



**SUPPLY CHAIN SAFETY
LEADERSHIP GROUP**

**Highways Safety Hub
Raising the Bar 3
Plant Person Interface**

Issued July 2012 Revised March 2021

Contents

Objective	1
Scope	1
Background	1
Governance Requirements	1
Minimum requirements	1
Guidance – Applying the Hierarchy of Controls	2
Overview	2
1. Elimination	2
2. Isolation	5
3. Engineering Controls applied via safe working practices	6
4. Minimise	6
People Requirements	9
Emergency Arrangements	9
References	9

Objective

This Raising the Bar Guidance Document provides practical guidance on how to comply with the Supply Chain Safety Leadership Council Common Intent Document on [Safe Working with Plant](#) as well as providing guidance to Designers and Contractors as to the standardised method of compliance preferred by Highways England to ensure the safety of persons in areas where it is necessary to have movement of plant during works.

Scope

The expectation is that this Raising the Bar Guidance Document will apply to all elements of working around plant and vehicles on Highways England worksites and will be implemented by all supply chain partners working with Highways England. It will be used by:

- › Highways England/ Principal Designers – when commissioning, designing, and planning works
- › Supply Chain Partners – when working for Highways England
- › Highways England and Supply Chain Partners when assuring compliance.

Background

Every year in the construction industry, people are killed or injured because of being struck by moving plant. Site personnel, site visitors and the public can all be at risk if the plant and pedestrian interface is not properly managed and controlled.

Data suggests that plant person interface injuries are relatively uncommon. However, due to the power, weight and hardness of plant, compared with the fragility of the human body, when they do occur the consequences are often serious. Increasing investment in roads, standardisation of products and methods, improved collaboration between organisations and developments in technology all offer opportunities to increase the HSW

benefits we can derive from the use of plant as well as opportunities to eliminate harm caused by plant.

Governance Requirements

There is a clear expectation within the Supply Chain Safety Leadership Group Common Intent Document on Safe Working with Plant that where people are required to unavoidably enter the “risk zone” as defined by this Raising the Bar then this will be subject to approval by a director of appropriate seniority (Managing/Sector/Operations Director or equivalent Level).

Minimum Requirements

The following elements are mandatory requirements and suppliers shall ensure these elements are applied fully on Highways England sites.

Mandatory Elements

- › All activity Risk Assessments and Method Statements must describe the limits of the risk zone and the physical segregation method to be used.
- › Where it is not possible to physically segregate persons from entering the risk zone then a specific safe system of work needs to be developed and signed off by a senior off site director (Managing/Sector/Operations Director or equivalent Level)
- › In the rare occasions alternatives to entering the risk zone cannot be achieved then those authorised to enter must have received ‘Red Zone’ Training.
- › All Highways England Sites must use 3D Machine Control (3DMC) for all earthwork’s operations unless a specific business case is provided.
- › Frontline Supervisors (FLS) do not operate plant and carry out their FLS role at the same time.

Guidance – Applying the Hierarchy of Controls

Overview

The following guidance is written with the expectation that it represents best practice and as such should normally be followed unless a better local solution has been devised to meet the overall objective.

The guidance follows the Hierarchy of Controls and assumes that we will first Eliminate the hazard posed by a plant / Person Interface by designing to avoid it. Where this is not possible, we will seek to isolate it – i.e. introduction of physical segregation and only when this is shown to not be possible will we rely on engineering controls.

1. Elimination

Design and Planning

The most effective means of reducing the risk is by eliminating all potential interfaces during the design or construction methodology stages. Areas to consider are as follows.

- › Where pedestrians may need to access to undertake their works.
- › The area plant and vehicles need to operate including haul routes.
- › The type of vehicle / plant to be used - At the early stages of the project identify the latest technology that prevents the need for persons to enter the risk zone

During the initial design stage consider the work process and try to manufacture as much of the construction elements off site to limit the number of plant movements required. A good example of this is on the A453 who have a manufacturing facility based locally who pre-cast sections of the bridges which are then transported to site. The sections are then lifted into place straight from the rear of the delivery vehicle, this

reduces the need to off load in a separate storage area minimising the number of vehicle movements.

By using BIM for the design process, it will ensure you can see how the size of plant will fit and able to operate safely within the area before any commitment needs to be made.

As part of the planning process consider removing the human interface required with plant e.g. use of GPS machine control, radio-controlled plant, auto feeders on drilling rigs and quick hitches on plant.



BIM used to plan interface between plant and persons

Organise

Every workplace should be organised so that pedestrians and plant can manoeuvre safely. Workplace traffic routes should be suitable for the people and item of plant using them. Where plant and pedestrians use the same traffic route, where possible there should be physical segregation of pedestrians from plant by the use of barriers as well as implementation of normal visual or audible warning materials.

Below are some things to consider when organising the workplace:

Pedestrian routes

Due to the nature of our business and the constantly changing environment in which it is carried out the designation, protection and maintenance of access routes to places of work is an issue that affects all construction / maintenance contracts.

Pedestrian access routes include but are not limited to:

- › Routes from car parks to offices
- › Routes to welfare facilities
- › Access into excavations
- › Access to structures
- › Routes within buildings or across structures
- › Routes across working yards or storage areas
- › Routes to any other area where pedestrians need to access for their work.

All pedestrian routes shall be planned to be separated from areas where plant movements are taking place.

Pedestrian routes shall be:

- › Separated from construction plant routes by a physical barrier.
- › Clearly signed, indicating routes, hazards and warnings.
- › Adequately lit.
- › Be a minimum of 1m in width.
- › As direct as possible to the work areas to encourage the right behaviour.
- › Set out to provide early visibility of oncoming construction vehicles. Every crossing must be sited to enable pedestrians to see any

vehicle approaching them from a place of safety i.e. they should have good lines of sight.

- › Separated from reversing areas, loading bays and high-risk construction operations.
- › Maintained in good condition: clear of obstacles, debris, litter, mud, snow and ice
- › All pedestrian site personnel should be instructed to keep to the pedestrian routes provided.
- › Consideration should be given to the wearing of Hi-Vis vests or jackets for pedestrians where vehicle routes are busy in areas that are not deemed as construction areas.
- › Where a pedestrian route needs to cross a traffic route there must be clear signage for drivers.
- › On larger construction sites and at busy crossing points the use of traffic lights or controlled pedestrian crossings should be considered.
- › Ensure crossing points are easily identifiable such as the use of red painted hoops over the path at either side of the haul route.



For works on the highway where it is not practical to establish permanent pedestrian routes, the control and planning of a live works area must include the establishment of agreed pedestrian safe access points, safe passage past the works area and control of pedestrians. Controls must be established in accordance with the Traffic Signs manual chapter 8.

This information should be communicated through the induction process and by signage.

Vehicle Routes

Vehicle routes shall be:

- › Planned and designed to ensure a one-way flow of traffic.
- › Designed to be one way in order to minimise the need for reversing vehicle collisions
- › Clearly signed, indicating routes, hazards and warnings, speed limits, etc, including road markings where possible.
- › Be of sufficient size / width / gradient to accommodate the largest required construction vehicle and peak construction vehicle traffic e.g.
 - Road gradients should be no more than 1:10
 - Single track haul roads should be 1½ times the width of the largest vehicle.
 - Two-way roads should be 3 times the width of the largest vehicle.
 - Where single track adequate passing bays built in.
- › Where on the public highway, be designed to ensure members of the public's vehicles can operate within road width restrictions.
- › Kept a sufficient distance away from any structure protecting an excavation.

- › Clear of hazards or likely hazards such as scaffolding, refuelling stations and LPG stores.
- › Maintained in good condition, of an even surface and free of hazards. Where hazards cannot be removed from the vehicle route, they should be signed, barriered and if necessary, lighting provided:

Vehicles / plant

Implement a system that assesses site plant / vehicles all round visibility before they are permitted to go out onto the network. In accordance with RTB1 Plant and Equipment, operators of all items of plant should have all round visibility and be able to see at least 1m height and perimeter from machine. A good example of how to check this is to paint a grid on the floor, park the vehicle in the centre and stand in each square to check whether the driver / operator can see the assessor.

This can then be transferred to a corresponding grid that can form part of the risk assessment for that vehicle and identify the vehicles blind spot and the controls required for its manoeuvres e.g. vehicle to be fitted with additional devices to give all around vision or to be guided by a suitably qualified person.



2. Isolation

Where an interface cannot be eliminated, the Supply Chain safety Leadership Group Common Intent document on Safe working with Plant requires delivery partners to identify the risk zones around plant and introduce physical segregation such as hard barriers to isolate people from the risk zones, with the risk zone acting as an exclusion area for all persons.



The risk zone may cover a single item of plant or multiple items working together and must consider additional risks such as

- › Embankments, structures or other crush zones
- › Operating radius.
- › Tracking movements and direction of travel.
- › Pedestrian zones.

The risk zone should be the maximum allowable exclusion zone taking into account the width the traffic management layout will allow.

All activity Risk Assessments and Method Statements should identify the following elements.

Amber Risk Zone – This is the area needed for the item of plant to operate safely including the space needed for any item of plant or vehicle to slew or track backwards and forwards to undertake its operation.

Red Risk Zone – This is the area around the item of plant with the greatest risk of being struck by a machine or vehicle. Anyone who has authorisation to enter this area must be specifically trained.

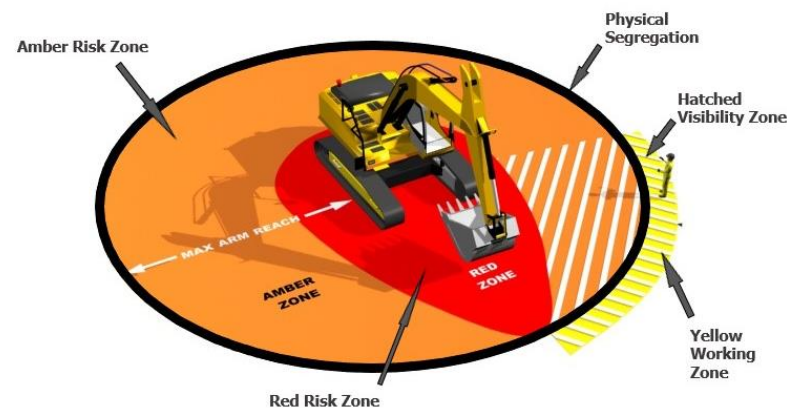
Physical Segregation System – this is the method used to prevent all persons entering the Amber and Red Risk Zones. Note the use of cones

spaced at intermittent distances are not considered physical segregation unless they are connected by a solid pole, tape or rope.

Yellow Working Zone – this is the area identified where workers can work with risk of being struck. There must be physical segregation unless signed off by an off site director.

Visibility Zone – Identified on the below image as the hatched area where pedestrians are approach and stand to get the machine / vehicle drivers attention.

A suite of JPEG images such as the one below are available on the [Highways Safety Hub](https://www.highways.gov.uk/) website.



Example images below of both good and poor working practices



3. Engineering Controls applied via safe working practices

If physical segregation cannot be installed or the activity cannot take place without an individual entering the Amber or Red Risk zones, then a director of appropriate seniority (Managing/Sector/Operations Director or equivalent Level) will need to sign off a safe system of work identifying the strict controls to be followed when working around plant and vehicles that focuses heavily on robust engineering controls, in order to prevent any plant or vehicles coming into contact with a pedestrian.

The below is a guide to the minimum expected level of process required to enter a risk zone

- › Pedestrians must approach the vehicle / machine operator from the identified visibility zone in order to get the driver / operators attention or if in post approach the appointed plant marshal.
- › The plant marshal or pedestrian is to obtain a positive invitation from the plant operator before entering the designated risk zone e.g. wave hello, thumbs up.
- › The driver / operator must ensure the vehicle / plant is stood down and turned off, prior to returning the thumbs up to allow persons to enter the risk zone.
- › If operating an excavator, the plant operator should first ground the bucket of the machine and use of 'Deadman' interlocks, before returning the thumbs up to allow persons to enter the risk zone.
- › If a worker is required to enter the red risk zone of the work area, for example to attach a lifting accessory to an excavator arm, then this worker must have received 'Red Zone' training.
- › The plant operator must not reengage the machine / vehicle until all persons are out of the risk zone. If the plant operative suspects a person has entered the risk zone, they must stop the plant / vehicle immediately. If a banksman has been appointed and they move out of sight, then they must also stop the plant / vehicle immediately.

The safe system of work should also include increased supervisory levels and strict discipline in executing the task exactly as written.

4. Minimise

The following are additional elements you may wish to consider as part of the overall safe system of work

Visibility aids

Eliminating blind spots and ensuring the plant / vehicle has 360° visibility is preferred. To enhance a plant / vehicle all round visibility there are several aids on the market from addition mirrors to sophisticated cameras with 360° view and sensory detectors.



There are even cameras which can determine the human form for other inanimate objects and upon doing so will trigger an alarm in the cab of the plant both on the display unit and also using visual/audible means.



For a full list of case studies on the use of 360° visibility aids please visit the [Highways Safety Hub](https://www.highwaysafetyhub.co.uk) website.

Proximity Warning Systems

Types of proximity warning systems

In deciding which type of proximity warning device is required on a project the following should be considered:

- › Circumstances of the workplace
- › Type and quantity of plant in use
- › Quantity of pedestrian interface
- › Is a combination of devices required?
- › Where there are multiple subcontractors in one location all proximity warning systems used are to be compatible.

There are four types of Proximity Warning Systems

- › Driver Warning Systems
- › Pedestrian warning systems
- › Pedestrian and driver combined warning systems.
- › Pedestrian and driver automated systems

Driver warning systems

The driver is alerted whenever someone enters the safety zone.

Advantages

- › The driver has ultimate control of being able to stop item of plant.
- › Doesn't always rely on pedestrians wearing a transponder.

Disadvantages

- › Single layer of protection
- › Relies on driver.

Pedestrians Warning Systems

The pedestrian wears a transponder and is alerted whenever they go too close to the item of plant.

Advantages

- › The pedestrian can move into a position of safety.

Disadvantages

- › Single layer of protection
- › The operative cannot stop the plant movement.
- › If a pedestrian without a transponder enters the zone the pedestrian will not be alerted
- › If the safety zone is set too large relative to where pedestrians need to routinely work, it may continuously cause the alarm to constantly sound causing complacency.

Pedestrian and driver combined warning systems.

Every item of plant is equipped with an active reader, with an adjustable range and each worker wears a tag which communicates with the reader.

When a worker with the transponder enters the range, the reader will trigger the alarm connected to it while the transponder will also sound an alarm thus warning both the operative and the driver.

Advantages

- › Double layer of protection
- › The driver has the control of being able to stop the item of plant.
- › The pedestrians can move into a position of safety.

Disadvantages

- › If the safety zone is set too large relative to where pedestrians need to routinely work, it may continuously cause the alarm to constantly sound causing complacency.
- › If a pedestrian without a transponder enters the zone neither the driver nor the operative will be alerted

Pedestrian and driver automated systems

Plant is isolated / stopped whenever someone enters the safety zone.

Advantages

- › The system is linked to the brakes / isolation system so cuts out immediately removing the need for operator intervention
- › Good for working under or near overhead services / structures.

Disadvantages

- › Single layer of protection.
- › Danger of cutting out engine when operator is taking action on the grounds of safety e.g. to stop overturning.

Several case studies for a variety of proximity sensors can be found on the [Highways Safety Hub](#) website.

Maintenance, monitoring, risk controls and use

A system of monitoring and maintenance for the specific device in place needs to be developed for each scenario however as a minimum:

- › Daily plant inspections must incorporate device checks and checked as part of the safety provision and shouldn't be used if found inoperable.
- › Any transponder issued to an individual should be signed in and out after each shift.
- › Transponders or vehicle devices must be checked prior to issue.
- › A risk assessment needs to cover the range of equipment to be covered, highlight all exemptions and explain the control measures for those exemptions (e.g. chain person is potentially more likely to be run over by the engineers pick up than the excavator).
- › Particularly where the system is warning pedestrians the risk assessment should cover how the system users will be briefed on which equipment on site and if at any time they are not covered by the system to avoid users developing a false sense of security.
- › A risk assessment needs to cover control and maintenance of the system and assign responsibility to specific site staff to police the system. On site plant audits we have found situations where the major components of proximity systems are not functioning and the users of the system who rely on a warning from the primary system have not realised.
- › Audits can be undertaken to analyse the number of breaches that have been committed to see if the original plan and risk assessment is adequate.

People Requirements

Training and Competency Requirements

All authorised persons who are required to work / enter the Red Risk Zone must have received appropriate Red Zone Training. This training should also include the plant operator working with the gang to ensure everyone is aware of the specific communication method and system to be used.

Communications and briefings

The Risk Zone exclusion requirements and all pedestrian and vehicle routes must be communicated to everyone on site, including visitors through the relevant induction process.

One off delivery drivers / plant operators must receive a specific vehicle movement induction before being allowed onto site.

If used, it is of paramount importance that anyone employed or visiting the project is briefed on the Proximity Warning device in use, even if they are not intending to visit or work in the risk zone. As a minimum the proximity warning device in use on the project should be communicated through the following channels:

- › Project inductions should include details of the device and its use.
- › Operatives who have been identified as needing to operate with the proximity device should have a separate briefing on its use and operation.
- › Pre-start briefings

As a desirable addition, sites should consider awareness workshops that demonstrate the hazards surrounding plant / person interface. Good example of this can be found on the [Highways Safety Hub](#) website.

Supervisory Requirements

All Frontline Supervisors will be assessed for their competency which will include a requirement to be qualified to SSSTS and NVQL3 (Gold Card) and are fully responsible for ensuring risks zones are adequately segregated and that operatives work in line with the approved safe system of work including those relating to management of PPI. Frontline Supervisors are not to operate plant and carry out their FLS role at the same time.

Emergency Arrangements

Reporting and Recording

All injuries, incidents or near miss events involving any plant and vehicles should be treated as a high potential event in accordance with GG128 and must be reported immediately to the Highways England Project Manager or Sponsor and investigated in accordance with their potential severity.

References

This Raising the Bar document is to be read in connection with the following other titles.

- › RTB1 – [Plant and Equipment Standards](#)
- › RTB 17 - [Traffic Marshalls](#)
- › RTB20 – [Transport Logistics](#)
- › RTB25 - [Falls from Vehicles](#)
- › RTB29 - [Supervision](#)
- › RTB35 – [Loading & Unloading Mobile Plant](#)