HKFEMC 香港機電工程商聯會

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

DfMA MiMEP Tradeshow 2021
MiC & MiMEP Webinar Forum

Application of Flexible Sprinkler Drops

5 March 2021

Mr. Victor Ng, General Manager – Operation

InnoTec Engineering Ltd.

What to be shared … …

- The Application of Flexible Sprinkler Drop
- Case Study 1 – Traditional Method of Sprinkler Dropper
- Case Study 2 – Flexible Sprinkler Drop
- Time and Cost Analysis – Value Stream Mapping (VSM)
- Real Case of Application and FSD’s Approval
- Takeaway … …

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Introduction

- Hong Kong have more than 7.5 million citizens.
- To provide office space for corporations and accommodation for citizens, many buildings are constructed in both public and private sectors each year.
- In 2019, the total gross value of construction work performed by Main Contractor at construction sites exceeded 135 billion Hong Kong Dollars.

Source: DEVB - Gross Value of Construction Work... (168)

- Construction industry in Hong Kong is facing 3 major obstacles:-
  - High Costs;
  - Short Construction Period; and
  - Unsatisfactory Performance.

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Modular **i**ntegrated **C**onstruction (MiC)
Design **f**or **M**anufacture and **A**ssembly (DfMA)
MultiTrade **i**ntegrated **MEP** (MiMEP)

Source: "Construction 2.0" 2018

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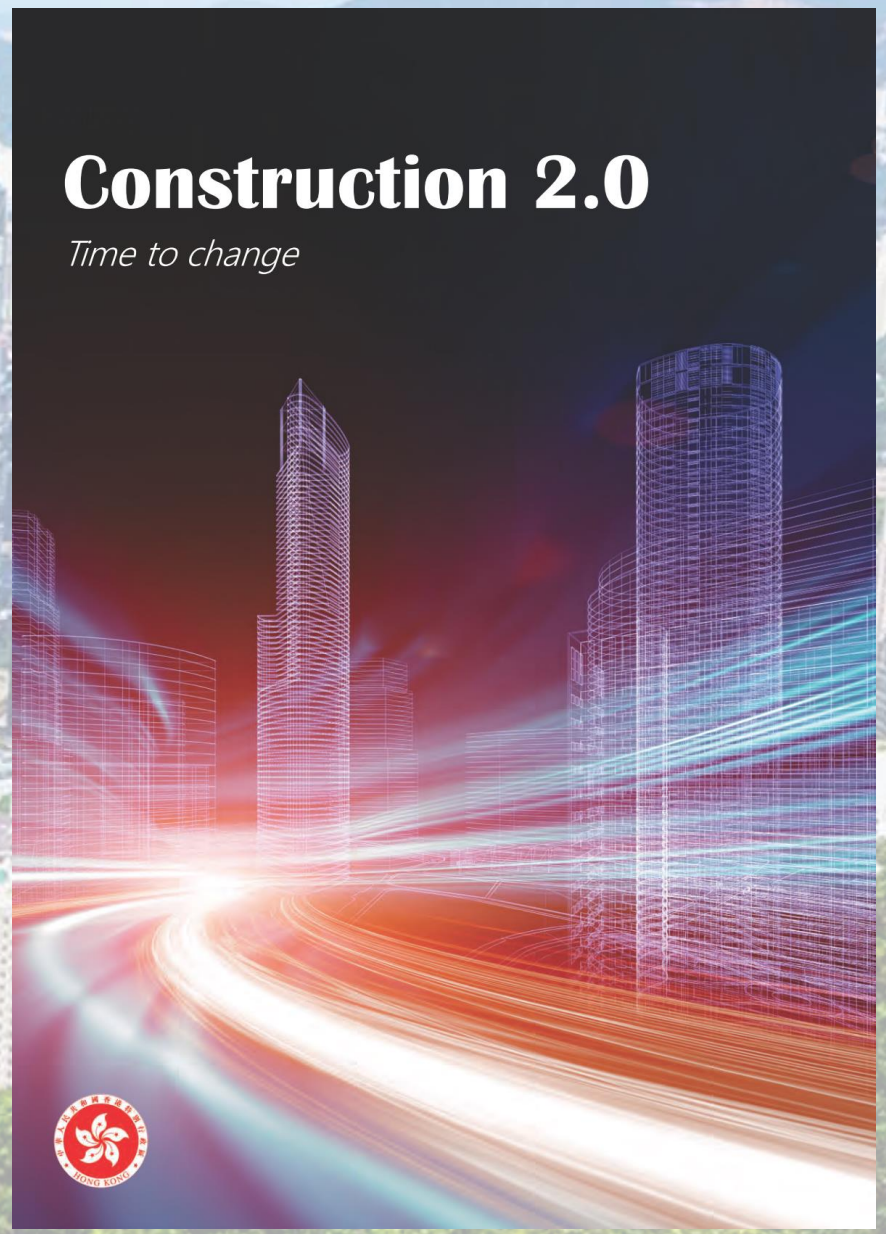
Core challenges facing the Industry

Refer to “Construction 2.0” published in 2018, the following core challenges are identified –

- Significant future construction volumes;
- High costs;
- Unsatisfactory mega-project performance;
- Unsatisfactory site safety performance;
- Declining productivity; and
- A lack of creativity & innovation.

Source: “Construction 2.0” 2018, pp.4



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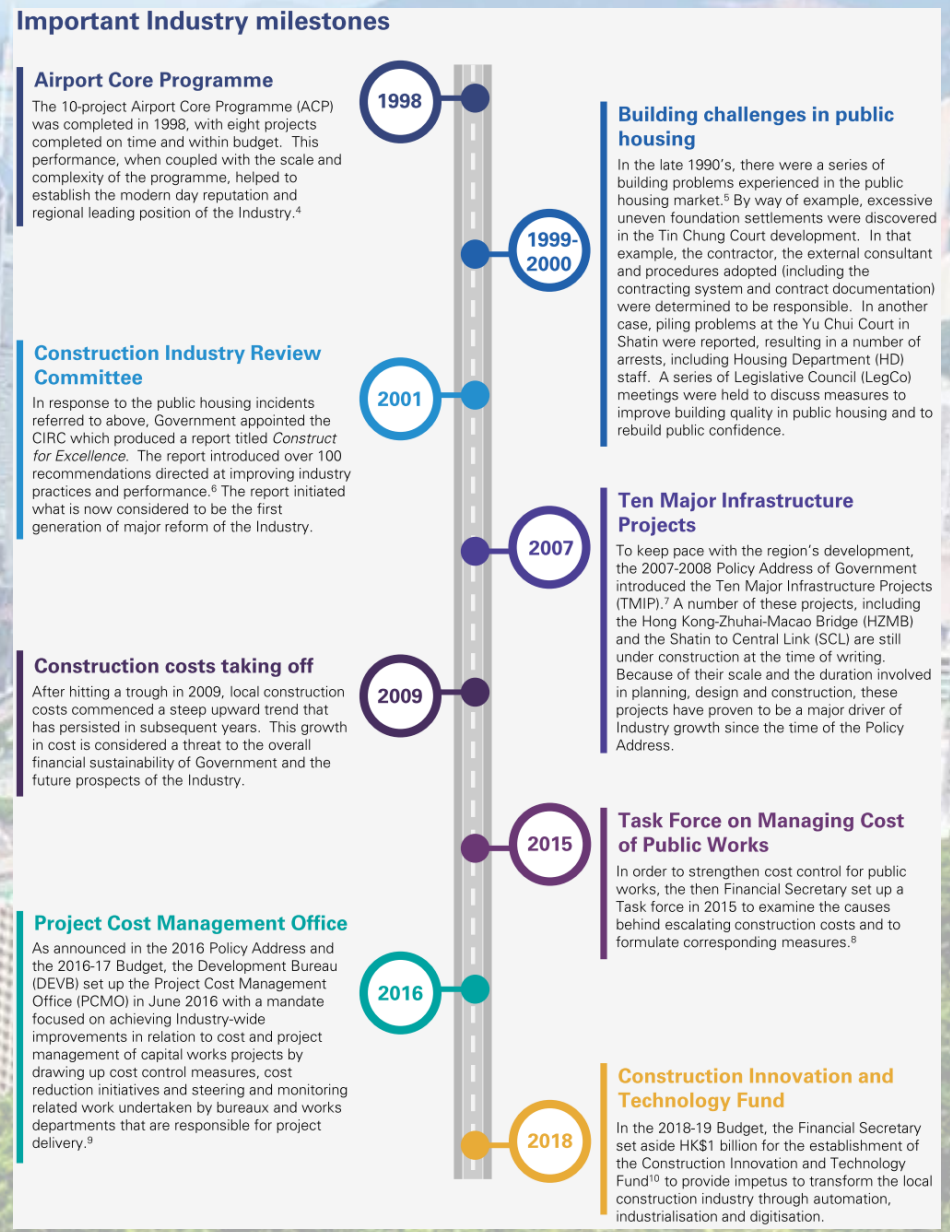
The impact of the Industry in Hong Kong

- Quality of infrastructure
- Economic contribution
- Employment

Source: "Construction 2.0" 2018, pp.8

Important Industry milestones



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What is DfMA?

DfMA stands for Design for Manufacture and Assembly.

DFMA is the combination of two methodologies –

Design for Manufacture - *the design for ease of manufacture of the parts that will form a Product*; and

Design for Assembly - *the design of the Product for ease of assembly*.

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香 港 特 別 行 政 區 政 府
The Government of the Hong Kong Special Administrative Region

政府總部
發展局
工務科
香港添馬添美道 2 號
政府總部西翼 18 樓

Works Branch
Development Bureau
Government Secretariat
18/F, West Wing,
Central Government Offices,
2 Tim Mei Avenue, Tamar, Hong Kong

Ref. : DEVB(PSGO) 38/1
Group : 5

31 March 2020

Development Bureau
Technical Circular (Works) No. 2/2020

Modular Integrated Construction (MiC)

Scope

This Circular sets out the policy on the adoption of Modular Integrated Construction (MiC) for new building works[1] with total construction floor area (CFA) larger than 300m^2 under the Capital Works Programme (CWP) to be tendered on or after 1 April 2020.

Effective Date

2. This Circular shall take immediate effect.

Effect on Existing Circulars and Circular Memoranda

3. This Circular has no effect on existing circulars.

Background

4. MiC is a construction method whereby freestanding volumetric modules with finishes, fixtures, fittings, furniture and building services installation, etc. manufactured off-site and then transported to site for assembly.

Government Policy

Continuous improvement is mandatory in construction industry, not just a policy.

DfMA has become a practice guide and a way of work for E&M as well as other construction activities.

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Buildings Department | Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers | ADV-36

Modular Integrated Construction

Introduction

Modular Integrated Construction (MiC) refers to a construction method whereby free-standing volumetric modules (with finishes, fixtures, fittings, etc.) are manufactured off-site and then transported for constructing buildings. Proven benefits include improved site safety, more efficient and better quality control, shortened construction period, less construction waste, less demand for on-site labour, less disturbance and nuisance to the neighbourhood, etc., not just contributing to the quality and sustainable built-environment but also help ease some of the challenges of the local construction industry. To encourage MiC, the Buildings Department (BD) has formulated streamlined measures and guidelines to facilitate the industry in meeting the relevant standards and requirements under the Buildings Ordinance (BO).

水務署
Water Supplies Department
總部 Headquarters
香港灣仔告士打道七號入境事務大樓 48 樓
48/F, Immigration Tower, 7 Gloucester Road, Wan Chai, Hong Kong

本署檔號 Our ref. : (8) in WSD 3318/50 Pt. 7
來函檔號 Your ref. :
電話 Tel. : 2829 4355
傳真 Fax. : 2824 0578

20 February 2019

Distribution: To all Licensed Plumbers and Authorized Persons

Dear Sirs,

Circular Letter No. 2/2019
Procedures for Applications for Water Supply in New Building Projects adopting "Modular Integrated Construction" Method

To facilitate the adoption of the "Modular Integrated Construction" (MiC)[1] method in Hong Kong, the Water Supplies Department (WSD) promulgates below the procedures for the applications for water supply in new building projects adopting MiC method (MiC projects). The WSD has consulted the Technical Committee on Plumbing on the procedures. The WSD will review the procedures from time to time with reference to the development in the adoption of MiC method in Hong Kong and the experience gained in implementing the procedures.

Guidance Note on Fixed Electrical Installations with Modular Integrated Construction Method

1. Introduction

1.1 The purpose of this guidance note is:

(a) to draw the attention of the Authorized Persons (APs)/ Consultant and developers to the requirements on the design, construction and installation of fixed electrical installations in buildings/ developments with Modular Integrated Construction (MiC) method;

(b) to draw the attention of the Registered Electrical Contractor (REC) and Registered Electrical Worker (REW) to the requirements on fixed electrical installations in buildings/ developments and their obligations; and

(c) to give guidance on the requirements which must be met in the design selection and installation of wiring and fixed electrical installations.

Guidelines on Application of Construction Noise Permit for using Modular Integrated Construction (MiC) Method

Introduction

Modular Integrated Construction (MiC) refers to construction whereby free-standing integrated modules (completed with finishes, fixtures, and fittings) are manufactured in a prefabrication factory and then transported to a site for building assembly. While building work can be carried out in daytime of normal weekdays in general, the modules which are comparatively large and may need to be transported to and installed at a construction site in restricted hours[1] under the Noise Control Ordinance (NCO), and hence a valid Construction Noise Permit (CNP) issued by the Environmental Protection Department (EPD) would be needed. In view of ever wider use of MiC method in Hong Kong, this paper provides guidance for developers, architects and contractors on the necessary justification when considering applying for an essential Construction Noise Permit (CNP) for MiC.

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消防總部大廈

本處檔號 OUR REF.: (48) in FP(LC) 314/07 Pt. 8
來函檔號 YOUR REF.:
圖文傳真 FAX: (852) 2723 2197
電子郵件 E-MAIL:
電 話 TEL. NO.: (852) 2733 7744

FIRE SERVICES DEPARTMENT
LICENSING AND CERTIFICATION COMMAND
Fire Services Headquarters Building,
5/F, No.1 Hong Chong Road,
Tsim Sha Tsui East, Kowloon,
Hong Kong

22 March 2019

To: Recipients of FSD Circular Letters
and Authorized Persons

Dear Sir/Madam,

FSD Circular Letter No. 3/2019

Guidance Notes on Submission, Approval and Acceptance Inspection of Fire Service Installations and Equipment in Modular Integrated Construction Building Projects

Modular Integrated Construction (MiC) refers to a construction method whereby free-standing integrated modules are manufactured off-site and then transported for constructing buildings on sites. The concept of "factory assembly followed by on-site installation" represents a shift of traditional method from the on-site construction to the modern off-site manufacturing and assembly.

Client Driven

Building Department (BD), Environmental Protection Department (EPD), Electrical & Mechanical Services Department (EMSD), Water Supplies Department (WSD) and Fire Services Department (FSD) had published some guidelines for stakeholders to follow.

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Unchanged Demand for Improvement

Simon Committee Report

Philips Report on Building

Bronowski Report (1950)
1. Standardization
2. Prefabrication

Large Industrial Sites Report

Wood Report

Faster Building for Industry

Faster Building for Commerce

Egan Report

Rethinking Construction

CIRC Report

Construct For Excellence

1944 1950 1962 1964 1965 1970 1975 1983 1988 1994 1995 1998 1999 2001 2002 2021

MiC
DfMA
MiMEP

Emmerson's Report

Banwell Report

Tavistock Studies

Latham Report

Constructing the Team

Egan 2002 Report

Accelerating Change

Committee on Civilian Industrial Technology (USA)

Achieving Excellence in Construction

(Canada Construction Research Board)

Construction 21 (Singapore)

Reference: Murray, Langford, "Construction Reports 1944-98, pp. xvi

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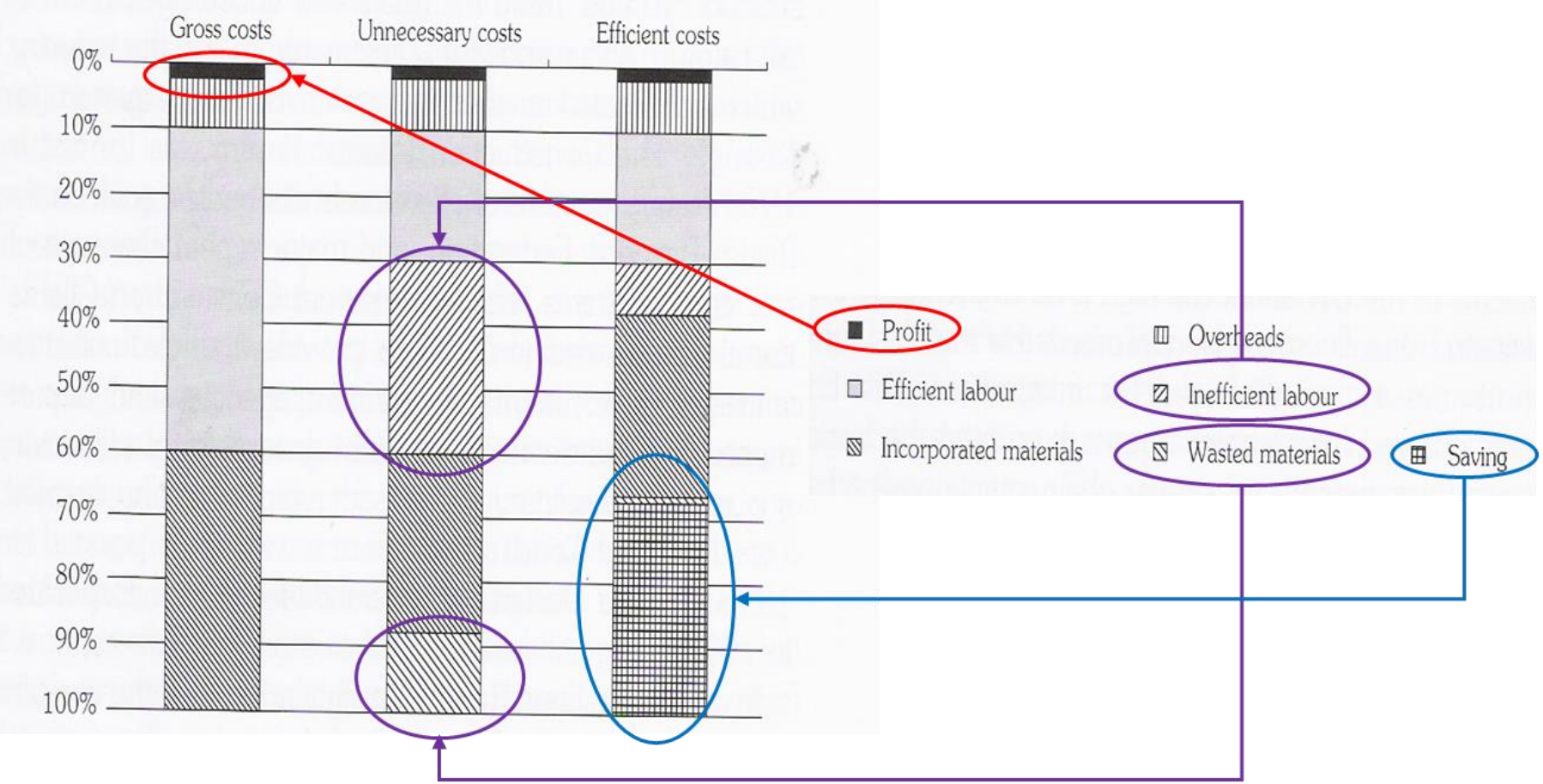
Unnecessary Costs



Source: Cain, CT, "Profitable Partnering for Lean Construction, 2004, Figure 3.1

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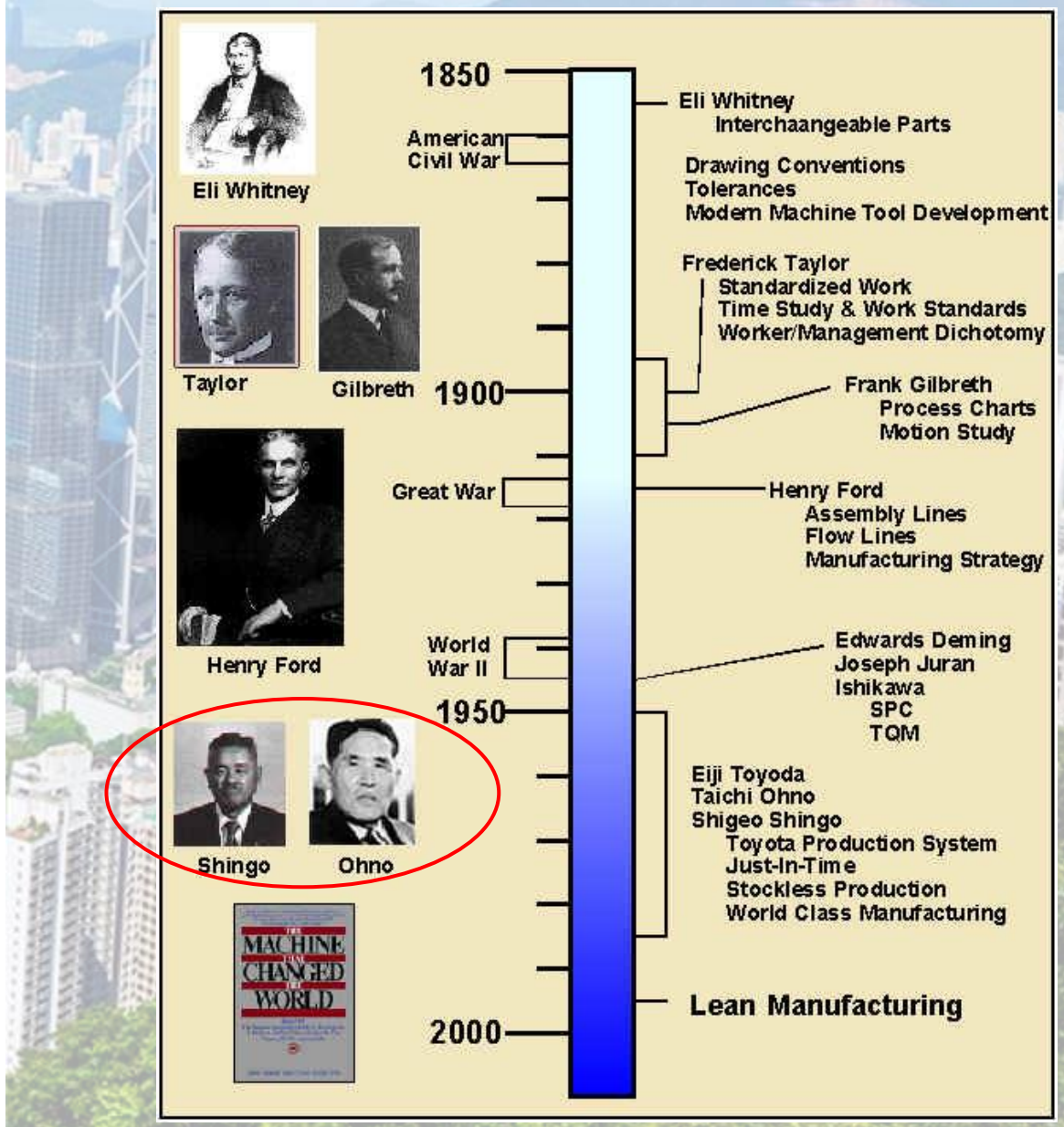
Lean Timeline of Manufacturing

Toyota Production System (TPS)

- Muda (無駄,), Waste
  - Non-value added
- Lean Manufacturing
  - Value (why am I doing it?)
  - Pull instead of Push
  - Value Stream
  - Continuous Improvement
- Value Stream Mapping (VSM)
  - A set of **activities**, **operations** and **associated information** made up the **final product**



Source: Womack, Jones, 'Lean Thinking", 2003, pp. 15-17; Carreira, "Lean Manufacturing That Wworks", pp.1-5

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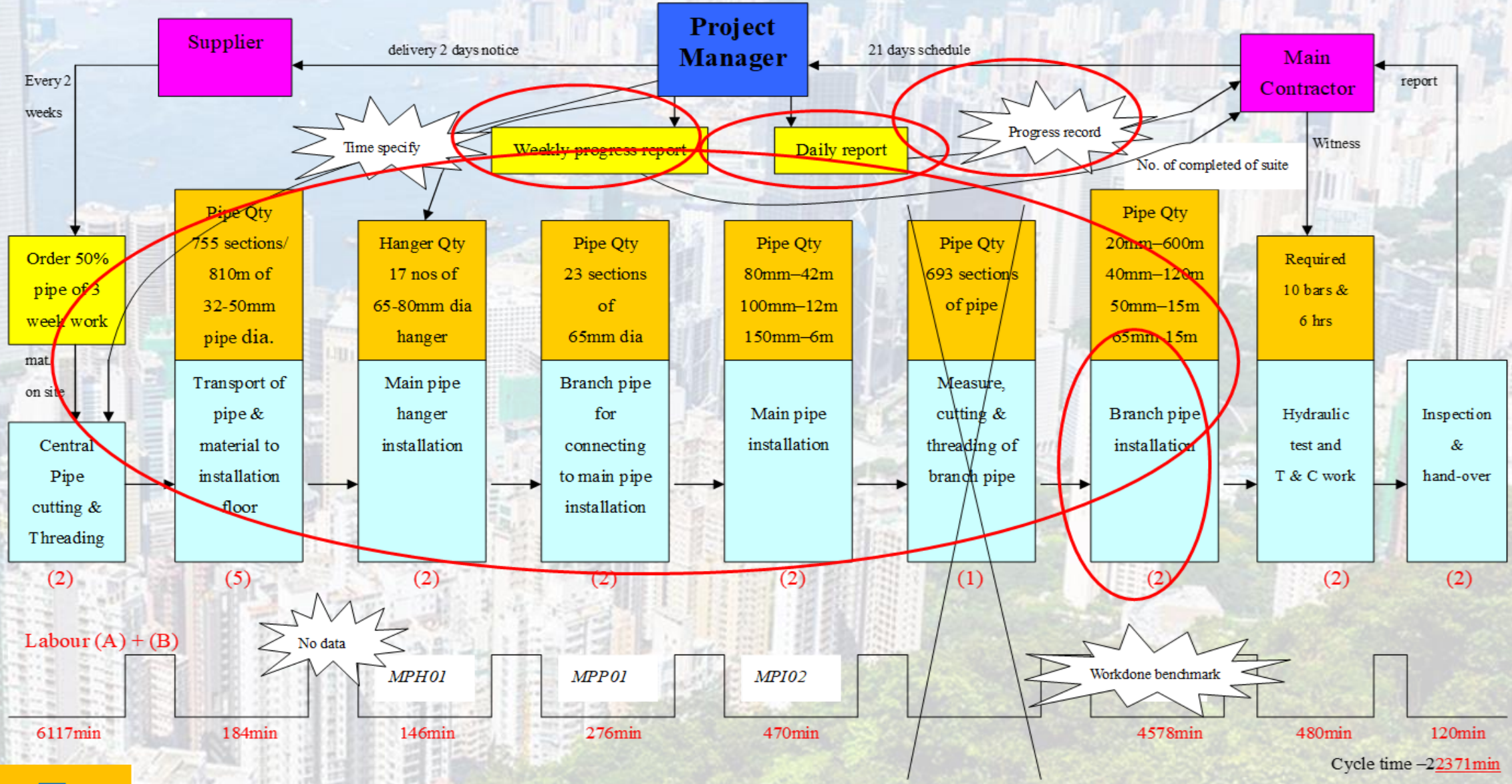
Typical Value Stream Map (VSM)

1. Productivity
2. Start date & end date
3. No. of work/material on site
4. No date

- Total 6 blocks, 1998 suites, 42 suites per floor
- 12 workers for 63 suites at 10.5 days of branch pipe, 1.8 worker for central pipe cutting and threading for 63 suites at 17.5 days
- 3 worker for 3 floors at 1 day for main pipe hanger, 4 workers to work 6 days for 3 floors for main pipe



Cycle time –22371min

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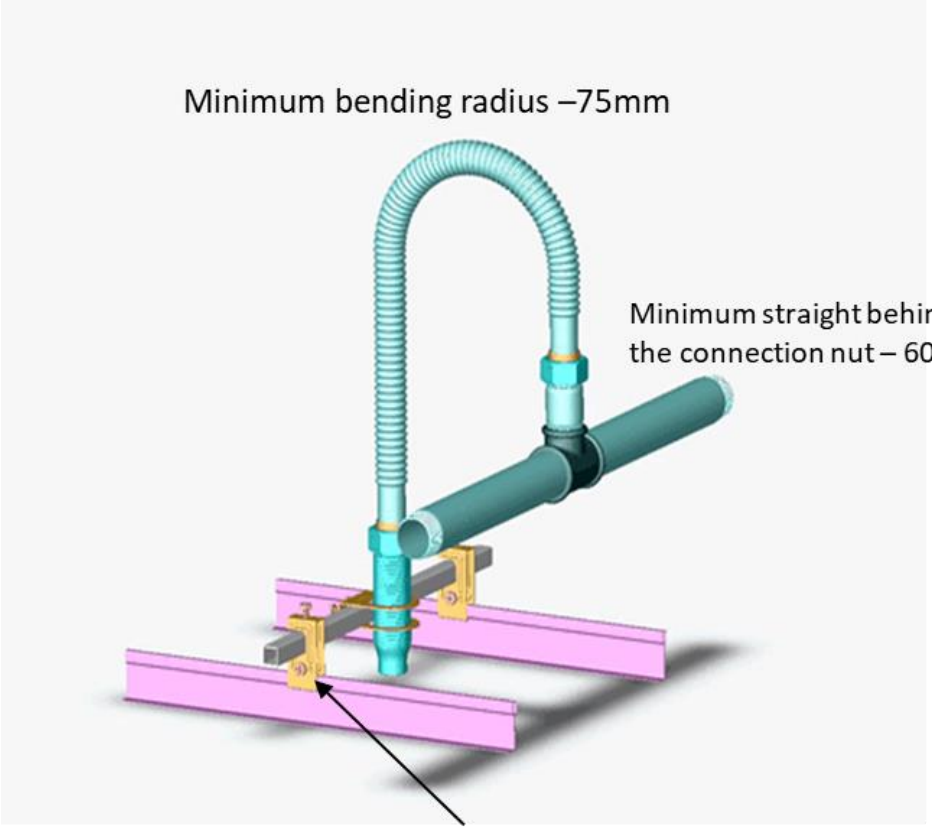
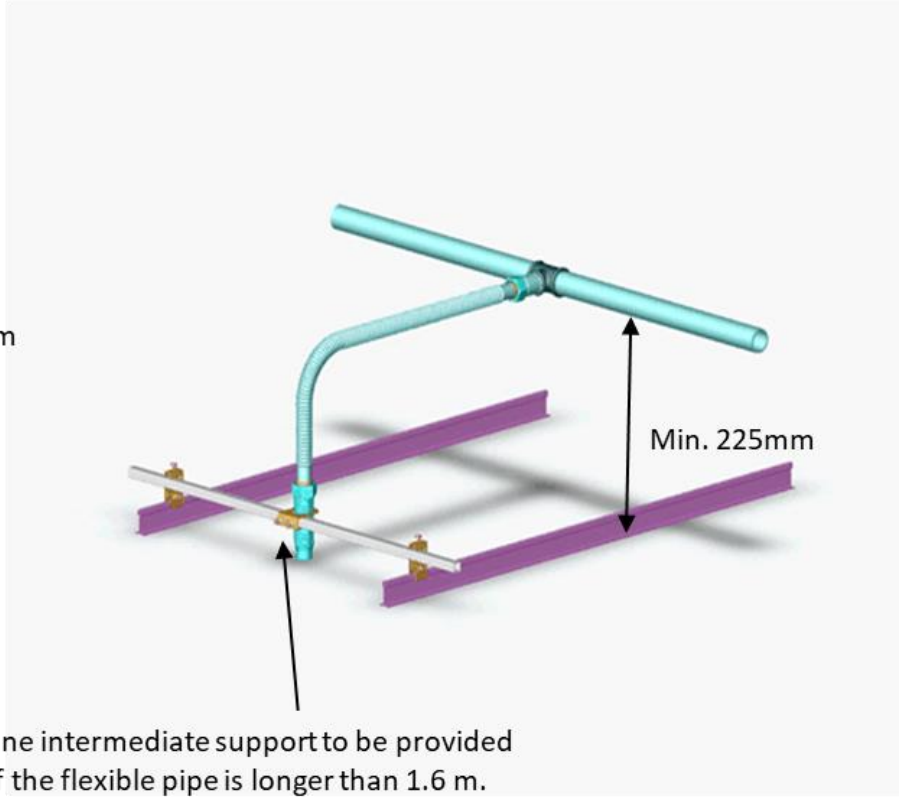
Flexible Sprinkler Drop





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Potential Benefit

- Long product lift-cycle
- Ease of installation
- Eliminate non-valued steps
  - No need for measuring
  - No cutting/ threading
- Standardization of pipe layout
- Reduce installation time
- Improve construction cycle

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Approvals and Limitations

- Dia. 25mm “flexible sprinkler connection” obtains the following approval
  - LPCB approval M.S.P. 16 bar
  - UL listing M.S.P. 12 bar
  - HKFSD acceptable letter
- Dia. 32mm
  - Same as above except item (iii), this is to be followed up.
- Pre-calculated
  - Town-main, up to 1220mm
  - Pumped, up to 1880mm
- Fully-hydraulically calculated
  - up to 3220mm

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What the Case Study will Tell You?

- A common case
- From Manufacturing Engineering perspective
- Process and workflow
- Waste identification
- Value Stream Mapping (VSM)

Reference: Arbulu, Tommelein, "Value Stream Analysis of Construction Supply Chain: Case Study on Pipe Supports Used in Power Plants, 2002

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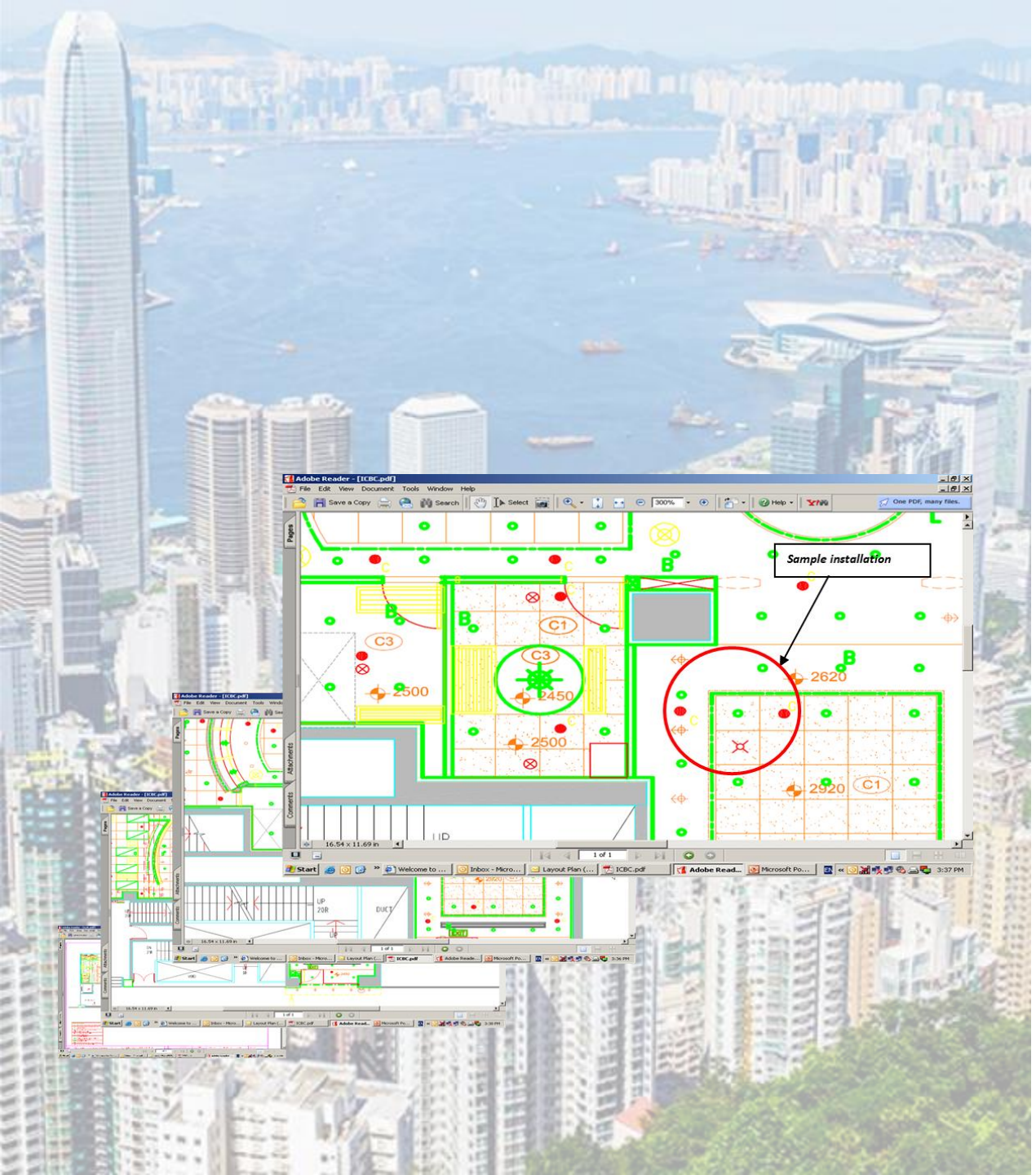

Case Study

Objectives:

- To compare the difference in waste elimination between applying VSM and traditional measurement through:
  - Mapping the process of installation of flexible sprinkler connection through a sample installation at a job site.
  - Measuring the potential saving on using flexible sprinkler connection to replace traditional G.I pipe dropper.

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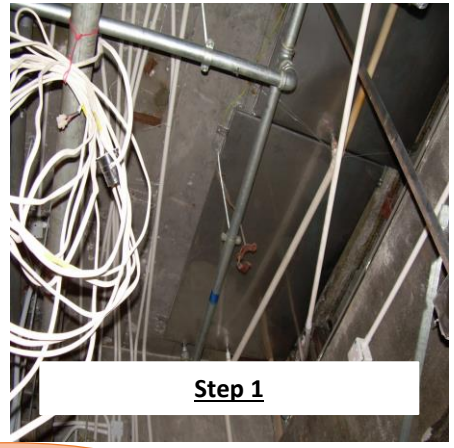
Case Study 1 – Traditional Method



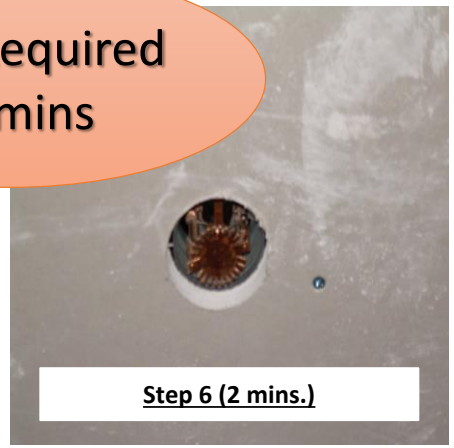
Step 1

Step 2 (10 mins.)

Step 3 (8 mins.)

Step 4 (9 mins.)

Step 5 (11 mins.)



Step 6 (2 mins.)

Total Required
40 mins

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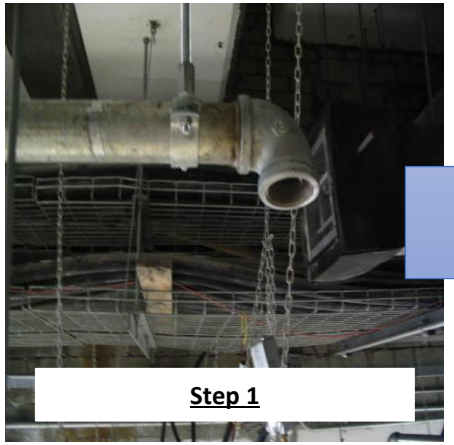
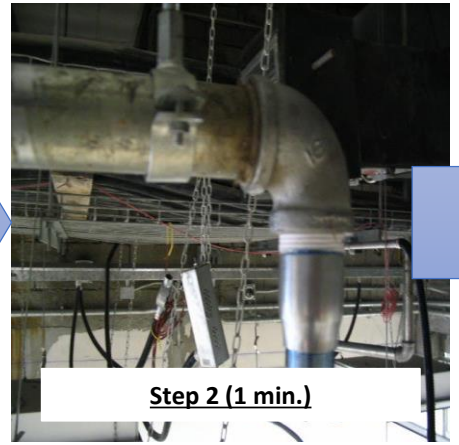
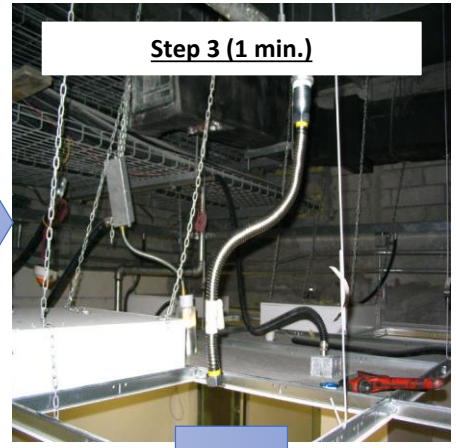
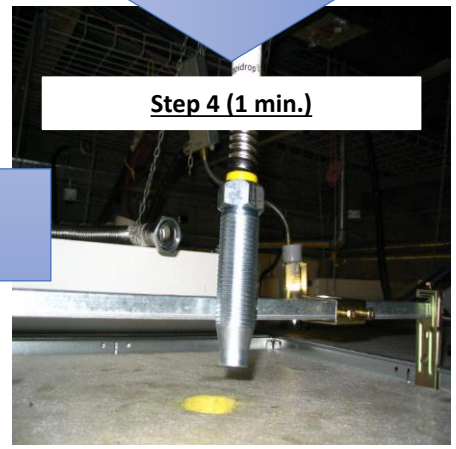
Case Study 2 – Flexible Sprinkler Drop

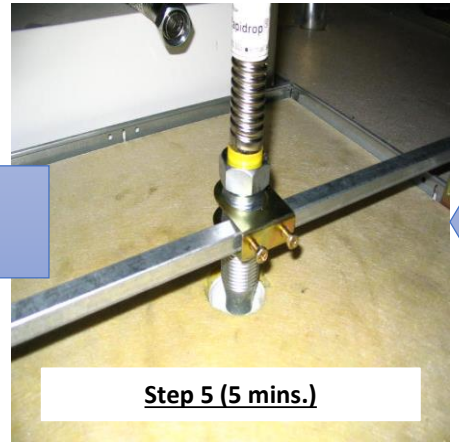
Total Required
15 mins

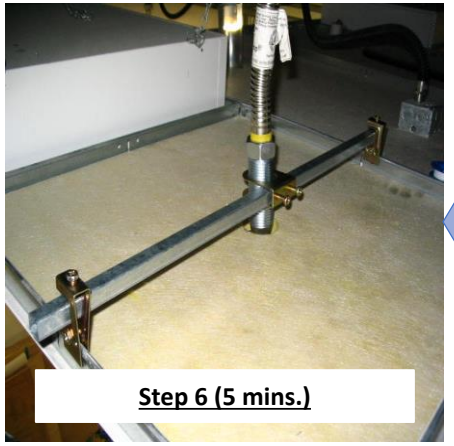












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Time Saving Analysis

Traditional Sprinkler Dropper Installation Time (Unit in min.)		**Flexible Sprinkler Dropper Installation Time (Unit in min.)**	
Step1	0	Step1	0
Step2	10	Step2	1
Step3	8	Step3	1
Step4	9	Step4	1
Step5	11	Step5	5
Step6	2	Step6	5
		Step7	2
Total Installation Time	40	Total Installation Time	15
		Time Saving	**25**

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Time Saving Analysis

Traditional Sprinkler Dropper Installation Time (Unit in min.)		Flexible Sprinkler Dropper Installation Time (Unit in min.)	
Step1	0	Step1	0
Step2	10	Step2	1
Step3			
Step4			
Step5			
Step6			
		Step7	2
Total Installation Time	40	Total Installation Time	15
		Time Saving	**25**

How about a project have 10,000 sprinkler droppers?

10,000 sprinkler points x 25 mins

250,000 mins or 556 mandays

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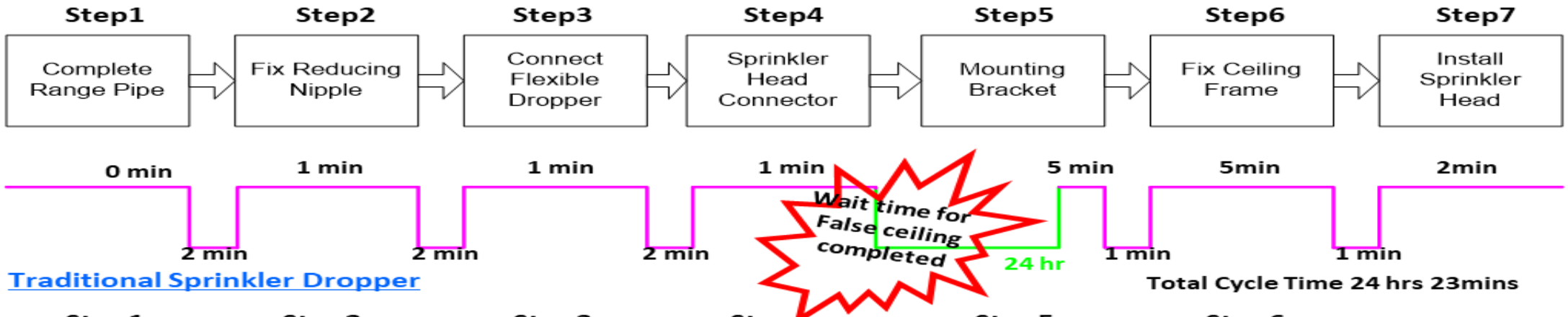
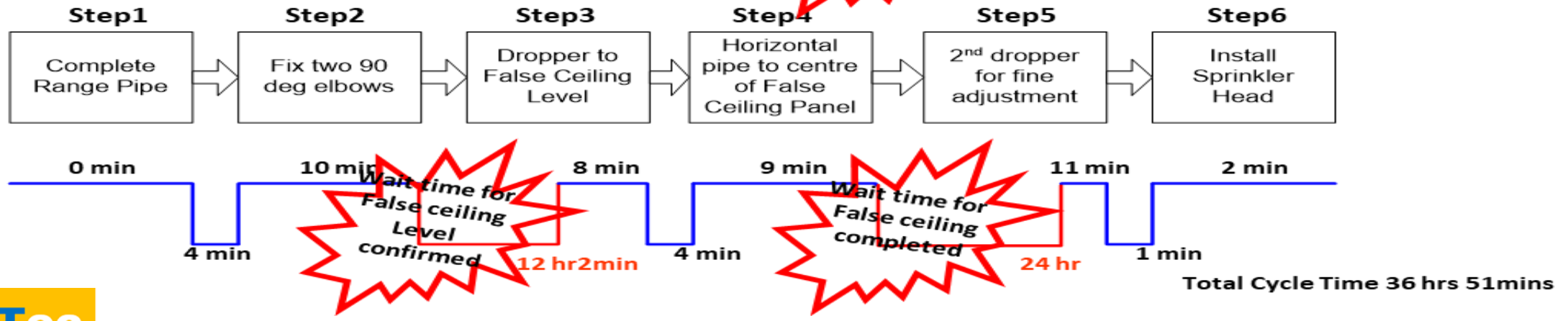
Time Saving Analysis Using VSM

Flexible Sprinkler Dropper



Total Cycle Time 24 hrs 23mins

Traditional Sprinkler Dropper



Total Cycle Time 36 hrs 51mins

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Revisit Time Saving Analysis

Traditional Sprinkler Dropper Installation Time (Unit in min.)		**Flexible Sprinkler Dropper Installation Time (Unit in min.)**	
Step1	0	Step1	0
Step2	10	Step2	1
Step3	8	Step3	1
Step4	9	Step4	1
Step5	11	Step5	5
Step6	2	Step6	5
		Step7	2
Total Installation Time	36 hours 51 minutes	Total Installation Time	24 hours 23 minutes
		Time Saving	**12 hours 28 minutes**

Wait time for False Ceiling Level 12 hours

Wait time for False Ceiling Frame completed 24 hours

Wait time for False Ceiling Frame completed 24 hours

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Revisit Time Saving Analysis

Traditional Sprinkler Dropper Installation Time (Unit in min.)		Flexible Sprinkler Dropper Installation Time (Unit in min.)	
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Total Installation Time	36 hours 51 minutes	Total Installation Time	24 hours 23 minutes
		Time Saving	**12 hours 28 minutes**

Wait time for False Ceiling Level 12 hours

24 hours

Wait time for False Ceiling Frame completed 24 hours

Saving 33% of Construction Time

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Other's Findings

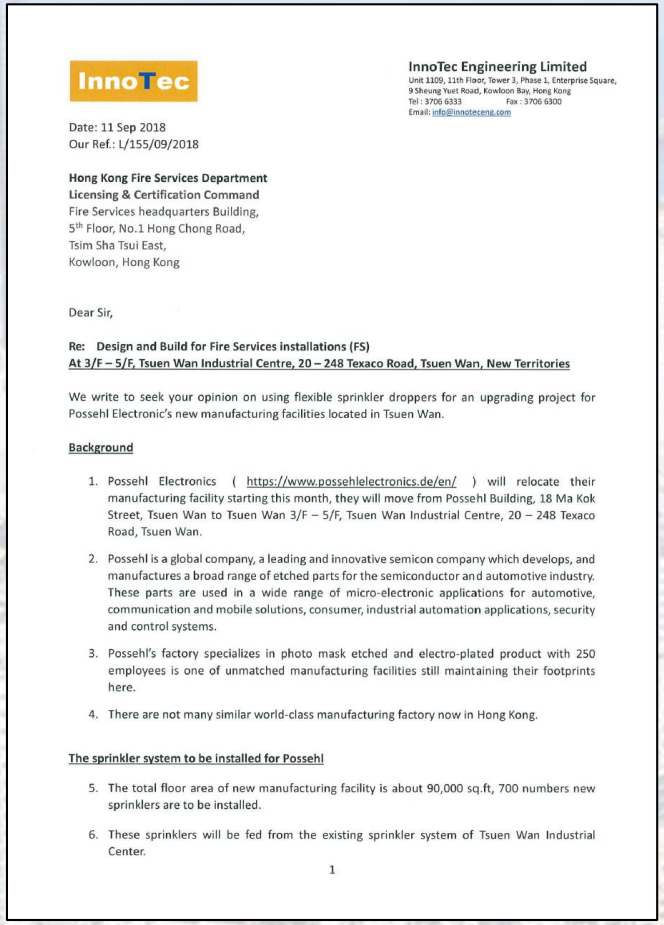
Wilson D., *(Reference: Womack, Jones, "Lean Thinking", 2003, pp. 51)*

- 84% of construction time occupied by
  - Waiting
  - Rework

Arbulu & Tommelein *(Reference: Arbulu, Tommelein, "Value Stream Analysis of Construction Supply Chain: Case Study on Pipe Supports Used in Power Plants, 2002)*

- 96% of time in supply chain of pipe support in non-value added
- Redesign accounted for 20% of time

Application to FSD for Approval



InnoTec

InnoTec Engineering Limited
Unit 1109, 11th Floor, Tower 3, Phase 1, Enterprise Square,
9 Sheung Yuet Road, Kowloon Bay, Hong Kong
Tel : 3706 6333 Fax : 3706 6300
Email: info@innoteceng.com

Date: 11 Sep 2018
Our Ref.: L/155/09/2018

Hong Kong Fire Services Department
Licensing & Certification Command
Fire Services headquarters Building,
5th Floor, No.1 Hong Chong Road,
Tsim Sha Tsui East,
Kowloon, Hong Kong

Dear Sir,

Re: Design and Build for Fire Services installations (FS)
At 3/F – 5/F, Tsuen Wan Industrial Centre, 20 – 248 Texaco Road, Tsuen Wan, New Territories

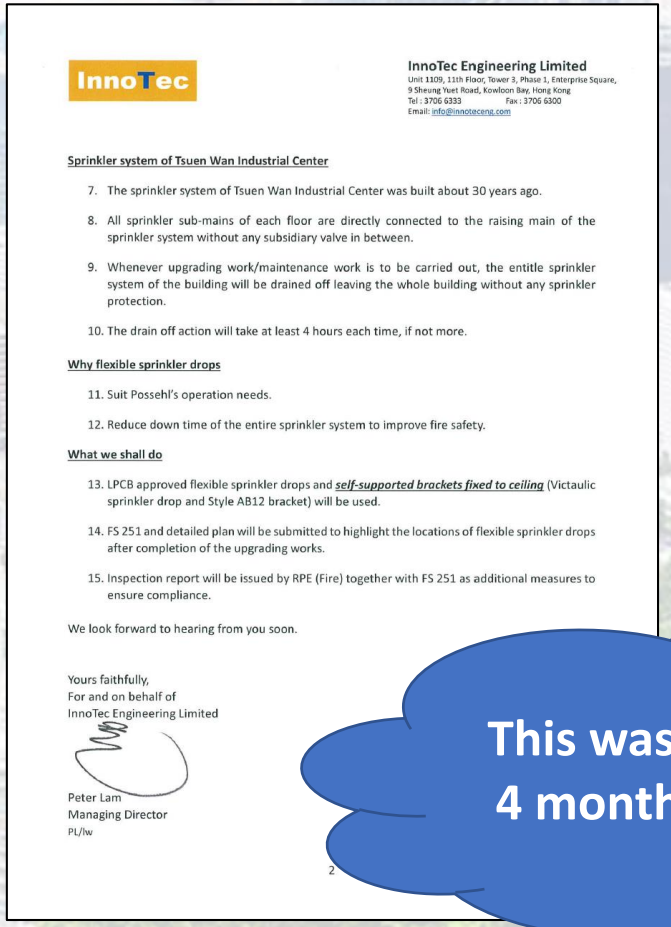
We write to seek your opinion on using flexible sprinkler droppers for an upgrading project for Possehl Electronic's new manufacturing facilities located in Tsuen Wan.

Background

1. Possehl Electronics (https://www.possehlelectronics.de/en/) will relocate their manufacturing facility starting this month, they will move from Possehl Building, 18 Ma Kok Street, Tsuen Wan to Tsuen Wan 3/F – 5/F, Tsuen Wan Industrial Centre, 20 – 248 Texaco Road, Tsuen Wan.
2. Possehl is a global company, a leading and innovative semicon company which develops, and manufactures a broad range of etched parts for the semiconductor and automotive industry. These parts are used in a wide range of micro-electronic applications for automotive, communication and mobile solutions, consumer, industrial automation applications, security and control systems.
3. Possehl's factory specializes in photo mask etched and electro-plated product with 250 employees is one of unmatched manufacturing facilities still maintaining their footprints here.
4. There are not many similar world-class manufacturing factory now in Hong Kong.

The sprinkler system to be installed for Possehl

5. The total floor area of new manufacturing facility is about 90,000 sq.ft, 700 numbers new sprinklers are to be installed.
6. These sprinklers will be fed from the existing sprinkler system of Tsuen Wan Industrial Center.



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Email: info@innoteceng.com

Sprinkler system of Tsuen Wan Industrial Center

7. The sprinkler system of Tsuen Wan Industrial Center was built about 30 years ago.
8. All sprinkler sub-mains of each floor are directly connected to the raising main of the sprinkler system without any subsidiary valve in between.
9. Whenever upgrading work/maintenance work is to be carried out, the entitle sprinkler system of the building will be drained off leaving the whole building without any sprinkler protection.
10. The drain off action will take at least 4 hours each time, if not more.

Why flexible sprinkler drops

11. Suit Possehl's operation needs.
12. Reduce down time of the entire sprinkler system to improve fire safety.

What we shall do

13. LPCB approved flexible sprinkler drops and ***self-supported brackets fixed to ceiling*** (Victaulic sprinkler drop and Style AB12 bracket) will be used.
14. FS 251 and detailed plan will be submitted to highlight the locations of flexible sprinkler drops after completion of the upgrading works.
15. Inspection report will be issued by RPE (Fire) together with FS 251 as additional measures to ensure compliance.

We look forward to hearing from you soon.

Yours faithfully,
For and on behalf of
InnoTec Engineering Limited

Peter Lam
Managing Director
PL/lw

This was a "Fast Track" project.
4 months construction period.

InnoTec

Application to FSD for Approval

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Date: 11 Sep 2018
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Hong Kong Fire Services Department
Licensing & Certification Command

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9 Sheung Yuet Road, Kowloon Bay, Hong Kong
Tel : 3706 6333 Fax : 3706 6300
Email: info@innoteceng.com

Sprinkler system of Tsuen Wan Industrial Center

7. The sprinkler system of Tsuen Wan Industrial Center was built about 30 years ago.

8. All sprinkler sub-mains of each floor are directly connected to the raising main of the sprinkler system without any subsidiary valve in between.

9. Whenever upgrading work/maintenance work is to be carried out, the entitle sprinkler system of the building will be drained off leaving the whole building without any sprinkler protection.

10. The drain off action will take at least 4 hours each time, if not more.

Why flexible sprinkler drops

11. Suit Possehl's operation needs.

12. Reduce down time of the entire sprinkler system to improve fire safety.

What we shall do

13. LPCB approved flexible sprinkler drops and ***self-supported brackets fixed to ceiling*** (Victaulic sprinkler drop and Style AB12 bracket) will be used.

14. FS 251 and detailed plan will be submitted to highlight the locations of flexible sprinkler drops after completion of the upgrading works.

15. Inspection report will be issued by RPE (Fire) together with FS 251 as additional measures to ensure compliance.

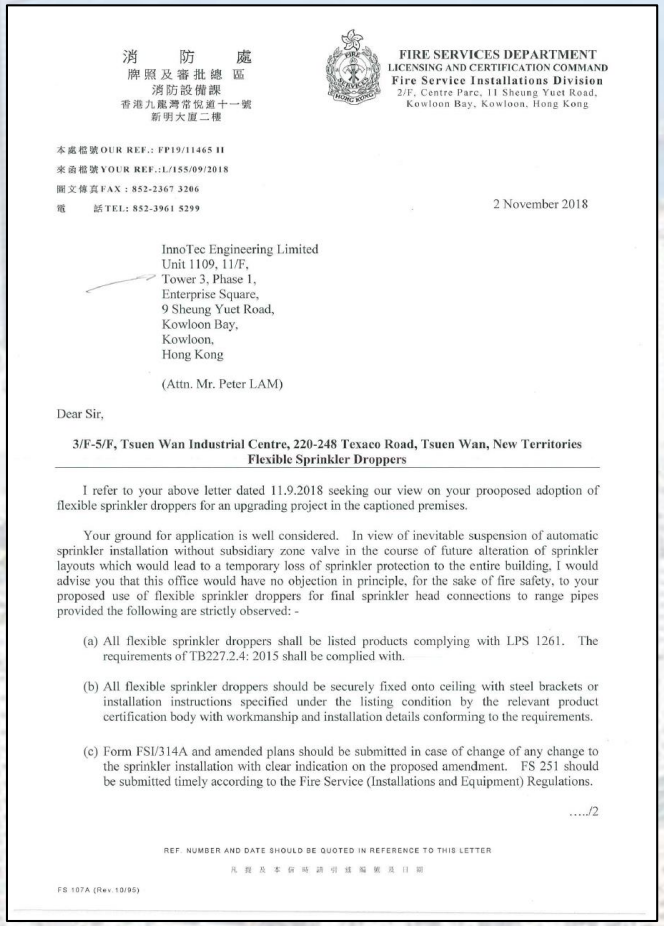
We look forward to hearing from you soon.

Yours faithfully,
For and on behalf of
InnoTec Engineering Limited

Peter Lam
Managing Director
PL/lw

InnoTec

Application to FSD for Approval



消　防　處
牌照及審批總區
消防設備課
香港九龍灣常悅道十一號
新明大廈二樓

FIRE SERVICES DEPARTMENT
LICENSING AND CERTIFICATION COMMAND
Fire Service Installations Division
2/F, Centre Parc, 11 Sheung Yuet Road,
Kowloon Bay, Kowloon, Hong Kong

本處檔號OUR REF.: FP19/11465 II
來函檔號YOUR REF.:L/155/09/2018
圖文傳真FAX : 852-2367 3206
電　　話TEL: 852-3961 5299

2 November 2018

InnoTec Engineering Limited
Unit 1109, 11/F,
Tower 3, Phase 1,
Enterprise Square,
9 Sheung Yuet Road,
Kowloon Bay,
Kowloon,
Hong Kong

(Attn. Mr. Peter LAM)

Dear Sir,

3/F-5/F, Tsuen Wan Industrial Centre, 220-248 Texaco Road, Tsuen Wan, New Territories
Flexible Sprinkler Droppers

I refer to your above letter dated 11.9.2018 seeking our view on your prooposed adoption of flexible sprinkler droppers for an upgrading project in the captioned premises.

Your ground for application is well considered. In view of inevitable suspension of automatic sprinkler installation without subsidiary zone valve in the course of future alteration of sprinkler layouts which would lead to a temporary loss of sprinkler protection to the entire building, I would advise you that this office would have no objection in principle, for the sake of fire safety, to your proposed use of flexible sprinkler droppers for final sprinkler head connections to range pipes provided the following are strictly observed: -

(a) All flexible sprinkler droppers shall be listed products complying with LPS 1261. The requirements of TB227.2.4: 2015 shall be complied with.

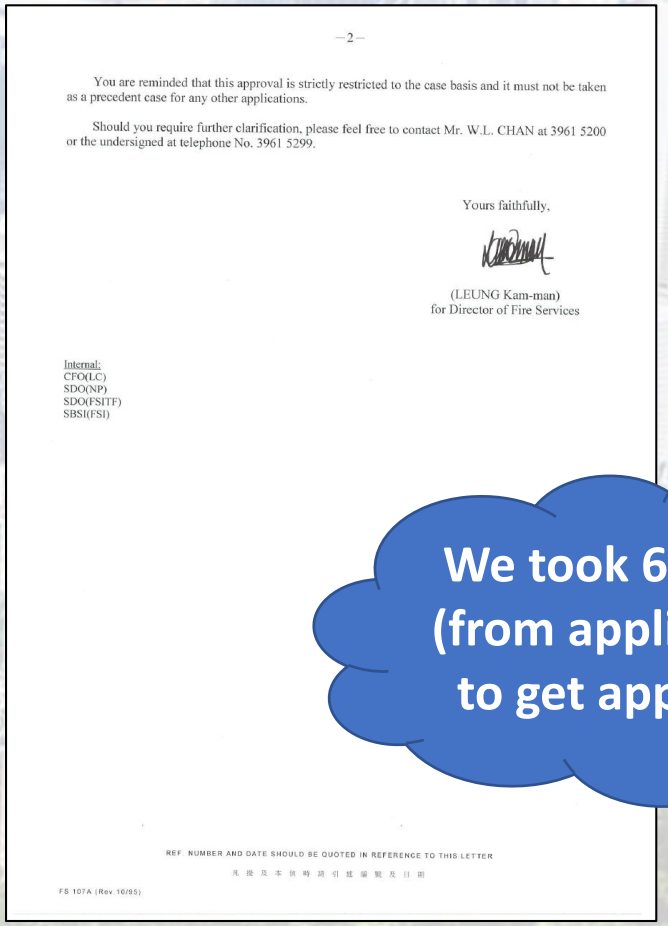
(b) All flexible sprinkler droppers should be securely fixed onto ceiling with steel brackets or installation instructions specified under the listing condition by the relevant product certification body with workmanship and installation details conforming to the requirements.

(c) Form FSI/314A and amended plans should be submitted in case of change of any change to the sprinkler installation with clear indication on the proposed amendment. FS 251 should be submitted timely according to the Fire Service (Installations and Equipment) Regulations.

...../2

REF. NUMBER AND DATE SHOULD BE QUOTED IN REFERENCE TO THIS LETTER
凡提及本信時請引述編號及日期

FS 107A (Rev. 10/95)



You are reminded that this approval is strictly restricted to the case basis and it must not be taken as a precedent case for any other applications.

Should you require further clarification, please feel free to contact Mr. W.L. CHAN at 3961 5200 or the undersigned at telephone No. 3961 5299.

Yours faithfully,

(LEUNG Kam-man)
for Director of Fire Services

Internal:
CFO(LC)
SDO(NP)
SDO(FSITF)
SBSI(FSI)

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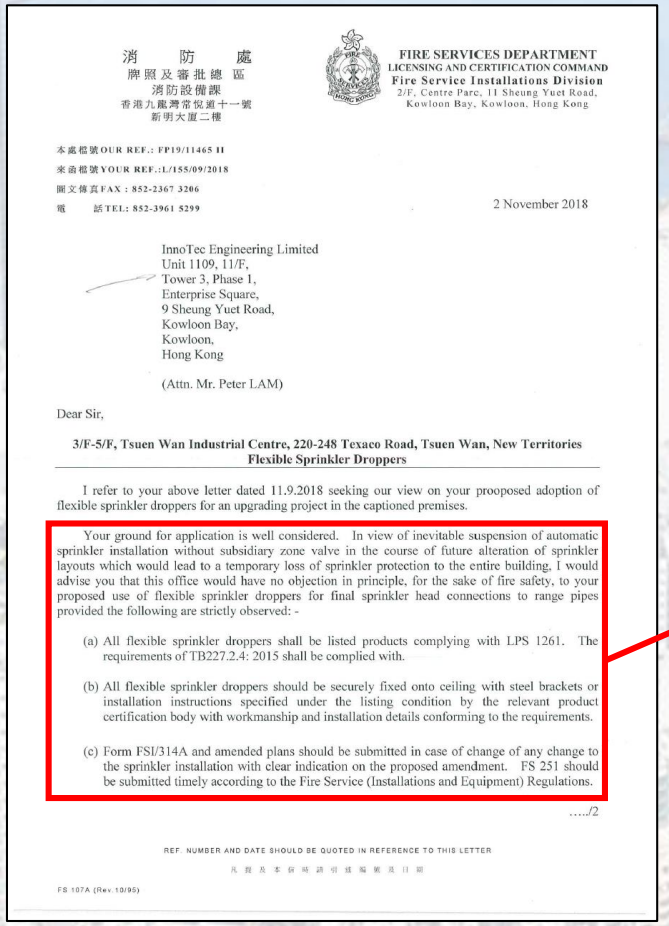
FS 107A (Rev. 10/95)

We took 6 weeks (from application) to get approval.

InnoTec

Application to FSD for Approval



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香港九龍灣常悅道十一號
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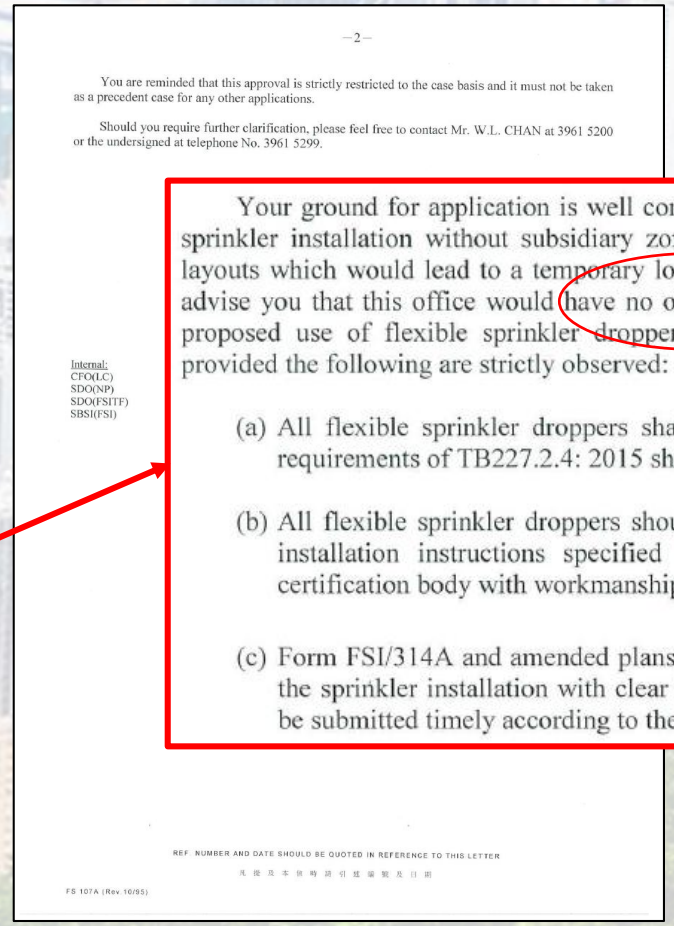

—2—

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Real Case Application



Two type of “L” angle bracket c/w Threaded Rod is required and to suit leveling adjustment (for horizontal adjustment)



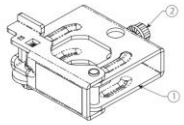
Style AB12

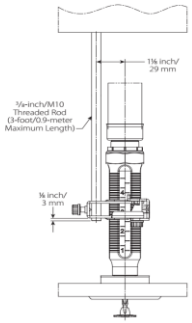
- Suspended ceilings
- Hard-Lid ceilings

Item	Description
1	Style AB12 Bracket Body
2	#2 Square Drive Set Screw

NOTE

- FM/VdS Approved.





Local “L’ Bracket”

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Real Case Application

Traditional G.I. Pipe work and fittings need occupies a larger space

Easy and small place to store the flexible sprinkler (say: 180 pcs flexible sprinkler need 1.5 x 1.5 area)

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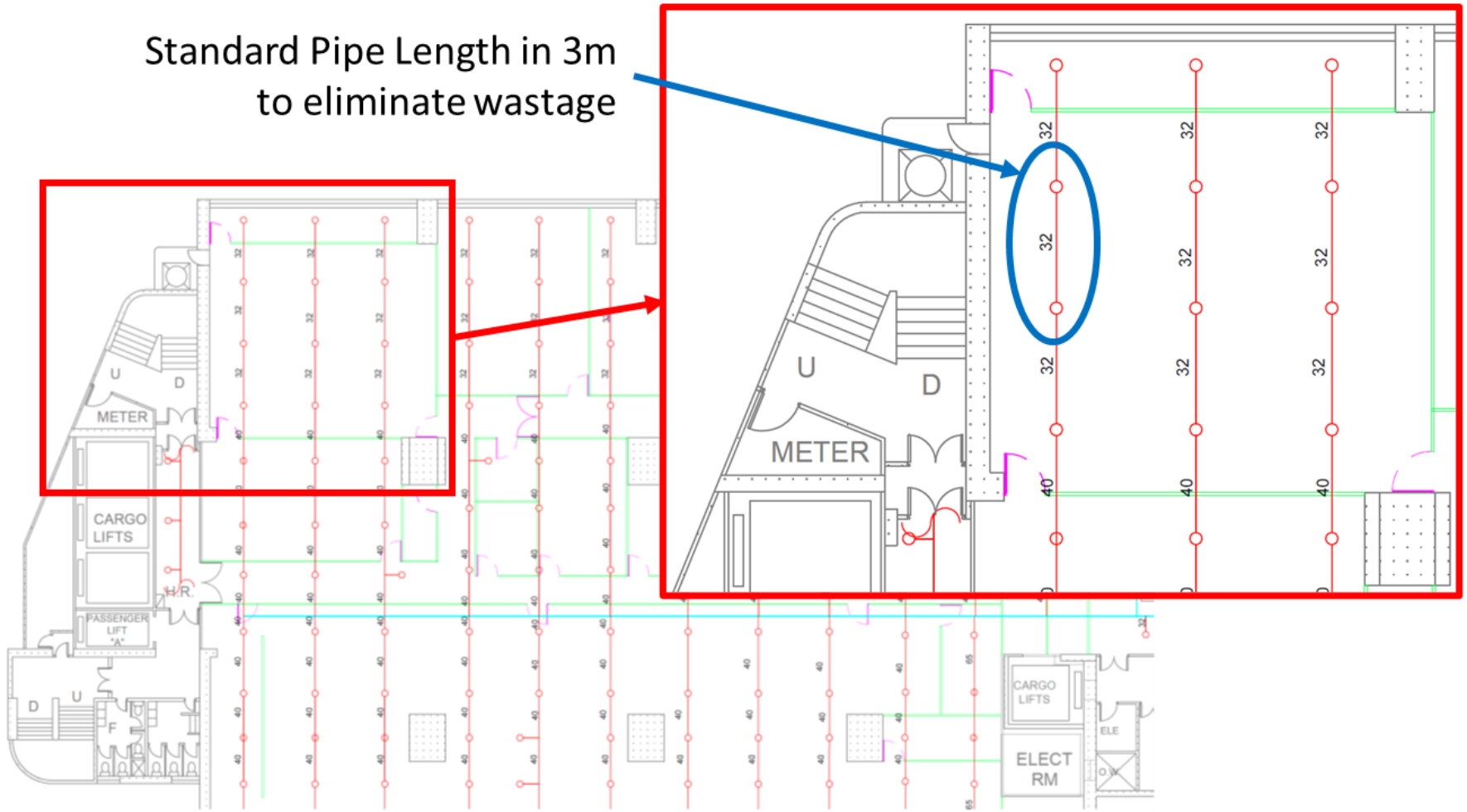
Standardization of Pipe Length



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Takeaway … …

Understand	Understand the opportunity for improving process cycle through waste elimination
See	See things from outside
Identify	Identify workflow through applying Value Stream Mapping
Find	Find invisible waste “wait time”

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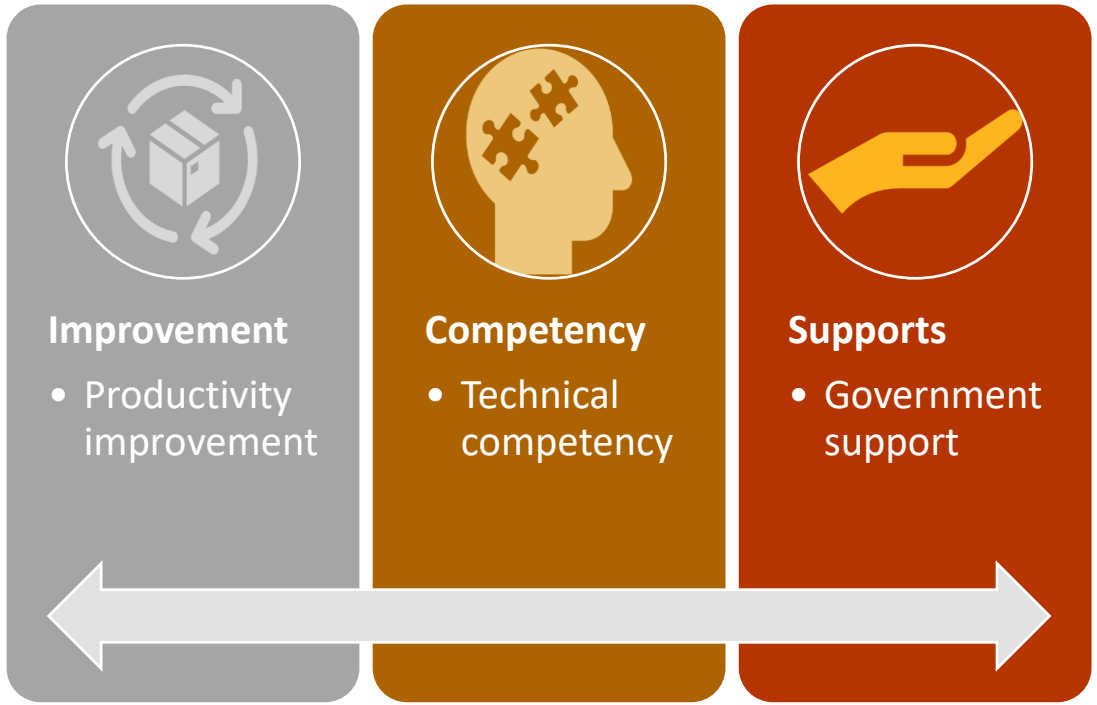
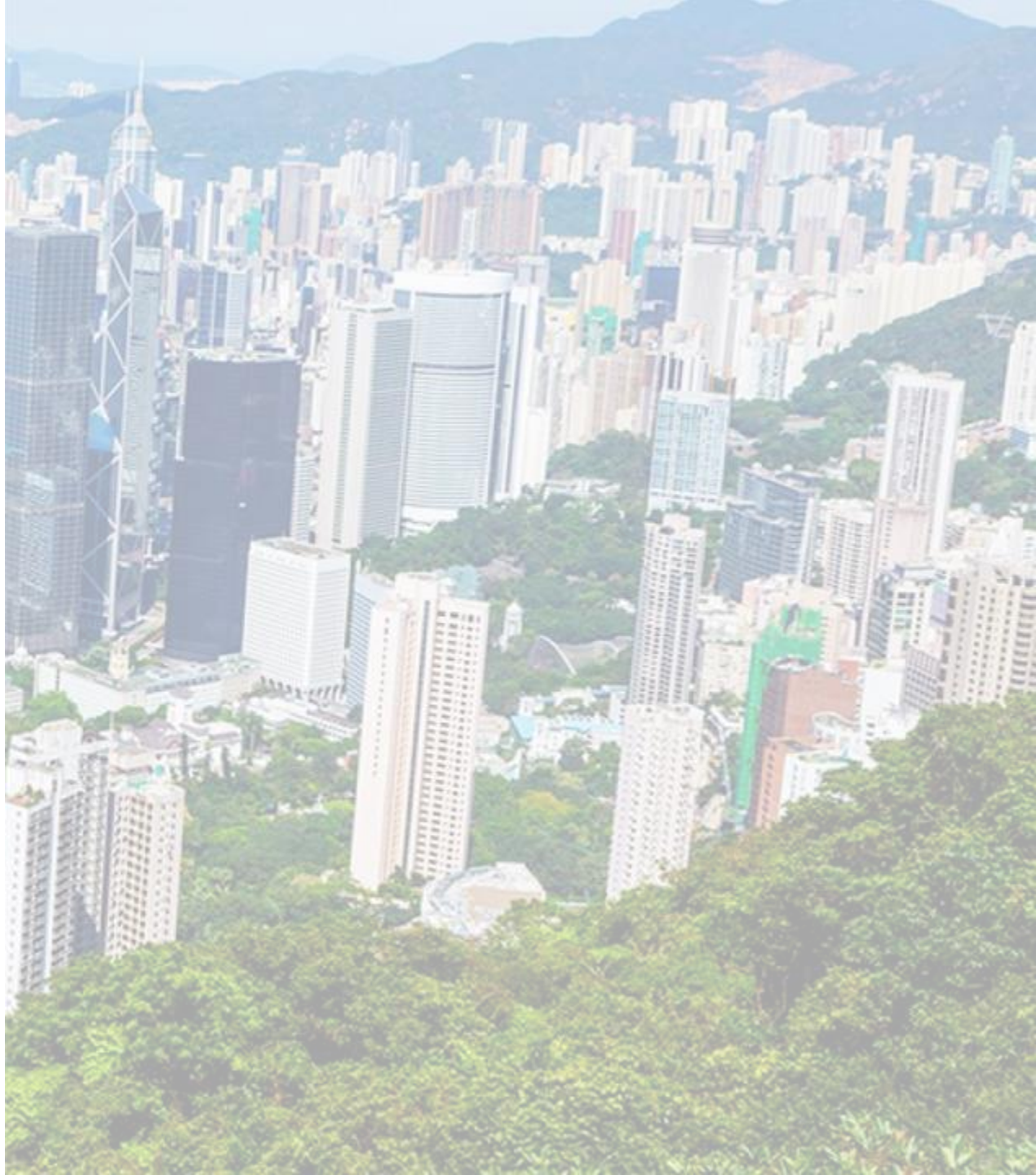
Takeaway … …

To apply DfMA, we shall fully understand the Ecosystem of DfMA –



We see our future through DfMA … …

InnoTec



HKFEMC 香港機電工程商聯會

CONSTRUCTION INDUSTRY COUNCIL 建造業議會

DfMA MiMEP Tradeshow 2021 – MiC & MiMEP Webinar Forum

Thank You!

5 March 2021

Application of Flexible Sprinkler Drops

InnoTec