

June 28, 2018



22 BISHOPSGATE Lift Evacuation Strategy

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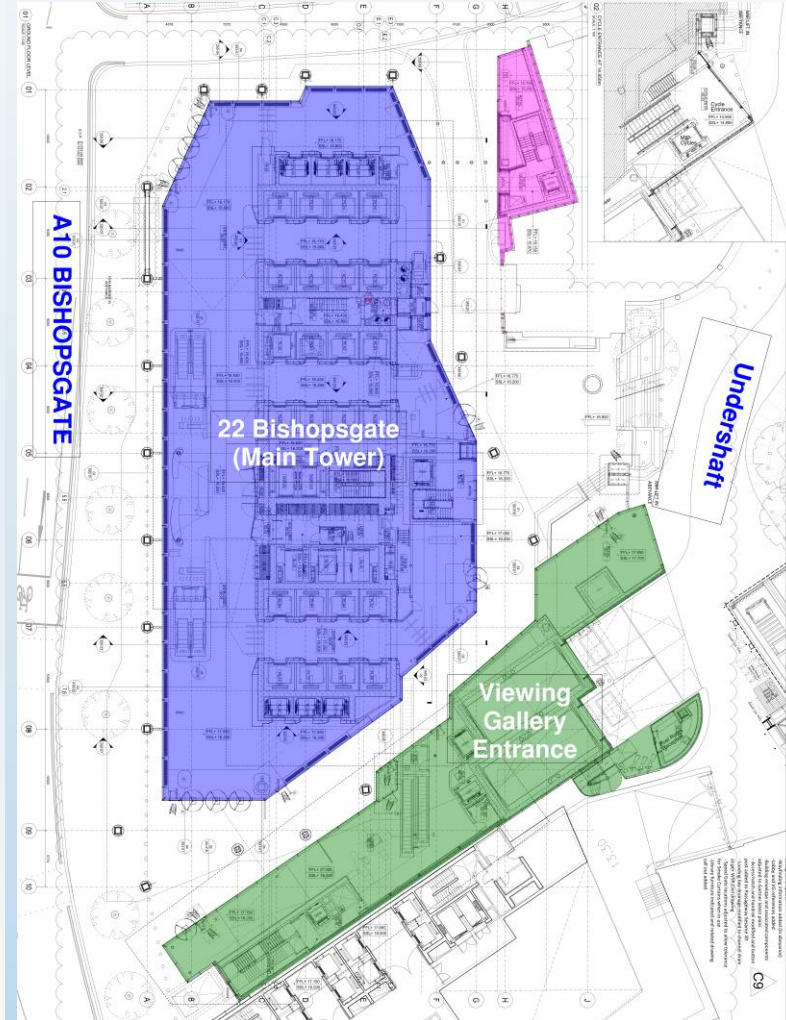
AGENDA

- The project
- Fire Safety Strategy
- Why lift evacuation?
- The principles
- Fire scenarios
- Detailed design
- Conclusion



THE PROJECT

- 22 Bishopsgate development, City of London, UK
- Architect: PLP/ARCHITECTURE
- Developer: Lipton Rogers Developments
- Engineering: WSP Global
- Main contractor: MULTIPLEX

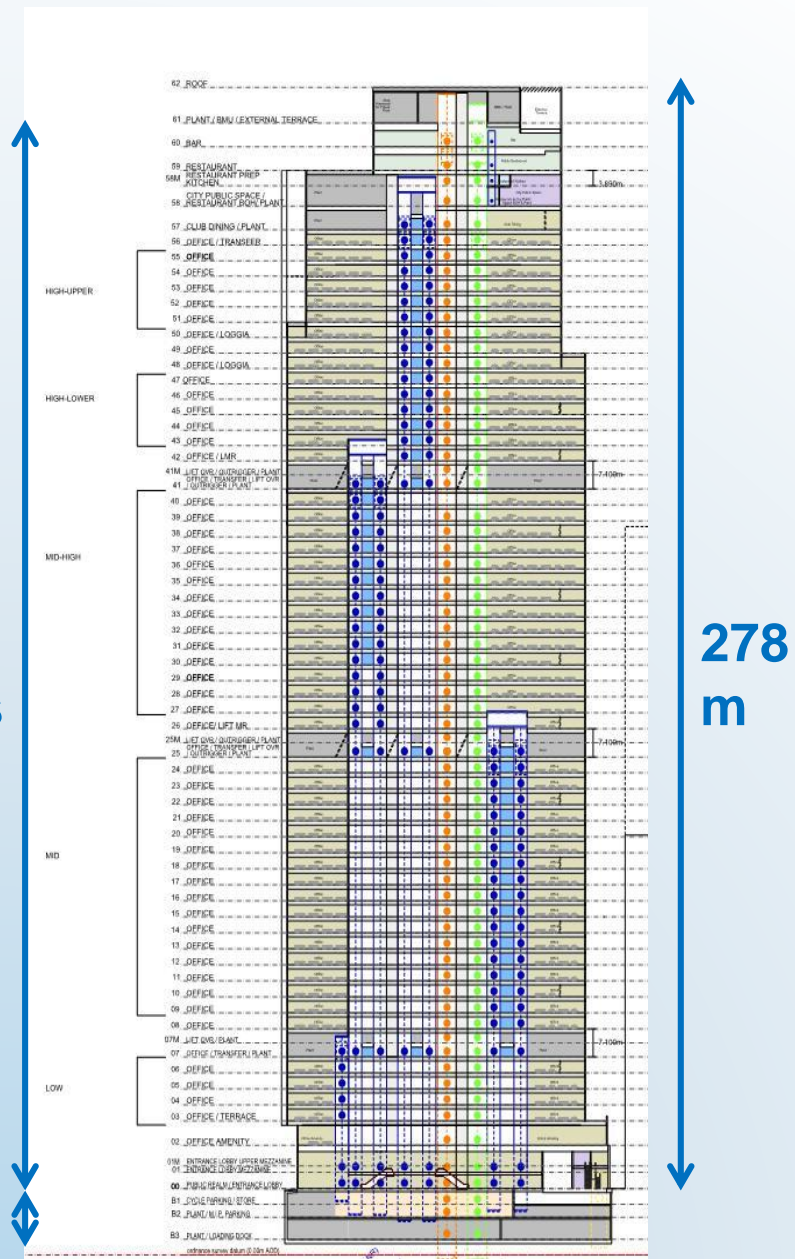


THE PROJECT

- 64 storeys of development
- Office use for most
- Public levels at top (L58-61)
- 13,000 people anticipated occupancy (designed for 30K)
- Basement BOH and support services

61
storeys

3
basements



FIRE SAFETY STRATEGY – SUMMARY

- Project designed to BS 9999:2008 “enhanced”
- Phased evacuation strategy (Fire floor and floor above)
- Two fire-fighting shafts (1250mm wide stairs) above ground
- Fire Control Centre
- Fire compartment floors/slabs
- L1 automatic fire detection
- Voice alarm system
- Sprinkler protection throughout
- Emergency lighting, exit signage, etc.
- High level of fire safety management

AND...lift evacuation

WHY LIFT EVACUATION?

Health & Safety – CDM regulations

Regulation 9 – Duties of Designers states: When preparing or modifying a design, the designer must take into account the general principles of prevention and any-preconstruction information to eliminate, so far as is reasonably practicable, foreseeable risks to the **health** of any person using a structure designed as a workplace.

Past experience

- World Trade Centre
 - 16% of tower 2 used the lifts to evacuate

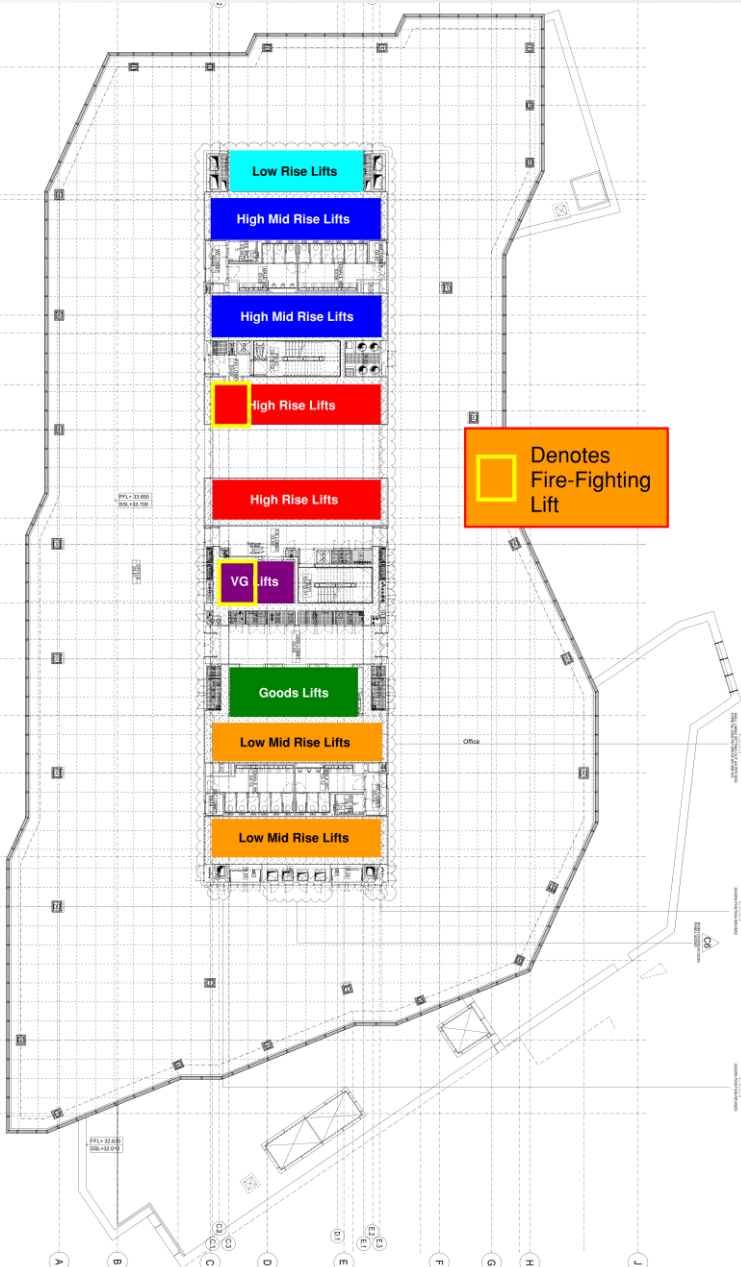
- By 2025, 47 per cent of men and 36 per cent of women (aged between 21 and 60) will be obese.
- By 2050, it is estimated that 60 per cent of males and 50 per cent of females could be obese.

Health related issues

- Fatigue
- Obesity (Refer to report for detailed data)
- Typology of occupants (elderly, pupils, pregnant women, etc.)

International practice for similar buildings

THE PRINCIPLES

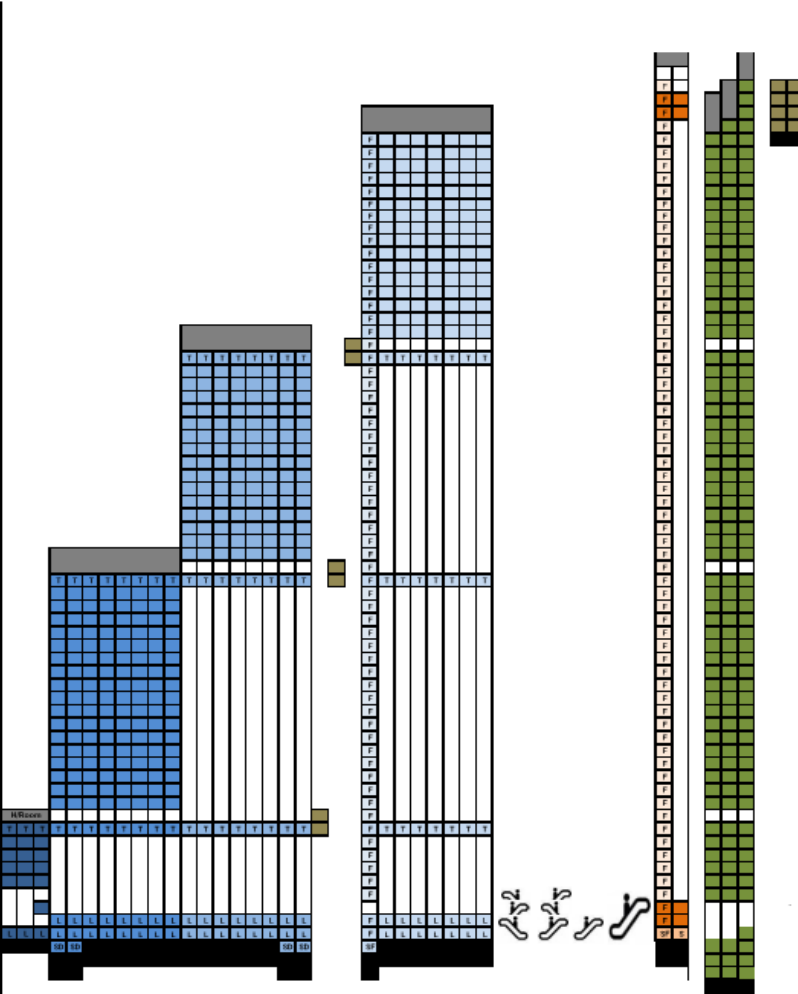


Denotes Fire-Fighting Lift

Usage and density	Floor Level	Population requiring lifts
Plant	01	
Galaxy Bar	50	
Private Restaurant	59	
Restaurant Kitchens/Plant	58M	
City Viewing Gallery	58	
Office 1/8 sqm	57	136
Office 1/8 sqm	56	203
Office 1/8 sqm	55	203
Office 1/8 sqm	54	203
Office 1/8 sqm	53	203
Office 1/8 sqm	52	203
Office 1/8 sqm	51	203
Office 1/8 sqm	50	203
Office 1/8 sqm	49	203
Office 1/8 sqm	48	227
Office 1/8 sqm	47	234
Office 1/8 sqm	46	234
Office 1/8 sqm	45	243
Office 1/8 sqm	44	243
Office 1/8 sqm	43	243
Office 1/8 sqm	42	243
Transfer Mezz	41M	0
Transfer	41	36
Office 1/8 sqm	40	243
Office 1/8 sqm	39	243
Office 1/8 sqm	38	243
Office 1/8 sqm	37	243
Office 1/8 sqm	36	243
Office 1/8 sqm	35	243
Office 1/8 sqm	34	243
Office 1/8 sqm	33	239
Office 1/8 sqm	32	239
Office 1/8 sqm	31	239
Office 1/8 sqm	30	239
Office 1/8 sqm	29	243
Office 1/8 sqm	28	243
Office 1/8 sqm	27	243
Office 1/8 sqm	26	243
Transfer Mezz	25M	0
Transfer	25	43
Office 1/8 sqm	24	227
Office 1/8 sqm	23	227
Office 1/8 sqm	22	227
Office 1/8 sqm	21	227
Office 1/8 sqm	20	227
Office 1/8 sqm	19	227
Office 1/8 sqm	18	227
Office 1/8 sqm	17	227
Office 1/8 sqm	16	227
Office 1/8 sqm	15	227
Office 1/8 sqm	14	227
Office 1/8 sqm	13	227
Office 1/8 sqm	12	227
Office 1/8 sqm	11	227
Office 1/8 sqm	10	227
Office 1/8 sqm	9	227
Office 1/8 sqm	8	109
Plant/Amenity	7M	0
Transfer/Office	7	227
Office 1/8 sqm	6	227
Office 1/8 sqm	5	227
Office 1/8 sqm	4	227
Office 1/8 sqm	3	227
Amenity	2	
Upper Restaurant Entrance	1M	
Public Realm/Lower Lobby	0	0
Centre Platform/Glare	0	
Plant/MSP Parking/Cycle Parks	-2	
Loading Bay/Plant	-3	
Lift Pit Access	-4	
Total Population Requiring Lifts		12010

Legend
 F = Floors served by fire entrance only during fire fighting mode
 VG Lifts Open F & R at these floors
 Special Firefighting service - top deck serves these floors
 Emergency Exit
 Special Disabled Service to allow top deck to serve level 0.
 No service to -1

Lift Numbers
Lift Identification for Destination Hall Call

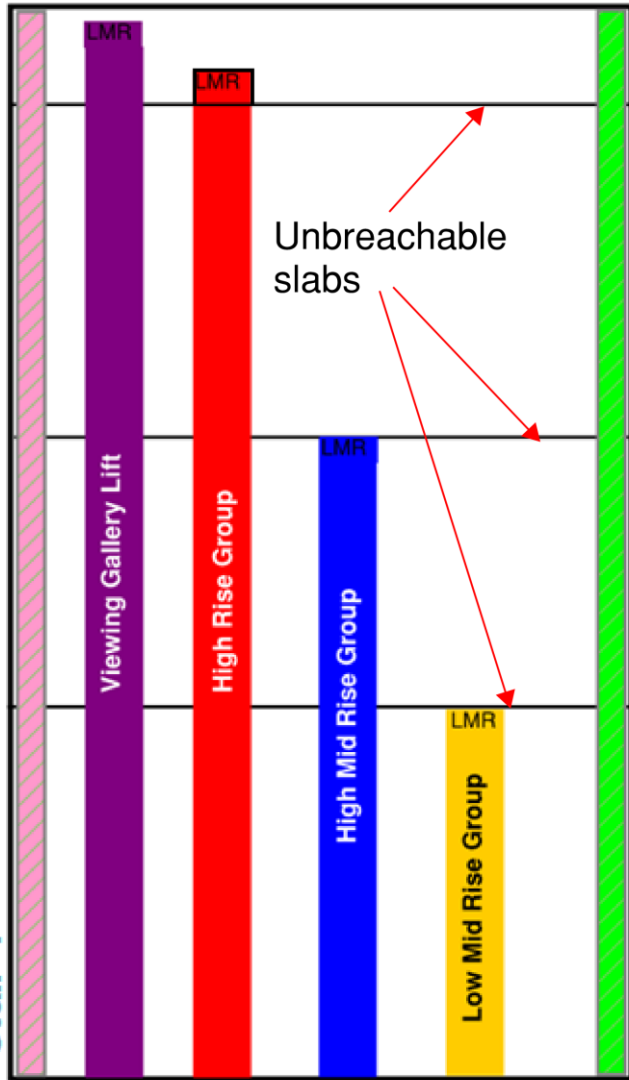


Low Rise Group 3 x 20p x 2 decks @ 2.5 m/s	Low Mid Rise Group 8 x 20p x 2 decks @ 5 m/s	High Mid Rise Group 8 x 20p x 2 decks @ 8 m/s	High Rise Group 8 x 20p x 2 decks @ 8 m/s
PL1-3	PL4-11	PL12-19	PLF20 & PL21-27
TBA	TBA	TBA	TBA
ET1-4 4 x 35 deg Escalators Serving to the 6-1, 11M & 1M-2	ET5-8 4 x 35deg Escalators Serving to the 6-1, 11M & 1M-2	ET9 1 x 20 deg Escalator Serving levels 0-1 in VG Entrance	ET10 1 x 30 deg Escalator Serving levels 1, 1M in VG Entrance
VGPF1 & VGPF2 Viewing Gallery Lifts 2 x 30p @ 8m/s	GL1-3 Goods Lifts 3 x 2000kg @ 4 Em/s (GL3 with temporary averaging to 7100kg)	PLJ2 & J3 Access to Restaurant/Bar 2 x 13 person @ 1.0m/s	

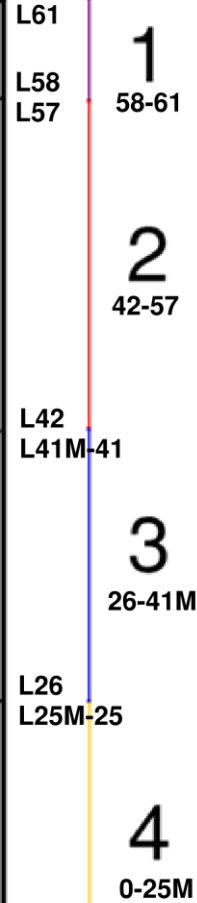
Tower

THE PRINCIPLES

Lift arrangement

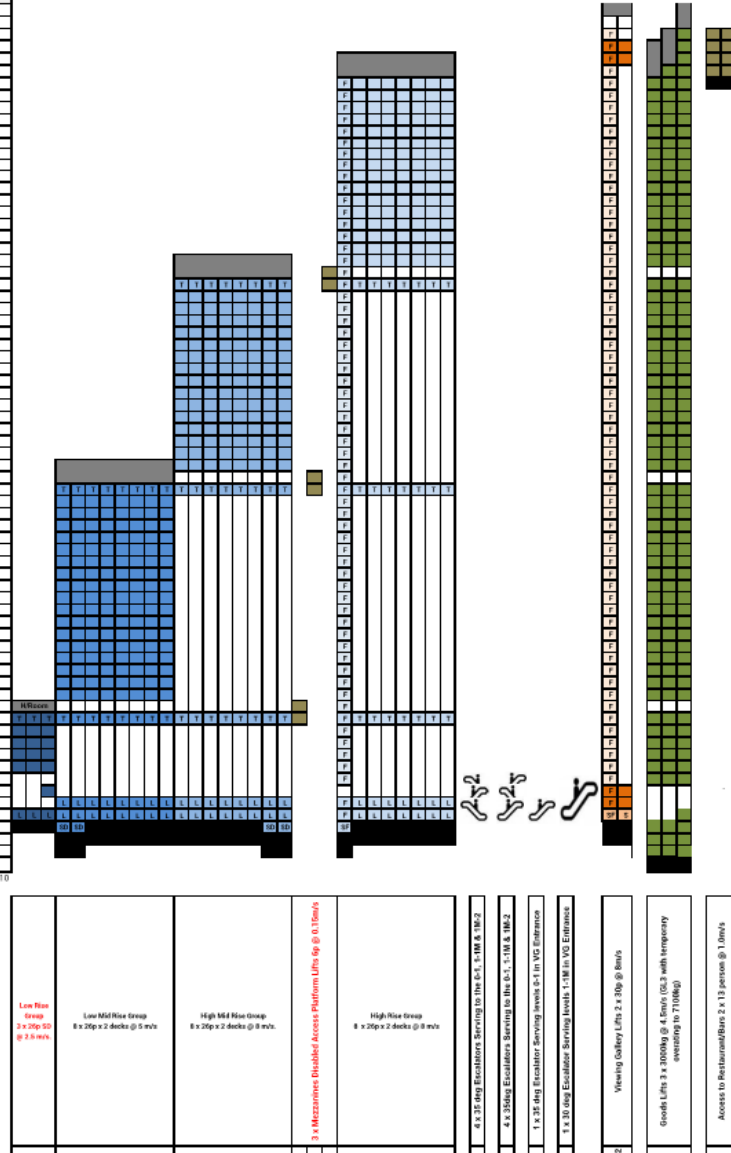


Fire Evacuation Levels

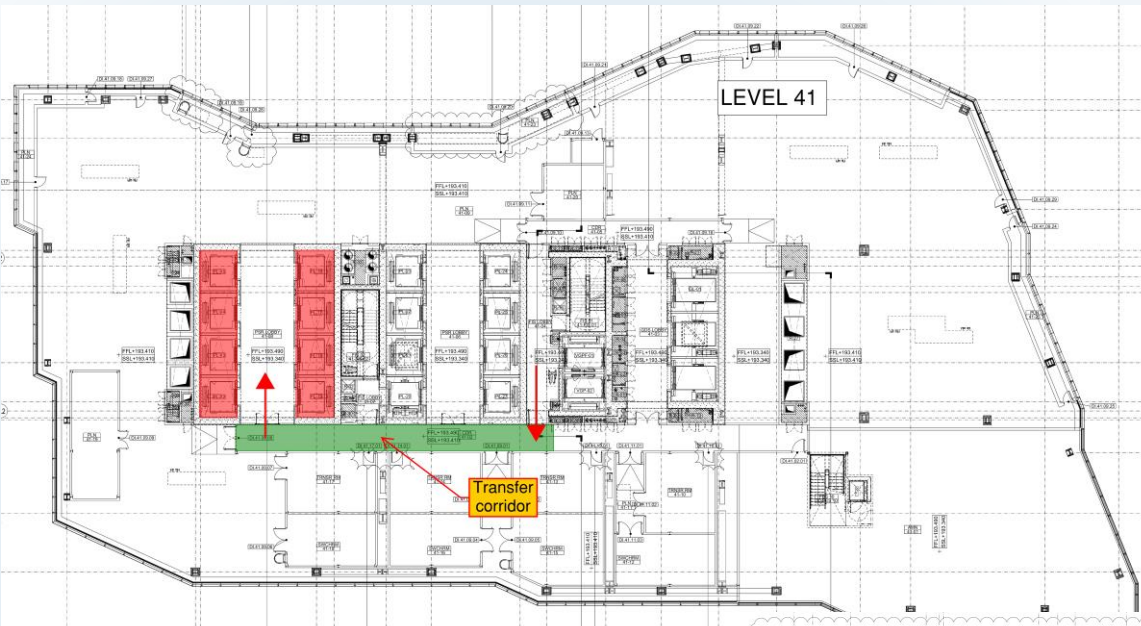


Usage and density	Floor Level	Population requiring lifts
Plant	61	
Galley/Bar	60	
Private Restaurant	59	
Restaurant Kitchen/Plant	58M	
City Viewing Gallery	58	
Office 178 sqm	57	136
Office 178 sqm	56	203
Office 178 sqm	55	203
Office 178 sqm	54	203
Office 178 sqm	53	203
Office 178 sqm	52	203
Office 178 sqm	51	203
Office 178 sqm	50	203
Office 178 sqm	49	203
Office 178 sqm	48	227
Office 178 sqm	47	234
Office 178 sqm	46	234
Office 178 sqm	45	243
Office 178 sqm	44	243
Office 178 sqm	43	243
Office 178 sqm	42	243
Transfer Mezz	41M	0
Transfer	41	36
Office 178 sqm	40	243
Office 178 sqm	39	243
Office 178 sqm	38	243
Office 178 sqm	37	243
Office 178 sqm	36	243
Office 178 sqm	35	243
Office 178 sqm	34	243
Office 178 sqm	33	239
Office 178 sqm	32	239
Office 178 sqm	31	239
Office 178 sqm	30	239
Office 178 sqm	29	243
Office 178 sqm	28	243
Office 178 sqm	27	243
Office 178 sqm	26	243
Transfer Mezz	25M	0
Transfer	25	43
Office 178 sqm	24	227
Office 178 sqm	23	227
Office 178 sqm	22	227
Office 178 sqm	21	227
Office 178 sqm	20	227
Office 178 sqm	19	227
Office 178 sqm	18	227
Office 178 sqm	17	227
Office 178 sqm	16	227
Office 178 sqm	15	227
Office 178 sqm	14	227
Office 178 sqm	13	227
Office 178 sqm	12	227
Office 178 sqm	11	227
Office 178 sqm	10	227
Office 178 sqm	9	227
Office 178 sqm	8	227
Plant/Amenity	7M	0
Transfer/Office	7	227
Office 178 sqm	6	227
Office 178 sqm	5	227
Office 178 sqm	4	227
Office 178 sqm	3	227
Amenity	2	
Upper Restaurant Entrance	1M	
Upper Lobby	1	
Public Realm/Lower Lobby	0	0
Cycle Parking/Store	-1	
Plant/Office/Plant/Cycle Parking	-2	
Loading Bay/Plant	-3	
Lift Pit Access	-4	
Total Population Requiring Lifts		12010

Main levels, usage and density:
 P - Floors served by rear entrance only during fire fighting mode
 VG Lifts Open F & R at these floors
 Special Firefighting service - top deck serves these floors
 Emergency Exit
 Special Disabled Service to allow top deck to serve level.
 No service to 1



THE PRINCIPLES



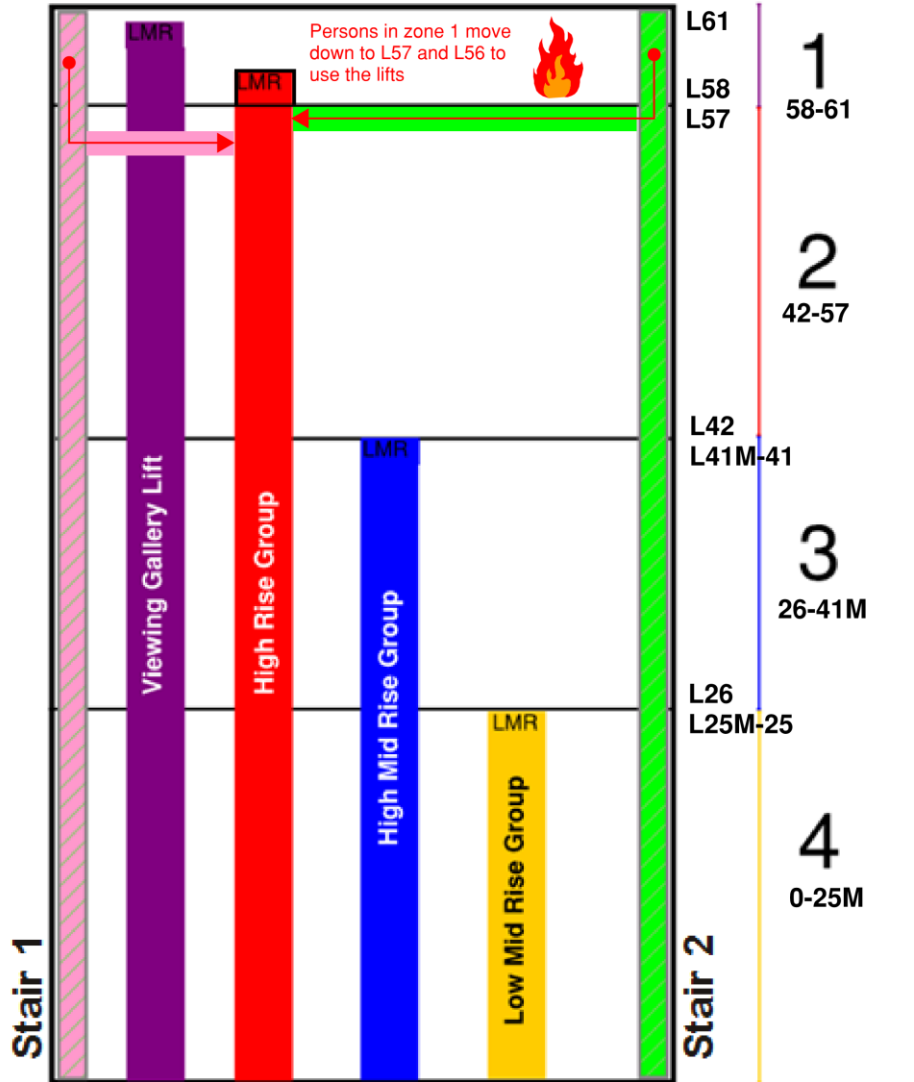
Bottom transfer floor
into bottom deck only

Top transfer floor
into top deck only

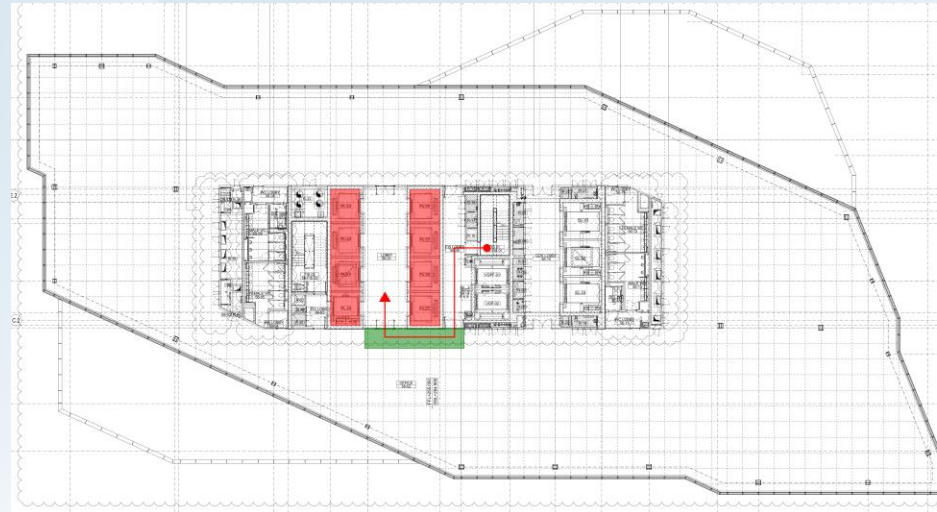


FIRE SCENARIOS

FIRE SCENARIO 1



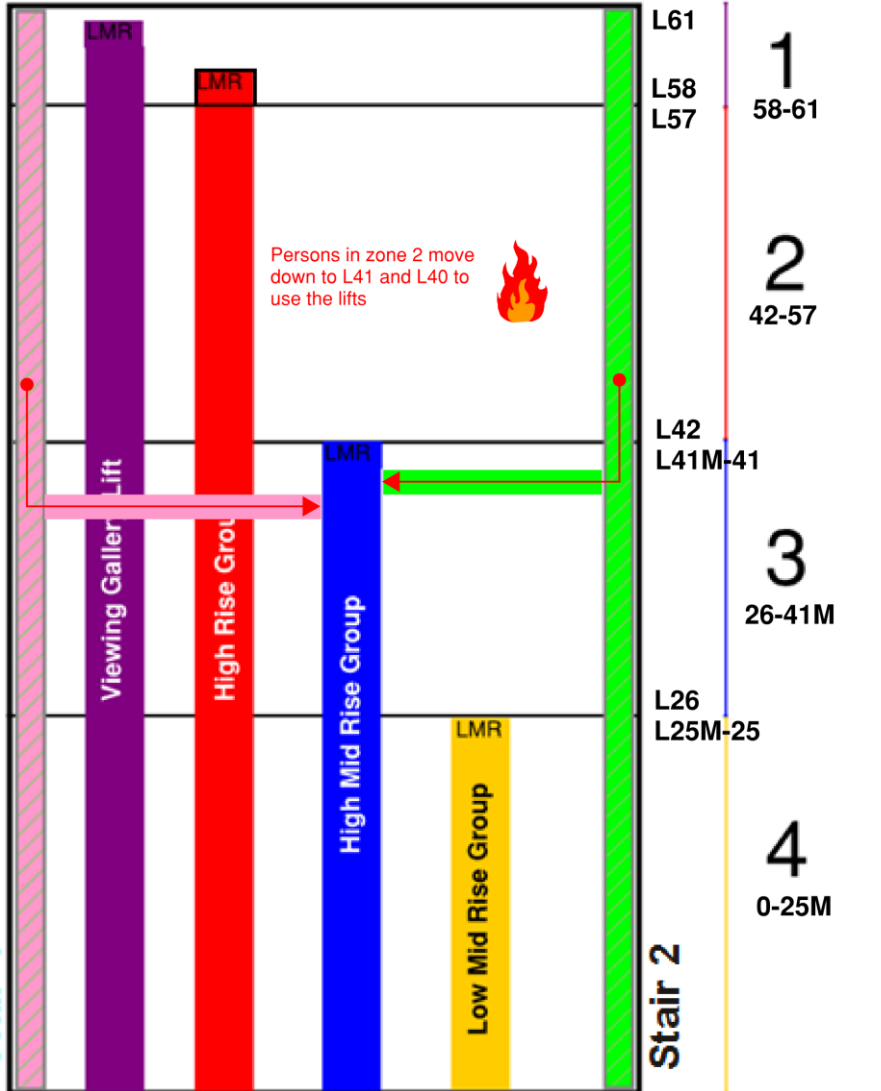
Level 57



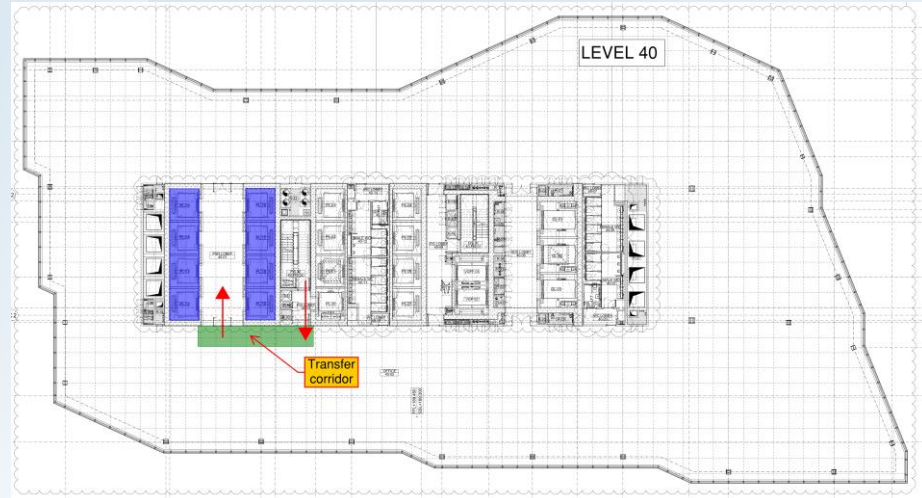
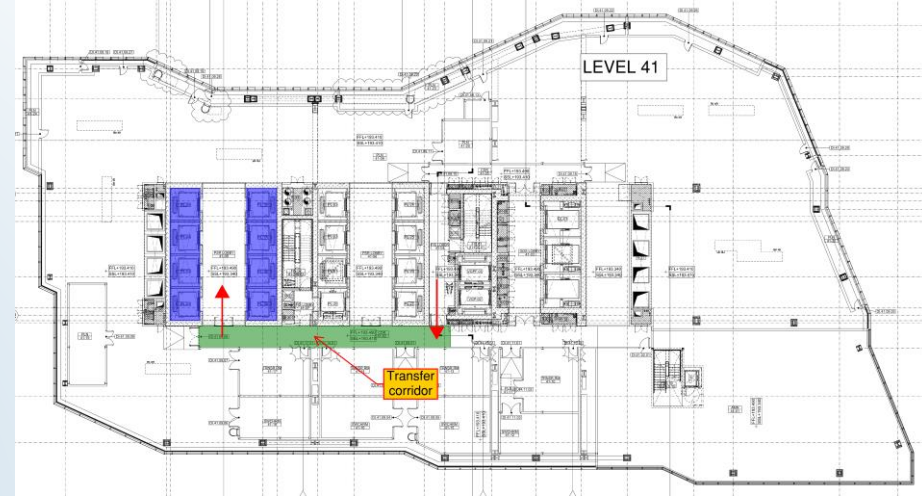
Level 56

FIRE SCENARIOS

FIRE SCENARIO 2



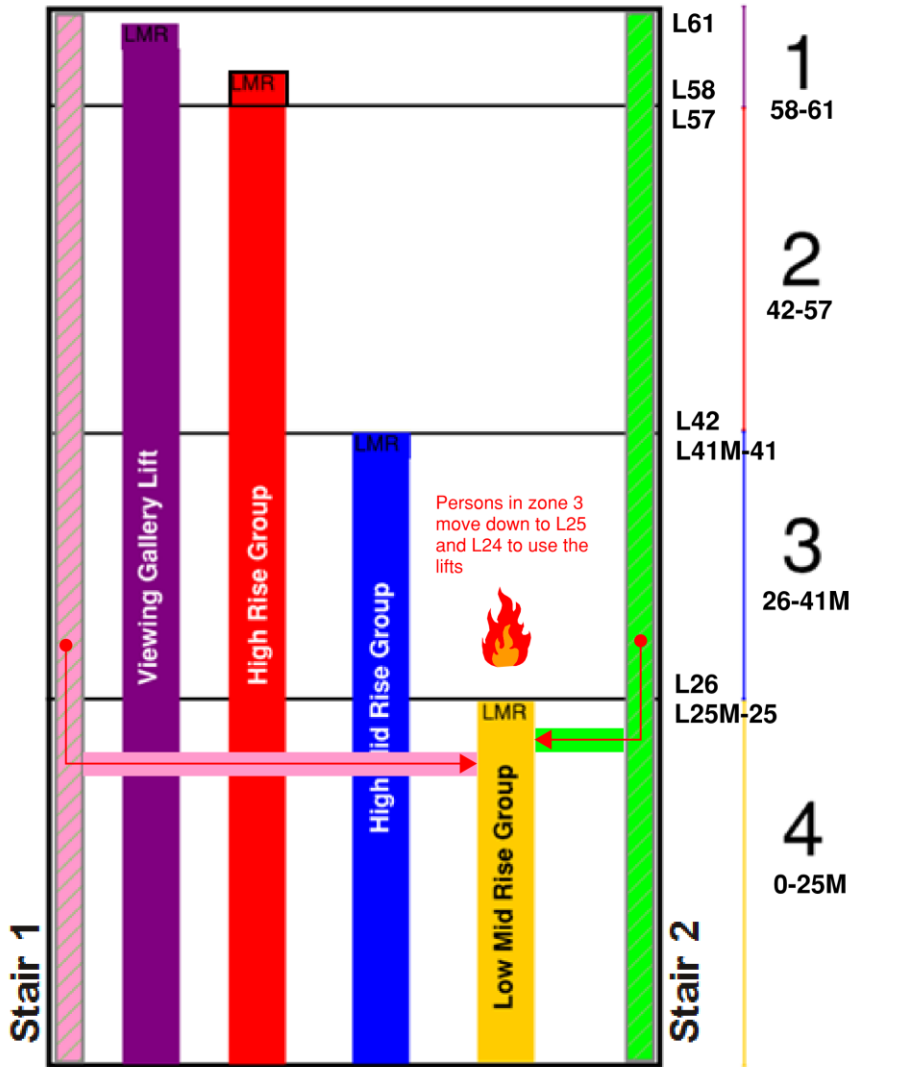
Level 41



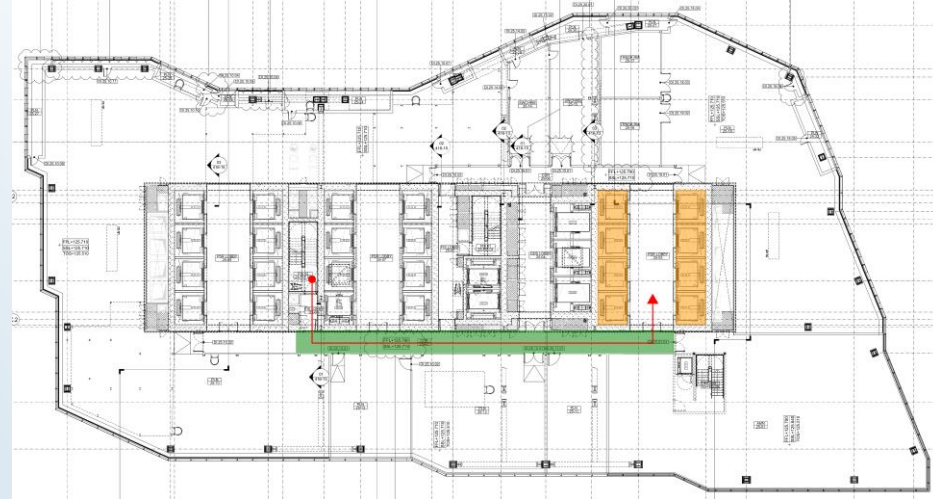
Level 40

FIRE SCENARIOS

FIRE SCENARIO 3



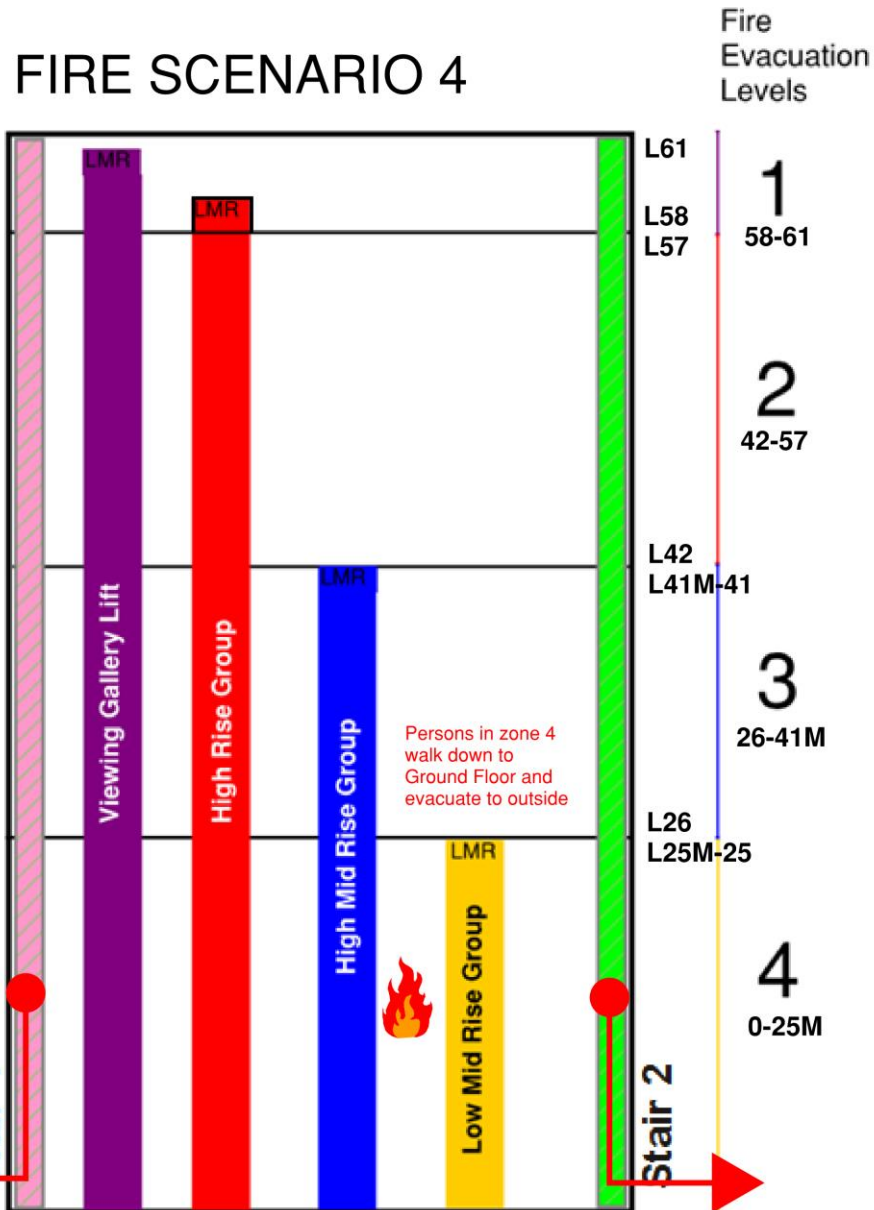
Level 25



Level 24

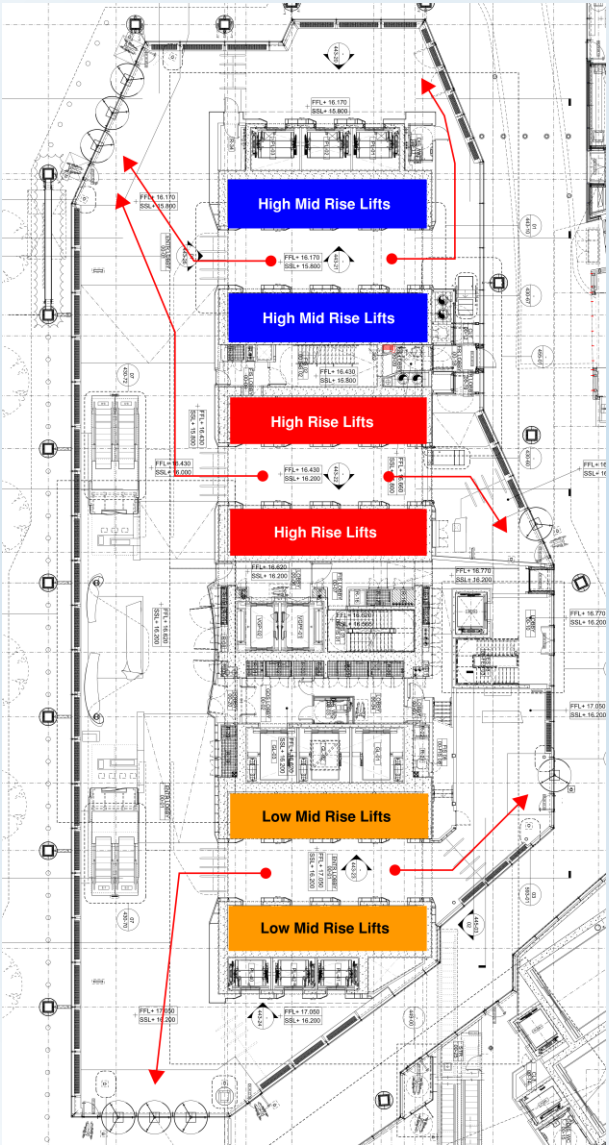
FIRE SCENARIOS

FIRE SCENARIO 4

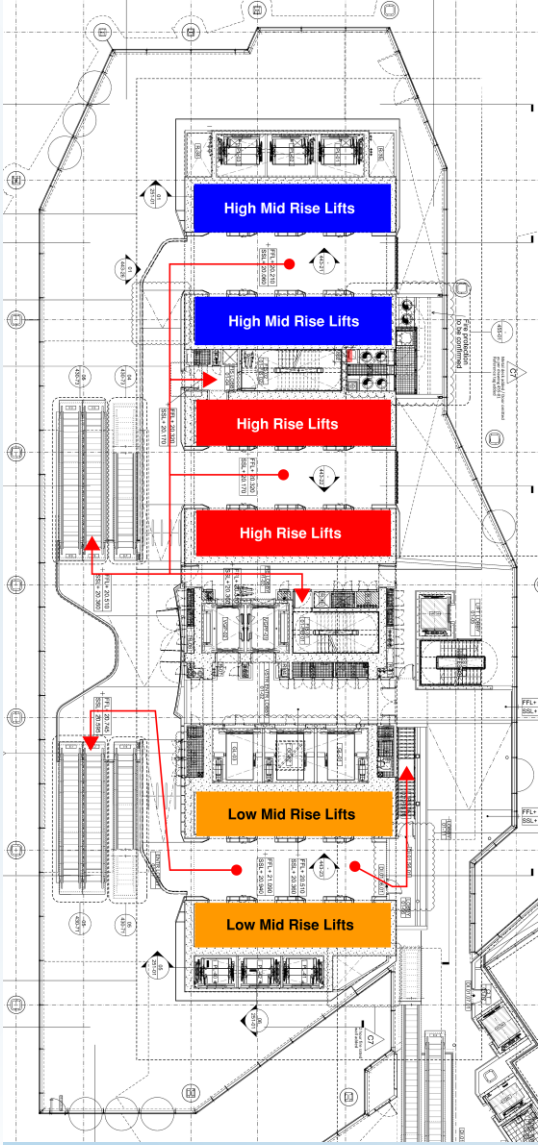


Alternative level of discharge – L7

LIFT DISCHARGE



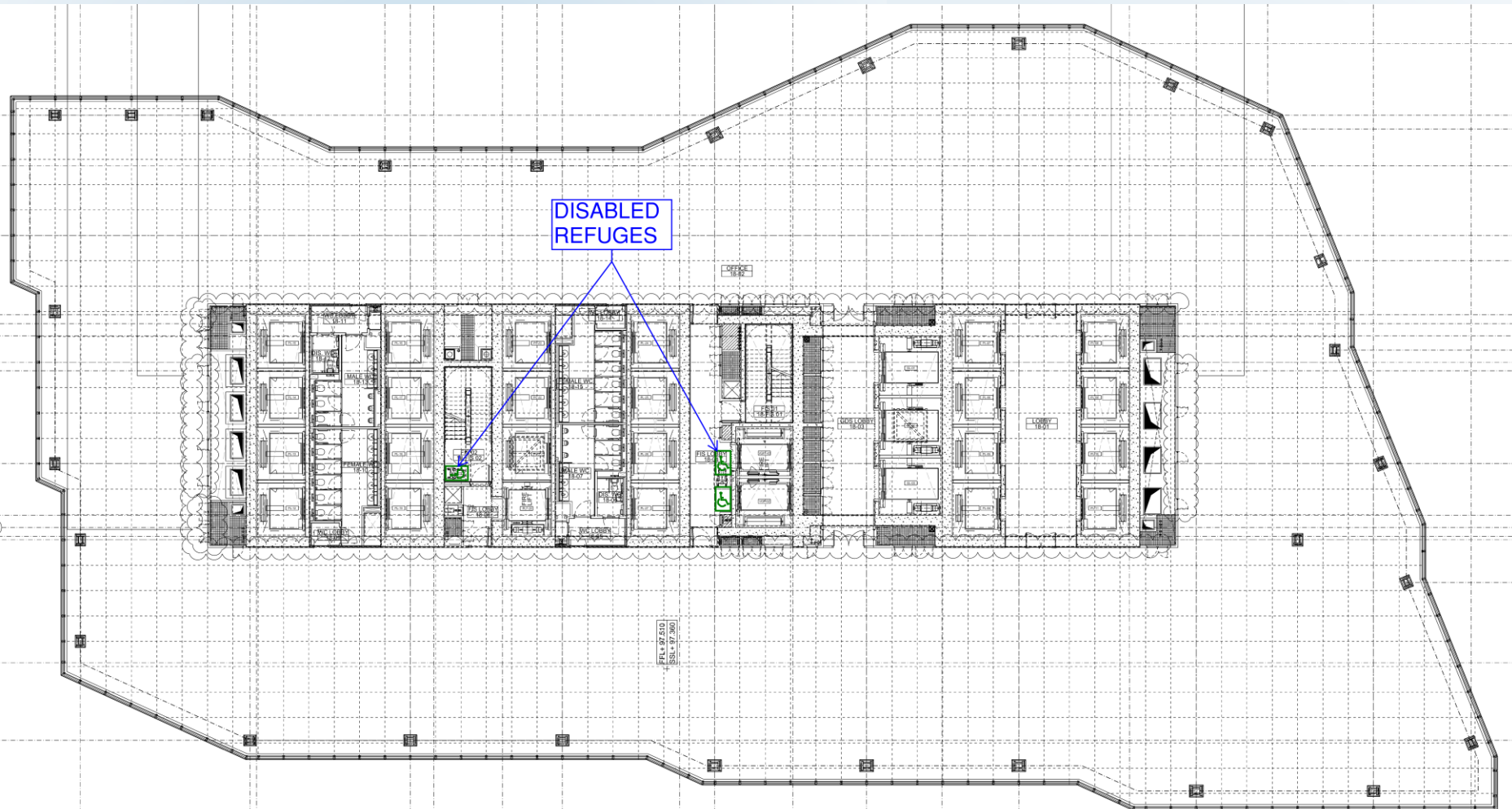
Ground Floor



Level 1

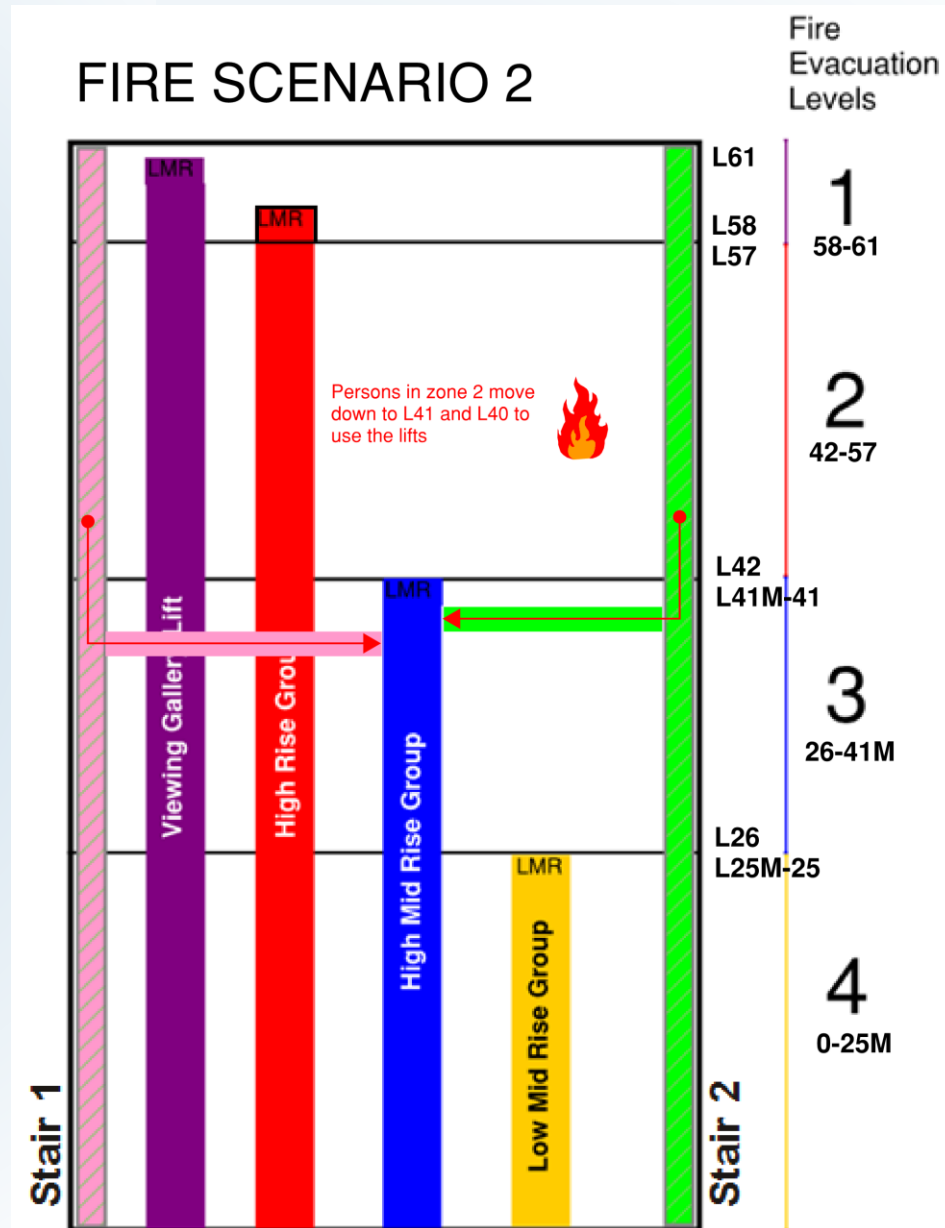
FIRE SCENARIOS

- Mobility Impaired Persons (MIP)
- Use of fire-fighting lifts for evacuation prior to LFB arrival
- Fire-fighting lifts not used more as part of the lift evacuation strategy



DETAILED SEQUENCE

- Confirmed fire detection in zone 2.
- 4 landlord fire wardens go to fire lifts.
- 2 stop at transfer floors (L40 & L41)
- 2 continue to rescue MIP in refuges (fire floor & floor above).
- 2 landlord fire wardens go to GF and L1.
- Fire floor & floor above evacuate using the stairs.
- People transfer from stairs into lift lobbies or continue walking down.
- People enter the evacuation lifts under fire warden supervision and move to ground floor for exit discharge.
- GF & L1 fire wardens clear the lifts before they go back up automatically.
- The process continues as long as necessary.



DETAILED DESIGN – TRANSFERS (LIFTS TO STAIRS)

- **Offices:** colour coding system, exit signage, tenant fire warden guidance, evacuation drills due to occupant type.
- **Top public levels:** colour coding system, exit signage, heavy landlord and tenant fire warden guidance (well managed areas).
- **CCTV presence in stairs and lift lobbies at transfer floors + VOICE ALARM.**



DETAILED DESIGN – LIFT JOURNEY TIME

TOP public levels

- Worst case fire: 58, 58M & 59
- Evacuating occupancy = 1,457p
- All 7 lifts can take 280p / run
- $1,457 / 280 = 6$ runs
- $6 \text{ runs} \times 152 \text{ s} = 15$ minutes total

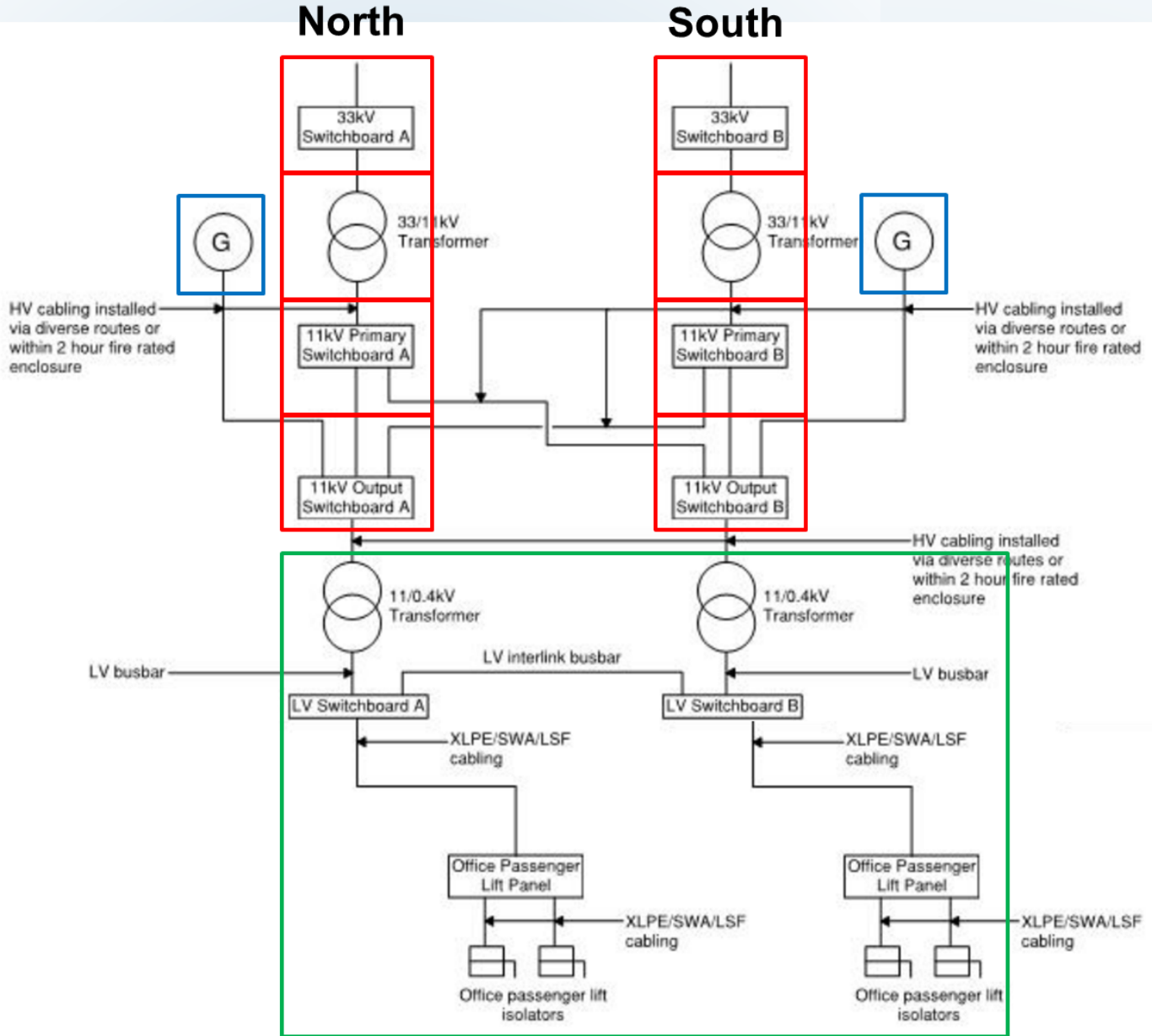
Office levels

- Worst case fire: 48 & 49
- Evacuating occupancy = 383p x 2 floors = 766p
- All 8 lifts can take 320p / run
- $766 / 320 = 3$ runs
- $3 \text{ runs} \times 136 \text{ s} = 7$ minutes total

Evacuation Mode PL21-27	Time (s)	Time per Cycle (s)
Time loading passengers at evacuation floor (including door operation)	33	33
Time unloading passengers at Ground level (including door operation)	33	33
Journey time one way (Rise = 239m) including jerk, acceleration and deceleration	43	86
Total Journey time including loading and unloading (s)		152

Evacuation Mode PL12-19	Time (s)	Time per Cycle (s)
Time loading passengers at evacuation floors (including door operation)	33	33
Time unloading passengers at Ground (including door operation)	33	33
Journey time one way (Rise = 174m) including Jerk, acceleration and deceleration	35	70
Total Journey time including loading and unloading (s)		136

DETAILED DESIGN – POWER SUPPLY



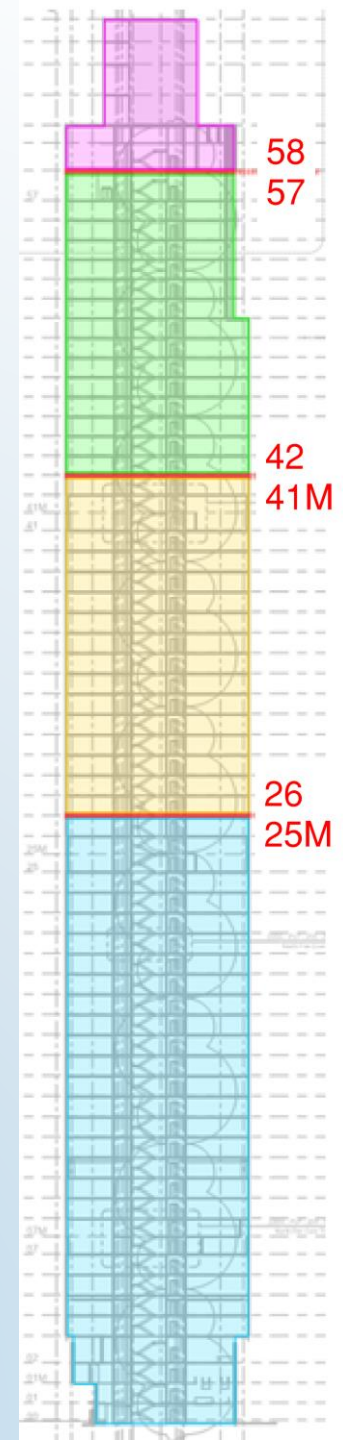
Individual fire rated rooms at B2 level

Level 57

In every lift motor room – L26, L42, L57

DETAILED DESIGN – UNBREACHABLE SLABS

- The slabs separate the lift banks from the fire zone.
- EI120 fire rated slabs.
- Slabs cannot be breached by tenants during fit-out.
- Technical shafts equipped with enhanced fire stopping:
 - Motorized fire dampers to ducts;
 - Fire-stopping materials or solid construction at slab level.
- Only the fire-fighting lobby smoke extraction shafts run continuously.

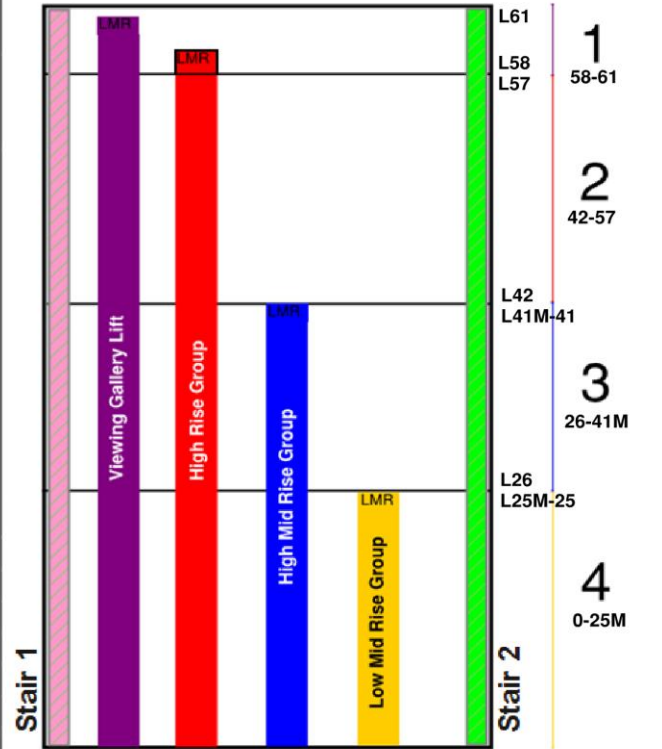


DETAILED DESIGN – CAUSE & EFFECTS MATRIX

22 Bishopsgate - Lift Evacuation - Cause & Effects Matrix for Lifts' behaviour

Lift Group	Low Rise Group (PL1-3)	Low Mid Rise Group (PL4-11)	High Mid Rise Group (PL12-19)	High Rise Group (PL21-27)	Viewing Gallery Lift VGP2	Fire-fighting lifts (VGPF1 & PLF20)	Goods Lifts (GL1-3)
Levels served	Ground floor up to Level 7	GF, Upper lobby, L7, L8 to L25	GF, Upper lobby, L7, L25, L26 to L41	GF, Upper lobby, L7, L25, L41, L42 to L57	Upper lobby, Upper restaurant entrance, L58M, L59	PLF20: L-1 to L57 VGPF1: GF to L60	All levels (few exceptions)
Effects	Lifts move to Ground Floor and park there	Lifts go to the alternative level of discharge (L7)	Lifts move to Ground floor (bottom deck) and first floor (top deck) and park there	Lifts go to the alternative level of discharge (L7) - Bottom deck first, second deck after and then park	Lifts ground to discharge occupants and move to L24/25 automatically for evacuation mode	Lifts move to Ground floor (bottom deck) and first floor (top deck) and park there	Lifts go to the alternative level of discharge (L7) - Bottom deck first, second deck after and then park
Cause							
Fire detection on levels 58 to 61	X	X	X	X	X	X	X
Fire detection on levels 43 to 57	X	X	X	X	X	X	X
Fire detection on levels 27 to 42	X	X	X	X	X	X	X
Fire detection on levels 3 to 26	X	X	X	X	X	X	X
Fire detection on levels 0 to 2	X	X	X	X	X	X	X
Fire detection on levels 83 to B1	X	X	X	X	X	X	X

Lift arrangement



CONCLUSION

- Unique buildings like 22BG must go beyond code requirements. The new BS 9999:2017 highlights this clearly. Always been the basis of The UK Building Regulations.
- Lift evacuation deemed to demonstrate compliance with CDM regulations.
- Starts to become the norm for tall buildings.
- The provisions outlined in this design are considered sufficiently robust for implementation on the 22 Bishopsgate project.
- Approved by City of London Building Control and the London Fire Brigade, including their Fire Engineering Group.