I CAN SEE CLEARLY NOW - THE “BLIND SPOT” HAS GONE!

ARE YOUR VEHICLES / EQUIPMENT COMPLIANT TO ISO 5006 / 16001
“OPERATORS VISIBILITY / PROXIMITY DETECTION?”

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Vehicle to Vehicle (V2V), Vehicle to Person (V2P) and Vehicle to Infrastructure (V2I) interactions are still one of the most significant OH&S mitigation challenges facing many Industries, where vehicles, infrastructure and people interact.

In Queensland Mining / Quarrying alone, more than 23% of HPI Hazards are related to Vehicles as reported by the Department of Natural Resources and Mines.

According to a recent report of a Loader Reversing over a Light Vehicle Incident (Safety Alert No 342 dated 5th June 2017) by the Queensland Department of Natural Resources and Mine (DNRM):

"Vehicle interactions are the second highest cause of serious accidents and high potential incidents in Queensland mineral mines and quarries. Vehicle interactions have resulted in several fatalities to date"

The below is an example of the reported HPI's (High Potential Incidents) for the state Queensland and only within the Mining / Quarrying Industry.

If one was to compile statistics from other states and industries the occurrence of V2P, V2V and V2I is as significant –if not higher– with thousands of HPI's / annum in Australia - many resulting in Injury and Fatality.

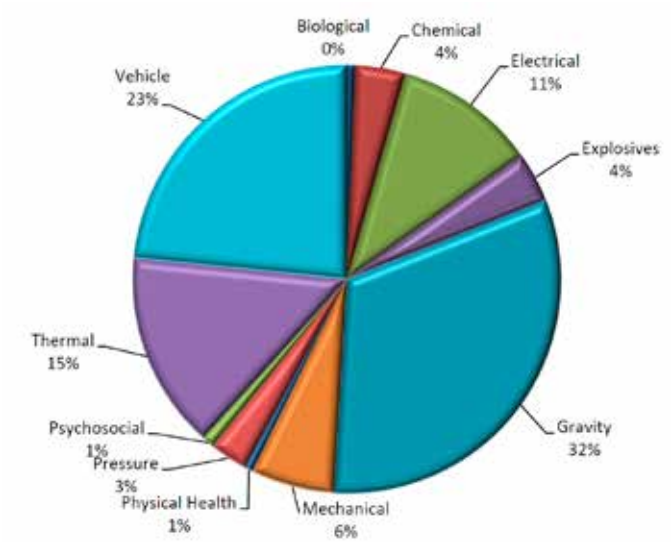

Figure 1: March 2017 DNRM Report- Hazard Category.
Of this Vehicle Hazard Category 74% are related to V2V, V2P and V2I Integrations.

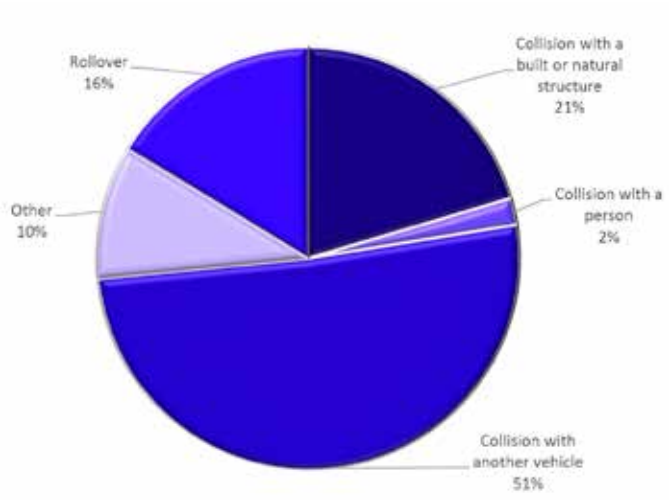

Figure 2: July- March 2017 DNRM Report- Vehicle Hazards.

Mitigation / Collision Avoidance / ISO 5006 / 16001

There are numerous Standards / Guidelines for mitigation of Operator Visibility / Proximity Detection around machines / equipment / vehicles.

One specific Standard that is also utilised and adopted in other Industry Standards or Guidelines is the ISO 5006 (16001) Standards for Earthmoving Equipment- Operators Visibility, developed > 20 years and made a full Standard in 2006.

The ISO 5006 clearly states: "The purpose of this International Standard is to address operator's visibility in such a manner that the operator can see around the machine (360 deg) to enable proper, effective and safe operation that can be quantified in objective engineering terms.

The ISO 5006 (and 16001) is specified / endorsed / mandated internationally to mitigate "blind spot" incidents by many safety / health authorities and industries. A few examples are:

- ISO 5006 and ISO16001 Standards
- S.A.E. J1091 (USA).
- Safety in Mines Research Advisory Committee- COL 451 Specification- Report (South Africa).
- NIOSH / MSHA / CDC (USA).
- Trade and Investment- Mine Safety (NSW)- MDG2007.
- Western Mining- WMC Specifications for Surface + EM +Surface Mobile Equipment 1999.
- Health & Safety Executive (HSE- UK) Assessing Field of Vision for Operators of Earth Moving Machinery on Construction Sites.

The ISO 5006 / 16001 is already adopted / adapted in many specifications / guidelines for various equipment / vehicles not only in the Mining / Earthmoving Industry but also Materials Handling (eg Forklifts), Quarrying, Agriculture, Construction (eg Cranes), Public Transport, Waste Vehicles, On / Off Road Transport, etc.

The following endeavours to provide the reader with some “food for thought” when considering their strategy in implementing technologies to mitigate safety issues associated with Vehicle to Vehicle (V2V), Vehicle to Person (V2P) and Vehicle to Infrastructure (V2I) interactions- primarily caused by restricted Operator Visibility / “Blinds Spot” around machines / vehicles / equipment.

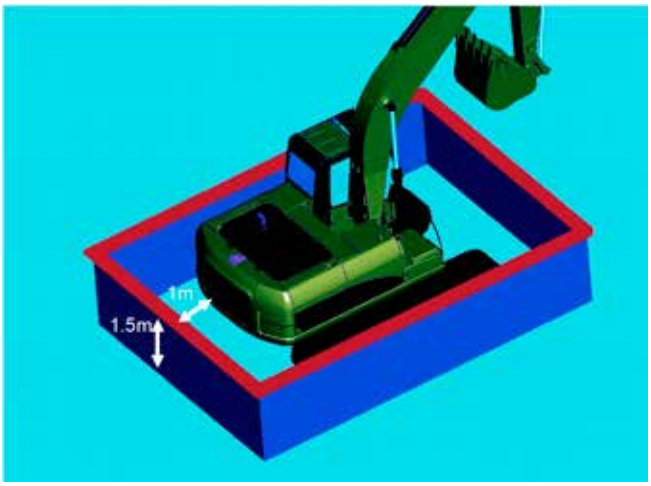

Figure 3: ISO 5006 specifies visibility on a machines boundary line of 1.0 metre / 1.5 metre (H)- on a circle of a 12.0 metre radius.

What are the Major Causes and Contributors?

It is acknowledged clearly by worldwide Industry Reports / Statistics and established Standards that approximately 80%- 90% of Fatalities, Injury and HPI’s involving V2V, V2P and V2I interactions are a result (or a significant factor), of restricted Operator Visibility around vehicles / equipment- “blind spots”.

They occur predominately:
- At low speeds of 0- 10 kilometres / hour.
- In situations where there is close proximity.
- Primarily Rearward travel- no visibility.

First Step - Risk Analysis

When considering technology to mitigate Fatalities, Injury and HPI’s, associated with V2V, V2P and V2I interactions, there is some trepidation as to where to start and what technology should be implemented.

It is acknowledged that the first step is to complete a thorough and detailed RA (Risk Analysis- Assessment) in providing a solution that can meet ALARA (As- Low-As- Reasonably- Achievable) / Zero Harm objectives.

Whilst many aspects of safety involving machines and human asset interaction are common, there are some different requirements when dealing with differing industries, applications, machines, operational environments, etc (eg Under- ground vs Above-ground) Mining / Earthmoving Operations.



Figure 4: Operator visibility is not the only issue- so is RSI neck / back injury claims.

Procedural / Non- Technology Mitigation

Part of an initial RA is to also consider what administrative / non- technology / procedural tools could also be utilised to mitigate Fatalities, Injury and HPI's, associated with V2V, V2P and V2I interactions.

For example:
- Berms at intersections to stop HME from "cutting corners".
- Road rules for overtaking.
- Elimination of service vehicles and personnel from Haulage roads- Service / Haulage Road separation.
- Pedestrian berm walkways- especially in Park- up areas.
- Restriction on number of intersections- Haulage road design.
- Restrict rearward travel where possible (eg forward only into / out of workshops).

So, what Technology(s) do we now implement?

What lines of "Defence" technology should be considered when endeavouring to mitigate Fatalities, Injuries and HPI's involving associated V2V, V2P and V2I interactions?

A combination of all "Defences" will also need on-going scrutiny, management and evaluation, to achieve ALARA and meet "Zero Harm" objectives, facilitate all stakeholders' acceptance and support.

Defence #1: Operator Visibility.
- Implement the ISO 5006 / 16001 to eliminate "blind spots" with the use of "Visual Aids" such as Mirrors and CCTV Systems.
- This should mitigate more than >90% of such incidents. The ISO5006 / 16001 Standards are excellent guidelines to assist with selection of your primary Defence Technology and how to assess the machine for visibility.
- Camera Systems are stand- alone technology that require little maintenance and no separate infrastructure (eg telemetry) to support them.
- Investment is minimal.

Defence #2: Proximity Warning / Detection Systems.
- Radar Sensors are robust and reliable Proximity Detection devices.
- These devices however are used to augment Defence #1 / Visibility. ISO 5006 (16001) identifies such devices for "Hazard Detection" and can only be used in "exceptional" circumstance on their own and in place of Camera / "Visual Aids".
- Hazard Detection (HD) are secondary devices that compliment Defence #1 so as reduce Operator interaction (changing camera views) and to "prompt / warn" the Operator to view the Camera Display or to automatically initiate a camera view should an object be detected.
- One also needs to consider the risk in using such devices as a primary Safety defence, as they are do not provide / replace Visibility.
- Hazard Detection / Proximity devices, require little maintenance and no separate infrastructure to support them.
- Investment is minimal.

Defence #3: Fleet Track / Positioning / Situation Awareness
- Usually consist of RF and / or GPS / Telemetry Systems.
- These systems are primarily utilised for Fleet Management Productivity / Despatch / Vehicle information and positioning of plant.
- Will provide management information for vehicle congestion, setting no- go zones (eg blast areas, overhead power lines, etc), gather non- compliance events (contravening speed, intersection stops), mapping of haul roads, etc.
- May provide some degree of mitigation of events in the previous point. And in these situations, mitigation may be better served by other methods and non-technology / procedural intervention.
- These devices / systems require extensive maintenance, service support contracts for software / data / hardware updating, support infrastructure and personnel to monitor / report data.
- Are usually designed for primarily production fleet (eg Dump Trucks / Excavators) or stationary plant (eg Pump Stations) and do not address close proximity or other types of equipment such as Telehandlers, Forklifts, Tyre Handlers, Motivators, Drag- line / Shovel operations, Cranes, etc.
- Operator "information overload" and the associated risks of distracted by "reading" a Display full of information-whilst moving.
- There can be considerable latency in attaining real-time information from these types of systems.
- Subjected to interference and "drop outs" by solid objects (eg workshops / buildings, etc) and other site RF communications.
- Initial investment is high, as well as on-going servicing costs.

Figure 5: Operator Visibility- Rear / LHSide / RHSide views with Radar Detection warning overlays.

Figure 6: Radar Sensors- Proximity Detection to augment Operator Camera System.

> **Reliability, Durability** and **Performance** of the **mitigation engineering controls** are all **key criteria** in selecting technology and such importance can not be overlooked.

Quality / Robustness / Fit-for-Purpose - “Park-up”?

Heavy Industry equipment in an arduous operating environment with high productivity demands need to ensure that their selected “Defence” Technologies are “fit- for- purpose”.

Reliability, Durability and Performance of the mitigation engineering controls are all key criteria in selecting technology and such importance can not be overlooked. Not just because of OH&S effectiveness but also the high cost of maintenance / component replacement and the net effect on Equipment Damage and Productivity.

Another significant aspect to consider- what is your “Park- up” policy should the Safety Defence Technologies fail?

As an example: If a Camera / Radar (RF Tag) / RF- GPS fail then should the “Operator “park- up” and await replacement / repairs?

Consider:

- No “Park- up” policy: Should the machine continue to operate then safety may be compromised and a high risk that an incident could occur- with substantial duty- of- care ramifications.
- “Park- up” Policy: Should the defence / device fail frequently then there will be a substantial risk of equipment damage and loss of productivity.

The ISO 16001: Earth-moving machinery -Hazard Detection Systems and Visual Aids -Performance Requirements and Tests, will assist you in the correct selection of both Visual Aids (VA) and Hazard Detection (HD) Safety / Control measures.

Ensure your technology suppliers meet the ISO 16001 Standards and that they support their devices with minimum 2-3 year warranties and are really “fit- for purpose”.

A common expression: “There is always a cheaper alternative available - as long as the end results and consequences are ignored”

We have implemented our Safety System - What now?

Once the chosen mitigation technological (and Procedural) “Defences” are in place, one needs to then record / log data for analysis, management and validation- especially if an incident occurs.

Recording of live Defence #1 (Video) and Defence #2 (Radar Events) can implemented easily technically and commercially. A solid-state Recorder mounted in the vehicle would collect and store in “real- time” both Proximity Warning (Radar) / Camera Video and be robust enough to survive an incident for post analysis.

Using Off- vehicle storage / acquisition of such information would require extensive network bandwidth, technology, suffer latency, etc.

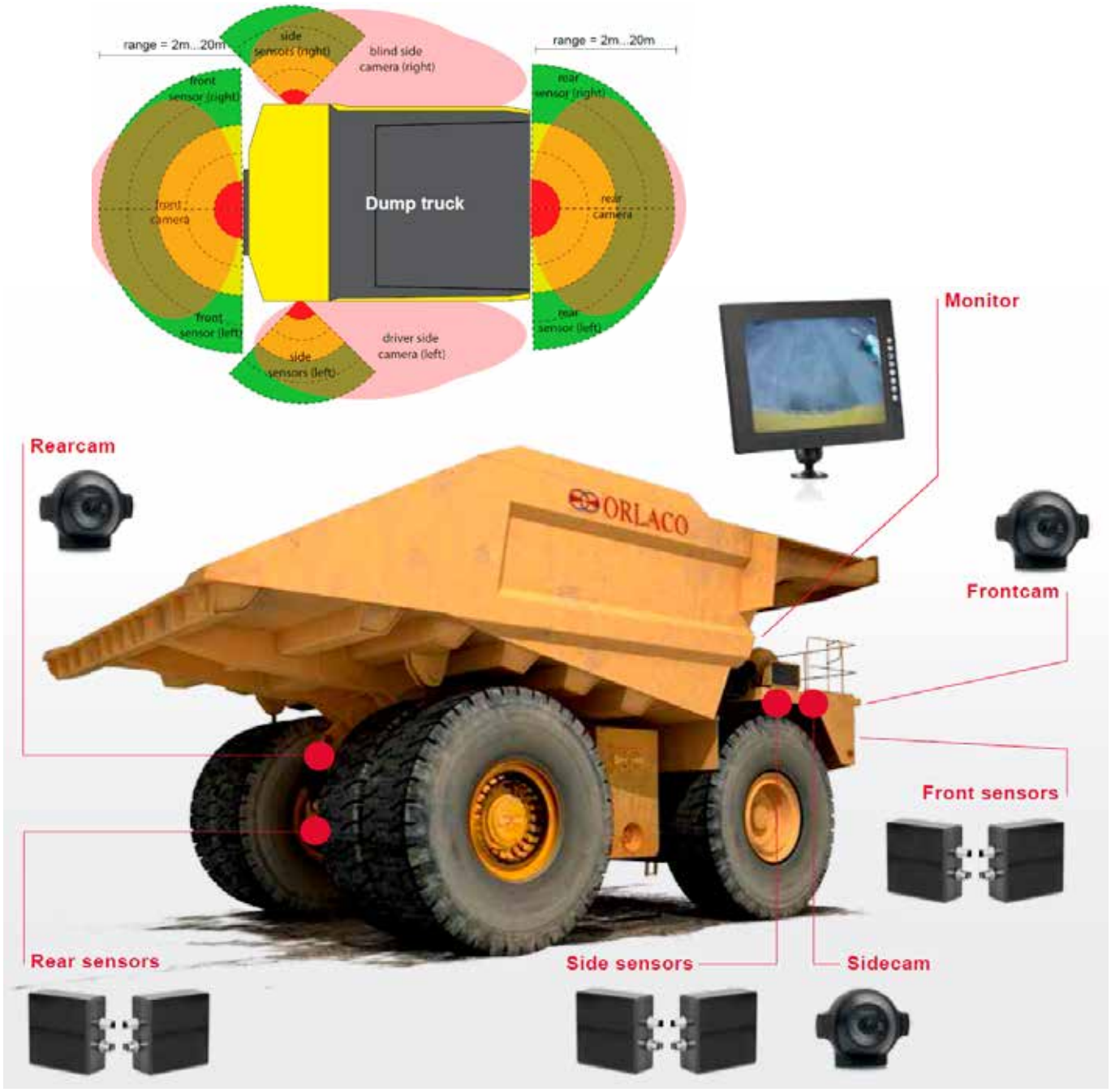

Figure 7: Camera Viewing + Radar Sensor- Proximity Detection virtual 360 degrees.

More than Safety - Productivity + Damage Control

OH&S initiatives can be met with initial resistance by all stakeholders. However, mitigating incidents associated with V2V, V2P and V2I interactions is a OH&S compliance requirement and will only increases Safety but also reduces Equipment Damage and enhances Productivity.

For example, some ROI's are:
- Reduction of damage: vehicles, berms, stationary objects, buildings, eg Excavator / DTruck impact, etc.
- Avoidance of obstacles: on road that can damage vehicles and tyres.
- Quicker turn- around: of vehicles- eg DTruck Fill-Dump cycles.
- Increased Operator awareness / lower fatigue.

Share Value / Investor Returns / Loss Productivity

It is a legislated OH&S requirement to record, disclose and report HPI's- not only to relevant Health and Safety Authorities- but also to Investors.

Besides the human effect, substantial costs are involved in OH&S incidents with loss if production, fines, compensation, civil litigation. Even permanent closure of sites / company and incarceration.

As detailed in a report completed by CITI Group- Safety Spotlight June 2009, there is a direct link to Companies Share Value and Investor Returns involving OH&S incidents.

Summary / Conclusion

There is still much more to consider- integration of various systems / devices, transfer of the technology between equipment / sites, mixture of site plant and contractors, redundancy, reliability, training, etc.

Also on- going management may require changes, upgrades, education / training of personnel / operators in the technology, avoiding complacency…and much more.

There are challenges in achieving ALARA / Zero Harm in any Industry but they are far from unsurmountable- both technically and commercially.

In Summary

- **Risk Analysis:** Complete a thorough RA for your equipment and operations and determine the technology and non- technology mitigation / engineering controls.
- **Administrative / Procedural (Non-Technology) Controls:** Implement unconditionally- some options will cost less and be as (or more) effective then technology.
- **Defence #1:** Implement ISO 5006 Operator Visibility to mitigate more that 80- 90% of Fatalities, Injuries and HPI's associated with V2V, V2P and V2I interactions.
- **Defence #2:** Hazard Detection Devices- augment Defence #1 where applicable.
- **Defence #3:** Implement- but consider the relationship to Safety and primarily objectives for such technologies.
- **Quality / Performance:** Ensure supplier conforms to ISO 16001, equipment is "fit- for purpose" and your "park- up" policy is in place.
- **Recording Data / Video:** Consider the need for collecting / storage of data and video images- one will need to validate an incident- if it occurs.
- **Company Value:** Not only is there a responsibility / accountability to the worker but also to the investors, in not only maximise productivity, lower costs but also the well- being of the Safety and Health of people in all industries and workplaces.
- **On- going Management:** Continuous improvement process with training / education / involvement of all personnel / stakeholders, measurement of effectiveness of controls, etc.
- Always keep your Supplier close and involved as a "Partner" in not just meeting but surpassing OH&S objectives- be more than just compliant.

LSM Technologies has been providing proven Collision Avoidance and Proximity Detection Technology, Advice and Support Services to assist industry to mitigate fatalities, injuries and HPI's, associated with vehicular interactions.

Our Camera Viewing and Radar Solutions exceed the conformance criteria of the ISO 5006 / 16001 Standards for Operator Visibility and Proximity Detection.

LSM Technologies as an industry champion committed to the on- going development of OH&S Technologies / Systems to continually improving our client's objectives of enhanced Safety (Health), Equipment Damage Control and Productivity.

Contact us or see www.lsmtechnologies.com.au

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