not identified as a change*
* *Selected plant/kit/components do not meet site requirements*
* *Changes in company standards not considered or reacted to*
* *Steering or braking compromised by engineering changes*
* *New personnel with limited training in or understanding of MoC requirements*
 | * BI-02D.01 Fit-for-purpose equipment selection and site use approval processes
* BI-05D.09 Change Management Process
* BI-05D.99 There is a documented site Traffic Management Plan
* BI-05P.01 Shift to shift communication
* BI-05P.02 Site change management process apply to changes in equipment, road networks and traffic flows
 |
| CFM.5SP-02 Inconsistent application of performance management processes (Supervisors and Management) | *Supervisors or more senior personnel are inconsistent with enforcement consequences for operator / worker non compliance, caused by:* * *Being too production focused and not prioritising safety*
* *Poor employee performance review and development processes*
* *Unaware of disciplinary / grievance procedures*
* *Supervisor not making necessary inspections, visiting locations, reviewing mimics to be aware of vehicle operator behaviours/performance*
 | * BI-01P.21 PPE, high visibility clothing, lights and alerting devices required in operational areas - information prepared for all personnel
* BI-01S.01 Clear operator performance management expectations supported by an active and consistent performance management process
* BI-05D.04 Position descriptions that specify expected supervisor performance
* BI-05P.06 Structured line and functional support for supervisors when applying site performance management processes
* BI-05S.01 Regular and consistent application of performance management processes
 |
| CFM.5SS-01 Inadequate monitoring that mine traffic management requirements have been implemented and are being maintained | *Caused by:** *Review or audit schedule does address traffic management*
* *Review or audit schedule not followed*
* *People reviewing or auditing traffic management plan lack skills or experience*
* *Traffic management issues are raised but resolved*
* *Excessive traffic congestion not identified or raised as an issue*
 | * BI-01P.02 Task expectations are well communicated and reinforced over the work shift.
* BI-01S.03 Consultation and communication on safety and health
* BI-05D.02 Clear accountabilities for planners are included in comprehensive and site relevant road design guidelines and traffic management plans
* BI-05D.03 Effective contractor management processes
* BI-05D.99 There is a documented site Traffic Management Plan
* BI-05P.01 Shift to shift communication
* BI-05P.02 Site change management process apply to changes in equipment, road networks and traffic flows
* BI-05P.03 Consultation and communication on HSMS and traffic management plan
 |
| CFM.5SS-02 Vehicle operator fails to comply with site requirements | *Mobile equipment operator or pedestrian fails to comply with site requirements, caused by poor Mobile Equipment Operation: Deliberate act, lapse or error when working with, in or around mobile equipment* * *Failure to follow operating instructions e.g. forklift driving with elevated load*
* *Driving in a competitive manner (racing to intersection, travel speed etc.)*
* *Ignoring directions or instructions in site communications (signs, work orders, supervisor given)*
* *Defeating or damaging speed, proximity or other alarm system*
* *Use of Personal Electronic Devices outside site rules and requirements*
* *Right of way rules not being followed*
* *CAS/PDS reports not reviewed to identify non conformances with site requirements*
 | * BI-01P.01 Trained, Competent and Authorised Mobile Equipment Operators
* BI-01P.02 Task expectations are well communicated and reinforced over the work shift.
* BI-01S.01 Clear operator performance management expectations supported by an active and consistent performance management process
* BI-01S.03 Consultation and communication on safety and health
* BI-05D.03 Effective contractor management processes
 |
| CFM.5SS-03 No aggregated monitoring and response to alarms  | *Not responding to Fatigue, CAS/PDS, over-speed and other abusive shift type reports, caused by:** *Supervisors etc. not understanding the output of the systems*
* *Lack of responsibility for/ownership of the system outputs*
* *System reports not accessible by supervisory personnel*
* *Interference (e.g. manual editing) or data logs*
 | * BI-01P.07 Site specific travelling speed information prepared for vehicle operators
* BI-02P.05 Regular checking and maintenance of speed measuring systems
* BI-03S.20 Speed and other operating parameter data send
 |
| CFM.5SS-04 Equipment faults arising from poor standard of maintenance | *Equipment faults and early failure caused by:* * *Incomplete execution of work orders by maintainers;*
* *Damaged or incorrect components installed by maintainers;*
* *Lack of checking on task completion - not detecting incomplete repair, missing bolts, screws or securing nuts, tools, rags and consumables left in/on machinery*
 | * BI-01P.20 Skilled and experienced personnel are accountable for maintaining mobile equipment
* BI-02P.01 All safety and operational systems on mobile equipment are maintained
* BI-02P.02 Regular checking and maintenance for cabin integrity, restraints, access and escape, auto shutdowns and other relevant protective systems
* BI-04P.02 Around vehicle inspection or use of spotters to identify hazard before moving
* BI-05P.04 Skilled and experienced personnel are accountable for specifying and selecting mobile equipment and mobile equipment components
 |
| CFM.5SS-05 Unit key system alarms are not monitored  | *Key alarm systems such as brake, speed, steering, fatigue are not monitored due to:** *Alarm systems not being included in maintenance strategies (and progressive loss of functionality over time)*
* *Deployed fleets not having a dedicated system (e.g. SMS/email) or resource (e.g. control room operator) in place post commissioning and into longer term operations*
* *Not including any reports on monitoring system health in work order close out reports considered by senior managers on site*
 | * BI-01P.08 Alarm and Vehicle information panel expected response - information prepared for Operators
* BI-02D.10 Operator ergonomics are considered for controls and before introducing vehicle alarms and other aids
* BI-02P.04 Regular checking and maintenance of alarms, monitors, cameras and other warning devices
* BI-02P.11 Protocols that detail how the status of vehicle alarms and monitors are checked prior to use
* BI-02S.06 New communications or technology equipment, specification, test and commissioning process
* BI-02S.30 Equipment systems data send
* BI-02T.30 Component alarm or safety device, alarm and data send on fault
 |
| CFM.5ST-01 Emergency response is significantly delayed | *Emergency response takes too long, caused by:** *Delayed request for emergency assistance*
* *Incorrect emergency call or poor communications*
* *Emergency responders are unsure of location, go to incorrect location*
* *The emergency location is distant or difficult to access*
 | * BI-05D.01 Clear accountabilities for managers, superintendents and supervisors are included in comprehensive, site relevant road design guidelines and traffic management plans
* BI-05D.11 Emergency Preparedness
* BI-05T.11 Strategy for testing, reviewing and maintaining the currency of the emergency response plan
 |
| CFM.5ST-10 Regulator prosecution  | *The regulator responds to a mobile equipment incident, including caused by:** *Ordering operations to cease until changes are made*
* *Failing to review procedures and management plans when legislation or licenses change*
* *Launching enforcement proceedings against the company*
* *Launching enforcement proceedings against company officers*

*The consequences for the operating site include a loss of production, legal costs, increased operating costs, reputational damage, prosecutions and fines* | * BI-01S.02 Pre-commencement and periodic medicals for mobile equipment operators
* BI-05D.12 External to site obligations are effectively met and information is controlled
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