香港房屋委員會工程和物業管理安全研討會

建造業高風險工序的風險管理

楊冠全博士

首席顧問

職業安全健康局
OCCUPATIONAL SAFETY & HEALTH COUNCIL

建造業高風險工序的風險管理

建造業工序...高風險嗎??

2020年建造業工序

人體從高處墮下意外
- 大坑東道維修工斜坡墮地亡 3月23日
- 工人補天花從5米高墮地身亡 5月13日
- 拆工作台失平衡2米墮地 工人頭部重創亡 6月4日
- 啟德地盤工字鐵斷裂擊斃印裔男工 6月27日
- 啟德地盤再奪命 工作台倒塌1死6傷 7月21日

吊運/負荷物移動機械意外
- 鰂魚涌地盤男雜工遭吊機夾斃1月13日
- 將藍隧道地盤男工遭吊運中的工字鐵擊斃 3月31日
- 跑馬地工人地底操作挖土機遭工字鐵擊中亡 4月27日
- 吊運中竹枝墮下擊中工人 工人從高處墮下不治 5月8日
- 啟德地盤工人遭4噸管道壓上身重創送院不治 7月14日
- 女工被行駛中的工程車撞斃 8月12日

操作/維修機械設備意外
- 將軍澳工人被碎石機夾斃 1月11日
- 維修工人被絞車鋼索擊中斃命 6月30日
- 啟德地盤再有工業意外 判頭墮兩米深坑不治 7月23日

觸電意外
- 九龍灣男工郵政署地盤觸電死亡 7月20日
- 維修工人修理冷氣機觸電死亡 9月16日

意外統計截至2020年9月30日
資料來自本地報章報導

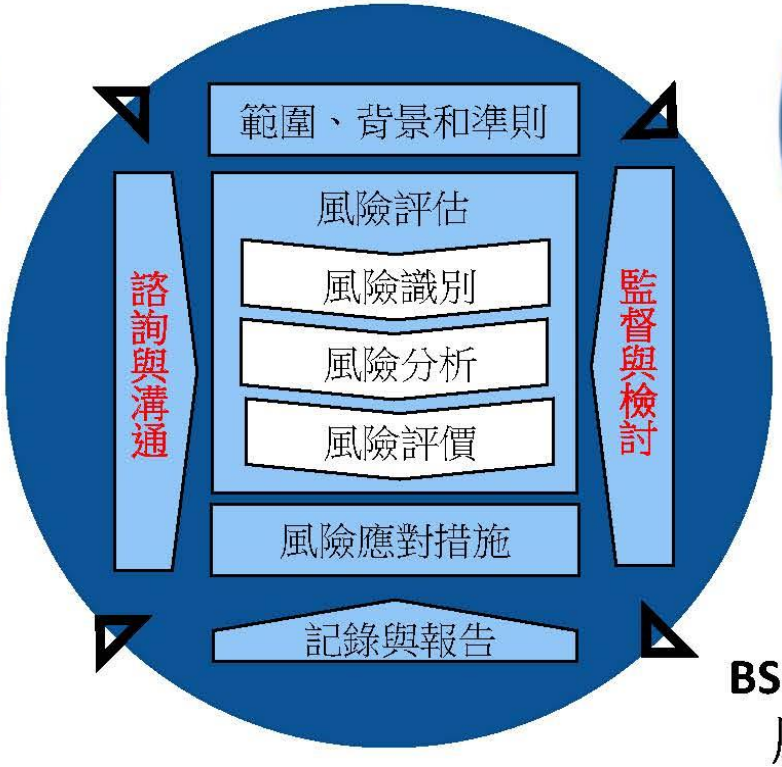
職業安全健康局
Occupational Safety & Health Council

為何意外會發生?

強化風險管理從源頭入手!

Ref: 瑞士乳酪理論 (Swiss Cheese Model)

風險管理 = 風險評估???



BS ISO 31000:2018
風險管理指引

風險評估的技巧

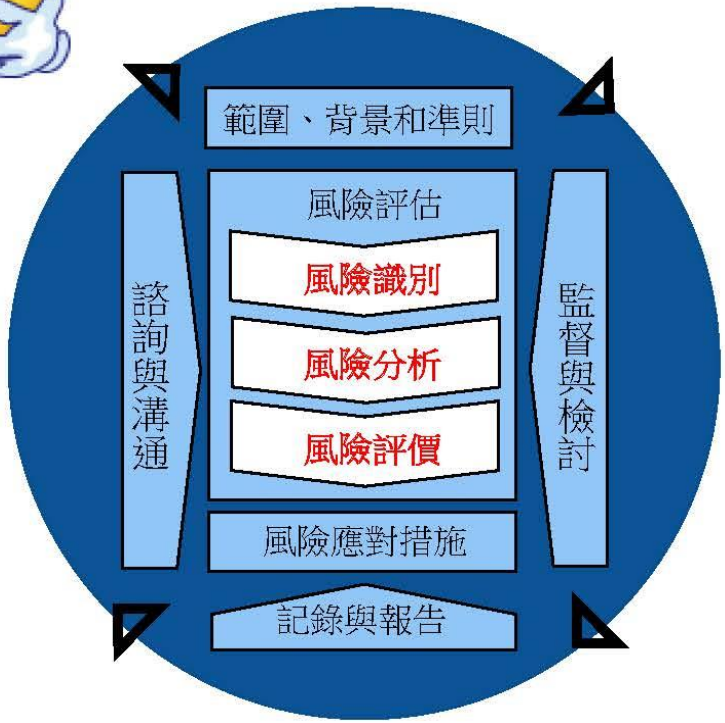
引發觀點的技巧
- 腦震盪
- 面談/調查

識別風險的技巧
- 檢查清單
- 情景分析

確認風險來源及成因的技巧
- 根本原因分析
- 魚骨圖

評估風險重要性的技巧
- 最低合理可行原則
- 柏拉圖分析圖

選擇應對措施的技巧
- 成本效益分析
- 決策樹分析



BS EN IEC 31010:2019
風險評估的技巧

分析應對措施的技巧
- 危害分析與關鍵控制點

瞭解危害發生的嚴重性和可能性的技巧
- 事件樹/ 故障樹分析

分析相互關係的技巧
- 交叉影響分析

量化風險的技巧
- 計算風險值

記錄和報告的技巧
- **風險矩陣**

風險矩陣及最低合理可行原則

等級	發生可能性	可能性定義
5	相當可能	預計數週內可發生
4	↓	↓
3	↓	↓
2	↓	↓
1	微乎其微	理論上可行 但極不可能發生

危害發生的可能性

等級	對安全和健康造成的影響	對環境與社區造成的影響
a	多人死亡事故	不可逆轉的 重大傷害
b	↓	↓
c	↓	↓
d	↓	↓
e	急救個案	輕微的臨時損壞

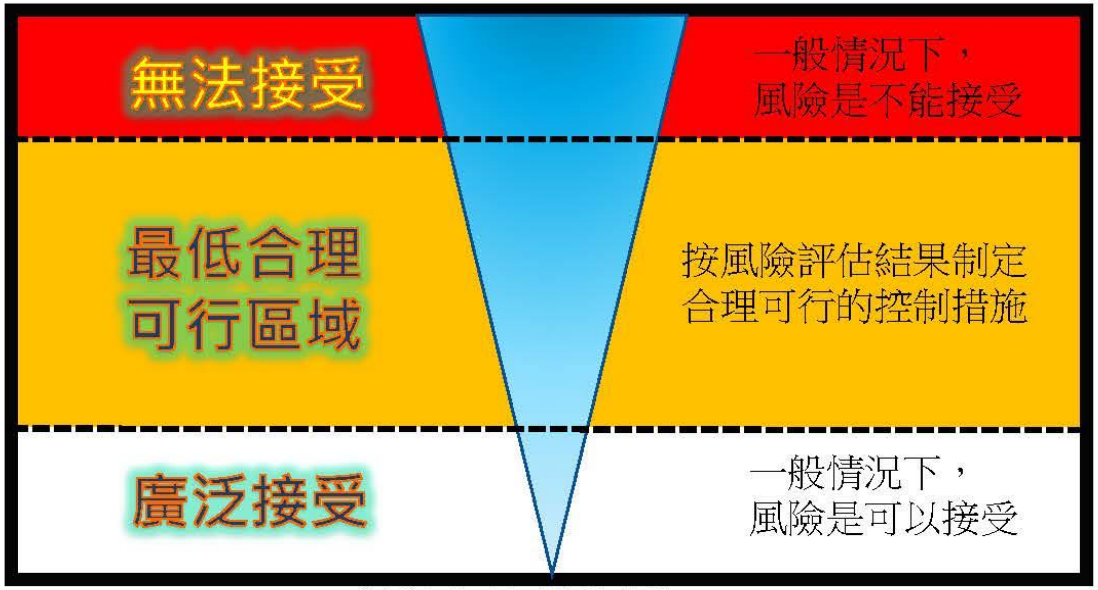
危害發生的嚴重性

Ref: BS EN IEC 31010:2019 風險評估的技巧

危害嚴重性等級	1	2	3	4	5
a	III	III	II	I	I
b	IV	III	III	II	I
c	V	IV	III	II	I
d	V	V	IV	III	II
e	V	V	IV	III	II

危害發生可能性等級

風險矩陣



最低合理可行原則 (ALARP)

風險管理面對的困難

1. 欠缺規劃階段的風險管理計劃

2. 欠缺針對性風險評估

進行風險管理面對的困難

3. 欠缺參與及溝通

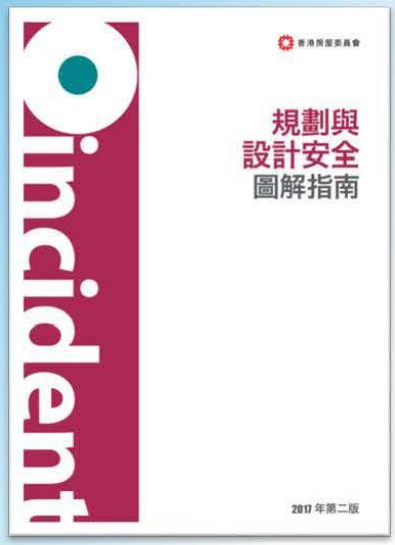
5. 未有考慮人為失誤因素

4. 未能明白或願意遵從安全措施

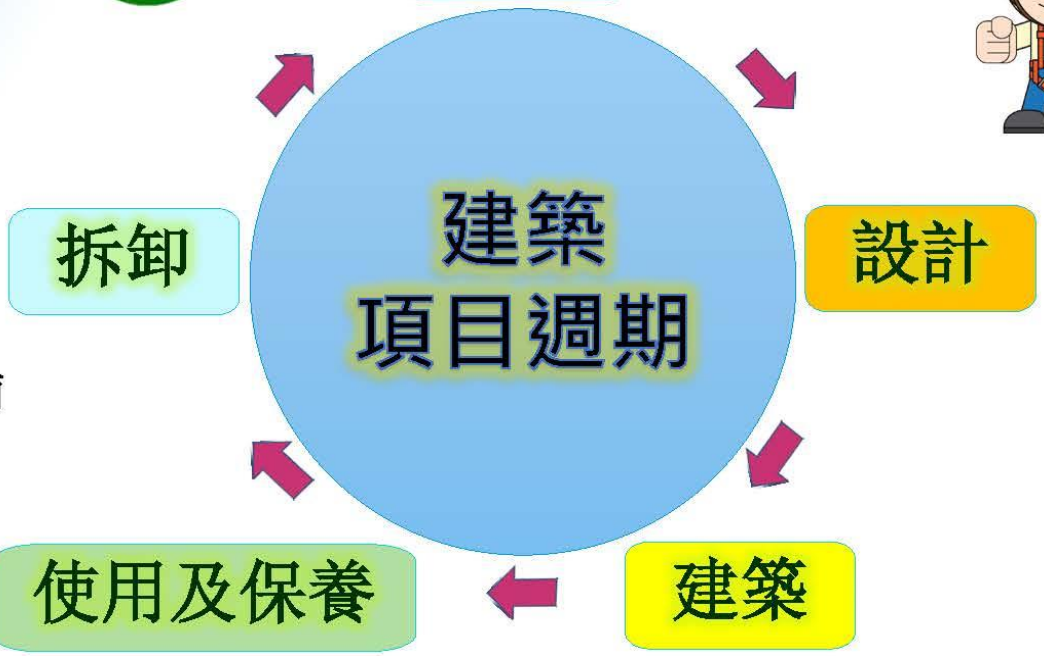
可行的解決方法

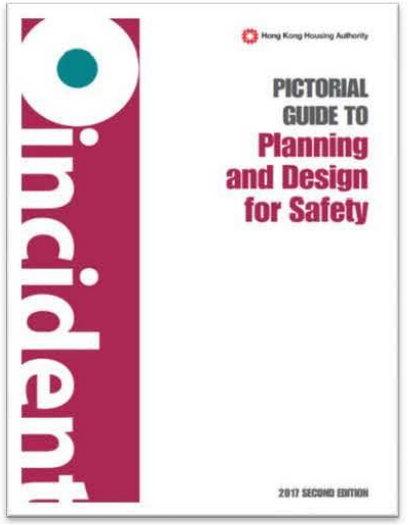

強化
風險管理
1
建築安全設計
2
針對性風險評估
3
動態風險評估
4
情境意識
5
創新科技的應用
6
以人為本的風險管理

1. 建築安全設計



規劃與設計安全圖解指南
(房委會)

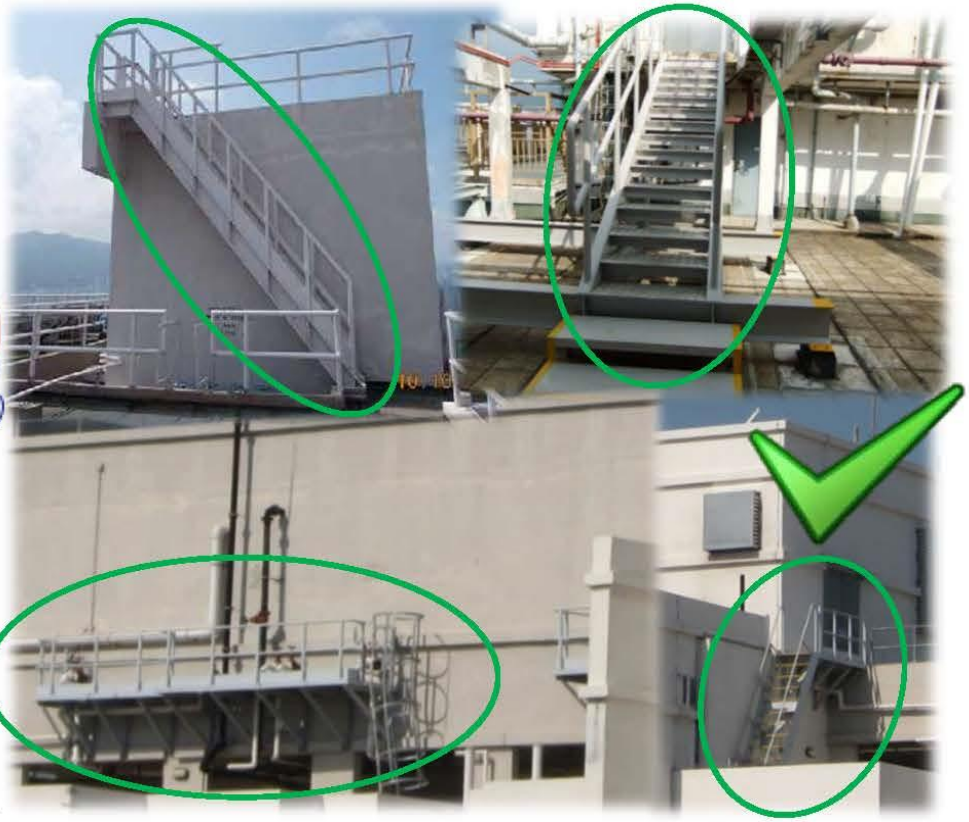




規劃與設計安全圖解指南
(房委會)

- 於前期的設計階段強化風險管理

1. 實行建築安全設計的例子 – 房委會



護欄及屏障

維修通道及工作平台

職業安全健康局
Occupational Safety & Health Council

2. 針對性風險評估

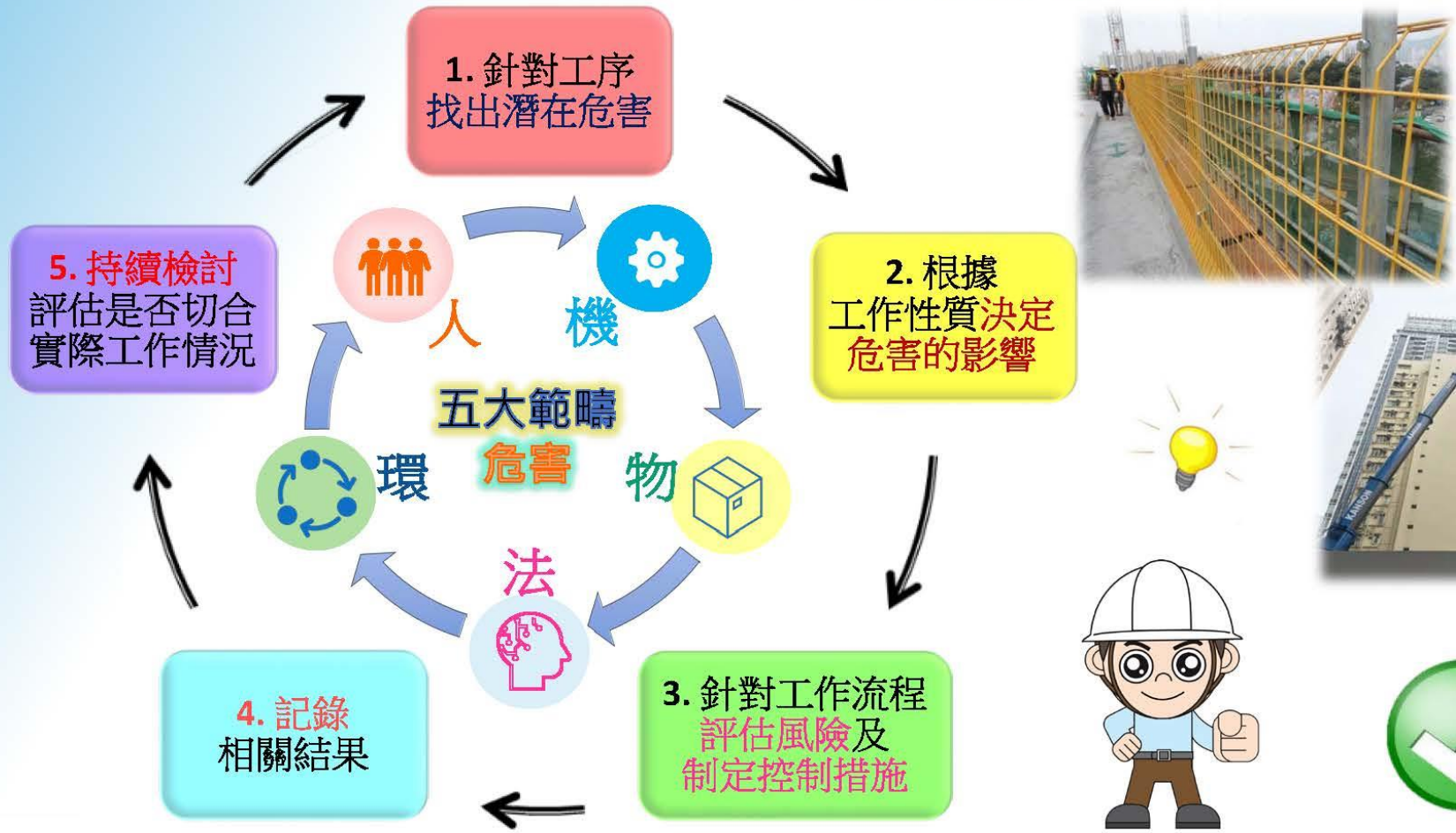
項目	工序步驟	危害來源	危害影響	風險評價			建議控制措施
1	吊運負荷物	不正確吊運工作	負荷物下墜	4	4	16	(1) 確保起重機操作員及吊索工已持 有有效訓練証書 (2) 起重機操作員應根據製造商的指引及規定，正確操作起重機 (3) 確保安全操作負荷已明確標明於起重機上 (4) 吊運負荷物時，不可超逾起重機標明的安全操作負荷

一般性的吊運風險評估

適用於<u>所有工序</u>嗎?

能針對<u>實際施工程序</u>嗎?

2. 針對性風險評估


1. 針對工序
找出潛在危害
2. 根據
工作性質決定
危害的影響
3. 針對工作流程
評估風險及
制定控制措施
4. 記錄
相關結果
5. 持續檢討
評估是否切合
實際工作情況
人
機
物
法
環
五大範疇
危害

2. 針對性風險評估例子 – 吊運天秤組件

特殊環境因素，如招牌林立的街道/附近的工作區域

埋碼工作涉及的其他危害，如高處工作

吊運工作成員的安排

吊運天秤組件針對性風險評估

組件擺放位置、存放區域及運輸方法

起重機的選擇、設置地點、負載能力及操作半徑

天秤組件的特徵如體積、重量及重心位置

2. 針對性風險評估例子 – 搭建懸空式棚架

特殊環境因素，如喉管及狗臂架的繫穩位置

往外牆工作的進出入通道及物料運輸

人手安排

搭建懸空式棚架
針對性風險評估

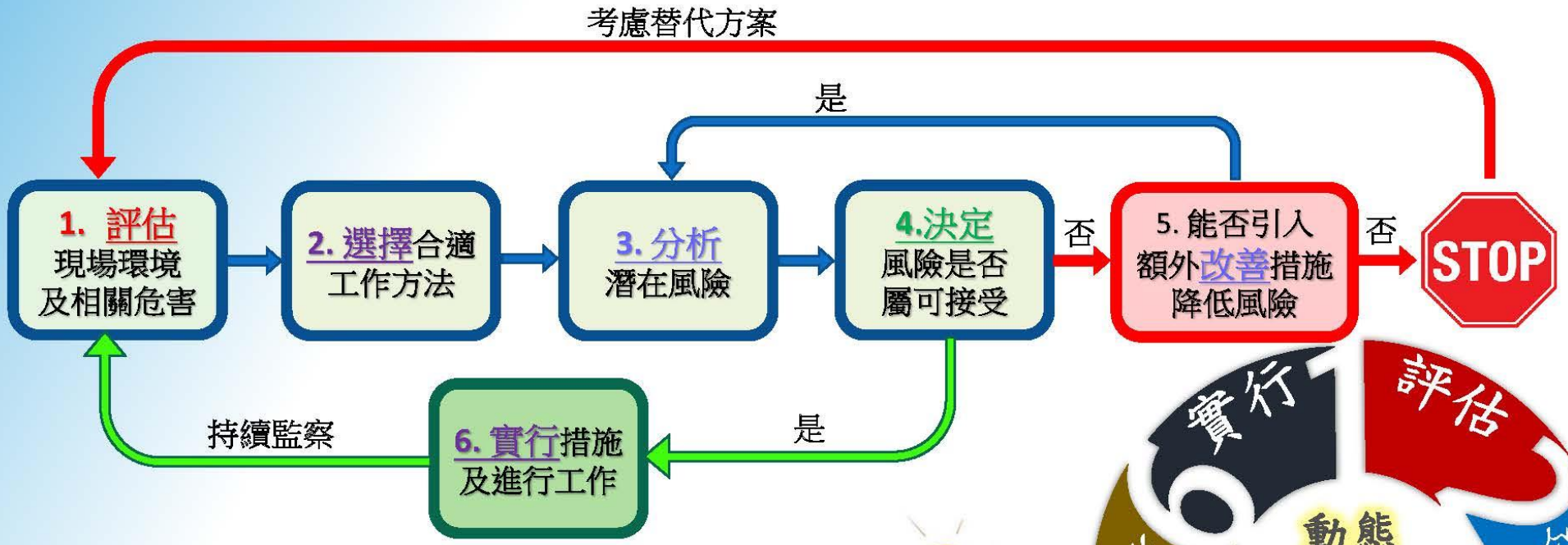
工具的選擇

物料的選擇

因應環境選用合適的防墮裝備

職業安全健康局
Occupational Safety & Health Council

3. 動態風險評估



動態風險評估的流程

3. 動態風險評估例子

EAST method

Evaluate the hazards

評估現場環境及相關危害
- 有否特殊天氣情況如強風或陣風
- 吊船設計所能承受風速
- 注意漏斗效應（例如在兩棟建築物之間）
- 吊船作業高度
- 吊船下方的工作區是否已經妥善圍封
- 建築物有否凸出的部分或倘開的窗戶

Assess potential risk

Select safe system of work

選擇工作方法及分析潛在風險
- 持續量度實際風速
- 選擇吊船作業高度
- 監察吊船的傾側度
- 員工的經驗及能力

Take decision wisely

決定繼續工作與否
- 實行措施或停止工作

4. 工作上活用情境意識

情境意識

留意及警覺身邊有否人、事物或環境**對自己或他人的安全構成威脅**

Ref: 英國健康安全執行處 (Health & Safety Executive)

- 身邊有否對你安全**構成威脅的事物**？
- 該威脅是否足以**危害你及他人的安全**？
- 能否採取適當措施**安全地工作**？

4. 工作上活用情境意識的例子

挖土機觸碰未固定的
工字鐵引致工字鐵墮下

於流動式起重機
與附近圍欄之間被夾到

被吊運中的竹枝墮下擊中
並從高處墮下

4. 大家一同活用情境意識

S Stop and think pay attention to the surroundings
停一停 諗一諗 留意身邊環境

A Ask and clarify before you work
問清楚 講清楚 先開工

G Get it done, do it right, do it Well
做完 做啱 做好

E Earn more only if you do safer
做足啲 安全啲 有著數

Let's be a

SAGE !

(智者)

「做完」 「做啱」 「做好」

職業安全健康局
Occupational Safety & Health Council

做完 做啱 做好

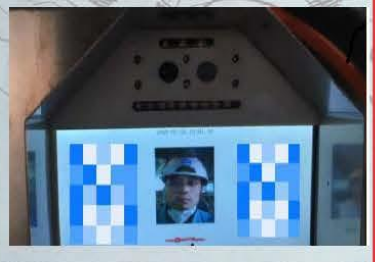
安全施工程序 - 風險管理工具的應用

進行動態風險評估
活用情境意識

檢討針對性風險評估

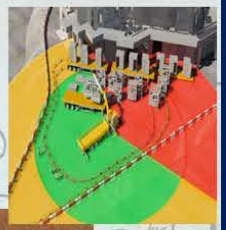
5. 創新科技的應用

人工智能(AI)



輔助機械應用 (Robotics, Exoskeleton)

建築信息模擬 (BIM)



無線射頻識別技術 (RFID)

虛擬/擴增實境 (結合VR及AR)

更多……

6. 以人為本的風險管理

職業安全健康局
Occupational Safety & Health Council

工作安全由我做起：
高處工作及操作重型機械安全推廣活動

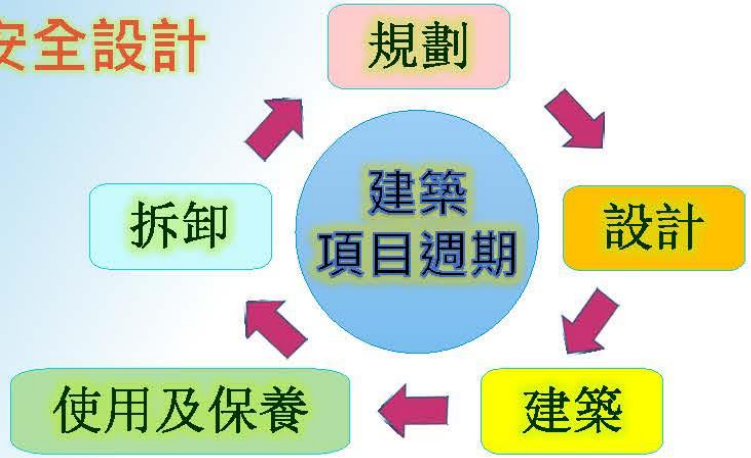
職業安全健康局
OCCUPATIONAL SAFETY & HEALTH COUNCIL

http://www.oshc.org.hk/tchi/main/hot/Safety_First_Campaign/index.html

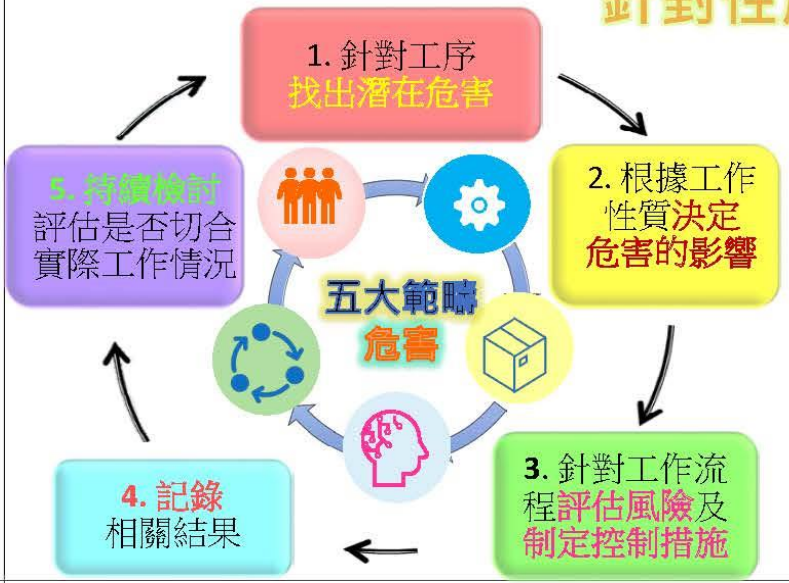
建造業高風險工序的風險管理

總結

建築安全設計



針對性風險評估



動態風險評估

情境意識

做好風險管理，保障工地安全

零傷亡願景運動

VISION ZERO
Safety.Health.Wellbeing.

issa

- 所有與工作有關的事故、疾病及傷害都是可以預防的
- 生命是不能妥協的
- 我們需要預防文化，因這是實現零傷亡願景的唯一方法

職業安全健康局
OCCUPATIONAL SAFETY & HEALTH COUNCIL

www.oshc.org.hk

Title: Safety Forum 2020 for Works Contracts and Property Management Services Contracts

Super Safety Forum 2020 for Works Contracts
and Property Management Services Contracts
2 November 2020

VO: Here is the footage from
"Safety Forum 2020 for Works Contracts and Property Management Services Contracts"
which was held on 2 November 2020

Super Dr. Winson Yeung
Principal Consultant of the Occupational Safety and Health Council
Topic: "Risk Management for High Risk Construction Work"

VO: The Speaker is Dr. Winson YEUNG, Principal Consultant of the Occupational Safety and Health Council.
His presentation topic is "Risk Management for High Risk Construction Work"

Dr. Yeung: Hello guests and friends from the industry
First, let me thank the Housing Authority (HA)
on behalf of the OSHC for the invitation to safety forum today
My topic today is in line with the theme
It is Risk Management for High Risk Construction Work
Is the construction industry actually a high risk industry?
Looking at the numbers of accidents until the end of September this year
we all know that over ten fatal accidents happened
If we classify the accidents
just now OSHC Chairman Dr Chan has also mentioned two categories
that we should pay more attention to
One is working at height and the other is using of heavy machinery
for example cranes or excavators
These are situations we should pay more attention to
Why do these accidents happen?
We find that many organisations want to prevent accidents
and they implement layers of protective measures
but when these measures are not implemented properly
or if there are flaws, then accidents happen
So, we are very concerned about strengthening the risk management
especially at the source of risk
Indeed, risk assessment is often mentioned in construction industry
but what is the difference between risk assessment and risk management?
If you have the time, you can check out
the BS ISO 30001 risk management guidelines
It mentions that
risk management comprises many categories
not only including risk assessment
but also staff consultation and communication
and monitoring the staff to follow up the results of risk assessment
Regular reviews are also very important
So, you can see on the top left corner
risk management is not static, it is dynamic
It changes with work environment or work procedure
It keeps on updating
Also, the risk management as shown on the top left corner
is not generic, it is task-specific

It is formulated by focusing on the work natures or work procedures
If you would like to know more about the techniques for risk assessment
please check out the BSEN IEC 31010
which introduces a lot of techniques for risk assessment
such as techniques for risk identification
We usually use checklists
and if we need to find out the source of a risk
we can use a fishbone diagram
what methods should the construction industry adopt?
You can see at the bottom right corner, it is a risk matrix
What is a risk matrix?
Simply speaking, after identifying the hazards of a work process
we need to assess these risks, in the risk assessment
We need to multiply the probability or likelihood of these hazards by the level of their consequence severity
Finally, the risk matrix works out as shown at the top right corner
For high-risk work processes
what reasonable and practical measures can we adopt
in order to minimise the risks?
It is very important
I want to explore with you now
What are the difficulties that the industry facing in risk management?
The first one is
risk management often focused on the construction period
and rarely considered at design stage
The second one is that our risk management is often generic
it does not specifically focus on the work nature or the work procedure
we have also discovered
How about the involvement and communication with the frontline staff?
Do they understand and follow the safety measures in workplace?
Lastly, do our risk management take into account of human factors?
In fact, the above questions make risk management even more difficult
How can we overcome these problems?
I have some preliminary ideas
Ideas for the industry to think about
The first one is how do we promote design for safety
The second one is how do we carry out task specific risk assessment
The third one is how do we promote dynamic risk assessment
The fourth one is how can we make good use of situation awareness while working
The fifth one is how do we adopt innovative technology
The last one is how do we promote a people-oriented risk management
First, concerning design for safety
If we can consider the risks of occupational safety and health (OSH)
in construction stage or maintenance stage during the project planning period
then many OSH problems can be overcome
I would like to thank the HA for keenly promoting design for safety
For example, in the picture on the left
you can see a canopy of the building, or the roof of a covered walkway
There are barriers and railings installed to prevent workers from falling while working
The picture on the right, for accessing the water tank on the roof
or carrying out the repairing works for the external pipeworks
HA requests the contractor
to reserve a safe maintenance access
or a safe working platform for workers
Second thing I want to point out

that the risk assessments in our industry are generic
Take a look at this chart for example, during lifting operation
the main cause of hazard is improper lifting
So, what exactly is the hazard? It has not been mentioned
How about the control measures?
For example, the crane operator and the rigger must complete relevant training
the operator should operate the crane according to the manufacturer's instructions
To be honest, we can jot these measures down even we are not on site
Such generic risk assessments are ineffective for preventing accidents
How do we improve?
Nowadays, there is a new trend in our industry
to carry out task-specific risk assessments
Task-specific risk assessments
target the job nature of the work and its workflow
To further enhance our work
we can use the 4M1E method
The first 'M' is 'man', referring to the qualifications and experience of people
The second 'M' is 'machine', referring to choice of machines
The third 'M' is 'material', referring the characteristics of the materials we use
The fourth 'M' is 'method', referring the methods we use in our work
Lastly, 'E' is 'environment', referring the work environment
If we can consider using this 4M1E framework
our risk assessments can be more specific
Let me give you an example
When we dismantle a tower crane, we need to lift some of its components
What can you think of for 'man'?
Maybe you will think of operators, riggers, signallers, lifting supervisors
how do you arrange their work?
Next, what 'machine' would you choose?
Do you choose a suitable tower crane
based on its safe working load or working radius?
For 'material', we need to consider the materials that we are lifting
For example, when lifting a component like an A-frame
have we taken into account of shifting of centre of gravity?
The next one is 'method'
For example, should the components be placed in a storage area
or put them directly onto a lorry-mounted crane for removal?
If we choose the latter
have we considered how workers can remove the hooks on the deck of lorry-mounted crane?
In the past, serious accidents happened
workers fell from the lorry-mounted crane while they were working
So that is how we approach task-specific risk assessment
Here was another example, about the truss-out scaffolding, the picture at the top left
Would the exterior environment obstruct the installation of anchor bolts to brackets?
The picture on the right, should we use a wired or wireless electric drill?
For the selection of truss-out scaffolding
Should we adopt I-shaped or T-shaped brackets?
we did a research with HKUST
Two advantages of T-shaped brackets when compare with I-shaped brackets are
First, it is easier to install the third anchor bolt
Second, if the bracket is damaged for the first time
the T-shaped brackets can provide more bearing capacities than the
I-shaped ones
so it improves safety
Therefore, the 4M1E approach can help us enhancing risk assessment

But task-specific risk assessment should start at the planning stage of a project
At workplace, the working environment changes from time to time
or workers in different trade work together
which may derive another risk
So, risk assessment is not static
it keeps updating in accordance with the change of work environment or procedure
So, a dynamic risk assessment is very important
Here is an example in the video on the right
This was widely circulated on social media a few months ago
This was at a commercial building in Hung Hom
Two workers were cleaning the curtain wall on a gondola
The gondola sway around like a pirate ship under a sudden strong wind
and it kept banging against the curtain wall
Actually, we can see here significantly that
a dynamic risk assessment was not carried out
Another example, workers were going to use the gondola from the roof
Was it windy?
Even if the Observatory had not issued any strong wind signal
we could measure the wind speed by anemometer
If it was over 7m per second
we should not use the gondola
Moreover, was the location of work at height?
Generally, the wind would be stronger when the place is higher
Or a place would be located between two other building structures
this could lead to a funnel effect and increase the wind pressure
Dynamic risk assessment can help us to consider many factors
The fourth idea is working on site
workers themselves have a degree of responsibility
Do they make use of situation awareness?
According to the Health and Safety Executive in the UK
“Situation Awareness” is that
Have you pay attention to the people, things or environment around you
which may be threatened your safety?
I can give you an example
In January this year, there was a fatal incident on a Quarry Bay construction site
A rigger was standing behind a crawler crane at work
He was trapped to death by the back of the crane and nearby barriers
This was an obvious case lacking of situation awareness
How do you know?
It was because standing behind the crawler crane was very dangerous
When it started to rotate , it could easily bump into the worker
Another fatal accident happened in Happy Valley in May this year
A worker was working on a scaffold, but he did not aware that
another gang of workers were lifting bamboo above him
Pay attention, everyone: the space directly under a lifting load
often called ‘danger zone’, is very dangerous
At the end, the wire was broken
the bamboo fell and hit the worker, finally he fell to his death from the scaffold
so situation awareness is very important
But how can we do practically?
I would like to recommend four steps for your consideration
The acronym is SAGE
‘S’ stands for ‘Stop and Think’
Pay attention to whether your surrounding environment threatening your safety

The second, ‘A’ is for ‘Ask and Clarify’
You need to ask, clarify and communicate clearly before work
What does ‘G’, the third letter, stand for?
we do not only complete the job
but we have to get it done, do a Good job
What about the last letter, the letter ‘E’?
We have to do more Explanation to our workers
and explain how additional safety measures can benefit them
Indeed, you can become a sage if you follow these steps
you are aware of the situation awareness when you are working
Before a lifting operation, think each step thoroughly
Stop and think: how can we do it correctly?
How can we do it well?
Make sure that the load is stable
Take all the safety precautions so that we can go home safe
The lifting operation just now was a good example
Also, the construction sites of HA are adopting the Safe Working Cycle (SWC)
We can also incorporate dynamic risk assessment
into the Hazard Identification Activity of the SWC
During the Safety Co-ordination Meetings after work each day
we can review the the effectiveness of the task-specific risk assessment
We can also integrate it into the review of the SWC
As Mr Leung mentioned just now
the Housing Department (HD) is keen in promoting innovative technology on sites
which can also help reduce risk
For example, many sites have adopted artificial intelligence (AI)
or RFID technology to locate the danger zones on site
so can remind workers of danger zones such as lifting zone or excavation area
HD also encourages contractors
to adopt Building Information Modelling (BIM)
This is a great tool. Why?
Because BIM can simulate high-risk work processes
What are the risks?
Then, through virtual reality or augmented reality
workers can get a better grasp of the risks involved
Lastly, it is also important to promote a ‘people-oriented’ risk management
Mr Luk also mentioned that HD has been promoting a caring culture
which is very important, because if we can create a caring culture
not only will our sites be safer, we can also be happier in our work
and we can be more effective
Most importantly we can reduce risks
As the Chairman of the OSHC said, we are working with the Labour Department
to promote a large-scale safety promotion event
In the event, the industry is reminded to pay more attention to
working at height or operating heavy machinery
In conclusion
The presentation today includes how to carry out design for safety
and also 4M1E for task-specific risk assessment
I have also emphasised the importance of dynamic risk assessment on site

Workers should apply situation awareness while working
We should not only complete our work
but also make sure it is done right and done well
To quote the International Social Security Association (ISSA)
which is promoting a campaign called Vision Zero

The campaign suggests that all work-related incidents
sicknesses and injuries are preventable
We cannot compromise when it comes to human lives
so let us do risk management well
Let us safeguard site safety and build a caring culture on site
Thank you

VO: Thank You For Watching