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Parameter Effects on the Time to Reach Flashover Conditions in Single Room Fires

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Key Words : flashover(), heat release rate(), structural fire(), zone method(), FAST(), Thomas method()

Abstract

In structural fires, flashover is characterized by the rapid transition in fire behavior from localized burning of fuel to the involvement of all combustibles in the enclosure. An investigation of parameter effects on the time to reach flashover conditions in a typical single room fire is undertaken using a zone method (FAST) and Thomas method. Major parameters affecting the time to reach flashover are found to be fire growth rate, ventilation opening area and internal room surface. The results of the FAST and the Thomas Method give very similar results of the time to reach flashover..

1.

A_o ; () (m²) 가 가
 A_w ; (m²) 가
 H_o ; (m) (flashover) .
 \dot{m}_a :
 \dot{m}_e : 가 가
 \dot{m}_f : 가 (rollover, 가 가
 \dot{m}_g :
 \dot{Q} ; (kW)) .
 \dot{Q}_{fo} ; (kW) (,) 가 , ,
 t_o : (s) 가
 α_f : (kW/s²)

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CFAST, FAST, FPETool HAZARD(NIST, National Institute for Standards and Technology, 가)

(1), Peacock (2), Deal(3) Peacock (4) Jones (Zone Model) FAST

(Thomas Method)

600°C

20 – 25k W/m² 가

1.1 (flashover)

(5) Drysdale(6)

FAST

(Zone method) NIST

Thomas

FAST

600°C

가

Babrauskas(7)

Thomas(8)

, kim

lilley(10)

(ventilation factor)

$$A_o\sqrt{H_o}$$

(m²), H_o, A_o (m)

가

(heat release rate)

(Thomas)

FAST

1.2 (Heat Release Rates)

), \dot{Q} (kW)

(t)

, \dot{Q}

(13) Krasny(11), Babrauskas Grayson(12), Krasny

t²

(Peacock (4), Babrauskas

(t_o)

$$\dot{Q} = \alpha_f(t - t_o)^2$$

(kW/s²), t_o

, α_f

(s)

10⁻³ kW/s²

1kW/s²

(t_o) (ignition source)

가 (가)

(Babrauskas(14)).

CFAST, FAST FPETool

(Jones et al¹, Peacock (2)

Deal(3))

가

(Slow) 0.00293 kW/s²

(Medium) 0.01172 kW/s²

(Fast) 0.04690 kW/s²

(Ultra-fast) 0.18760 kW/s²

1.3 (Zone Method)

가

(plume)

(source)

(\dot{m}_e)

$$(\dot{m}_p = \dot{m}_f + \dot{m}_e)$$

가

1

가

(CV₁)

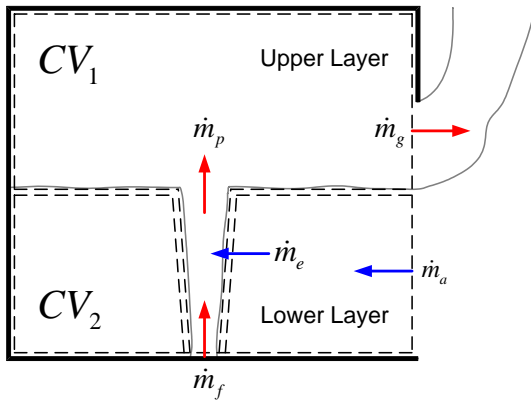


Fig. 1 Control volumes selected in zone modeling

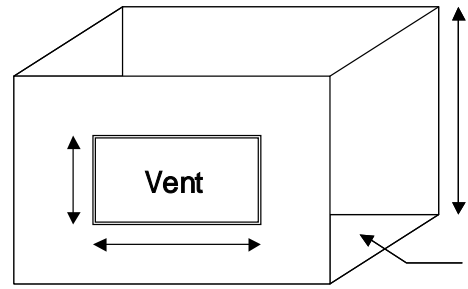


Fig. 2 Parameters investigated

가

2.

2

(1,2,3,4)

가

- 1.
- 2.
- 3.
- 4.

1. = 2 m
2. = 1 m
3. = 4m * 4m = 16m²
4. = 2.5 m
5. =

FAST

가 600°C

가 600°C
FAST

1.4 (Thomas)
Babrauskas⁽⁷⁾
50%

FAST

(Thomas⁽⁸⁾, Walton Thomas⁽⁹⁾)

kW

2.1

$$\dot{Q}_{fo} = 378 A_o \sqrt{H_o} + 7.8 A_w \quad (\text{Thomas Method})$$

()가

, A_w t² (m²)

1, 2)

(3

4

3

1m 0.5

3.5m

4

FAST

2m

0.5m

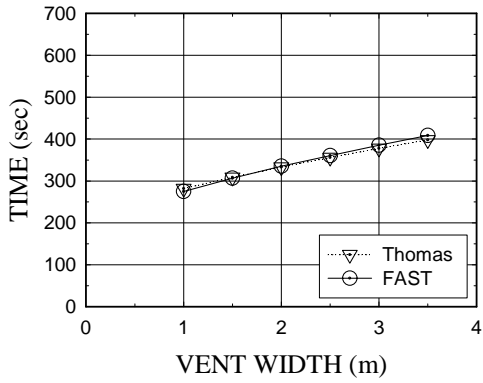


Fig. 3 Flashover time vs. vent width

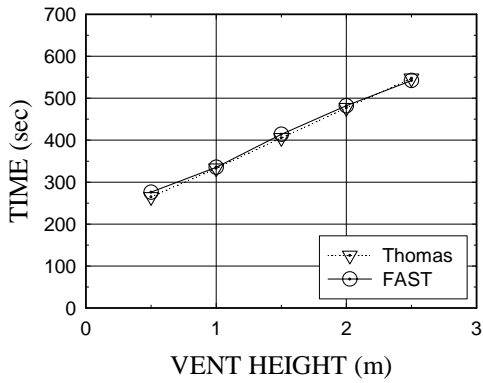


Fig. 4 Flashover time vs. vent height

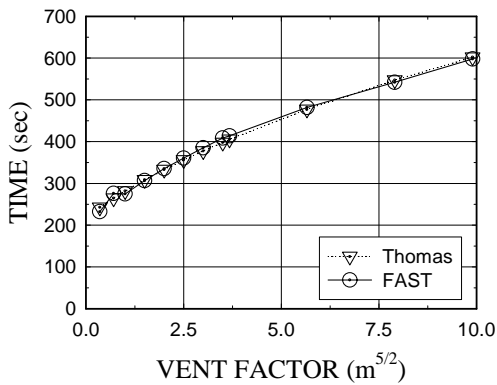


Fig. 5 Flashover time vs. vent factor ($A_o\sqrt{H_o}$)

. FAST

FAST

가

($A_o\sqrt{H_o}$)
 5).
 가 가 가 가
 2.2
 6
 9, 16, 25, 36, 49m²
 가
 1.5 가 . 5.4 가 가
 . 1.5m 4m 0.5m
 7
 8) 가 가 가
 가 가 가
 2.3

, , t²-
 가 , / 9
 가
 9

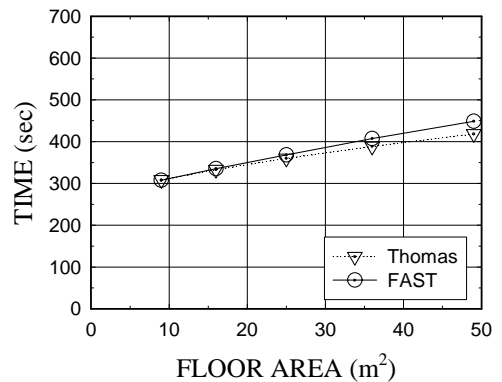


Fig. 6 Flashover time vs. floor area

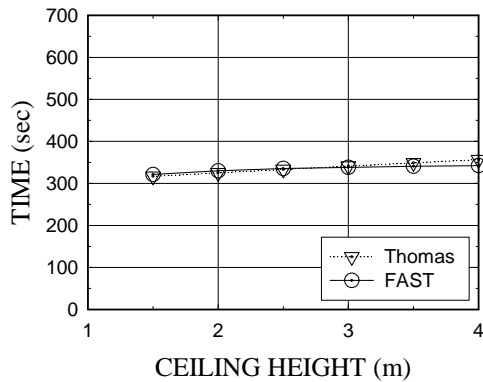


Fig. 7 Flashover time vs. ceiling height

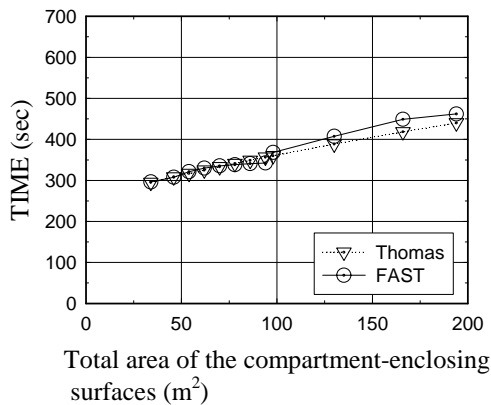


Fig. 8 Flashover time vs. internal room surface

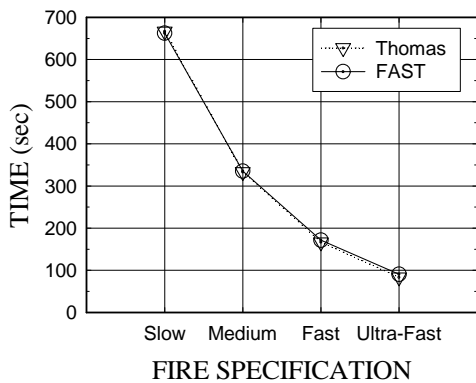


Fig. 9 Flashover time vs. fire specification

3.

FAST

가

4.

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