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REVIEW OF EVACUATION PROCEDURES FOR THE PETRONAS TWIN TOWERS

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1. Introduction

Following the attack and collapse of both Tower 1 and 2 of the World Trade Centre New York in September 2001, it was apparent that a new realm of potential incidents need to be planned. Emergency Response plans which are considered adequate previously are now showing many gaps in terms of scenarios planned, whilst nervous tenants and occupants are now currently demanding tighter security controls and safety measures.

The PETRONAS Twin Towers (PTT) were not spared from this situation. Prior to September 11, 2001 incident all occupants were already required to attend safety briefings and periodic fire drills and refresher courses held regularly for Floor Safety Managers or Wardens of the PPT.

In meeting the changing climate, the evacuation procedures have had to be revised. As like other buildings the management are well prepared for fire related evacuations but had only written processes for emergency procedures of both Towers in the event of terrorist attacks, whether from ground or the air, or other similar type of incidents previously deemed "unlikely". Amongst others the management had to work hard to restore the confidence of current tenants are reassuring safety and security of their premises.

The paper describes the emergency response plans (ERP) and evacuation procedures of the Petronas Twin Towers in the case of minor and major events. A reviewed evacuation procedure for PTT was also presented to take into account of simultaneous evacuation of both towers.

2. The KLCC Development

The PETRONAS Twin Towers is a prominent construction of a 100-acre development, within the Northwest corner of KLCC Master Plan (Fig. 1). This high density northwest corner or commonly referred to as the Northwest Development (NWD), comprises:

- The Maxis Tower - a 50 storey office building
- Suria KLCC - a 1.5 Million sq. ft. retail complex, on 5 storeys at the podium of the NWD
- Basement Car park - 4 storey - 5,400 car parking bays.

The NWD was designed as an integrated facility, with a Central Fire Command Centre monitoring and managing the Fire Alarm systems for the entire area.

Other buildings within the KLCC Development includes the 640-room Mandarin Oriental Hotel and the 30 storey-Exxon Mobil Tower. The buildings form a ring to the central 50 acre KLCC Public Park.

The second phase of the development is currently under construction, starting with the Kuala Lumpur Convention Centre and followed by the Luxury Condominiums.
3. Safety Considerations

Prior to 911, the PETRONAS Twin Towers management had an Emergency Response Plan (ERP) which was approved by the Fire Department and City Hall. The ERP is based on an Incident Command Structure which covers not only the PETRONAS Twin Towers (PTT) but also all other facilities including the Maxis Tower, Philharmonic Concert Hall, the Petroleum Discovery Centre, Art Gallery, Suria KLCC, the 5 storey Basement Carpark, and the corresponding Tunnels and Ramps. Apart from PTT and the Maxis Tower, all other facilities are considered public space.
The ERP for PTT cover written procedures for the following events:

i. Fire or explosion
ii. Bomb threats
iii. General power failure
iv. Lift man traps
v. Gondola breakdowns
vi. Natural disasters
vii. Terrorist attacks
viii. Hostage/robbery
ix. Hazardous materials/gas releases
x. Medical responses

For PTT, an Emergency Response Team is available on a 24 hour, 7 day-week standby basis. A three-man team, trained in fire fighting and first aid, readily available to provide first line response, prior to the arrival of the Fire Department, or paramedics. This team is also responsible in assisting Lift technicians in the event of a man-trap. A charge men is also on duty of 24 hours, on a 7 day-week basis in the event of power failure. Additionally, the Central Fire Command Room and Building Controls are also manned on a 24 hour, 7-day week basis to provide immediate response to any incidents.

4. Levels Of Emergency

The levels of emergency conditions defined for PTT are defined in 3 tiers. A description of these emergency levels are described in the following paragraph.

4.1 Tier 1: Minor Emergency

Tier 1 is a situation where there is no danger to life and where the risk to property is minimal and can be controlled by the Emergency Response Team (ERT). Simultaneously, the Fire Department or relevant authorities would be called to attend to the emergency case and assess the situation together with the KLCC management, in deciding whether a Tier 2 Emergency be activated. Emergencies not involving the participation of the authorities will remain as Tier 1 for as long as it does not result in building evacuation.

4.2 Tier 2: Serious Emergency

Tier 2 is a situation where there is danger to life and/or risk of damage to property. The situation is beyond the capability of the internal responders (ERT) and therefore require the Fire Department first response or the Police in case of emergencies other than fire. The KLCC Emergency Management Team shall be called to support and provide manpower and equipment as and when necessary.

4.3 Tier 3: Major Emergency

Tier 3 is situation where the emergency escalates to a major disaster and emergency response operation will be in accordance with regulations under the National Security Council.

5. Evacuation Procedures for the PETRONAS Twin Towers

The PETRONAS Twin Towers were designed in accordance to the requirements specified by Standards for fire and life safety requirements. Fire alarm and fire fighting systems are installed with requisite backup systems including power and controls.

A typical floor of PTT has three stairwells, two located in the mid-core and the third in the bustle, serving floors 43 and below. Two firemen's lifts are located in the same vestibule of the two mid core stairwells. (Fig. 2)
Amongst others, PTT has developed a Standard Operating Procedures (SOP) for the Fire Emergency and Evacuation Procedures. These are broken into Stage 1 for a Tier 1 Emergency and Stage 2 for a Tier 2 or 3 Emergency. After 911, the Stage 2 evacuation, originally planned for the evacuation of only one Tower, has been expanded to include the simultaneous evacuation of both Towers in the event where both Towers are unsafe at the same time.

5.1 Stage 1 Evacuation

The stage 1 evacuation applies to an emergency event contained on only one floor for example a fire. In this case occupants on that floor, the floor above and the floor below will vacate their floors and respectively re-enter the building three floors below their floor (Fig. 3) named the Temporary Refuge Floor. These occupants will then remain on alert and await further instructions.

Occupants on two floors above and below the affected floor will also be put on alert via an announcement to prepare for evacuation should the need arise. If the fire is contained and put out, and all clear instruction from the CFCR will be issued and occupants will be allowed to return to their floors via the passenger lifts.
5.2 **Stage 2 Evacuation**

If stage One incident cannot be contained, a Stage 2 evacuation will be called whereby the whole Tower is evacuated. In the original planning, only one Tower is envisioned requiring evacuation. The Procedure is then as follows:

i. **Low Zone (Level G to 37)** - Down the stairwells to Concourse, exit and assemble at the KLCC Park

ii. **Middle Zone (Level 40 to 60)** - Down the stairwells to Level 41, cross over the Sky bridge, use shuttle lifts to Ground, exit and at KLCC Park.

iii. **High Zone (Level 61 to 77)** - Down the stairwells to Level 42, cross over the Sky bridge, use shuttle lifts to Mezzanine, exit and assemble at KLCC Park (Fig. 4)

iv. **Top Zone (Level 78 to 86)** - as similar for High Zone evacuation

A diagrammatic presentation of the evacuation procedures can be seen in Fig. 4. As in the original case, the evacuation of occupants with special cases (physically infirmed, pregnant, asthmatic and heart problem cases) will be conducted via the service lifts and specially manned by security personnel. Casualties if any will be rescued using the firemen's lifts.
6. Review Of Stage Two Evacuation Procedures Post Sept 11

The September 11 Incident prompted a review of the Stage Two Evacuation Procedure in the event the unlikely happens and where both Towers requiring simultaneous evacuation.

Amongst others, some considerations and deliberation were given to the safety of evacuation, speed, resource requirements and support from respective authorities.

Similar to the case of the World Trade Centre, the occupants at the higher zones of PTT are more vulnerable. Evacuation via the stairwells will take longer time as this is higher up. For PTT level 43 and above are served with only 2 stairwells. Whilst the building design allows adequate evacuation during a normal fire, ways to quicken evacuation are explored. In this case all escape corridors are two hour fire rated with the stairwell in a core within a core. It was proposed that in order to increase the speed of evacuation, designated shuttle lifts will be used to evacuate the upper half of the PTT.

In the event if both Towers are affected, or the Sky Bridge is rendered unusable and when speed is of essence, the Total Buildings Evacuation procedure in a non-fire mode will be adjusted as follows:
i. Low Zone (Level G to 37) - Down the stairwells to Concourse, exit and assemble at KLCC park.

ii. Middle Zone (Level 40 to 60) - Down the stairwells to Level 41, use the designated shuttle lifts of the same tower to Ground, exit building and assemble at KLCC Park.

iii. High Zone (Level 61 to 77) - Down the stairwells to Level 42, use designated the shuttle lifts of the same tower to Mezzanine, exit the building and assemble at KLCC Park.

iv. Top Zone (Level 78 to 86) - similar to evacuation for High Zone

A diagrammatic presentation of the above evacuation procedures can be seen in Figure 5.

As in the original case all disabled and occupants with special cases will be evacuated via service lifts and special manned by security personnel. Casualties will be rescued using the firemen’s lifts.

A series of mockups and evacuation drills were held to test the new procedures. Tests were conducted on lifts usage during evacuation, pressurization and ventilation systems. Generally, all tests indicated positive results. A Total Building Evacuation Drill was held in October 2002, which showed that total evacuation was achieved in 32 minutes.

After the incident of 911, the evacuation Assembly Area was moved from the Front Plaza to KLCC Park, away from the danger zone of falling debris, with the case of any events involving explosions.

7. Security Considerations

Prior to 911, all entrants to the PTT office areas are required to pass security access gates, using their tenants or visitors passes. The new regulations now require all entrants to also pass through a metal detector whilst all bags and packages have to be screened through X-Ray machines strategically located to minimise queuing and waiting time.

Public visitors to the Sky bridge essentially go through the same security procedures although screening of bags and packages is arguably more stringent now.

Visitors to public spaces namely Suria KLCC, the Concert Hall, Art Gallery and the Petroleum Discovery Centre are not screened as this is physically impossible.

Since 911, the PTT have received five bomb threats, and four parcels suspected of containing anthrax which all turned out to be hoaxes.

The Emergency Response Procedures for terrorist attacks, bomb threats, and handling of hazardous materials were also reviewed and updated. A special isolation room to “hold” suspicious parcels and letters has also been constructed.
Fig. 5: Concept of Building Evacuation of Both Towers Simultaneously

Conclusions

The September 11 tragedy has certainly caused a major impact on the way building are operated and managed. Emergency response plans and evacuation procedures of building which are formerly considered adequate will now require revision. It is now necessary to look beyond and examine possible eventualities and preparing for them. A renew on the evacuation procedures and preparing for the PETRONAS Twin Towers is timely to accommodate the changing and new environment for the safety requirements and comfort of building occupants.