

Smoke Flow Control and related tactical issues



Prof. Dr. Michael Reick

Successful Fire Fighting



1. Rescue the People
2. Extinguish the Fire



Tactical Decision



1. Extinguish the Fire
2. Rescue the People



Sucessful Fire Fighting



Tactical Decissions



Rescue People

Extinguish the Fire



Air/Smoke Flows

Fire Ventilation

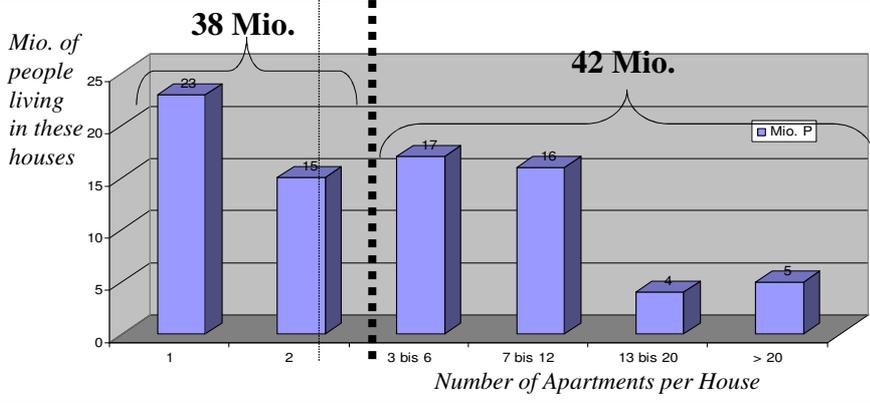
Dangerous Area

Fire Dynamics

*Toxic / Temperature / Visibility /
Fire Spread /*

Smoke Flow Control is a key factor

Housing Situation in Germany



Fires in large apartment buildings



Berlin 02.04.2004



Ratingen 07.06.2006



Sindelfingen 16.05.2014



Fire Ventilation in buildings

(with confined spaces)

Keep escape routes smoke free

(or get the smoke out)

Smoke Flow / Flow Path Control:

for rescue operations

and fire fighters safety

with a fan: "defensive ventilation"



Ventilate a fire in a confined space

Fire stage? Building?

Flow path control?

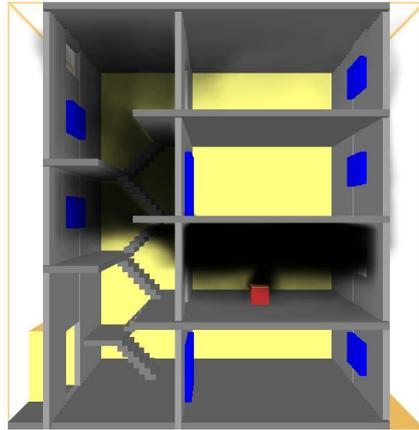
Risk for fast fire development

with a fan: "aggressive ventilation"



House fire – escape routes for people

Smokeview 4.01 - Aug 24 2004



escape routes:

- maybe: 1. escape-way
- maybe: 2. escape-way (second stairs/
portable ladder/aerial)
- (safe place concept ?)

at high risk:

- kids
- elderly people
- handicapped people

Frame: 100
Time: 60.0

With an open door
to the stairway

(or after we open
the door to the
stairway) :

***“a working fire
will lead to a
lost stairway”***



interior attack of
fire fighters =>
smoke path open



interior attack of
fire fighters =>
smoke path open ...





interior attack of
fire fighters =>
smoke path open ...



**Wrong Tactic –
Big Damage**

1st edition in 2002
7th edition in 2012





Attack route
through windows
using portable
ladders or aerial
ladders?



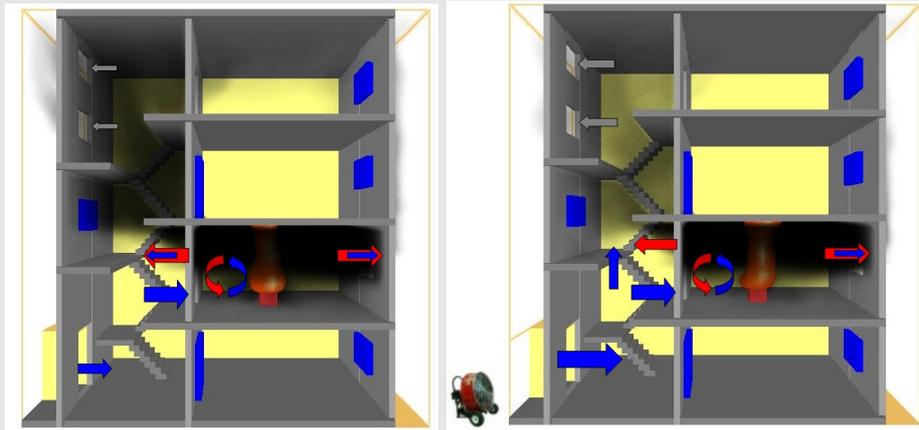
unfortunately:
this is not possible ...

***Doors are held open
by fire crews using
hoses***

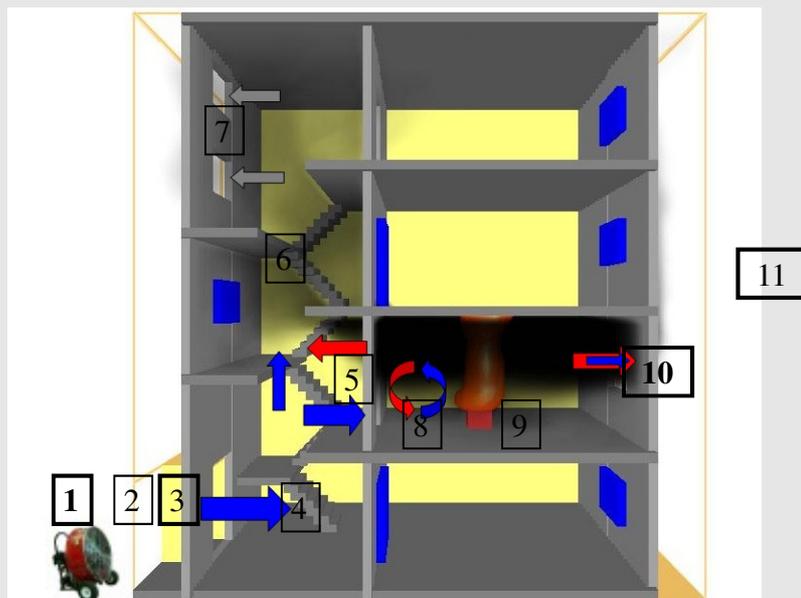
- fire proof doors
- smoke proof doors
- apartment doors
- room doors



Open door to the fire compartment

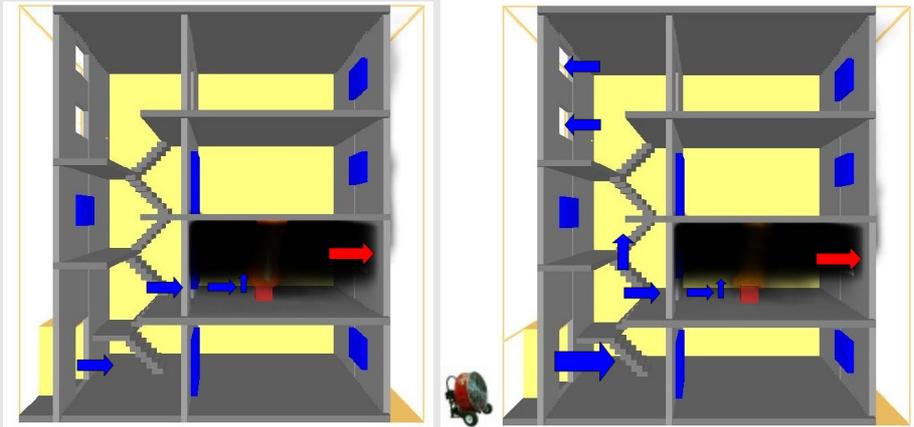


Fire and Flow Calculations



Entrance door is

- closed in the upper half
- open in the lower half



Multiple fire tests (in wood driven training facilities)
testing different types of blocking devices



03.11.2005:
room fire
in Göppingen



06.02.2006
room fire
in Heilbronn

apartment fire in Munich –
08.01.2008



14.04.2009 BF München

*12 Calls with the BlockAID
in München in 2009:*



07.09.
31.08.
05.06.
14.04.
02.04.
05.03.
16.02.
14.02.
16.01.
11.01.
08.01.
03.01.



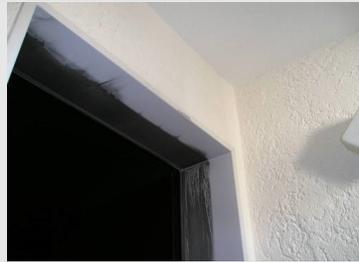
Basement Fire in Ratingen

13.04.2007

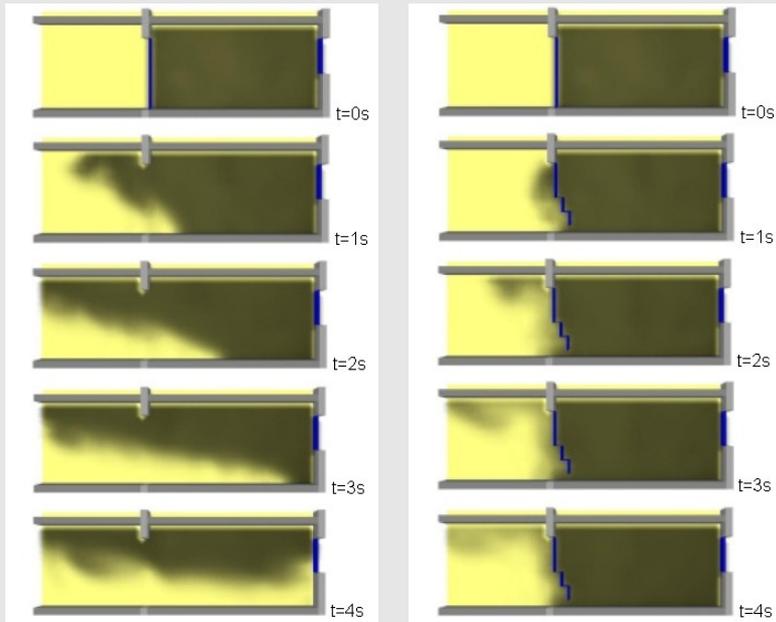


08.04.2008 room fire in Reutlingen

Appartment fire in Bad Mergentheim



Bi-Directional flow through a door



Pressure in a fire compartment

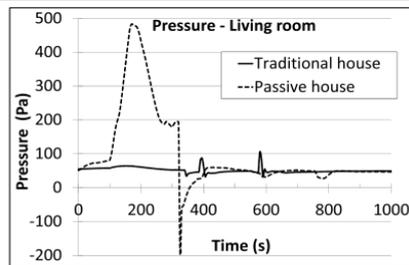


Figure 4: Pressure inside the living room.

After forcing the door:

Limited amount of smoke comes out (or steady flow)?

Limited amount of air sucked in (or steady flow)?

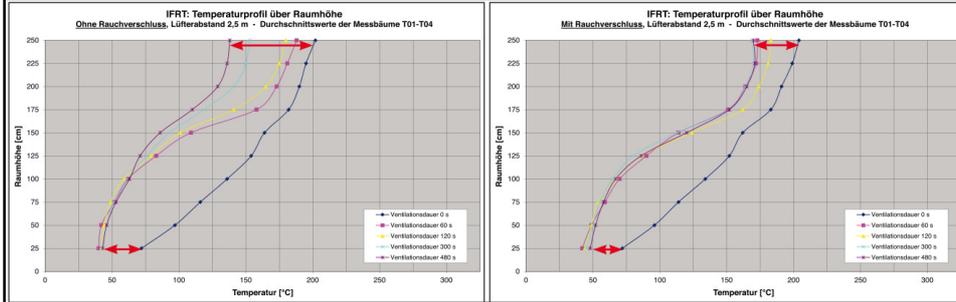
=> Fire Stage? Open Window?

4 Flow Situations when opening the door to the fire compartment

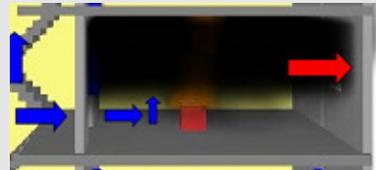
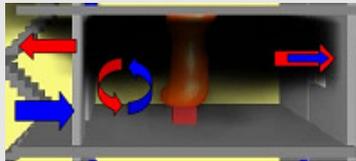
The four flow situations are:

- Constant flow outwards:** A red arrow points left from the doorway. A 'STOP' sign is placed below the doorway.
- 1-2 m³ Smoke outwards:** A red arrow points left from the doorway. A 'STOP' sign is placed below the doorway.
- 1-2 m³ Smoke inwards:** A blue arrow points right into the doorway. A 'STOP' sign is placed below the doorway.
- Constant flow inwards:** A blue arrow points right into the doorway.

Flow pattern: Influence on the fire



links unten: Temperaturprofil über der Raumhöhe zu den Zeitpunkten 0, 60, 120, 300 und 480 Sekunden ohne Mobilem Rauchverschluss bei 2,5 Metern Lüfterabstand (IFRT) rechts unten: Temperaturprofil über der Raumhöhe zu den Zeitpunkten 0, 60, 120, 300 und 480 Sekunden mit Mobilem Rauchverschluss bei 2,5 Metern Lüfterabstand (IFRT)



Backdraft-hazard:

*Protect people
in the building.*

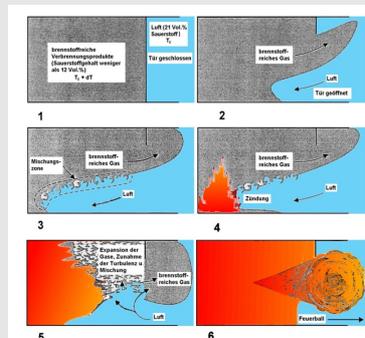
Protect fire fighters.

Install "Portable Fire Door"

fight the fire (outside?)

fight the fire (inside?)

but no further oxygen!





best position for ventilator?



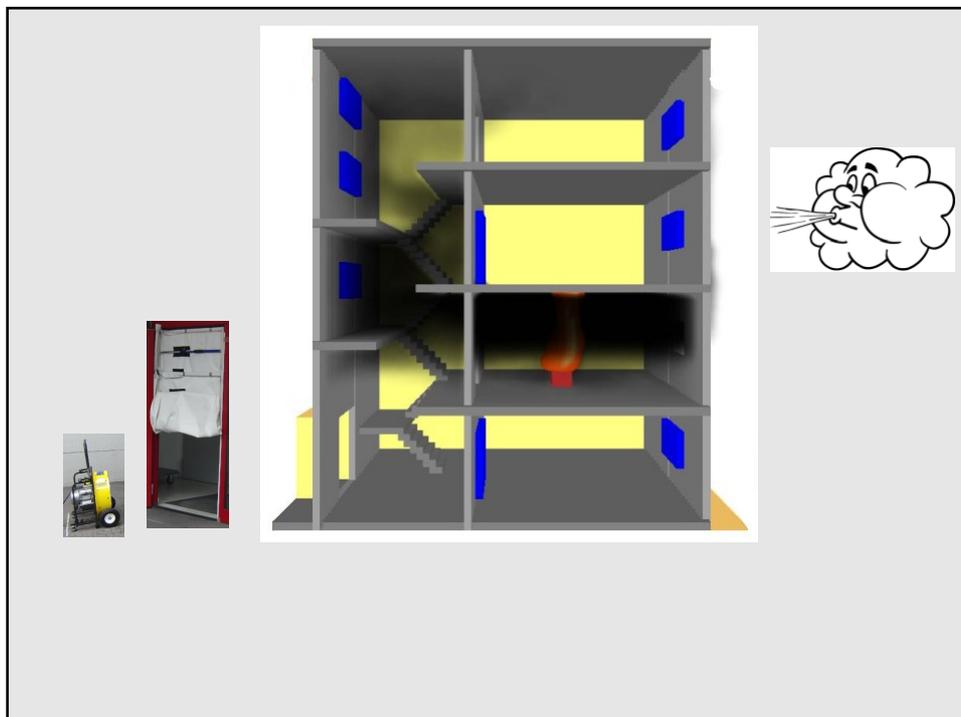
links: Bei einer lichten Höhe der Zuluftöffnung von rund 1,5 Meter sollte der Abstand des Belüftungsgerätes ebenfalls 1,5 Meter betragen. rechts: Bei einer geringeren Höhe ist auch der Abstand zwischen der Zuluftöffnung und dem Belüftungsgerät entsprechend zu verringern.

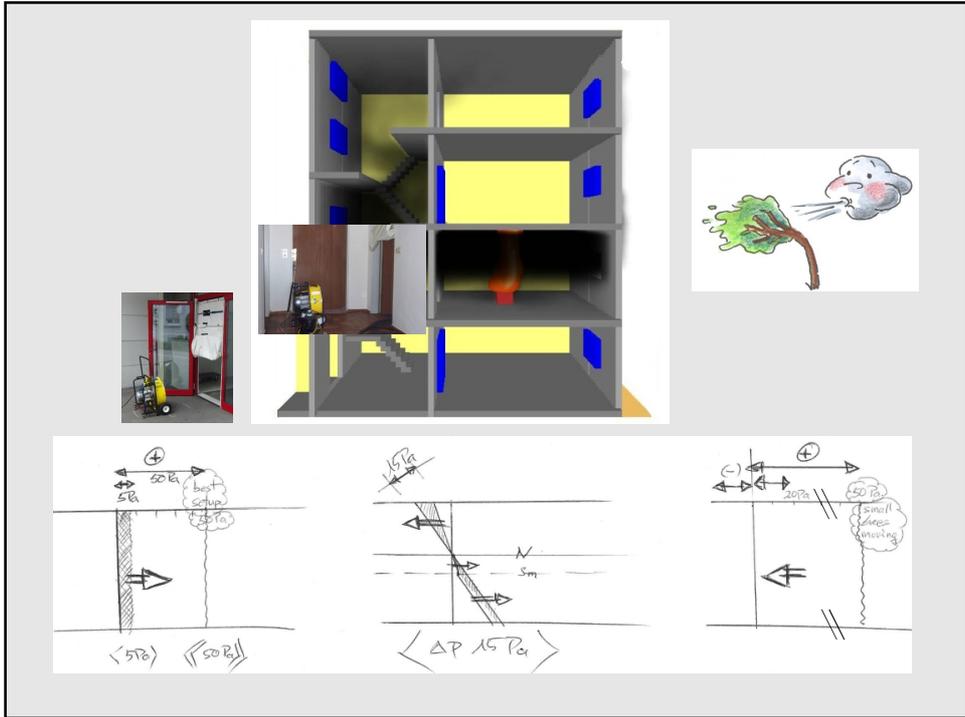
+50%

+100%



Wind driven Fire in Stuttgart: 02. March 2008





Highrise fire / wind driven fires





14.01.2009
Bad Harzburg
BlockAID
*mounted in a door
fully affected by the
fire to rescue
two children*



Smoke BlockAID used in fires: elderly people homes and hosiptals

- Altenheim Selbitz (05.05.2009)
- Uniklinik Würzburg (26.10.2009)
- Klinik Konstanz (06.11.2009)
- Klinik Koblenz (15.01.2010)
- Altenheim Bleckede (23.05.2010)
- Seniorenwohnanlage Seesen (23.06.2010)
- Klinik Bad Wildbad (05.08.2010)
- Altenheim in München (11.08.2010)
- Spital Wien (16.12.2010)
- Klinik Karlsruhe (22.02.2011)
- Altenheim München (04.03.2011)
- Klinik Mainburg (29.07.2011)
- Altenpflegeheim Lindenberg (25.01.2012)
- Altenheim Hannover (20.03.2012)
- Seniorenheim Weinheim (15.04.2012)
- Pflegeheim Weinheim (06.06.2012)
- Klinik Göppingen (05.08.2012)
- Seniorenheim Kernen (20.08.2012)
- Pflegeheim Naila (25.08.2012)
- Klinik Stuttgart (30.09.2012)
- Seniorenwohnheim Schönberg (19.12.2012)
- Krankenhaus Roth (09.02.2013)
- Betreutes Wohnen – Iserlohn (11.02.2013)



30.05.2014 - Fire in elderly people home – (3 deaths)



26.10.2009 – Würzburg
Fire in Hospital



09.02.2013 – Roth - Hosital



Further Experience in real fires

- Prevent smoke spread into escape routes
apartment/basement fires
mostly with a ventilator in front of the house
stairway already filled with smoke / still smoke free
- Close the upper part of an opening to place a ventilator closer to a door
- Close an opening for negative pressure ventilation
- Partially Close an Opening to limit fresh air flow to the Fire

sponsored by insurance companies



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