

Validation of Hypothesis

Ir Dr TO Chi-wing

Three Dominant Modes of Fire Spread

1. Rapid Vertical Fire Spread



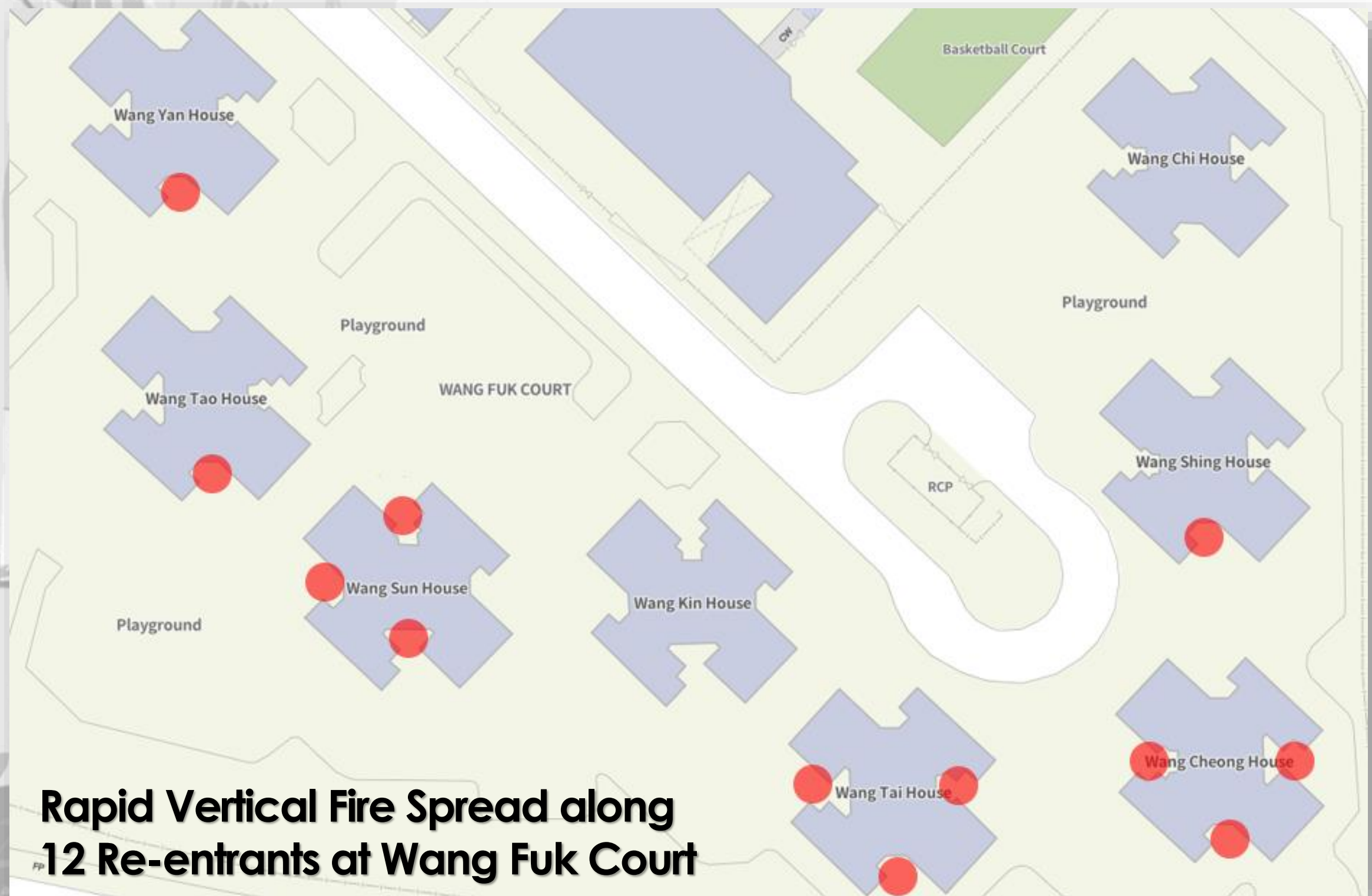
2. Fire Spread into Units



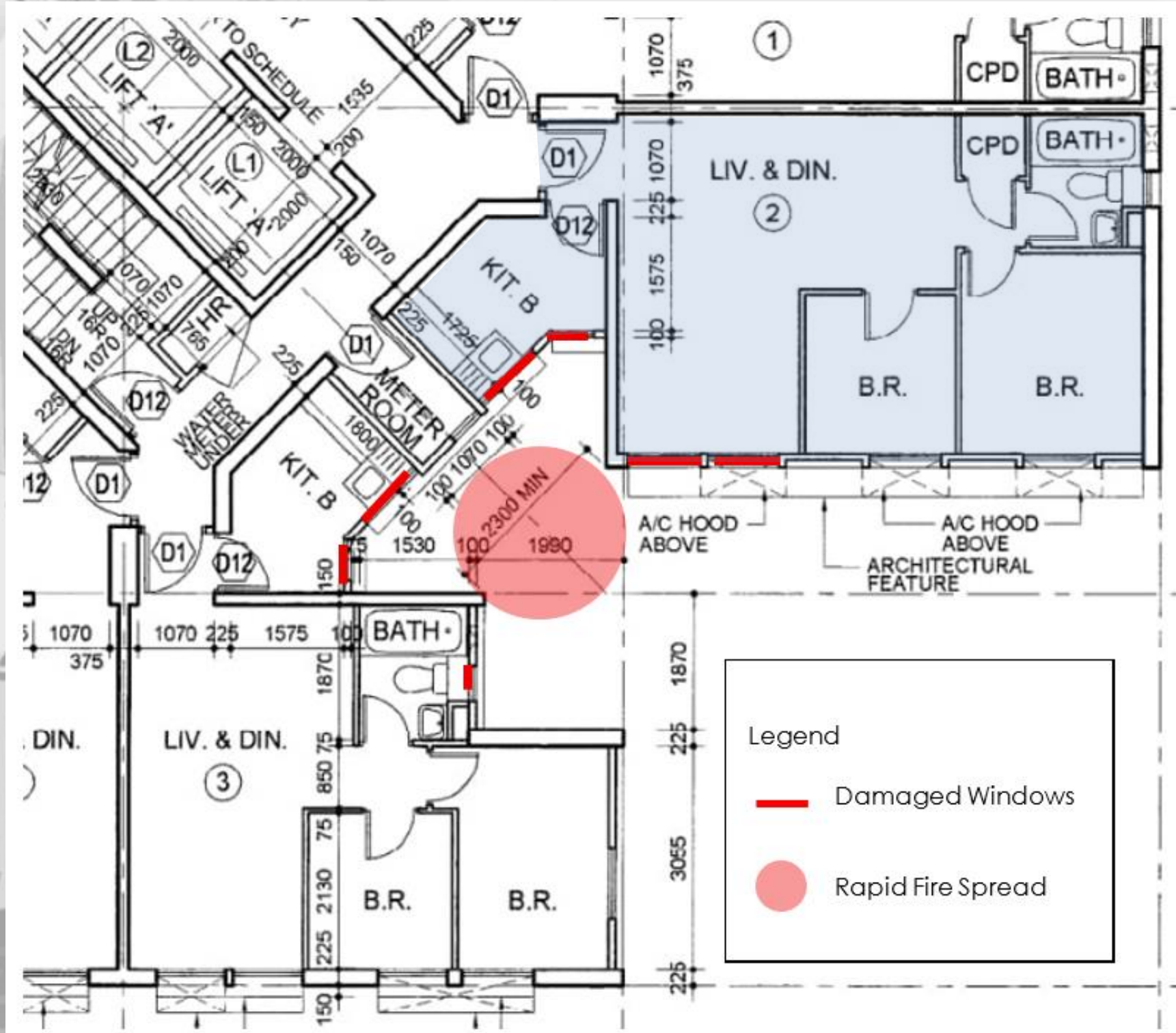
3. Secondary Ignitions



Fire Spread into Units



Fire Spread into Units



Extract of Floor Plan of Wang Yan House

Post Fire Condition of Unit 02



Kitchen



Living Room

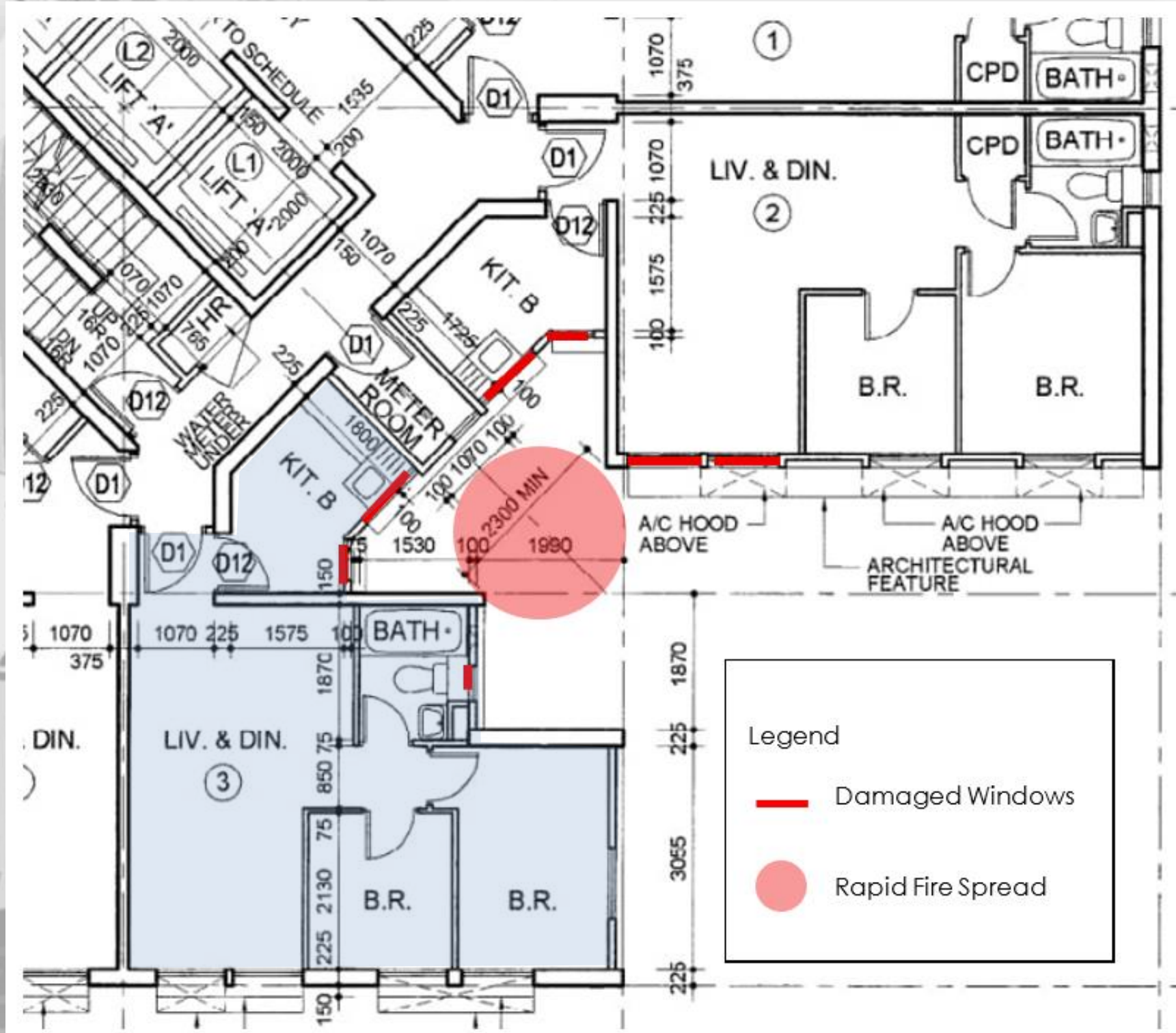


Toilet



Bedroom

Fire Spread into Units



Extract of Floor Plan of Wang Yan House

Post Fire Condition of Unit 03



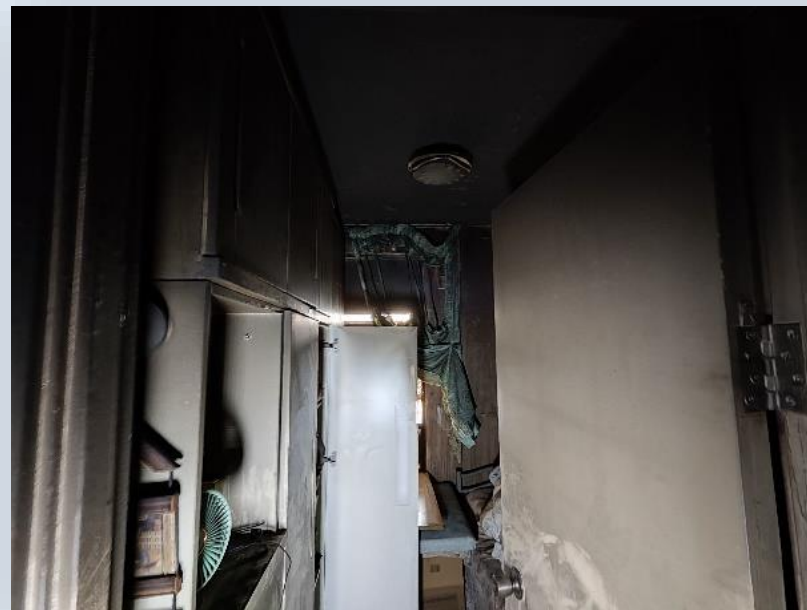
Kitchen



Living Room



Toilet



Bedroom

Fire Spread into Units



South Re-entrant of
Wang Tao House



Once the fire entered a unit, it could further **spread** through openings and windows **to previously unaffected façades.**

Fire Spread into Units – Other Observations



- Façade to Units Spread **Beyond Re-entrant Area**



External View of Wang Kin House

Fire Spread into Units – Other Observations

- Façade to Units Spread Beyond Re-entrant Area
- **Internal Fire Spread**



Figure 8-4: Floor Plan of Wang Yan House

Floor Plan of Wang Yan House



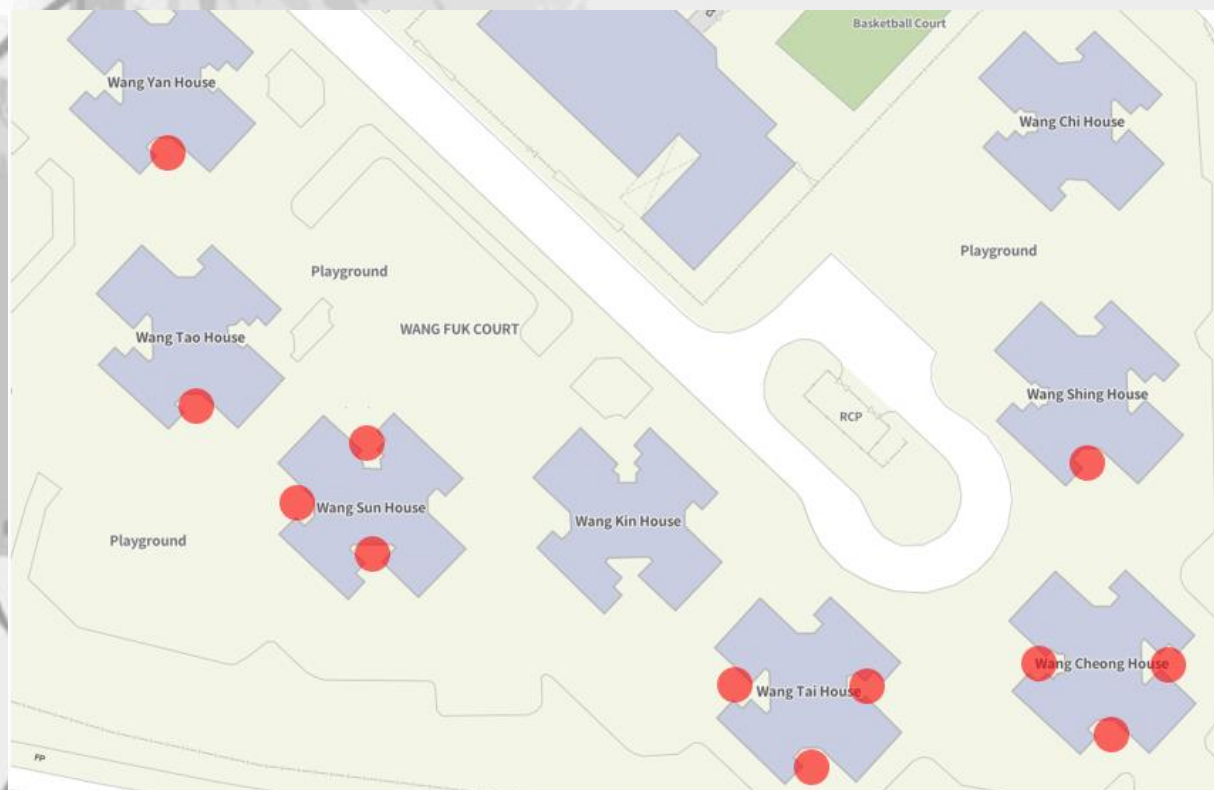
Damaged Unit Entrance Door



Damaged Smoke Stop Door

Fire Spread into Units

Façade Fire Transforming into Interior Fires



Rapid Vertical Fire Spread along
12 Re-entrants at Wang Fuk Court

- Within a **two-hour period**, 11 instances of rapid fire spread were observed at various re-entrants across multiple buildings.
- It is conservatively estimated that more than **470 units** were affected by the fire.



West Re-entrant
Wang Cheong House - 1509 Hrs



Wang Cheong House - 1545 Hrs

Fire Spread into Units

Façade Fire Transforming into Interior Fires



Rapid Vertical Fire Spread along Wang Cheong House and Wang Tai House

- Within a **two-hour period**, 11 instances of rapid fire spread were observed at various re-entrants across multiple buildings.
- It is conservatively estimated that more than **470 units** were affected by the fire.



West Re-entrant
Wang Cheong House - 1509 Hrs



Wang Cheong House - 1545 Hrs



Secondary Ignitions



Test 3 - Sample 2 (Uncertified)



Test 8 - Sample 3 (Non-FR)



Test 12 - Sample 4 (Wang Chi)

Secondary Ignitions – Source



Flaming Droplets



Wind-Carried Embers



Falling Debris

Secondary Ignitions – **Flaming Droplets**

Video



Wang Cheong House
1451 Hrs

Video

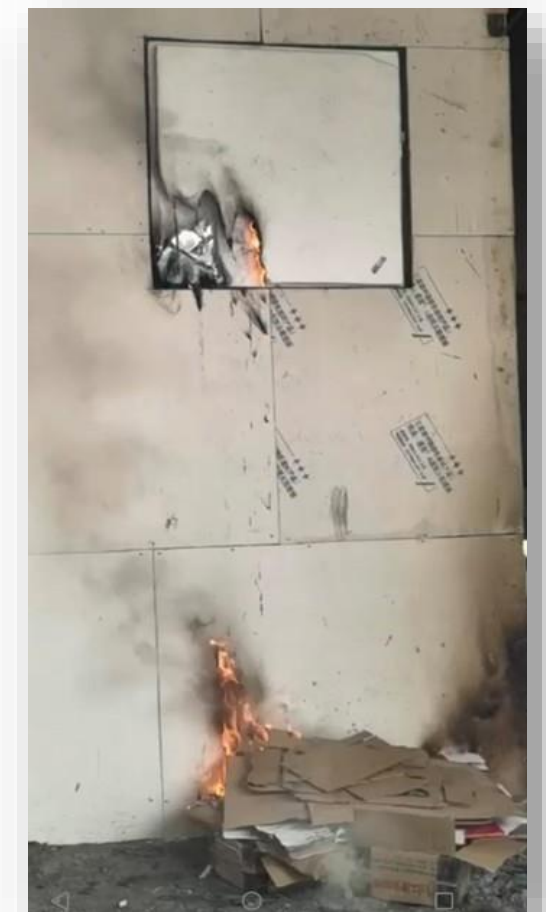
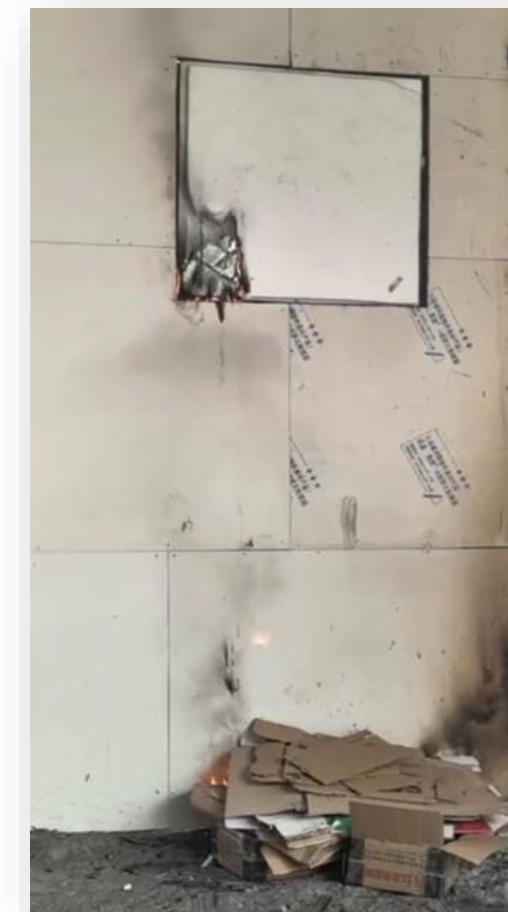


Test 3 - Sample 2 (Uncertified)

Test Reports from GL

Formation of Flaming Droplets

- Safety Nets
- Polystyrene Window Covers
- Canvas
- Toe-boards
- Corrugated Plastic Boards

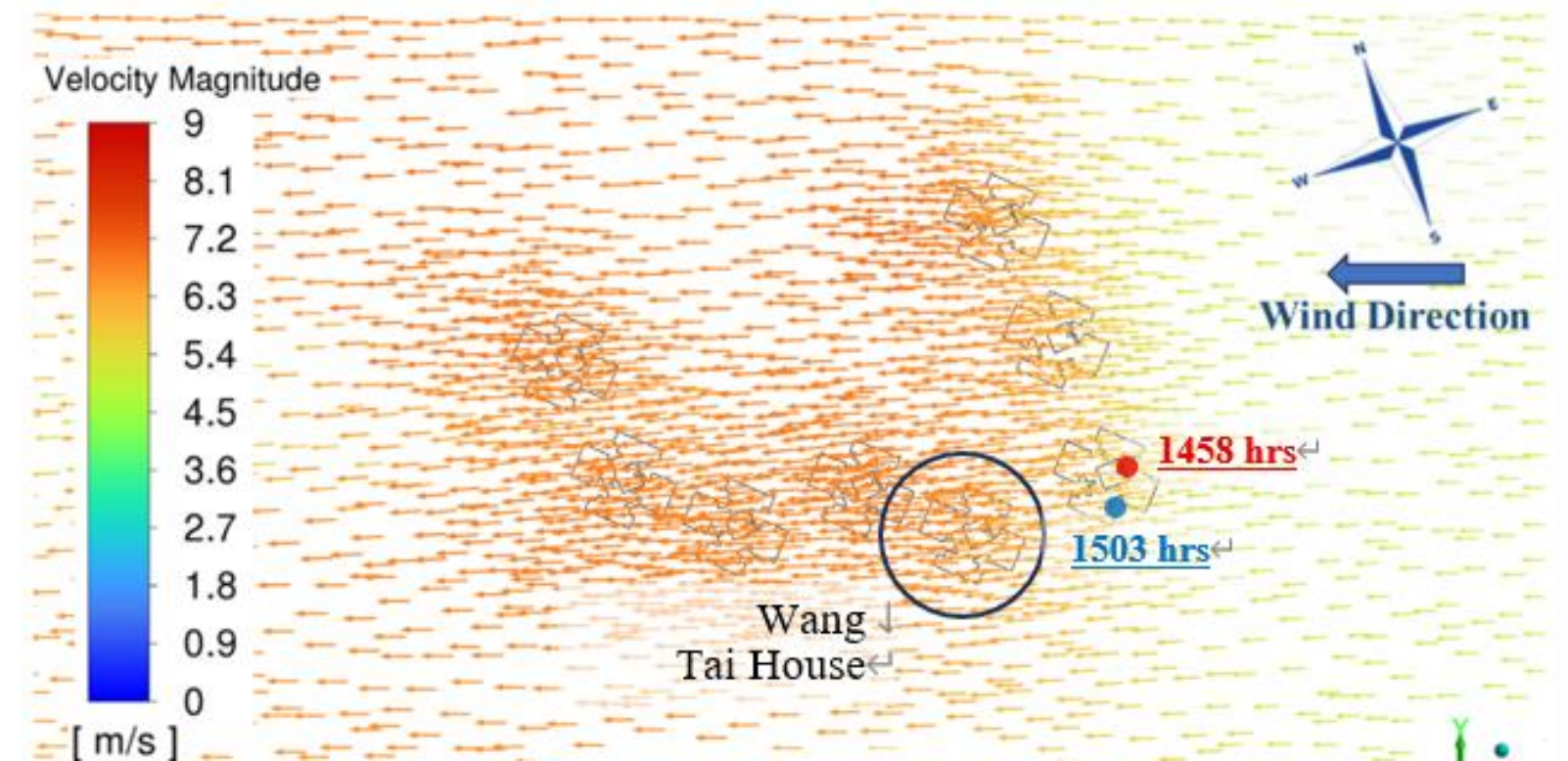


Secondary Ignitions – Wind-Carried Embers

Wang Cheong House



R/F, Wang Tai House - 1458 Hours

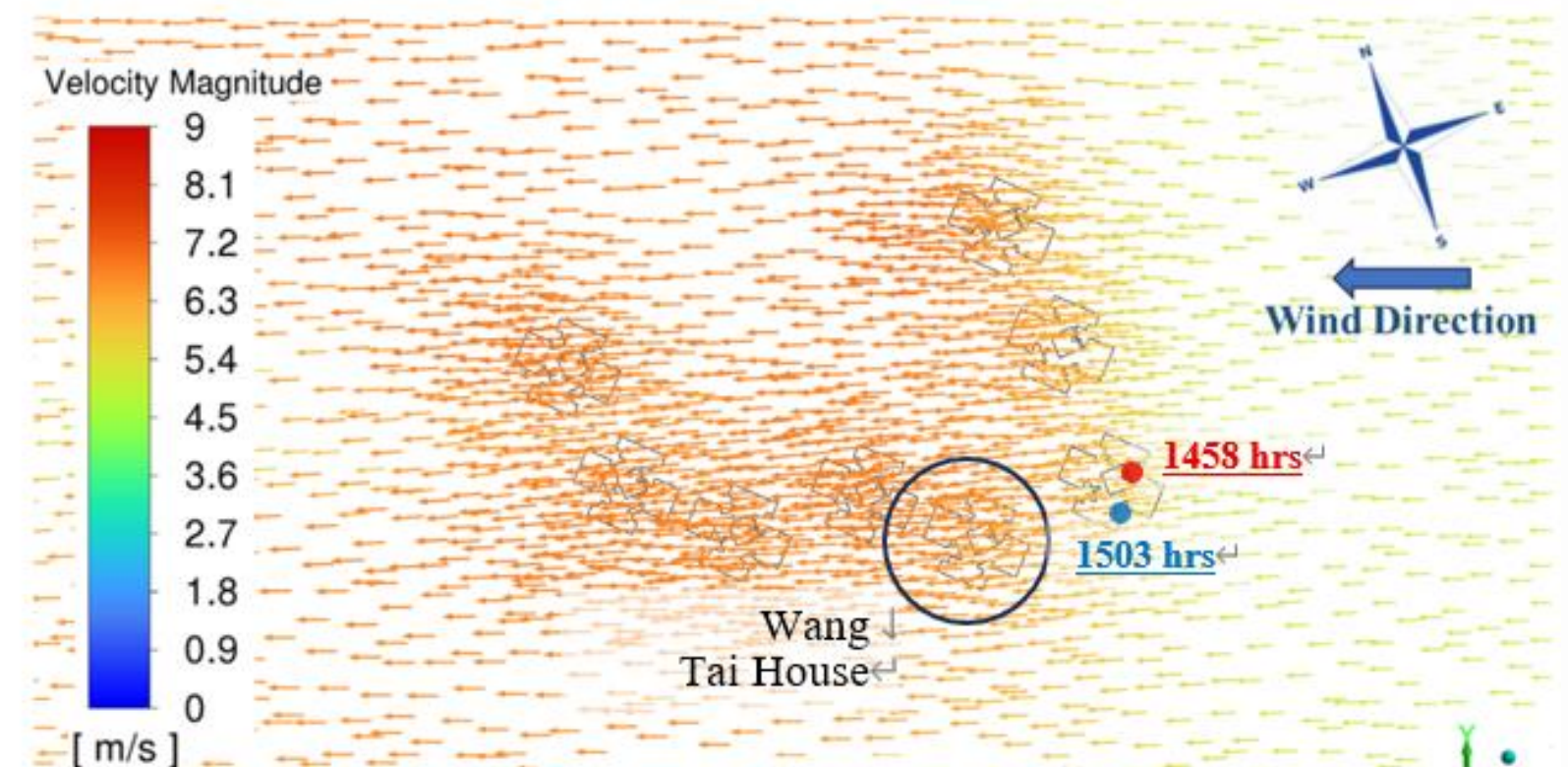


Secondary Ignitions – Wind-Carried Embers

Wang Cheong House

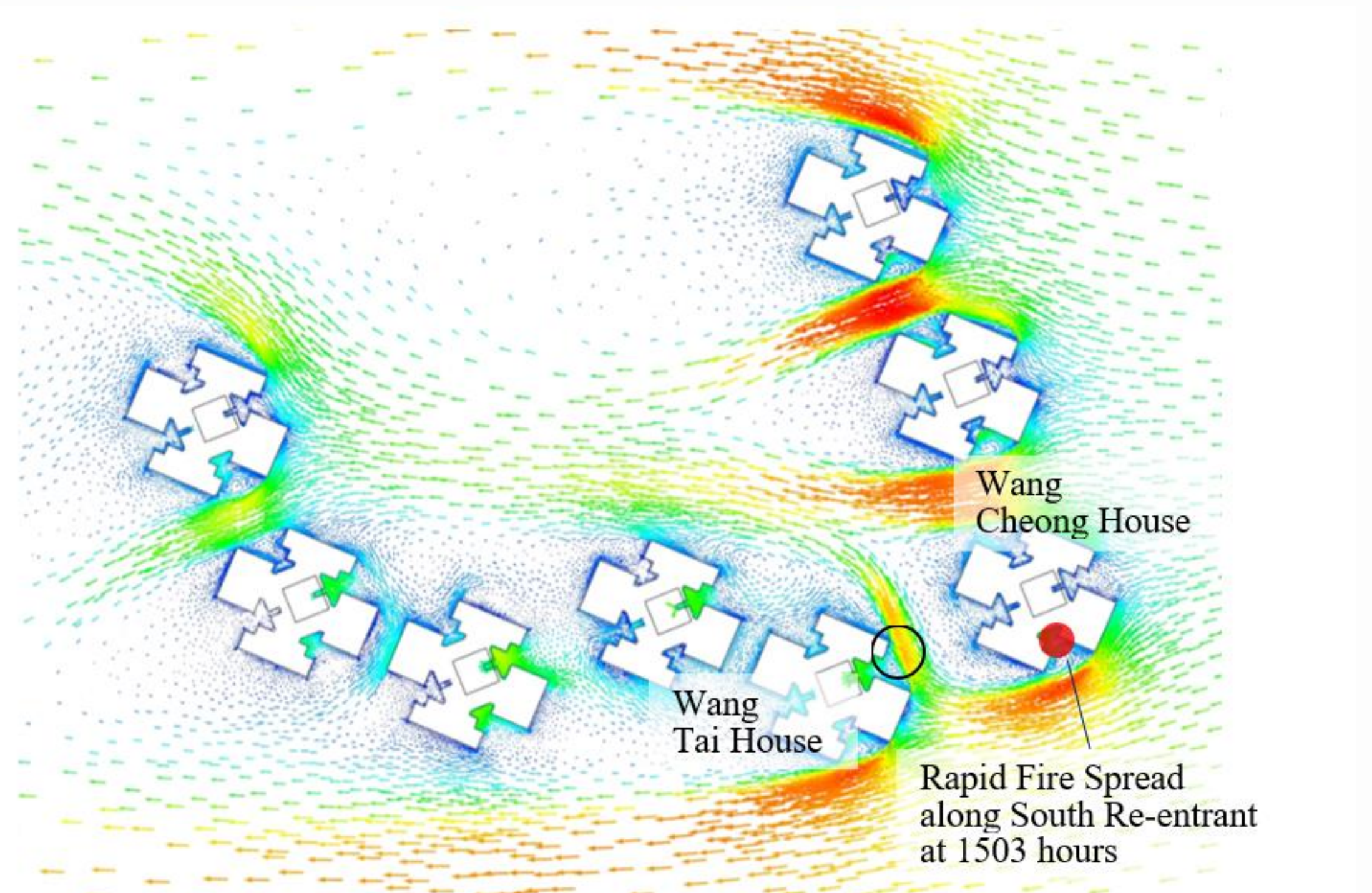


R/F, Wang Tai House - 1505 Hours



Secondary Ignitions – Wind-Carried Embers

Wang Cheong House



Wind Vector Contour at 40m Height

Secondary Ignitions – **Falling Debris**

Video



Wang Sun House 1601 Hrs

Secondary Ignitions – Falling Debris

Video

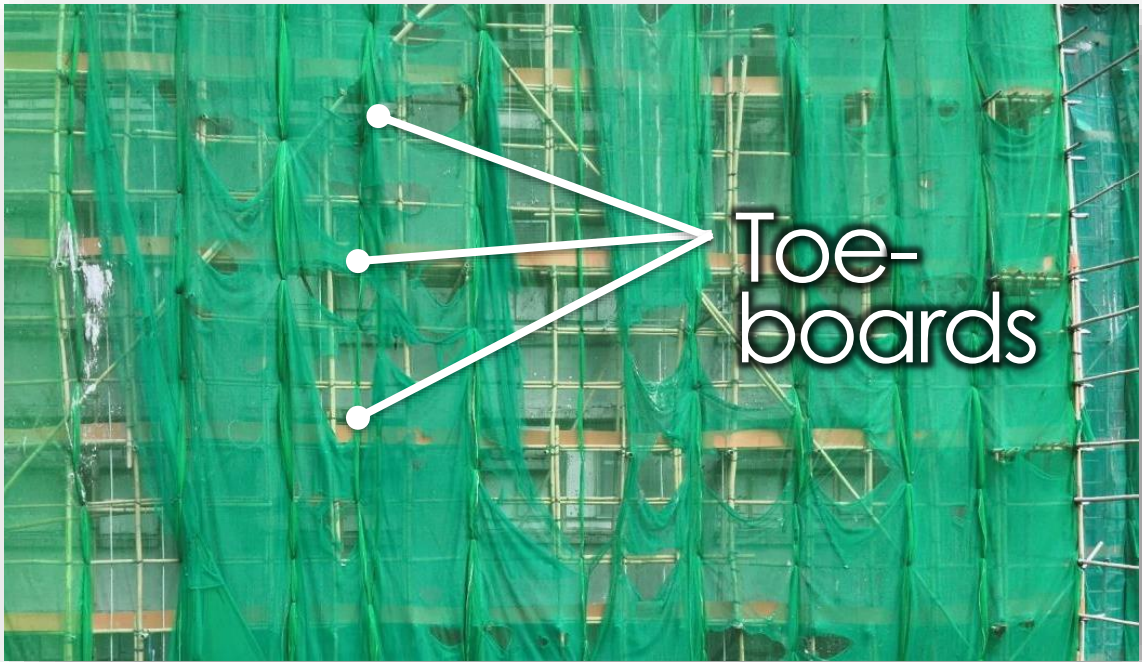
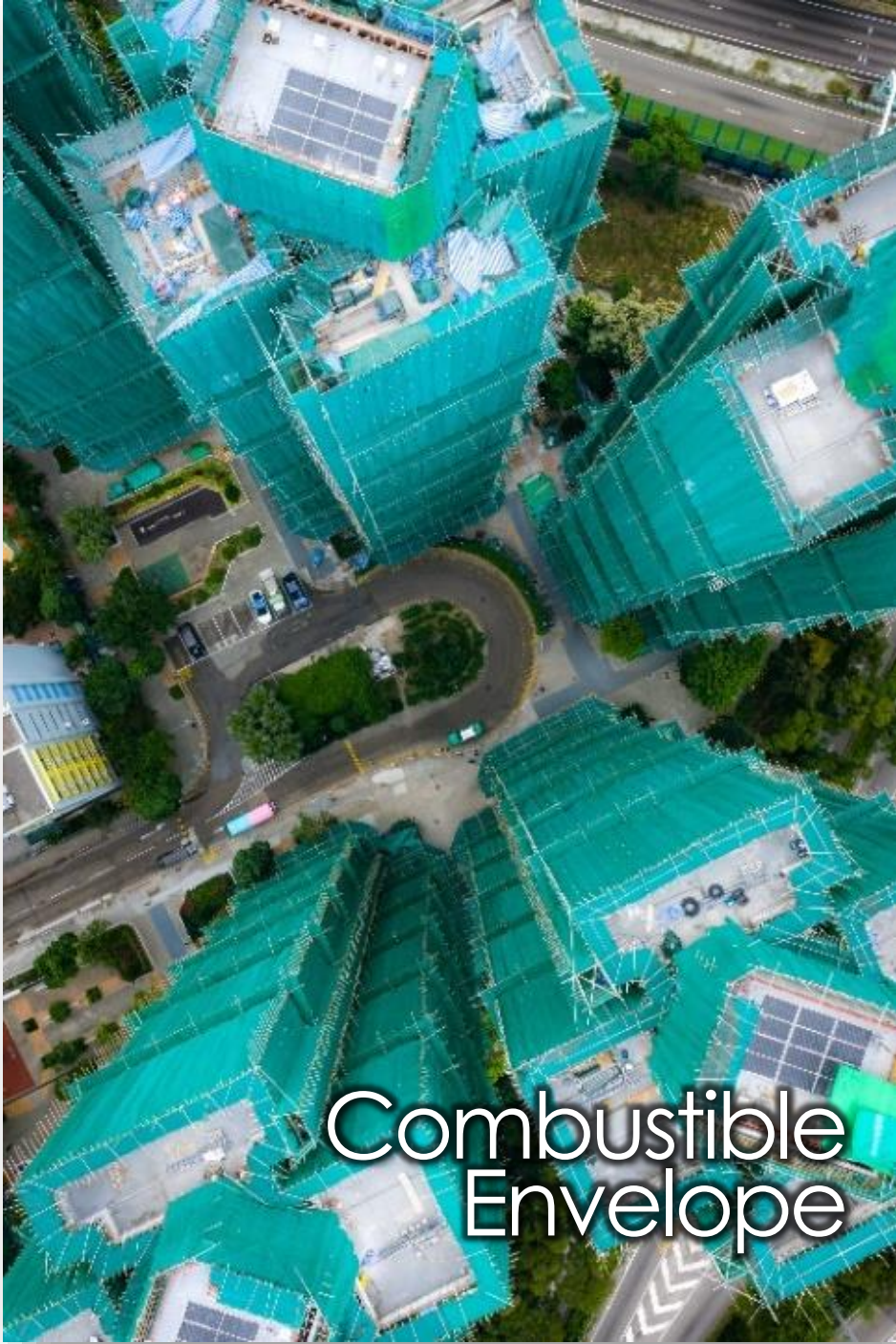


**Wang Cheong House
East Re-entrant 1458 Hrs**

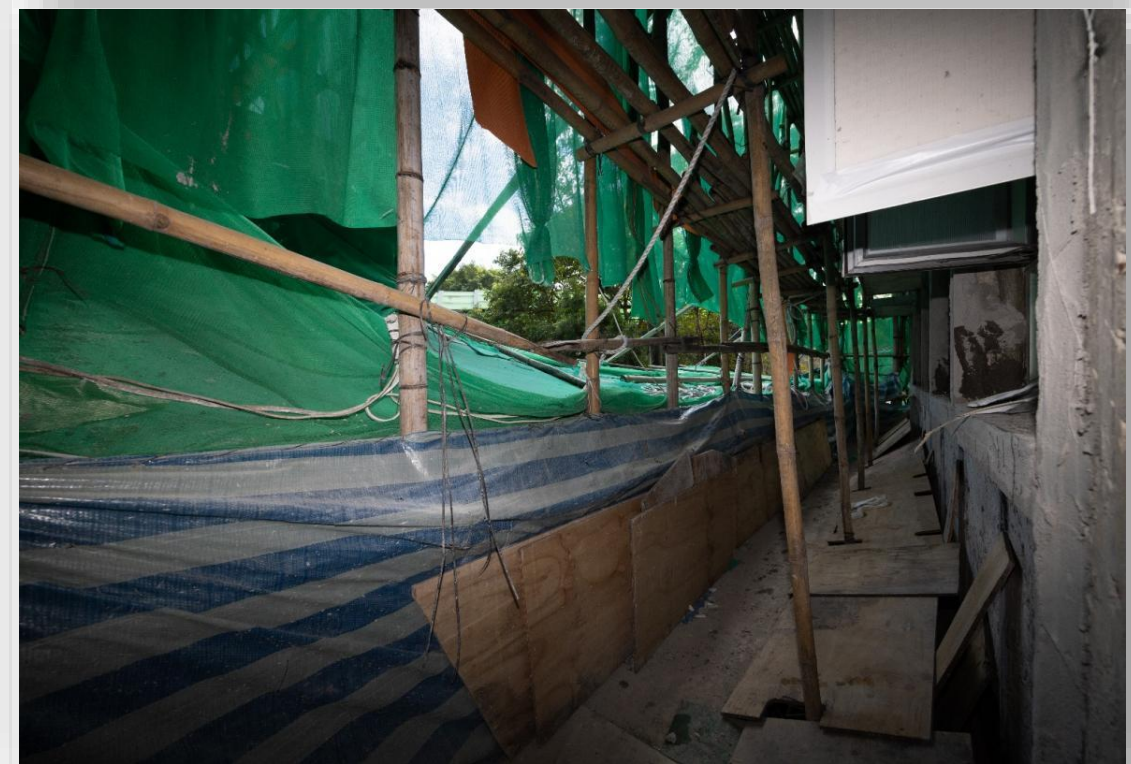


**Post-Fire Condition Outside
East Re-entrant of Wang Cheong House**

Secondary Ignitions – Combustibles



Secondary Ignitions – Effect of Canvas



1/F Wang Chi House

Secondary Ignitions – Effect of Canvas



**North Re-entrant of
Wang Cheong House**

Wang Chi House



Three Dominant Modes of Fire Spread

1. Rapid Vertical Fire Spread



2. Fire Spread into Units



3. Secondary Ignitions

Interconnected Modes Promoting Fire Progression



Rapid Vertical Fire Spread along the Re-entrant

This allowed the fire to **spread simultaneously across 31 levels**. The intense flames and heat generated in the re-entrant drove the rapid vertical progression of the fire.



Interconnected Modes Promoting Fire Progression



Façade Fire Transforming into Interior Fires

The **rapid vertical fire** spread along the re-entrant **transitioned the façade fires into interior fires** through broken or open windows and other openings, or in some cases, through radiation ignition.

Interconnected Modes Promoting Fire Progression



Rapid Vertical Fire Spread



- **Carried embers to great heights**, allowing them to follow the wind flow and travel considerable distances before falling



- **Propelled debris** to surrounding areas.

Interconnected Modes Promoting Fire Progression



Flaming Droplets



Wind-Carried Embers



Falling Debris



Secondary Ignition



Combustible
Envelope

Interconnected Modes Promoting Fire Progression



Secondary Ignition



Secondary Ignitions via Embers, Flaming Droplets and Falling Debris

When these secondary ignitions occurred **within nearby re-entrants**, they had the potential to initiate a **new cycle of fire development**. This, in turn, led to the rapid vertical fire spread along another re-entrant, perpetuating the fire's growth and destruction.

Interconnected Modes Promoting Fire Progression



Discovery of Fire at Wang Cheong House

The escalation of the **Tiny Ignition Source** was driven by two key factors:

- **Accumulation of combustible materials;**
- Presence of suspected non-FR materials in the re-entrant space.



**Fire Developed from
a Small Fire Source During Fire Tests**

Interconnected Modes Promoting Fire Progression



Suspected
Canvas

The escalation of the Tiny Ignition Source was driven by two key factors:

- Accumulation of combustible materials;
- Presence of suspected non-FR materials in the re-entrant space.



1/F Wang Chi House



Post-Fire Condition
in Test 11 using **FR Safety
Nets** and **FR Canvas**



Test 13 using Safety Nets
collected from **Wang Chi House**
and **non-FR Canvas**

Weather
Condition



Re-entrant

Ignition Source

Combustible

Non-FR Materials



**Rapid Vertical Fire Spread
Along Re-entrant**

Weather
Condition



Full Scale Fire Test – Test 13



Rapid Vertical Fire Spread
Along Re-entrant

Rapid Vertical Fire Spread
Along Re-entrant



Weather
Condition



Re-entrant



Ignition Source



Combustible



Non-FR Materials

Interconnected Modes
Promoting Fire Progression

**Rapid Vertical Fire Spread
Along Re-entrant**

**Fire Spread
into Units**

**Weather
Condition**



**Spread to
Unaffected Façade**



Droplet

Ember

Debris



Re-entrant



Ignition Source



Combustible



Non-FR Materials

**Interconnected Modes
Promoting Fire Progression**

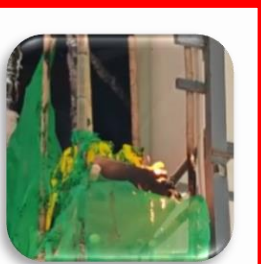
**Rapid Vertical Fire Spread
Along Re-entrant**

**Fire Spread
into Units**

**Weather
Condition**



**Spread to
Unaffected Façade**



Droplet



Ember



Debris



Re-entrant



Ignition Source



Combustible



Non-FR Materials

**Interconnected Modes
Promoting Fire Progression**

**Rapid Vertical Fire Spread
Along Re-entrant**

**Fire Spread
into Units**

**Weather
Condition**



**Spread to
Unaffected Façade**

Droplet



Ember



Debris



Combustible Envelope



Secondary Ignition



Re-entrant



Ignition Source



Combustible



Non-FR Materials

**Interconnected Modes
Promoting Fire Progression**

**Rapid Vertical Fire Spread
Along Re-entrant**

**Fire Spread
into Units**

**Weather
Condition**



**Spread to
Unaffected Façade**



Combustible Envelope

Droplet



Ember



Debris



Secondary Ignition



Re-entrant



Ignition Source



Combustible



Non-FR Materials

**Interconnected Modes
Promoting Fire Progression**

**Rapid Vertical Fire Spread
Along Re-entrant**

**Fire Spread
into Units**

**Weather
Condition**



**Spread to
Unaffected Façade**



Droplet



Ember



Debris

Combustible Envelope



Secondary Ignition



Re-entrant



Ignition Source



Combustible



Non-FR Materials

**Interconnected Modes
Promoting Fire Progression**

**Rapid Vertical Fire Spread
Along Re-entrant**

**Fire Spread
into Units**

**Weather
Condition**



**Spread to
Unaffected Façade**

Droplet



Ember



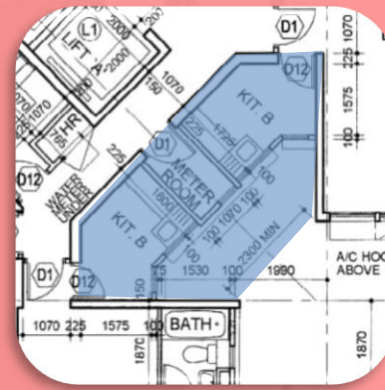
Debris



Combustible Envelope



Secondary Ignition



Another Re-entrant



Ignition Source



Combustible



Non-FR Materials

**Interconnected Modes
Promoting Fire Progression**



THE END