Workplace Safety and Health Guidelines on Design for Safety

Draft for Public Comment

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This draft should NOT be regarded or used as a final guidance document issued by WSH Council.

Feedback will be incorporated and copy-editing/ visual layout will be undertaken prior to publication.
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1. Introduction

The **WSH (Design for Safety) Regulations will be effective from 1 Aug 2016** and requires stakeholders such as Developers, Designers and Contractors to work together to address the risk at source and plan for the construction work, so as to identify and eliminate, as far as reasonably practicable, foreseeable risk(s) to the safety or health of any person –

- carrying out or 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 carries out or is liable to be affected by the demolition of the structure.

The WSH (DfS) Regulations’ intent is also to **direct stakeholders to work together to ensure smooth planning, management and monitoring of the project for safe execution of construction and maintenance works**.

**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 the Regulations

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

- Undertaken by a developer in the course of his business,
- With contract sum of $10 million or more, and
- Involves development under section 3(1) of the Planning Act (Cap. 232).

To cater to future developments, the WSH (DfS) Regulations is applicable to all projects that modify an existing building or structure, which have an existing DFS register and involves a development under section 3(1) of the Planning Act. This will be applied regardless of contract sum.

The definition of “Development” under the Planning Act (Cap. 232) is replicated in **Annex 1** for reference.

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, which value includes the goods and services tax payable in relation to the supply of the work. This contract sum refers to the total contract sum in term contracts. Variation Orders are not considered in contract sum.

In general, maintenance contracts which do not constitute as developments under the Planning Act are not required to comply with the WSH (DfS) Regulations. However, Alterations and Addition (A&A) works which are considered developments under the Planning Act and comply with other requirements such as contract sum exceeding $10 million are required to comply with the WSH (DfS) regulations.
1.2  Definition of “Structures”

In the regulations, “structures” is defined as any permanent or temporary structure, and 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.

Whether it is also reasonable usually takes into account:

- 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 the 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, the more likely it is to be reasonable to go to very 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 the employer can afford to put the necessary safeguards in place is not a consideration, particularly where there is risk of serious injury, or frequent but less severe injury.

Common practice and knowledge throughout the relevant industry are sometimes taken into account when judging whether a safeguard is “reasonably practicable”. Individual employers cannot claim that they do not know what to do about certain hazards if those hazards are widely known by others in the same industry, and safeguards are in place elsewhere.

Good reference guides on what safety and health measures are reasonably practicable include the following:

- WSH-related Singapore Standards published by SPRING Singapore;
- WSH materials published by the Workplace Safety and Health Council
1.3 DfS Register

The DfS Register is a collection of documentation generated through the DfS review process, for two key purposes. Firstly, 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 risk-facers.

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

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 organizations. 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 who undertake modification projects done to their existing building.

Domestic Developer means a developer for whom a project is being carried out which is not in the course or furtherance of a business of that developer. This would include home owners who engage contractors to construct their own homes. Developers of schools, hospitals and non-profit organisations are not considered to be Domestic Developers and hence need to comply with the WSH (DfS) Regulations in the event that they meet with other qualifying criteria. Projects for Domestic Developers are not covered under the WSH (DfS) Regulations.

2.2 What must Developers do to comply with their duties?

As the key stakeholder in the project, the Developer is responsible under the WSH (Dfs) Regulations to:

(a) *Ensures foreseeable design risks in the project are eliminated. Where it is not reasonably practicable to eliminate the design risks, Developer shall ensure the design risks is reduced to as low as reasonably practicable.*

The Developer is the one who engages professionals to design and construct his project at his allocated budget. As the key stakeholder in the construction project, he is the one that selects the scheme and makes key decisions in the design of the project. As such, it is the duty of the Developer 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 will have to work with the Designer, DfS Professional or the Contractor to ensure that the design risks are reduced to as low as reasonably practicable.

When reducing the risks, the design risks 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 guardrails along an open edge instead of lifelines.

While it is understandable that Developers may not have the domain knowledge to ensure that foreseeable design risk is eliminated, he/she should leverage on the expertise of his designers and contractors to assist him/her in making the appropriate decisions.
(b) Engage competent Designer(s), Contractor(s) and DfS Professional such that they are able to comply with their duties under the WSH Act and the subsidiary Regulations.

Competency of a person is defined as the experience and training that the person has which helps him comply with his duties. In the assessment of the competency of a person to take 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 contractual requirements, but also able to perform the duties prescribed under the WSH ACT and the subsidiary Regulations. In the assessment of a firm to perform the job, the Developer shall check that the firm has the relevant track records and experienced personnel to adequately fulfil the competency requirements expected of them.

Taking reference from the Quality Fee Method (QFM), examples of areas which the Developer could check to assess the competence of the individual or firm includes:

- Firm or individual’s track record including awards attained,
- Relevant expertise and experience of the proposed project team,
- How the project team intends to deal with the design risks of the project as informed to them by the Developer, and
- Safety and risk management capabilities of the construction project team (where applicable).

Example:

In a proposed residential development, the Developer requires five high rise buildings to be designed and connected at the mid and top level by sky bridges. The Developer initially engaged a building designer for the design, but subsequently realized that the building designer did not have the competence in both training and experience to design bridges. The Developer eventually engaged a bridge designer for the sky bridges while the building designer designed the building.

(c) Plan and manage the project such that all Designers and Contractors appointed by the Developer have sufficient time and resources throughout the project.

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

(i) Designers 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.

(ii) 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 (for example staff, equipment and, particularly, time) needed to plan and do the work properly. At the tendering stage, Developers should take into consideration the minimum time period allowed to the Contractor for planning and preparation before construction work begins on site. Contractors should be given sufficient time after their appointment to allow them to plan the work and mobilise the
necessary equipment (for example cranes, piling rigs) and staff to allow the work to proceed safely and without risk to health. This is particularly important where the project involves demolition work and Contractors must be given sufficient time for the planning and safe execution of any demolition activities.

After the awarding of contracts at agreed prices with the Designer and Contractor, in the event of major changes in the project leading to safety and health issues, the Developer should discuss with the Designers and Contractors on the allocation of time and resources to determine if they are sufficient for the project. All parties should come to a mutual agreement on the resources and time allocated such 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 previously not known during the tender stage, it was later discovered that the existing building that was to be demolished contained asbestos containing material. This would require more time and specialists asbestos removal contractors to be brought in. Hence, the developer should provide the main contractor with additional time and resources to cater to this situation.

(d) **Provide relevant information** to all Designers and Contractors engaged by the Developer. This includes providing them with:

1. Site plans and photographs of the project location
2. As-build plans
3. Utilities and Services plans
4. Soil investigation reports
5. Existing DfS register (if any)
6. Information on the design risks associated with the project (if any)

The provision of such information should be done before the tender is awarded so as to enable the Designers and Contractors hired by the Developer to assess at the pre-construction information and the risks involved. This would then enable the Designers and Contractors to understand the design risks involved for the project such that they are able to perform their jobs and comply with their duties under the WSH Act and the subsidiary Regulations.

The Developer may assign the Designer, the Contractor or the DfS Professional to obtain the pre-construction information on his behalf from the Authorities or other parties, but the duty remains that of the Developer.
(e) **Convene DfS Review Meeting(s) with the relevant Designer and Contractor so as to identify all foreseeable design risks to people who may be affected and discuss how each of the foreseeable design risks can be eliminated.**

To fulfil this requirement, the Developer shall conduct DfS Review Meeting(s) with the relevant stakeholders at the various key stages of the projects. Relevant stakeholders are the 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. It is noted that these stakeholders may not be on the project team during the key stages of the projects but their inputs should be sought once on board the team, so as to ensure fruitful DfS Review Meeting.

In the event that a foreseeable design risk identified 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 in the DfS Review Meeting(s) are recorded.

Finally, all residual design risks highlighted and recorded must be communicated to the contractor engaged in the relevant scope of works, such that he is aware of the risks involve and takes steps to manage the risks.

While it is recommended that the DfS Review Meeting(s) be done using the GUIDE process in page 20, the Developer may also chose other hazard identification tools to identify the risks for the project.

To perform this duty, the Developer may appoint his employees to undertake this task, or engage a person deemed competent for this duty, termed as DfS Professional. In the event the Developer appoints a DfS Professional to assist him, the duties to convene the DfS Review Meeting(s) will be fulfilled by the DfS Professional. However, the Developer must ensure that the DfS Professional is competent to perform his functions and duties under the regulations.

**Example:**

The Developer engaged an architect and an engineer to design a condominium with the associated facilities. Under the DfS Regulations, the Developer is required to implement a DfS Review Process so as to eliminate foreseeable risks to people who may be affected by the construction or maintenance of the building. The Developer then appoints a DfS Professional for implementing the DfS Review Process and gathers the architect, the engineer and relevant stakeholders to join in the review.

In the review, one of the items discussed was that high gloss tiles are installed at the edge of the foyer where the canopy overhangs partially. In the event of rain, the tiles would be wet and highly slippery, possibly leading to slips and falls of persons. As such, the team agreed that tiles at areas which could get wet from inclement weather should be non-slip tiles so as to reduce the risk of slips and falls.
While DfS Review Meeting is typically done during the pre-construction phase, during the construction stage of the project, the Developer may still conduct the DfS Review Meeting so as to:

(i) Review any new or revised designs (eg variations, designs for temporary works, and designs by specialist contractors),

(ii) Provide necessary briefings and clarifications to the Contractor as part of passing-on information of residual design risks from the DfS Review Meeting.

It is important to remember that **the DfS Review Meeting is not the same as Risk Management process**. The DfS Review Meeting looks at the risk associated with the design and considers how the building/structure can be constructed, maintained and cleaned safely and if there are safety issues with using the completed structure as a workplace. Risk Management, on the other hand, only looks at the risks associated with physically carrying out the construction work.

(f) **Prepare a DfS Register** containing information and records on DfS Review Meeting convened 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, this could be when there are reduced risks in a particular area of the project as a result of proposed design change or change in construction sequence.

It is noted 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 the Contractor(s) are required to provide information with regards to the risks of the project and this information is to be kept 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** such that they are informed of them. This would then allow them to look into the risks and mitigate them accordingly in their works.

The Developer may either take on the duty to prepare the DfS Register himself, appoint his employee to undertake the task, or appoint a DfS Professional to take on this duty.

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 the 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, electronic modes of information sharing and storage/filing can be used, subject to appropriate document control measures being in place.

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

- Design Review records of risks and mitigation measures which may follow the recommended GUIDE process:
  - GUIDE1 records of risks and mitigation measures.
  - Notes on special risks and hazards arising from the design, eg. Materials used, structural concepts.
  - GUIDE2 records of risks and measures.
  - Information provided by contractor on mitigation of risks and hazards
GUIDE3 records of risks and mitigation measures.
- Residual hazards which will be brought over to the maintenance phase
- Maintenance methods of the building/structure/equipment.

- Services Plan
- Plans of existing building/structures

It is important to note that the information in the risk register is to be revised from time to time to ensure their relevance and **irrelevant or outdated information should be discarded** to avoid unnecessary piling up of information.

(g) **Ensure the continuity of the DfS Register** by passing it to the person who acquires the Developer’s interest in the project.

This would include building owners and in the case of sub-divided buildings, the Management Corporation Strata Title (MCST) who acquires the Developers’ interest in the project.

The Developer shall ensure that the person who acquires the interest in the project is aware of the nature and purpose of the DfS Register. In the event that the DfS Register is passed over during the pre-construction or the construction phase, information on the risks concerning both the construction and maintenance of the project should be informed to the person who acquires the Developer’s interest. In the event that the DfS Register is passed 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**

As mentioned earlier, the Developer may delegate his duties in relation to:
- Convening the DfS Review Meeting
- Maintaining a DfS Register,

by appointing an external party, known as the DfS Professional, to undertake the duties. In the event that these duties have been delegated, the Developer will not be responsible for the performance of these duties.

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 in safety and health for construction, and
- Attended the Design for Safety for Professional Course (formally known as the DfS Coordinator Course) and passed the assessment, or equivalent, and

  EITHER

- Be a registered PE or Architect with a Practicing Certificate

  OR
• Have 10 years relevant experience in the design (at least 5 years in design which includes contributions to designs, writing specifications) and the supervision of the construction of structures; and
• Have a degree accepted by PEB or BOA and construction-related degree accepted by SISV and SPM

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

The Developer must also provide the DfS Professional with the information necessary for him to perform his duties.

Other than the duties to convene the DfS Review Meetings and maintain the DfS Register, the DfS Professional needs to update the Developer with regards to the DfS review meeting and DfS register.

The DfS Professional needs to ensure that the Developer is provided as soon as practicable after the DfS review meeting, with the relevant information on each foreseeable design risk identified and how each design risk can be eliminated. In addition, the DfS Professional also needs to provide the Developer with updated DfS Register after the adding of any information or record. The updating is important to ensure that the Developer has an oversight with regards to the design risks of the project and is able to make the right decisions on how the design risks are to be mitigated.

2.4 Design & Build Contracts

In Design & Build (D&B) contracts, the Developer would need to assess the Contractor’s competence in terms of his whole team, including the Designer he is engaging, their experience and training to handle the risks of the project and to fulfil their duties under the WSH Act and subsidiary Regulations. In particular, this refers to the Contractor’s competence to perform his duty under WSH (DfS) Regulation 10 and his Designer’s competence to perform his duty under the WSH (DfS) Regulations 9.
3. Designers

3.1 Who are Designers?

Under the WSH (DfS) Regulations 2015, a “Designer” refers to the person or an organization or a company who prepares a design plan relating to a structure. This would include engineers, architects, Professional Engineers, 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.

A list of design and design inputs are shown in Annex 4.

In relation to the works listed in Annex 4, a list of persons deemed as Designers are shown in Annex 5.

3.2 What must Designers do to comply with their duties?

As 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 important that safety and health be considered right from the start of the design.

The designer can greatly assist in this by considering the following:

- can prefabrication be used to limit the 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 which need bringing to the attention of the contractor?
- can permanent facilities be built-in to ease access for maintenance of the structure over its life?

The designer is in the unique position of being able to remove risks at the design stage instead of leaving the contractor to manage difficult access problems on site.

Hence, the Designer is the key stakeholder in a project working for the Developer and/or Contractor(s) and is responsible under the WSH (DfS) Regulations 2015 to:

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

While developing a design plan, the Designer shall begin with the elimination of foreseeable design risks as the ideal solution. To be able to foresee the design risks, the Designer must consider the people affected, namely people:
(i) carrying out or liable to be affected by construction work for the structure,
(ii) for whom the structure is a workplace, including an individual who maintains or cleans the structure, or anything in or on the structure, or
(iii) who carries out or is 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,
- have the right skills, knowledge, and experience so as to be adequately resourced to address the safety and health issues arising from the design

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

(i) Site plans and photographs of the project location
(ii) Relevant drawings/plans (eg. Architectural plans, structural plans, as built plans, etc)
(iii) Utilities and Services plans
(iv) Soil investigation reports
(v) Existing DfS register (if any)
(vi) Information on the risks associated with the project (if any)

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

Example:

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

A list of typical design hazards is included in Annex 6. The list serves as a reference for designers when doing design work, but does not limit possible hazards to only those listed there.

(b) 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 to be 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 risk associated with those hazards which remain.

This can be achieved by the following manner:
(i) reduce the design risk at its source; and
(ii) use collective protective measures rather than individual protective measures

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

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

When considering safety and health risks, Designers are expected to do what is reasonable at the time that the design is prepared, taking into account current industry knowledge and acceptable practices, requirement for maintenance, cleaning and access to the finished project. Discussing these aspects with those who will be carrying out this work is important, as they may have established methods of working or specific needs or suggestions which Designers will need to consider in their design. Examples of such are the use of Mass Elevated Work Platform (MEWP) for maintenance of internal structures, or use of suspended scaffolding or industry rope access system for maintenance of building façades.

Modification of the design while construction works are on-going is an additional work and such efforts may not be cost effective to the project. 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, so as to prevent reworking of the design.

Example:

The distribution box of a multi-storey carpark was sited at the wall of a carpark next to the traffic lanes, which would cause the maintenance workers to be in the path of the traffic. To reduce the risk of being hit by vehicles, the distribution box was sited further down the carpark to the corner where the risk of being hit by a vehicle during maintenance of the distribution box was eliminated.

(c) **Provide all the information relevant** to the design, construction or maintenance of the structure to the person who appointed the designer.

In addition to the reduction of the risks through modification of the design, the **Designer shall provide information about those risks** to assist main stakeholders who include Developer, delegated Designer, and Contractor.

To enable the residual risks to be dealt with, they must be highlighted to the:

(i) Developer so that he 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 phase to the construction phase.
(ii) Developer and/or Contractor to allow them to make informed decision with engineering judgments at an early stage in order to avoid foreseeable risks to those involved in the
construction and future use of the building 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. If in doubt about the level of information needed,
besides asking those who will use it, it is sometime best to ask themselves some pertinent questions
such as:

• "If I were the operative maintaining this plant/roof/ etc, what would I want to be provided
to achieve safe working access, in a manner that will not affect my safety and health? “

• "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 amounts of unnecessary paperwork. However he should
maintain records on why key decisions were made with respect to the design or modifications to the
design when they are passed to another. The information should be clear, concise, and in a format
suitable for the users. This can be achieved using:

(i) Notes on drawing
Since the notes will be immediately available to those carrying out the work, this format of
information is therefore direct and concise. They can refer to other documents if more detail
is needed, and be annotated to keep them up to date and current. An example is given in
Annex 7.

(ii) Written notes provided together with the DfS Register
These notes should be project specific, and should only contain information which will be
useful to those constructing or maintaining the structure.

(d) Attend and participate actively in the design-for-safety (DfS) review meeting as required by
the Developer and/or Contractor or their appointed DfS Professional.

Under the WSH (DfS) Regulations 2015, the Developer or his appointed DfS Professional is
responsible for implementing the DfS review process. In the event that the Designer is appointed by
the Developer, the latter may require the Designer to participate in the DfS review process at any
time during the pre-construction phase or even the construction phase of the project so as to review
the design and how it affects the safety and health of people affected. In instances where the
Designer for permanent works or temporary works is appointed by the Contractor, the Designer may
also be required to join in the DfS review process as his inputs would be important.

A safe design of a building structure will always be part of a wider set of design objectives, including
practicability, aesthetics, cost and functionality. These sometimes competing objectives need to be
balanced in a manner that does 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 the
discussion on the design and the risks it poses and allows the duty and stake holders to work
together to resolve the issues.
(e) Appointment of a delegated designer

The WSH (DfS) Regulations 2015 has made provision for the appointed Designer to appoint another Designer, called a delegated Designer, for the structure. This can take place when the following conditions are fulfilled:

(i) only if the appointed Designer reasonably believes that the delegated Designer is competent to perform the duties of a Designer under the WSH (DfS) Regulations 2015 and any other subsidiaries regulations made under section 65 of the WSH Acts.

(ii) 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 Acts.

The Designer should also consider whether he/she has any gaps in his/her own knowledge or experience and, if so, seek out other professionals to help him/her to bridge those gaps. If a Designer delegate a portion of work to another designer (for example, a specialist), he/she should make inquiries about their skills, knowledge and experience to ensure 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 for the performance of any duty under para (a) or (b) described above.

The delegated Designer must also satisfy himself / herself that he/she indeed has the appropriate skills, knowledge, training and experience to do the work. This can be demonstrated by providing evidence of references from previous clients, portfolio of past work on similar projects, and attending certification courses such as DfS Professional Course organized by professional institutions.
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 Sub Contractors. As such, the duties of Contractors would also apply to both Main Contractors and Sub Contractors.

4.2 What must Contractors do to comply with their duties?

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

(a) Inform the person who appointed the contractor of any foreseeable design risk that the contractor knows the structure will 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 main-contractors to inform the developer or for sub-contractors to provide their main-contractors with information on any foreseeable design risks as soon as reasonably possible.

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

Competency of a person is defined as the experience and training that the person has which helps him comply with his duties under the regulations. In the assessment of the competency of a person who is taking 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 contractual requirements, but also able to perform the duties prescribed under the regulations. In the assessment of a firm to perform the job, the Contractor shall check that the firm has the relevant track records and experienced personnel to adequately fulfil the competency requirements expected of them.

Example:

A Contractor needs to engage a Professional Engineer (PE) to design a formwork structure for a transfer slab which is 3 meters deep and is required by the Designer to be cast in 3 stages to control thermal heat dissipation. Under the regulations, the Contractor is required to engage a competent temporary works Designer. In order to ensure that the PE engaged is competent, the Contractor will need to check that the PE he is engaging has the relevant training and experience in designing similar formwork structure for transfer slabs.
(c) **Provide relevant information to Designers** who are engaged by the Contractor. This includes providing them with:

(i) Site plans and photographs of the project location
(ii) Relevant drawings/plans (e.g. Architectural plans, structural plans, as built plans, etc.)
(iii) Utilities and Services plans
(iv) Soil investigation reports
(v) Existing DfS register (if any)
(vi) Any other information that the Designer would require to perform his jobs and comply with their duties under the WSH (DfS) Regulations

(d) **Participate in the DfS Review Process as required by the Developer or the DfS Professional.**

The Contractor may also be called to participate in the DfS review process at any time during the project. In the event where the Contractor has been 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 commenced. This would allow for better planning in the pre-construction phase in terms of work processes and construction methods that will be carried out by the Contractor.
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 refers 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 (MA’s) are considered as occupiers of a worksite.

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 interest in the structure in the project he had undertaken, the Developer is required to handover the DfS Register to the next person who acquires the Developers’ interest in the structure.

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

(a) Keep the DfS Register for a structure that is not a subdivided building. He will be required to share the information on the residual risks in the DfS register with affected persons such as those carrying out cleaning and maintenance works.

(b) Ensure that the DfS Register, for a structure that is not a subdivided building, is available for inspection when requested by an inspector.

(c) Ensure that in the event that the Registered Proprietor disposes his interest in the structure;

   (i) The DfS register is given to the person who next acquires the interest in the structure when the registered proprietor disposes of his interest in the structure. The DfS register is a live document which needs to stay with the structure for its entire life span, from design conceptual phase till its demolition. Hence, this document will be required to be handed over from one Registered Proprietor to the next for their future reference and updating.

   (ii) 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 is required to 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 they can make the information on residual risk 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 hands over the property to new owner who bought over the property. The developer will be 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 the MCST’s has a MA to manage their property, the Registered Proprietors or the MCST’s has the duty to ensure that the MA has access to the DfS register and is informed of the residual risks. When the MA engages a contractor to carry any work, the MA is required to inform the contractor of any residual risks involved in their scope of works.

Example:
A Registered Proprietor owns a shopping center and engages a Managing Agent (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 facade of the shopping center. The MA will be required to ensure that the contractor has been informed of all the residual risks involved in carrying out the landscaping works on the façade wall of the shopping center.
6. The GUIDE Process

6.1 Introduction

To ensure the design is safe, a DfS Review Process is introduced in the project flow. The DfS Review Process shall involve the main stakeholders, such as the Developer, Designer (engineer and architect), and Contractor if he is appointed already.

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

(a) carrying out or liable to be affected by construction work;
(b) maintaining or cleaning a completed structure; or
(c) using a completed structure designed as a workplace.

After the DfS Review Process is done, there should be (i) the safest possible design as endorsed by all parties of the DfS Review Process and (ii) a record of the residual hazards and vital safety and health information.

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

GUIDE stands for the following process to ensure a systemic way of doing the DfS review:

Step 1 G – Group together a review team consisting of main stakeholders.

Step 2 U – Understand the full design concept by looking at the drawings and calculations, or have the designers elaborate on the design.

Step 3 I – Identify the 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.

Step 4 D – Design around the risks identified to eliminate or to mitigate the risks.

Step 5 E – Enter all the information including vital design change information affecting safety and health or remaining risks to be mitigated into the DfS Register.

Steps 3 and 4 should be iterative and 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 competent person and the stakeholders guided accordingly to identify the foreseeable risks in the projects. After following the steps required for GUIDE, the 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:

**GUIDE-1**: Concept Design Review  
**GUIDE-2**: Detailed Design, Maintenance and Repair Review  
**GUIDE-3**: Pre-Construction Review

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

**GUIDE process for TYPICAL contracts:**

**GUIDE process for Design and Build (D&B) contracts:**
GUIDE-1: Concept design review should look at general location of the project, traffic and vehicular flow in the surroundings, type of building, and other general constraints.

GUIDE-2: Detailed design, maintenance and repair review should look at the detailed architectural and structural design. The review should also determine the risks involved in the construction methods, the access and egress, whether the design will create confined space or other hazards. The risks related to maintenance and repair of the building, such as the cleaning methods, should also be studied.

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

GUIDE-3: Pre-construction design review should examine temporary works design and design by specialist contractors not covered during the concept and detailed design phases.

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/ Weight
- Layout
- Maintenance
- Material Handling/ Storage
- Means/ Methods
- Operation
- Physical Hazards
- Sequence of construction
- Standardisation of building elements
- Weather
Sample of topics that can be discussed for GUIDE-1, GUIDE-2 and GUIDE-3 are enclosed in the next few pages respectively. The hazards highlighted then should be singled out and addressed in the DfS Risk Register.

The residual hazards should be highlighted to the contractor to ensure that they will be dealt with. The project team should note that while the lists for GUIDE-1, GUIDE-2 and GUIDE-3 serve as a reference, there may be other topics not discussed in the lists that are specific to the project itself. The project team should therefore diligently 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 the critical risks associated with the use, construction, maintenance (including cleaning and repair), alterations, additions, decommissioning and demolition of the building/structure.

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

GUIDE-1 will typically need to address the following:

**SITE FEASIBILITY ANALYSIS**
- Impact on Site / Development by existing surroundings
- Impact on Site / Development by environmental factors
- Impact of Site / Development on surroundings/public
- Existing Site Conditions
- Conceptual/Schematic Site Planning - Constraints & Opportunities
- Feasibility of Construction Operations & Site Management
- Adjacent Structures
- Ground / Soil Conditions

Sometimes, risks identified in GUIDE-1 can only be addressed later in the project when more of the project details are known. However, the highlighting of the risks aids the Designer in understanding the feasibility as well as 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 a group of main stakeholders and not only by the Designer in isolation. The contribution of the various people will therefore help to ensure that safety at every stage and level is examined and discussed.

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

(a) the generic **TYPE** (or nature) of the proposed development, and  
(b) the **LOCATION** of the project (i.e. analysis of potential Sites to determine the selection of an appropriate Site).

**LOCATION** determines several major considerations such as soil assessment, the public, traffic, the existing services and the placement of major machinery. GUIDE-1 therefore needs to examine the issues associated and highlight the risks and hazards arising.

To aid the GUIDE-1 Design Review Team, the following series of questions are tabulated. While the questions may highlight important issues, they serve only as a reference for the team and may not be comprehensive. As such, the team should still have a "brainstorming" session which will be more effective in highlighting the hazards and concerns of the main stakeholders.
### Considerations

<table>
<thead>
<tr>
<th><strong>Soil</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Has the soil profile of the site of the proposed project been studied by the QP?</td>
<td></td>
</tr>
<tr>
<td>Are there buildings or structures that may have shallow foundation in the vicinity of the proposed project?</td>
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<tr>
<td>Will there be possible lowering of ground water table as a result of the proposed construction?</td>
<td></td>
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<tr>
<td>Will there be possible settlement due to the proposed project?</td>
<td></td>
</tr>
<tr>
<td>Are there any possible preventive measures to ensure settlement is minimised?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Public</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Will the commencement of the project affect the public in any way?</td>
<td></td>
</tr>
<tr>
<td>Will the commencement of the project affect the traffic in any way?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Services</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there underground services in the site that need to be removed for the project?</td>
<td></td>
</tr>
<tr>
<td>Will the removal of these services, if any, be a hazard to the workers or the public?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Others</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there any special features that require special arrangements during construction?</td>
<td></td>
</tr>
<tr>
<td>Can the method of construction/sequence be identified at present?</td>
<td></td>
</tr>
<tr>
<td>Are there any hazards associated with the method of construction/sequence that can be dealt with at present?</td>
<td></td>
</tr>
<tr>
<td>Are there any special features such as façade, roof and skyrise greenery features that require special arrangements during maintenance?</td>
<td></td>
</tr>
<tr>
<td>Are there any foreseeable hazards that can be identified and eliminated?</td>
<td></td>
</tr>
</tbody>
</table>

Having answered the above list of questions and identifying the hazards, the significant hazards identified should then be transferred to a Design Risk Record Form.

The form allows for the hazards and control measures to be indicated and the Design Review Team should then agree on the party to be assigned to take the actions to further address the hazard. A follow-up review should be done to ensure that the hazards to be addressed are not merely shelved.
and filed away for information. Other considerations by the review team or actions done to mitigate the risks should be documented in the Design Risk Record Form so as to ensure that all relevant information is captured.

Unless the exercising of GUIDE-1 at conceptual design stage proves that a redesign/relocation of the project is required, the risks identified under GUIDE-1 can usually be addressed in the GUIDE-2 design stage. As such, typically GUIDE-1 needs only to be performed once.

Design issues highlighted in GUIDE-1 should be addressed by the Designer when doing the detailed design. GUIDE-2 will hence be an exercise to identify the hazards as well as ensure that the significant hazards 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 the design for the building / structure progressively as it develops. Although design of buildings / structures is often done by consultant designers on behalf of the Client, designs can also be done as a whole on a Design & Build basis by a Contractor, or parts of the building / structure can be design by the Contractor’s specialist contractors or other designers.

GUIDE-2 will typically need to address the following:

SCHEMATIC / DC PLANNING DESIGN
- Impact on Site / Development by existing surroundings
- Impact on Site / Development by environmental factors
- Impact of Site / Development on surroundings/public
- Existing Site Conditions
- Conceptual/Schematic Site Planning - Constraints & Opportunities
- Feasibility of Construction Operations & Site Management

DEVELOPED / BP DESIGN
- Adjacent Structures
- Ground / Soil Conditions

SCHEMATIC / DC PLANNING DESIGN
- Design of Permanen Works - Layouts / Configurations / Relationships & Spatial Use/Function

DEVELOPED / BP DESIGN
- Design of Permanent Works -
  - Site Formation -
    - Earthworks
  - Underground Services
  - Sub-structure -
    - Foundation & Footings
    - Excavation
    - Basement
  - Building Super-structure & External Structures
  - Building Envelope
  - Internal & External Assemblies, Systems & Plant (M&E and Architectural) -
    - M&E Plant / Major Equipment
    - Architectural Systems / Assemblies
    - M&E Systems
  - General Design Function

DEVELOPED / BP DESIGN &/OR CONSTRUCTION / CONTRACT
- Design of Permanent Works -
  - Materials, Fixtures & Detailing -
    - Architectural Fixtures
    - M&E Fixtures
    - Materials
    - Furniture, Fittings & Equipment


While GUIDE-2 serves to identify and address hazards as they emerge from the development of the design, the issues raised during GUIDE-1 should also be reviewed and closed out if possible.

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

A series of questions are tabulated below to aid the GUIDE-2 Design Review Team. **While the questions may highlight important issues, they serve only as a reference for the team and are certainly not comprehensive.** As such, the team should still have "brainstorming" sessions to effectively identify the hazards and concerns of the main stakeholders.

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Details / Hazards Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prefabrication</strong></td>
<td></td>
</tr>
<tr>
<td>Can elements such as steel structures be prefabricated, assembled on ground and then lifted to position for installation?</td>
<td></td>
</tr>
<tr>
<td>Can the cutting of steel members be done off-site, under controlled conditions to reduce the dust created?</td>
<td></td>
</tr>
<tr>
<td>Can site welding be reduced so as to reduce fire or burn risks and prefabricated nuts and bolts used as connections?</td>
<td></td>
</tr>
<tr>
<td>Can prefabricated elements be provided with designed lifting points, and the weight, the centre-of-gravity marked on the drawings and on the items?</td>
<td></td>
</tr>
<tr>
<td>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 are removed?</td>
<td></td>
</tr>
<tr>
<td>Can joints in vertical steel structure members be designed such that bolting can be done while on the ground?</td>
<td></td>
</tr>
<tr>
<td>Can connections be designed to minimise risk of incorrect assembly (e.g. unique bolt layout for each connection) and clear instructions provided on drawings?</td>
<td></td>
</tr>
<tr>
<td>Before deciding on prefabrication, Designer to verify if site conditions allow for lifting cranes to be positioned safely.</td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Questions</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Heavy Lifting</td>
<td>Consider the work process and the equipment required for heavy lifting. Can the position for parking of these equipment be finalised and cordoned off? Does a foundation for these lifting equipment need to be designed so as to minimise settlement and failure of support? Consider the worst case scenario. Can this scenario be prevented or managed to minimise injuries?</td>
</tr>
<tr>
<td>Falling from Height</td>
<td>Can the need to work at height be removed? E.g. removing the need to work from ladders, removing the need to work where a safe means of access cannot be provided. Can fragile roofing materials be removed or an alternative access route (including a work platform) to the roof be designed? Can there be early installation of permanent access, such as stairs, to reduce the use of ladders or scaffolds? Can edge protection or other features that increase the safety of access and construction be designed and installed? Can anchor points for installation of life-line or safety harnesses be mounted where work platforms cannot be installed? Can floor openings, if any, be minimised?</td>
</tr>
<tr>
<td>Temporary Works and Sequencing</td>
<td>Can a safer means of access or egress be used instead of the temporary means required? Can the permanent staircase and lifts be completed first and used during the construction stage? Will the design affect the work process and stages during construction? Can temporary works required during construction be planned for? E.g. specifying the type and position of the temporary works so as to ensure spatial considerations have been considered. Are there special construction considerations that need to be highlighted to the contractor for his construction?</td>
</tr>
</tbody>
</table>
| Layout               | Does the sequence of construction create any temporary unstable working platform, which requires additional bracing?  
|---------------------|-------------------------------------------------------------------------------------------------------------------------------|
|                     | Can adequate safety factors be incorporated in the design such that overloading or collapse of the permanent or temporary structure is not possible?  
| Confined Space      | Can the layout be optimised to prevent any accidents from the flow of traffic, pedestrian, equipment, etc. within and around the site during the construction stage?  
|                     | Consider the flow of traffic, pedestrian, equipment within and around the site during the permanent stage.  
|                     | Can the layout be optimised to prevent any accidents?  
|                     | Is there a need to designate specific material, equipment, vehicular and human traffic flow diagram?  
| Access for Maintenance | Does the design create any confined space in the permanent or temporary stage?  
|                     | Can the confined space be removed from the design?  
|                     | Can the requirement to enter the confined space be minimised by removal of vital equipment or controls from the confined space?  
|                     | Does the provision of access take into account the safe and efficient movement of maintenance personnel and the tools and equipment needed to carry out the maintenance work?  
|                     | Can temporary means of access (scaffolding, makeshift ladder, etc.) be eliminated by the provision of permanent safe access to areas requiring regular maintenance?  
|                     | Does the design incorporate permanent safety lines, anchorage and hoisting points into structures for maintenance work that needs to be carried out at height?  
|                     | Consider using durable materials that require lower frequency of maintenance e.g. powdered coated aluminium materials versus mild steel materials that require regular repainting.  

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Date: 18 Feb 2016  
DfS Guidelines  
Document: WSHP-HKS-08
| **Emergency Route** | Can the maintenance work be carried out at ground level in a safe and productive manner? For example, positioning air-conditioning units at ground level, positioning luminaires within reachable height.  
Does the design create low headroom that reduces the safety and efficiency of people carrying out the maintenance work?  
Does the design minimise the need for maintenance personnel to enter ducts and crawlspace?  
Does the design minimise the need for the deconstruction of bulkheads, claddings, casings, etc during routine inspection and maintenance?  
Does the design allow sufficient space and routes of access for vehicles (e.g. cranes, cherry-pickers) to operate safely and efficiently during the maintenance and operation of the building?  
Has the design allowed for sufficient working space in M&E rooms and around M&E equipment for inspection, maintenance, repair and replacement of equipment?  
In cases where vertical greenery systems span a few storeys, does the design provide maintenance access at every level? |
| **Health Hazards** | Is the emergency route for both the temporary and permanent stages the shortest and most direct?  
In the emergency route, is there adequate lighting, directions, warning and backup power for mass evacuation of people?  
Can less hazardous materials be specified? E.g. solvent-free or low solvent adhesives and water-based paints.  
Can processes that create hazardous fumes, vapors, dust, noise or vibration be avoided? E.g. disturbing existing asbestos, cutting chases in brickwork and concrete, breaking down cast-in-situ piles to level, scrabbling concrete, hand-digging tunnels, flame cutting or sanding areas coated with lead paint or cadmium.  
Can alterations that have changed the structure significantly be highlighted? |
Can disruptions to existing utilities within occupied buildings be avoided?

Can materials that are easier to handle be specified? E.g. lightweight building blocks, limiting the weight of formwork components to less than 25kg.

| Weather | Is there a possibility of floods in the site? If so, how can the hazard be minimised in the temporary and permanent stages?
|         | Is there a possibility of lightning strike in the site? If so, how can the hazard be minimised in the temporary and permanent stages?
|         | Are there any other adverse weather conditions that can affect the ability to safely construct the work?
|         | What are the effects of extreme temperature or humidity on instrumentation?

| Others  | Are there any other major hazards that need to be dealt with? Can materials that can create significant fire risk be removed?
|         | Can sources of substantial stored energy, such as pre- or post-tension cables be specified in the drawings and highlighted for future demolition?
|         | Can alterations that have changed the structure significantly be highlighted?
|         | Can disruptions to existing utilities within occupied buildings be avoided?

Having answered the above list of questions and identifying the hazards, the hazards identified should then be transferred to a Design Risk Record Form. The form allows for the hazards and control measures to be indicated and the Design Review Team should then agree on the party to be assigned to take the actions to further address the hazard. A follow-up review should be done to ensure that the hazards to be addressed are not merely shelved and filed away for information. Other considerations by the review team or actions taken to mitigate the risks should be documented in the Design Risk Record Form so as to ensure that all relevant information is captured.

As mentioned previously, design issues highlighted in GUIDE-1 should be addressed by the Designer when doing the detailed design. GUIDE-2 will hence be a session to identify the new hazards as well as ensuring hazards raised in GUIDE-1 are followed through and mitigated.
6.6 Sample GUIDE-3: Pre-Construction Review

Temporary Works designs are typically part of the scope of works in construction contracts, but sometimes the Temporary Works are designed by the consultants on behalf of the Client.

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

GUIDE-3 will typically need to address the following:

**EMPLOYER/CONSULTANT DESIGN**
- Prescription/specification of Site Arrangements, Facilities and Scheduling requirements
- Prescription/specification of Interim Works for construction of Permanent Works

**CONTRACTOR DESIGN**
- Interim Works for Site Arrangements & Facilities
- Interim Works for construction of Permanent Works

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

To aid the GUIDE-3 Design Review Team, the following series of questions are tabulated. While the questions may highlight important issues, they serve only as a reference for the team and are certainly not comprehensive. As such, the team should still conduct "brainstorming” sessions to effectively identify the hazards and concerns of the main stakeholders.

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Details / Hazards Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary Works and Sequencing</td>
<td>Can a safer means of access or egress be used instead of the temporary means required?</td>
</tr>
<tr>
<td></td>
<td>Can monitoring instrumentation that provides early warning of possible collapse or ground movements be installed?</td>
</tr>
<tr>
<td></td>
<td>Can the permanent staircase and lifts be completed first and used during the construction stage?</td>
</tr>
<tr>
<td></td>
<td>Will the design affect the work process and stages during construction?</td>
</tr>
<tr>
<td></td>
<td>Can temporary works required during construction be planned for? E.g. specifying the type, position of temporary works so as to ensure spatial considerations have been considered.</td>
</tr>
<tr>
<td></td>
<td>Are there special construction considerations that need</td>
</tr>
</tbody>
</table>
| Specialist Design | to be highlighted to the contractor for his construction?  
| Does the sequence of construction create any temporary unstable stage, which requires additional bracing?  
| Can adequate safety factors be incorporated in the design such that overloading or collapse of the permanent or temporary structure is not possible?  
| Will there be possible basal heave and piping during excavation?  
| Will there be possible settlement due to the proposed project?  
| Has a proper schedule for monitoring of instrumentation been provided?  
| Will there be any adverse effects on adjacent structures during the removal of temporary works?  
| Are there any alternatives or measures that could reduce or minimise such adverse effects? |
| Weather | Are there any safety concerns on elements of specialist design to be considered by the contractor?  
| Can alternative safe work practices be employed to mitigate such concerns? |
| Is there a possibility of floods in the site? If so, how can the hazard be minimised in the temporary and permanent stages?  
| Is there a possibility of lightning strike in the site? If so, how can the hazard be minimised in the temporary and permanent stages?  
| Are there any other adverse weather conditions that can affect the ability to safely construct the work?  
| What are the effects of extreme temperature or humidity on instrumentation? |
| Others | Have the risks and hazards identified in GUIDE-1 and GUIDE-2 been addressed or mitigated? |
Having answered the above list of questions and highlighted the hazards, the hazards identified should then be transferred to a Design Risk Record Form. The form allows for the hazards and control measures to be indicated and the Review Team should then agree on the party to be assigned to take the actions to further address the hazard. A follow-up review should be done to ensure that the hazards to be addressed are not merely shelved and filed away for information. Other considerations by the review team or actions done to mitigate the risks should be documented in the Design Risk Record form so as to ensure that all relevant information is captured.

Aside from going through the GUIDE-3 Process, further Design Review sessions should be held to ensure that hazards raised in GUIDE-1 and GUIDE-2 are followed through and mitigated.
Sample Design Risk Record Form

<table>
<thead>
<tr>
<th>Project Title</th>
<th>Company:</th>
<th>Review date:</th>
<th>Next review date:</th>
<th>Process/Location:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazard Identified</th>
<th>Risk Assessment</th>
<th>Can these hazards be designed out?</th>
<th>Proposed Control Measures</th>
<th>Residual Risk Level</th>
<th>Further review required?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk</th>
<th>Likelihood</th>
<th>Severity</th>
<th>Risk Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Attachment: GUIDE 1, GUIDE 2, GUIDE 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conducted by:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>
Annex 1: Definition of “Development” under Section 3(1) of Planning Act

Planning Act (Chapter 232)
Meaning of “development”

3.—(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:

(a) 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;
(b) 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;
(c) 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;
(d) 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;
(e) the carrying out of any act authorised or required by the Control of Vectors and Pesticides Act 1998 (Act 24 of 1998);
(f) 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;
(g) 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;
(h) 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 —

(a) 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;
(b) 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;
(c) 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;
(d) the demolition or reconstruction of or addition to a building constitutes development;
(e) 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;
(f) 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 —

(i) the superficial area of the deposit is extended; or
(ii) the height of the deposit is extended and exceeds the level of the land adjoining the site;
(g) 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;
(h) 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
(i) 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 following table shows what are the duties of the various stakeholders under the WSH (DfS) Regulations:

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Duties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developers</td>
<td><strong>General duties of Developers</strong></td>
</tr>
<tr>
<td></td>
<td>• Ensure all foreseeable design risks are eliminated</td>
</tr>
<tr>
<td></td>
<td>• Where not reasonably practicable to eliminate the design risks, Developer shall ensure the design risks is reduced to as low as reasonably practicable.</td>
</tr>
<tr>
<td></td>
<td>• When reducing the risks, the design risks shall be reduced at its source and collective protective measures shall be used instead of individual protective measures.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that all Designer, Contractor and any DfS Professional which the Developer appoints are competent to perform their duties.</td>
</tr>
<tr>
<td></td>
<td>• Plan and manage the project such that all designers and contractors appointed by the Developer have sufficient time and resources to perform their duties.</td>
</tr>
<tr>
<td></td>
<td>• Ensure relevant information is provided to all designers and contractors appointed by the Developer.</td>
</tr>
<tr>
<td></td>
<td><strong>DfS Review Meeting</strong></td>
</tr>
<tr>
<td></td>
<td>• Convene DfS review meeting to identify all foreseeable design risks and discuss how each of the foreseeable design risks can be eliminated.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that the DfS review meeting is attended by the relevant designers and contractors.</td>
</tr>
<tr>
<td></td>
<td><strong>Maintaining a DfS Register</strong></td>
</tr>
<tr>
<td></td>
<td>• Keep a DfS Register containing information and records on DfS review meeting convened and every residual design risk for the project.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that the DfS Register is up to date.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that all Designers and Contractors appointed for the project have access to the DfS Register</td>
</tr>
<tr>
<td></td>
<td>• Ensure the DfS Register is available for inspection by registered workplace inspectors</td>
</tr>
<tr>
<td></td>
<td><strong>Delegation of Developer’s Duties to DfS Professional</strong></td>
</tr>
<tr>
<td></td>
<td>• Developer may delegate the following duties to the DfS register:</td>
</tr>
<tr>
<td></td>
<td>o Convening DfS Review Meetings</td>
</tr>
<tr>
<td></td>
<td>o Maintaining a DfS Register</td>
</tr>
<tr>
<td></td>
<td>• The Developer must provide the DfS Professional with the information necessary for him to perform his duties.</td>
</tr>
<tr>
<td></td>
<td><strong>Passing on the DfS Register</strong></td>
</tr>
<tr>
<td></td>
<td>• If Developer disposes of his interests in the structure, ensure that the DfS register is given to the person who acquires his interests in the project and inform him of the nature and purpose of the DfS register.</td>
</tr>
</tbody>
</table>
|              | For subdivided buildings, ensure that the register is to be given to
the subsidiary management corporation of the subdivided building and inform them of the nature and purpose of the DfS register.

<table>
<thead>
<tr>
<th>DfS Professional</th>
<th><strong>DfS Review Meeting</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Convene DfS review meeting to identify foreseeable design risks and discuss how each of the foreseeable design risks can be eliminated.</td>
</tr>
<tr>
<td></td>
<td>• Ensure that the DfS review meeting is attended by the relevant designers and contractors.</td>
</tr>
</tbody>
</table>

**Maintaining a DfS Register**

- Keep a DfS register containing information and records on DfS review meetings convened and every residual design risk for the project.
- Ensure that the DfS Register is up to date.
- Ensure that all Designers and Contractors appointed for the project have access to the DfS Register.
- Ensure the DfS Register is available for inspection by registered workplace inspectors.

**Updating the Developer**

- Ensure that the Developer is provided as soon as practicable after the DfS review meeting, with the relevant information on each foreseeable design risk identified and how each design risk can be eliminated.
- Provide the Developer with updated DfS Register after the adding of any information or record.

<table>
<thead>
<tr>
<th>Designers and Delegated Designers</th>
<th>• Prepare a design plan that eliminates, as far as reasonably practicable, all foreseeable design risks.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Where not reasonably practicable to eliminate the foreseeable design risk, to propose to the person who appointed him, a modification to the design plan that reduces the design risks to as low as reasonably practicable.</td>
</tr>
<tr>
<td></td>
<td>• When reducing the risks, the design risks shall be reduced at its source and collective protective measures shall be used instead of individual protective measures.</td>
</tr>
<tr>
<td></td>
<td>• Provide information relevant to the design, construction or maintenance of the structure to the person who appointed the designer.</td>
</tr>
<tr>
<td></td>
<td>• Attend DfS Review Meeting where required by the Developer.</td>
</tr>
<tr>
<td></td>
<td>• Ensure any Designer appointed (called Delegated Designer) is competent to perform his duties under the regulations.</td>
</tr>
<tr>
<td></td>
<td>• Ensure Delegated Designers are provided with relevant information.</td>
</tr>
<tr>
<td></td>
<td>• Designer is still responsible for his duties even if a Delegated Designer is appointed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contractors (Main contractors &amp; Sub-contractors)</th>
<th>• Inform the person who appointed the contractor of any foreseeable design risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Ensure that any Designer he appoints is competent</td>
</tr>
<tr>
<td></td>
<td>• Ensure that any Designer he engages is provided with relevant</td>
</tr>
<tr>
<td><strong>Information to assist him with his duties</strong></td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>• Ensure that any sub-contractor he engages is competent</td>
<td></td>
</tr>
<tr>
<td>• Ensure that any sub-contractor he engages is provided with relevant information to assist him with his duties</td>
<td></td>
</tr>
<tr>
<td>• Attend and participate in the DfS review process where required by the developer</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Registered Proprietors</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Keep the DfS register <em>(For a structure that is not a subdivided building)</em></td>
</tr>
<tr>
<td>• Ensure that DfS register is available for inspection upon inspectors request <em>(For a structure that is not a subdivided building)</em></td>
</tr>
<tr>
<td>• Provide the DfS register to the person who next acquires the interest in the structure</td>
</tr>
<tr>
<td>• Ensure the person who acquires the interest in the structure is aware of the nature and purpose of the DfS register</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Subsidiary Management Corporations (For a subdivided building)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Keep the DfS register</td>
</tr>
<tr>
<td>• Ensure that DfS register is available for inspection upon inspectors request</td>
</tr>
</tbody>
</table>

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. A list of the subsidiary legislation may be found in **Annex 3**.
Annex 3: List of WSH Legislation

Workplace Safety and Health Act (WSHA)
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 & 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 & earthworks, foundation, roadwork, drainage and sewerage system, bridges and land surveying.

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

Building (Mechanical and Electrical) Services
Design inputs include drawings, design details, analysis, calculations, specifications & 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 & electrical, plumbing & sanitary services in a building.

Architectural Works
Design inputs include drawings, design details, analysis, calculations, specifications & 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, façade, door, wall & floor finishes, paints and vanished and landscaping including skyrise greenery.

Construction Management and Demolition Works
Design inputs include drawings, design details, analysis, calculations, specifications & 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 & Alternation Works
Design inputs include drawings, design details, analysis, calculations, specifications & 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 & 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 & ventilation system. Passive Fire Protection (PFP) includes compartmentalisation of the overall building through the use of fire-
resistance rated walls and floors, compartmentalization, fire dampers and fire door closers, as well as intumescent fire protection coatings etc.
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 (for example, 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 (for example, 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 & façade retention schemes, scaffolding, and sheet piling;

7. interior designers, including shop fitters who also develop the design;
Annex 6: Areas which designer has influence over

To aid the designers in carrying out the guide process, this section identifies some areas over which 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 as follows:

1. The design of buildings or structures should consider risk from site hazards such as:
   - Underground services;
   - Vehicular traffic movements to and within the site;
   - Pedestrian movements 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 height 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 including 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:
   - Designing elements like steel structures so that they can 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
   - Reducing site welding so as to reduce fire or burn risks and using prefabricated bolt 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 height:
   - Early installation of permanent access, such as stairs, to reduce the use of ladder or scaffolds;
   - Edge protection or other features that increase the safety of access and construction; and
   - Anchor points for installation of life-line or safety harnesses when a work platform cannot be installed.

6. Design to simplify safe construction by:
   - Providing lifting points on prefabricated elements and marking the weight and the centre of gravity of heavy or bulky items both on the drawings and on the items themselves;
• 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 providing clear directions on drawings; and
• Designing for safe installation of external cladding i.e. installation of cladding from the inside of the building.

7. Identify worst case scenarios and implement the preventive control measures, such as:
• Designing adequate safety factors such that overloading (static, dynamic and impact) and collapse of permanent or temporary structure are not possible;
• Putting in place monitoring instrumentation that provide early warning of possible collapse or ground movements; and
• Emergency route for mass evacuation in the event of emergency.

8. Design to simplify future inspections, maintenance and cleaning work by:
• Making provision for safe permanent access;
• Specifying windows that can be cleaned from the inside;
• Placing all controls and electrical boxes at accessible locations;
• Designing safe access to the roof;
• Making provision for safe temporary access to allow for painting and maintenance of facades, re-application of fire protection material on steel structures, etc.;
• Using paints or materials that require less frequent maintenance or replacement;
• Designing the ventilation system for easy access and maintenance; design should be flexible to accommodate minor changes to building usage; and
• Considering safe movement of pedestrian and vehicular 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.

The designer is to note that their creativity should not be limited by the above, but safety and health requirements should still be evaluated. The designer need not design out every single hazard identified, but he 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: Design notes on drawings
Annex 8: Access for Maintenance Report

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

(i) are carried out in a particular manner;
(ii) affect the health and safety of maintenance personnel or building users;
(iii) entail a disciplined approach e.g. in scheduling, coordination and execution.

In developing the access strategies and maintenance work methods, Designers should consult relevant people who have the specialised knowledge and/or capacity to control or influence the design (for example the client, engineers, contractors, facility managers, DfS coordinators and products specialists/ 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 the following:
(i) Key building features relating to maintenance tasks;
(ii) Anticipated maintenance tasks and their frequencies;
(iii) Proposed work equipment and methods employed for achieving accessibility and productivity in maintenance;
(iv) Specific safety measures.
An example of an Access for Maintenance Report is shown below:

### A. EXTERNAL AREAS

<table>
<thead>
<tr>
<th>Building Area/Element</th>
<th>Routine Maintenance</th>
<th>Major Maintenance</th>
<th>Solution</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Tower Block - Façade curtain wall</td>
<td>Façade cleaning and inspection</td>
<td>Glass replacement</td>
<td>Routine maintenance</td>
<td>A: Permanent suspended platform with monorail system to access all façade surfaces, Integrated restraints in façade system</td>
</tr>
<tr>
<td>2 Tower Block – External planters</td>
<td>Routine inspection and cleaning</td>
<td>Plant/soil replacement</td>
<td>Routine maintenance</td>
<td>A: Permanent suspended platform with monorail system to access all planters, Integrated restraints in façade system, Protection rail for hanging planters</td>
</tr>
<tr>
<td>3 Tower Block - Entrance glass canopy</td>
<td>Cleaning</td>
<td>Luminaire replacement</td>
<td>Routine maintenance</td>
<td>B: Accessible using self-propelled access platform, Accessible via paved fire engine access, Fall arrest system provided on surface of canopy</td>
</tr>
<tr>
<td>4 Covered walkways</td>
<td>Cleaning</td>
<td>Cladding repairs</td>
<td>Routine maintenance</td>
<td>C: Accessible via ground level walkway, Fall arrest system provided on surface of canopies</td>
</tr>
</tbody>
</table>

### B. INTERNAL AREAS

<table>
<thead>
<tr>
<th>Building Area/Element</th>
<th>Routine Maintenance</th>
<th>Major Maintenance</th>
<th>Solution</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Atrium</td>
<td>Glass cleaning</td>
<td>Glass repair/ replacement</td>
<td>Routine maintenance</td>
<td>D: Personnel lifting hoists for suspended platforms</td>
</tr>
<tr>
<td></td>
<td>Cleaning shading devices</td>
<td>Ceiling/shading devices repair</td>
<td>Major maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Luminaire replacement</td>
<td>Building services repair</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legend**

- Solution A – Suspended platform with monorail system (see details in Annex 1)
- Solution B – Self-propelled access platform (see details in Annex 2)
- Solution C – Rope access (see details in Annex 3)
- Solution D – Personnel lifting hoists (see details in Annex 4)
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- Real Estate Developers Association of Singapore (REDAS)
- Singapore Institute of Architects (SIA)
- Institution of Engineers Singapore (IES)
- Association of Consulting Engineers Singapore (ACES)
- Singapore Contractor Association Limited (SCAL)
- Specialists Trade Alliance of Singapore (STAS)
- Centre for Public Project Management (CP2M)
- Ministry of Manpower
- Workplace Safety and Health Council