

Big Indoor Bus Fire Disaster at Taiwan

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1. The Disaster

A horrible bus fire occurred on 19 July 2016 in Taiwan [1] with all passengers trapped inside and killed. This was different from just burning out all combustibles completely within a short time as in previous cases [2-5]. Fire investigation is underway but there are many information reported in the news and websites. Anyway, the fire source appeared to start from the bus interior, not at the engine at the back as in many other bus fires [2-5].

The hazardous scenario of having an indoor bus fire should be watched [2,6]. As no passengers in previous bus fires were killed [2], the hidden bus fire hazard was not alerted. This disastrous fire [1] of killing all trapped passengers sounded the alarm on having indoor bus fires.

2. Post-flashover Fire inside the Bus

Even for a small fire starting in an air-conditioned bus with good thermal insulation enclosure materials, heat will be trapped and hence flashover will occur quickly [7-12]. The heat released by burning the bus interior finishes, furnitures and combustible items is demonstrated to bring serious consequences as in this case [1]. All the combustibles will be ignited by high heat fluxes in a post-flashover fire, might be over 100 kWm^{-2} as measured in some experimental fires [13]. Adding fire retardant to combustible foam materials for seating and thermal insulation in buses can only delay ignition [14] by a small fire. The peak heat release rate might be reduced. When burning combustibles with fire retardant under high heat fluxes in a post-flashover fire, more smoke [15,16] will be liberated. Note that smoke might be another possibility of killing so many passengers in that bus fire [1].

3. Protection Proposed Earlier

As raised before [6] from preliminary bus fire research with limited support, fire protection for buses can be upgraded by [2,6]:

- Protecting occupants from fire as quick evacuation is very important as indicated in the recent bus fire [1], particularly for those buses enclosed with plastic glazing windows that are difficult to break.
- Preventing fire or retarding its growth and spread.
- Minimizing the impact of fire.

4. Immediate Action

Bus fire hazards must be watched after having so many bus fires [6]. An immediate action is to consider the following:

- Emergency exit doors of buses must be ensured to be openable when needed. After that big disaster [1], police had already set up road blocks in highways occasionally to check the exit doors of buses in Taiwan.
- Provide appropriate fire suppression system [17] demonstrated to work.
- Provide smoke control as pointed out before [11,12].

5. Concluding Remarks

Accidental fire must be prevented, and if it occurs, must be controlled to limit the fire size and spread to other combustibles. It is very important to provide appropriate protection, both active system and more exits, for buses. Workable fire suppression systems [17] would lower the risk of post-flashover fires in buses. Smoke control system appears to be important within some time after starting the fire.

Very little bus fire research was reported in the literature [2,7-12] in this part of the world, though millions of passengers travel everyday by bus. More effort should be made to carry out in-depth investigations into the possible bus fire hazards as in advanced countries [17]. Appropriate hardware fire safety provisions can then be installed and workable software fire safety management implemented. Otherwise, big disasters like this bus fire [1] might occur again.

Further, there might be even more challenges in using Liquefied Petroleum Gas (LPG) [18] or even hydrogen buses [19].

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