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**Ref. : DEVB(W) 516/80/01**

**Group : 2, 8**

**27 February 2023**

**Development Bureau  
Technical Circular (Works) No. 3/2023**

**Smart Site Safety System**

**Scope**

This Circular sets out the policy on adoption of Smart Site Safety System (“SSSS”) to enhance our safety management system, with a view to striving for further excellence on the safety performance in public works contracts.

**Effective Date**

2. This Circular shall take immediate effect.

**Effect on Existing Circulars**

3. This Circular shall be read in conjunction with the Construction Site Safety Manual (“CSSM”), DEVB TC(W) No. 1/2020 on Score Card for Assessment of Site Safety Performance, DEVB TC(W) No. 2/2023 on Digital Works Supervision System and their subsequent updates.

## **Background**

4. In reviewing the construction accidents occurred in public works contracts in recent years, we note that quite a number of them, especially the serious ones, could possibly be avoided if prior alerts could be timely issued to the site personnel concerned. SSSS is readily available for monitoring high-risk construction activities continuously. This can help uplift the site safety performance through early identification of potentially dangerous incidents or dangers and taking immediate follow-up mitigation actions. In addition, by analysing the data collected by SSSS, the crux of the safety problems could be revealed for formulating enhancement measures.

5. SSSS generally comprises the following three components –

- (a) smart safety devices for monitoring high-risk construction activities and identifying safety hazards;
- (b) a communication network for transmission of data collected from smart devices; and
- (c) a centralized management platform<sup>1</sup> for providing a one-stop hub for data analysis and alerts generation, as well as facilitating follow-up actions with potential hazards and abnormalities identified.

6. As announced in the Chief Executive's 2022 Policy Address, we decided to require capital works contracts with estimated contract sum exceeding \$30 million to adopt SSSS in early 2023.

## **Policy**

7. All capital works contracts with an estimated contract sum exceeding \$30 million to be tendered on or after the date of this Circular shall adopt SSSS. For capital works contracts with an estimated contract sum exceeding \$30 million and with tenders invited before the date of this Circular, SSSS shall also be adopted. For existing capital works contracts with a contract sum exceeding \$30 million, the project teams, with advice

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<sup>1</sup> For cost effectiveness, the centralized management platform of SSSS may amalgamate with the Digital Works Supervision System.

from the Departmental Safety and Environmental Advisor (“DSEA”), are strongly recommended to issue variation orders or *Project Manager/Service Manager* Instructions for adopting SSSS<sup>2</sup>, pursuant to the established mechanism and administrative procedures.

8. Project teams are also encouraged to adopt SSSS in other types of public works contracts with a contract sum exceeding \$30 million, such as maintenance and term contracts, by making reference to the policy measures depicted in paragraph 7 above.

9. The sample contract provisions for SSSS (viz. Particular Specification, Method of Measurement and Bills of Quantities) are at **Annexes A, B and C** respectively. For the avoidance of doubt, project teams may select suitable types of smart safety devices for use in works contracts (not limited to those provided in the Annexes) based on the nature of the construction works and details of high-risk activities involved.

10. The estimated cost of SSSS would normally not exceed \$10 million or 1% of the estimated contract sum, whichever is lower. If the aforementioned limit is to be exceeded, advice from DSEA and approval from an officer at D2 rank or above shall be sought. For avoidance of doubt, the estimated cost of SSSS shall not form part of the estimated cost of contract computer facilities under ETWB TC(W) No.12/2004 or estimated sum for Pay for Safety Scheme or Pay for Safety Performance Merit Scheme specified in CSSM.

11. Throughout the contract stage of public works contracts, to encourage contractors to adopt SSSS not specified in works contracts but available in the market which could uplift site safety performance, the project teams, with advice from DSEA, are encouraged to issue variation orders or *Project Manager/Service Manager* Instructions, as appropriate, to adopt SSSS not included in the works contracts, pursuant to the established mechanism and administrative procedures.

12. To facilitate regular review of contract provisions on SSSS for public works contracts, all variation orders or *Project Manager / Service Manager* Instructions to instruct contractors to adopt other SSSS not specified in works contracts, with the details and specifications of respective SSSS being instructed, shall be copied to DSEA, as appropriate, for record.

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<sup>2</sup> Factors to be considered include but not limited to the following –

- (i) remaining contract period, taking cognizance of the lead time for delivery of SSSS;
- (ii) funds availability; and
- (iii) specific nature, needs and situations of the contract.

13. During the contract stage of public works contracts, the performance of contractors in adoption, implementation and maintenance of SSSS shall be duly reflected in the Report on Contractor's Performance, vide the Score Card for Assessment of Site Safety Performance.

### **Exemption**

14. On exceptional grounds such as serious contractual implications, substantial impact on project delivery, the Heads of Works Departments ("WDs") may exempt the adoption of SSSS as required under this Circular. WDs shall keep records on such decision and inform DEVB and DSEA of the respective WD of the approvals for exemptions with detailed justifications.

### **Enquiries**

15. Enquiries on this Circular should be addressed to Chief Assistant Secretary (Works) 5.

**( Ricky C K LAU )**  
**Permanent Secretary for Development (Works)**

## Sample Particular Specification for Smart Site Safety System

[**Note:** The optional entries with asterisk (\*) are for selection by contract drafter to suit contracts using NEC Engineering and Construction Contract (ECC) or NEC Term Services Contract (TSC) or Government of the Hong Kong Special Administrative Region (HKSARG) General Conditions of Contract (GCC) 1999 Edition or HKSARG GCC for Term Contracts. Contract drafters are reminded to remove the inapplicable ones in blue.

\*\* amend as appropriate

\*\*\* delete or suitably amend if Centralized Management Platform is not required or amalgamated with Digital Works Supervision System. If the Centralized Management Platform is amalgamated with Digital Works Supervision System, the requirements on Centralized Management Platform shall be incorporated into the Digital Works Supervision System with necessary adaptation.

# Contract drafters shall determine whether the SSSS components could be incorporated into the respective contracts, taking into account the specific nature, needs and situations of the contracts.

\$ Contract drafters shall adjust the list based on the specific circumstance, situation and needs of the respective contracts.]

### General

- 1 (1) The *\*Contractor / Contractor* shall provide and maintain “Smart Site Safety System” (SSSS) during the continuance of the *\*works / Works* to enhance site safety management. The *\*Contractor / Contractor* shall provide and maintain all necessary materials and services for the implementation of SSSS, including but not limited to telecommunication network(s), power supply, computer hardware / software, data storage facilities, automation / remote sensing devices, operation system, accessories and corresponding services and license. The proposed SSSS components shall be well proven and shall not infringe any copyrights.

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- (2) The operation and collection of all data of SSSS and all its components shall comply with the Personal Data (Privacy) Ordinance (Cap. 486).
- (3) The *\*Contractor / Contractor* shall ensure that the Centralized Management Platform, telecommunication network or each component of SSSS shall have 99.9% uptime during working hours and at other time when the *\*Contractor / Contractor* is working or other time as advised by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.

### Implementation Plan for SSSS

- 2 (1) The *\*Contractor / Contractor* shall, within 14 days from the *\*starting date / date of acceptance of the tender*, submit the implementation plan on SSSS to the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* for acceptance. The implementation plan on SSSS shall include –
  - (a) a general description on overall SSSS setup, including site telecommunication networking, list of individual SSSS components as specified in Clause 5, implementation and operation schedule and a management plan with key personnel responsible for SSSS general implementation and maintenance;
  - (b) site telecommunication network and infrastructure proposal as stated in Clause 4 for supporting SSSS implementation;
  - (c) details of all computer hardware and software and the associated furniture for SSSS;
  - (d) proposal for each SSSS component to be implemented –
    - (i) The proposal for each SSSS component specified in Clause 5 and any other additional SSSS

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components initiated by the *\*Contractor / Contractor* or instructed by *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*;

(ii) Each SSSS component proposal shall include, but not limited to the following –

- details on the corresponding SSSS component performance specifications;
- a location plan for the corresponding SSSS devices and sensors setup during the continuance of the *\*works / Works*, and the arrangement of video cameras where SSSS components include video cameras;
- specification of computer system, including all associated hardware and software supporting the Centralized Management Platform as specified in Clause 5(12)(a);\*\*\*
- the format, report and presentation details of the dashboard for the Centralized Management Platform as specified in Clause 5(12)(a);\*\*\*
- details, layout and furniture for housing the Centralized Management Platform as specified in Clause 5(12)(a) inside the site office; \*\*\*
- action plan on site personnel's required actions and responses to SSSS components generated alarm / alert or identified unsafe acts / conditions which shall include detail on immediate / follow-up actions required, recommend response time, designate

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responsible supervising personnel and establish procedures to record all incidents triggered by SSSS components; and

- details on the emergency support services provision for the SSSS components where necessary, which shall also include an alternative monitoring back-up plan for each of the SSSS components in case where malfunctioning of any of the SSSS component cannot be rectified in a short period of time.
- (2) The *\*Contractor / Contractor* shall review and update the implementation plan on SSSS monthly according to the prevailing site condition. The review of implementation plan on SSSS shall be one of the agenda items of the Site Safety Management Committee meetings.
  - (3) Unless agreed by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*, the *\*Contractor / Contractor* shall deliver and implement all components of SSSS within 1 month from the date of acceptance of the first implementation plan on SSSS.
  - (4) The *\*Contractor / Contractor* shall deliver and implement any additional components on SSSS as stated in the updated implementation plan on SSSS as stated in Clause 2(2) above within 1 month from the date of acceptance of the updated implementation plan on SSSS concerned.
  - (5) Within 5 working days of delivery of any component, the *\*Contractor / Contractor* shall arrange the components of SSSS to be installed and tested for demonstrating that the SSSS components are in good working order to the satisfaction of the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance*



Surveyor.

- Delivery of SSSS**      3    (1)    The *\*Contractor / Contractor* shall make all necessary efforts and take all necessary precautions and security measures to ensure uninterrupted operation of all SSSS components installed till *\*Completion of the whole of the works / completion of the Works* or for such shorter or longer period as instructed by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*. The SSSS and all its components shall be able to operate automatically 24 hours per day and 7 days per week. The *\*Contractor / Contractor* shall be responsible for the cost of servicing, repair and maintenance of all SSSS components as well as the computer hardware and software. The *\*Contractor / Contractor* shall be responsible for the cost of supplying all consumables of all SSSS components and training of all site personnel for SSSS.
- (2)    The *\*Contractor / Contractor* shall be responsible for the cost for replacement of worn out or defective parts of all SSSS components and computer hardware and software. In the event of a breakdown of any SSSS components, or computer hardware or software, the *\*Contractor / Contractor* shall provide the respective replacement for the period of breakdown.
- (3)    The *\*Contractor / Contractor* shall implement appropriate security controls and measures to protect the confidentiality, integrity and availability of all data and information obtained, stored, processed or transmitted for the implementation and delivery of SSSS. The *\*Contractor / Contractor* shall review monthly the adequacy of the security control and protection measures, and implement additional measures where necessary at their own costs. The *\*Contractor / Contractor* shall also be responsible for briefing all site personnel on the collection of data for SSSS.

**Site telecommunication network**

- 4 (1) The *\*Contractor / Contractor* shall provide site telecommunication network which shall support mobile communication with adequate data transmission speed, capacity, coverage, connectivity, stability and cybersecurity to ensure uninterrupted, reliable and effective real-time data transmission, including any video / audio signals, from any automation / remote sensing devices to their targeted operators / receivers / monitors / data storage devices for efficient implementation of the proposed SSSS components. Due consideration on the flexibility and adjustability of the network system with respect to change in construction development and work progress fluctuation shall be taken in selection of the telecommunication network.
- (2) The *\*Contractor / Contractor* is obliged to adopt more than one telecommunication network systems available in the markets, including but not limited to Wi-Fi, broadband network, 4G/5G network, Bluetooth, LoRa, Ultra wideband etc., to suit the proposed SSSS components and with respect to site construction progress. However, the *\*Contractor / Contractor* shall ensure the accessibility and compatibility among multiple network systems with the corresponding SSSS components and that there shall not be any signal interference between different network systems adopted.
- (3) The *\*Contractor / Contractor* shall provide all necessary power supply and all associated infrastructures (including hardware and software) for the site telecommunication network.

**SSSS components 5**

General

- (1) The *\*Contractor / Contractor* shall adopt reliable and proven automation and remote sensing systems available in the market including but not limited to CCTV system, facial recognition system, artificial intelligence system, Radio Frequency Identification (RFID), infrared, Internet of Things (IoT), Ultra wideband (UWB), LoRa, etc. for the SSSS components.

- (2) The *\*Contractor / Contractor* shall ensure that any proposed SSSS component that required issue of automated warning, alarm or alert in the process to achieve and maintain an adequate accuracy but in no case lesser than 90% in detecting scenarios for triggering alert/warning signal on routine operation during the continuance of the *\*works / Works*. The *\*Contractor / Contractor* shall provide a live trial to prove the accuracy of the SSSS component in issuing warning, alarm and alert to the corresponding incident. The *\*Contractor / Contractor* shall also ensure that each time the automated warning system activates, a signal shall be automatically transmitted to a **[\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate]** for record, review and data analysis. The warning trigger record shall include but not limit to the involved personnel and machinery identification, warning trigger date, time and duration etc. The *\*Contractor / Contractor* shall review and analyse all the records and submit summarized report monthly to *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.
- (3) Where SSSS components include video cameras, the camera shall have a protective casing. The video cameras resolution shall not be less than 1080 pixels with at least 5X optical zoom and able to continuously transmit wireless encrypted live-streamed video signal to a **[\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate]** for recording, viewing and monitoring by the *\*Contractor / Contractor* and *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.
- (4) Where interim modification / adjustment to the operating SSSS components are proposed, the corresponding modification / adjustment shall be undertaken with minimum interruption to normal SSSS components operation and the

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*\*Contractor / Contractor* shall submit the corresponding modification / adjustment proposal to the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* for acceptance before implementation.

- (5) The *\*Contractor / Contractor* shall ensure the necessary power supply, as applicable, for the operation of all SSSS components. The *\*Contractor / Contractor* shall also conduct the necessary system maintenance, repair and/or replacement of any SSSS component / unit, at his own cost, within 24 hours upon reporting of any system abnormality, malfunction or damage to ensure normal operation of the SSSS components as necessary.
- (6) The *\*Contractor / Contractor* shall ensure that all audio, video, image and data transmitted from SSSS components shall –
  - (i) be digitized signal chronologically marked with the time and date of the signal transmission, be available for integration by an Application Programming Interface (API); and
  - (ii) be live-streamed to [\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate] for storage, viewing and analysis by personnel authorized by the *\*Contractor / Contractor*.

The *\*Contractor / Contractor* shall allow the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* to access the stored audio, video, image and data upon request. All audio, video, image and data shall be encrypted. The *\*Contractor / Contractor* shall maintain all APIs during system upgrade or maintenance and keep copy of the API library documents after launching of SSSS and major system upgrades.

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- (7) The *\*Contractor / Contractor* shall implement appropriate security controls and measures to protect the confidentiality, integrity and availability of all data and information obtained, stored, processed or transmitted through SSSS components during the continuance of the *\*works / Works*. The *\*Contractor / Contractor* shall make reference to the prevailing best practices, review regularly the adequacy of the security control and protection measures, and implement additional measures where necessary.
- (8) The *\*Contractor / Contractor* shall assign competent persons with relevant knowledge, experience and training to check and ascertain the proper functioning of the SSSS components, such as correct alarm triggering, real-time transmission and receiving of warning/alert signal between devices and concerned workers, supervisors and stations etc., before commencement of works on each day. Any irregularity observed during daily checks shall be recorded and rectified before conducting any related work activities. The daily check records with the irregularity and rectification records shall be kept on the Site for inspection by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* upon request.
- (9) The *\*Contractor / Contractor* shall establish and implement an action plan on site personnel's required actions and responses to SSSS components generated alarm / alert or identified unsafe acts / conditions which shall include detail on immediate / follow-up actions required, recommend response time, designate responsible supervising personnel and establish procedures to record all incidents triggered by SSSS components.
- (10) The *\*Contractor / Contractor* shall provide appropriate training to site personnel involving in the use of SSSS components to ensure they are familiar with the concerned SSSS components operation before commencement of

*\*works / Works.*

- (11) The *\*Contractor / Contractor* shall submit monthly report on implementation of SSSS components on site to *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* in advance of the monthly Site Safety Management Committee (SSMC) meeting for record and discussion in the SSMC meeting. The monthly report shall include, but not be limited to, updates on site SSSS components setup, operation, malfunction, interruption and modification, etc. The report shall also include a summary of all SSSS components triggered incidents, including false alarm, with details of incidents, actions taken and response time, consequence of incidents and follow up actions, and the site monitoring and analysis report on the unsafe practices/behaviours detected on site and the warning signals/alerts issued and associated measures retrieved from the **[\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate]**.
- (12) The *\*Contractor / Contractor* shall provide the following SSSS components on Site Safety Management –
- (a) Centralized Management Platform\*\*\*
- (i) The *\*Contractor / Contractor* shall provide and operate a Centralized Management Platform (CMP) to respond, manage and record signals/alerts received from all SSSS components implemented in the Site. The CMP shall be run in automatic mode. The CMP shall be compatible and work with the BIM model of *\*this contract / the Contract*. A trained site management personnel from the *\*Contractor / Contractor* shall be assigned to oversee the operation of the CMP during working hour of the Site and promptly attend to the alerts/signals for taking immediate actions to address the alerts/signals or

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emergency situations. The CMP could amalgamate with the Digital Works Supervision System provided under *\*this contract / the Contract*.

- (ii) The *\*Contractor / Contractor* shall ensure uninterrupted operation of the CMP upon setting up with the necessary backup and support in terms of equipment, device, power supply, data storage, telecommunication connection, maintenance and repair personnel and emergency support.
- (iii) The *\*Contractor / Contractor* shall develop a CMP that can display video, audio, image and data transmitted from different SSSS components on corresponding CMP monitors and ensure the various signals will not interfere or corrupt one another. The CMP shall have the capacity to control, monitor, manage and maintain simultaneous operation of all SSSS components under a single platform. The CMP shall also be designed to display various warning signals from different SSSS components with highlighted pop-up notification display on corresponding CMP monitors with details of warning and necessary follow up actions. The CMP shall allow concurrent access by not less than 30 users.
- (iv) The CMP shall support real time distributed event data streaming for large volume and high speed data handling. [*\*\*It shall support real-time video streaming from the Safety Monitoring System using Artificial Intelligence specified in sub-clause 5(12)(g) of this Clause.*]

**[Note: This sub-clause highlighted by \*\* shall only be used when Safety Monitoring System using Artificial Intelligence is specified in the contract.]**

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- (v) The *\*Contractor / Contractor* shall develop a CMP dashboard with a unique website link based on signals collected from SSSS. The *\*Contractor / Contractor* shall also provide the necessary training for designated management personnel on operating the CMP and on procedures to handle received warning signal and any emergency situation.
- (vi) The *\*Contractor / Contractor* shall provide the access policy of the CMP for acceptance by *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* before the delivery of the CMP. The access policy of the CMP shall cover, but not limited to user accounts control, access for system support personnel and procedures for management of users account created.
- (vii) The *\*Contractor / Contractor* shall establish a rational and logical filing system for automatic storage of all data, video, audio and images received from SSSS components, with a storage duration of at least 3 months. The *\*Contractor / Contractor* shall ensure that the computer system supporting the CMP has adequate processing power and storage space for storing all data, video, audio and images received from SSSS components. The servers for CMP for storing video, audio, image and data transmitted from different SSSS components shall be hosted at site office or externally in data centre or cloud-based system.
- (viii) The CMP and its server shall be fully accessible vide a web-browser by a desktop computer/laptop computer with secured internet connection (HTTPS) without physical or geographical limitation. No other software or licenses shall be necessary to access CMP.



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- (ix) For CMP servers hosted at site office, it shall be protected and separated from other systems by firewall (e.g. trusted zone, DM zone, etc.) and/or Virtual Private Network (VPN). The *\*Contractor / Contractor* shall ensure the hosting environment meets the requirements of data confidentiality, system integrity, system availability/accessibility, and data privacy aspect as agreed with *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.
- (x) For CMP servers hosted in data centre or cloud-based system, the *\*Contractor / Contractor* shall ensure that the selected hosting solution is configured, deployed and managed to meet the data confidentiality, integrity, availability and privacy aspects in compliance with globally recognised industrial security standard, e.g. TIA-942 certified Tier 3 data centre and, ISO/IEC 27001. The *\*Contractor / Contractor* shall provide an up-to-date independent auditor report for achieving international recognised certification, e.g. ISO/IEC 20000 or ISO/IEC 27017 to demonstrate the cloud service provider has required capability in security and risk management.
- (xi) Secure connection of at least 256-bit SSL shall be used for any network communication, transaction and data feed.
- (xii) The *\*Contractor / Contractor* shall implement measures and conduct IT security audits to ensure the security of CMP in accordance with Chapter IX of the Security Regulations, the Baseline IT Security Policy promulgated by the OGCIIO and the derived employer/client's IT Security Policy that complies with the Security Regulations and the Baseline IT Security Policy. The *\*Contractor / Contractor* shall also implement appropriate arrangements for

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preventing unauthorised access to CMP and its data.

(b) Digitized tracking system for site plants, powered tools and ladders<sup>#</sup>

- (i) The *\*Contractor / Contractor* shall provide and implement a digitalized system for real-time on-line tracking of all site plants, powered tools and ladders up-to-date status with respect to record of test certification, examination, checking and maintenance by mobile device. The *\*Contractor / Contractor* shall attach and secure a unique digital identification code for each and all plants, powered tools and ladders used in the Site. The site supervisor(s) and site management of the *\*Contractor / Contractor* concerned shall be able to scan the digital identification code with a mobile device which can extract and display information from a [\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate] on certification, examination, checking and maintenance records of the equipment being scanned. The *\*Contractor / Contractor* shall update and maintain the [\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate] records on certification and maintenance for all plants, powered tools and ladders used in the Site.
- (ii) The mobile device shall also display an alert message if the corresponding plant / powered tool / ladder has an outdated certification or is overdue for examination, checking or maintenance and automatically generate an alert message to the concerned site supervisors, Safety Officer of the *\*Contractor / Contractor* by means of Short Message Service (SMS) or in-app pop-up notification and record at [\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as

appropriate] for follow up actions. The alert message shall include details of the equipment digital identification number, date and time of scanning and the equipment status and record.

(c) Digitalized permit-to-work system for high risk activities<sup>#</sup>

(i) In addition to the requirements in *\*this contract / the Contract*, the *\*Contractor / Contractor* shall provide and implement a digitized permit-to-work system to facilitate on-line real-time application, issuance and tracking of permit-to-work/permit to move and operate for the following high risk activities<sup>\$</sup> –

- work in confined spaces
- work with electrical hazard
- work in lift shaft
- mobile crane, heavy machinery and piling rig operating or moving on the Site
- hot work
- use of ladder for work above ground for work purpose
- lifting operations by tower cranes, mobile cranes, crawler cranes, or cranes alike or lifting operation by mechanical means (excluding lifting operation with load not exceeding 2.5 tonnes within a distance of 2.5 metres from the edge of such crane)

(ii) The permit-to-work system for high risk activities shall allow electronic application, issuance and tracking of permit to work/permit to move and operate in the Site. The site supervisor(s) and site management of the *\*Contractor / Contractor* concerned shall be able to access the system using a mobile device to display real-time information on the corresponding permit-to-work/permit to move and

operate status.

- (iii) The mobile device shall also display an alert message if the corresponding permit-to-work/permit to move and operate has expired and automatically generate an alert message to the concerned site supervisors, Safety Officer of the *\*Contractor / Contractor* by means of SMS or in-app pop-up notification and record at a **[\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate]** for follow up actions. The alert message shall include details of the permit-to-work/permit to move and operate, date and time of alert message.
- (d) Hazardous areas access control by electronic lock and key system<sup>#</sup>
- (i) The *\*Contractor / Contractor* shall provide automated access control and warning system to prevent unauthorized opening of locked cover, doorway and barrier to hazardous areas within the Site which shall include but not limit to the following<sup>\$</sup> –
- electrical distribution board cabinet;
  - floor opening equal to or larger than 500mm x 500mm;
  - entrance to confined space area; and
  - lift shaft opening.
- (ii) The access control and warning system shall include an electronic lock and key system for locking down access to hazardous areas in the Site. The electronic lock shall only be openable to authorized electronic keys with key owners' identity electronically embedded in the key. The *\*Contractor / Contractor* shall review and renew all electronic locks access authority periodically or as necessary and maintain an update register of all electronic key issued with the

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corresponding authority for opening designated electronic locks. The *\*Contractor / Contractor* shall prohibit unauthorized duplication of electronic keys.

- (iii) When an unauthorized person attempts to open the electronic lock by using an outdated key or by force, the system shall immediately issue a warning siren with minimum 70 dB noise level and flashing red light and the siren can only be turned off when the electronic lock is re-engaged or by an authorized electronic key. Furthermore, every time a warning siren is triggered, an automatically generated alert message shall be sent to the mobile devices of the concerned site supervisors, Safety Officer, Registered Electrical Worker of the *\*Contractor / Contractor* by means of SMS or in-app pop-up notification for immediate actions to check the corresponding electronic lock being tampered with and recorded at **[\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate]** for the *\*Contractor's / Contractor's* actions where necessary. The alert message shall include location of electronic lock being tampered, date and time of incident and the electronic key identification number.

- (e) Unsafe acts / dangerous situation alert<sup>#</sup>

### Mobile plant operation danger zone<sup>#</sup>

- (i) The *\*Contractor / Contractor* shall install automated warning system on all mobile plants including but not limited to excavators, crawler cranes and mobile cranes operating on site to alert the mobile plant operator and any site personnel encroaching the mobile plant danger zone perimeter of the risk of being run over or hit by the plant moving components. The automated warning system shall include adequate number of sensors installed on the mobile plant

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chassis and movable superstructures to ensure full 360° coverage around the mobile plant danger zone perimeter. The danger zones of the mobile plant operation shall be determined by Safety Officer according to risk assessment but in no case shall the extent of the danger zone be less than 2m from any part of the mobile plant.

- (ii) When any one of the sensors detect a person encroaching upon the mobile plant danger zone perimeter, a warning light signal shall flash on the plant operating dash board and an automated warning message shall be delivered via speaker or headphone to the plant operator to stop all plant operation. At the same time, siren speaker attached to the top of the mobile plant shall automatically turn on with flashing red light and continuous alarm at minimum 100 dB to warn away any encroachment of the plant danger zone. All warning signal shall be automatically turned off when the encroaching person leave the plant danger zone perimeter. An alert message shall be generated to the site supervisors, Safety Officer of the *\*Contractor / Contractor* concerned by means of SMS or in-app pop-up notification and record at the *\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate* for follow up actions. The alert message shall include the date and time of the person encroached upon the danger zone of the plant, *\*\*and the video clip capturing the person 15 seconds before encroachment of the danger zone until 10 seconds after the encroaching person leave the plant danger zone*].

### Tower crane lifting zone<sup>#</sup>

- (i) The *\*Contractor / Contractor* shall install automated warning system on all tower cranes operating on site to alert tower crane operator and any site personnel

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encroaching upon the tower crane loading/unloading danger zone perimeter of the risk of being hit by the moving load under the crane hook. The automated warning system shall include adequate number of sensors installed on or around the tower crane to ensure full coverage of all loading/unloading areas danger zone perimeter at all floor levels involved. The loading/unloading danger zones of the tower crane operation shall be determined by Safety Officer according to risk assessment but in no case shall the extent of the danger zone be less than 7m radius from the crane hook. The minimum clearance between cargo being lifted and the loading/unloading area activating the automatic warning system shall be determined by Safety Officer according to risk assessment but in no case be less than 3m.

- (ii) When clearance between tower crane cargo and loading/unloading area is less than the minimum clearance for system activation and any one of the sensors detect person encroaching upon the danger zone perimeter, a warning light signal shall flash on the plant operating dash board and an automated warning message shall be delivered via speaker or headphone to the tower crane operator to stop all crane motion. At the same time, siren speaker attached to the crane hook shall automatically turn on with flashing red light and continuous alarm at minimum 100 dB to warn away any encroachment of the danger zone. All warning signal shall be automatically turned off when the encroaching person leave the danger zone perimeter. An alert message shall be generated to the site supervisors, Safety Officer of the *\*Contractor / Contractor* concerned by means of SMS or in-app pop-up notification and record at the *[\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate]* for follow up actions. The alert message shall include

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the date and time of the encroachment upon the loading/unloading danger zone, [\*\*and the video clip capturing 15 seconds before encroachment of loading/unloading danger zone until 10 seconds after the encroaching person leave the plant danger zone].

(f) Smart monitoring devices for workers and frontline site personnel<sup>#</sup>

(i) The *\*Contractor / Contractor* shall provide every workers and frontline site personnel deployed for the *\*works / Works* with smart monitoring devices or other equivalent wearable smart monitoring devices including but not limited to smart wristband and/or smart helmet.

(ii) The smart monitoring devices or other equivalent wearable smart monitoring devices shall include, but not limited to, the following functions\$ –

- capable of both outdoor and indoor location tracking and visualization of location in [\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate], and recording of workers' and frontline site personnel in different area and time of working. The location data shall be stored in the [\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate];
- real time detection of any standstill and sending alerts to [\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate]; SMS or in-app pop-up notification shall be generated and record at the database platform for follow up actions. The period of standstill criteria



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shall be adjustable;

- real time detection of body temperature and heart beat rate and sending alerts to cloud-based platform [\*\*\*Centralized Management Platform in sub-clause 5(12)(a) or a control platform, as appropriate] when the threshold is exceeded. SMS or in-app pop-up notification shall be generated and record at the database platform for follow up actions. The threshold of body temperature and heart beat rate shall be adjustable;
- actual body vital sign data shall not be displayed on the platform for privacy protection;
- allowing both battery and wireless charging;
- wireless connection to cellular, WiFi, NBIoT and/or LoRa networks, or equivalent;
- warning of entry to restricted area: Only authorized workers and frontline site personnel could enter the restricted area and any unauthorized entry shall trigger alerts to workers and frontline site personnel.

(g) Safety Monitoring System using Artificial Intelligence<sup>#</sup>

- (i) The \*Contractor / Contractor shall provide and install the Safety Monitoring System using Artificial Intelligence, comprising sufficient number, but not less than [X] number, of Internet Protocol (IP) cameras and associated Artificial Intelligence (AI) processors with protective casings and sensor systems to collect videos that can cover all areas of the Site for real-time monitoring of the site conditions.

**[Note: Contract drafters shall fill in the number [X] in this sub-clause based on the needs and situations of the contract.]**

- (ii) \*\*A control platform shall be provided to manage all IP cameras, sensors and related video recordings.

**[Note: This sub-clause shall only be used when Centralized Management Platform is not specified in the contract.]**

- (ii) \*\*All IP cameras, sensors and related video recordings shall be managed by the CMP specified in sub-clause 5(12)(a) of this Clause.

**[Note: This sub-clause shall only be used when Centralized Management Platform is specified in the contract.]**

- (iii) The proposed AI detection and video analytics shall pass an accuracy test with a testing dataset. The *\*Contractor / Contractor* shall conduct a live test with the pre-built AI engine modules to achieve an accuracy of AI detection of at least 80% (true positive) for each type of Unsafe Scenario required. The testing dataset comprises not less than 10,000 images and it shall be split into half between image data with and without the proposed detecting object (or event) in those images.

- (iv) In the fourth weeks after deployment of AI detection on Site, the *\*Contractor / Contractor* shall provide the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* with weekly AI improvement plan (with re-training and other proposed methodology) to achieve the required accuracy of AI detection.

- (v) Between the fourth week and twelfth week after the deployment of AI detection on Site, the *\*Contractor / Contractor* shall provide the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* with bi-weekly AI improvement plan (with re-training and other proposed methodology) to achieve the required accuracy of AI detection.
- (vi) Between the third months after the deployment of AI detection on Site and *\*Completion of the whole of the works / completion of the Works* or for such shorter or longer period as instructed by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*, the *\*Contractor / Contractor* shall provide the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* with monthly AI improvement plan (with re-training and other proposed methodology) to achieve the required accuracy of AI detection.
- (vii) The *\*Contractor / Contractor* shall improve and maintain the required AI detection accuracy of at least 90% on average covering all types of Unsafe Scenarios (as defined in sub-clause 5(12)(g)(ix) below) required to be detected at all times after 4 weeks from the deployment of AI detection on Site till *\*Completion of the whole of the works / completion of the Works* or for such shorter or longer period as instructed by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.
- (viii) The *\*Contractor / Contractor* shall provide a total of two (2) on-site technical training courses (4 hours for each course) for implementing the site monitoring

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system using AI. The details are as follows –

- The content of each course shall cover aspects of data acquisition, processing and detection analysis for different types of Unsafe Scenarios (as defined in sub-clause 5(12)(g)(ix) below) relevant to the AI engine modules required at different stages.
  - The trainer shall possess extensive knowledge and practical experience in deploying IP cameras for surveillance and analysing data collected from site videos by appropriate AI engine modules.
  - The training course shall be conducted within 2 weeks from the date after deployment of AI detection on Site.
  - The content of each course, the experience and qualifications of the trainer shall be accepted by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* prior to commencement of the training course.
- (ix) By using the Safety Monitoring System using Artificial Intelligence, videos shall be recorded and analysed in real-time by AI engine modules designed to detect, identify and classify the different types of Unsafe Scenarios, including but not limited to the following<sup>s</sup> –
- unauthorised access to restricted zones, danger zones, lifting zones and no-parking zone (detection zones and alerts should be configurable);

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- workers near site vehicles or plant as designated by the *\*Contractor / Contractor*;
  - potential collisions between workers and site vehicles or other plant;
  - monitoring of fatigue, distraction, inattentive behaviours of site vehicles drivers and plant operators during operation of site vehicles and plant;
  - workers and other personnel not wearing the required personal protective equipment (PPE), including safety helmet and safety vest;
  - heights of lifting in excess of the authorized limits; and
  - workers working at height either without wearing safety belt and fixed it to a proper anchorage point of lifeline, or without a proper ladder.
- (x) The AI engine shall be able to detect multiple physical events at the same time.
- (xi) The Safety Monitoring System using Artificial Intelligence shall allow restricted zones, danger zones and lifting zones to be defined on the screen either by the user or by recognition of a series of plastic barriers placed on site.

**[Note: This sub-clause shall only be used when any of the first three bullets in sub-clause 5(12)(g)(ix) is specified.]**

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- (xii) When any Unsafe Scenarios specified in sub-clause (ix) above is detected, siren speaker attached to the top of the mobile plant concerned and/or at the incident location concerned shall automatically turn on with flashing red light and continuous alarm at minimum 100 dB. The siren can only be turned off when the workers concerned left the restricted zones, danger zones or lifting zones, the plant operator stopped the plant operation and the workers or site personnel concerned addressed the warning signals/alerts. In addition, every time a warning siren is triggered, an automatically generated alert message shall be sent to the mobile devices of the concerned site supervisors and Safety Officer of the *\*Contractor / Contractor* by means of SMS or in-app pop-up notification for immediate actions. The automatically generated alert message shall also be sent and stored in the *\*\*\* the control platform specified in sub-clause 5(12)(g)(ii) of this Clause OR CMP in sub-clause 5(12)(a) of this Clause*. All the sound/light signals/alerts mentioned in this sub-clause shall be triggered within 1 seconds after any Unsafe Scenario is detected.
- (xiii) The duration of the recorded videos for Unsafe Scenarios shall commence 1 minute before and finish 1 minute after the identified Unsafe Scenarios. The videos shall be captured and stored for future analysis.
- (xiv) The videos, data, warning alerts/signals and response times collected by the Safety Monitoring System using Artificial Intelligence shall be live-streamed to *\*\*\* the control platform specified in sub-clause 5(12)(g)(ii) of this Clause OR CMP in sub-clause 5(12)(a) of this Clause* for viewing. All videos or image data shall be encrypted. The display format at the *\*\*control platform OR CMP* shall be accepted by *\*Project Manager / Engineer / Surveyor /*

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Supervising Officer / *Service Manager* / Maintenance Surveyor.

- (xv) The *\*Contractor / Contractor* shall record the response time of the follow-up actions triggered by each warning signal/alert and furnish a summary report to the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*, which covers the period from the warning signal/alert to close of the case.
- (xvi) A drill shall be conducted by the *\*Contractor / Contractor* once every 6 months to test the effectiveness of Safety Monitoring System using Artificial Intelligence.

(h) Confined Spaces Monitoring System<sup>#</sup>

- (i) The *\*Contractor / Contractor* shall propose and implement a Confined Space Monitoring System to monitor the locations on the Site defined as confined spaces under the Factories and Industrial Undertakings (Confined Spaces) Regulation (Cap. 59AE). The Confined Space Management System shall fulfil following functions –

- \$ Real time site worker counting and location tracking inside confined spaces

**[Note: This bullet shall be suitably amended if smart monitoring devices for workers and frontline site personnel is specified and could adequately covered this function.]**

- Confined space environment monitoring including –

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- Oxygen (O<sub>2</sub>) level
  - Temperature
  - PM2.5 level
  - Carbon Monoxide (CO), Carbon Dioxide (CO<sub>2</sub>) & Hydrogen Sulfide (H<sub>2</sub>S), Methane (CH<sub>4</sub>) level
  - Combustible gas
- real-time alert if any monitoring parameter exceeds the pre-determined safety levels or any anomaly of workers' conditions is detected.
- (ii) \*\*A control platform shall be provided to manage all sensors and related warning signals/alerts.

**[Note: This sub-clause shall only be used when Centralized Management Platform is not specified in the contract.]**

- (ii) \*\*All sensors and related warning signals/alerts shall be managed by the CMP specified in sub-clause 5(12)(a) of this Clause.

**[Note: This sub-clause shall only be used when Centralized Management Platform is specified in the contract.]**

- (iii) The warning alerts/signals and response times collected by the Confined Spaces Monitoring System shall be automatically transferred to **[\*\* the control platform specified in sub-clause 5(12)(h)(ii) of this Clause OR CMP in sub-clause 5(12)(a) of this Clause]** for viewing. All warning alerts/signals shall be encrypted. The display format at the **[\*\*control platform OR CMP]** shall be accepted by *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.



**Safety Training  
with Virtual  
Reality  
Technology**

- 6 (1) In addition to the safety training required in *\*this contract / the Contract*, the *\*Contractor / Contractor* shall provide safety training using virtual reality (VR) technology for workers engaging in the following high risk activities on topic(s) relevant to their duties on a half-yearly basis –
- (i) Heavy lifting operation;
  - (ii) Heavy machinery operation;
  - (iii) Working in confined space;
  - (iv) Use of suspended working platform;
  - (v) Erection/alteration/dismantle of bamboo scaffolds and/or truss-out bamboo scaffolds; and
  - (vi) Electrical and other works with potential electrical hazards or chance of coming into contact with live electrical parts.
- (2) The *\*Contractor / Contractor* shall prepare and provide the training content for safety training using VR technology for acceptance by *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*. The content of the toolbox talks could be based on VR training kits prepared by the Development Bureau, Construction Industry Council, the Hong Kong Construction Association or equivalent. The *\*Contractor / Contractor* shall provide all necessary hardware and software for smooth conduction of safety training using VR technology.
- (3) The *\*Contractor / Contractor* shall keep on the Site records of the safety training using VR technology, including the names and trades of the workers engaging in the above high risk activities, the dates and topic(s) of training they have received with their signature, for inspection by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* upon request.

**Sample Method of Measurement for Smart Site Safety System**

- [Note:** (1) The optional entries with asterisk (\*) are for selection by contract drafter to suit contracts using NEC Engineering and Construction Contract (ECC) or NEC Term Services Contract (TSC) or Government of the Hong Kong Special Administrative Region (HKSARG) General Conditions of Contract (GCC) 1999 Edition or HKSARG GCC for Term Contracts. Contract drafters are reminded to remove the inapplicable ones in blue.
- (2) The sample is based on the Hong Kong Government Standard Method of Measurement for Civil Engineering Works. For Bill of Quantities based on other standard methods of measurement, appropriate amendments shall be made.
- (3) For item with #, contract drafters shall only include the method of measurement for the components of Smart Site Safety System included in the Contract.
- (4) For ^, please update the clause number accordingly.]
- (5) If the Centralized Management Platform (CMP) is amalgamated with the Digital Works Supervision System (DWSS) provided under the contract, please suitably amend the method of measurement for CMP with % or incorporate the method of measurement into the item for DWSS as appropriate.

**Particular Preamble**

**General Principle**

- xx.1 Rates appearing in this Section of the Method of Measurement shall be deemed to allow for the value of work in connection with meeting all statutory and contractual obligations in the upkeeping of safety and health in the execution of the *\*works / Works*, providing and maintaining “Smart Site Safety System” (SSSS) during the continuance of the *\*works / Works* and any other related obligations, liabilities, risks and profit. In the event that the rates have been insufficient or where there are any aspects where the methods provided hereunder do not measure any item

or exclude the measurement of any item or part thereof, the difference in value shall be deemed to have been included in the rates inserted elsewhere in the *\*Bills of Quantities / Activity Schedule / Schedule of Rates*.

**IMPLEMENTATION PLAN FOR SMART SITE SAFETY SYSTEM**

- Units*            xx.2    The units of measurement shall be:
- (i) complete Implementation Plan for Smart Site Safety System ..... item
  - (ii) review, update and implement Implementation Plan for Smart Site Safety System ..... month
- Measurement*    xx.1    The item “complete Implementation Plan for Smart Site Safety System” shall be measured once for the whole *\*contract/Contract* when the Implementation Plan for SSSS *\*accepted/approved* by *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.
- xx.2    The measurement of the “review, update and implement Implementation Plan for Smart Site Safety System” shall be the period of time commencing from the date of approval of Implementation Plan for SSSS by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* until the date for completion of *\*the whole of the works / Works* or an earlier or later date notified by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.
- xx.3    No measurement and payment shall be made for the item “review, update and implementation of Implementation Plan for SSSS” for any month during which the *\*Contractor / Contractor* fails to discharge any of his contractual obligations in respect of –

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- (a) reviewing, revising or updating the Implementation Plan for SSSS; and
- (b) delivering and implementing all components of SSSS as stated in the Contact and the Implementation Plan for SSSS.

### *Itemisation*

- xx.4 Separate items shall be provided for “Implementation Plan for Smart Site Safety System” in accordance with General Principles paragraphs 3 and 4 and the following:

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Group	Feature
I	<ul style="list-style-type: none"><li>1. Complete Implementation Plan for Smart Site Safety System</li><li>2. Review, update and implement Implementation Plan for Smart Site Safety System</li></ul>

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### *Complete Implementation Plan for Smart Site Safety System*

- xx.5 The item for “complete Implementation Plan for Smart Site Safety System” shall, in accordance with General Preambles paragraph 2, include for:

### *Item Coverage*

- (a) prepare and develop the Implementation Plan for SSSS taking into account the comments made on the Implementation Plan for SSSS by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* and any other parties including but not limited to members of Site Safety Management Committee; and
- (b) all efforts, costs, expenses, loss or profit provided, incurred or allowed by the *\*Contractor / Contractor* for striving to achieve the performance required by this item.

*Review, update and implement Implementation Plan for Smart Site Safety System*      xx.6      The item for “review, update and implement Implementation Plan for Smart Site Safety System” shall, in accordance with General Preambles paragraph 2, include for:

- Item Coverage*
- (a) review, update and revise the Implementation Plan for SSSS taking into account the comments made on the Implementation Plan for SSSS by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* and any other parties including but not limited to members of Site Safety Management Committee;
  - (b) implementation of the decisions and recommendations made by the Site Safety Management Committee on matters relating to implementation of SSSS; and
  - (c) all efforts, costs, expenses, loss or profit provided, incurred or allowed by the *\*Contractor / Contractor* for striving to achieve the performance required by this item.

**SITE COMMUNICATION NETWORK**

*Units*      xx.7      The unit of measurement shall be:

- (i) provide site communication network ..... month

*Measurement*      xx.8      The measurement of the item “provide site communication network” shall be the period of time commencing from the date of operation of the first component of SSSS until the date on which last component of SSSS under *\*this contract / the Contract* ceases to operate, or an earlier or later date notified by the *\*Project*

*Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor.*

xx.9 No measurement and payment shall be made the item “provide site communication network” when the site communication network does not fulfil the uptime requirement specified, does not have adequate data transmission speed, capacity, coverage, connectivity, stability and cybersecurity to support uninterrupted, reliable and effective real-time data transmission any of the components of SSSS.

*Itemisation*

xx.10 Separate items shall be provided for “Site Communication Network” in accordance with General Principles paragraphs 3 and 4 and the following:

Group	Feature
I	1. Provide site communication network

*Provide site communication network*

xx.11 The item for “provide site communication network” shall, in accordance with General Preambles paragraph 2, include for:

*Item Coverage*

- (a) provide site telecommunication network systems which shall support mobile communication, fulfilling uptime requirements specified, with adequate data transmission speed, capacity, coverage, connectivity, stability and cybersecurity to ensure uninterrupted, reliable and effective real-time data transmission, including any video / audio signals, from any automation / remote sensing devices to their targeted operators / receivers / monitors / data storage devices for efficient implementation of the proposed SSSS components as required by *\*this contract / the Contract*;
- (b) all necessary measures and installations for ensuring the accessibility and compatibility among multiple

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telecommunication network systems with the corresponding SSSS components as required by *\*this contract / the Contract*;

- (c) provide all necessary power supply and associated infrastructures for the site telecommunication network systems; and
- (d) all efforts, costs, expenses, loss or profit provided, incurred or allowed by the *\*Contractor / Contractor* for striving to achieve the performance required by this item.

**COMPONENTS OF SMART SITE SAFETY SYSTEM<sup>#, %</sup>**

*Units*

xx.12 The units of measurement shall be:

- (i) Centralized Management Platform ..... month
- (ii) digitized tracking system for site plants, powered tools and ladders ..... month
- (iii) digitalized permit-to-work system for high risk activities ..... month
- (iv) hazardous areas access control by electronic lock and key system ..... month
- (v) unsafe acts / dangerous situation alert for mobile plant operation danger zone ..... month
- (vi) unsafe acts / dangerous situation alert for tower crane lifting zone ..... month
- (vii) Smart monitoring devices for workers and frontline site personnel ..... month
- (viii) Safety Monitoring System using Artificial Intelligence ..... month
- (ix) Confined Space Monitoring System ..... month

*Measurement*

xx.13 The measurement for the items “Centralized Management Platform”, “digitized tracking system for site plants, powered tools and ladders”, “digitalized permit-to-work system for high risk activities”, “hazardous areas access control by electronic lock and

key system”, “unsafe acts / dangerous situation alert for mobile plant operation danger zone”, “unsafe acts / dangerous situation alert for tower crane lifting zone”, “Smart monitoring devices for workers and frontline site personnel”, “Safety Monitoring System using Artificial Intelligence” and “Confined Space Monitoring System” shall be the period of time commencing from the date of uninterrupted operation of the first respective component of SSSS until the date on which the last respective component of SSSS ceases to operate under *\*this contract / the Contract*, or an earlier or later date notified by the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*.

- xx.14 No measurement and payment shall be made for the respective items “Centralized Management Platform”, “digitized tracking system for site plants, powered tools and ladders”, “digitalized permit-to-work system for high risk activities”, “hazardous areas access control by electronic lock and key system”, “unsafe acts / dangerous situation alert for mobile plant operation danger zone”, “unsafe acts / dangerous situation alert for tower crane lifting zone”, “Smart monitoring devices for workers and frontline site personnel”, “Safety Monitoring System using Artificial Intelligence” and “Confined Space Monitoring System” when the respective SSSS components do not fulfil the uptime requirement or fulfil the requirements on the respective SSSS components as required by *\*this contract / the Contract* during the month.

- Itemisation*      xx.15 Separate items shall be provided for “components of Smart Site Safety System” in accordance with General Principles paragraphs 3 and 4 and the following:



Group	Feature
I	<ol style="list-style-type: none"> <li>1. Centralized Management Platform</li> <li>2. Digitized tracking system for site plants, powered tools and ladders</li> <li>3. Digitalized permit-to-work system for high risk activities</li> <li>4. Hazardous areas access control by electronic lock and key system</li> <li>5. Unsafe acts / dangerous situation alert for mobile plant operation danger zone</li> <li>6. Unsafe acts / dangerous situation alert for tower crane lifting zone</li> <li>7. Smart monitoring devices for workers and frontline site personnel</li> <li>8. Safety Monitoring System using Artificial Intelligence</li> <li>9. Confined Space Monitoring System</li> </ol>

*Smart Site Safety System*

xx.16 The items for components of Smart Site Safety System shall, in accordance with General Preambles paragraph 2, include for:

- (a) provide all necessary submissions, plant, materials, installation, infrastructures, hardware, software, power supply, personnel, training, effort and take all necessary precautions and security measures to ensure continuous operation of all components of SSSS as required by *\*this contract / the Contract* and for compliance of all requirements related to SSSS as required by *\*this contract / the Contract*;
- (b) replacement of worn out, defective or broken down parts, hardware and software of all components of SSSS as required by *\*this contract / the Contract*;
- (c) review and implement all necessary audits, security controls and measures to protect the confidentiality, integrity and

availability of all data and information obtained, stored, processed or transmitted for the implementation and delivery of SSSS for compliance of all requirements related to SSSS as required by *\*this contract / the Contract*;

- (d) prepare report on implementation of SSSS components to *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* for discussion in the Site Safety Management Committee meetings as required by *\*this contract / the Contract*; and
- (e) implement all necessary measures to ensure the operation and collection of data of SSSS and its components complying with the Personal Data (Privacy) Ordinance (Cap. 486).

**SAFETY TRAINING WITH VIRTUAL REALITY TECHNOLOGY**

*Units*

xx.17 The unit of measurement shall be:

- (a) safety training with Virtual Reality technology ..... number

*Measurement*

xx.18 The measurement and payment for the item “safety training with Virtual Reality technology” shall be made on a per person per talk basis. No measurement and payment shall be made for this item if the attendees of the safety training with Virtual Reality technology has attended the safety training with Virtual Reality technology held by the *\*Contractor / Contractor* under *\*this contract / the Contract* in the past half-year interval.

xx.19 No measurement and payment for the items “safety training with Virtual Reality technology” shall be made if the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor* or his Representative is dissatisfied with the frequency, arrangements, relevance or quality

of such training and the *\*Contractor / Contractor* cannot provide any justification acceptable to the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor's Representative*.

*Itemisation*

xx.20 Separate item shall be provided for “safety training with Virtual Reality technology” in accordance with General Principles paragraphs 3 and 4 and the following:

Group	Feature
I	1. Safety training with Virtual Reality technology

*Safety training with Virtual Reality technology*

xx.21 The item for “safety training with Virtual Reality technology” shall, in accordance with General Preambles paragraph 2, include for:

- (a) provide safety training with Virtual Reality technology to workers engaging in the high risk activities specified in Clause [6] of the Particular Specification;
- (b) the necessary training of personnel to conduct such talks;
- (c) the necessary facilities, personnel and demonstration equipment for complying with (a) above;
- (d) preparation and submission of training programme and records, submission of certified monthly statements to the *\*Project Manager / Engineer / Surveyor / Supervising Officer / Service Manager / Maintenance Surveyor*; and
- (e) all necessary administration to arrange workers to participate in safety training with Virtual Reality technology.

**Sample Bills of Quantities for Smart Site Safety System**

<b>Item No.</b>	<b>Description</b>	<b>Quantity</b>	<b>Unit</b>	<b>Rate</b>	<b>TOTAL</b>
A	Complete Implementation Plan for Smart Site Safety System	-	item	^	
B	Review, update and implement Implementation Plan for Smart Site Safety System	\$	mth	^	
C	Provide site communication network	\$	mth	^	
D	Centralized Management Platform <sup>#, %</sup>	\$	mth	^	
E	Digitized tracking system for site plants, powered tools and ladders <sup>#</sup>	\$	mth	^	
F	Digitalized permit-to-work system for high risk activities <sup>#</sup>	\$	mth	^	
G	Hazardous areas access control by electronic lock and key system <sup>#</sup>	\$	mth	^	
H	Unsafe acts / dangerous situation alert for mobile plant operation danger zone <sup>#</sup>	\$	mth	^	
I	Unsafe acts / dangerous situation alert for tower crane lifting zone <sup>#</sup>	\$	mth	^	

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<b>Item No.</b>	<b>Description</b>	<b>Quantity</b>	<b>Unit</b>	<b>Rate</b>	<b>TOTAL</b>
J	Smart monitoring devices for workers and frontline site personnel <sup>#</sup>	\$	nth	^	
K	Safety Monitoring System using Artificial Intelligence <sup>#</sup>	\$	nth	^	
L	Confined Space Monitoring System <sup>#</sup>	\$	nth	^	
M	Safety training with Virtual Reality technology	\$	nr	^	
<b>Total to Collection Sheet</b>					

**Note:**

# Contract drafters shall only include the payment items for the components of Smart Site Safety System included in the Contract.

\$ The quantities are to be determined by the contract drafters depending on circumstances.

^ To be tendered by the *Contractor* / Contractor

% If the Centralized Management Platform (CMP) is amalgamated with the Digital Works Supervision System (DWSS) provided under the contract, please suitably amend the payment item and the method of measurement for CMP, and/or incorporate the method of measurement into the item for DWSS as appropriate.

nth month

nr number