

# Workplace Safety and Health Guidelines

Design for Safety



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# 1. Introduction

The Workplace Safety and Health (Design for Safety) Regulations 2015 (herein referred as “WSH (DfS) Regulations”) will be effective from 1 August 2016. The Regulations require stakeholders such as Developers, Designers and Contractors to work together to address risks at source and plan for safe work in regard to a building or structure as a workplace. By working together, they can identify and eliminate or reduce, as far as reasonably practicable, all foreseeable design risk(s) to any person’s safety or health. Person is defined as anyone:

- carrying out or liable to be affected by construction work (including additions, alterations and demolition) for the structure, or
- working in a completed building or structure as a workplace including an individual who maintains or cleans the structure, or anything in or on the structure.

It is also the WSH (DfS) Regulations’ intent to direct stakeholders to work together to perform their DfS duties and promote safe execution of construction and maintenance works so that buildings or structures can be safe workplaces.

**Note:**

This set of guidelines replaces the Guidelines on Design for Safety in Buildings and Structures (first issued in 2008, first revision in 2011).

## 1.1 Application of Regulations

The WSH (DfS) Regulations do not apply to a project where a Designer is appointed before 1 August 2016.

The WSH (DfS) Regulations is applicable to all projects:

- undertaken by a Developer in the course of his or her business;
- with contract sum of \$10 million or more; and
- that involve development under section 3(1) of the Planning Act (Cap. 232).

Any modification carried out on a building or structure that has an existing DfS Register and falls under the definition of “Development” under the Planning Act will have to comply with the DfS Regulations. This is regardless of the contract sum value.

See Annex 1 for the definition of “Development” under the Planning Act (Cap. 232).

Contract sum in relation to any construction work, means the value specified in a contract of the works to be carried out by the Contractor undertaking the construction work; it includes goods and services tax payable in relation to the supply of the work. Contract sum here refers to the total contract sum in term contracts; variation orders are not considered in contract sums.

The stakeholders should also take into consideration that all systems and equipment are installed with safety and health provision in accordance to WSH requirements and best practices for future downstream maintenance. Some examples include safe access to cleaning, delivering or removing heavy parts, such as chiller plants, water tanks, or diesel where standby generators are mounted on roof level (with provision of minimum space to carry out maintenance safely and ergonomically). All such considerations should be addressed in a Maintenance Strategy Report. A Maintenance Strategy Report is a document where Designers record their proposals and requirements regarding access strategies for maintenance tasks (see Annex 8). Developer or Designer may use the recommended GUIDE process, in particular, GUIDE-2 outline in Section 6, when preparing a Maintenance Strategy Report.

“Alterations and Addition” (A&A) works that are considered developments under the Planning Act are required to comply with the WSH (DfS) Regulations if all the qualifying criteria are met (e.g., contract sum exceeding SGD\$10 million).

In general, contracts that are not defined as developments under the Planning Act are not required to comply with the WSH (DfS) Regulations.

See Table 1 for examples of applications of the DfS Regulations.

Scenarios	Do the DfS Regulations apply? (Yes/ No)
1. I am building a good class bungalow with a contract sum of \$12 million for my own occupation. Do the DfS Regulations apply to me?	No
2. Our company is developing a residential condominium project with a contract sum of \$20 million. Do the DfS Regulations apply to our project?	Yes
3. We are developing a commercial building with a contract sum of \$9 million. However, due to variation orders during the design phase, the contract sum is now \$10.5 million. Are we required to comply with the DfS Regulations?	No
4. We appointed a Designer for our development project in 2015. Are we still required to comply with the DfS Regulations?	No

5. We are carrying out Addition and Alteration works with a contract sum of \$6 million on a building which already has a DfS Register. Do we need to continue updating the DfS Register and comply with the Regulations?	Yes
6. We are carrying out Addition and Alteration works on an existing building built before 1 August 2016 and it does not have a DfS Register. The contract sum for this project amounts to more than \$10 million and falls under the definition of the term “development” as specified in the Planning Act. Do we need to comply with the DfS Regulations?	Yes

Table 1: Examples of applications of DfS Regulations.

**Note:**

Despite the ambit of DfS application, WSH Council encourages Developers, Designers and Contractors to apply DfS to all building projects. The restricted applicability of the Regulations should not be construed as prohibiting or discouraging the practice of DfS to all building projects.

## 1.2 Definition of “Structures”

Under the Regulations, “structures” are defined as any permanent or temporary structures. A reference to a structure includes any part of the structure and any product, or mechanical or electrical system intended for the structure.

For permanent structures, this would include any building, timber, masonry, metal, composite or reinforced concrete structure, structure designed or used to provide support or means of access, railway line or siding, dock, harbour, inland navigation, tunnel, shaft, bridge, viaduct, waterworks, reservoir, pipe or pipe-line, cable, aqueduct, sewer, sewage works, gasholder, road, airfield, sea defence works, river works, drainage works, earthworks, lagoon, dam, wall, caisson, mast, tower, pylon, underground tank, earth retaining structure or structure designed to preserve or alter any natural feature, fixed plant and any structure similar to those listed.

For temporary structures, this would include any formwork, falsework, scaffold or other structure designed or used to provide support or means of access during construction work.

### 1.2.1 What is “Reasonably Practicable”?

The term “reasonably practicable” means that the degree of risk in a particular situation can be balanced against the time, trouble, cost and physical difficulty of taking measures to avoid the risk. An action is considered to be practicable when it is capable of being done. To decide if an action is reasonable, one has to consider:

- the severity of any injury or harm to health that may occur;
- the degree of risk (or likelihood) of that injury or harm occurring;
- how much is known about the hazard and ways of eliminating, reducing or controlling it;
- the availability, suitability and cost of the safeguards.

The risk and severity of injury needs to be weighed against the overall feasibility of the safeguards needed to remove the risk. The greater the risk, and/or severity, the more reasonable it is to go to considerable expense and effort to reduce it.

The cost of putting safeguards in place needs to be measured against the consequences of failing to do so. The judgement is an objective one. Whether an employer can afford to put the necessary safeguards in place is not a consideration, particularly when there is a risk of serious injury, or frequent but less severe injury.

Common practice and knowledge in the relevant industry are sometimes taken into account when one is deciding whether a safeguard is considered “reasonably practicable”. Employers cannot claim that they do not know what to do about certain hazards if those hazards and their safeguards are widely known in the same industry.

For information on safety and health measures considered to be reasonably practicable, refer to WSH-related Singapore Standards published by SPRING Singapore; and WSH materials published by the WSH Council.

### 1.3 DfS Register

The DfS Register is a collection of documents generated through the DfS review process. The Register serves two key purposes.

First, the DfS Register serves as a record and evidence that the DfS review process has been properly undertaken. This includes:

- diligent and systematic identification of foreseeable design risks;
- elimination and/or mitigation of the identified risks as far as reasonably practicable; and
- effective communication of risk information to affected persons.

Second, the DfS Register contains vital information which needs to be communicated to individuals facing design risks, for example, during the construction, maintenance, repair or demolition of a structure, so that they are aware of any identified risks that they ought to address, and the control measures, if available, to implement.

For more information on DfS Register, see Section 2.2 (f) and Section 3.2 (c).

#### **Note:**

Documents kept in the DfS Register must be up-to-date and comply with the requirements of ISO 9001:2015.

### 1.4 Penalties

Under the WSH (DfS) Regulations, the failure to make available the DfS Register for inspection by a registered workplace inspector will result in a fine of not more than \$10,000 upon conviction.

The penalties for failure to perform other duties under the WSH (DfS) Regulations will result in a fine of not more than \$20,000 or imprisonment for a term not exceeding 12 months or to both. This is the maximum penalty for the contravention of each duty.

## 2. Developers

### 2.1 Who are Developers?

Developers are persons for whom or on whose behalf a construction project is carried out. In this context, Developers could be individuals or organisations. Developers are at the top of the construction value chain and have the greatest influence on the project. Developers also include the subsidiary management corporation of the subdivided building undertaking modification projects on existing building.

Homeowners who engage Contractors to build their homes or undertake project to build or rebuild houses for personal dwelling not intended for use as a business are not covered under the WSH (DfS) Regulations.

### 2.2 What must Developers Do to Comply with their Duties?

Under the WSH (DfS) Regulations, the Developer is the key stakeholder responsible for ensuring that foreseeable design risks in the project are eliminated. Where it is not reasonably practicable to eliminate the design risks, the Developer shall ensure that the design risks is reduced to as low as reasonably practicable.

The Developer is the one who engages professionals to design and construct a project at an allocated budget. As the key stakeholder in the construction project, he or she is the one who selects the scheme and makes key decisions in the design of the project. As such, it is the Developer's duty to ensure that the foreseeable design risks in the project are eliminated. In the event that it is not reasonably practicable to eliminate the design risks, the Developer has to work with other stakeholders (e.g., Designer, DfS Professional, Contractor) to ensure that the design risks are reduced to as low as reasonably practicable.

When reducing a design risk, it shall be reduced at its source and collective protective measures shall be used instead of individual protective measures. Individual protective measures refer to measures such as the usage of personal protective equipment (PPE). Instead of selecting PPE, collective protective measures which look at protecting workers as a whole team should be selected. An example would be opting for guardrails along an open edge instead of lifelines.

While it is understandable that the Developer may not have the domain knowledge to ensure that foreseeable design risk is eliminated, he or she should leverage on Designers' and Contractors' expertise to help him or her make the appropriate decisions.

- Engage competent Designer(s), Contractor(s) or DfS Professional(s) who is (are) able to perform the duties stipulated under the WSH Act and the subsidiary Regulations.

The competency of a person is defined as the experience and training that one has which helps one to carry out one's duties. To assess the competency of a person for the job, the Developer shall check that the person has the relevant training and experience in the scope required and is able to not just fulfil his or her contractual requirements, but also able to perform the duties prescribed under the WSH ACT and the subsidiary Regulations. To assess if a company is capable to do the job, the Developer shall check that the company has the relevant track records and experienced personnel to adequately fulfil the competency requirements expected of it.

Using the Quality-Fee Method (QFM) as reference, a vendor selection framework used by the Building and Construction Authority (BCA), here are examples of areas the Developer could check to assess an individual's or a company's competency:

- Company's or individual's track record including awards attained (e.g., bizSAFE level);
- Relevant expertise and experience of the proposed project team;
- How the proposed project team intends to manage with the project's design risks communicated to them by the Developer, and
- Safety and risk management capabilities of the construction project team (where applicable).

#### Example:

In a proposed residential development, a Developer required five high-rise buildings to be designed and connected at the mid and top floors via sky bridges. The Developer initially engaged a building designer for the design, but subsequently realised that the building designer did not have the competence, training and experience to design bridges. The Developer then engaged a bridge designer to design the sky bridges while the building designer designed the building.

- Plan and manage the project such that all Designers and Contractors appointed by the Developer have sufficient time and resources to complete the project.

This is to ensure that the project can proceed safely and smoothly from the pre-construction to the construction phase. This includes allocation of sufficient time and resource for:

- Designers including architects, engineers, and so on (see Annex 5 for a list of typical designers) to look into the safety and health of persons doing the construction work, cleaning or maintaining the completed structure and using the completed structure as a workplace.
- Contractors doing the construction work to look into the safety of persons doing the construction work, cleaning or maintaining the completed structure and using the completed structure as a workplace.

- When engaging Designers and Contractors, Developers have to consider the resources (e.g., staff, equipment and, particularly, time) needed to plan and do the work properly. At the tender stage, Developers should take into consideration the minimum time period Contractors need to plan and prepare before construction work begins on site. After they are appointed, Contractors should be given sufficient time to plan the work and mobilise the necessary staff and equipment (e.g., cranes, piling rigs) so that work can proceed without risk to workers' safety and health. This is particularly important when the project involves demolition work. Contractors must be given sufficient time for the planning and safe execution of any demolition activities.
- After awarding the contracts to Designers and Contractors at agreed prices, if there are major changes in the project that would lead to safety and health issues, the Developer should discuss with the Designers and Contractors if the time and resources agreed earlier are sufficient for the project. All parties should come to a mutual agreement on the resources and time allocated so that the project can proceed safely.

### Example:

A Developer awarded a contract to a Contractor for the construction of a new development on a lot with an existing building. While it was unknown during the tender stage, it was later discovered that the building that was to be demolished contained materials with asbestos. With this new information, the main Contractor would need more time to engage and work with Contractors who are asbestos removal specialists to help demolish this building. Hence, the Developer should provide the main Contractor with additional time and resources to resolve this situation.

- Provide relevant information to all Designers and Contractors engaged by the Developer. This includes:
  - site plans and photographs of project location;
  - as-build plans;
  - utilities and services plans;
  - soil investigation reports;
  - existing DfS Register (if any); and
  - information on design risks associated with the project (if any).

The risks involved in the project shall be made clear by the Developers to Designers and Contractors before the tender starts. This would enable the Designers and Contractors to understand the design risks and help them determine if they are able undertake the project and comply with the WSH Act and its subsidiary Regulations.

Developers may assign a Designer, Contractor or DfS Professional to obtain the relevant information on their behalf from the authorities or other parties, but the responsibility to do so resides with the Developers.

- Convene DfS review meeting(s) with the relevant Designer and Contractor to identify all foreseeable design risks to people who may be affected and discuss how each foreseeable design risks can be eliminated or reduced.

To fulfil this requirement, the Developer shall conduct DfS review meeting(s) with relevant stakeholders at various key stages of the project. Relevant stakeholders are personnel who may affect the design, construction and/or maintenance of the project. These could include Designers (permanent, specialist or temporary works), Contractors (permanent, specialist, temporary or maintenance works), surveyors and other stakeholders. Note that these stakeholders may not be on the project team during the key stages of the project but their inputs should be sought once they are appointed, so that DfS review meetings will be fruitful.

When an identified foreseeable design risk cannot be eliminated, the Developer shall ensure that the design risk is reduced to as low as reasonably practicable and all residual design risks highlighted during the DfS review meeting(s) are recorded.

Finally, all residual design risks highlighted and recorded must be communicated to Contractors engaged for the relevant scope of works so that they are aware of the risks involved and take steps to manage them.

While it is recommended that DfS review meeting(s) be conducted using the recommended GUIDE process (see section 7), the Developer may choose other hazard identification tools to identify the risks for the project.

While DfS review meetings are typically done during the pre-construction phase, the Developer may still conduct DfS review meetings during the construction stage of the project to:

- Review any new or revised designs (e.g., variations, designs for temporary works, and designs by specialist contractors),
- Provide necessary briefings and clarifications to the Contractor as part of passing-on information of residual design risks from the DfS review meetings.

The DfS review meeting looks at risks associated with the design which begins on the drawing board, and considers how a building or structure can be constructed, maintained, cleaned and demolished safely, and if there are safety and health issues at every stage of the building's or structure's life cycle.

- Prepare a DfS Register containing information and records on every DfS review meeting and every residual design risks for the project.

The information should be revised from time to time as and when new information concerning risks of the project is obtained. For example, the Register should be revised when there are reduced risks in a particular area of the project as a result of proposed design change or change in construction sequence.

Note that there could be more than one Designer and one Contractor in the course of the project. Under the WSH (DfS) Regulations, the Designer(s) or Contractor(s) is (are) required to provide information about risks of the project and this information has to be recorded in the DfS Register. To ensure that the risks identified are mitigated, the relevant risk information in the DfS Register or the DfS Register itself must be shared with the relevant Designers and Contractors so that they are informed of them. This would then allow them to look into and mitigate the risks accordingly.

The DfS Register shall be kept available for inspection by an inspector upon request. For practical reasons, at the pre-construction stage, the DfS Register should be kept in the premises of either the Developer or DfS Professional tasked to assist the Developer. At the construction stage, an updated copy of the DfS Register should be kept in the project worksite for ease of reference. Alternatively, subject to appropriate document control measures being in place, electronic modes of information sharing and storage or filing can be used.

Items that could be included in the DfS Register are listed, but not limited to:

- Design review records of risks and mitigation measures which could be generated by following the recommended GUIDE process described in Section 7;
- Services plan; and
- Plans of existing building or structures.

It is important to note that the information in the DfS Register has to be updated from time to time to ensure its relevance. Irrelevant or outdated information should be discarded to avoid unnecessary piling up of information.

- Ensure the continuity of the DfS Register by passing it to the person who acquires the Developer's interest in the building or structure.

This would include building owners and in the case of subdivided buildings, the Management Corporation Strata Title (MCST) who acquires Developer's interest in the projects.

The Developer shall ensure that the person who acquires the interest of the project is aware of the nature and purpose of the DfS Register. When the DfS Register is handed over during the pre-construction or construction phase, information on the risks concerning both the construction and maintenance of the project should be communicated to the person who acquires the Developer's interest. When the DfS Register is handed over after the construction phase, the Developer shall ensure that the person who acquires the Developer's interest is aware of the maintenance risks of the completed building or structure.

## 2.3 Delegation of Developer's Duties to DfS Professional

The Developer may appoint his or her employees or engage a person deemed competent or with expertise on safety and health risks of design of building or structure, termed as DfS Professional to undertake the duties of the Developer.

The Developer may delegate his or her duties only in relation to:

- convening DfS review meetings; and
- maintaining a DfS Register.

When these duties have been delegated, the Developer will not be responsible for their performance. This is provided that the Developer has ensured that the DfS Professional appointed is competent to perform the duties stipulated in the DfS Regulations.

The Developer shall ensure that the DfS Professional is competent in terms of experience and training to perform the tasks. The candidate shall have:

- Reasonable exposure and experience in safety and health matters in the construction industry; and
- Attended and passed the assessment on the Design for Safety for Professional Course (formally known as the DfS Coordinator Course) conducted by professional bodies, industry associations or statutory boards or attain equivalent qualifications.

The candidate must also either:

- Be a registered Professional Engineer (PE) or architect with a practicing certificate; OR
- Have 10 years of relevant experience in the design (at least 5 years in design which includes contributions to designs, writing specifications) and supervision of the construction of structures; and
- Have a degree accepted by PE Board (PEB) or Board of Architects (BOA) and a construction-related degree accepted by Singapore Institute of Surveyors and Valuers (SISV) and Society of Project Managers (SPM).

### Example:

A Developer engaged an architect and an engineer to design a shopping mall with associated facilities. Under the DfS Regulations, the Developer is required to implement a DfS Review Process to eliminate foreseeable risks to people who may be affected by the construction or maintenance of the building. The Developer then appointed a DfS Professional to implement the DfS Review Process and gathered the architect, engineer and relevant stakeholders to join the review.

During the review, one of the items discussed was the installation of glossy ceramic floor tiles, which would get wet and slippery during washing or when water got spilled onto them, in the kitchen, cold rooms and toilet areas. Installation of the tiles in these areas would possibly lead to cleaners or kitchen staff slipping or falling. With this consideration, the team agreed that floor finishes at these areas should be of non-slip material to reduce the risk of slips and falls.

Developers may assign existing duty holders such as the Designer or Contractor as the DfS Professional under the WSH (DfS) Regulations. However, assigned DfS Professionals must be able to fulfil all their duties under the WSH (DfS) Regulations with due diligence.

Developers must also provide DfS Professionals with the information necessary for them to perform their duties.

Other than carrying out duties such as arranging for DfS review meetings and maintaining the DfS Register, the DfS Professional is also responsible for updating the Developer on all matters arising from DfS review meetings and all updates to the DfS Register.

The DfS Professional needs to ensure that relevant information on each foreseeable design risk identified and how each design risk can be eliminated is communicated to the Developer as soon as possible after each DfS review meeting.

The DfS Professional also needs to provide the Developer with an updated DfS Register after adding any new information or record. This is important to ensure that the Developer has an accurate oversight of the project's design risks and is able to make the right decisions on how the design risks are to be mitigated.

The duty of keeping a building's and/or structure's DfS Register updated and current shall be returned to the Developer unless stated otherwise in the contract of service by both parties.

## 2.4 Design and Build Contracts

In Design and Build (D&B) contracts, a Developer would need to assess a Contractor's competence by considering the experience and training of each member on the team. For example, the Developer has to assess if the team's Designer has the expertise to handle the risks of the project and fulfil his or her duties under the WSH Act and its subsidiary Regulations. In particular, this refers to the Contractor's competence to perform his or her duty under WSH (DfS) Regulation 10 and the Designer's competence to perform his or her duty under the WSH (DfS) Regulations 9.

## 3. Designers

### 3.1 Who are Designers?

Under the WSH (DfS) Regulations 2015, a "Designer" refers to a person or an organisation or a company who prepares a design plan relating to a structure. This would include PEs, engineers, architects, Qualified Persons (QPs) and even Contractors or Developers if they prepare a design plan for permanent or temporary structures.

A design plan includes drawings, building information modelling (BIM), design details, specifications, materials and bills of quantities (including specifications of articles or substances) relating to a structure, and calculations prepared for the purpose of a design.

See Annex 4 for a list of design and design inputs and Annex 5 for a list of persons deemed as Designers.

### 3.2 What must Designers do to comply with their Duties?

Decisions made by Designers have significant impact on the safety and health of workers, particularly to those who construct, maintain, repair, clean, refurbish and eventually demolish or remove the building or structure. It is, therefore, important that safety and health are considered at the start of the design process.

The Designer can help ensure workers' safety and health by considering these questions:

- Can prefabrication be used to limit risks arising from working at heights?
- Can permanent access arrangements be detailed to permit their early construction?
- Can slabs or hard-standings be detailed to suit mobile access equipment?
- Are there any potentially hazardous features of the site or permanent works that would need the Contractor's attention?
- Can permanent facilities be built in to allow easy access for workers doing maintenance work on the structure?

The Designer is a key stakeholder working for the Developer and/or Contractor(s) and is responsible under the WSH (DfS) Regulations to:

- Prepare a design plan for the structure that eliminates, so far as reasonably practicable, foreseeable design risks to the safety and health of any person affected by the project.

While preparing a design plan, the Designer shall begin with the elimination of foreseeable design risks as the ideal solution. To be able to foresee design risks, the Designer must consider the people affected, namely persons:

- who carry out or are liable to be affected by construction work for the structure,
- for whom the structure is a workplace, including an individual who maintains or cleans the structure, or anything in or on the structure, or
- who carry out or are liable to be affected by the demolition of the structure.

The Designer must also:

- understand and be aware of significant design risks that construction and maintenance workers can be exposed to; and
- have the right skills, knowledge, and experience to address safety and health issues arising from the design.

To eliminate design risks, the Designer shall take into account all information provided by the Developer and/or the Contractor for the project. This would typically include:

- site plans and photographs of the project location;
- relevant drawings or plans (e.g., architectural plans, structural plans, as-built plans, etc);
- utilities and services plans;
- soil investigation reports;
- existing Dfs Register (if any); and
- information on risks associated with the project (if any).

The Designer shall not produce designs that cannot be constructed, maintained, used or demolished in a reasonably safe manner.

### Example:

A Designer designed a 10m tall external green wall facade, which required regular maintenance, for a building. To eliminate risks of falling from heights during maintenance, the Designer designed a green wall with rotatable green wall panels and access walkway inside the building so that the maintenance of the green wall could be done from the walkway.

See Annex 6 for a list of typical design hazards. The list serves as a reference for Designers and it does not limit possible hazards to only those listed.

- Propose to the person who appointed the Designer, a modification to the design plan that reduces the design risks to as low as reasonably practicable.

If the foreseeable risks to the safety and health of any person affected by the design decision cannot be eliminated due to the nature or functionality of the design, the next preferred measure is to control the risk arising from the design and reduce the risks associated with those hazards which remain. This can be achieved by:

- reducing the design risk at its source; and
- using collective protective measures rather than individual protective measures.

Designers can help to avoid, isolate or reduce risks that arise during the construction and subsequent maintenance work for the completed structure.

Design is not a one-step operation, but one that often requires modifications to address thoroughly what could go wrong during a structure's construction or maintenance phase. This would involve making modifications as a result of discussion with other stakeholders along the way and as more information becomes available.

When Designers are preparing the design, they are expected to do what is reasonable to prevent safety and health risks. They need to take into account current industry knowledge and acceptable practices, requirement for maintenance, cleaning and access to the finished project. Discussing these with those carrying out the work is important because they may have methods of working, specific needs or suggestions which Designers will need to consider in their design. Some examples include the use of Mass Elevated Work Platforms (MEWPs) for maintenance of internal structures, and use of suspended scaffolding or industry rope access system for maintenance of building facades.

Modifications to the design during construction are additional work and such efforts may not be cost effective. As such, Designers are advised to consider the people affected and eliminate the risks right from the start of the design, before key decisions are made, to prevent reworking of the design.

### Example:

The distribution box of a multistorey carpark was located at the wall of a carpark next to the traffic lanes. This location put workers in the path of traffic during maintenance work. To reduce the risk of being hit by vehicles, the distribution box was relocated further down the carpark where the risk of being hit by a vehicle during maintenance of the distribution box was eliminated.

- Provide all information relevant to the design, construction or maintenance of the structure to the person appointed as the Designer.

In addition to reducing risks through design modification, the Designer shall provide information about residual risks to assist main stakeholders such as the Developer, Contractor, and/or delegated Designer for further mitigation. This information is important and should be highlighted to the:

- Developer so that he or she can allocate sufficient time and resources throughout the project to ensure that the project is able to proceed safely and smoothly from the pre-construction to the construction phase.
- Developer and/or Contractor to allow him or her to make informed engineering decisions at an early stage in order to avoid foreseeable risks to those involved in the construction and future use of the building and/or structure. This could possibly include construction method which is unique to the design or maintenance notes.

Designers need to provide information about aspects of the design that could create significant risks during future construction work or maintenance. When in doubt about the level of information needed, besides asking those who will use or work in the building or structure, Designers can ask themselves:

- “If I were the operator maintaining this plant or roof, what would I need to access the plant or roof in a manner that will not affect my safety and health? Can the plant or roof be isolated for maintenance to be done safely?”
- “If I were the facilities manager, about to engage Contractors to undertake maintenance work, is it likely that I would be paying a premium due to poorly thought out access provision?”

A Designer is not expected to produce huge amount of unnecessary paperwork. However, he or she should maintain records on why key decisions were made with respect to the design or modifications to the design. The information must be presented in a clear and concise manner. It can be presented in these formats:

- Advisory notes on drawing  
These notes are immediately made available to those carrying out the work so they should be direct and concise. They must also be annotated and updated to be current (see Annex 7 for examples). Users can refer to other documents if more details are needed.
  - Written notes provided together with the DfS Register  
These notes should be project specific, and should only contain information useful to those constructing or maintaining the structure (see Annex 8 for an example). The intent is for the maintenance strategy to be part of the DfS Register that will be eventually handed over to parties who acquire interest in the building.
- Attend and participate actively in DfS review meetings as required by the Developer, Contractor, and/or their appointed DfS Professional.

Under the WSH (DfS) Regulations, the Developer or his or her appointed DfS Professional is responsible for implementing the DfS review process. When a Developer appoints a Designer, he or she can request the Designer to participate in the project’s DfS review process any time during the pre-construction or construction phase to review the design and how it affects the safety and health of people working on and maintaining the building.

In instances when the Designer for permanent or temporary works is appointed by the Contractor, the Designer may also be required to join the DfS review process as his or her inputs would be important.

The safe design of a building structure will always be part of a wider set of design objectives that include practicability, aesthetics, cost and functionality. These, sometimes competing, objectives need to be balanced so that they do not compromise the health and safety of those who work on or use the structure throughout its life cycle. The DfS review meeting is therefore the platform for duty and stakeholders to come together to discuss and resolve design risks and issues.

- Appointment of a Delegated Designer

The WSH (DfS) Regulations has made provision for the appointed Designer to appoint another Designer, called a delegated Designer, for the structure. This can only take place when the following conditions are fulfilled:

- the appointed Designer reasonably believes that the delegated Designer is competent to perform the duties of a Designer under the WSH (DfS) Regulations and any other subsidiaries regulations made under section 65 of the WSH Act.
- the delegated Designer is provided with all relevant information so that the delegated Designer is able to perform the duties of a Designer under the WSH (DfS) Regulations and any other subsidiaries regulations made under section 65 of the WSH Act.

The Designer should also consider whether he or she has any gaps in his or her knowledge or experience. If so, the Designer should seek out other professionals to help him or her to bridge those gaps. If a Designer delegate a portion of work to another Designer (e.g., a specialist), he or she should make enquiries about their skills, knowledge and experience to ensure that they are capable of carrying out the job in question.

However, it is important to note that in situations where the Designer appoints a delegated Designer to prepare a design plan for a structure, the Designer remains liable of the design plan in terms of its design risk in these two aspects:

- All foreseeable design risks are eliminated as far as it is reasonably practicable.
- If such risks cannot be eliminated, propose to the person who appointed the Designer, modifications to the design plan that reduce design risks to as low as reasonably practicable.

The delegated Designer must also be confident that him- or herself has the appropriate skills, knowledge, training and experience to do the work. This can be demonstrated by providing a portfolio of past work on similar projects and references from previous clients.

## 4. Contractors

### 4.1 Who are Contractors?

Contractors are persons or companies who have entered into a contract for the purpose of carrying out any construction work. In the WSH (DfS) Regulations, the term “Contractors” refers to both Main Contractors and Subcontractors. As such, the duties of Contractors would also apply to both Main and Subcontractors.

### 4.2 What must Contractors Do to Comply with their Duties?

Contractors of a structure are required under the WSH (DfS) Regulations to:

- Inform the person who appointed the Contractor of any foreseeable design risk that the structure poses or will pose to an affected person to ensure that the project is carried out without risks to safety or health of any person who may be affected by it.

The person who appoints a Contractor may refer to a Developer, Main Contractor or any other stakeholder who appoints a Contractor. This would require the Developer or Subcontractors to provide their Main Contractors with information on any foreseeable design risks as soon as reasonably possible.

- When engaging a Designer or Subcontractor, a Contractor needs to ensure that the Designer or Subcontractor is competent and able to comply with his or her duties under the WSH (DfS) Regulations and any other regulations under the WSH Act.

The competency of a person is defined as the experience and training that one has which helps one to carry out one’s duties under the regulations. To assess the competency of a person for the job, the Contractor shall check that the person has the relevant training and experience in the scope required and is able to not just fulfil his or her contractual requirements, but also perform the duties prescribed under the WSH ACT and the subsidiary Regulations. To assess if a company is capable to do the job, the Contractor shall check that the company has the relevant track records and experienced personnel to adequately fulfil the competency requirements expected of it.

#### Example:

A Contractor needs to engage a PE, under the WSH (Construction) Regulations to design a formwork structure for a transfer slab that is 3 metres deep. The Designer requires the formwork to be cast in three stages to control thermal heat dissipation. Under the Regulations, the Contractor is required to engage a competent temporary works Designer. To ensure that a competent PE is engaged, the Contractor needs to check that the PE has the relevant training and experience in designing similar formwork structure for transfer slabs.

- Provide relevant information to Designers engaged by the Contractor. This includes providing them with:
  - site plans and photographs of the project location;
  - relevant drawings or plans (e.g., architectural plans, structural plans, as built plans, etc);
  - utilities and services plans;
  - soil investigation reports;
  - existing DfS Register (if any); and
  - any other information that the Designers would require to perform their jobs and comply with their duties under the WSH (DfS) Regulations.
- Participate in the DfS Review Process as required by the Developer or the DfS Professional.

The Contractor may be called to participate in the DfS Review Process any time during the project. If the Contractor was appointed by the Developer in the pre-construction phase, the Developer may request for the Contractor to participate in the design review process even though the construction phase may have not started. This would allow for better planning of the project’s work processes and construction methods in the pre-construction phase.

## 5. Registered Proprietors and Subsidiary Management Corporations

### 5.1 Who are Registered Proprietors and Subsidiary Management Corporations?

Registered Proprietors refer to building owners.

Subsidiary Management Corporations refer to Management Corporation Strata Title (MCST) engaged by building owners to manage the maintenance and upkeep in the common areas of a building. It is defined in the Building Maintenance and Strata Management Act as, in relation to any limited common property comprised in a strata title plan, the subsidiary management corporation constituted for that limited common property under the Land Titles (Strata) Act.

Managing Agents (MAs) are considered as occupiers of a workplace.

### 5.2 What must Registered Proprietors and Subsidiary Management Corporations Do to Comply with their Duties?

Upon completion of a structure, in the event the Developer disposes his or her interest in the structure in the project he or she had undertaken, the Developer is required to hand over the DfS Register to the next person who acquires the Developer's interest in the structure.

Registered Proprietors are required under the WSH (DfS) Regulations to:

- Keep the DfS Register for a structure that is not a subdivided building. They will be required to share information on residual risks in the DfS Register with affected persons such as those carrying out cleaning and maintenance works.
- Ensure that the DfS Register, for a structure that is not a subdivided building, is available for inspection when requested by an inspector.
- In the event that the Registered Proprietor disposes his or her interest in the structure, ensure that:
  - The DfS Register is given to the person who next acquires the interest in the structure when the Registered Proprietor disposes of his or her interest in the structure. The DfS Register is an up-to-date document that needs to stay with the structure for its entire life span, from design conceptual phase till its demolition. Hence, this document must be handed over from one Registered Proprietor to the next for their future reference and updating.
  - The person who next acquires the interest in the structure is informed of the nature and purpose of the DfS Register. The Registered Proprietor should ensure that the person who next acquires the interest is made aware of the maintenance and other residual risks associated with the structure.

For a subdivided building, the DfS Register must be kept by the subsidiary management corporation of the building. Under the WSH (DfS) Regulations, it is the duty of the subsidiary management corporation to ensure that the DfS Register is available for inspection by an inspector upon the inspector's request.

Registered Proprietors and subsidiary management corporations are required to keep the DfS Register so that information on residual risks is readily available for reference to those who will be using the structure as a workplace (cleaning or maintenance) or during demolition.

A subdivided building refers to any one or more buildings comprised in a strata subdivision plan approved by the relevant authority.

#### Example:

Upon completion of a condominium development project, the Developer will hand over the property to a new owner who has bought over the property. Under the Regulations, the Developer is required to hand over the DfS Register to the new owner. However, because the condominium is a subdivided building, the DfS Register is required to be kept by the MCST of the condominium.

In situations where Registered Proprietors or MCSTs have MAs to manage their properties, the Registered Proprietors or MCSTs have the duty to ensure that the MAs have access to the DfS Register and are informed of the residual risks. When MAs engage Contractors to carry out any work, MAs are required to inform Contractors of any residual risks involved in their scope of works.

#### Example:

A Registered Proprietor owns a shopping centre and engages a MA to manage the property. In this situation, the Registered Proprietor is required to keep the DfS Register and inform the MA of the residual risks. The MA then engages a Landscaping Contractor to carry out maintenance and pruning works on a green wall on the shopping centre's facade. The MA will be required to ensure that the Contractor has been informed of all residual risks involved in carrying out landscaping works on the shopping centre's facade.

# 6. The GUIDE Process

## 6.1 Introduction

To ensure that a design is safe, a DfS Review Process is introduced in the project flow. The DfS Review Process involves main stakeholders, such as the Developer, Designer (engineer and architect), and Contractor if he or she has been appointed.

The DfS Review Process shall be implemented by the Developer or his or her appointed DfS Professional who should chair and facilitate all discussions. There should also be a systematic process whereby risks of the design are highlighted, reviewed and recorded. The outcome of the DfS Review Process is to eliminate, as far as reasonably practicable, foreseeable risks to the safety and health of any person:

- carrying out or are liable to be affected by construction work;
- maintaining or cleaning a completed structure; or
- using a completed structure designed as a workplace.

After the DfS Review Process is done, there should be:

- endorsement of safest possible designs by all parties of the DfS Review Process; and
- a record of residual risks and vital safety and health information.

To assist stakeholders in reviewing the design, a process called GUIDE is recommended.

**Note:**

GUIDE is a recommended process but stakeholders are free to adopt, adapt or use other processes they deemed fit for their respective projects.

GUIDE ensures a systemic way of doing the DfS review (see Table 2).

<b>Step 1</b>	<b>G:</b>	Group together a review team consisting of main stakeholders.
<b>Step 2</b>	<b>U:</b>	Understand the full design concept by looking at the drawings and calculations, or have designers elaborate on the design.
<b>Step 3</b>	<b>I:</b>	Identify risks that arise as a result of the design or construction method. The risks should be recorded and analysed to see if they can be eliminated by changing the design.
<b>Step 4</b>	<b>D:</b>	Design around the risks identified to eliminate or to mitigate the risks.
<b>Step 5</b>	<b>E:</b>	Enter all the information including information on vital design change that would affect safety and health or remaining risks to be mitigated into the DfS Register.

Table 2: The GUIDE Process.

Steps 3 and 4 should be repeated until the review team is satisfied that the design can no longer be changed to totally eliminate all risks.

The process should be facilitated by the Developer or his or her appointed DfS Professional together with other stakeholders guided accordingly following a disciplined approach to identify foreseeable risks in the projects. After following the steps required for GUIDE, residual risks should be recorded and signed off by the project team.

## 6.2 Implementation Stages for the GUIDE Process

It is recommended that the GUIDE Process be done in three phases. See Figure 1 for GUIDE Process for typical contracts and Figure 2 for GUIDE Process for D&B contracts.

### 1) GUIDE-1: Concept Design Review

Concept design review should look at a project's general location, traffic, type of buildings in the surroundings, and other general constraints.

GUIDE-1 records risks and mitigation measures for risks and hazards arising from the design (e.g., materials used, structural concepts).

### 2) GUIDE-2: Detailed Design, Maintenance and Repair Review

Detailed design, maintenance and repair review should look at a building's detailed architectural and structural design. The review should determine risks involved in the construction methods, access and egress, and whether the design will create confined space or other hazards. Risks related to maintenance and repair of a building, such as cleaning methods, should also be studied.

GUIDE-2 records risks and measures such as:

- information provided by Contractor on mitigation of risks and hazards;
- residual hazards brought over to the maintenance phase; and
- maintenance methods of the building, structure or equipment.

For D&B contracts which the Contractor is in-charge of the project's design. GUIDE-2 should be done with the Contractor's input. The Contractor can then highlight constraints that he or she will face when constructing the building or structure. This would further help in the GUIDE process.

### 3) GUIDE-3: Pre-construction Review

Pre-construction design review should examine temporary works design and design by specialist contractors not covered during the concept and detailed design phases.

GUIDE-3 records risks and mitigation measures such as:

- shoring, trenches and deep excavation;
- confined spaces; and
- formwork and falsework.

GUIDE-1, 2 & 3 will be applied, where possible, at each stage of the design preparation process.

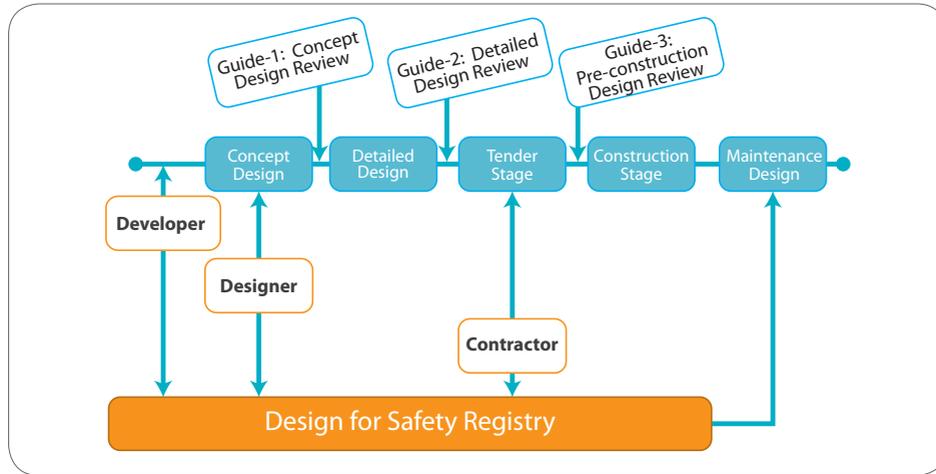


Figure 1: The GUIDE Process for typical contracts.

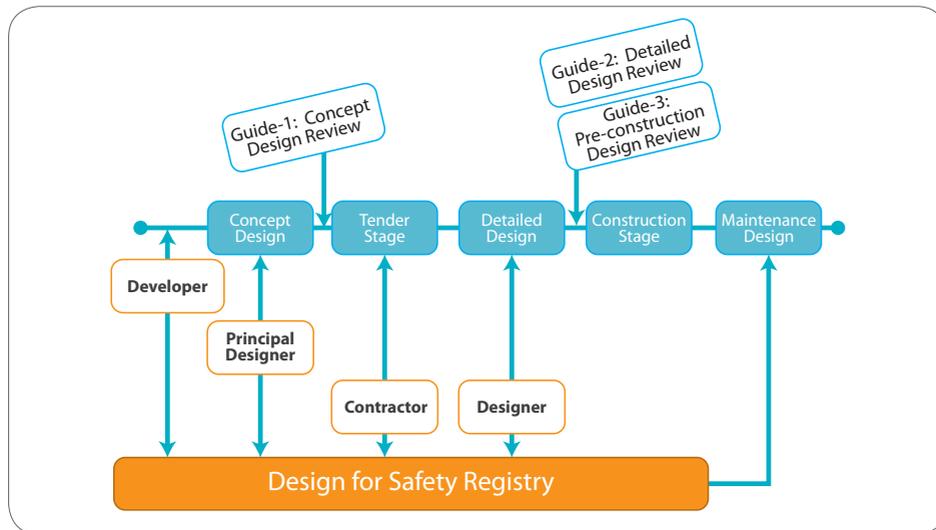


Figure 2: The GUIDE Process for D&B contracts.

## 6.3 Key Focus for GUIDE

The key aspects to be covered, when doing GUIDE, are suggested (but not limited) as follows:

- General design concept
- Accessibility
- Confined space
- Emergency
- Lighting
- Excavation
- Fall prevention
- Working platforms
- Hoisting or weight
- Layout
- Maintenance
- Material handling or storage
- Means or methods
- Operation
- Physical hazards
- Sequence of construction
- Standardisation of building elements
- Weather

Sample topics that can be discussed during GUIDE-1, GUIDE-2 and GUIDE-3 can be found below. Risks highlighted during the GUIDE process should be singled out and addressed in the DfS Register.

Residual risks should be highlighted to the Contractor so that they will be dealt with. The project team should note that the lists for GUIDE-1, GUIDE-2 and GUIDE-3 are references and there may be topics that are not in the lists but are specific to the project itself. The project team should therefore consider other safety and health risks that could exist as a result of the design.

## 6.4 Sample GUIDE-1: Concept Design Review

The purpose of GUIDE-1 is to review the conceptual design and identify critical risks associated with the use, construction, maintenance (including cleaning and repair), alterations, additions, decommissioning and demolition of a building or structure.

By identifying and understanding the risks very early at the start of the project, risk controls can be established to ensure that these risks are managed either by eliminating or controlling them.

GUIDE-1 typically addresses the following:

### Site feasibility analysis

- Impact on site or development by existing surroundings
- Impact on site or development by environmental factors
- Impact of site or development on surroundings or passersby
- Existing site conditions
- Conceptual or schematic site planning—constraints and opportunities
- Feasibility of construction operations and site management
- Adjacent structures
- Ground or soil conditions

Sometimes, risks identified in GUIDE-1 can only be addressed later in the project when more details are known. However, highlighting risks at this stage will aid the Designer to understand the feasibility and the hazards associated with the project. The Designer may be well-informed but not equipped with WSH knowledge. As such, GUIDE-1 should be done by all the main stakeholders and not just by the Designer alone. The contribution of different stakeholders will help to ensure that safety at every stage and level is examined and discussed.

The primary concerns of GUIDE-1 will be on safety issues related to:

- the generic type (or nature) of the proposed development; and
- the location of the project (i.e., analysis of potential sites to determine the selection of an appropriate site). Analysis of location will include several major considerations such as soil assessment, the public, traffic, existing services and placement of major machines. GUIDE-1 will examine issues associated and highlight risks and hazards arising from the location of the project.

To aid the GUIDE-1 Design Review Team, the following questions can be used. While the questions highlight important issues, they are not comprehensive and serve only as references for the team. As such, the team should have a brainstorming session to raise and highlight hazards and concerns of the main stakeholders.

Considerations		Details or Hazards Identified
Soil	<p>Has the soil profile of the proposed project's site been studied by Qualified Persons (QPs)?</p> <p>Are there buildings or structures that may have shallow foundation in the vicinity of the proposed project?</p> <p>Will the groundwater table be lowered as a result of the proposed construction?</p> <p>Will there be possible settlement due to the proposed project?</p> <p>Are there preventive measures to ensure that settlement is minimal?</p>	
Public	<p>Will the commencement of the project affect the public?</p> <p>Will the commencement of the project affect traffic?</p>	
Services	<p>Are there underground services in the site that need to be removed or relocated for the project?</p> <p>Will the removal or relocation of these services, if any, be a hazard to workers or the public?</p>	

Others	Are there special features that require special arrangements during construction?	
	Can the method of construction or sequence be identified at present?	
	Are there hazards associated with the method of construction or sequence that can be dealt with at present?	
	Are there special features such as facade, roof and skyrise greenery features that require special arrangements during maintenance?	
	Are there any foreseeable hazards that can be identified and eliminated?	

After hazards are identified from answering these questions, significant hazards should then be transferred to a Design Risk Record Form. The Design Review Team should then agree on the stakeholder to address the hazards. A follow-up review should be done to ensure that the hazards are addressed and not merely filed away. Other considerations by the review team or actions taken to mitigate the risks should be documented in the Design Risk Record Form to ensure that all relevant information is recorded.

Unless results from applying GUIDE-1 at conceptual design stage indicate that a redesign or relocation of the project is required, risks identified under GUIDE-1 can usually be addressed during GUIDE-2 design stage. As such, GUIDE-1 is usually performed once.

Design issues highlighted in GUIDE-1 should be addressed by the Designer when he or she is doing the detailed design. GUIDE-2 will hence be an exercise to identify risks and ensure that risks raised in GUIDE-1 are eliminated or mitigated.

## 6.5 Sample GUIDE-2: Detailed Design Review

GUIDE-2 serves to assist the Designer to review a building's or structure's design progressively as it develops. Although building or structure design is often done by Consultant Designers on behalf of the Client, designs can also be done on a D&B basis by a Contractor. Parts of the building or structure can also be designed by the Contractor's Specialist Contractors or other Designers.

GUIDE-2 typically addresses the following:

### **Schematic or Development Control (DC)\* planning design**

- Impact on site or development by existing surroundings
- Impact on site or development by environmental factors
- Impact of site or development on surroundings or passersby
- Existing site conditions

- Conceptual or schematic site planning—constraints and opportunities
- Feasibility of construction operations and site management
- Design of permanent works—layouts, configurations, relationships and spatial use or function

#### Developed or Building Plan (BP) design

- Adjacent structures
- Ground or soil conditions
- Design of permanent works:
  - Site formation:
    - i. earthworks
  - Underground services
  - Sub-structure:
    - i. foundation and footings
    - ii. excavation
    - iii. basement
  - Building super-structure and external structures
  - Building envelope
  - Internal and external assemblies, systems and plant (mechanical and electrical [M&E] and architectural):
    - i. M&E plant or major equipment
    - ii. architectural systems or assemblies
    - iii. M&E systems
- General design function

#### Developed, BP design and/or construction or contract

- Design of permanent works:
  - Materials, fixtures and detailing:
    - i. architectural fixtures
    - ii. M&E fixtures
    - iii. materials
    - iv. furniture, fittings and equipment

#### Note:

Development Control (DC) is a type of planning application submitted to regulatory authorities such as URA, LTA, NParks, and CBPU (NEA & PUB). DC plans usually use schematic design to format drawings for submission.

Building Plan (BP) is a type of technical application submitted to regulatory authorities such as BCA, FSSD, LTA, NParks, and CBPU (NEA & PUB). BP plans usually use developed design to format drawings for submission.

While GUIDE-2 identifies and addresses hazards as they emerge from the development of the design, the issues raised during GUIDE-1 should also be reviewed and resolved if possible.

GUIDE-2 should be done by all the main stakeholders and not just the Designer in isolation. It is important that proper documentation is done so that relevant information are passed on and recorded in the DfS Risk Register.

To aid the GUIDE-2 Design Review Team, the following questions can be used. While the questions highlight important issues, they are not comprehensive and serve only as references for the team. As such, the team should have brainstorming sessions to identify hazards and concerns of the main stakeholders.

Considerations		Details or Hazards Identified
Prefabrication	<ul style="list-style-type: none"> <li>• Can elements such as steel structures be prefabricated, assembled on ground and then lifted to position for installation?</li> <li>• Can the cutting of steel members be done off-site, under controlled conditions to reduce the dust created?</li> <li>• Can site welding be minimised to reduce fire or burn risks?</li> <li>• Can prefabricated nuts and bolts used as connections?</li> <li>• Can prefabricated elements be provided with designed lifting points, and the weight and centre-of-gravity marked on the drawings and prefabricated items?</li> <li>• If the prefabricated structure is required to be temporarily suspended for a period of time before final installation, are there means to ensure the hazards arising this are removed?</li> <li>• Can joints in vertical steel structure members be designed such that bolting can be done on the ground?</li> <li>• Can connections be designed to minimise risk of incorrect assembly (e.g., unique bolt layout for each connection)?</li> <li>• Can clear instructions provided on drawings?</li> <li>• Can the Designer verify if site conditions allow for lifting cranes to be positioned safely before deciding on prefabrication as the method of construction?</li> </ul>	

Heavy Lifting	<ul style="list-style-type: none"> <li>Consider the work process and equipment required for heavy lifting. Can the position for parking these equipment be finalised and cordoned off?</li> <li>Does the lifting equipment need a customised foundation to minimise settlement and failure of support?</li> <li>Consider the worst case scenario. Can this scenario be prevented or managed to minimise injuries?</li> </ul>	
Falling from Heights	<ul style="list-style-type: none"> <li>Can the need to work at heights be removed? For example, removing the need to work at heights when a safe means of access cannot be provided.</li> <li>Can fragile roofing materials be removed or can an alternative access route to the roof (e.g., a work platform) be designed?</li> <li>Can an early installation of permanent access (e.g., stairs) reduce the use of ladders or scaffolds?</li> <li>Can edge protection or other features which allow safe access and construction be designed and installed?</li> <li>Can anchor points for installation of life-line or safety harnesses be mounted where work platforms cannot be installed?</li> <li>Can floor openings, if any, be minimised?</li> </ul>	
Temporary Works and Sequencing	<ul style="list-style-type: none"> <li>Can a safer means of access or egress, instead of temporary means, be used?</li> <li>Can the permanent staircase and lifts be completed first so that they can be used during the construction stage?</li> <li>Will the design affect the work process during construction?</li> <li>Can temporary works required during construction be planned for earlier? For example, specifying the type and position of temporary works required to ensure that spatial considerations are taken into the account during the design stage.</li> <li>Are there special construction considerations that need to be highlighted to the Contractor?</li> </ul>	

	<ul style="list-style-type: none"> <li>Does the sequence of construction create any temporary unstable working platform that requires additional bracing?</li> <li>Can adequate safety factors be incorporated in the design so that overloading or collapse of the permanent or temporary structure is prevented?</li> </ul>	
Layout	<ul style="list-style-type: none"> <li>Can the layout be optimised to prevent any accidents arising from the flow of traffic, pedestrian, equipment, and so on within and around the site during the construction stage?</li> <li>Consider the flow of traffic, pedestrian, equipment within and around the site during the permanent stage.</li> <li>Can the layout be optimised to prevent accidents?</li> <li>Is there a need to designate specific material, equipment, vehicle and human traffic flow diagram?</li> </ul>	
Confined Space	<ul style="list-style-type: none"> <li>Does the design create confined space in the permanent or temporary stage?</li> <li>Can the confined space be removed from the design?</li> <li>Can the need to enter the confined space be minimised by removing vital equipment or controls out of the confined space?</li> </ul>	
Access for Maintenance  (see Annex 8: Maintenance Strategy Report)	<ul style="list-style-type: none"> <li>Does the provision of access take into account the safe and efficient movement of maintenance workers and the tools and equipment needed to carry out maintenance work?</li> <li>Can temporary means of access (e.g., scaffolding, makeshift ladder, etc.) be eliminated by providing workers with permanent safe access to areas requiring regular maintenance?</li> <li>Does the design incorporate permanent safety lines, anchorage and hoisting points into structures for maintenance work that need to be carried out at height?</li> </ul>	

	<ul style="list-style-type: none"> <li>• Can durable materials that require lower frequency of maintenance be used (e.g., powder-coated aluminium materials versus mild steel materials that require regular repainting)?</li> <li>• Can the maintenance work be carried out at ground level in a safe and productive manner? For example, locating air-conditioning units at ground level, locating luminaires within reachable height.</li> <li>• Does the design create low headroom that reduce the safety and efficiency of workers carrying out the maintenance work?</li> <li>• Does the design minimise the need for maintenance workers to enter ducts and crawlspaces?</li> <li>• Does the design minimise the need for the deconstruction of bulkheads, claddings, casings, and so on, during routine inspection and maintenance?</li> <li>• Does the design allow sufficient space for vehicles (e.g., cranes, cherry-pickers) to operate safely and efficiently during maintenance and operation of the building?</li> <li>• Does the design allow for sufficient working space in M&amp;E rooms and around M&amp;E equipment for inspection, maintenance, repair and replacement of equipment?</li> <li>• Does the design provide maintenance access at every level if there are vertical greenery systems that span a few storeys?</li> </ul>	
Emergency Route	<ul style="list-style-type: none"> <li>• Is the emergency route for the temporary and permanent stages the shortest and most direct?</li> <li>• Are there adequate lighting, directions, warning and backup power for mass evacuation of people along the emergency routes?</li> </ul>	

Health Hazards	<ul style="list-style-type: none"> <li>• Can less hazardous materials be used (e.g., solvent-free or low solvent adhesives and water-based paints)?</li> <li>• Can materials that can create significant fire risk be removed?</li> <li>• Can processes that create hazardous fumes, vapours, dust, noise or vibration be avoided? Examples of such process include disturbing existing asbestos, cutting chases in brickwork and concrete, breaking down cast-in-situ piles to level, scrubbing concrete, hand-digging tunnels, flame-cutting or sanding areas coated with lead paint or cadmium.</li> </ul>	
Weather	<ul style="list-style-type: none"> <li>• Is there a possibility of floods happening in the site? If so, how can the hazards be minimised in the temporary and permanent stages?</li> <li>• Is there a possibility of lightning strike happening in the site? If so, how can the hazards be minimised in the temporary and permanent stages?</li> <li>• Are there other adverse weather conditions that can affect workers' safety and health on site?</li> <li>• What are the effects of extreme temperature or humidity on instrumentation?</li> </ul>	
Others	<ul style="list-style-type: none"> <li>• Are there other major hazards that need to be dealt with?</li> <li>• Can sources of substantial stored energy, such as pre- or post-tension cables, be specified in the drawings and highlighted for future demolition?</li> <li>• Can alterations that have significantly changed the building or structure be highlighted?</li> <li>• Can disruptions to existing utilities within occupied buildings be avoided?</li> </ul>	

After hazards are identified from answering these questions, identified hazards should then be transferred to a Design Risk Record Form. The Design Review Team should then agree on the party to address the hazards. A follow-up review should be done to ensure that the hazards are addressed and not merely filed away. Other considerations by the review team or actions taken to mitigate the risks should be documented in the Design Risk Record Form to ensure that all relevant information is recorded.

Design issues highlighted in GUIDE-1 should be addressed by the Designer when he or she is doing the detailed design. GUIDE-2 will hence be a session to identify new hazards and making sure that hazards raised in GUIDE-1 are eliminated or mitigated.

## 6.6 Sample GUIDE-3: Pre-construction Review

Temporary works designs are part of the scope of works in construction contracts, but sometimes temporary works are designed by Consultants on behalf of their clients.

GUIDE-3 aims to provide the Design Review Team with a tool to identify and address risks associated with temporary works design.

GUIDE-3 typically addresses the following:

### Employer or consultant design

- Prescription or specification of site arrangements, facilities and scheduling requirements
- Prescription or specification of interim works for construction of permanent works

### Contractor design

- Interim works for site arrangements and facilities
- Interim works for construction of permanent works

Along with the main stakeholders involved in GUIDE-1 and GUIDE-2, the Contractor and his or her appointed Designers should be part of GUIDE-3 Process Design Review Team. Similar to GUIDE-2, it is important that proper documentation is done so that relevant information is passed on and recorded in the DfS Risk Register.

To aid the GUIDE-3 Design Review Team, the following questions can be used. While the questions highlight important issues, they are not comprehensive and serve only as references for the team. As such, the team should have brainstorming sessions to identify hazards and concerns of the main stakeholders.

Considerations		Details or Hazards Identified
Temporary Works and Sequencing	<ul style="list-style-type: none"> <li>• Can a safer means of access or egress, instead of the temporary means, be used?</li> <li>• Can monitoring instrumentation that provides early warning of possible collapse or ground movements be installed?</li> </ul>	

	<ul style="list-style-type: none"> <li>• Can the permanent staircase and lifts be completed first so that they can be used during the construction stage?</li> <li>• Will the design affect the work process during construction?</li> <li>• Can temporary works required during construction be planned for earlier? For example, specifying the type and position of temporary works required to ensure that spatial considerations are taken into the account during the design stage.</li> <li>• Are there special construction considerations that need to be highlighted to the Contractor?</li> <li>• Does the sequence of construction create temporary unstable stage that requires additional bracing?</li> <li>• Can adequate safety factors be incorporated in the design so that overloading or collapse of the permanent or temporary structure is prevented?</li> <li>• Will there be possible basal heave and piping during excavation?</li> <li>• Will there be settlement due to the proposed project?</li> <li>• Has a proper schedule for monitoring of instrumentation been provided?</li> <li>• Will there be adverse effects on adjacent structures during the removal of temporary works?</li> <li>• Are there alternatives or measures that could reduce or minimise such adverse effects?</li> </ul>	
Specialist Design	<ul style="list-style-type: none"> <li>• Are there safety concerns on elements of specialist design to be considered by the Contractor?</li> <li>• Can alternative safe work practices be used to mitigate such concerns?</li> </ul>	
Weather	<ul style="list-style-type: none"> <li>• Is there a possibility of floods happening in the site? If so, how can the hazards be minimised in the temporary and permanent stages?</li> <li>• Is there a possibility of lightning strike happening in the site? If so, how can the hazards be minimised in the temporary and permanent stages?</li> </ul>	

	<ul style="list-style-type: none"> <li>Are there other adverse weather conditions that can affect workers' safety and health on site?</li> <li>What are the effects of extreme temperature or humidity on instruments?</li> </ul>	
Others	<ul style="list-style-type: none"> <li>Have the risks and hazards identified in GUIDE-1 and GUIDE-2 been addressed or mitigated?</li> </ul>	

After hazards are identified from answering these questions, identified hazards should then be transferred to a Design Risk Record Form. The Review Team should then agree on the party to address the hazards. A follow-up review should be done to ensure that the hazards are addressed and not merely filed away. Other considerations by the review team or actions taken to mitigate the risks should be documented in the Design Risk Record form so that all relevant information is recorded.

**Note:**

DfS Regulations only require documentation and/or highlighting of residual risks that would be encountered by someone downstream during the building's or structure's lifecycle. The stakeholders can decide if they want to keep design risk records on hazards that had been eliminated or mitigated.

Aside from going through the GUIDE-3 Process, further Design Review sessions should be held to ensure that risks identified in GUIDE-1 and GUIDE-2 are eliminated or mitigated.

**Sample Design Risk Record Form**

Example of Safety and Health Risk Assessment Form

Project title													
Company:										Conducted by:			
Review:													
Review data:													
Next review data:													
Process / Location:													
S/No.	Design consideration	Risks	Hazards identified	Risk assessment			Can these hazards be designed out?	Proposed control measures	Residual risk level			Further review required	Action by
				Severity	Likelihood	Risk level			Severity	Likelihood	Risk level		

Note: This design risk record form is a sample. Other formats may be used if deemed suitable.

# 7. Annex

## Annex 1: Definition of “Development” under Section 3(1) of Planning Act

### Planning Act (Chapter 232)

#### Meaning of “Development”

- (1) Subject to subsections (2) and (3), in this Act, except where the context otherwise requires, “development” means the carrying out of any building, engineering, mining, earthworks or other operations in, on, over or under land, or the making of any material change in the use of any building or land, and “develop” and “developing” shall be construed accordingly.
- (2) The following operations or uses of land shall not be deemed for the purposes of this Act to involve development of land:
- the carrying out of works for the maintenance, improvement or other alteration of a building which do not materially affect the external appearance or the floor area of the building;
  - the carrying out of such minor or preliminary works and such temporary use of land as may be declared by the competent authority for the purpose of this subsection;
  - the carrying out by any statutory authority of any works on land within the boundaries of a street, being works which are necessary for the maintenance or improvement of the street;
  - the carrying out by any statutory authority of any works for the purpose of laying, inspecting, repairing or renewing any sewers, mains, pipes, cables or other apparatus, including the breaking open of any street or other land for that purpose;
  - the carrying out of any act authorised or required by the Control of Vectors and Pesticides Act 1998 (Act 24 of 1998);
  - the use of any existing building or land within the curtilage of a dwelling-house for any purpose incidental to the enjoyment of the dwelling-house as such;
  - the use of any land for the purposes of agriculture or forestry (including afforestation) and the use for any of those purposes of any building occupied together with land so used; and
  - in the case of buildings or land which are used for a purpose of any class specified in any rules made under section 61, the use of the building or land or any part thereof for any other purpose within the same class.
- (3) For the avoidance of doubt, it is hereby declared that for the purposes of this section—
- the use as 2 or more separate houses of any building previously used as a single house involves a material change in the use of the building and of each part thereof which is so used;

- the use as a dwelling-house of any building not originally constructed for human habitation involves a material change in the use of the building;
- the use for other purposes of a building or part of a building originally constructed as a dwelling-house involves a material change in the use of the building;
- the demolition or reconstruction of or addition to a building constitutes development;
- the use for the display of advertisements of any external part of a building which is not normally used for that purpose involves a material change in the use of the building;
- the deposit of refuse or waste materials on land involves a material change in the use thereof notwithstanding that the land is comprised in a site already used for that purpose, if
  - the superficial area of the deposit is extended; or
  - the height of the deposit is extended and exceeds the level of the land adjoining the site;
- subject to subsection (2)(h), the use of any building or part thereof for any purpose other than that for which the building was originally constructed involves a material change in the use of the building;
- any decorative, painting, renovation or building works, whether external or internal, to or on a monument in respect of which there is in force a preservation order under the Preservation of Monuments Act 2009 shall constitute building operations; and
- the use and operation as 2 or more separate entities of any building or buildings or part of a building which is or are approved or authorised to be used and operated as one single entity for any of the uses specified in the Second Schedule involves a material change in the use of the building or buildings or part of the building.

## Annex 2: Summary of Duties under the WSH (DfS) Regulations

The table below shows duties of various stakeholders under the WSH (DfS) Regulations.

Stakeholders	Duties
<b>Developers</b>	<p><b>General duties</b></p> <ul style="list-style-type: none"> <li>• Ensure that all foreseeable design risks are eliminated if reasonably practicable.</li> <li>• Where not reasonably practicable to eliminate foreseeable design risks, Developer shall ensure that the design risks are reduced to as low as reasonably practicable.</li> <li>• When reducing risks, design risks shall be reduced at its source and collective protective measures shall be used instead of individual protective ones.</li> <li>• Ensure that all Designers, Contractors and DfS Professionals appointed are competent to perform their duties.</li> <li>• Plan and manage the project such that all appointed Designers and Contractors have sufficient time and resources to perform their duties.</li> <li>• Provide relevant information to all appointed Designers and Contractors.</li> </ul> <p><b>DfS Review Meeting</b></p> <ul style="list-style-type: none"> <li>• Convene DfS review meetings to identify all foreseeable design risks and discuss how each foreseeable design risk can be eliminated or reduced where it is not reasonable practicable to eliminate.</li> <li>• Ensure that the DfS review meetings are attended by all relevant Designers and Contractors.</li> </ul> <p><b>Maintaining a DfS Register</b></p> <ul style="list-style-type: none"> <li>• Keep a DfS Register containing information and records on all DfS review meetings and every residual design risk for the project.</li> <li>• Ensure that the DfS Register is up-to-date.</li> <li>• Ensure that all appointed Designers and Contractors for the project have access to the DfS Register.</li> <li>• Ensure that the DfS Register is available for inspection by registered workplace inspectors.</li> </ul>

	<p><b>Delegation of Developer's Duties to DfS Professional</b></p> <ul style="list-style-type: none"> <li>• Developer may delegate the following duties to a DfS Professional: <ul style="list-style-type: none"> <li>– convening DfS review meetings; and</li> <li>– maintaining a DfS Register.</li> </ul> </li> <li>• The Developer must provide a DfS Professional with information necessary for him or her to perform his or her duties.</li> </ul> <p><b>Passing on the DfS Register</b></p> <ul style="list-style-type: none"> <li>• If Developer disposes his or her interests in the structure, ensure that the DfS Register is given to the person who acquires his or her interests in the project. The Developer is then responsible for informing him or her the nature and purpose of the DfS Register.</li> <li>• For subdivided buildings, ensure that the Register is given to the subsidiary management corporation of the subdivided building. The Developer must inform them the nature and purpose of the DfS Register.</li> </ul>
<b>DfS Professional</b>	<p><b>DfS Review Meetings</b></p> <ul style="list-style-type: none"> <li>• Convene DfS review meetings to identify foreseeable design risks and discuss how each foreseeable design risk can be eliminated or reduced.</li> <li>• Ensure that DfS review meetings are attended by relevant Designers and Contractors.</li> </ul> <p><b>Maintaining a DfS Register</b></p> <ul style="list-style-type: none"> <li>• Keep a DfS Register containing information and records on all DfS review meetings and every residual design risk for the project.</li> <li>• Ensure that the DfS Register is up-to-date.</li> <li>• Ensure that all appointed Designers and Contractors for the project have access to the DfS Register.</li> <li>• Ensure that the DfS Register is available for inspection by registered workplace inspectors.</li> </ul> <p><b>Updating the Developer</b></p> <ul style="list-style-type: none"> <li>• Ensure that the Developer is provided, as soon as practicable after DfS review meetings, with relevant information on all foreseeable design risks identified and how they can be eliminated or reduced.</li> <li>• Provide the Developer with the updated DfS Register after new information or record is added.</li> </ul>

<b>Designers and Delegated Designers</b>	<ul style="list-style-type: none"> <li>• Prepare a design plan that eliminates, as far as reasonably practicable, all foreseeable design risks.</li> <li>• Where not reasonably practicable to eliminate foreseeable design risks, propose to the person who appointed him or her, a modification to the design plan that would reduce design risks to as low as reasonably practicable.</li> <li>• When reducing risks, design risks shall be reduced at its source and collective protective measures shall be used instead of individual protective ones.</li> <li>• Provide information relevant to the design, construction or maintenance of the structure to the person who appointed the Designer.</li> <li>• Attend and participate in DfS Review Meetings when required by the Developer.</li> <li>• Ensure that any appointed Designer (called Delegated Designer) is competent to perform his or her duties under the Regulations.</li> <li>• Ensure that Delegated Designers are provided with relevant information.</li> <li>• A Designer is still responsible for his or her duties even if a Delegated Designer is appointed.</li> </ul>
<b>Contractors (Main Contractors and Subcontractors)</b>	<ul style="list-style-type: none"> <li>• Inform the person who appointed the Contractor of any foreseeable design risk.</li> <li>• Ensure that any Designer he or she appoints is competent.</li> <li>• Ensure that any Designer he or she engages is provided with relevant information to assist him or her with his or her duties.</li> <li>• Ensure that any subcontractor he or she engages is competent.</li> <li>• Ensure that any subcontractor he or she engages is provided with relevant information to assist him or her with his or her duties.</li> <li>• Attend and participate in DfS Review Meetings when required by the Developer.</li> </ul>
<b>Registered Proprietors</b>	<ul style="list-style-type: none"> <li>• For a structure that is not a subdivided building, keep the DfS Register.</li> <li>• For a structure that is not a subdivided building, ensure that the DfS Register is available for inspection upon inspectors' request.</li> </ul>

	<ul style="list-style-type: none"> <li>• Provide the DfS Register to the person who next acquires the interest in the structure.</li> <li>• Ensure that the person who acquires the interest in the structure is aware of the nature and purpose of the DfS Register.</li> </ul>
<b>Subsidiary Management Corporations</b> (For a subdivided building)	<ul style="list-style-type: none"> <li>• Keep the DfS Register.</li> <li>• Ensure that DfS Register is available for inspection upon inspectors' request.</li> </ul>

Aside from complying with the duties stated in the WSH (DfS) Regulations, the duty holders are required to comply with the WSH Act and its other subsidiary legislation. See Annex 3 for a list of the subsidiary legislation.

## Annex 3: List of WSH Legislation

Workplace Safety and Health (WSH) Act  
WSH (Workplace Safety and Health Officers) Regulations  
WSH (General Provisions) Regulations  
WSH (Construction) Regulations 2007  
WSH (First Aid) Regulations  
WSH (Incident Reporting) Regulations  
WSH (Risk Management) Regulations  
WSH (Registration of Factories) Regulations 2008  
WSH (Workplace Safety and Health Committees) Regulations 2008  
WSH (Abrasive Blasting) Regulations 2008  
WSH (Explosive Powered Tools) Regulations 2009  
WSH (Confined Spaces) Regulations 2009  
WSH (Safety and Health Management System and Auditing) Regulations 2009  
WSH (Noise) Regulation 2011  
WSH (Medical Examinations) Regulations 2011  
WSH (Operation of Cranes) Regulations 2011  
WSH (Scaffold) Regulations 2011  
WSH (Work at Heights) Regulations 2013  
WSH (Asbestos) Regulations 2014

## Annex 4: List of Design Works

### Civil and Geotechnical Works

Design inputs include drawings, design details, analysis, calculations, specifications and bills of quantities, terminology, definitions, classification and use of materials, products, their performance requirements, methods of tests, and good practices in the area of civil and geotechnical works such as in the area of reclamation and earthworks, foundation, roadwork, drainage and sewerage system, bridges and land surveying.

### Building Structure and Substructure

Design inputs include drawings, design details, analysis, calculations, specifications and bills of quantities, terminology, definitions, classification and use of materials, their performance requirements, methods of tests and good practices in building structure and substructure, including reinforced concrete, steel and composite steel, pre-cast and pre-stressed, and tall building structures.

### Building (Mechanical and Electrical) Services

Design inputs include drawings, design details, analysis, calculations, specifications and bills of quantities, terminology, definitions, classification and use of materials, products, their performance requirements, methods of tests, and good practices pertaining to the design, installation, maintenance, testing and commissioning of mechanical and electrical, plumbing and sanitary services in a building.

### Architectural Works

Design inputs include drawings, design details, analysis, calculations, specifications and bills of quantities, terminology, definitions, classification and use of materials, products, their performance requirements, methods of tests, and good practices in the area of architecture works encompassing building components such as roof work, facade, door, wall and floor finishes, paints and varnish and landscaping including skyrise greenery.

### Construction Management and Demolition Works

Design inputs include drawings, design details, analysis, calculations, specifications and bills of quantities, terminology, definitions, classification and use of materials, products, their performance requirements, methods of tests, and good practices including effective management techniques pertaining to the construction of a project from inception to completion.

### Facilities Management and Addition and Alternation Works

Design inputs include drawings, design details, analysis, calculations, specifications and bills of quantities, terminology, definitions, classification and use of materials, products, their performance requirements, methods of tests, and good practices pertaining to maintenance and repair, energy conservation, indoor air quality and upgrading of building.

### Fire Protection Provision and Maintenance

Design inputs include drawings, design details, analysis, calculations, specifications and bills of quantities, terminology, definitions, classification and use of materials, products, their

performance requirements, methods of tests, and good practices pertaining to the design, installation, maintenance, testing and commissioning of both active and passive fire protection provision and maintenance. Active Fire Protection (AFP) includes fire suppression system, sprinkler systems, fire detection and alarms system, and smoke and heat extraction and ventilation system. Passive Fire Protection (PFP) includes compartmentalisation of the overall building through the use of fire-resistance rated walls and floors, compartmentalisation, fire dampers and fire door closers, as well as intumescent fire protection coatings, and so on.

## Annex 5: List of Typical Designers

With the whole scheme of works mentioned in Annex 4, Designers include:

1. Architects, civil, geotechnical and structural engineers, building designers, engineers, fire safety engineers, interior designers, landscape architects, town planners and all other design practitioners contributing to, or having overall responsibility for, any part of the design (e.g., drainage engineers designing the drain for a new development) building service designers, engineering firms or others designing services that are part of the structure such as ventilation, electrical systems and permanent fire extinguisher installations;
2. Anyone who specifies or alters a design, or who specifies the use of a particular method of work or material, such as a design manager, quantity surveyor who insists on specific material or a client who stipulates a particular layout for a new building;
3. Building service designers, engineering practices or others designing plant which forms part of the permanent structure (including lifts, heating, ventilation and electrical systems), for example, a specialist provider of permanent fire extinguishing installations;
4. Those purchasing materials where the choice has been left open, for example, those purchasing building blocks and so deciding the weights that bricklayers must handle;
5. Contractors carrying out design work as part of their contribution to a project (e.g., an engineering contractor providing design, procurement and construction management services);
6. Temporary works engineers, including those designing formwork, falsework, scaffolding and sheet piling, curtain wall and facade retention schemes, scaffolding, and sheet piling; and
7. Interior designers, including shop fitters who also develop the design.

## Annex 6: Areas which Designer has Influence Over

To aid Designers to carry out the GUIDE process, this section identifies some areas the Designer has direct influence. Designers should note that the list is not exhaustive, nor is every item relevant to every project. Items that the Designer should note are:

1. The design of buildings or structures should consider risks from site hazards such as:
  - underground services;
  - vehicle traffic movement to and within the site;
  - pedestrian movement within and around the site; and
  - condition and proximity of adjacent buildings.
2. Health hazards should be designed out by:
  - Specifying less hazardous materials (e.g., solvent-free or low solvent adhesives and water-based paints);
  - Avoiding processes that create hazardous fumes, vapours, dust, noise or vibration, including disturbance of existing asbestos, cutting chases in brickwork and concrete, breaking down cast-in-situ piles to level, scabbling concrete, manual digging of tunnels, flame cutting or sanding areas coated with lead paint or cadmium; and
  - Specifying materials that are easier to handle, (e.g., lightweight building blocks, limiting the weight of formwork for easier handling).
3. Safety hazards should be designed out by:
  - Removing the need to work at heights wherever possible, particularly where it requires work from ladders or where safe means of access cannot be provided;
  - Removing fragile roofing materials or designing access route to the roof (e.g., a working platform);
  - Eliminating deep or long excavations in public areas or on highways; and
  - Eliminating materials that could create a significant fire risk during construction.
4. Consider prefabrication to minimise hazardous work on site, for example:
  - Incorporating design elements like steel structures that be prefabricated and assembled on ground and then safely lifted for installation;
  - Specifying cutting of steel members to be done off-site, under controlled conditions, to reduce the amount of dust created; and
  - Minimise site welding to reduce fire or burn risks and using prefabricated bolts and nuts as connections.
5. Features that reduce or eliminate the risk of falling should be introduced where it is not possible to remove the need to work at heights:
  - Early installation of permanent access (e.g., stairs) to reduce the use of ladders or scaffolds;
  - Edge protection or other features that increase safe access and construction; and
- Anchor points for installation of life-lines or safety harnesses when work platforms cannot be installed.
6. Design to simplify safe construction by:
  - Providing lifting points on prefabricated elements and marking the weight and centre of gravity of heavy or bulky items on drawings and on prefabricated items;
  - Making provision for temporary works required during construction;
  - Designing joints in vertical steel structure members such that bolting can be easily done by someone standing on the floor using seating angles to provide support while bolting is being done;
  - Designing connections to minimise risk of incorrect assembly and clear directions on drawings on how to do so; and
  - Designing for safe installation of external cladding (e.g., installation of cladding from the inside of the building).
7. Identify worst case scenarios and implement preventive control measures, such as:
  - Designing adequate safety factors so that overloading (static, dynamic and impact) and collapse of permanent or temporary structure are not possible;
  - Putting in place monitoring instruments to provide early warning of possible collapse or ground movements; and
  - Emergency route for mass evacuation in the event of emergency.
8. Design to ease future inspections, maintenance and cleaning work by:
  - Making provision for safe permanent access, including to roofs and M&E spaces;
  - Making provision for safe temporary access to allow for painting and maintenance of facades, reapplication of fire protection material on steel structures, and so on;
  - Provision of adequate working space in M&E areas;
  - Using paints or materials that require less frequent maintenance or replacement;
  - Designing features on facades that facilitate cleaning from inside, for example, windows, vertical greenery, and so on;
  - Placing all controls and electrical boxes at accessible locations;
  - Considering safe movement of pedestrian and vehicle traffic flow during occupancy.
9. Identify unusual demolition hazards for future plans:
  - Sources of substantial stored energy, such as pre- or post-tension cables;
  - Unusual stability concepts;
  - Alterations that have changed the structure significantly; and
  - Embedded materials, utilities, or artefacts whose exposure or removal may introduce new hazards.

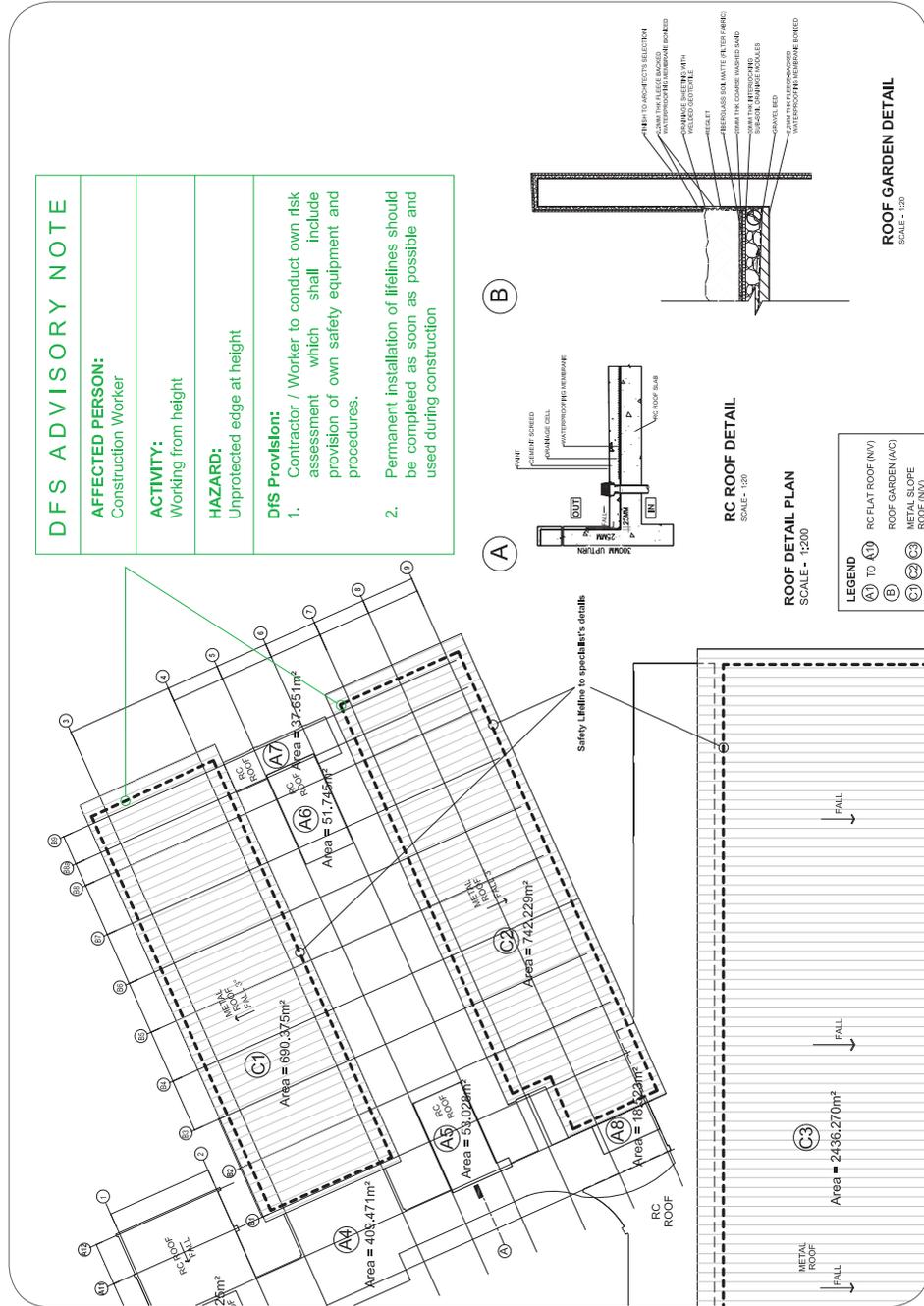
Designers have to note that their creativity should not be limited by the above. Designers need not design out every hazard identified, but they should weigh the risk level of the hazards and as far as reasonably possible, design out the risks either by eliminating the hazards or incorporating control measures to reduce the risks to acceptable levels.

## Annex 7: Advisory Notes

It is recommended that effective communication of residual risks is best achieved through “advisory notes”. Such advisory notes should appear in the documents the affected person would refer to in the natural course of their work, for example:

- In construction: Advisory notes should be provided in the contract documents (including working drawings and details, specifications, preliminaries, etc). The Contractor should transfer such advisory notes onto shop drawings, method statements, construction planning documents, and so on that would be disseminated to workers on the ground.
- In maintenance: Advisory notes should be provided in the Operations and Maintenance Manual (including as-built drawings) typically provided to building owner upon handover of the building.
- In occupancy (of a building used as a workplace), the advisory notes should be provided in the Standard Operating Procedures that may be provided, if applicable, to building owner upon handover of the building.

An example of an advisory notes on drawings is shown on the next page.



## Annex 8: Maintenance Strategy Report

During early design processes, Designers should document their proposals and requirements regarding access strategies for maintenance tasks via a Maintenance Strategy Report, which should then be collated into the DfS Register. Designers should identify key features relating to maintenance activities that:

- are carried out in a particular manner;
- affect the health and safety of maintenance workers or building users;
- entail a disciplined approach, for example, in scheduling, coordination and execution.

In developing access strategies and maintenance work methods, Designers should consult relevant people who have specialised knowledge and/or capacity to control or influence the design (e.g., the client, engineers, contractors, facility managers, DfS Professional and products specialists or manufacturers) to identify risks and appropriate solutions.

A typical report should contain sufficient details to inform those undertaking the maintenance tasks. The content of the report should include but not limited to:

- key building features relating to maintenance tasks;
- anticipated maintenance tasks and their frequencies;
- proposed work equipment and methods employed for achieving accessibility and productivity in maintenance; and
- specific safety measures.

An example of Maintenance Strategy Report is shown on the next page.

FAÇADE MAINTENANCE STRATEGY

A. EXTERNAL AREAS

Building Area/Element	Routine Maintenance	Major Maintenance	Solution	Comments
1 Tower block: Facade curtain wall • Full height from ground level to roof • All elevations including recesses and protrusions	<ul style="list-style-type: none"> <li>• Facade cleaning and inspection</li> </ul>	<ul style="list-style-type: none"> <li>• Glass replacement</li> <li>• Curtain wall repairs</li> <li>• Facade lighting repairs</li> </ul>	<ul style="list-style-type: none"> <li>• Routine maintenance</li> <li>• Major maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Permanent suspended platform with monorail system to access all facade surfaces</li> <li>• Integrated restraints in facade system</li> </ul>
2 Tower block: External planters	<ul style="list-style-type: none"> <li>• Routine inspection and cleaning</li> <li>• Planting, pruning and fertilising</li> </ul>	<ul style="list-style-type: none"> <li>• Plant or soil replacement</li> <li>• Drainage or irrigation repairs</li> </ul>	<ul style="list-style-type: none"> <li>• Routine maintenance</li> <li>• Major maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Permanent suspended platform with monorail system to access all planters</li> <li>• Integrated restraints in facade system</li> <li>• Protection rail for hanging planters</li> </ul>
4 Tower block: Entrance glass canopy • Top and underside including structural element	<ul style="list-style-type: none"> <li>• Cleaning</li> <li>• Luminaire replacement</li> </ul>	<ul style="list-style-type: none"> <li>• Glass replacement</li> <li>• Building services repair (drainage, electrical, etc)</li> </ul>	<ul style="list-style-type: none"> <li>• Routine maintenance</li> <li>• Major maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Access using self-propelled access platform</li> <li>• Accessible via paved fire engine access</li> <li>• Fall arrest system provided on surface of canopy</li> </ul>
5 Covered walkways	<ul style="list-style-type: none"> <li>• Cleaning</li> </ul>	<ul style="list-style-type: none"> <li>• Cladding repairs</li> <li>• Building services repair (drainage, electrical, etc)</li> </ul>	<ul style="list-style-type: none"> <li>• Routine maintenance</li> <li>• Major maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Accessible via ground level walkway</li> <li>• Fall arrest system provided on surface of canopies</li> </ul>

B. INTERNAL AREAS

Building Area/Element	Routine Maintenance	Major Maintenance	Solution	Comments
6 Atrium	<ul style="list-style-type: none"> <li>• Glass cleaning</li> <li>• Cleaning shading devices</li> <li>• Luminaire replacement</li> </ul>	<ul style="list-style-type: none"> <li>• Glass repair or replacement</li> <li>• Ceiling or shading devices repair</li> <li>• Building services repair</li> </ul>	<ul style="list-style-type: none"> <li>• Routine maintenance</li> <li>• Major maintenance</li> </ul>	<ul style="list-style-type: none"> <li>• Personnel lifting hoists for suspended platforms</li> </ul>

**Legend**

Solution A – Suspended platform with monorail system

Solution B – Self-propelled access platform

Solution C – Rope access

Solution D – Personnel lifting hoists or other suitable means

More details on Maintenance Strategy Report can be found in the Design for Maintainability Checklist by the Building and Construction Authority (BCA).

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Building and Construction Authority (BCA)

Centre for Public Project Management (CP2M)

Institution of Engineers Singapore (IES)

Ministry of Manpower (MOM)

Real Estate Developers Association of Singapore (REDAS)

Specialists Trade Alliance of Singapore (STAS)

Singapore Institute of Architects (SIA)

Singapore Contractor Association Limited (SCAL)

Workplace Safety and Health (WSH) Council

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