

Special points of interest:

- PtD is an emerging trend in OSH in construction
- PtD is mandatory in UK since 1995 and Singapore in 2016
- PtD is required in Europe, South Africa, United States, Australia and New Zealand
- PtD is required in Malaysia through Guidelines of Occupational Safety and Health in Construction Industry (Management)

OSH IN CONSTRUCTION—Prevention through Design (PtD)

The contractor often has limited options hierarchically to control construction risks, and is not in the most ideal phase of the project to effectively prevent the OSH risks from occurring in the construction project. The OSH risks of the construction project can be more sustainably avoided, eliminated, or controlled in the design phase (pre-construction phase) of the project. Prevention through Design (PtD), as popularly known in the US and literature, in construction (also known as Design for Safety (DFS) in Singapore, Construction Design and Management (CDM) in the UK and Safe Design in Australia, see Figure 1) is an emerging trend in the construction safety whereby design professionals are required to take into account the

safety of construction and maintenance workers at the design phase of the project. This short article provides an overview of the PtD principle, summarises its application/ implementation in few countries and describes current effort by the Department of Occupational Safety and Health (DOSH) to integrate the

PtD principle into the current OSH legislation in Malaysia. The PtD principle will likely transform the OSH management practices in Malaysia's construction industry.

Figure 1. Some of the terms in relation with PtD.



Main construction OSH legislations

The Occupational Safety and Health Acts (OSHA) places duty to ensure the protection of construction workers and members of public from construction risks to the main contractor who controls the construction site. The Factories and Machinery (Building Operations and Works of Engineering Construction) (Safety) (BOWECS) Regulations prescribe specific obligations to the main contrac-

tor to address construction hazards and specify control measures to several hazardous works. The BOWECS Regulations also outline specific duties to the Professional Engineer, as a designer, who designs temporary works related with formwork-falsework, structural steel and precast concrete assembly, catch platform, chute, runways and ramps, scaffold, excavation and piling.

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Managing risk at project phase

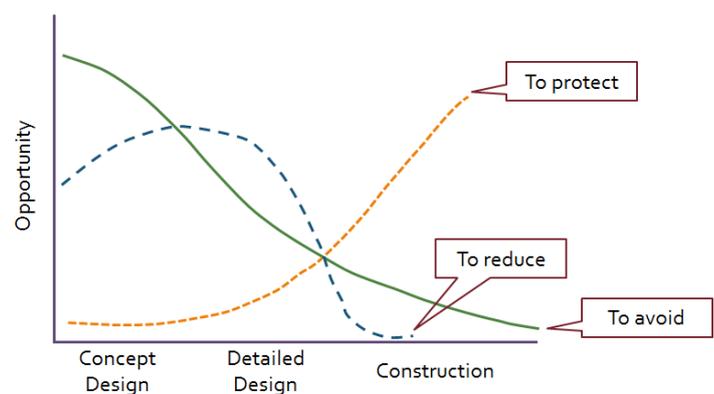
Looking back at the accident statistics in the last couple of years, it is very obvious to suggest that change is indispensable to the way the construction is currently doing. The industry, as a whole, may argue that they have done their best, but their best aren't good enough!

During the construction phase, the main contractor usually has limited options to control hazards. As indicated in Figure 2, the opportunity to avoid and reduce risks diminishes abruptly as the project progresses from the design phase to the construction phase. It also denotes that the ability to influence the OSH risks in construction is greatest at the planning and design stages of the project lifecycle. Unless the contractor is also involved during the design phase, as in the design and build contractual

arrangement, the contractor's option to manage risks is often limited to the provision of protection to his employees. Managing OSH risk in a construction project should not only start at the onset of the construction phase (when the main contractor has control), but must commence at the pre-construction phase (when the client and designer assume

control). Paradigm shift is needed to move the safety consideration in a project from afterthought to a forethought in design of: 1) work methods and organization of work; 2) tools and equipment; 3) processes; 4) products; and 5) work premises and facilities.

Figure 2. Opportunity to manage risks at different project phase.



“the ability to influence the OSH risks in construction is greatest at the planning and design stages”

Prevention through Design (PtD)

Indeed, the OSH risks in the construction project are most sustainably avoided, reduced or controlled in the design phase or pre-construction phase of a project. Prevention through design (PtD) is an effort to design out construction and maintenance hazards to workers as early as in the design phase of a project. The PtD is

defined as the **integration of hazard analysis and risk assessment methods early in the design and engineering stages** and taking the actions necessary so that risks of injury or damage are at an acceptable level. Scope of application of the PtD principle is targeted to the design professionals who can have a significant impact in

managing construction risks, effectively and economically. As pointed out in the definition, the key factor to ensure successful implementation of PtD principle in the construction industry is adequate knowledge of the designers on hazard analysis and risk assessment methods (HIRARC).

PtD in the UK

 In the UK, the PtD principle is fully embedded in the **Construction (Design and Management) (CDM) Regulations**. The regulations were first introduced to the construction industry in the UK in 1994. The framework of the regulations were based on the **Temporary or Mobile Construction Sites Directive**

issued by the European Council in 1992. The regulations have been revised twice, namely in 2007 and 2015.

The CDM Regulations are explicitly drafted to influence the processes of planning and design to avoid or mitigate the hazards and commensurate risks during the construction phase. The implementation of

the Regulations are guided by an Approved Code of Practice (ACOP), the first edition was published after the regulations were revised in 2007. The new revision was published in 2015 to incorporate changes that were made to the current CDM Regulations. The PtD requirement in the UK is made mandatory by the CDM Regulations.

PtD in the US



In the US, the National Safety Council (NSC)

has conducted many researches and promotions on PtD principle since the early 1990s, that eventually led to the establishment of the Institute for Safety through Design. The collaboration between the National Institute for Occupational Safety and Health (NIOSH) and the American Society of Safety Engineers (ASSE) have led to the development of a technical report on PtD in 2009, which later was superseded by the **American National Standard ANSI/ASSE Z590.3-2011 Prevention through Design: Guidelines for addressing occupational hazards and risks in design and redesign**

“explicitly drafted to influence the processes of planning and design to avoid or mitigate the hazards and commensurate risks during the construction phase”

processes. Publication of this standard underlines the nationwide interest in the PtD principle. The Z590.3 standard defined PtD as addressing occupational safety and health needs in the design and redesign process to prevent or minimize the work-related hazards and risks, associated with the construction, manufacture, use, maintenance, retrofitting, and disposal of facilities, processes, materials, and equipment.

The PtD requirement in the standard is voluntary, but can become mandatory if the standard is approved as a code by the state authority. Nonetheless, much was accomplished in the US with many seminars, workshops, symposia

and presentations were organised to promote the PtD principle to the construction industry. Various tools and methodologies have been developed and proposed by academia, practicing engineers and safety professionals in the construction industry to achieve buy-in from the industry as a whole. The implementation of the PtD principle in the planning and design processes in the US construction industry can be regarded as a long-term and continuous efforts. Currently, NIOSH carries out extensive PtD activities and initiatives in areas such as research, education, practice and policy, in partnership with various agency, association and organisation.

PtD in Singapore



In Singapore, the **Guidelines on Design for Safety in Buildings**

and Structures was first issued in 2008 and later was revised in 2011. Through this guidelines, the PtD requirement was voluntary at the beginning and eventually was made mandatory by the enactment of the **Work-**

place Safety and Health (Design for Safety) (DfS) Regulations in 2015. Similar to the CDM Regulations in the UK, the DfS Regulations give duty to the client and designer in the planning and design stages of a construction project. The role of a DfS Professional (similar to CDM Coordinator in UK, but later was removed

in CDM Regulations 2015) is introduced to help client complying with the law.

The Workplace Safety and Health Council then published the **Workplace Safety and Health Guidelines - Design for Safety** in 2016 to replace the previous guidelines and provide supporting guidance to the DfS regulations.

PtD in Australia



In Australia, the duty of the designer in the

Model Work Health and Safety Bill (equivalent to Section 20 of OSHA 1994) has been amended to include the duty of person that design structures (in addition to plant and substance). The implementation of the PtD principle would become mandatory if

the state government approves the Bill. For example, the Victorian Government has incorporated the PtD principle in its **Occupational Health and Safety Act** (Part 3, Section 28) in 2006, that makes it incumbent to the construction industry. The practical application of the PtD principle is described in the **Safe Design of Structures – Code of Prac-**

tice, published in 2012 by the Commonwealth, and the WorkSafe Victoria has developed a **Guide—Designing Safer Buildings and Structures** to assist designers to develop and organize their design and decision processes and to make sure that the design enables any work to be carried out once it is completed, is safe and without risk to health.

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We're on the web!
<http://www.dosh.gov.my/index.php/en/construction-safety>

A 1991 study done in Europe found that 60% of fatalities were the result of decisions made before the site work even began.

During the years 2000-2002, 22% of injuries in Oregon, Washington and California were linked to design. Across US, 42% of construction fatalities were related to design issues between the years 1990 and 2003.

In Australia, it was reported that "of the 210 identified workplace fatalities, 37% definitely or probably had design-related issues involved." In another report, it was mentioned that 63% of all fatalities and injuries could be attributed to design decisions or lack of planning.

The PtD principle has been successfully adopted in many countries by incorporating the principle in national's acts, regulations, code of practice or standard. This article discusses approaches that are taking place in some of these countries. Although the methods of implementation differ, but significant effects of PtD principle to the OSH performance of construction in these countries have been observed and reported. Among benefits of applying the PtD principle are: 1) improved productivity; 2) decreased operating costs; 3) significant risk reduction; and 4) avoiding expensive retrofitting/ remedial works.

PtD in Malaysia



In Malaysia, the PtD principle is being ingrained in the **Guidelines of Occupational Safety and Health in Construction Industry (Management)**. The guidelines were mainly adopted from the ACOP for CDM Regulations. However, having access to various references and documents from many countries who have implemented the PtD principle, the guidelines would also contain requirements from other countries. Additional requirements are inevitable in order to provide comprehensive (if not prescriptive) guidance to the construction industry.

The draft has been pub-

lished and disseminated for public comment since November 2016. The guidelines is scheduled to be published in 1st Quarter of 2017. The PtD requirements will become voluntary in order to provide ample opportunity for the design professionals in the construction industry to prime themselves with the new requirements and at the same time acquire knowledge in hazards analysis and risk assessment methods.

To expedite the 'buy-in' from the industry, the Construction Safety Division,

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Drafting: Sep-Oct 2016
Public Comment: Nov-Dec 2016
• online
• seminar

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Figure 3. Progress of the guidelines on PtD principle.