

Workplace Safety and Health Guide

Video Surveillance Systems



WSHCOUNCIL

Tripartite Alliance for
Workplace Safety and Health

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1. Introduction

1.1 Objective and Scope

Technology can transform workplace safety and health (WSH) practices, enabling companies to proactively identify and address WSH challenges before they become serious accidents. This creates safer work environments, reduce accident rates, and cultivate a culture of accident prevention in workplaces.

Video Surveillance Systems (VSS) is one way that companies can deploy technology to monitor operations and better manage WSH risks. It provides real-time monitoring of work activities, allowing for quick intervention and prevention of accidents.

This guide introduces VSS and how it can be deployed to enable employers to improve their oversight of WSH at their workplaces. This guide also covers recommendations to be considered before installation and provides examples of where and how VSS may be installed.

1.2 WSH Legislation on VSS

WSH Regulations will state the specific industries and conditions where the deployment of VSS will be mandatory.

This Guide supplements the upcoming Regulations by providing guidance to companies on VSS deployment.

1.3 Using VSS to Improve WSH

VSS helps companies to manage risks and improve WSH in several ways:

1. **Monitoring:** Surveillance cameras provide real-time monitoring of the workplace, allowing occupiers/employers/principals to identify risks, potentially unsafe situations, and act on any lapses observed before an incident occurs.
2. **Deterrence:** The presence of cameras acts as a deterrent for unsafe behaviours for all persons onsite (including contractors and visitors) by knowing the workplace is being monitored and work activities captured, even if it is not in real-time. This improves compliance with WSH practices and prevents WSH incidents.
3. **Training:** Surveillance recordings can be used for training as it provides examples of both safe and unsafe behaviours at the workplace. This reinforces the company's WSH policy, safe work procedures and train employees on the risks associated with the work activity.

4. Insight: In the event of a WSH incident, e.g. a near-miss, dangerous occurrence or accident, surveillance recordings can be analysed to provide valuable insight for investigations. Through the video footage, important lessons can be identified and additional measures introduced to prevent a similar incident from recurring.

Management, supervisors, and WSH personnel should use VSS as an additional tool to verify compliance with the company's WSH standards. It should complement, rather than replace, established WSH management tools and on-the-ground practices such as conducting risk assessments (RA), communicating safe work procedures and checking the effectiveness of risk controls.

Higher-risk work activities need greater attention and the use of VSS enables remote monitoring to ensure these activities are carried out safely, regardless of one's physical location. This real-time oversight contributes to a proactive approach to workplace risk management.

The video footage can also be shared with workers during safety briefings, toolbox meetings and/or training sessions to identify what were the unsafe acts and lapses, and lessons that can be learnt from it. The identified risks and unsafe conditions can also be communicated to workers through internal alerts or instant messaging to advise workers to keep away from danger areas or avoid performing such unsafe acts.

Records of these lapses found and corrective actions taken may also be part of the company's audit, demonstrating that actions were taken to intervene and prevent workplace accidents.

2. VSS Recommendations

A VSS comprises a network of cameras, monitors or display units, transmission systems, recording equipment and storage devices. A VSS may be used to monitor and record activities within specific work areas.

A VSS can be installed by vendors or self-installed (for smaller or simpler set-ups).

Companies are advised to conduct an RA to ensure the VSS can be installed safely and will pose no risk to surrounding work activities.

2.1 Video Surveillance System

This section covers recommendations on basic camera specifications, area coverage recommendations and power supply.

2.1.1 Basic camera specifications

Cameras are the most important component of a VSS. They can be mounted in many locations and capture video footage in different formats and resolutions.

Camera type and features

The two common camera types and their typical use cases are:

Type	Benefits	Typical Use Cases
Dome Camera (circular in shape)	<ul style="list-style-type: none">Discrete appearance (blends in with surroundings)Direction where the camera is pointing is not visibleTamper-resistant as lens is protected	<ul style="list-style-type: none">Indoor or outdoor useShorter range surveillance
Bullet Camera (cylindrical in shape)	<ul style="list-style-type: none">Highly visible (deterrent effect)Accommodates larger lensesSmall lip at the tip of the camera protects against glare and weather	<ul style="list-style-type: none">Indoor or outdoor useShorter range surveillance

Companies may decide on dome or bullet cameras (or other suitable alternatives) to suit the needs of the workplace to be monitored.

Companies may choose to acquire cameras with pan, tilt and zoom functions which features a movable lens (for wider range of coverage) and a zoom lens (to enable a closer look at specific areas).

Cameras with night vision capability is necessary for work activities carried out in low-light conditions.

Depending on business needs, companies may also wish to consider a VSS that allows for third party systems integration and tapping on live video feeds for analysis.

Camera robustness, portability and resolution

The selected camera should be sufficiently robust to withstand environmental challenges such as rain, dust and temperature change. Selecting a weather-proof and dust-proof camera is recommended.

Fixed or portable VSS (or a combination of both) may be deployed depending on site conditions and the availability of power supply.

The video resolution of the VSS should be dependent on how far the cameras are placed from the work area(s) being monitored. Higher resolution cameras are recommended for wide area coverage and long-distance monitoring to ensure clear visual output. The minimum camera resolution recommended is 1080p (1920x1080 progressively displayed pixels).

Wearable cameras, e.g. body-worn or helmet-mounted cameras, can supplement the overall video surveillance system at the workplace. Such cameras capture close footage of work processes, complementing the overall coverage captured by fixed cameras. Wearable cameras, however, should not be used as a substitute for fixed cameras, as the viewpoints of wearable cameras are limited by the workers' location and direction to which it faces. Wearable camera batteries are also not likely to last the entire day.

2.1.2 Area coverage recommendations

The VSS should cover all higher-risk work activities listed in the table below. Companies may choose to extend coverage to other locations or include additional work activities for monitoring based on their RA.

Examples of higher-risk work activities and locations to be covered by VSS monitoring at a construction site

Higher-risk work activities

- Work-at-height activities where a worker may fall a distance ≥ 2 metres, e.g. working on roofs, scaffolds, formwork, places where there are openings or open sides.
- Construction of support structures and scaffolds.
- Excavation and shoring works.
- Working near lifting operations, e.g. operation of cranes and lifting appliances, lifting activities where a permit-to-work is required.
- Works in confined spaces where VSS deployment does not pose a hazard.

Higher-risk work locations

- At every floor of a building under construction where there are higher-risk works.
- At worksites where heavy/industrial machinery or equipment are used, e.g. cranes, excavators, mobile elevating working platforms, any machine with moving parts that can cause injury.
- Areas with high vehicular and human traffic, e.g. where forklifts or reach trucks are used.
- Loading/unloading areas.

Note: Installation of a VSS will not be required for temporary buildings or structures built for the purpose of short-term events.

The number, location(s) and exact positioning of cameras are based on how large the worksite is, range of each camera, and number of such cameras needed to fully cover the higher-risk activities taking place in the worksite.

Cameras should be placed such that it has an unobstructed view and a clear line of sight on the work activities being carried out. It is recommended for cameras to be mounted at high vantage points to better capture works in progress.

Minimise unnecessary recording of neighbouring premises. This could include methods such as setting up physical barriers to limit the range of video capture, shifting the camera position, or setting up virtual privacy zones digitally.

The VSS should be switched on and recording so long as higher-risk work activities are being carried out.

In the course of work, if any of the cameras need to be relocated, e.g. due to obstructed view, the relocation should be done such that coverage of the ongoing works from the remaining cameras will not be disrupted.

In locations where occupiers and owners assess that the installation of a VSS may give rise to intellectual property, privacy, or security issues, the occupiers and owners should ensure there are valid reasons to support the decision of not installing a VSS at the said locations. Such decisions should be properly documented at the time the decision is made to ensure accountability.

2.1.3 VSS power supply

Power supply is usually readily available in a built-up environment, e.g. a completed building. However, at a construction worksite, power supply may not be available as it depends on the work location to be monitored and stage of construction.

In areas where power supply is not available, it is recommended to use high-capacity rechargeable battery packs. The battery technology chosen should be non-flammable and does not generate harmful vapours when in use.

For a VSS that is to be operated outdoors in the daytime, solar power may be harnessed to supplement its battery use.

A VSS may also be mounted on a building, vehicle (e.g. a van) or industrial machinery (e.g. a tower crane) and draw power from the building, vehicle or machinery.

Companies may also install an Uninterruptible Power Supply to ensure the VSS is continuously operating in the event of power disruption or if the battery runs out.

2.2 Transmission and Storage

Digital video file sizes may be large depending on the video bitrate, duration of recording, and extent of video compression, and hence requires plenty of storage capacity. This can be addressed through local storage devices, e.g. SD cards and thumb drives, or network-based drives and cloud-based storage solutions.

The transmission mode for video data can be through network cables or wirelessly via Bluetooth, Wi-Fi, or SIM card/mobile data.

Storage recommendations

- Select a storage system that can operate reliably for the working environment, e.g. outdoors.
- Video files may be in any open-source container format or common multi-media container format such as *.avi (Microsoft) and *.mp4 (MPEG).
- Have sufficient capacity to store 30 days of recorded footage (if no WSH incidents).
- If there are WSH incidents, its video footage must be archived for 180 days from the date of incident. This footage must not be overwritten or deleted.
- All video recordings should feature camera identification, location/area of recording, and date/time stamp and they should not be altered. The date and time for all cameras must be synchronised from a single source.

The selected VSS should include backup facilities and the ability to export video footage to external storage devices such as thumb drives and portable hard disks.

2.3 Viewing and Access

Companies may select a suitable Video Management System (VMS) software that allows the video files to be easily stored, managed, and viewed. The VMS software typically allows users to toggle between live footage and recorded footage, and perform other remote functions like camera pan, tilt or zoom, and/or editing of footage.

Companies should consider having real-time monitoring of high-risk works that are underway, as an added layer of surveillance. This can be especially useful if the cameras provide a vantage that cannot be obtained by in-person monitoring.

Companies are fully accountable for the VSS security and access given to users.

Storage recommendations

- Allows real-time monitoring of live footage.
- Enables retrieval of recorded footage for any date and time interval.
- Able to export desired portion of video footage onto external storage devices.

Project managers, supervisors, WSH officers, WSH Coordinators or assigned personnel should regularly monitor the VSS footage (either in real-time or for subsequent review), identify unsafe work practices, and put in place suitable accident prevention measures.

Companies are also advised to review the VSS footage as part of incident self-investigation. Selected clips can be used to train workers on safe versus unsafe practices.

2.4 Other Operational Considerations

Companies need to establish a set of procedures for the effective use and security of the VSS. Some key operational considerations are highlighted below:

2.4.1 Lighting

Lighting should be provided for the areas covered by VSS cameras. Adequate lighting not only allows work activities to be carried out safely, but also ensures quality video can be captured.

2.4.2 Tamper protection

Select VSS cameras with vandal-resistant and tamper-proof enclosures. Mounting VSS cameras at higher locations not only provides better vantage for monitoring of work activities but also makes the cameras more difficult to tamper with.

Any camera found damaged should be replaced as soon as possible so that coverage of the ongoing works is not disrupted.

2.4.3 Signages

Sufficient signages should be put up to inform all persons at the workplace of the VSS monitoring. Place the signages at prominent locations and points of entry to the workplace to inform all persons that a VSS is in operation.

2.4.4 Training

Send VSS operators for training on how to operate the VSS, what to look out for, and how to respond when a near-miss or WSH incident occurs.

Set up VSS Standard Operating Procedures (SOPs) and conduct refresher trainings to ensure that VSS operators are familiar with the SOPs.

2.4.5 Cyber security

Workplace occupiers, principals and employers should consider engaging the services of a cybersecurity specialist to understand potential cybersecurity risks and measures to prevent unauthorised access, interference, or remote disabling of the VSS.

For more information, you may refer to the Infocomm Media Development Authority's Internet of Things Cyber Security Guide.

For internet-enabled VSS, you may refer to the General Cybersecurity Guidelines for Internet Protocol Video Surveillance Systems in Annex B of the Singapore Police Force's Video Surveillance System Standard for Buildings for recommendations on how a VSS may be safeguarded.

2.5 System Maintenance

Preventive maintenance (e.g. checking and cleaning of the camera lens and replacement of mechanical parts showing signs of wear and tear) ensures the VSS remains operational with minimal downtime, prevents sudden equipment failure and prolongs the lifespan of the equipment. Regular and proper maintenance will keep the VSS running smoothly, reduce servicing and repair costs, and protect your investment.

Reactive (breakdown) maintenance is also necessary in the event of a component fault. Specific camera, system or software faults should be rectified as soon as possible such that VSS downtime is minimised.

3. Examples of VSS Installation

This section provides visual examples of how and where VSS cameras may be installed along with video stills of work areas that can be monitored.

3.1 Examples of Camera Types and Mounting Locations



Figure 1: Dome camera mounted on an indoor ceiling



Figure 2: Bullet camera mounted on an exterior wall



Figure 3: Bullet camera mounted on a specially erected support at a site under construction

3.2 Examples of Areas Monitored

Based on work activity:

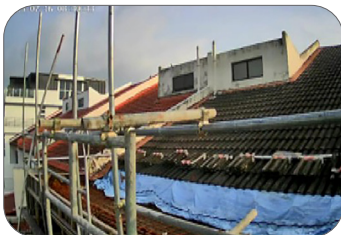


Figure 4: Work-at-height activity



Figure 5: Construction of support structure

Based on location:



Figure 6: At a floor of a building under construction

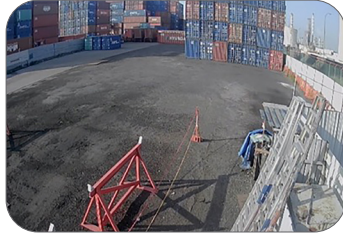


Figure 7: Loading/unloading area

4. References

- Workplace Safety and Health Act
- WSH (General Provisions) Regulations
- WSH (Risk Management) Regulations
- WSH (Approved Codes of Practice) Notification
- Personal Data Protection Act
- Approved Code of Practice on WSH Risk Management
- Approved Code of Practice for Working Safely at Heights
- Approved Code of Practice on Safe Lifting Operations in the Workplaces
- WSH 2028 Strategy Booklet
- Start Guide for Small and Medium-sized Enterprises
- IMDA's Internet of Things Cyber Security Guide
- PDPC's Guide to Notification
- SPF's Video Surveillance System Standard for Buildings
- WSH Guidelines published by the WSH Council
- WSH Council's Case Studies on Accidents Involving Working at Heights
- WSH Council's Case Studies for Construction Industry

5. Annex

Annex A: Summary of VSS Recommendations

	Recommendations
Basic Camera Specifications	
1. Camera type	Dome, bullet or suitable alternative
2. Video resolution	Minimum resolution of 1080p. Higher resolution recommended
3. Pan, tilt and/or zoom function	Optional
4. Cameras with artificial intelligence	Optional
5. Video analytics capability	Optional
6. Night vision capability	Optional
7. Weather-proof	Recommended
8. Dust-proof	Recommended
9. Portability	Fixed or portable

	Recommendations
Area Coverage Recommendations	<i>See Annex B for a sample checklist of activities and locations to be covered</i>
10. Cameras switched on and recording whenever there is work activity	Necessary
11. Camera has clear line of sight to the work activity	Necessary
12. Mounted at high vantage point	Recommended
13. Neighbouring premises not recorded	Recommended

		Recommendations
VSS Power Supply		
14.	Power source	Power line or battery pack
15.	Backup power	Recommended

		Recommendations
Transmission and Storage		
16.	Storage medium	Local storage device (e.g. SD card), network-based drive or cloud-based solution
17.	Transmission mode	Optional (via wired or wireless transmission)
18.	Storage capacity	30 days of recorded footage (if no WSH incident)
19.	Archival capacity	180 days from the date of WSH incident
20.	Video recordings to have camera identification, location/area of recording, and date/ time stamp.	Necessary
21.	Date and time for all cameras to be synchronised	Necessary
22.	Able to export video footage to external storage devices	Necessary

		Recommendations
Viewing and Access		
23.	VMS software that allows video files to be easily managed and viewed	Recommended
24.	Real-time monitoring capability	Necessary
25.	Able to retrieve recorded footage for any date and time interval	Necessary

		Recommendations
Other Operational Considerations		
26.	Adequate lighting for areas covered	Necessary
27.	Tamper-proof	Recommended
28.	Signages put up to inform a VSS is in operation	Necessary
29.	VSS operator(s) completed the necessary training	Necessary
30.	Set up VSS Standard Operating Procedures	Necessary
31.	Cyber security measures in place	Necessary

		Recommendations
System Maintenance		
32.	Preventive maintenance regime	Necessary
33.	Breakdown maintenance plan	Necessary

Annex B: Sample checklist of activities and locations to be covered by VSS Monitoring

Determine the higher-risk work activities/locations for your workplace based on Risk Assessment.

Below is a sample checklist for construction sites:

Higher-risk work activities at a construction site		VSS Monitored? (Y / N)
1.	Working at height activities where a worker may fall a distance ≥ 2 metres	
2.	Construction of support structures and scaffolds	
3.	Excavation and shoring works	
4.	Working near lifting operations	
5.	Works in confined spaces	
	{Insert additional higher-risk activities taking place at your site}	

Higher-risk locations at a construction site		VSS Monitored? (Y / N)
1.	At every floor of a building under construction where works are in progress	
2.	At worksites where heavy/industrial machinery or equipment are used	
3.	Areas with high vehicular and human traffic	
4.	Loading/unloading areas	
	{Insert additional higher-risk locations at your site}	

6. Acknowledgements

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