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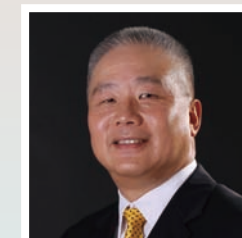
## Let's Pay Our Tribute to Mr. Andy Lo and Dr Daron Leung

We are proud to announce the remarkable achievements received recently by our past presidents and current Executive Council members, Mr. Andy Lo and Dr Daron Leung.



Mr. Andy Lo, our past President (1986-1987) and Executive Council member since 1984, is awarded with President's Distinguished Services Award from IOSH in November 2021 for his contribution in IOSH development, including his efforts in establishing IOSH (Hong Kong Branch) with other fellow OSH practitioners in Hong Kong.

Dr Daron Leung, our Immediate Past President (2016-2019) and Executive Council member since 1997, is honored as APOSHO Honorary Member at the AGM of APOSHO 35 in October 2021 for his long-term significant commitment and contributions to APOSHO; Cross-Strait, Hong Kong and Macau Occupational Safety and Health Symposium and local OSH Organizations in Hong Kong.



Both of them have demonstrated their passion and devotion to OSH development, not as a job but a career with their lifelong commitment.

Our heartfelt thanks to Mr. Lo and Dr Leung for their efforts and achievements in the past, present and future, and all HKOSHA members appreciate that you have not only shown us a path forward, but a career path that could make a difference without geographical boundaries!

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# Safety of Luffing Crane during Operation and under Typhoon

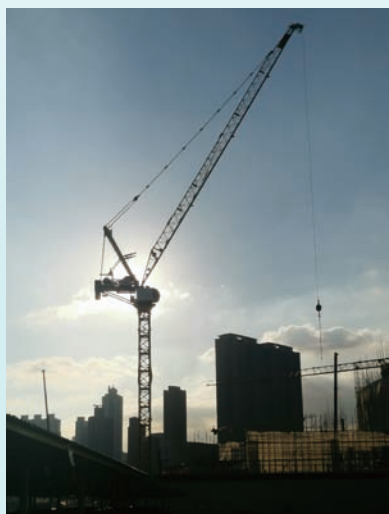
Authored by: **Mr. Clement Yeung, Deputy General Manager of Manta Equipment Rental Co. Ltd.**  
 Edited by: **Dr Daron Leung, Immediate Past President of HKOSHA**



Mr. Clement Yeung is the Deputy General Manager of Manta Equipment Rental Company Limited (Manta). Manta is a leading tower crane and hoist rental company in Hong Kong and Macau providing equipment and lifting operation solutions.

## Introduction

In order to meet the demand of lifting work in high-density areas, luffing cranes with saddle jib have been developed for some years. Hong Kong is a very typical good example in the use of luffing cranes to maneuver building elements with heavy weight and long working radius restricted by primarily surrounding high rise structures or special environment, e.g., existing utilities, rail and road and other infrastructures, etc.



Although there is no official record suggested that luffing cranes have higher accident potential, there are certainly some incident cases relating to luffing cranes in particular during typhoons and in operational status under wind load. There are several important features for safe operation of luffing crane that both the management and the operator or those involved should thoroughly understand under strong wind. Unless these key features are genuinely executed, it will not only cause damage to the crane itself but could also cause catastrophic accidents to the neighborhood and the public. This paper would examine these important factors and offer solutions to minimize the occurrence of these accidents.

## Luffing Crane

A luffing crane is the best choice for building projects where there are space limitations and restrictions on one or both sides of the site. A luffing crane can raise or lower its jib such that the slewing radius and jib angle can be varied to suit the site environment. In general, the luffing saddle jib via wire rope can provide a working range by angular motion from 15° to 86° (Figure 1). It is also ideal for construction sites where two or more cranes are working in the vicinity at the same time with the highest coverage. This is due to the slewing radius can be greatly reduced in comparison to

standard types of tower crane. It also gives a higher lifting capacity because the load is much more effectively transferred through the structure. However, when the jib is raised close to its vertical position, the exposed jib surface area against the wind direction would catch more wind force thus subject to higher risk of overturn backward, especially under typhoon weather. The following chart shows the different parking radius of a typical luffing crane model depends on its jib length ranging from 25m to 60m.

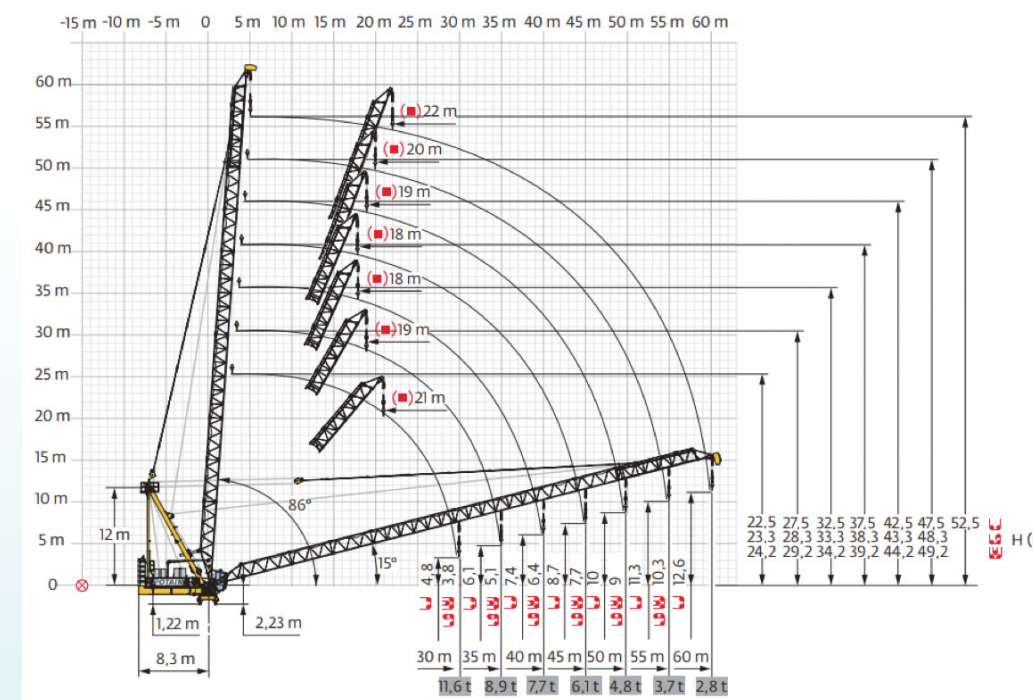


Figure 1. Luffing jib parking radius various with jib length (15° - 86°)

So far there is no official record or statistics indicating that luffing crane has a higher tendency to induce incidents, however there are on and off crane collapsed cases occurred pertaining to luffing crane. Among those cases, the two most common categories are firstly during in-operation under strong wind condition; and secondly during out-of-service status under typhoon environment. Although most of these cases did not cause fatal or serious bodily harm, the serious consequence potential should not be ignored. We should not rely on luck as damage to the crane itself is also a significant property loss.

In order to prevent these mishaps from happening, there are two major aspects need to be reinforced. Firstly, it is the safe system of work that the site management can exert control on and secondly, but not less important, is the competency of the crane operators. Safe system of work is not only a mandatory requirement but also the foundation for all activities. The employer and/or the proprietor have a statutory duty to provide information, instruction, adequate training and supervision to ensure the work is being carrying out in a safe manner.

## In-Service Condition

All crane manufacturers shall publish operation and maintenance instructions and manuals based on their design which provides precise and adequate information and procedure to install, test, operate, maintain and dismantle the cranes. It is therefore extremely important for the owner of the equipment or their representative to familiar with these procedures and manuals to ensure they are strictly followed.

On the same page the operator shall receive adequate training both on the knowledge and skills in the operation of the crane. All the information necessary to know about the safe operation of the crane is included in this “Bible” - crane manual which the operator could refer to. In Hong Kong, in order to be the operator of a crane, one shall hold a valid operator’s license issued by the Construction Industry Council and in addition, in the opinion of the owner the person is competent to operate the crane, then he could be appointed to be the crane operator. It is again the management who is ultimately responsible for verifying the operator’s competency prior to their employment. As crane nowadays becomes more complex, multifunctional and capable, they are also more expensive too. In order to protect their interest and assets, some foreign companies require the potential candidate to take written examination and practical test to demonstrate their technical knowledge and operation skills during interview. It seems that this will be the future trend in Hong Kong as well.

The operator, in conjunction with the appointed person or crane supervisor have the primary responsibility to make decision on whether the crane could still be in operable condition which needs to be clearly stated in the lifting plan. In no circumstances would site management override the decision to take the crane out-of-service. In general, the crane’s operation manual shall specify the maximum wind speed at which the tower crane must be taken out-of-service (Figure 2 refers). This is normally set at 45 mph (20 m/s, 72kph) and is based on the requirements of the tower crane design standards. However, in practice, this maximum value might not fully take into consideration the time required to take the crane out-of-service or the difficulty of lifting large area loads under strong wind condition.

|                             |                                                                            |
|-----------------------------|----------------------------------------------------------------------------|
| <b>Maximum wind speed:</b>  |                                                                            |
| ● during assembly           | <b>14 m/s (~50 km/h)</b>                                                   |
| ● in service conditions     | <b>20 m/s (72 km/h)</b>                                                    |
| ● out of service conditions | <b>42 m/s (~150 km/h)</b><br>(for tower height less than or equal to 100m) |

Figure 2. Operation manual specifies the maximum wind speed during assembly, in-service and out-of-service conditions.

Anemometer is a very useful device that can give important data for operating the crane safely. It normally comes with the crane to alert the operators with the wind speed status and sudden gust wind. Nowadays modern and advanced digital devices can provide instant alert to the site management as well as the operator on how the luffing crane behaves and performs under windy condition.

Besides hardware, operators must ascertain that the jib of luffing crane is parked at an appropriate angle and position no matter how short the break is. Operator’s misbehavior and unsafe practices may also pose very serious potential consequence and need to be rectified, e.g., during lunch and tea time they will order food and raise it to their cabinet using the main hoisting cable ignoring the short jib radius effect and face the wind direction. In some cases, they may even bypass the limiter until they can grab the food pack by hand from the operator’s cabinet which should be prohibited (Figure 3).

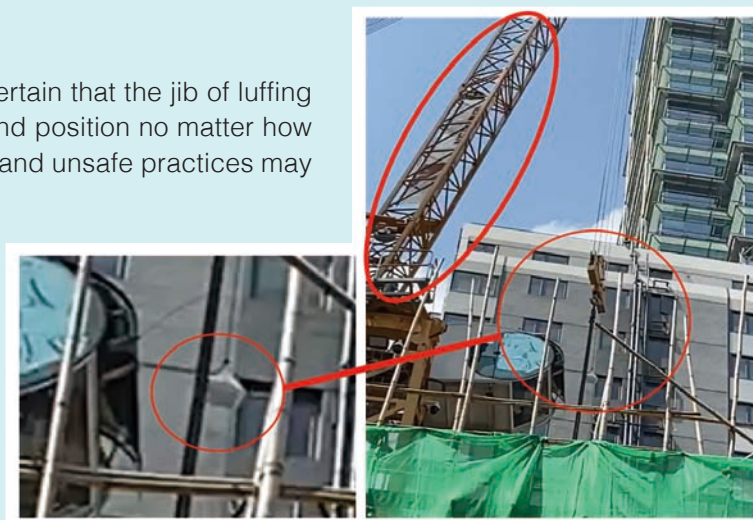


Figure 3. Operator’s misbehavior

## Typhoon Condition

Mathematically **Wind Pressure** is directly in proportional to the **square** of the **Wind Speed**. In general term, it means if wind speed is double then the wind pressure will exponentially increase by four times. When luffing crane is put out-of-service, the turn table should be set to slew freely similar to a weathervane and the jib set at the right parking radius such that it presents the optimum surface area to the wind, thus minimize the effect of wind forces act onto the crane. Figure 4 explains step by step the luffing crane stability and moment change principle under strong wind and no-load situation.

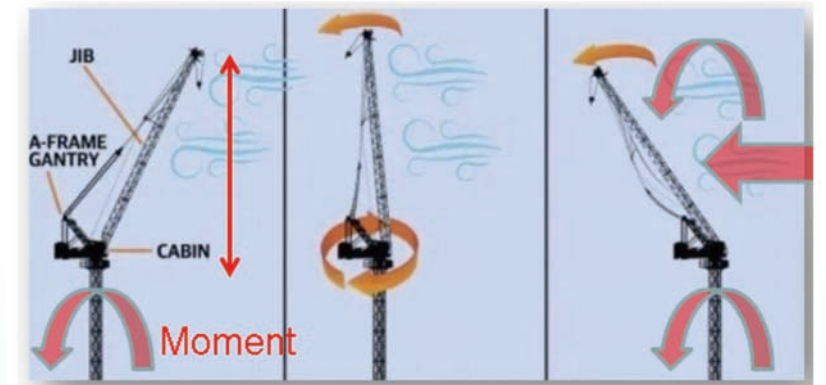


Figure 4. Luffing crane jib against wind and un-slew free

Before typhoon approach, Hong Kong Observatory would broadcast the typhoon information and forecast its development in the region. The topography nearby might also greatly affect the wind path and their strength development. Site management should be alert and give special high attention if their site is located in the high-risk areas such as near the seaside or at highland. Site management should be familiar with the respective crane model in use of their safety measures to be taken before typhoon and closely monitor the weather change and development. Where necessary, additional safety precautions should be taken to ensure its safe conditions and keep all damage to a minimum.

**Duties of Key Personnel under strong wind and typhoon condition are as follows:**

### a) Site Engineers

The site engineer should inspect the anchorage and tie-in point of the luffing crane to the building to ensure that it is securely fixed and the structural stability of the crane has not been compromised due to additional wind loadings act on the crane and building.

### b) Operators

Before leaving the cabinet and descending the tower, the operator should put the luffing crane in out-of-service condition, i.e., to set the slewing ring in free movement mode without any obstruction and also the jib at the designated angle and radius as per the manufacturer’s manual instruction.

### c) Technicians / Mechanics

Technicians / Mechanics on site should perform checks to ensure both post-erection of the crane and periodically afterward during in-service status that the setting and function of any devices which give off warning to the operator and all the other limit switches are in good order. They should also be able to observe if the crane has been improperly operating and inform site management accordingly.

## Conclusion

Luffing crane is a piece of extra-ordinary useful equipment in modern construction due to its excellent design and versatile usage. However, same as other equipment they also have their limitations and need to properly observe and give special attention. Amongst all the safety issues, operating conditions under strong wind and precautions against typhoon should be given high attention. Managing crane safety is not only the responsibility of the operator but also the whole site management team including engineers, mechanics / technicians, rigger, etc. With the efforts of all the parties involve, luffing crane accidents can be greatly reduced.

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## Digital Transformation for Construction Safety & Health (Part 2 of 2)

Authored by: Mr. Au Ling Ming, Stephen

Managing Director and founder of MTECH Engineering Company Limited

### 3. Digital Safety Construction

Under the evolution of digital construction technology, Building Information Modeling, Digital Works Supervision System, Laser Scanning, Virtual Reality, Internet of Things and Big Data are widely used in construction projects. Hence this is the right time to set up the Digital Safety Construction Platform to facilitate the Safety Management Model:

- Utilization of digital construction technology connects safe system more closely to construction planning, provides more illustrative site safety layout plans, enables effective communication & support as well as promotes occupational safety on site operation.
- From the viewpoint of occupational safety, the 4D sophisticated BIM model with 5G mobile application enable simulation of safety arrangements in construction projects at different moments of time and provide instant response to any potential risks under dynamic working environment.

The digital safety approach includes:

- Unifying safety definition to bridge the gap between all disciplines from requirements, design to execution by a common platform that fosters collaboration and innovation;
- Integrating safety design with project definition ensuring right execution through traceability between different safety needs and throughout the entire project lifecycle;
- Integrating change management process to manage requirement changes to drive consistency, and
- Complying with standards and requirements by perfectly controlling the requirement management process.

By adopting digital safety, it facilitates:

- People - Break down traditional silos and drive a culture of SAFETY that values transparency & accountability;
- Process - Instant and integrate Plan-Do-Check-Act cycle;
- Technology - Apply technology for zero risk by BIM, AR/VR, DWSS, IoT, AI, etc., and
- Governance - Continuous improvement through establishing new policies and compliance to realize Zero Accident.

#### 3.1 Construction Sequence Simulation for Safety Analysis

In the past 10 years, construction industry starts a new paradigm of design and construction methodology from 2D drawing to 3D via BIM. BIM is being used in work design for safety, safety planning, safety training and education, job hazard analysis and pretask planning, accident investigation, as well as facility & maintenance safety. Safety, Health & Environment professionals encourage other construction disciplines to review safety issues while performing design or constructability validation through the Safety BIM models. The Safety BIM sophisticated model enables visualization of safety arrangements on the construction site at different moments of time.

4D BIM simulation is used to validate construction sequences and procedures with safety consideration. Integration with project schedules, a safe working environment and work breakdown procedures are simulated so that all project stakeholders can investigate if the temporary works, walkway, tower crane, machinery and workers are putting at the right position, in right time and operate correctly.

Below are some examples of 4D BIM safety simulation cases:

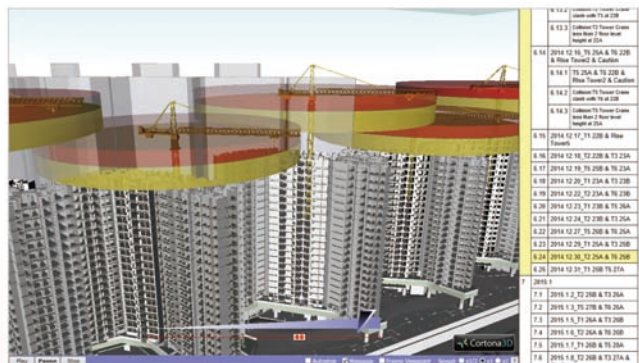


Figure 5) Safety Operation of Tower Crane for Highrise Building

The site in Tung Chung under restricted air zone area. Operations of tower cranes is monitored to avoid collision with each other and must be worked below restricted air zone height.



Figure 6) Simulation of safety installation of the steel bright at night besides the highway

The prefabricated steel bridge was to be installed besides a highway and a flyover at night in order to minimize the disturbance of the traffic in daytime. Thus a sophisticated installation procedures must be validated via 4D BIM simulation to ensure the operations are safely executed and on time.

### 3.2 Digital Works Supervision System for Safety (DWSS-S)

Nowadays, collaboration is one of the critical factors in the success of construction projects. Improvement in quality, productivity and safety of construction projects are linked with task management in the project life cycle. We know that collaboration is hard and takes time — to build relationships, to clear-up misunderstandings, to record, to distribute and to get things done. Past experience can hold teams back, and one of the barriers to collaboration remains organizational silos. To solve this issue, we set up a close loop Total Safety Management System by integrating the BIM model with the Digital Work Supervision System (DWSS).

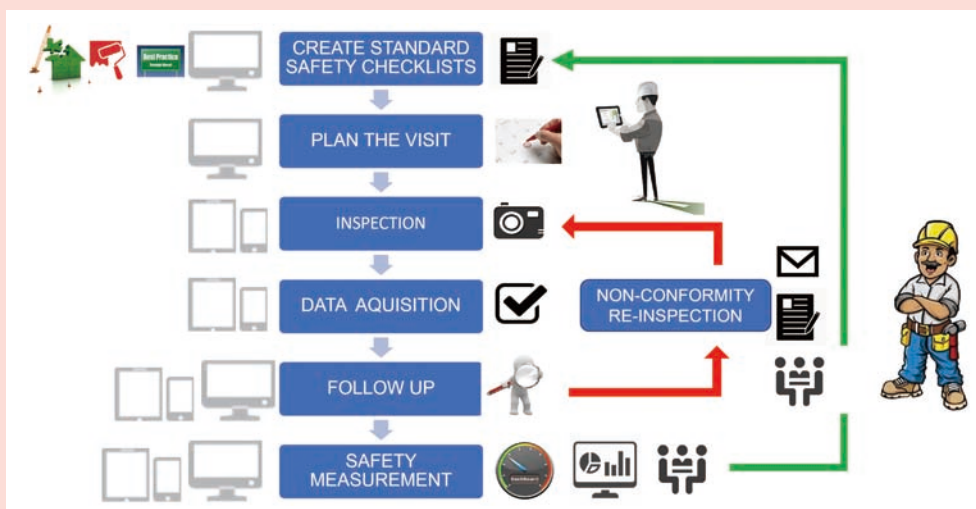


Figure 7)  
Process of Digital Safety  
Inspection and  
Management by DWSS

The safety manager records all safety issues and marks in the 2D drawing or 3D BIM model with photo via the mobile device during the site inspection. The record will immediately forward to the person-in-charge and take corrective actions. Afterwards, he will send back the result to the safety manager for validation and record. This greatly reduces the time to respond and the risk exposure time. As the record is in digital, we can do the safety analysis on demand and make the improvement actions quickly.



Figure 8) Safety Inspection via Mobile Device

### 3.3 Virtual Safety Training Kit

Today more and more teaching or learning is through 3D interactive e-Learning which can cover a wide range of age group. Embedding the Safety BIM models into 3D e-Learning provides an opportunity for learners to apply acquired knowledge and to experiment, get feedback in forms of consequences thus getting the experiences in the “safe virtual world”. There are specific educational domains where 3D interactive e-Learning concepts and approaches have a high learning value. Figure 9 shows one of interactive training of using the Gondola. 3D interactive e-Learning are simulations of real-world events or processes designed for the purpose of providing a unique opportunity for situated learning. Their main purpose is to initiate the users learning by themselves, stimulate safety awareness.



Figure 9) The virtual training kit for Gondola

## 4. Digital Transformation

Today government projects over HK\$30M must use BIM and over HK\$300M require DWSS. Many large & medium scale commercial projects start to use BIM & DWSS as the property owner look for long term ROI. Thus safety team do not need to develop the digital safety system from scratch by themselves. They can just participate in the project as usual but add the safety requirements and contents to the digital construction platform to build up the integrated digital safety operation platform as Figure 10 below:



Figure 10) Digital Construction Safety Operation Platform

The safety team just need to:

- Use BIM model for
  - Safety site planning and set up
  - Apply 4D BIM simulation for safety operation validation
- Use DWSS for safety inspection & management
  - Customize the DWSS system to include safety inspection
  - Use DSWW for site safety inspection
  - Generate analysis report for safety monitoring and improvement

## 5. Conclusion

To conclude, Bandura's model of reciprocal determinism has been adopted (Cooper and Phillips, 1995; Cooper, 1996, 1997a, b) to reflect the concept of safety culture. It contains three elements which encompass subjective internal psychological factors, observable ongoing safety-related behaviours and objective situational features.

The internal psychological factors (i.e. attitudes and perceptions) can be assessed via safety climate analysis through Virtual Training Suit, actual ongoing safety-related behaviour is built up via BIM - Virtual 3D Safety Plan developed as a part of behavioural safety initiatives, while the situational features are measured via the DWSS.

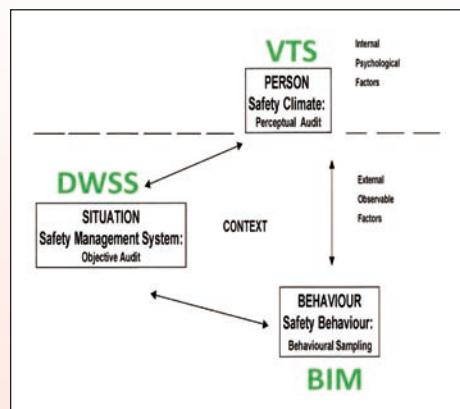


Figure 11) Towards a Model of Safety Culture  
M.D. Cooper / Safety Science 36 (2000) 111±136

Last but not least, to apply new technology, businesses typically look for cost savings. However, safety industry is aiming to save every human life and create happiness. We cannot just seek for staying in the game. We need to take serious action to proceed the digital transformation for "Zero Accident"!

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# HKOSHA NEWS

## New Members

As of end of December 2021, there are 451 members in HKOSHA.

The following membership applicant were approved in November and December 2021

## A. Approval of Membership

| Name           | Grade of Membership           |
|----------------|-------------------------------|
| YEUNG Yip Wah  | Associate Member              |
| TANG Chun Pong | Member                        |
| CHAN Shiu Mo   | Professional Member (General) |
| YEUNG Ka Chun  | Professional Member (Safety)  |

## B. Membership Upgraded

| Name           | Grade of Membership          |
|----------------|------------------------------|
| KWAN Chi Leung | Professional Member (Safety) |



香港大約每4個人  
就有1人患有高血壓

定期  
量度血壓

成年人正常：  
上壓 120mmHg 或以下  
下壓 80mmHg 或以下



## 了解血壓度數

| 分類      | 血壓度數(mmHg) |          | 建議的跟進行動                  |
|---------|------------|----------|--------------------------|
|         | 上壓 / 收縮壓   | 下壓 / 舒張壓 |                          |
| 高血壓     | 140 或以上    | 90 或以上   | 盡快約見家庭醫生 聽取建議            |
| 正常 高值血壓 | 130至 139   | 85至 89   | 每6個月檢查一次                 |
| 正常血壓    | 120至 129   | 80至 84   | 每年檢查一次                   |
| 理想血壓    | 低於 120     | 低於 80    | 兩年內再次檢查 (75歲以上人士 每年檢查一次) |

資料來源：食物及衛生局《香港高血壓參考概覽—成年高血壓患者在基層醫療的護理(病友篇)》

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