CCBST 15 – Paper 89

Implementing Compartmentalization and Ventilation Strategies in Tall Multi-Use Buildings to Control Stack-Effect Related Performance Issues

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SYNERGY PARTNERS

Introduction

Trends

- taller buildings
- multi-use buildings

Case Study

- 60+ storey tower in a cold climate
- residential, hotel, retail, commercial, event space over multi-level underground parking garage
- stack-effect related issues

Issues Reported

- Cold temperatures in lobby/parking levels;
- Whistling through elevator and stairwell doors;
- Rattling/whistling and damaged latches/astragals on doors between suites and corridors;
- Elevator doors not closing properly;
- Suite ventilation reversals;
- Whistling noise through suite range hoods;
- Condensation on glazing systems (Floors 18-25); and
- Garbage chute/shaft odour transfer

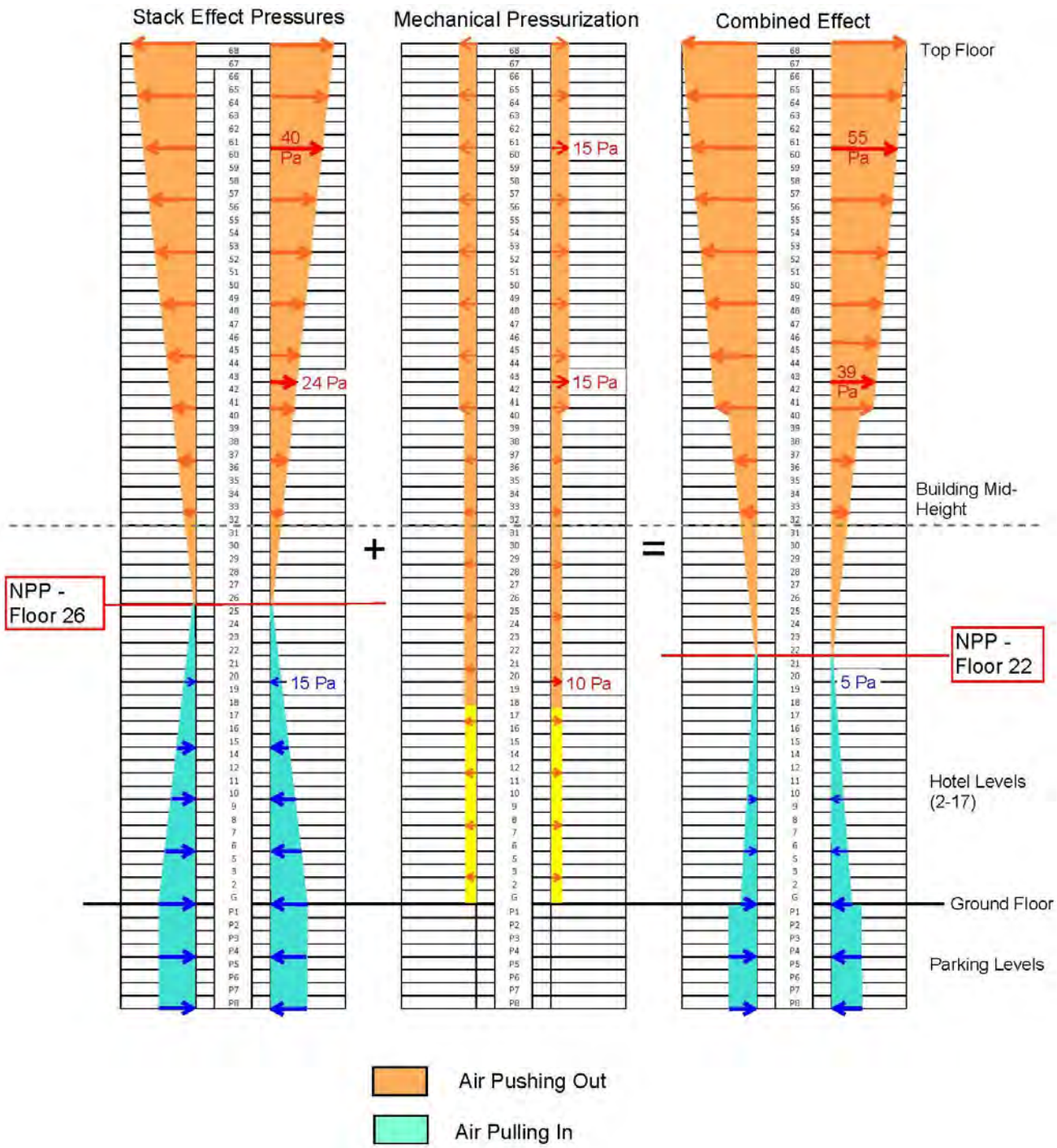
Energy Loss (?)
Indoor Air Quality (?)

NPP Location?

- No operable windows or sliding doors in the hotel (i.e. Floors 6 to 17)
- Suites not finished at top of building(?)

Evaluation

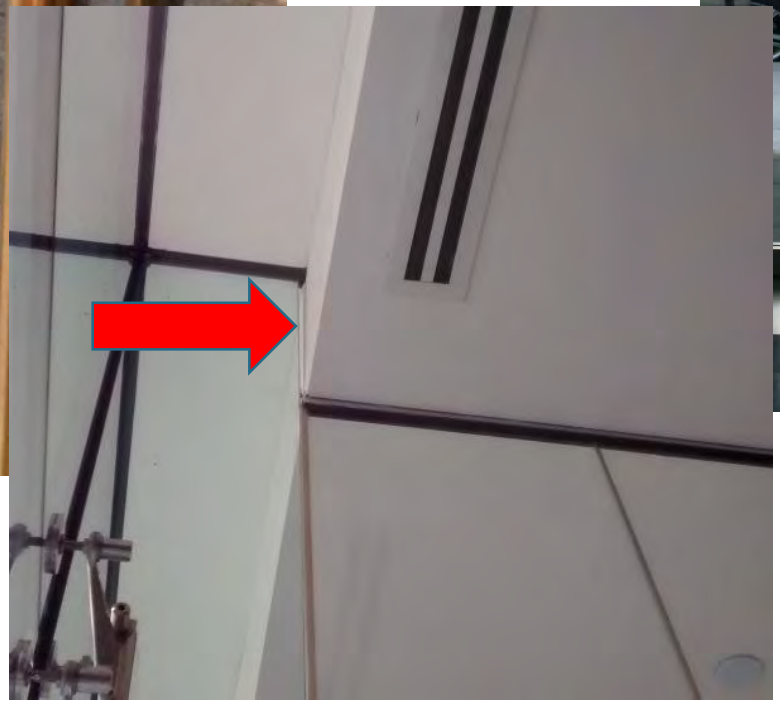
- Visual Review (Exterior/Interior Air Seals)
- Air Pressure, Temperature, and Relative Humidity Sensors (suite/stairwell doors)
- Thermographic Scan across the building envelope

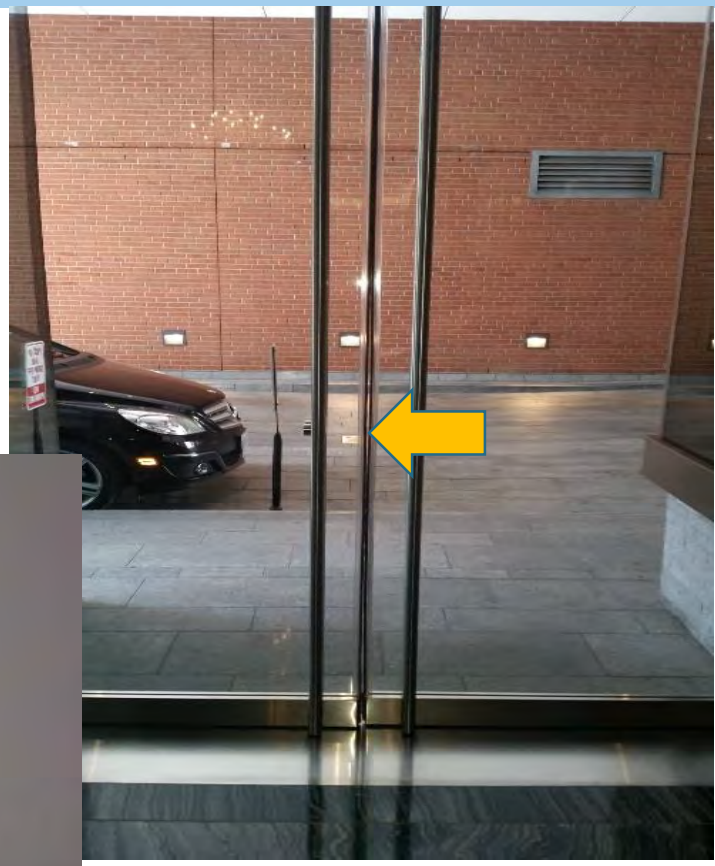

Stack Effect Pressures
Mechanical Pressurization
Combined Effect
Top Floor
40 Pa
24 Pa
15 Pa
15 Pa
15 Pa
10 Pa
55 Pa
39 Pa
5 Pa
Building Mid-Height
NPP - Floor 26
NPP - Floor 22
Hotel Levels (2-17)
Ground Floor
Parking Levels
+
=
Air Pushing Out
Air Pulling In

Paths

- Envelope openings below NPP - infiltration
- Vertical Shafts
- Corridors/Suite Doors
- Envelope openings above NPP - exfiltration

Significant Openings at Building Base





Significant Openings at Building Base

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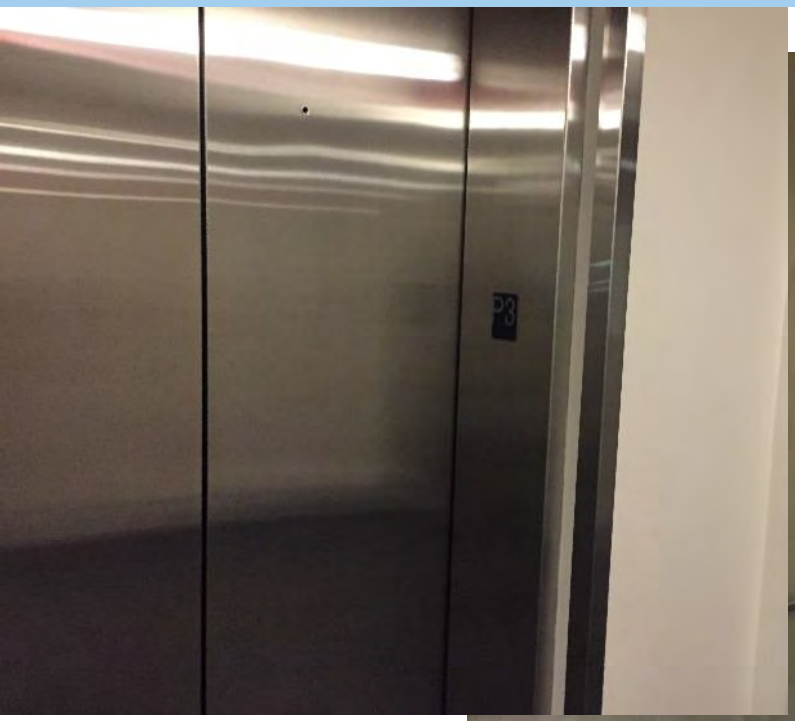
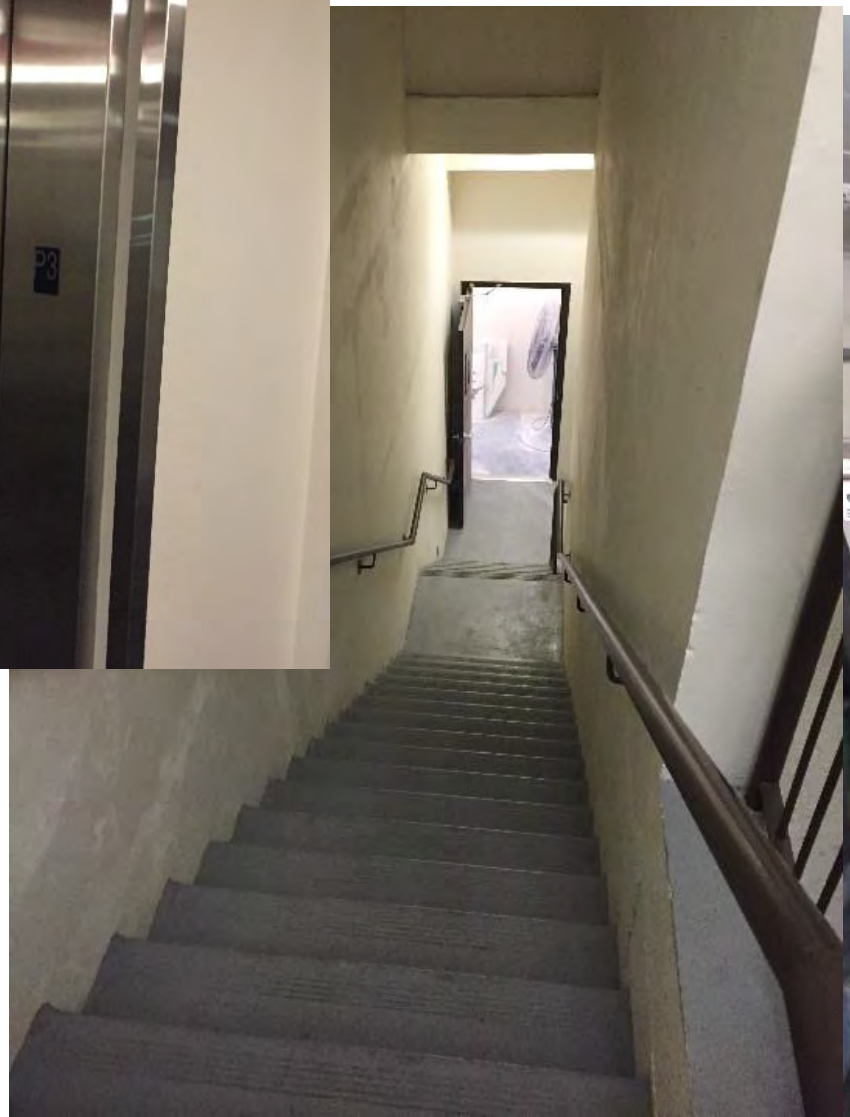
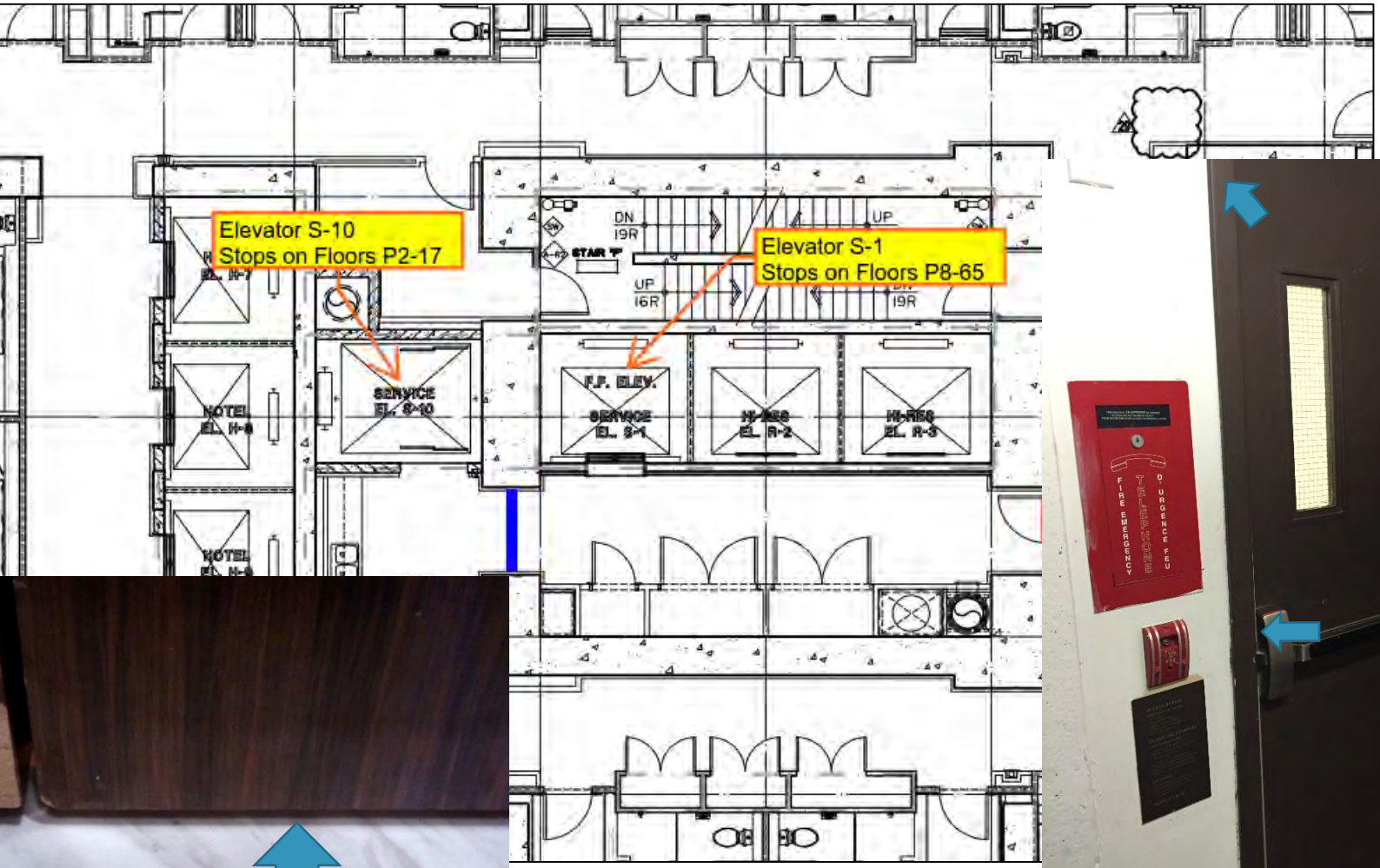
Inadequate Seals/Separations
Vertical Shafts

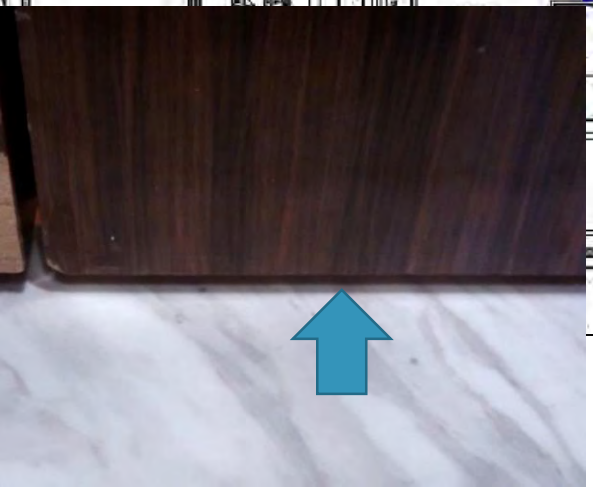




Inadequate Seals/Separations

Adjacent to Vertical Shafts





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Above NPP

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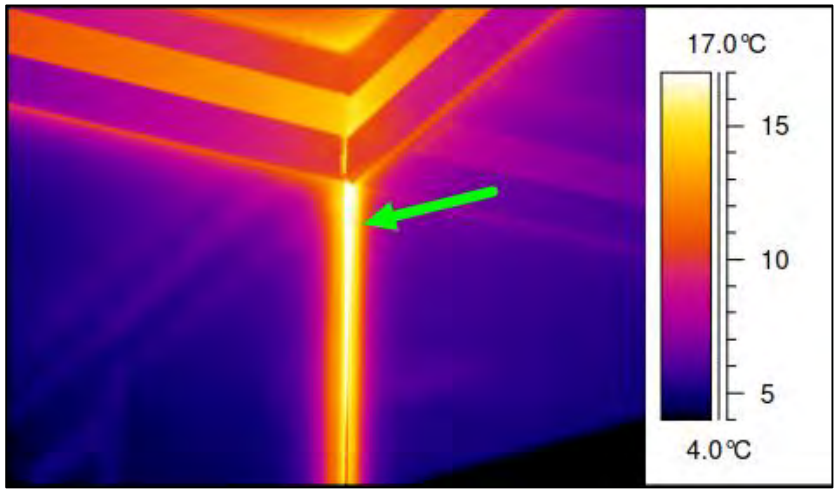
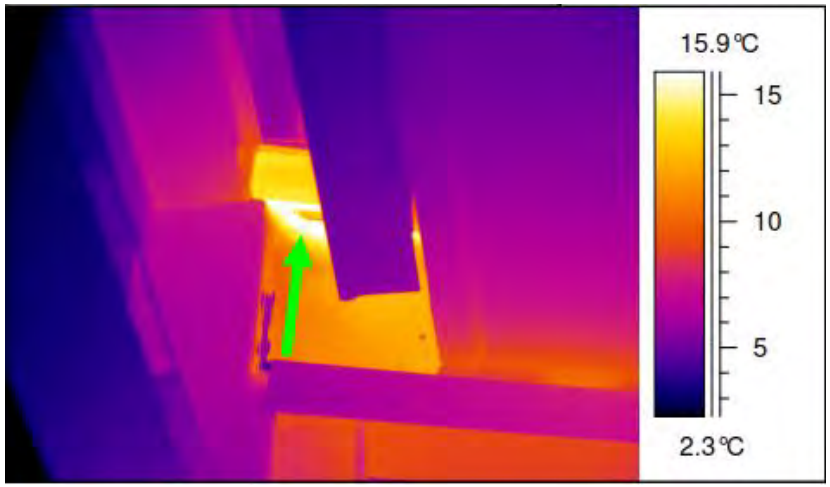
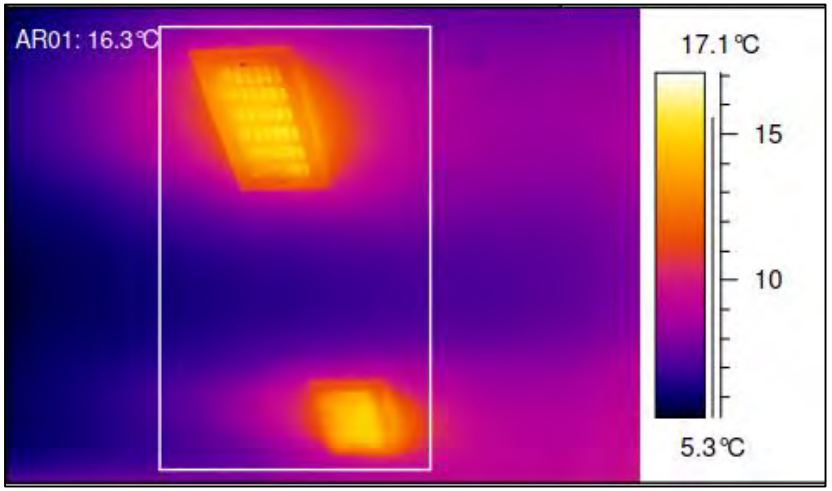
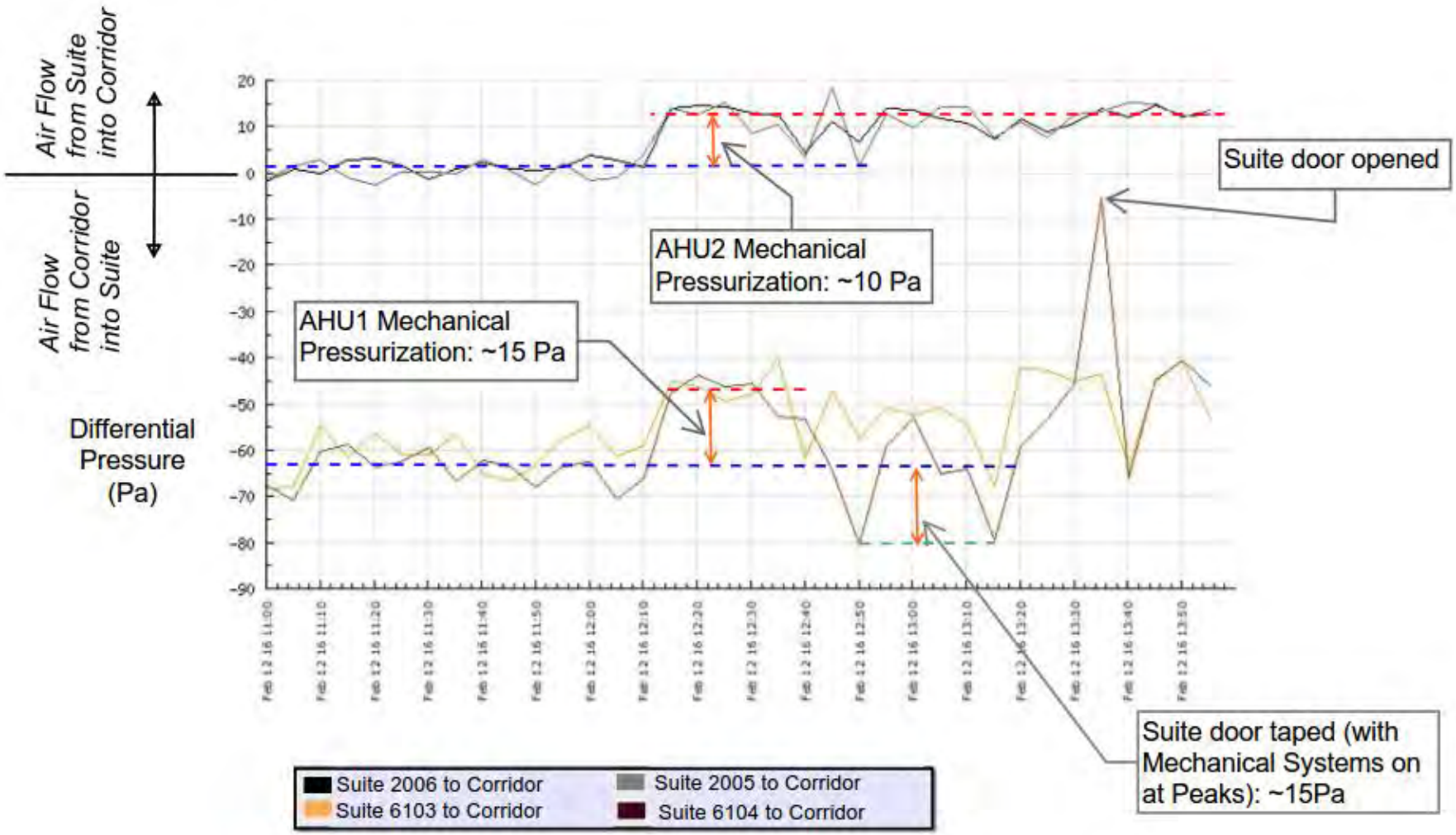
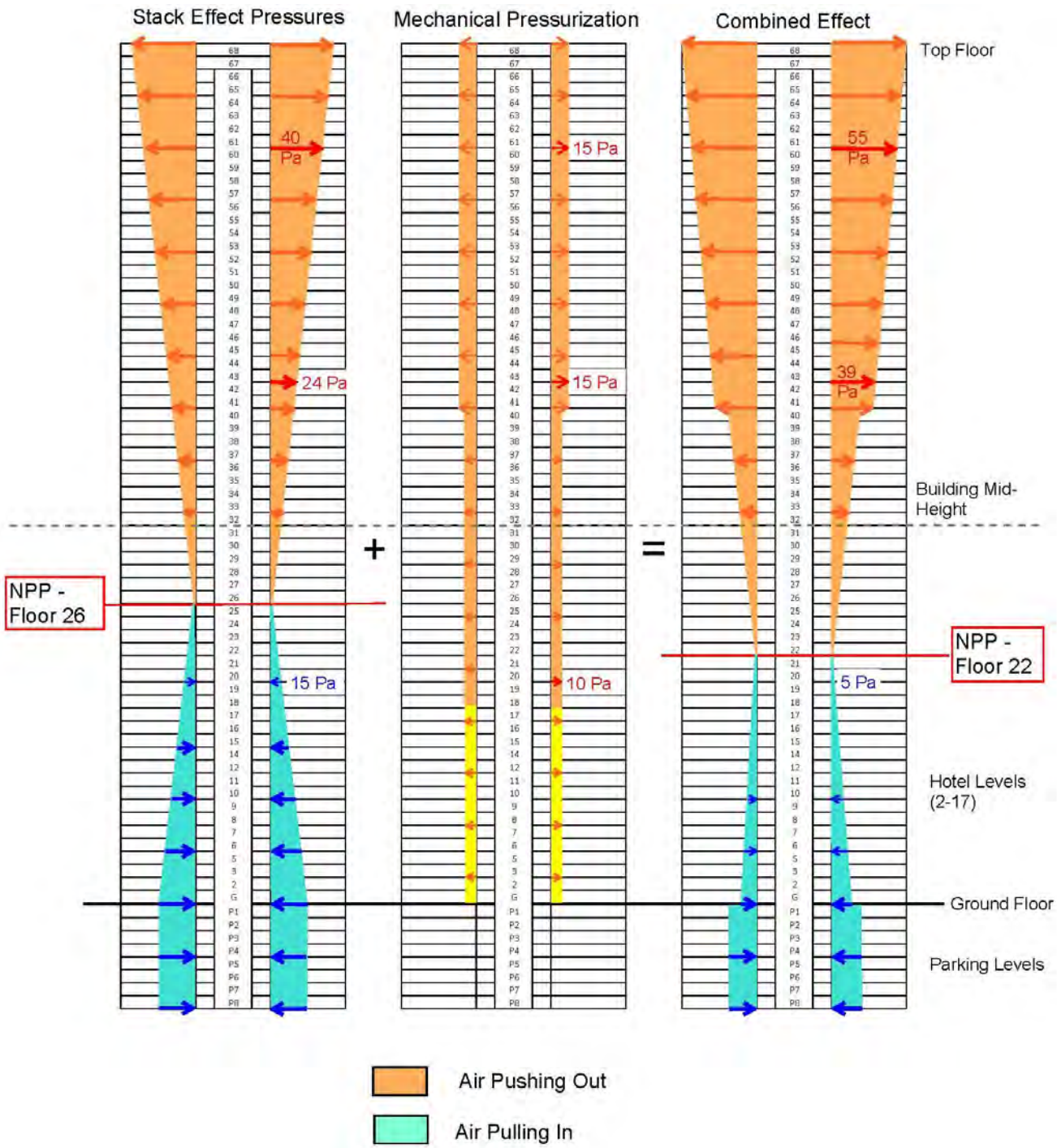






Ventilation System is not Operating as Intended

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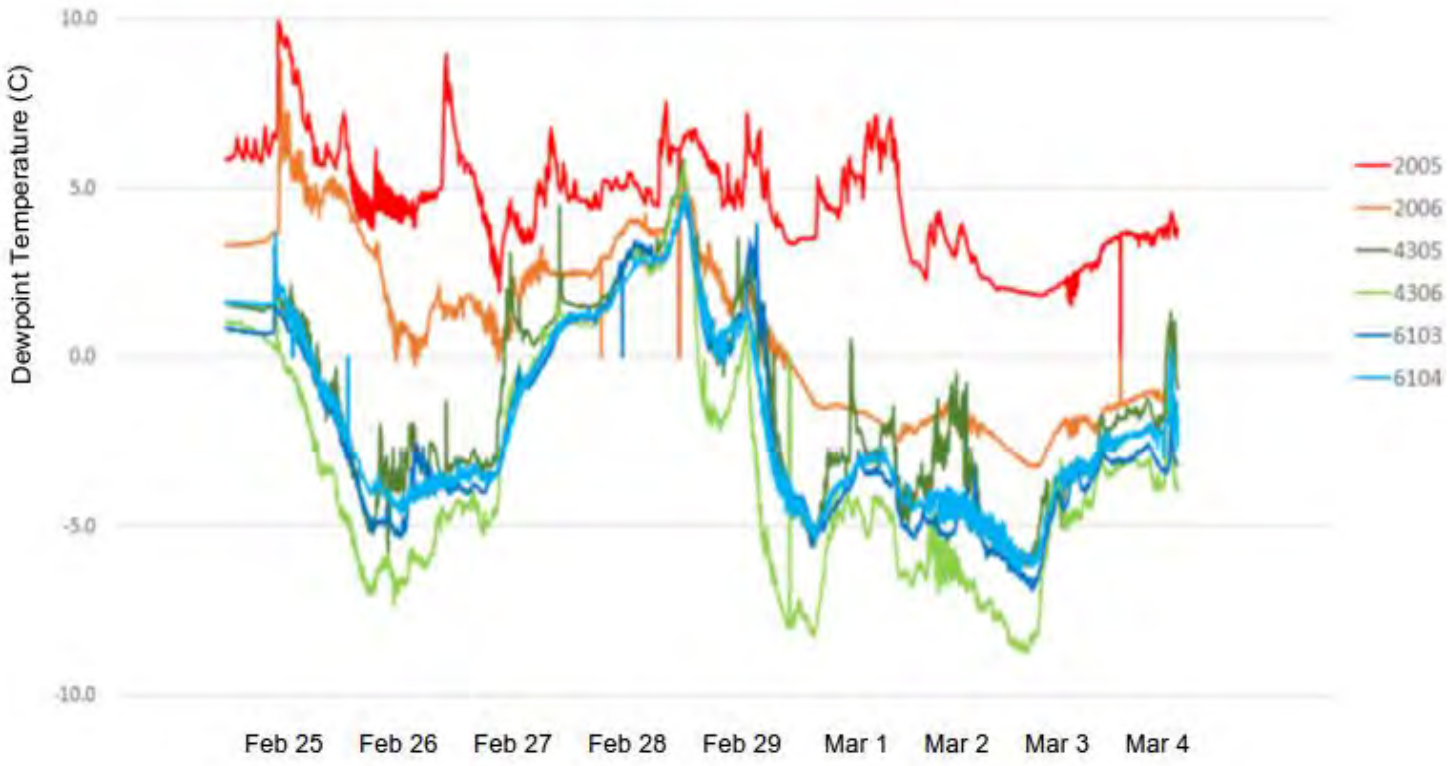
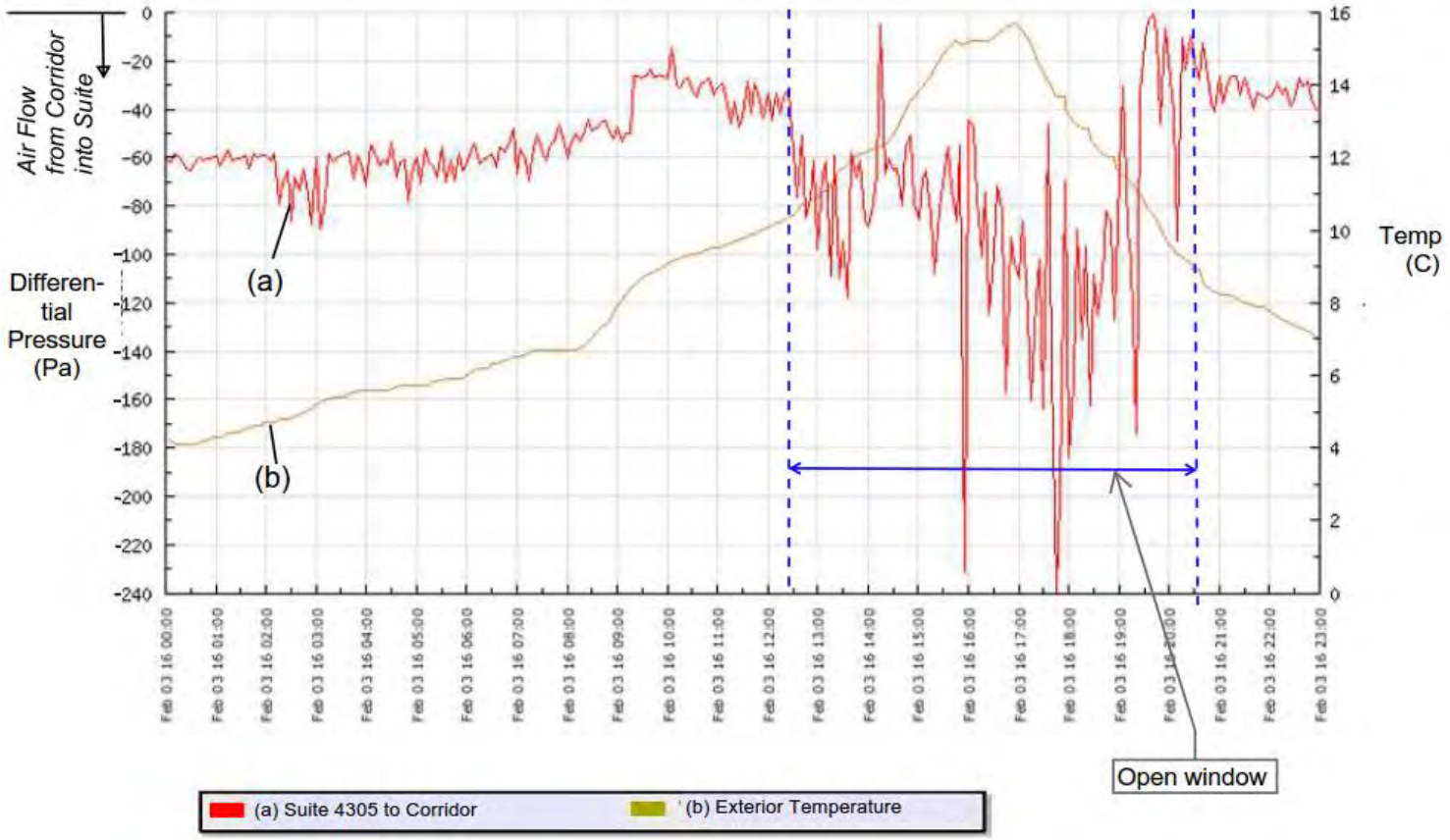
Air Pulling In

Stack Effect Pressures affect Interior Suite Humidity and Condensation



Intermittent Peak Pressures



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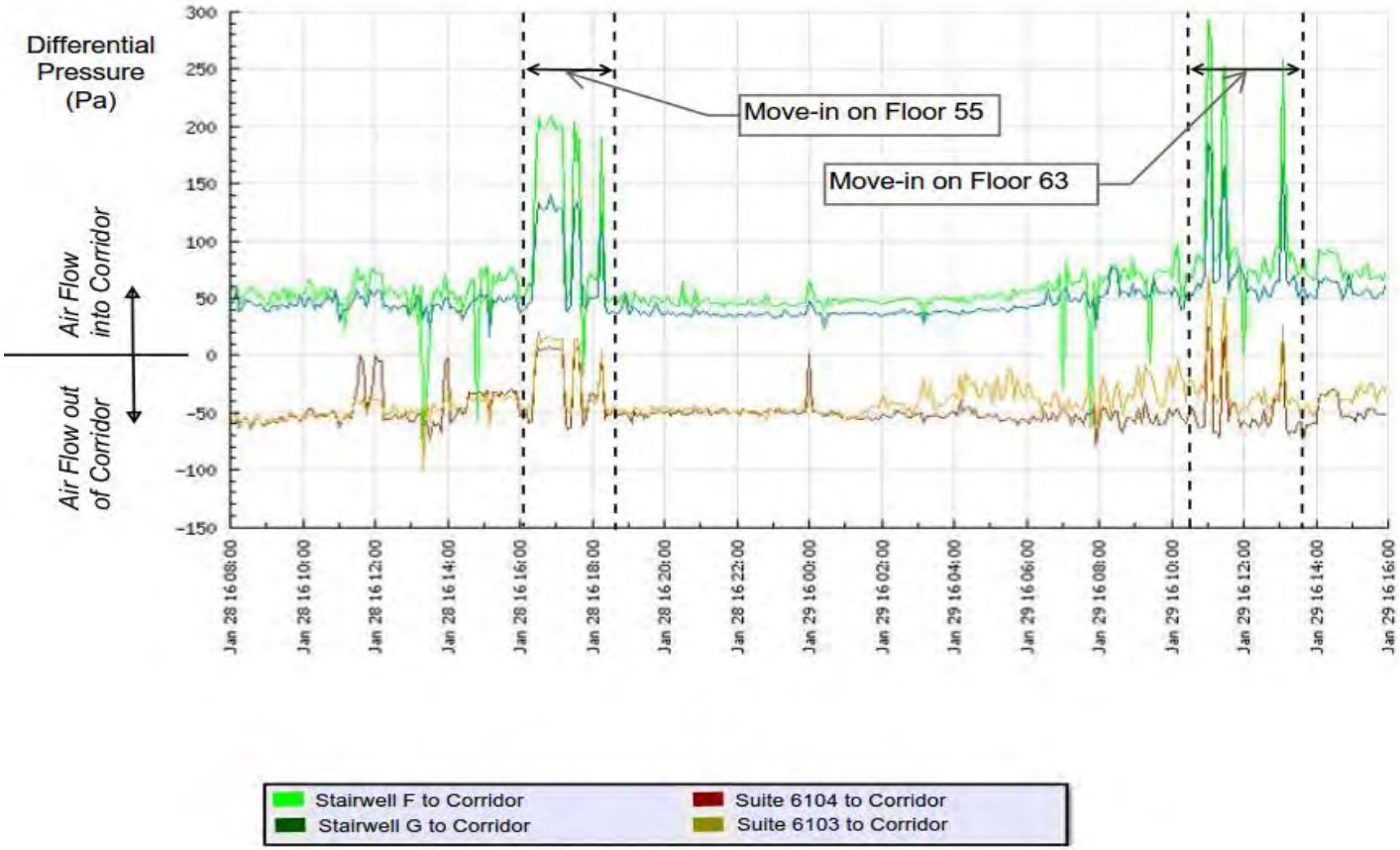
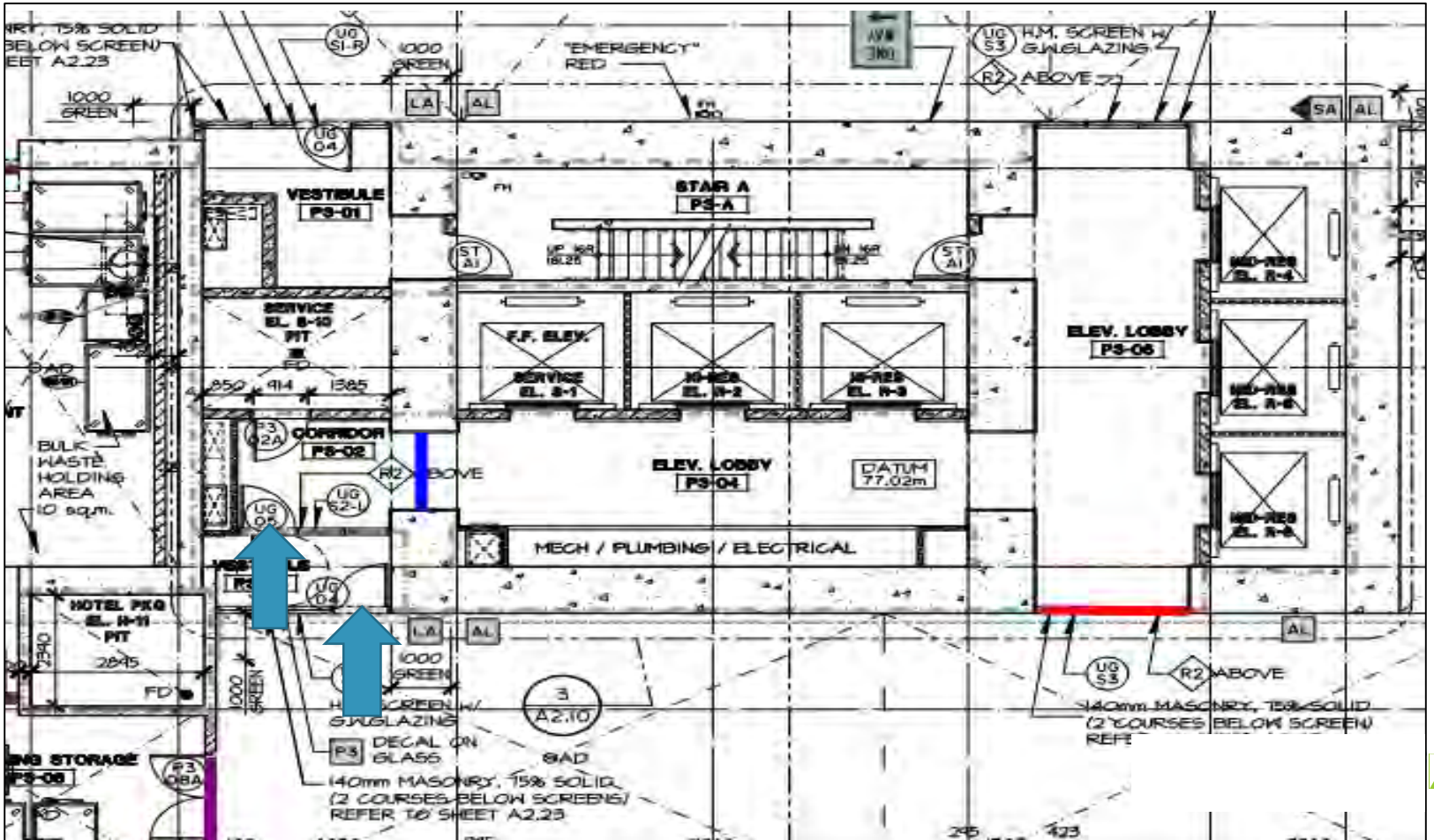


General Repair Strategies

- Implement Barriers and Compartments
- Implement Suite-Dedicated Ventilation Systems

High Impact Items

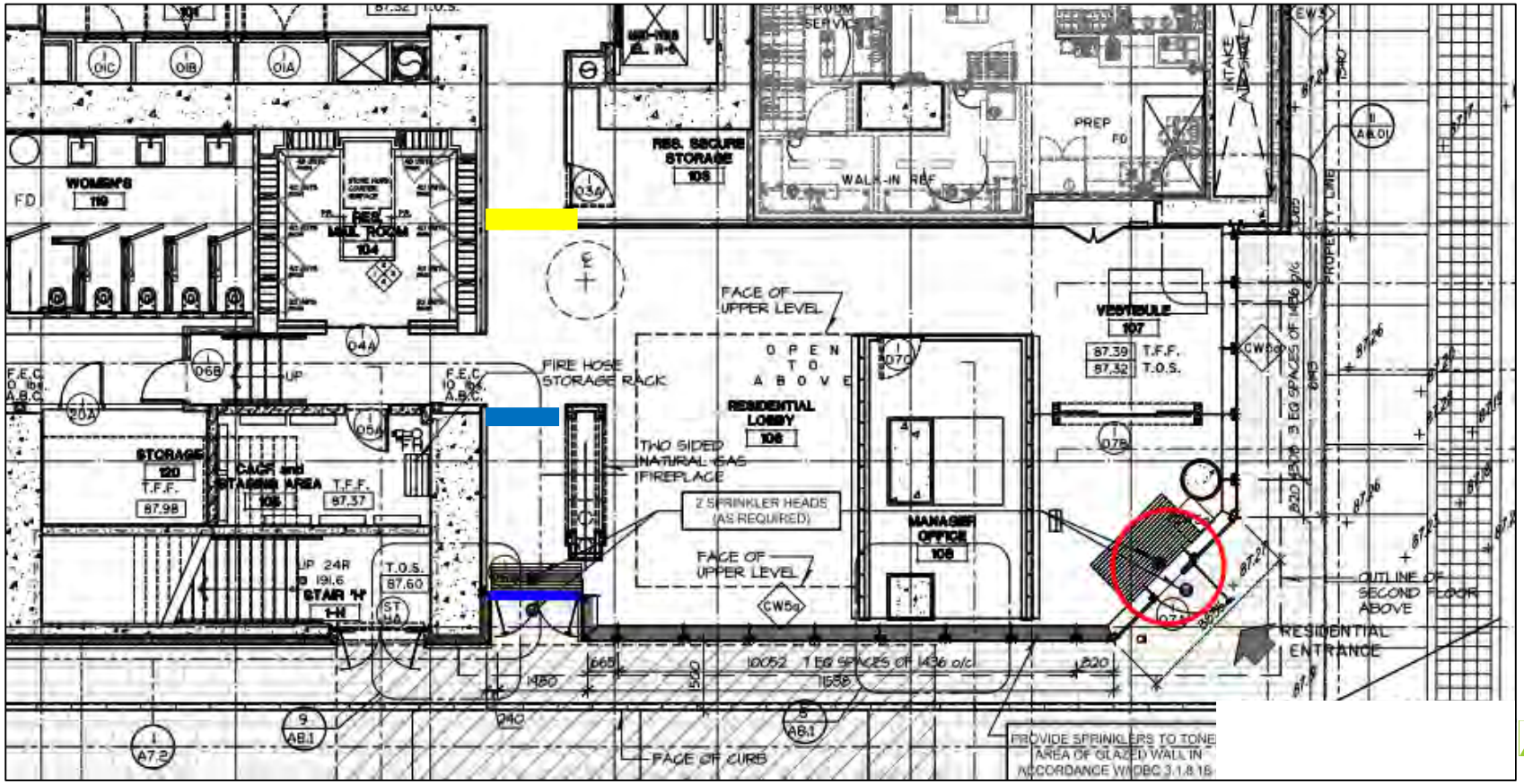
Add door between elevator lobby and the existing vestibule on each parking level (blue line)



High Impact Items

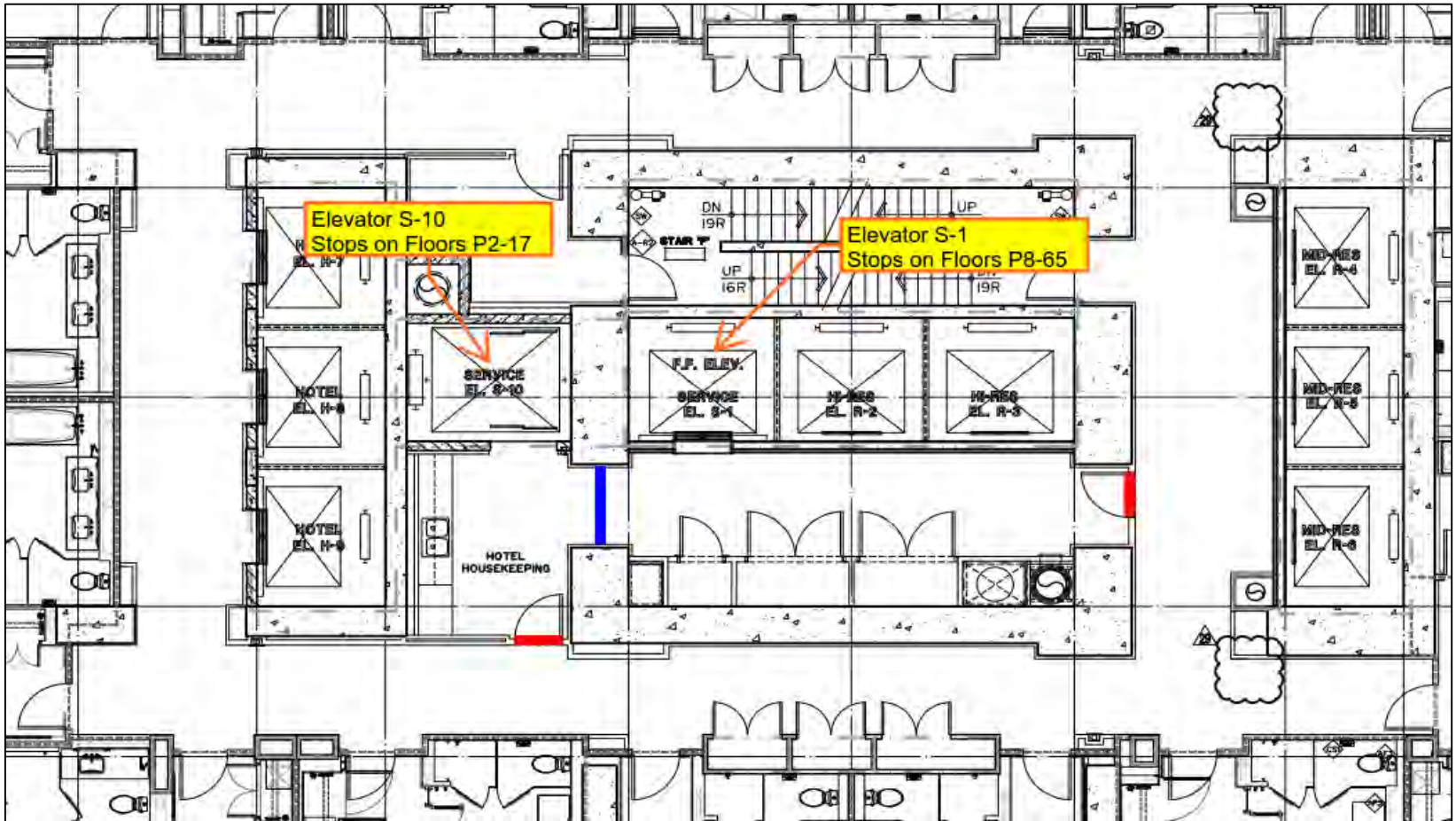
Main Entrance - revolving door (red)

Vestibule with Barrier-Free requirements (blue)



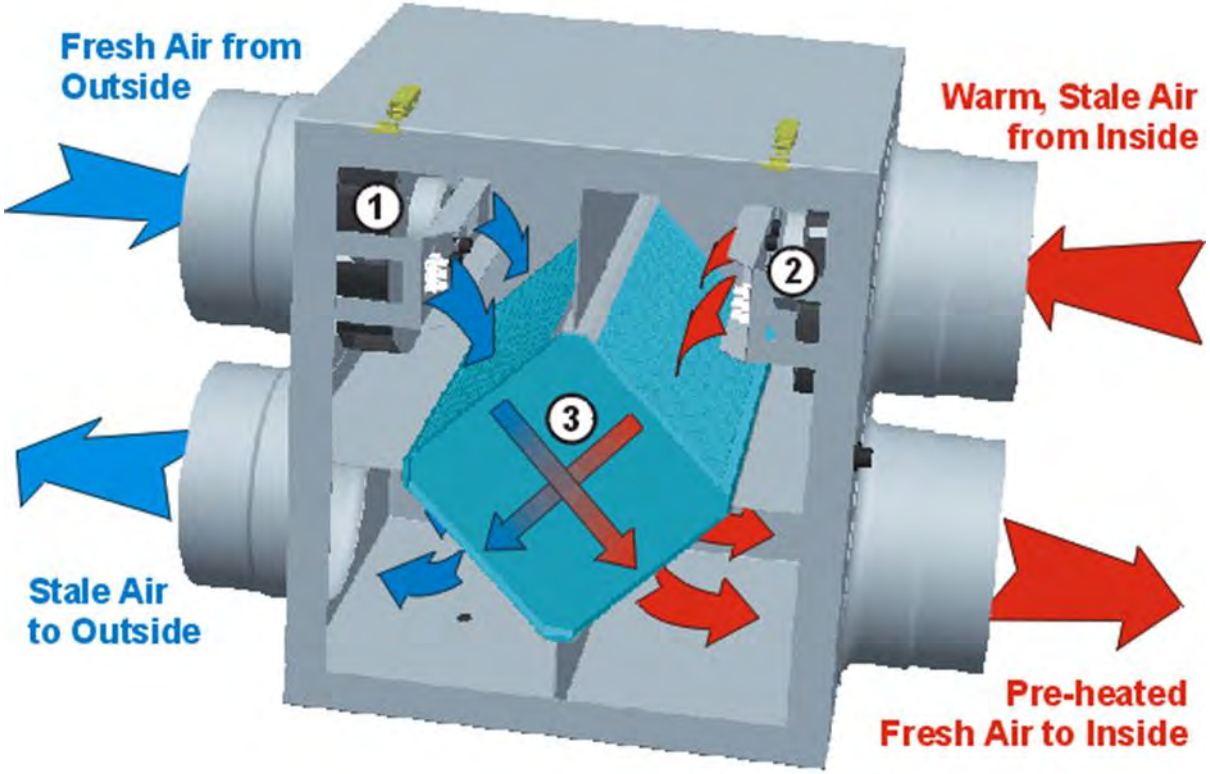
High Impact Items

Add separation between residential and hotel elevator lobbies at Floors 2 to 17 (blue)



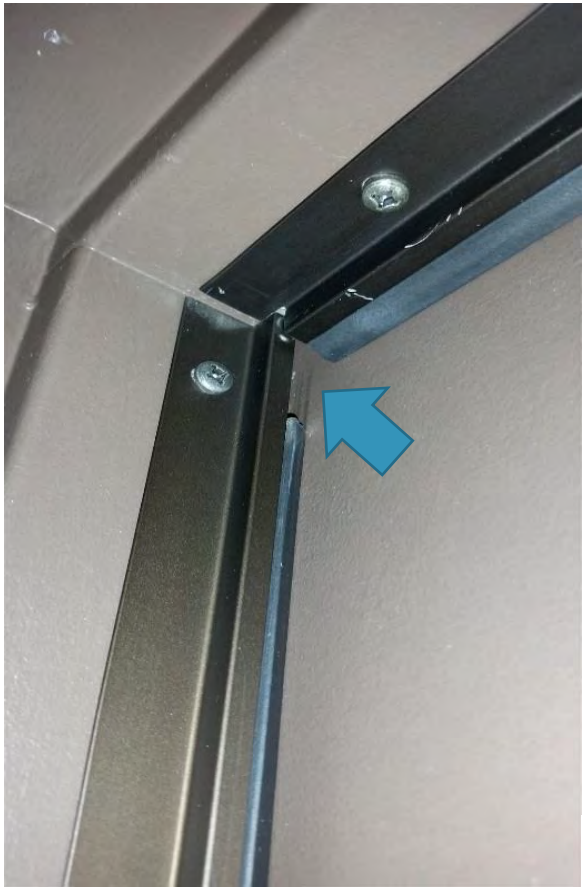
High Impact Items

Implement ERV's / seal suite entry door perimeters



High Impact Items

Seal Elevator, Stairwell, Mechanical, & Garbage Chute Room Door Perimeters

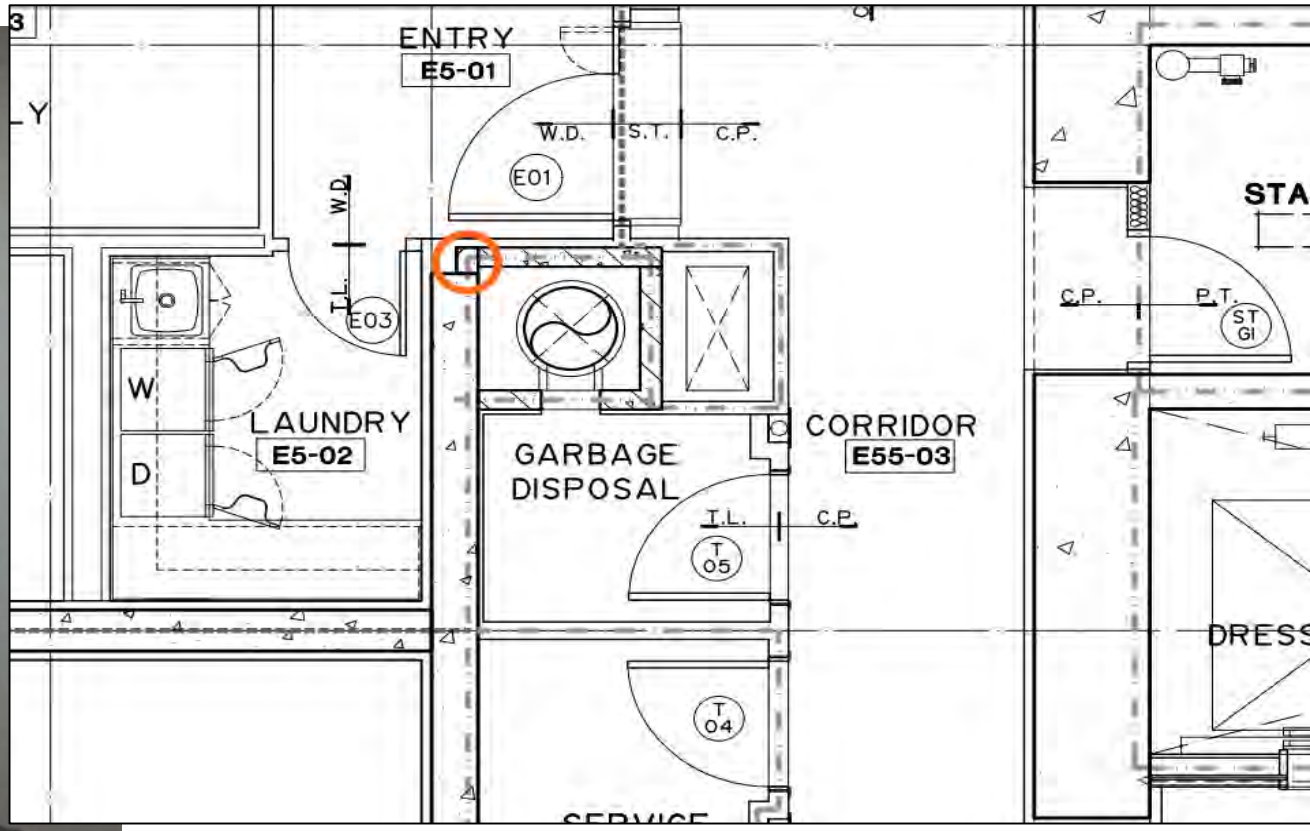


High Impact Items

Seal Elevator, Stairwell, Mechanical Room Door Perimeters

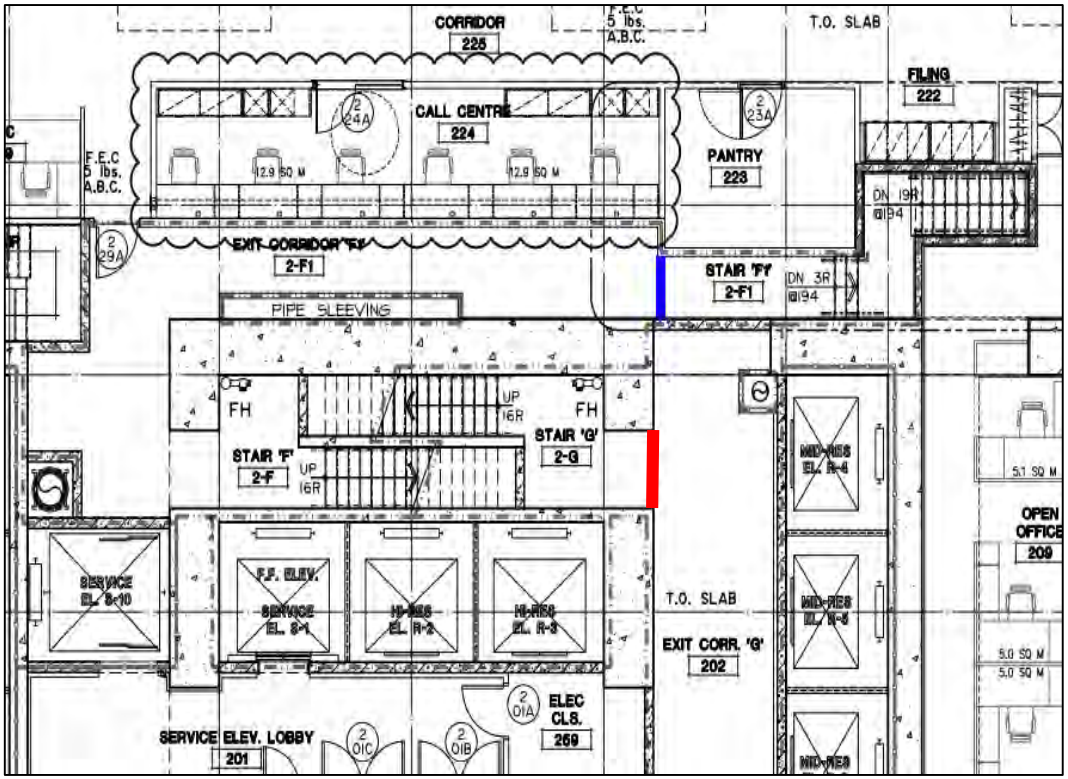
High Impact Items

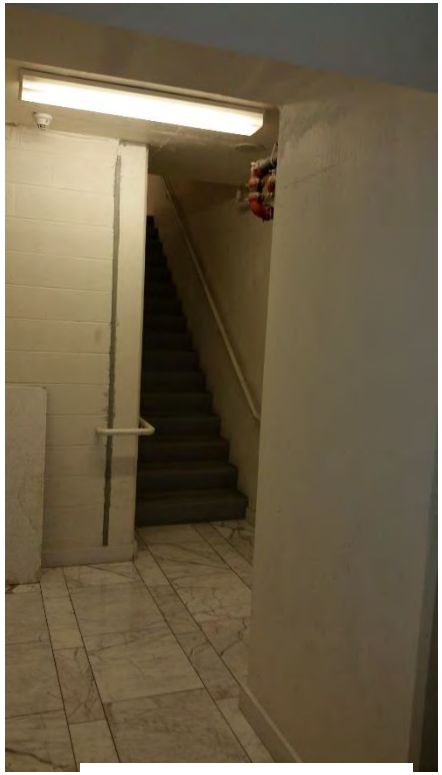
Seal joints in garbage shaft walls



High Impact Items

Add an additional door separation at the bottom of the stairwell shafts





High Impact Items

Source and replace broken sliding door locks and non-engaged gaskets

Concluding Remarks

Repair strategies presented for use in other tall multi-use buildings with similar problems or new construction to avoid similar performance issues.

Assign responsibility to prepare compartmentalization strategies during initial design (i.e. identify the continuous flow paths that allow air flow into, up, and out of the building and seal/compartment as required, prepare interior air seal details, etc.)

Install barriers/compartments during initial construction or provide rough-ins (eg. vestibule electrical servicing and vertical partitions above drop ceilings could be installed during initial construction to allow subsequent cost-effective barrier implementation should problems arise).

SYNERGY PARTNERS

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Thank You!

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