HIGHWAYS AGENCY

Safe roads, reliable journeys, informed travellers

The Delivery Hub health, safety and environment Raising the bar 21

Lean Health & Safety

Version 1 - November 2013

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Objective

The objective of this "Raising the Bar" document is to highlight some of the lean tools and techniques, which demonstrate a positive impact on Health, Safety and Well-being.

Background

Lean is an approach that seeks to identify and reduce anything that does not add value for the customer and hence is some form of Waste.

Waste can be categorised in 8 forms;

Ultimately, by challenging the way in which we currently work and activity removing waste from what we do, we will use less human effort, less equipment, less materials, less time and less space. All of this can only be achieved by greater employee engagement, which in turn we have witnessed improvements in morale and a corresponding reduction in stress.

"Safety is value-adding, where as hazards are considered waste"

Minimum requirements

Lean is still considered very much in its infancy within the construction industry however, through successful experiences and good practice to date, the Highways Agency promotes the use of the following six tools. As a minimum, project teams should consider using these lean tools to aid safety management. In the spirit of lean we would not expect projects to change their processes to literally adopt these tools providing they can demonstrate they are doing something similar. Where lean tools are being used, the projects should measure the safety benefits as well as the standard cost saving and efficiency metrics and summarise any identified successes in a project case study.

- Collaborative Planning - The mutual production of 'the plan' by all stakeholders.
- Process Improvement – Actions to identify, analyse and improve processes.
- Visual Management – Techniques that make standards more open and visible
- 5S Workplace Organisation – Five simple steps to workplace improvements
- Standard Work – Breaking operation down in standard components.
- Failure Mode Effect Analysis – Risk assessment applied to a process

Lean Safety Assessment Toolkit

These tools/principles can be combined and at the end of this document some examples of how they can be used to extend site safety inspections beyond a simple pass or fail.

Collaborative Planning (CP)

The Highway Agency, sponsored by Andrew Watson, is promoting the use of collaborative planning on all schemes. Over the past couple of years it has seen the benefit CP can bring with schemes such as Boston Manor having not only completed on time and on budget but with an excellent safety record.

CP has 5 important characteristics:

1.CLARITY – The work force has easy access to information covering their task, responsibilities and timeline and how they fit in relation to the wider project.

Boston Manor Viaduct programme

2. HONESTY - All personnel and organisations are actively or preventatively, encouraged to raise issues relating to ability, capacity, travel demands, health, welfare and safety.

3. SHARING - All participating organisations understand their interdependencies and make resources, expertise, labour, plant and materials available to each other.

Collaborative mapping

4. IMPROVEMENT - There is a recognisable system for analysing non-completion of tasks and addressing these in order to drive improvement in performance and efficiency.

5. RELIABILITY -There is a visible system for short interval review of Reliability in delivering promises / commitments.

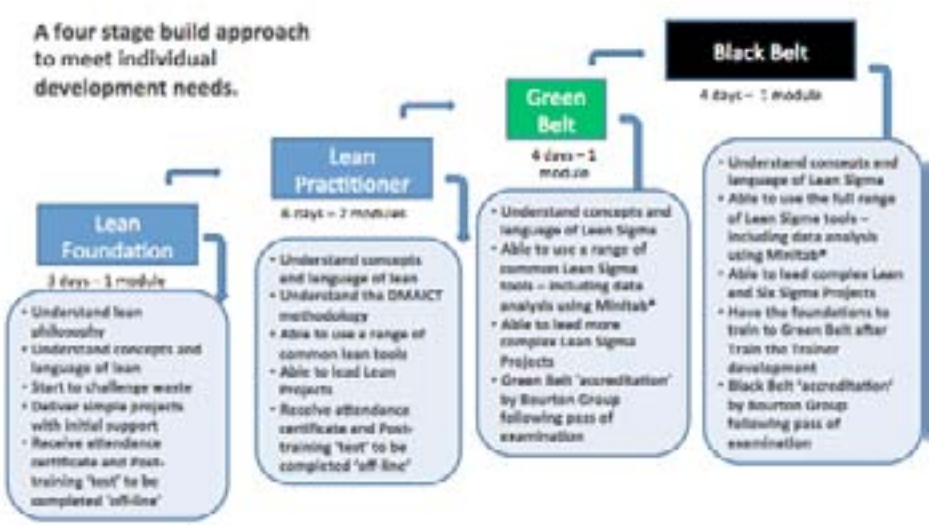
CASE STUDY – Collaborative Planning on the Bidston Moss Project (Appendix 1);

Process Improvement

Improvements don't happen on their own - they can only be made by dedicating the correct resources at the process. Any operation on site or back office process can benefit from improvement and using the DMAICt (Define Measure Analyse Control Transfer) methodology. This gives a structured method of solving problems with solutions, which not only last but can be transferred to others.

Many Health and Safety incidents occur as a result of unplanned change. By using DMAICt, variation is reduced, as is the risk.

To enable the correctly skilled resource is available the Highways Agency has a recognised training route-map, for personnel associated with undertaking improvement projects.



As a minimum expectation, the majority of staff associated with the project should have some form of 'basic lean awareness'. Advisory to this, projects would be expected to have available qualified "Lean practitioners" or "Green belts" to facilitate improvement projects or work studies. Typically, these are familiar with RDeMAICT and other common lean tools.

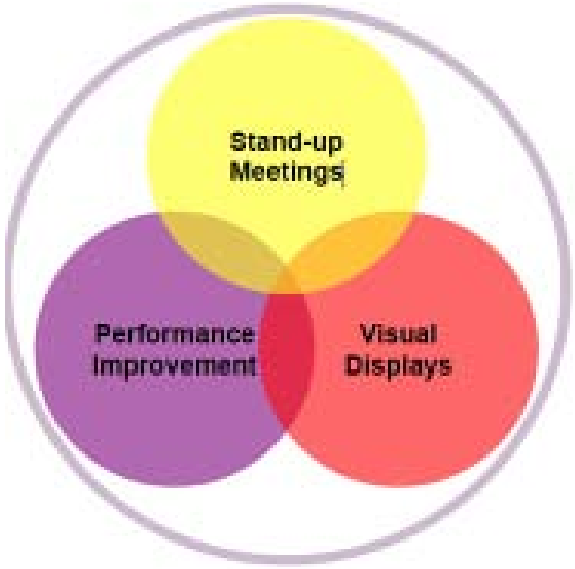
Process improvement applied to raising the bar for safety would see proactive improvement projects undertaken around key safety risks but the problem solving would be carried out by the workforce as they are nearest to the activity, guidance and direction would be given by the lean practitioners

CASE STUDY – Review of the Permit to Dig process on the M62 Project (Appendix 2);

Visual Management - Daily Meetings

The Highways Agency have produced a guide “Introduction to Lean Visual Management” to assist in the introduction of visual management to schemes. It’s not about notice boards but around displaying live information about a projects performance, updated daily with information as it happens but all around a quick 15 minute meeting.

Key to the correct operation of these meetings is ensuring you have the correct people attend i.e. the people involved in the operation, you give these people the authority (within defined limits) to solve their own problems and actively encourage them to set daily targets and communicate these targets to all involved.



Including safety as the first visual display board at every meeting gives the opportunity daily to get feedback on safety related issues rather than just deliver a briefing. An example of a safety board is below

Each day the site team discuss and record accidents, close calls and positive safety interventions. This information is then available to all who work in the location to instantly see how the team are performing, any ongoing safety problems they might need help with and who is due that day to carry out an inspection. Any one not carrying out an inspection is red crossed and peer pressure within the group is often all that is needed to correct this.

For raising the bar this style of meeting should be seen as the norm for projects. Workforce engagement in solving their own problems and it only costs 15minutes each day.

CASE STUDY – Visual Management guide / examples on portal;

http://www.highways.gov.uk/publications/lean-deployment-guides/

5S Workplace Organisation

“A place for everything and everything in its place”

The use of 5S workplace organisation is encouraged, as it engages people in promoting culture change. It should not be commonly mistaken as just a housekeeping activity.

As a minimum expectation, projects are expected to be familiar with the teachings and able to demonstrate at least ONE case study of where the methods have been employed.

Sort - Distinguish between what is needed and not needed and to remove the latter.

Set - Enforce a place for everything and everything in its place.

Sweep - Clean up the workplace and look for ways to keep it clean.

Standardise - Maintain and monitor adherence to the first three Ss.

Sustain - Follow the rules to keep the workplace 5S-right—"maintain the gain."

Phase 1 SORT

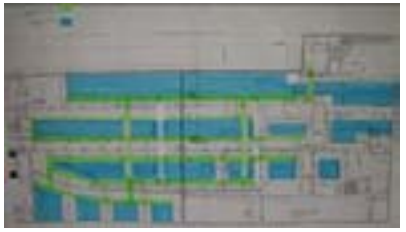
Removing materials and equipment from the workplace which is not required. This includes waste, damaged materials, surplus materials, materials delivered to early and plant not in use.

On this example 35m2 of the 120m2 work area was not available for use as materials not required were stored but not required for the next operation. This equates to 30% of the work area not in use and made the current activity more difficult increasing the risks of slips and trips and hindering productivity.

Phase 2 SET

Plan out how you are going to use the workplace, compound, office. Define areas for storage, working, pedestrian movement and plant movement. Plan it on paper first and then physically mark this plan onto the site.

Plan how you are going to do it and then apply it



Phase 3 SWEEP

Following on from Stabilize keep the workplace clean, walkways clear of debris, storage correctly used etc.

Phase 4 STANDARDISE

Formalise procedures across site/offices so as people move between jobs they understand colour coding, signage straightaway. Use of standard solutions, shadow boards for storage, racks/pallets modified for purpose

Phase 5 SUSTAIN

Through regular audit check standards are been maintained

Feedback from projects which have implemented 5S highlight the benefits this can bring to both productivity and safety

Workforce Feedback	Management Feedback
We don't waste time anymore	Behaviour change around individuals own safety with better productivity and working conditions
Tools are no longer untidy	Improvement in behaviour of the workforce in both responsibility and participation in both safety and production
Slips and trips have reduced	Workforce ideas make the systems improve
5S makes the job easier to do	5S method is a efficient method to make our site team management improve
Less time is wasted looking for tools so we gain time and energy	

CASE STUDY – Park Royal Depot 5S

http://www.highways.gov.uk/publications/lean-presentations-and-webinars/

Standard Work

Standard work is an important element in eliminating variation and the potential to carry unsafe actions. Most construction operations are complex by their nature but often they can be broken down into a series of standard work activities or complex operations, which contain a certain amount of standard work.

Standard work by its definition is repetitive work, which can be documented as the best way of carrying out the task such that to do it differently will seem strange. Often a complex task will have a number of standard tasks built in. An example is a bridge beam lift which is complex in nature and site specific in location and lift radius. But within this operation standard work exists such as deployment of the crane outriggers, slinging the load, banksman signals to the crane driver (already a standard work operation). These standard work parts can be documented using visual guides so all involved can clearly understand the correct way of working.

When planning work operations as a desktop operation, thought should be given to identify which elements are standard work and can be included in both method statements as the way of doing the work and as part of the risk assessment as a method of reducing the risk.

Example of a standardised work instruction;

Failure Mode Effect Analysis (FMEA)

Failure Mode Effect Analysis (FMEA) is a technique used for managing risks within a process or operation. FMEA can be a used both as a proactive or reactive tool that enables the identification and prevention of process or product errors.

As a tool embedded within Six Sigma methodology, FMEA can help identify and eliminate potential Health and Safety issues early in the development of a process or new service delivery. It works in a similar way to a risk assessment but looks at all aspects rather than just at operation which could cause harm. It goes one step further than a risk assessment in not only looking at severity and occurrence but also at how you would detect the risk.

It is a systematic way to examine a process prospectively for possible ways in which failure can occur, and then to redesign the processes so that the new model eliminates the possibility of failure. FMEA can assist in improving overall satisfaction and safety levels.

Typically rated on a scale of one through ten focusing on the three key criteria by which risks can be evaluated.

1. Severity - the severity of the effect of the risk/cause
2. Occurrence – the likely occurrence of the risk/cause
3. Detection – the ability to detect the risk/cause

Why Do a FMEA?

The majority of root cause analysis is performed after sentinel events, Health and safety errors or when a mistake occurs. With the added focus on safety and error reduction, however, it is important to analyze information from a prospective point of view to see what could go wrong before the adverse event occurs. Examining the entire process and support systems involved in the specific events – and not just the recurrence of the event – requires rigor and proven methodologies.Here are some potential targets for a FMEA application:

- New processes being designed
- Existing processes being changed
- Carry-over processes for use in new applications or new environments
- After completing a problem-solving study (to prevent recurrence)

Benefits of FMEA

- Captures the collective knowledge of a team
- Improves the quality, reliability, and safety of the process
- Logical, structured process for identifying process areas of concern
- Documents and tracks risk reduction activities
- Provides historical records; establishes baseline
- Helps increase satisfaction and safety

FMEA reduces time spent considering potential problems and keeps crucial elements of the project from slipping through the cracks. Increased ability to carry structured information forward from project to project can drive repeatability and reproducibility across the system, leading to a safer work environment.

CASE STUDY – FMEA applied to Carillion Predict and Prevent <See Appendix 3>

Lean Safety Assessment Tool

Introduction

The HUB Lean team have been tasked to develop tools, based on Lean principles, that may assist the HUP Safety Function. The Lean Safety Assessment Tool (LSAT) is an idea of how lean tools can be combined with existing project/company site safety inspections compiled by the Lean function.

The principles of a Lean Safety Assessment Tool (LSAT)

The principles of Lean have many parallels to those of good safety management. Applying a LSAT draws on 3 Lean tools which have particular relevance to safety, mistake proofing, Visual Management and Poke Yoke. Poke Yoke is a phrase used to describe error proofing, example given as;

a three pin plug, as you can't insert it into a socket the wrong way round

a boom restrictor on an excavator making it physically impossible to over-slew

a diesel fuel nozzle which cannot be inserted into a petrol filler

You can apply these principles to any safety inspection by adding five scoring columns and assessing a site with these principles in mind rather than the simple pass/fail approach. The scoring is

Score	Description	Means
0	No strategy or coverage; the risk is not brought to the attention of those at risk	No information
1	Basic information only, such as alerts, Method Statement etc; the information is available, but the drawback is that effort is required to transmit this to users or for users to remember it at site	Information readily forgotten by personnel
2	5S is in place, Sort, Sweep, Straighten, Standardise and Sustain; this goes one better than mere information and on level 1 as compliance is actively made easier through zoning etc	Information could be ignored
3	Visual Management; this goes further again through adding visual cues to emphasise 5S and zoning, this is considered superior to 5S as this actively controls non-compliance; eg it takes a conscious decision to ignore a good visual clue allied to 5S	Easier to comply than not
4	Poke Yoke / error proofing; this goes one further again in referring to barriers and constraints that can act to prevent unsafe situations arising; this is concluded to be the ultimate goal as system users are physically protected from harm or forced to overcome obstacles to enter a risk zone	Conscious effort required to not comply

See Appendix 4 for a blanked LSAT example carried out on the M62 Project

Appendix 1 – Collaborative Planning Bidston Moss

Lesson Reference No: L104

Summary of Lesson

Commercial Sensitivity - Please indicate if the idea has commercial sensitivity and therefore does not merit wider visibility, by stating yes/no in the adjacent box.

No*

Scheme	M53 Bidston Moss Viaduct
Approx works value (£m)	£89.9m
Evidence Coordinator Name & Details	Adam Bennett - Costain Project Systems and Performance Manager - 07717838866
Date Submitted	29/09/2011

Key Issue:	Extremely complex, reasonably repetitive working environment which is controlled that could benefit from process smooting, interface management and efficient handover
Short Overview of Issue	Through extensive early invovlement with the Highways Agency it was identified the project could take advantage of Lean construction and collaborative planning techniques. The idea was developed to hold weekly meeting with the designers, daily production meetings and weekly collaborative meetings. This would harness communication and enhance collaborative planning in running smooth site operations to enusure seemless integration and significant interface managment and trade seperation.
Solutions to the Problem or Opportunity	Holding daily collaborative meetings Involving all sub-contractors at the earliest stage and get them all sat within a meeting room. The task is to plan for the following days activities and review the previous days activities in task completion. If a task is not completed, a reason is required which then provides detailed information as to recurring problems. Daily commitment reliability is measured which shows improvement throughout a scheme. On the M53 Bidston Moss this has seen on average a 10% increase in commitment reliability and a small reduction in pre-lim costs due to more effective working. Further to this a weekly meeting is held to plan for the next 3-weeks in the same format as above. This enable collaboration in planning for the critical activities to be achieved Through understanding why tasks planned were not achieved significant blockers to progress were removed in the 'live' construction environment. Through integration and building a team environment relationships are formed and each individual sub-contractor can understand each other requirements, operations and associated works. Through the utilisation of this technique reliability on site can be leveled and a true 'Lean Culture' implemented which
Associated Risks & Issues:	No risk to the project. Needs to be driven from the top for implementation and attendance mandatory until format maintaned. With effective skills transfer the meetings become self-contained. The level of detail to go into and the right people in the meeting (the supervisors who can influence the relevant sub-contract package) is imperative. Focussed meeting is required to ensure deviation is not seen.
Departures required	No departures required
Justification of Selectivity Matrix Indicators	The project has attributed over £2.3m worth of savings due to the lean implementation techniques used and developed from the collaborative planning environment. The project has attributed 2 weeks savings specifically to collaborative planning however with the enviornment created on site the removal of a critical weight restriction was completed 3 months early. Through being able to understand different trades, areas of work and access locations significant benefits can be seen through raised awareness. The meeting also allows the forum to voice and resolve any major safety issues and successes in the period Benefits to the Highways Agency include the image of being on the leading edge of industry transformation and reducing the money being spent on government funded schemes. Minimising waste allows a reduction in the amount of materials used amonst other sustainable benefits
Repeatability - Please provide your assessment on whether the idea is a one off for your scheme or if there is potential for wider cost benefits if used on successive projects.	The solution is very simple to implement and is highly repeatable. However a slightly tailored approach is required to suit each individual application. The wider benefits are inherent however very difficult to quantify, especially with the 'softer' benefits that can be seen through implementation such as pride, relationships, trust and removal of blockers.
Does this idea have links to any other ideas already on the Ideas Knowledge Bank Database or the HA Toolkits?	Link to the HA Lean Deployment initiatives where full reports and knowledge transfer packs have been completed by the team

Email: DeliveryHub@highways.gsi.gov.uk
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Appendix 2 – rovements M62

bmJV

HIGHWAYS AGENCY

LEAN IMPROVEMENT SUMMARY
M62 PERMITS TO DIG PROCESS IMPROVEMENT STABILISES LEAD TIMES

Headline

- Permits take too long to produce
- Gangs waiting for Permits to be put in place
- Quality of permits needs improving
- We produce too many

Objective

Current BMJV procedures on the issuing of a Permit to Dig have, in many instances, led to on site activities being delayed due to the time required to process and verify that all precautions have been taken.

Hence, the purpose of this project is to investigate and ensure that permits are correctly completed and issued to minimise on any programme impact.

- To provide improved service in preparing and obtaining a permit to dig
- To reduce waiting time from first submission of application for Permit to Dig to final approval.
- To ensure that programme demands are met in a timely fashion

Benefits

- Clear process established
- Stable lead times
- Perceived reduced delays at the work face from waiting

How?

- Agreed project charter using Quad of Aims
- "As is" process mapping
- Lead times measured by sampling the "as is"
- Clarified value adding steps and agreed future state with key stakeholders
- Clarified process
- Briefed new state and establish within teams
- Measured new lead times to confirm the measured improvement

Transferability / Use on other schemes

- Established process map can be passed onto others and tailored as necessary to suit other organisations
- For further information see Project number 227 on the HA Lean Tracker.

Appendix 3 – Failure Mode & Effect Analysis - Carillion Predict and Prevent

Headline

- Predict and Prevent is an initiative about predicting from our experience where things might go wrong and addressing them before they reach their potential.

Objective

- If Carillion are to become a world class leader in safety it isn't sufficient for us to implement action plans following incidents or investigation, we need to be pushing further forward and looking into the future at what could go wrong.

- Predict & prevent is a process we want our management teams to get involved in, so that they can identify situations which will probably arise and then provide solutions, which prevent it.

Benefits

- A predict & prevent culture is seen as a progressive culture with immeasurable safety benefits.

How?

- Using the lean Failure Mode Effect Analysis (FMEA) tool, each of the business operations teams are required to conduct a number of Predict & Prevent exercises throughout the year. From this we have identified (predicted) many issues which will occur during this year and therefore we need to put controls in place to stop these occurring.

Transferability / Use on other schemes

- Predict and prevent is a simple initiative that can be transferred to any project undertaking any discipline of work. If we can predict then why can't we prevent?

If you ask me, one day this is bound to happen on a Carillion site…

	a pedestrian will be struck by a vehicle
	a serious injury would result from a damaged underground electricity cable
	because we don't adequately learn, share and educate people about risk awareness, identification and avoidance
	Cable Strike/Repetitive strain injury (digging)
	somebody will get seriously injured or worse by hitting a live underground cable. The statement is in relation to the Utilities business where we undertake a lot of excavation work in the highway around live services.
	someone will fall of reach into live lane & get hit
	because there were signs that procedures were not being followed and when challenged little or nothing has been done by the business to improve the inefficiencies.
	this is where operatives wearing safety helmet peer over a scaffold and the helmet will fall off & fall to ground & hit someone.
	pedestrian coordination around MEWPS
	work outside constraint of method statement or POWRA on unauthorised and uncoordinated with adjacent trades
	I will say that records show that all these events have occurred on one of our sites. We are tackling Supervisor and Operative behaviour to try to prevent them happening here.
	dropping materials from height
	Carillion-Eltel JV will during this season's outage construction works will suffer a HPI incident due to the failure of a holding out rope, whilst lifting and lowering materials or equipment up or down a tower.

Prediction Verses Actual Incidents

		Actual												
	Prediction for 2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Cable strikes "using" cat & genny	100	7	3	2										12
Metal pin/rod strike into electric cable.	1													
Person hit by vehicle	20		2											2
Person hit by plant	15		2											2
RIDDORs with no POWRA	15		4	1										5
LTIs with no POWRA	0.5		4	1										5
People falling from height	8	1	1											2
People falling from height Life Threatening	4													
People injured during loading/unloading	25	1	1											2
Plant overturn	8													
Do something against our better judgement to please client	10		1											1
Objects falling into un-segregated area (with potential to kill)	15			1										1
Plant/vehicles damaged by fire	4	2												2

		Actual												
	Prediction for 2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Totals
Non attendees at H&S training without appropriate approvals.	100	2	1											3
Above ground electric cables hit - life threatening	5													
Runaway vehicles (unmanned)	3													
Repeated serious incidents - learning previously communicated	33%			1										1
Exposure to asbestos - rules not followed	4	1												1
Serious incidents with inadequate plan of those 10% will have unplanned changes	80%		3	2										5

Appendix 4 - Lean Safety Assessment

Site / Project_____		Assessed by_____of_____(Org) &_____of_____(Org)			Assessment date_____
1.0 Control of access to live carriageway (location)	0, No strategy	1, Information only; alerts, Method Statements, induction information	2, Site, safety zones and live areas segregated; no obstructions, parked vehicles etc	3, Delineations clearly marked and fenced, visible to all users	4, Impact – resistant barriers in place, gated manned access
2.0 Control of site access routes (location)	0, No strategy	1, Information only; alerts, Methods Statements, access plan available, induction information	2, Access routes, site and live areas segregated; no tools, obstructions, storage etc	3, Delineations clearly marked and fenced, visible to all users	4, Impact – resistant barriers in place, gated manned access
3.0 Control of access to working areas (location)	0, No strategy	1, Information only; alerts, access plan available, induction information	2, Laydown, storage and equipment storage areas delineated	3. Delineations clearly marked and visible to all users	4, Physical barriers in place, gated manned access
4.0 Control of risk of fall from height (location)	0, No strategy	1, Information only; alerts, access plan available, induction information	2, Areas delineated where risk exists of fall from height	3. Risk areas clearly marked and visible to all users	4, Risk areas physically sealed off except when work is ongoing
5.0 Storage of tools and equipment (location)	0, No strategy	1, Information only; alerts, ,	2, Equipment, tools and materials stacked separately in orderly fashion	3, Storage areas clearly marked and visible to all users	4, Access controlled through locked storage etc
6.0 Protection in respect of ohead cables (location)	0, No strategy	1, Information only; alerts, access plan available, induction information	2, Warning signs in risk areas	3, Boundaries of risk area clearly marked, visible to all users and drivers	4, Goalposts at all crossings and risk zones
7.0 Protection to excavations (location)	0, No strategy	1, Information only; alerts, induction information	2, Warning signs in risk areas	3, Delineations clearly marked and fenced, visible to all users	4, Risk areas physically sealed off except when work is ongoing
8.0 Protection of buried services (location)	0, No strategy	1, Information only; alerts, Permit to Dig system, induction information	2, Warning signs in risk areas	3, Service routes and risk zones clearly marked and visible to all users	4, Services protected by above-ground barriers and impact resistant blocks
9.0 Control of access to harmful materials (location)	0, No strategy	1, Information only; alerts, COSHH data sheets	2, Dedicated storage area, materials stacked separately in orderly fashion	3, Storage areas clearly marked and visible to all users 3,	4, Access to materials locked other than to authorised users
10.0 Control of fuel and flammables (location)	0, No strategy	1, Information only; alerts, induction	2, Dedicated storage area provided for fuel and flammable materials	3, Storage areas clearly marked and visible to all users	4, Access to materials locked other than to authorised users

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