

Highways Safety Hub

Raising the Bar 3

People Plant Interface

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Objective

This Raising the Bar document is aligned to the RtB Framework Constitution, and its purpose is to promote ever higher standards of OSH management, sharing the successes and challenges in implementation, to champion and inspire innovation on the topic of People Plant Interface (PPI). The intention is therefore to promote and encourage embracing all of the content. The term “shall” shall only to be applied for a standard or control which the National Highways supply chain community representatives consider to be fundamental and to be reasonably practicable in the majority of circumstances. It would be expected by the client and community that such items will be incorporated into all supply chain partner processes for working for or on behalf on National Highways and supported by National Highways where relevant.

Scope

The expectation is that this Raising the Bar Guidance Document will apply across all National Highways worksites (from design, construction, maintenance through to decommission) and will be implemented by all supply chain partners working with National Highways.

Governance requirements

Assurance arrangements against the requirements of this document are to be undertaken through self-audit at a timescale determined by each supply chain partner. A tool to support the self-audit of the mandatory elements is available on the Safety Hub website (and will be updated each time a RtB document is revised / issued).

Supply chain partners must be satisfied that all mitigation measures have been considered and exhausted with respect to elimination and isolation prior to accepting proposals for engineered controls.

Minimum requirements

The following elements are mandatory requirements and supply chain partners shall ensure these elements are applied fully across all National Highways worksites. Where an action plan to achieve any mandatory requirements is required, it is the supply chain partners responsibility to manage such.

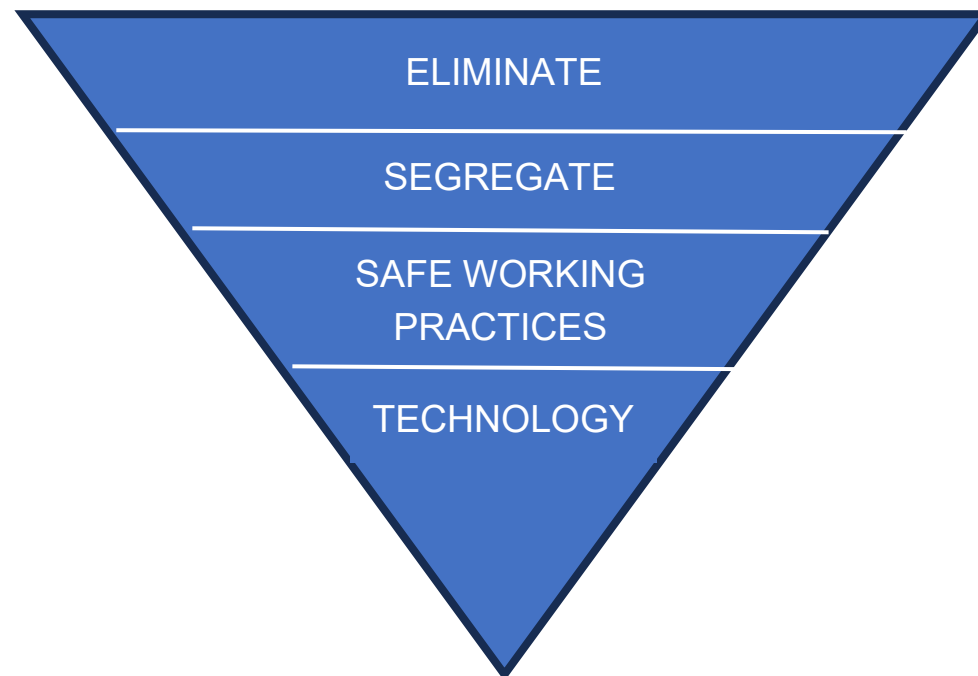
Mandatory Elements

- PPI shall be considered on every relevant RAMS and Safe System of Work
- Supervisors shall not operate plant and conduct their supervisory role at the same time.
- All persons who are required to interact with plant should receive People Plant Interface Training

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 in the first instance, the hazard shall be eliminated, where possible. Second, segregation shall be used so that the risk of moving plant is isolated away from people. Third, Safe Working Practices are applied, and finally, technology features on plant support through detection, reduction in movement and communication.



Elimination

Design process

Designers should consider how the design will be built and how the design team can reduce the number of People Plant Interfaces through engineering or selection of products, for example:

- Removing buried drainage for ditches
- Self-levelling concrete
- Digital rehearsals, avoiding need to go on site.

Worksites should consider modern methods of working and the modern types of plant and equipment, for example:

- 3D machine control has almost eliminated People Plant Interface on many earthworks' projects
- Offsite modular construction



Machine control display



Digital rehearsal

Sites can be designed to accommodate autonomous plant

Projects can consider use of fully autonomous plant which can eliminate plant pedestrian interfaces. National Highways have a Connected Autonomous Plant Roadmap which aims to deploy autonomous plant on projects by 2035. Remote equipment is already in use on Highways projects (e.g. **rollers, crane lorries**). Semi-autonomous plant is also becoming available. For example, CAT Command is a system which enables a plant operator to operate equipment from a remote location.



Semi Autonomous Plant



Fully Autonomous Plant



Remote Roller



Remote lawnmower

Segregation

Designs shall consider the following areas to eliminate People Plant Interface:

- Access and Egress
- Pedestrian and vehicle separation
- Designated separation zones for plant maintenance work
- Designated area for loading/unloading



Sites shall use physical segregation methods to keep people away from plant and vehicle working areas. There are a variety of segregation standards that are utilised successfully on National Highways projects.

- Full physical segregation
- Gate controlled segregation (with use of gate person). Commonly used on lane working, the worksite has a linear flow; every vehicle and pedestrian may only gain access via the gate person who ensures the working area is safe before entering.
- Zonal Working. A system which clearly identifies red exclusion zones as well as amber/restricted zones and normal zones.
- Portable barriers around working areas. For work activities that regularly move, (e.g. drainage and lifting), a suitable form of segregation is to move barriers along with the work.



Zonal Working



Full physical segregation



Gate controlled segregation

Safe Working Practices

Within the Hierarchy of Controls for managing Plant Person Interface risks, safe working practices are applied after elimination, and segregation measures have been considered and implemented wherever possible. Safe working practices provide simple methods of keeping safe around moving plant. These practices shall be formally trained to all staff who work in the vicinity of plant.

Core Principles

- Pedestrians should always stay out of the way of moving plant.
- Access into the plant working area must only occur under an approved Safe System of Work and Risk Assessment
- Explicit communication between plant operators and pedestrians

Minimum Safe Working Process

1. No one may enter the plant working area unless they are trained and authorised to do so.
2. Pedestrian gains the operator's attention and approaches only via the designated visibility zone.
3. Plant is isolated — attachment grounded, Deadman lever/ handbrake engaged, before entry.
4. Positive confirmation (e.g. thumbs-up) is exchanged before entering the zone.
5. Work resumes only after all persons have exited and the operator has re-checked the area.



Thumbs up safe approach



Entering from safe visibility zone

Technology

Technology is applied only after elimination, segregation and safe working practices have been fully exhausted. The technology on plant equipment acts as an aid to the operator in terms of visibility and alerting of people. Plant can also have restrictions to reduce risk of movement.

360° visibility

Sites shall ensure that plant operators have full visibility around their plant equipment (according to ISO 5006). Methods to achieve this are:

- **Mirrors** positioned to cover blind spots.
- **Cameras** that provide live video feeds to in-cab monitors, often combining multiple angles into a single 360° image.



Cameras with live video feed

Radio communication

Clear, reliable communication is essential in managing plant pedestrian interface. Radios, whether hand-held units or headsets, may be used to maintain constant contact between operators, banksmen, and pedestrians. They reduce the risk of misunderstandings, cut down reliance on hand signals alone, and allow instructions to be given instantly even when visibility is poor.



Hand held radio



Headset radio

Human Form Recognition



Human Form Recognition is designed to reduce the risk of plant pedestrian contact by detecting when people are too close to moving plant.

Modern recognition systems can distinguish people from objects and alert both the operator and the pedestrian through visual or audible warnings. Some can also automatically intervene by slowing or stopping the machine.

Projects can collect data on near misses and zone breaches, which can be analysed to identify patterns, improve site planning, and strengthen future controls. Using this information helps teams act before incidents occur.

Other forms of detection systems are available, including wearable tag-based systems and radar.

Guidance on application of Human Form Recognition on site is available from the CPA Guidance Document found in reference section.

Physical aids

Mechanical or hydraulic safety features built into plant to physically limit unsafe actions, such as:

- Deadman lever – Prevent machine movement when a person is in the risk zone.
- Machine Control 3D Avoidance – Creates virtual boundaries that trigger warnings or automatic shutdowns if plant leaves or enters restricted areas.
- Height and Slew restrictors – Limit the rotation of the upper structure so the plant cannot slew into unsafe areas.
- Remote cut off switch. A remote stop switch used by Banksmen to immediately stop plant item when risk identified.
- Digital Thumbs Up – immobilises the machine and gives a visual/audible confirmation to the pedestrian.



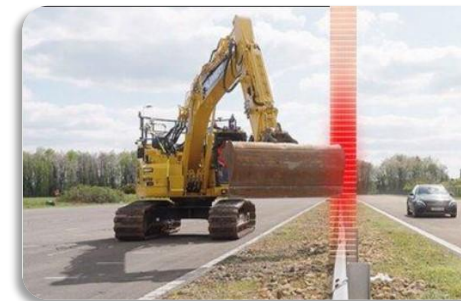
Remote cut off



Deadman lever



Digital Thumbs Up



Machine Control 3D
Avoidance

Monitoring and inspections

Regular and unannounced inspections which cover PPI shall occur. These checks should include:

- Safe Systems of Work – check these adequately address PPI risk.
- Plant and systems – confirm that visibility aids, human form recognition technology are fitted, functional, and properly maintained.
- Operator compliance – observe working practices to ensure operators are consistently following the agreed Safe System of Work (SSoW)
- Training and qualifications – verify that operators and those entering risk zones hold the correct training, authorisations, and up-to-date competencies.

People requirements

Competency requirements

People Plant Interface Training is included in various qualifications, but specific People Plant Interface Training completed on site enables the workforce to confirm and demonstrate safe working practices around plant.

All persons who are required to interact with plant should receive People Plant Interface Training.

People Plant Interface Training will:

- Identify the risk areas around working plant.
- Highlight plant operator visibility constraints.
- Demonstrate the way to safely approach plant.

NOCN Accredited Full Course Content in the reference section.



People Plant Interface Training Session



Compound Training Area



Operator Visibility Awareness

Plant operators should be familiarised with the Human Form Recognition system (or other types of proximity warning systems) in their machine. Pedestrians should also be aware of its use on site and its detection zones.

For work activities that require workers to interact with moving plant (i.e. concreting, pipe laying, lifting), further training may be used to ensure the work activity is safely managed. An example of such training is provided in the reference.

Traffic marshals should have at least CPCS A73 card Plant & Vehicle Marshaller or NPORS N133 for plant marshal and N403 for vehicle marshal.

Supervisors are responsible for ensuring risk zones are adequately segregated and that operatives work according to the approved safe system of work. Supervisors are not to operate plant and conduct their supervisory role at the same time.

Communications and briefings

The arrangements to manage plant pedestrian interface and all pedestrian/vehicle routes should be communicated to everyone on site, including visitors through the relevant induction process.

Diagrams displaying the red zones around different plant types should be clearly displayed on noticeboards.

Transient delivery drivers/plant fitters should receive a specific vehicle movement induction or briefing before being allowed on site.

Assurance activities

The contractor should establish assurance measures with ongoing monitoring of the implementation of the PPI arrangements and measurement of operator's and operatives' compliance with it. Assurance against the requirements of the PPI arrangements are to be undertaken through self-audit and should review the effectiveness of the implementation of the plan and should be conducted at a timescale determined by the level of risk and activities undertaken.

The assurance plan post monitoring, should discuss any identified observations, including non-conformances, or inappropriate practices, together with any actions to prevent reoccurrence.

Sites should check the following points for PPI compliance:

- providing safe construction vehicle routes around the site
- providing 'construction vehicle-only' areas, where only designated personnel can enter.
- reviewing work practices with the aim of avoiding situations where pedestrians closely supervise the movement of plant and vehicles in a situation where they could be injured.
- providing safe pedestrian routes to and from work locations
- all plant to be inspected prior to first use, and the appropriate pre-start check sheet completed and daily recorded inspections thereafter.
- separation of pedestrian traffic and construction vehicle traffic at or before the site entrance
- providing 'pedestrian-only' areas

Emergency arrangements

Site emergency plan

Sites should have an emergency plan to include the potential of a plant collision with personnel and the potential recovery methods.

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 National Highways Project Manager or Sponsor and investigated in accordance with their potential severity.

References



HFR User Guidance

Example 1



Close Proximity Working

Example 2



PPI Inspection Form



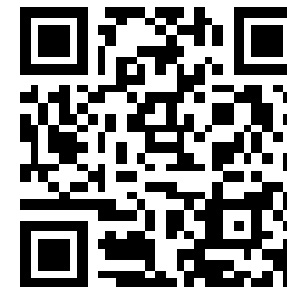
Transport Pedestrian
Standards
Presentation



Transport Pedestrian
Technical Guidelines



Red Zone Guidelines



NOCN Accredited PPI
Training



Zonal Working