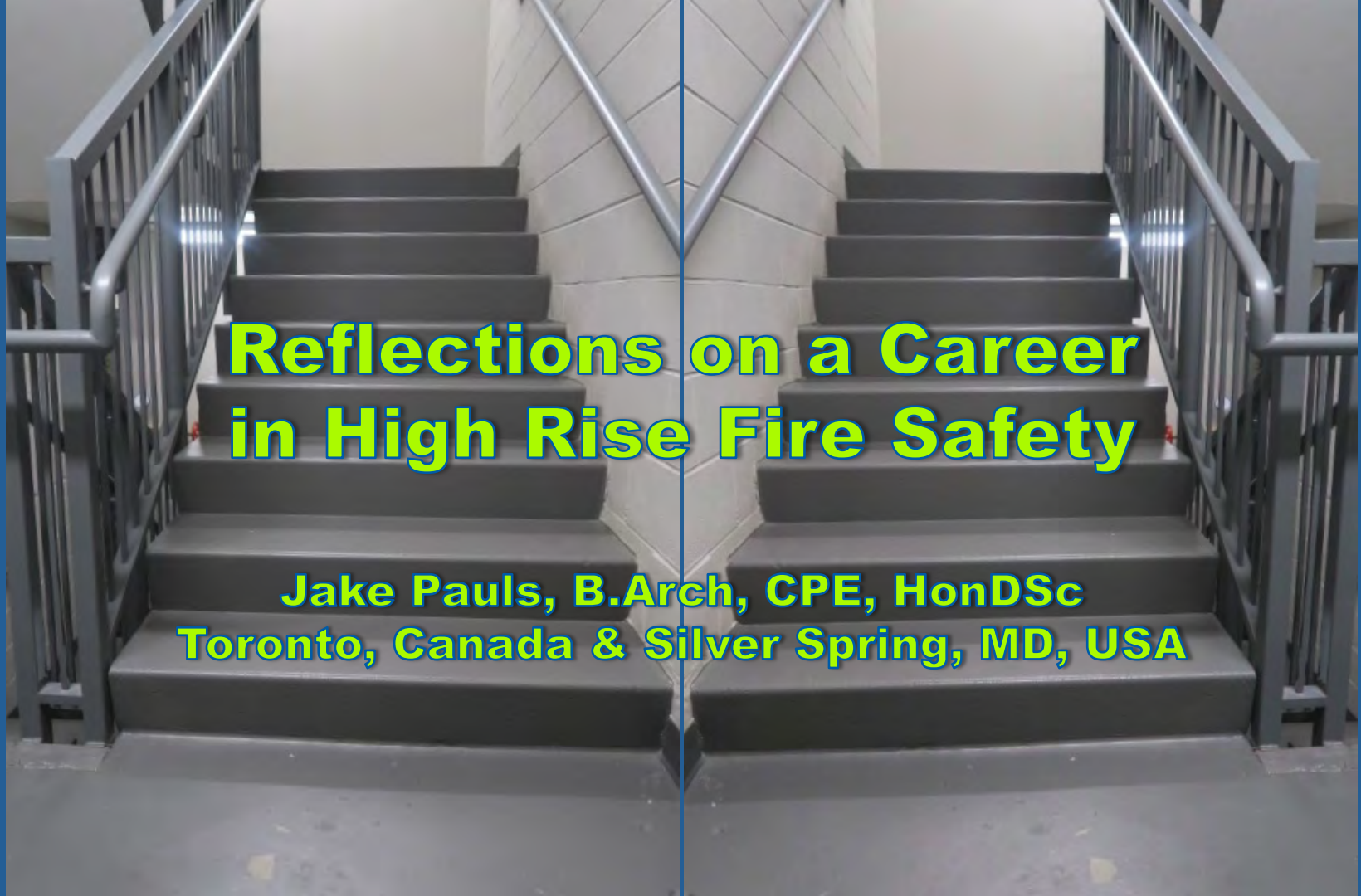
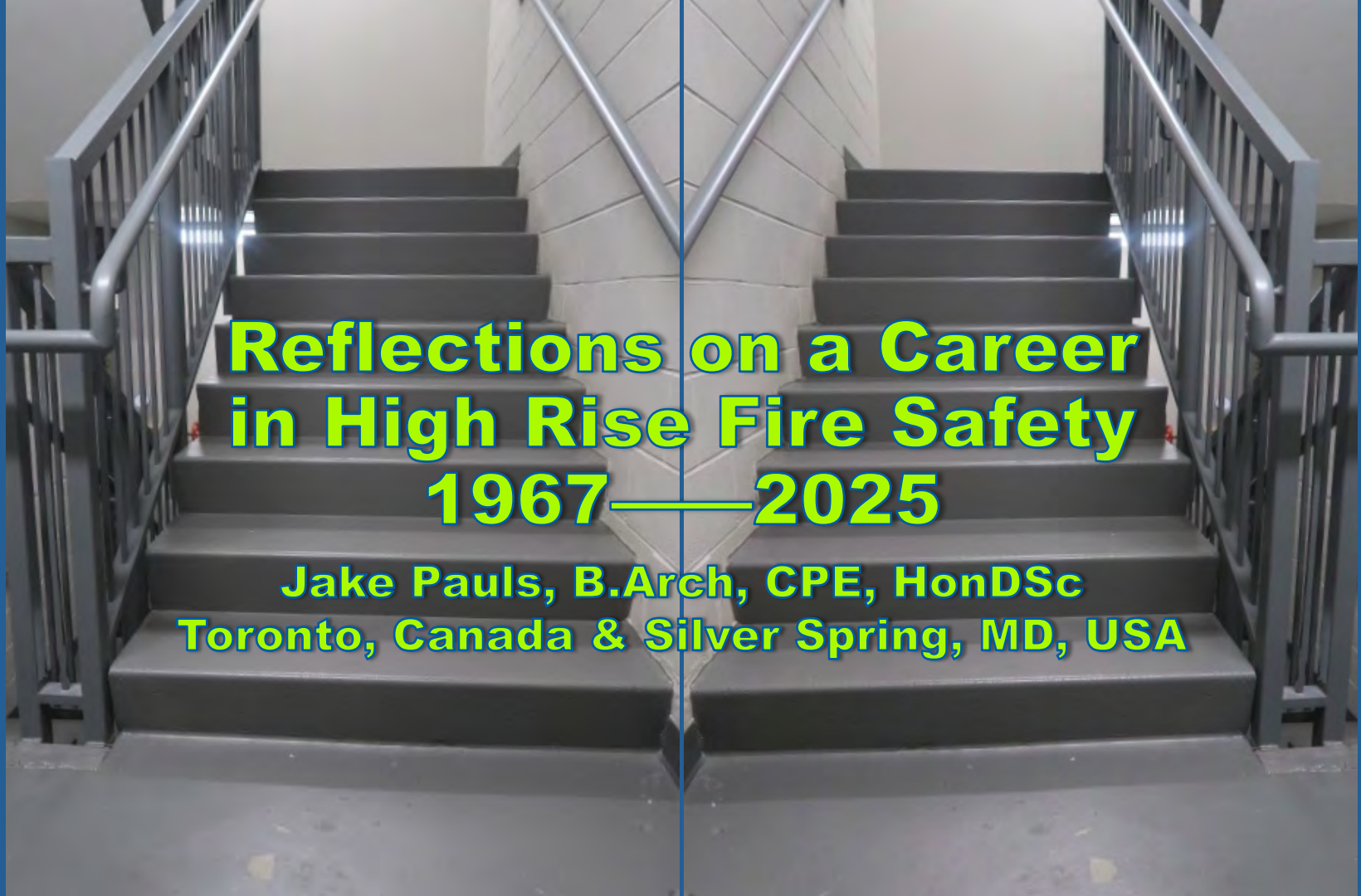


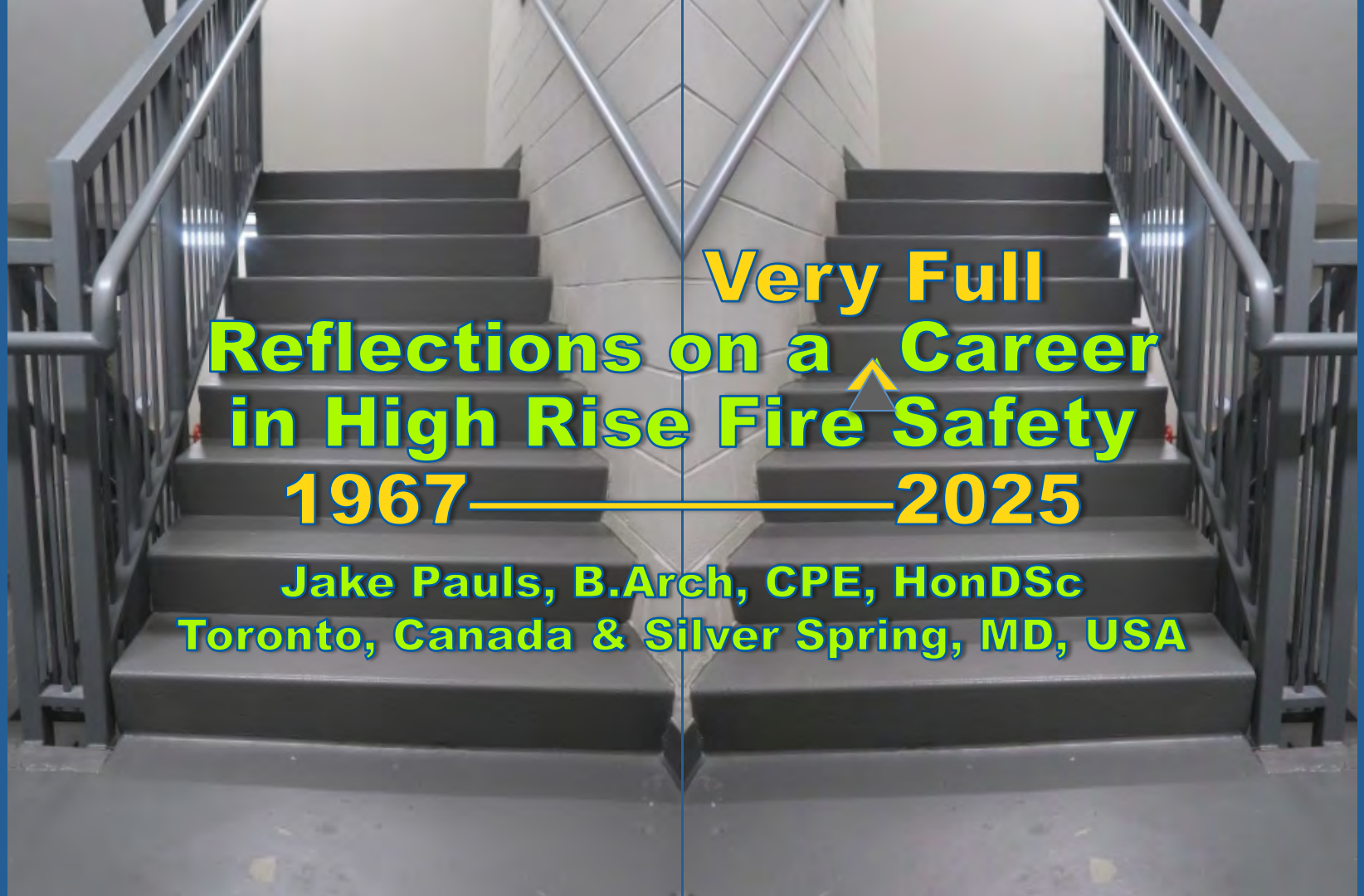
Reflections on a Career in High Rise Fire Safety

Jake Pauls, B.Arch, CPE, HonDSc
Toronto, Canada & Silver Spring, MD, USA



Reflections on a Career in High Rise Fire Safety 1967——2025

Jake Pauls, B.Arch, CPE, HonDSc
Toronto, Canada & Silver Spring, MD, USA



Very Full Reflections on a Career in High Rise Fire Safety

1967——————2025

Jake Pauls, B.Arch, CPE, HonDSc
Toronto, Canada & Silver Spring, MD, USA

Very Full, 58-Year Reflections on a Career in High Rise Fire Safety

1967——————2025

Jake Pauls, B.Arch, CPE, HonDSc
Toronto, Canada & Silver Spring, MD, USA

Born 9 March 1943

In Grandmother's Home

(Photo: 3 decades later, c./1973)


GRAIN ELEVATORS, GRENFELL, SASK.
This all started in 1943 on the Canadian prairies
82 years ago when the only high-rise structures
my young eyes saw were used to store grain.

March 3, 1943: Bethnal Green London Underground bomb shelter access on stair originally located here.

Crowd disaster on a London bomb shelter stairway a week prior to Jake Pauls' birth

. . . it was found that the pressure and possibly the pitch of the stair had produced a strange and terrible result. The bodies of the few still alive and the dead were pressed together into a tangled mass of such complexity that the work of extrication was interminably slow and laborious. . . . Death was, in all cases examined, due to suffocation, and the vast majority of cases showed signs of intense compression.

Bethnal Green Tube Station Shelter Incident, 3 March 1943, Inquiry Report [into 173 fatalities and 92 hospitalizations]

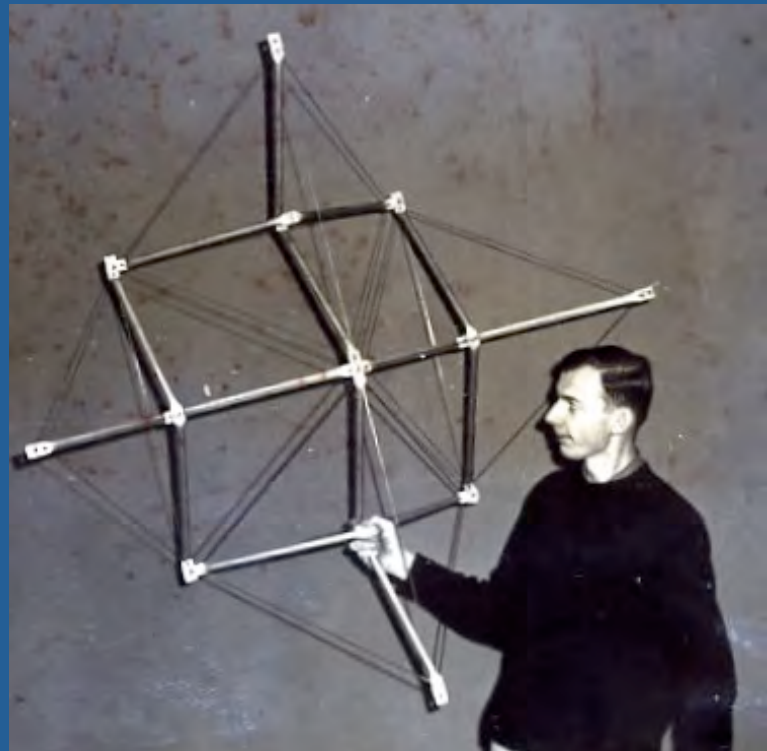
Two Decades Later

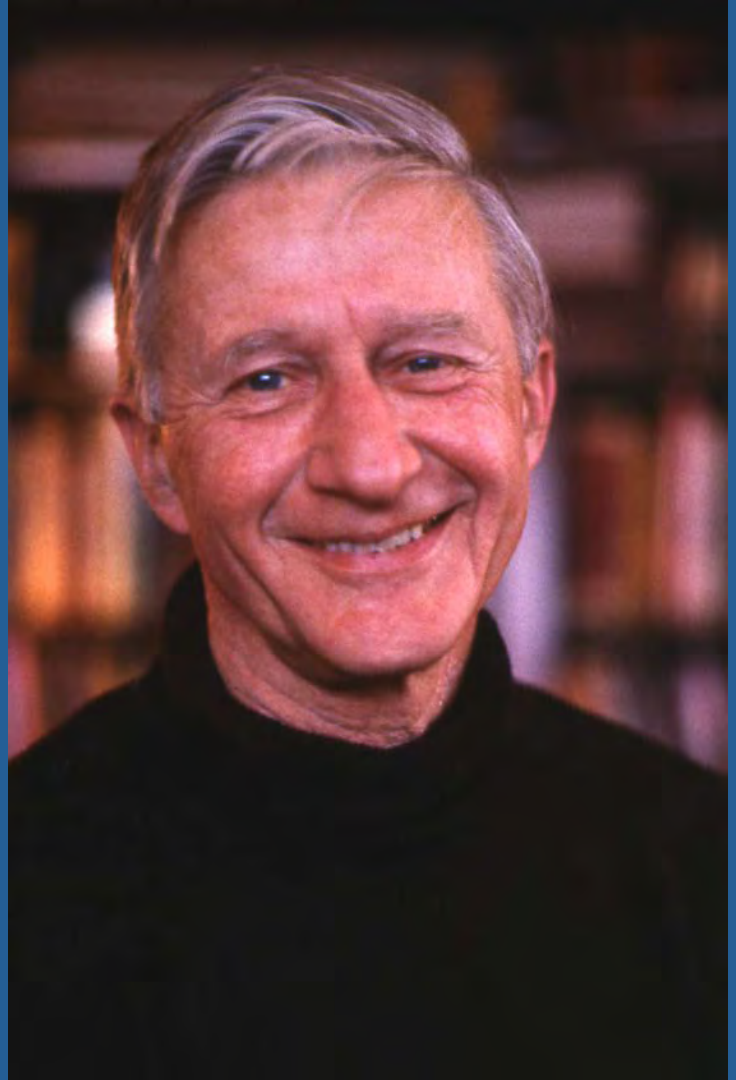
At the University of British Columbia, three years in Honors Physics was rejected by Jake Pauls in order to pursue something more practical: Electrical Engineering.
This was also rejected after two years.
Then five years, of more general, academic education, ended with a three-year, experimental program in the School of Architecture.

Two Decades Later

At the University of British Columbia, three years in Honors Physics was rejected by Jake Pauls in order to pursue something more practical: Electrical Engineering. This was also rejected after two years. Then five years, of more general, academic education, ended with a three-year, experimental program in the School of Architecture.

Here, in 1966, he invented—*then with colleagues, engineered and built*—a new space-frame system the Univ. of British Columbia sought to patent.





1967- Summer

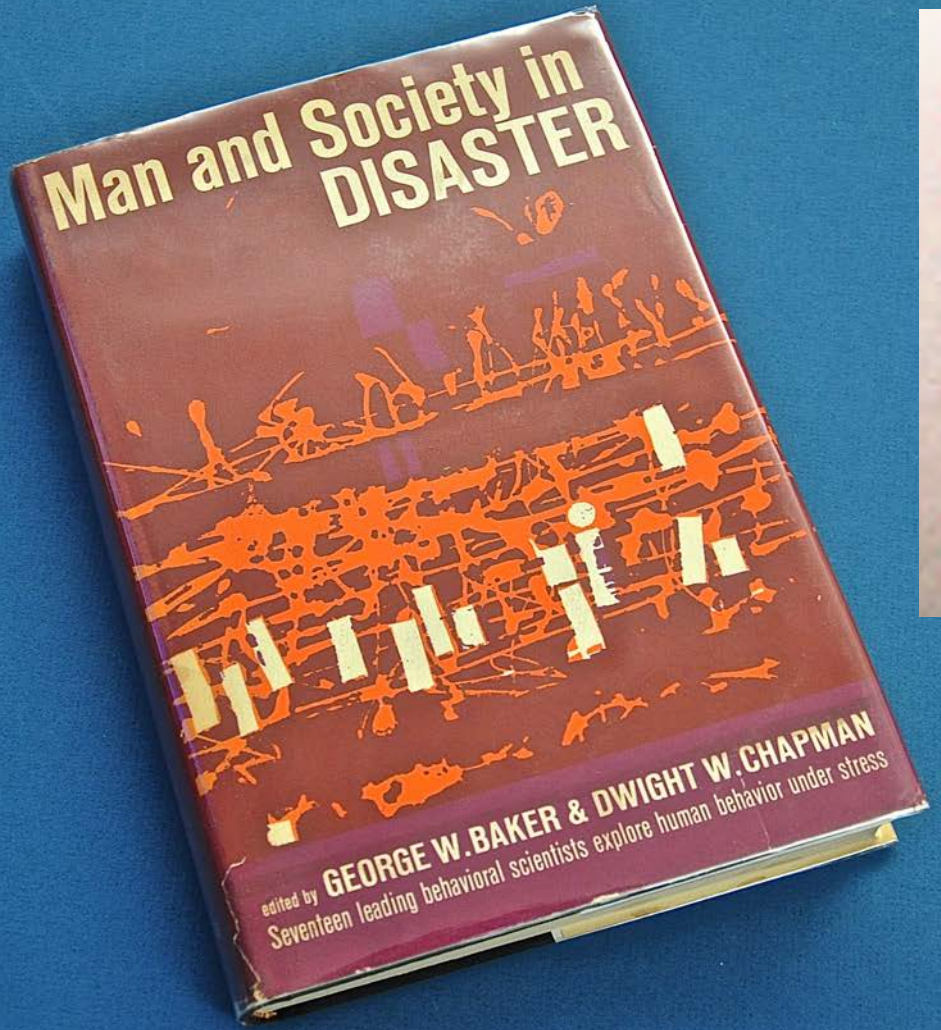
Stirling Ferguson, an Architect with the National Research Council of Canada (NRCC)—*and colleague of the UBC School of Architecture Director*—visited UBC to hire two students for summer positions at NRCC. As a result, two students, Donald Henning and Jake Pauls, were invited to join NRCC as Summer Students, to assist Stirling in national model building code development work Stirling had lead for decades in Canada.

1968 - Summer

Both Don Henning and Jake Pauls, continued to work under Stirling Ferguson, again as Summer Students assisting with national model building code development work. Don got even more involved on the code development issues related to people with disabilities. Jake got into more detail on egress generally from human factors and social behavioral points of view.

1969 all year

Both Don Henning and Jake Pauls worked on issues related their prior year fields of interest and research. Both were awarded B. Architecture degrees. Jake's focus was best served, not by faculty advice, but with a state-of-the-art book, *Man and Society in Disaster,* edited by sociologists Baker and Chapman published in 1962. Lessons from this historic book were considered in the context of building-scale disasters, principally fire-related.



Drawing on more than 100 studies of human behavior during war bombings, tornadoes, fires, floods, epidemics, airplane crashes, civil defense exercises and other natural and man-made disasters, seventeen leading behavioral scientists here explore our knowledge to date about human behavior under stress.

This 1962 book was the main academic reference for Jake Pauls' report, "*Responses to Emergencies in Buildings*" in 1969 for the BArch degree, also based on student positions at NRCC in 1967 and 1968.

RESPONSES TO EMERGENCIES IN BUILDINGS

A Graduation-Project Report

Presented to

the Faculty of the School of Architecture

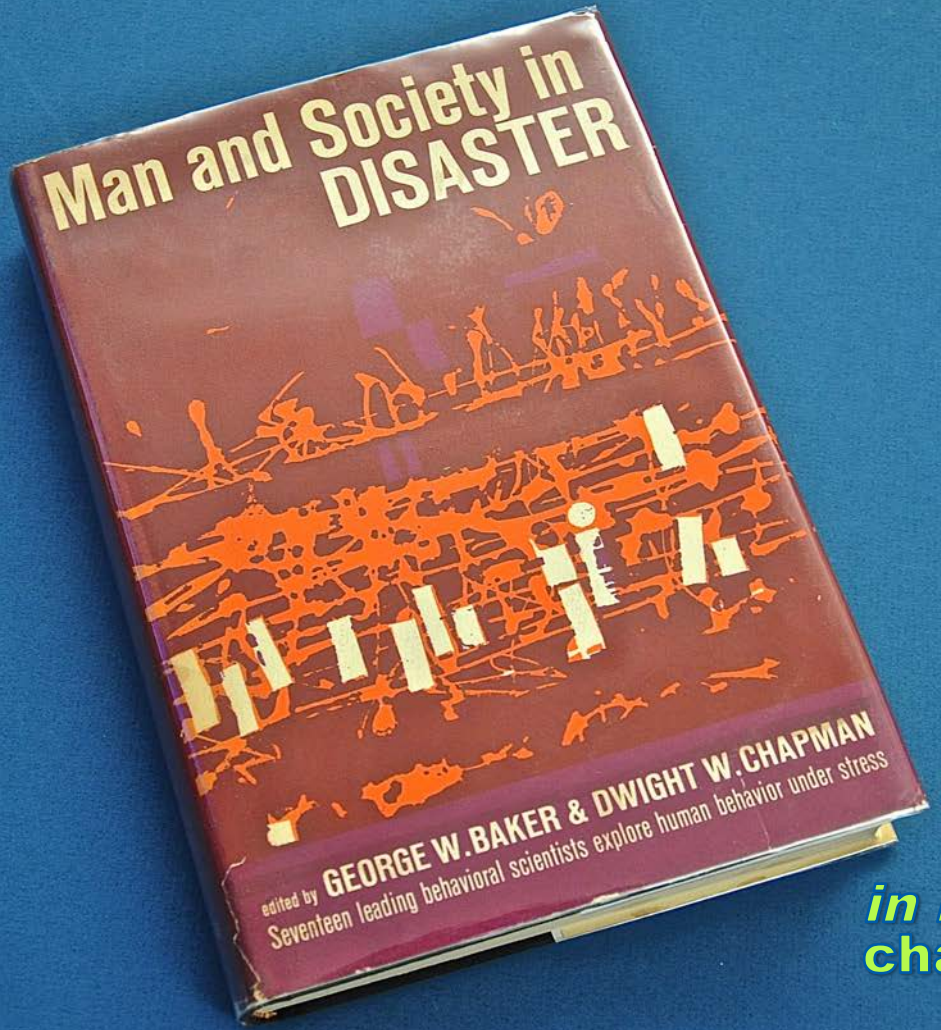
the University of British Columbia

Responses to Emergencies in Buildings

J.L. Pauls

1969

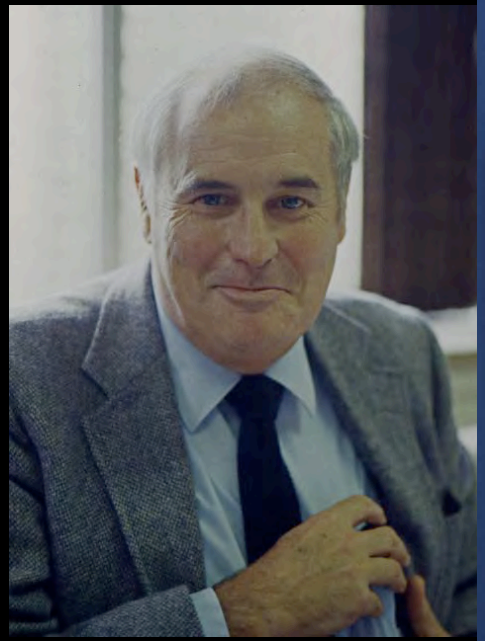
"Responses to Emergencies in Buildings" Revisited after 36 Years



"*Responses to Emergencies in Buildings*" owes much to the chapter by Stephen Withey.

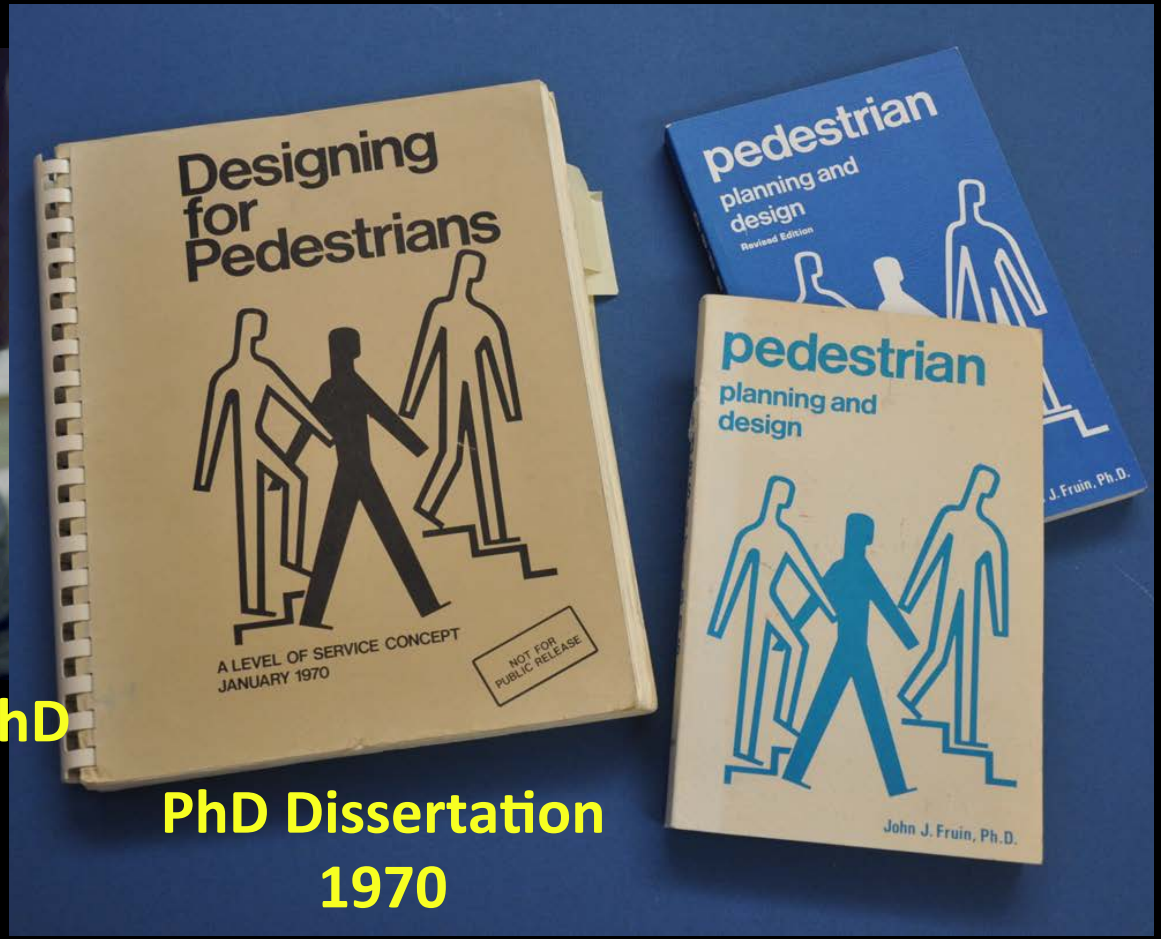
As a direct
result of Jake's
key discussions
with local fire officials
and building management,
he was invited to work with
such people on a full egress drill
in this BC Hydro Building in May 1969.
It had an office occupancy at that time.


c. 1970



John J. Fruin, PE, PhD

1928-2025



PhD Dissertation

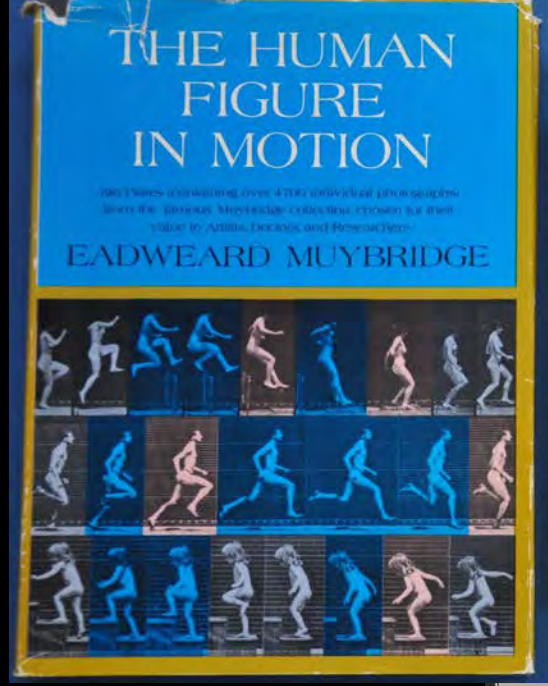
1970

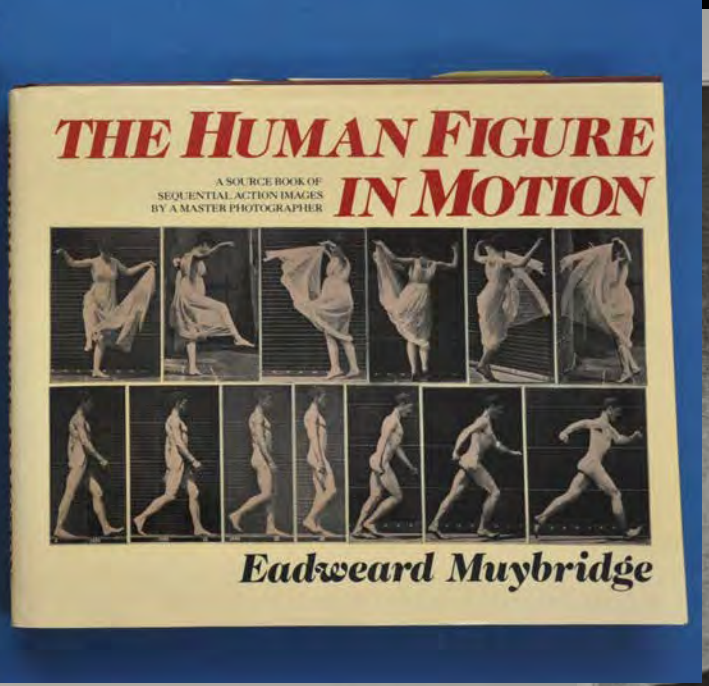
My personal library started in the early 1970s with works often written by people I knew and, in some cases, was the product of personal collaboration with authors and editors. My publications are a small, but significant part of this.

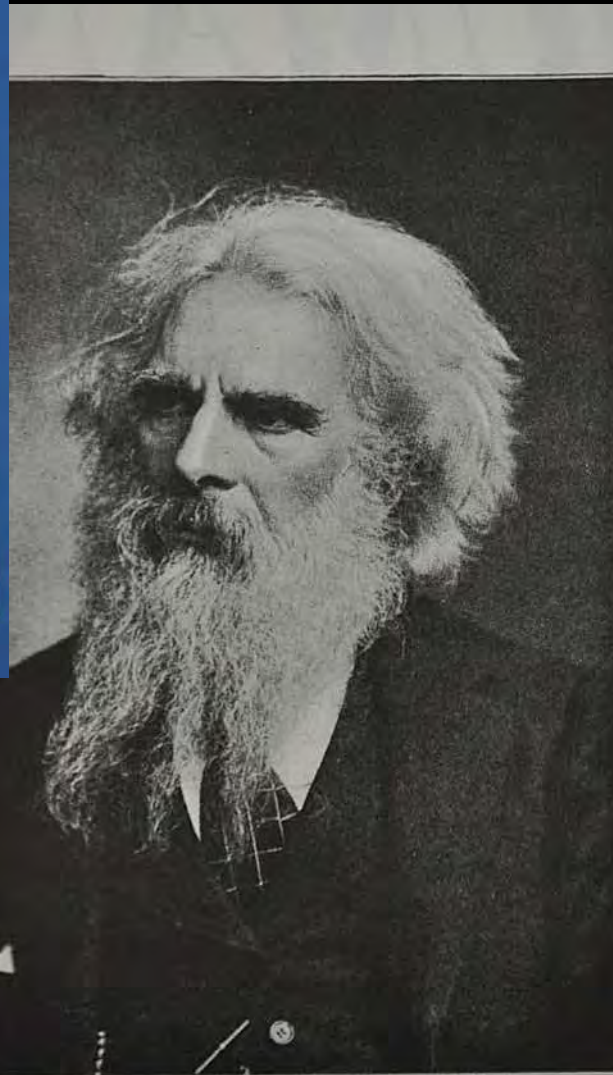
Today, the library holds over 700 separate publications. Most of these are held in my Toronto apartment-based office and the rest in my Silver Spring, MD, apartment. *All now need a new home.*


FIRES AND HUMAN BEHAVIOUR
Edited by DAVID CANTER
FIRES & HUMAN BEHAVIOUR
SECOND EDITION
EDITED BY DAVID CANTER
Human Behaviour in Fire
Proceedings of the First International Symposium
International Symposium on
Human Behaviour in Fire
- Understanding Human Behaviour for Better Fire Safety Design -
Conference Proceedings
26/28 March 2001
Massachusetts Institute of Technology, USA
MARKS & SPENCER
NFPA
SFPE
Organised by
interscience
3rd International Symposium on
HUMAN BEHAVIOUR IN FIRE
Public Fire Safety - Professionals in Partnership
Conference Proceedings
Europa Hotel, Belfast, UK
1-3 September 2004
Supported by
MARKS & SPENCER
Chubb
NFPA
SFPE
Organised by
interscience
4th International Symposium on
HUMAN BEHAVIOUR IN FIRE
Conference Proceedings
Robinson College, Cambridge, UK
13-15 July 2009
6th International Symposium
Human Behaviour in Fire 2015
SYMPOSIUM PROCEEDINGS
interscience

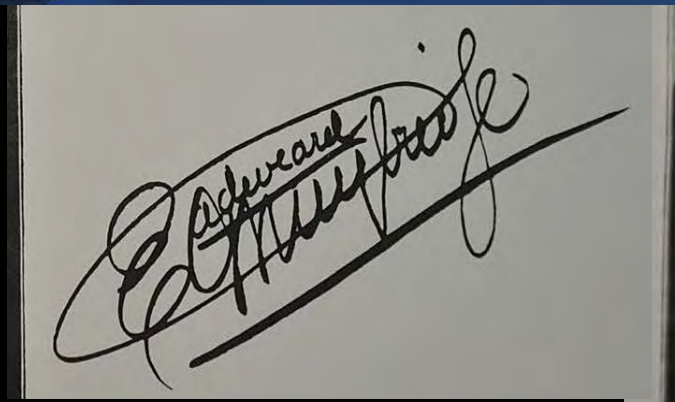

M. Schreckenberg
S. D. Sharma
Editors
Pedestrian and Evacuation Dynamics
Springer
Pedestrian and Evacuation Dynamics
Pedestrian and Evacuation Dynamics 2005
Springer
W. W. F. Klingsch
C. Rogsch
A. Schadschneider
M. Schreckenberg
Editors
Pedestrian and Evacuation Dynamics 2008
Springer
Richard D. Peacock · Erica D. Kuligowski
Jason D. Averill Editors
Pedestrian and Evacuation Dynamics
Springer

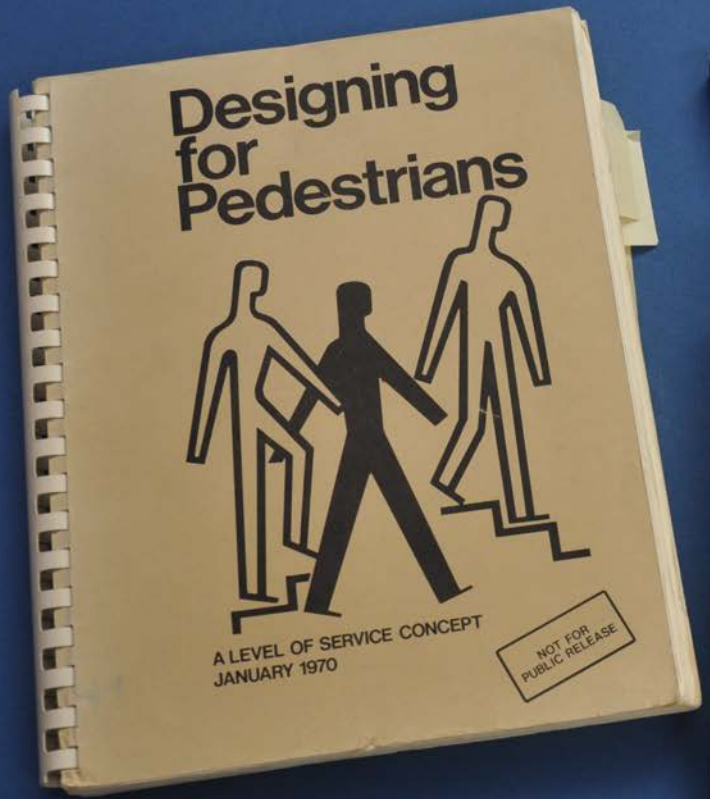

THE HUMAN
FIGURE
IN MOTION
EADWEARD MUYBRIDGE


THE HUMAN FIGURE
IN MOTION
A SOURCE BOOK OF
SEQUENTIAL ACTION IMAGES
BY A MASTER PHOTOGRAPHER
Eadweard Muybridge



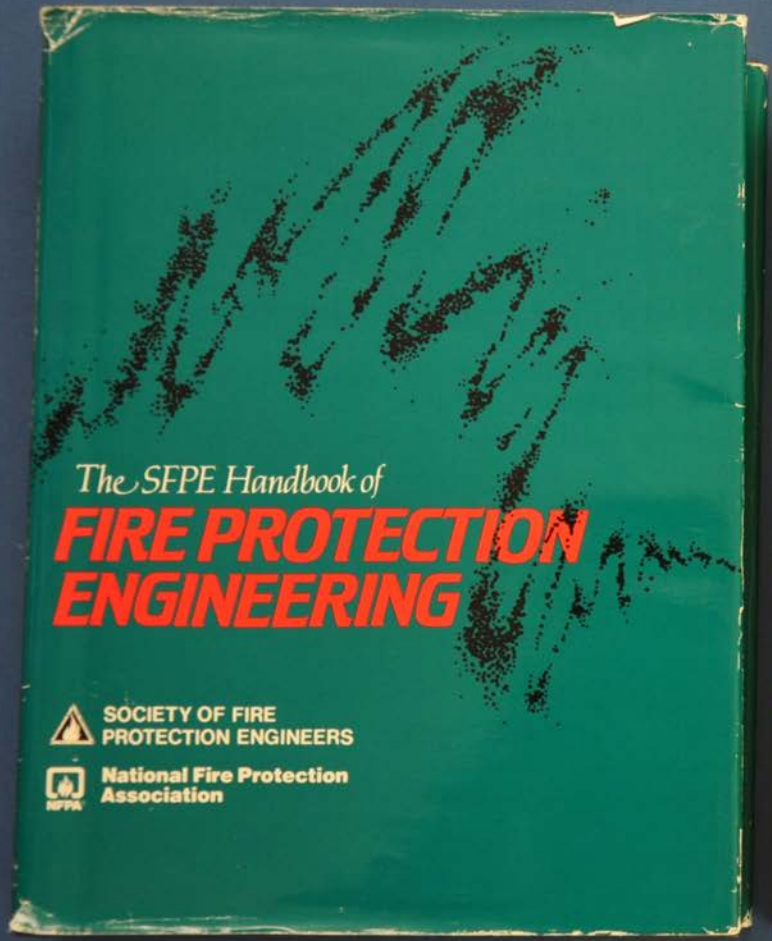
c. 1890s

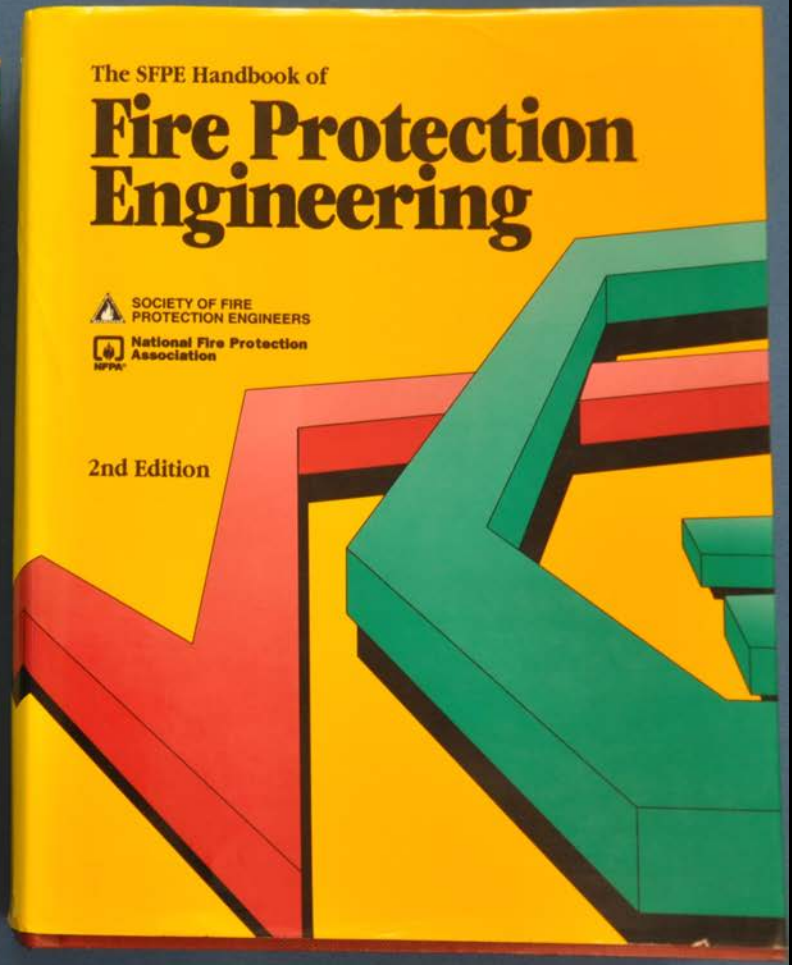

Eadweard Muybridge

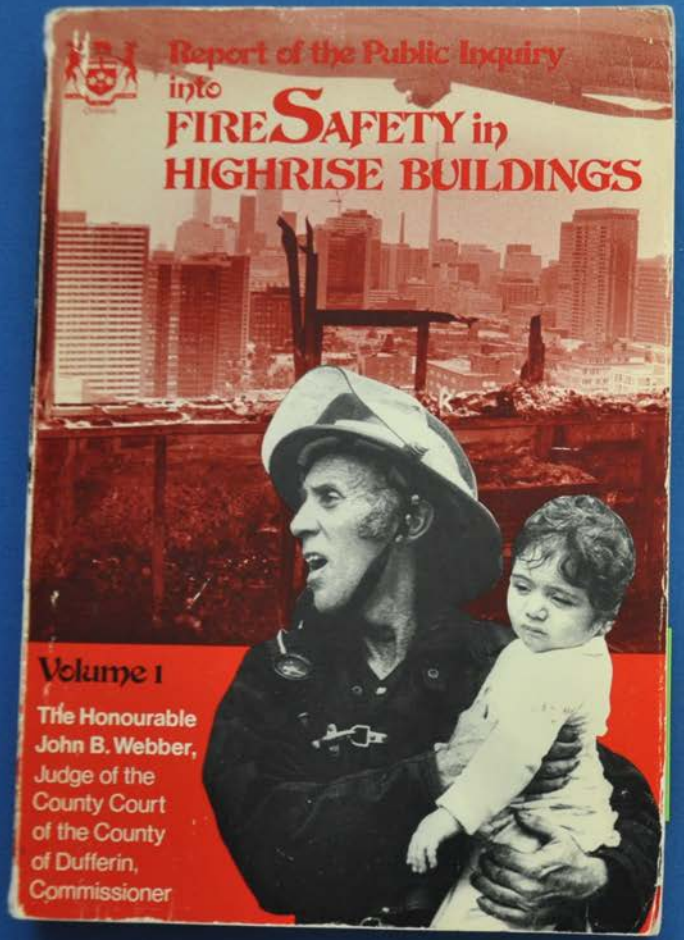

Designing
for
Pedestrians
A LEVEL OF SERVICE CONCEPT
JANUARY 1970
NOT FOR
PUBLIC RELEASE

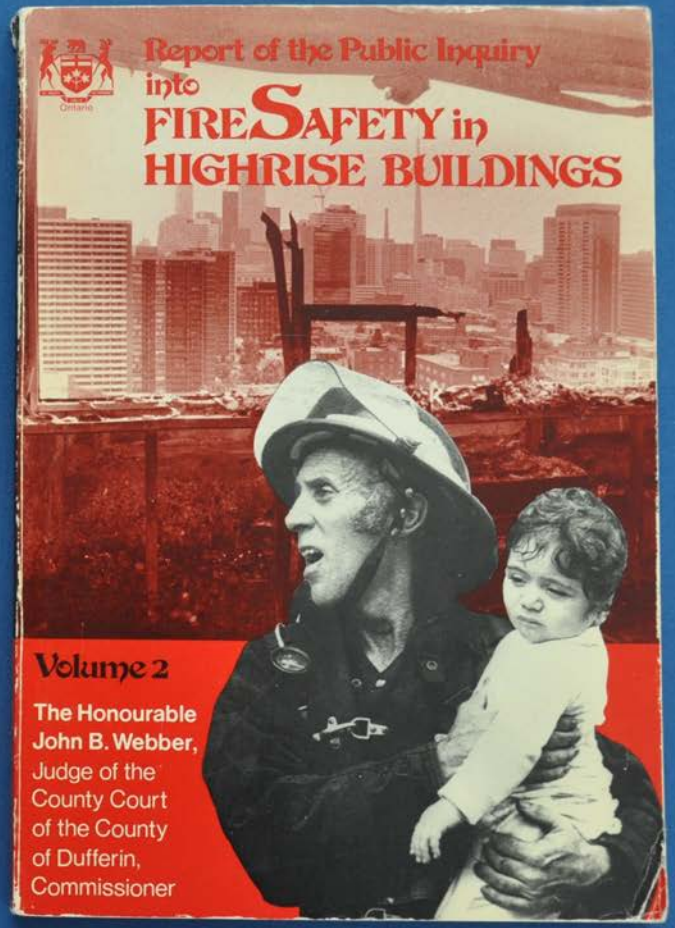

pedestrian
planning and
design
Revised Edition
J. Fruin, Ph.D.


pedestrian
planning and
design
John J. Fruin, Ph.D.

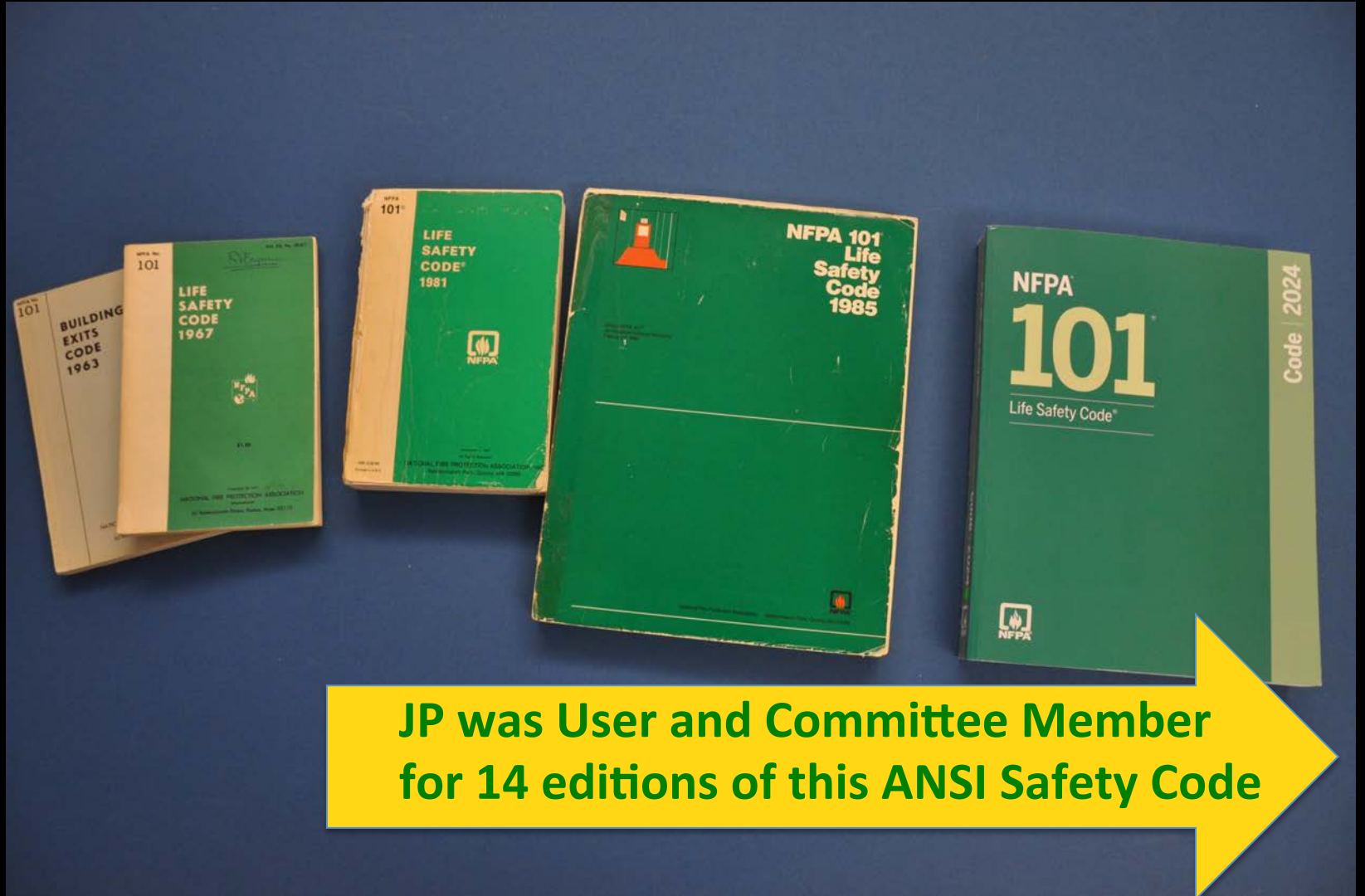

The SFPE Handbook of
FIRE PROTECTION
ENGINEERING
SOCIETY OF FIRE
PROTECTION ENGINEERS
National Fire Protection
Association
NFPA


The SFPE Handbook of
Fire Protection
Engineering
SOCIETY OF FIRE
PROTECTION ENGINEERS
National Fire Protection
Association
NFPA
2nd Edition

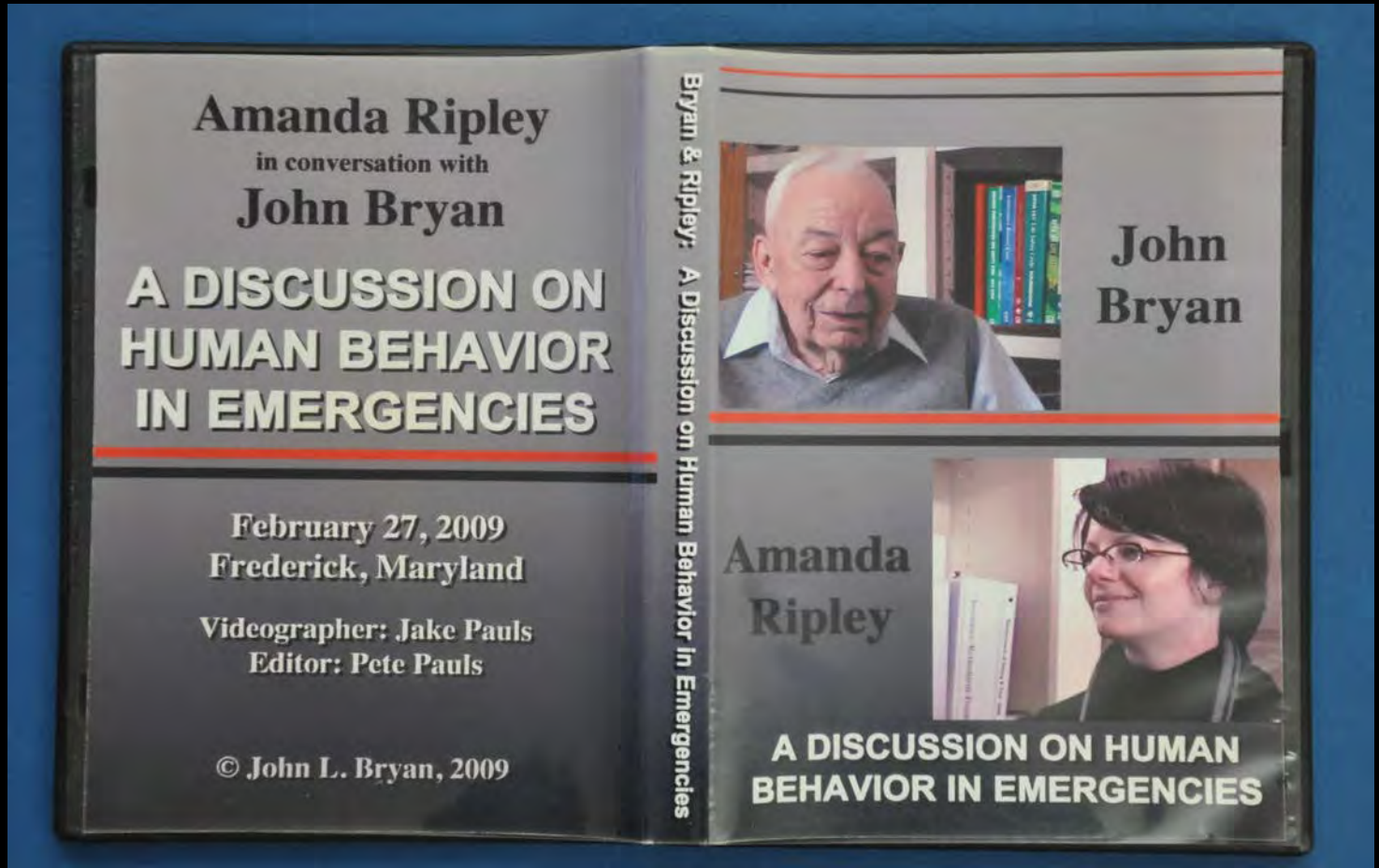

Report of the Public Inquiry
into
FIRE SAFETY in
HIGHRISE BUILDINGS
Volume 1
The Honourable
John B. Webber,
Judge of the
County Court
of the County
of Dufferin,
Commissioner


Report of the Public Inquiry
into
FIRE SAFETY in
HIGHRISE BUILDINGS
Volume 2
The Honourable
John B. Webber,
Judge of the
County Court
of the County
of Dufferin,
Commissioner

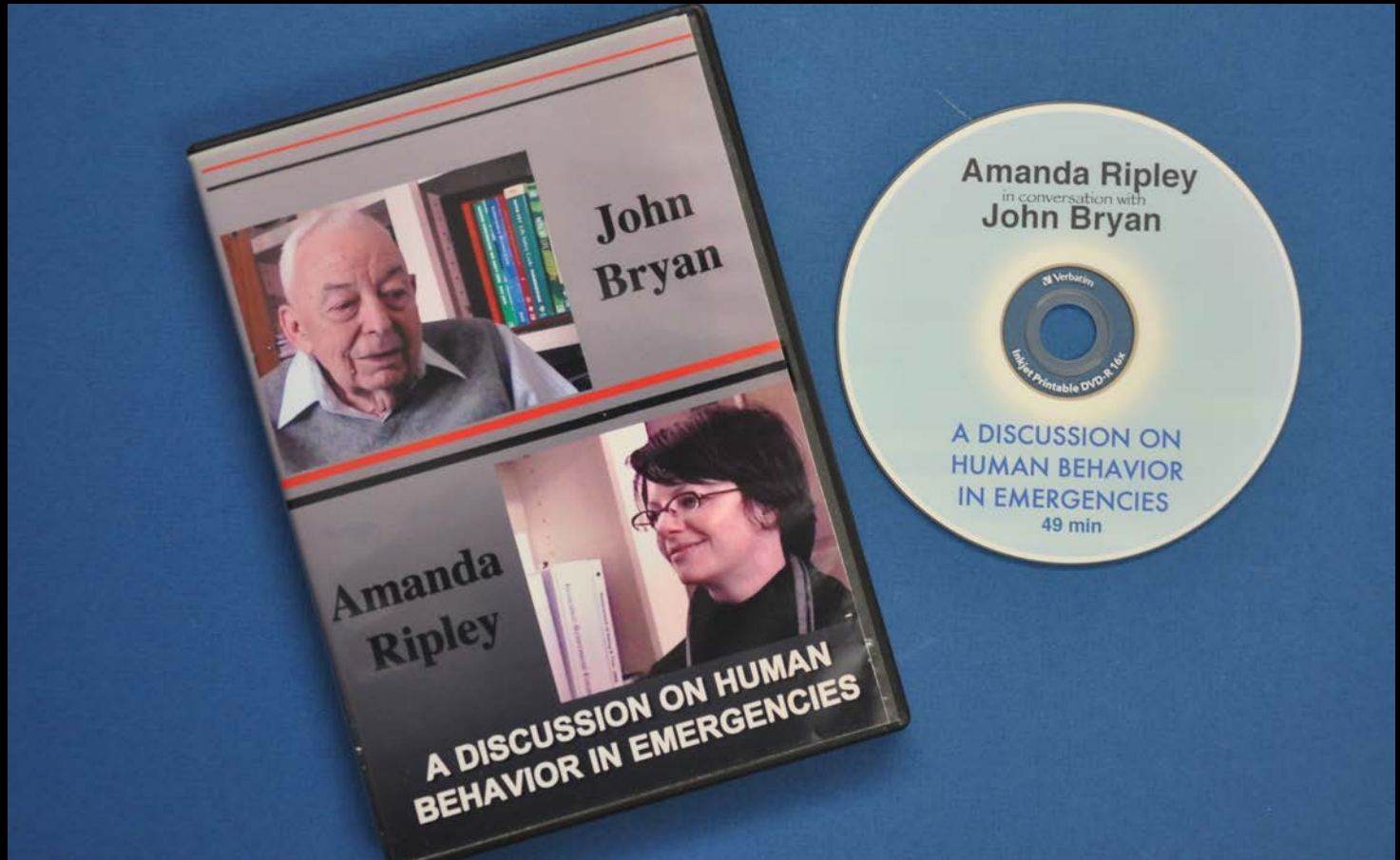
c. 1983


101
BUILDING EXITS CODE 1963
101
LIFE SAFETY CODE 1967
101
LIFE SAFETY CODE 1981
NFPA 101 Life Safety Code 1985
NFPA
101
Life Safety Code
Code | 2024
JP was User and Committee Member
for 14 editions of this ANSI Safety Code

Jake Pauls as videographer and Producer to Honor a Treasured Colleague



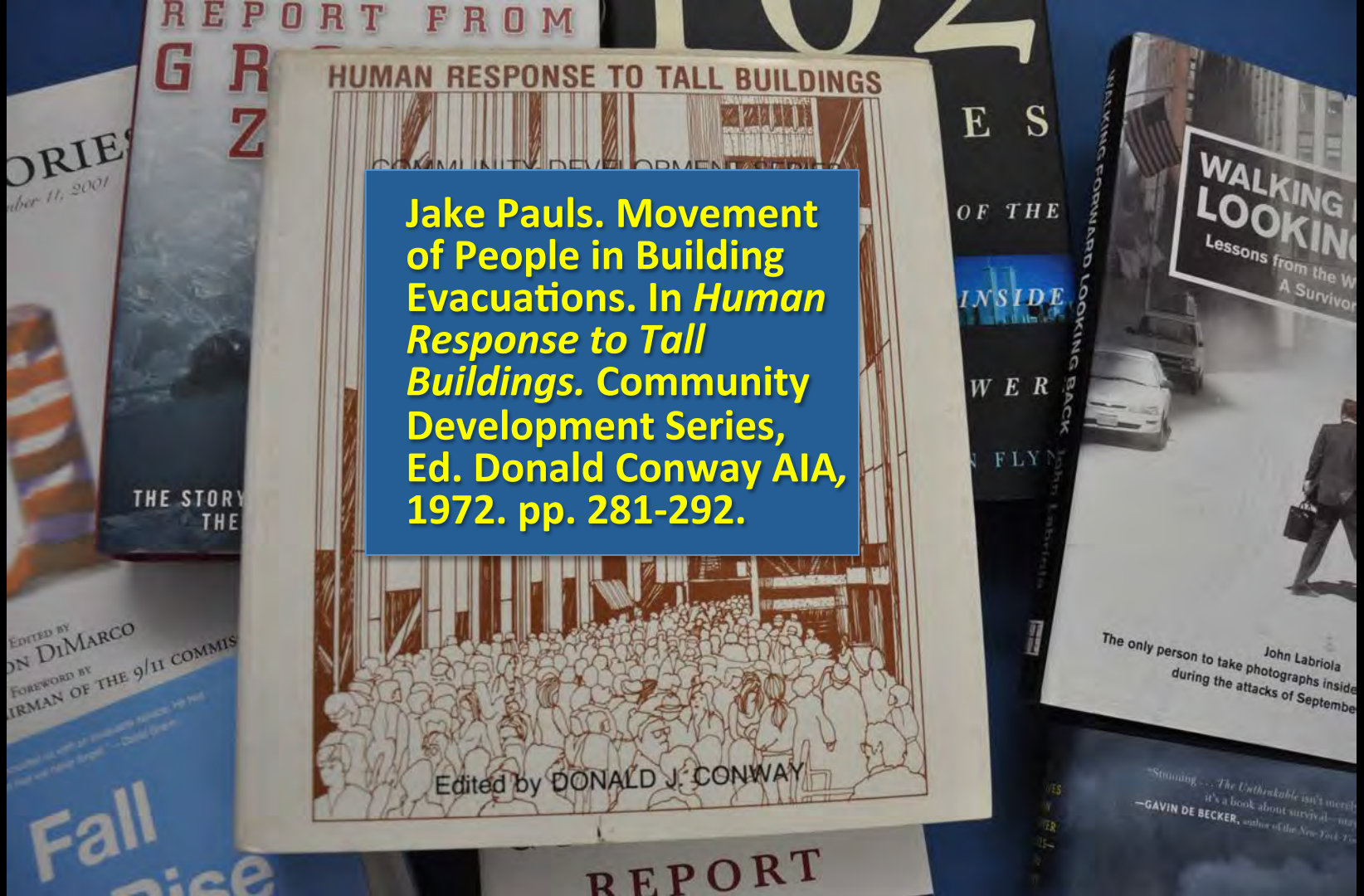
Jake Pauls as Videographer and Producer to Honor a Treasured Colleague
(At the reported request of the Family, the DVD is not publicly available.)



February 1993

Study Team for 1993 Study of Evacuation of WTC Occupants with Disabilities. *Fire Engineering* published highlights (by Edwina Juillet) of this study in the very extensive Dec. 1993 issue covering many apects of the bombing and large-scale evacuation.

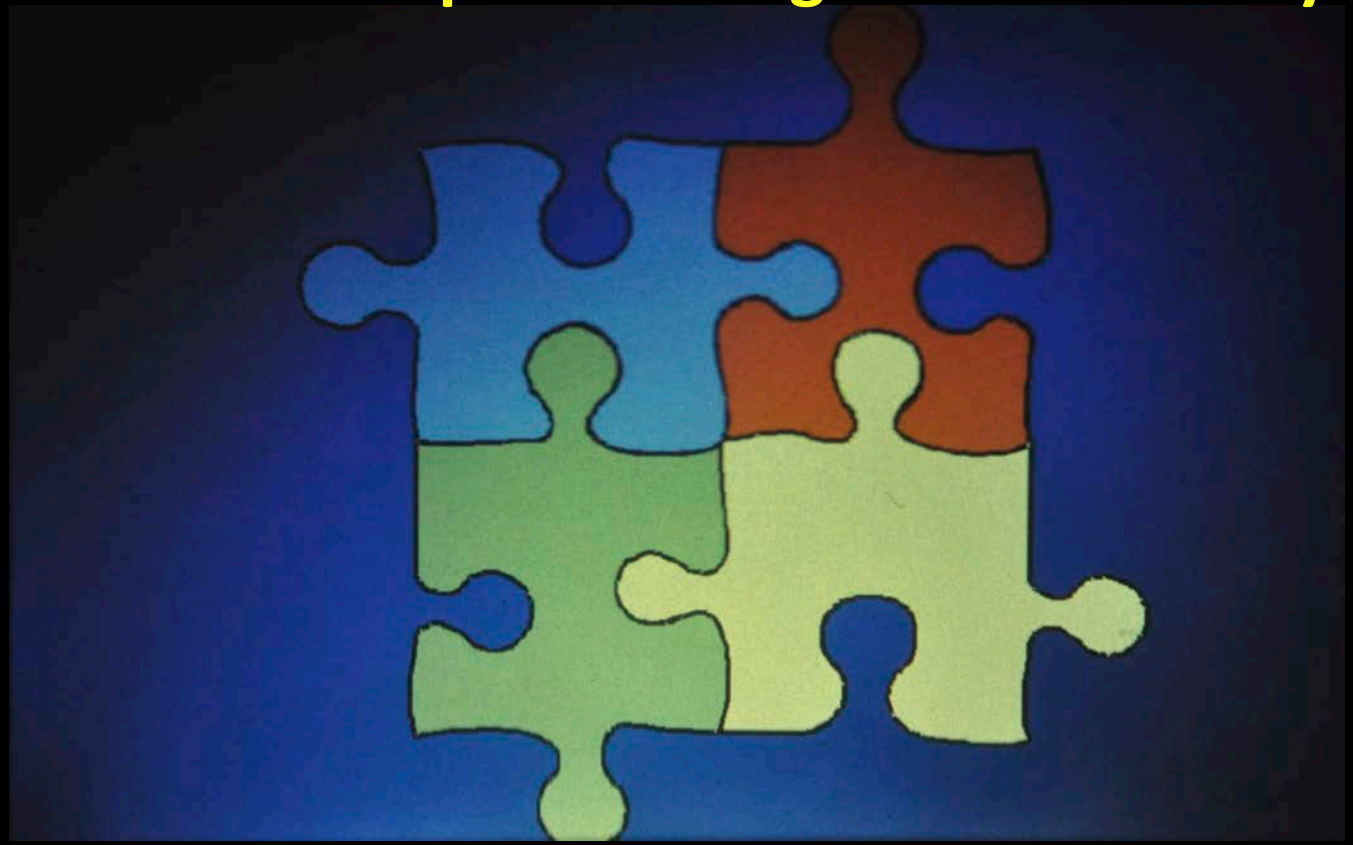

Against All Enemies
Richard A. Clarke
Tower Stories
Damon DiMarco
Dennis Smith
Report from Ground Zero
The Story of the Rescue Efforts at the World Trade Center
102 Minutes
The Untold Story of the Fight to Survive Inside the Twin Towers
Jim Dwyer and Kevin Flynn
Walking Forward, Looking Back
Lessons from the World Trade Center: A Survivor's Story
Inviting Disaster
Lessons from the Edge of Technology
An Inside Look at Catastrophes and Why They Happen
James R. Chiles
Fall and Rise
The Story of 9/11
Mitchell Zuckoff
The 9/11 Commission Report
Final Report of the National Commission on Terrorist Attacks Upon the United States
Authorized Edition
What We Saw
The Events of September 11, 2001—In Words, Pictures, and Video
CBS News
The Unthinkable
Who Survives When Disaster Strikes—and Why
Amanda Ripley
Terrorism and Public Health
A Balanced Approach to Strengthening Systems and Protecting People
Barry S. Levy | Victor W. Sidel



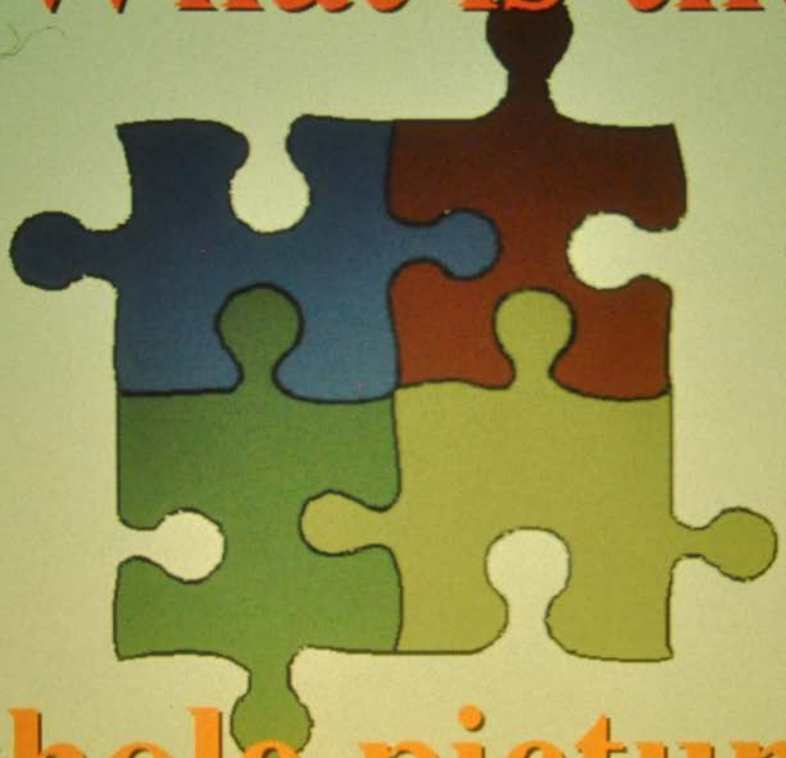
Jake Pauls. Movement of People in Building Evacuations. In *Human Response to Tall Buildings.* Community Development Series, Ed. Donald Conway AIA, 1972. pp. 281-292.

The ***Jake Pauls Award For Outstanding Advocacy for Building and Fire Safety*** **(**from RACERS at John Jay College, NYC) **conferred on Author Peter Apps, December 2024**.

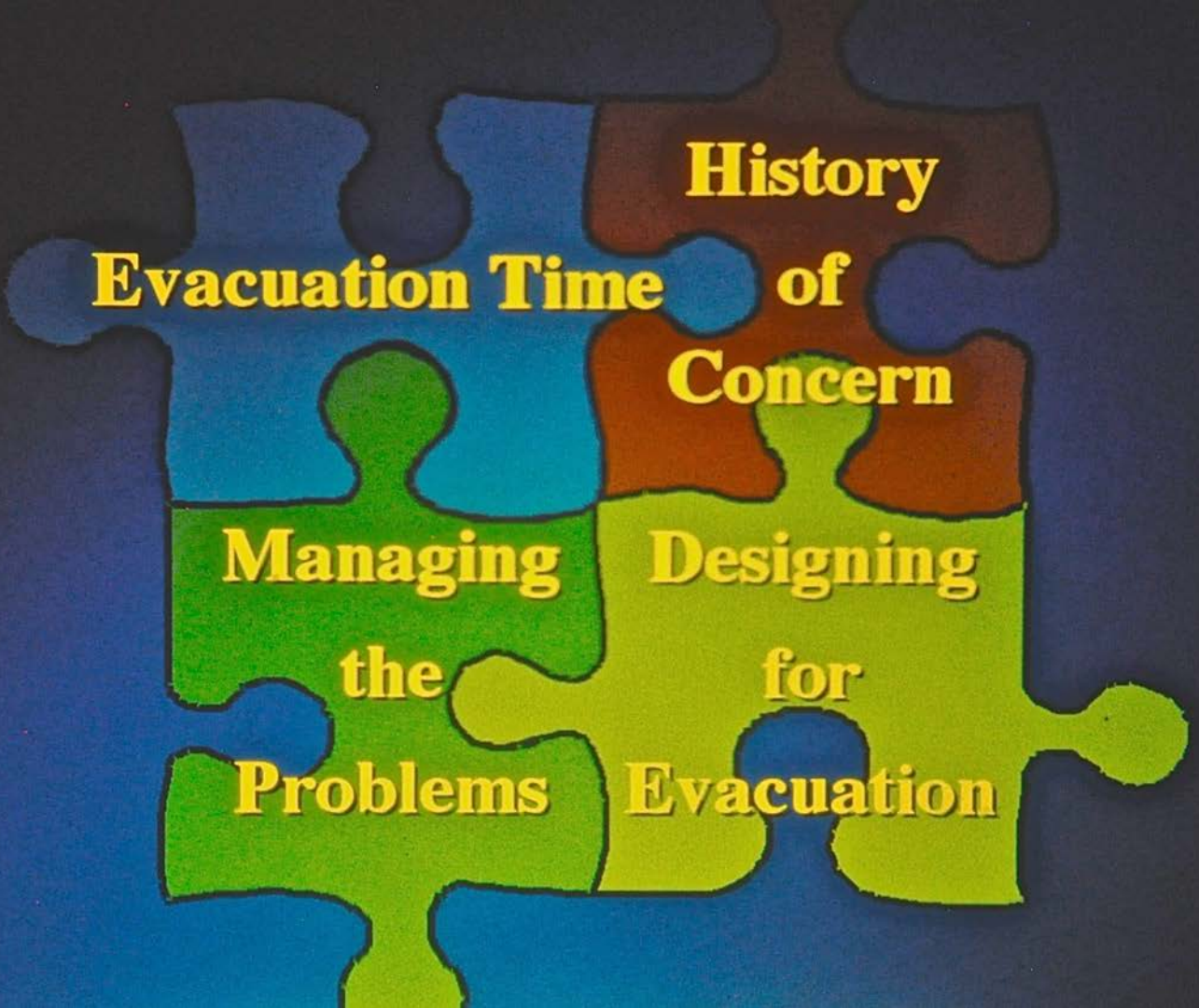
This presentation covers only a few pieces of the whole puzzle of high-rise fire safety

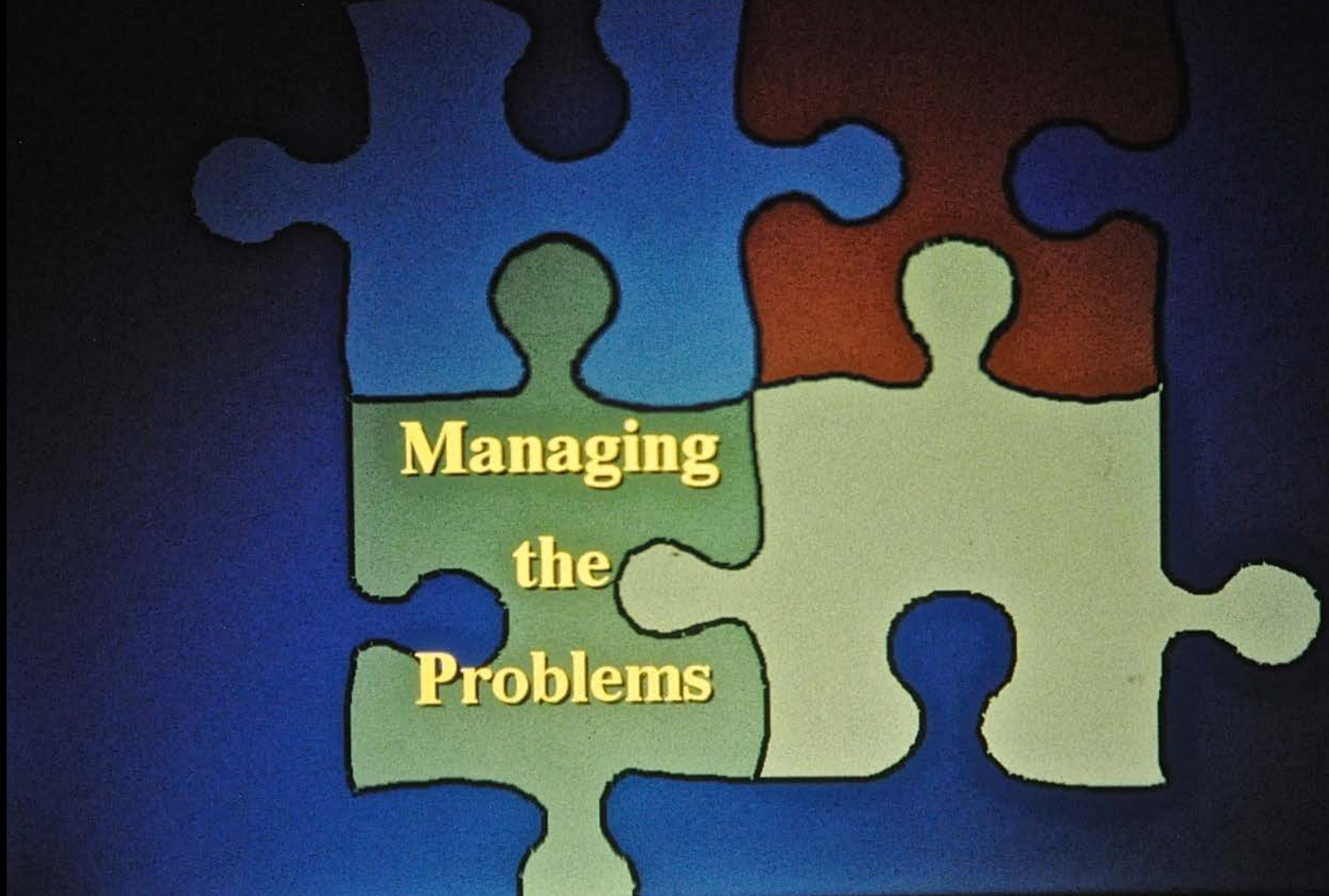


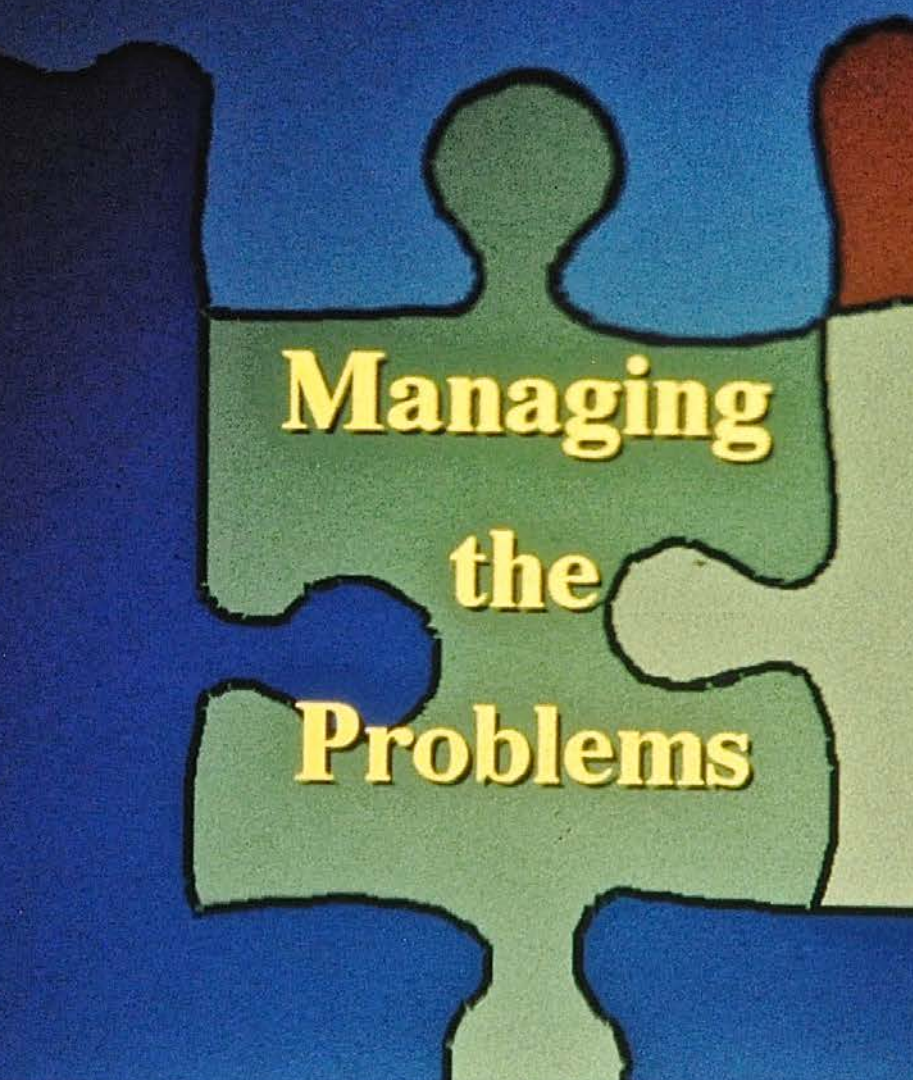
What is the



whole picture?

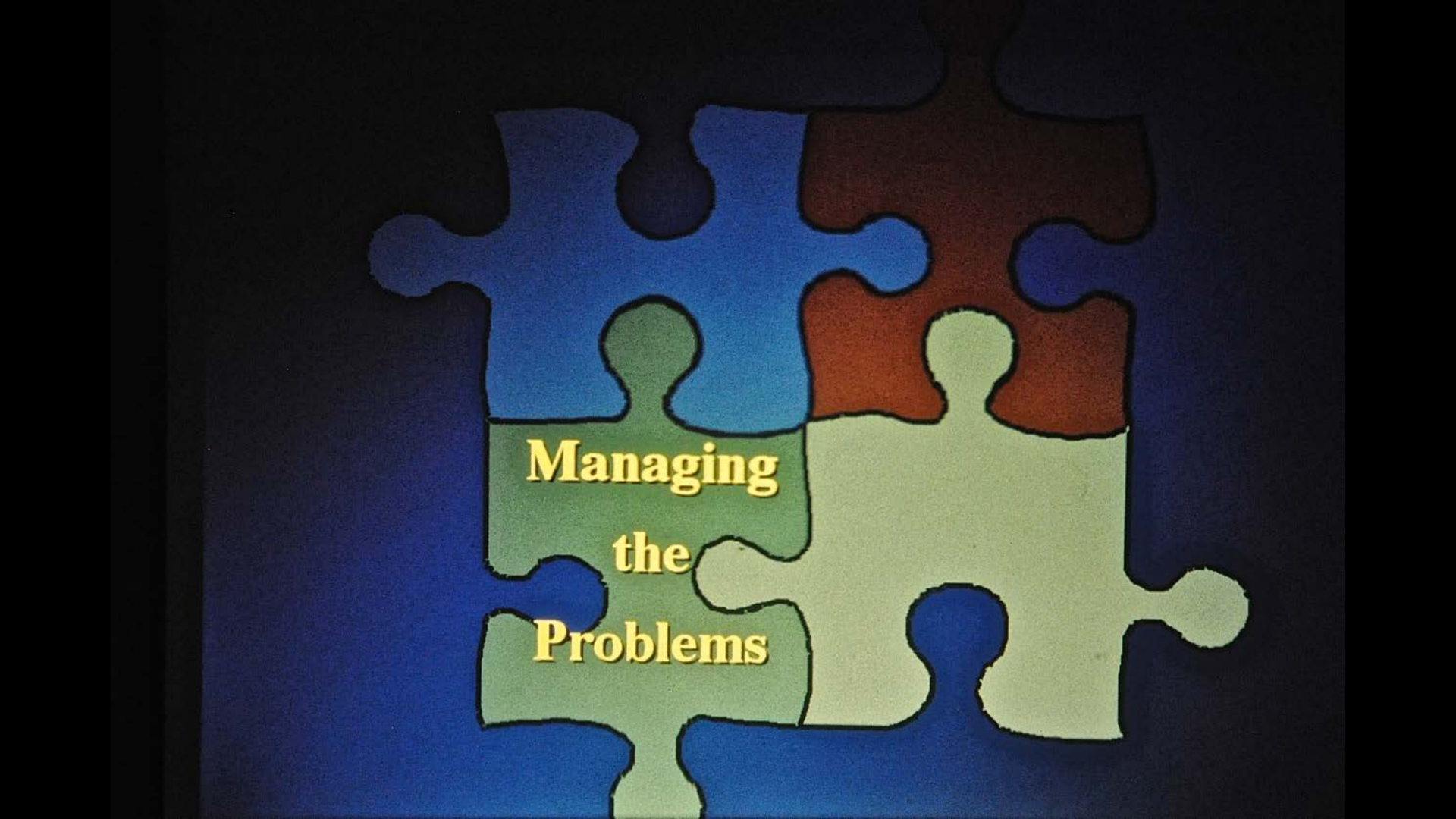

History of Concern
Evacuation Time
Managing the Problems
Designing for Evacuation


Managing
the
Problems



"Managing the Problems" is a major emphasis in this presentation. Significant problems—*that warrant more study and implementation efforts*—include what happens in exit stairways as affected by:

- **facility design, construction and management,**
- **fire service policies and activities,**
- **the building's occupants.-**


Managing
the
Problems

John Labriola's photos of the WTC evacuation were taken in one of the two 44-inch, nominal width stairs in Tower 1. They clearly show the inadequacy of this stair width to facilitate counter flow by fire fighters.

Evacuees, on the right, have to stop and twist to the side avoid collision with the fire fighters.

A third stair had a width of about 56 inches, which readily facilitates such counter flow, as well as permitting two-abreast movement, while having a flow capacity 37 percent better than a 44-inch stair.

What is actually happening here

Outer side of stair bad for evacuees.

Especially on the WTC stairs, and generally on switchback stairs, descending evacuees should have priority use of the inner side of the stairs where proper handrails are available and overall descent would be significantly faster—and significantly safer.

Post-911 NIST Study of Firefighter-Evacuee Interaction Options on 44-in Nominal Width Exit Stairway:

WHO WALKS ON WHICH SIDE?

Figures 5–7 through 5–10 show an occupant and a firefighter carrying a length of hose passing on a 1,118 mm (44 in) wide stairway. The Figures also show a firefighter and occupant passing at the landing. Note that the stair width does not provide adequate space for the individuals to pass without hitting each other. This occurs on the stairway as well as on the landing when the firefighter makes the turn to start climbing the next flight of stairs.

Source: NIST.

Figure 5–7. Top view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–8. Front view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–9. Front view of occupant and firefighter passing on landing.

Source: NIST.

Figure 5–10. View from above of occupant and firefighter passing on landing.

Post-911 NIST Study: Counterflow Interaction Options on 44-in Stair

Figure 10–7. Firefighter and occupants using a 44 in. stairwell in WTC 1 on September 11, 2001.

WTC-911 Photo of Conterflow in WTC Stairwell by John Labriola

NIST NCSTAR 1-7 Draft.pdf

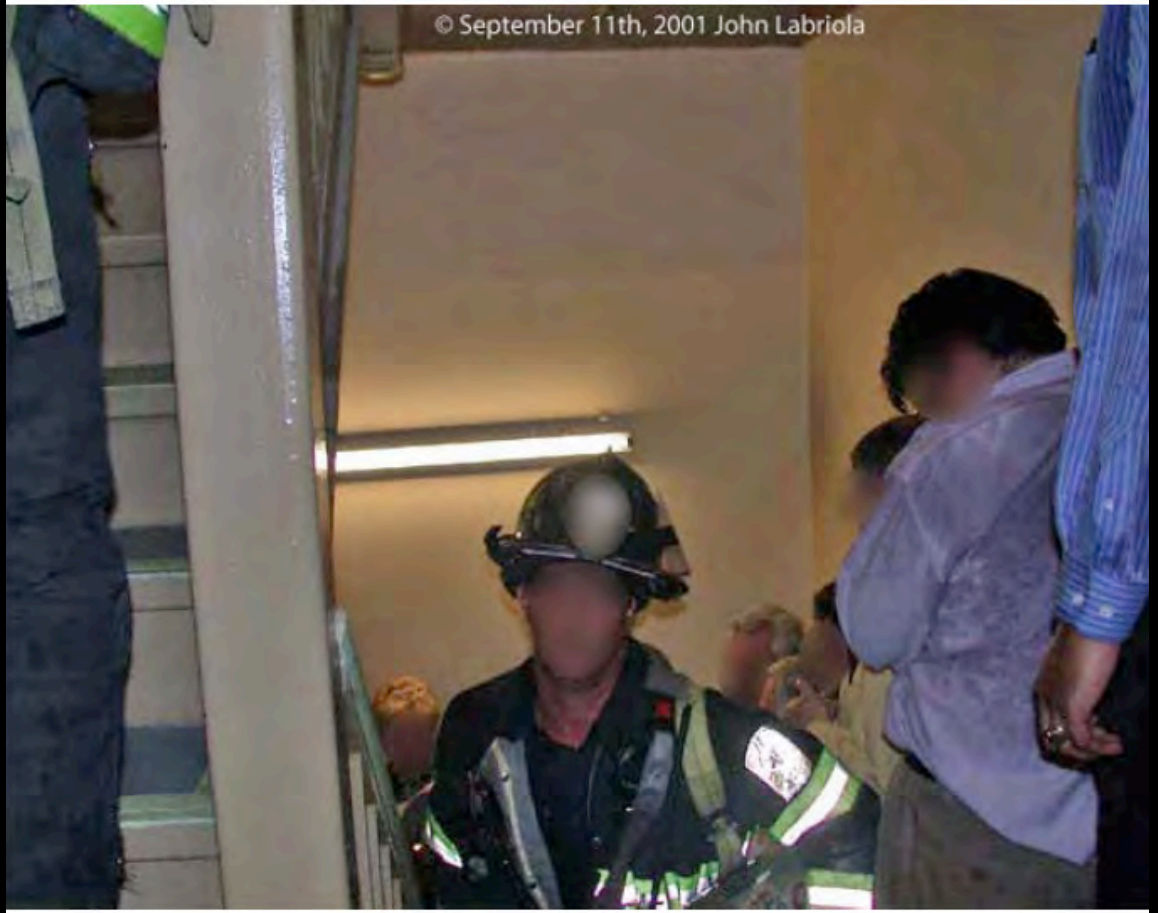


Figure 10–7. Firefighter and occupants using a 44 in. stairwell in WTC 1 September 11, 2001.

Evacuees being forced to WTC stairs' outer side wasn't good practice—*in hindsight*.

NIST NCSTAR 1-7 Draft.pdf

Figure 10–7. Firefighter and occupants using a 44 in. stairwell in WTC 1 on September 11, 2001.

Evacuee's path of travel and exposure increased to defective handrails

Figures 5–7 through 5–10 show an occupant and a firefighter carrying a length of hose passing on a 1,118 mm (44 in) wide stairway. The Figures also show a firefighter and occupant passing at the landing. Note that the stair width does not provide adequate space for the individuals to pass without hitting each other. This occurs on the stairway as well as on the landing when the firefighter makes the turn to start climbing the next flight of stairs.

Source: NIST.

Figure 5–7. Top view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–8. Front view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–9. Front view of occupant and firefighter passing on landing.

Source: NIST.

Figure 5–10. View from above of occupant and firefighter passing on landing.

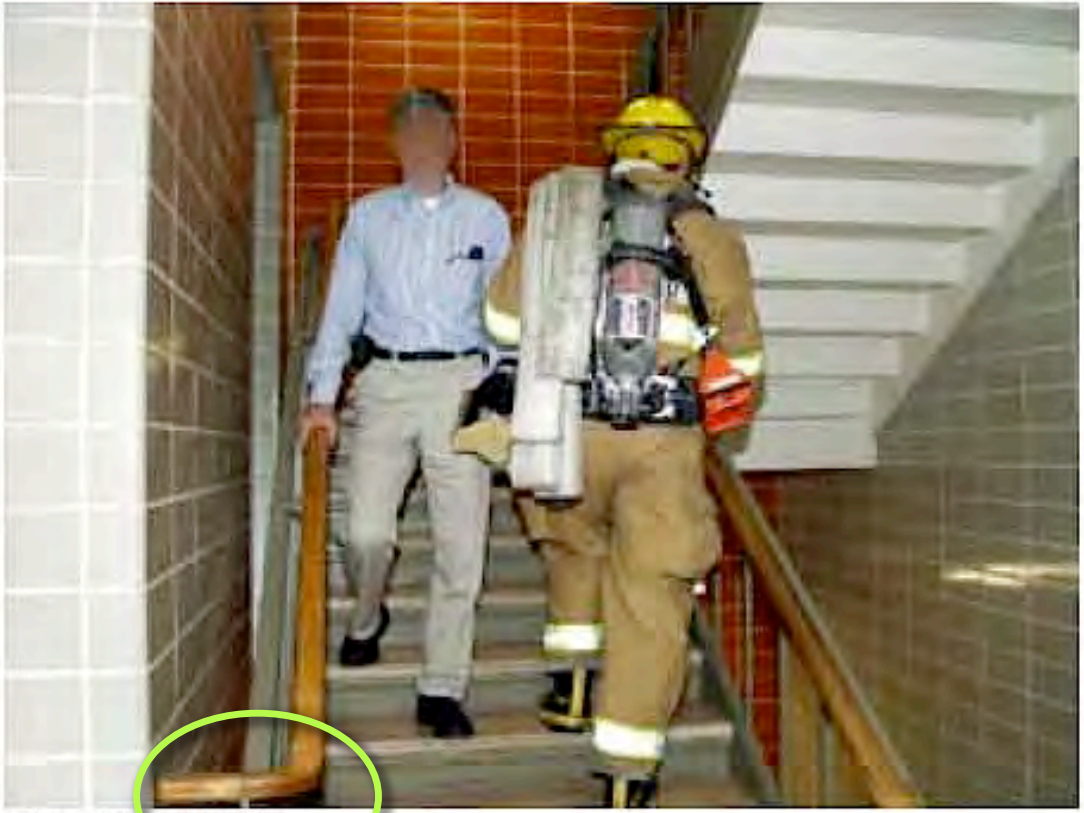
Notably, none of the illustrated examples show the firefighter on the outside lane of the stair.

Was this option even tested by NIST?

Source: NIST.

Figure 5–7. Top view of occupant and firefighter passing on stairs.

Evacuee's path of travel and exposure to defective handrails increased *—even on this NIST stair!*



Source: NIST.

Figure 5–8. Front view of occupant and firefighter passing on stairs.

Evacuee's path of travel and exposure to defective handrails increased *—even on this NIST stair!*

Source: NIST.

Figure 5–9. Front view of occupant and firefighter passing on landing.

Evacuee's path of travel and exposure to defective handrails increased *—even on this NIST stair!*

Source: NIST.

Figure 5–10. View from above of occupant and firefighter passing on landing.

Evacuee's path of travel and exposure to defective handrails increased *—even on this NIST stair!*

Figures 5–7 through 5–10 show an occupant and a firefighter carrying a length of hose passing on a 1,118 mm (44 in) wide stairway. The Figures also show a firefighter and occupant passing at the landing. Note that the stair width does not provide adequate space for the individuals to pass without hitting each other. This occurs on the stairway as well as on the landing when the firefighter makes the turn to start climbing the next flight of stairs.

Source: NIST.

Figure 5–7. Top view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–8. Front view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–9. Front view of occupant and firefighter passing on landing.

Source: NIST.

Figure 5–10. View from above of occupant and firefighter passing on landing.

Notably, none of the illustrated examples shows the firefighter on the outside lane of the stair.

Was this option *tested ?*

Figures 5–7 through 5–10 show an occupant and a firefighter carrying a length of hose passing on a 1,118 mm (44 in) wide stairway. The Figures also show a firefighter and occupant passing at the landing. Note that the stair width does not provide adequate space for the individuals to pass without hitting each other. This occurs on the stairway as well as on the landing when the firefighter makes the turn to start climbing the next flight of stairs.

Source: NIST.

Figure 5–7. Top view of occupant and firefighter passing on stairs.

Source: NIST.

Figure 5–8. Front view of occupant and firefighter passing on stairs.

Source: NIST.

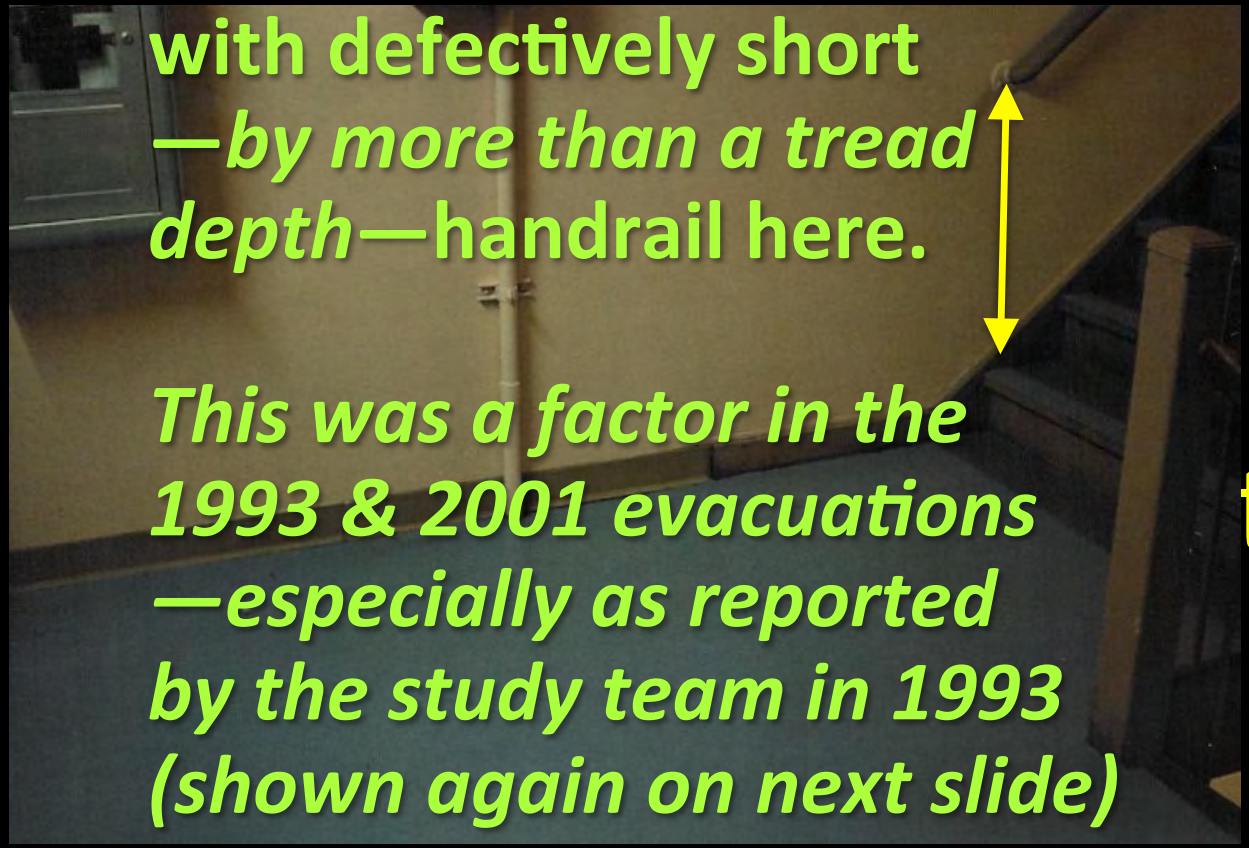
Figure 5–9. Front view of occupant and firefighter passing on landing.

Source: NIST.

Figure 5–10. View from above of occupant and firefighter passing on landing.

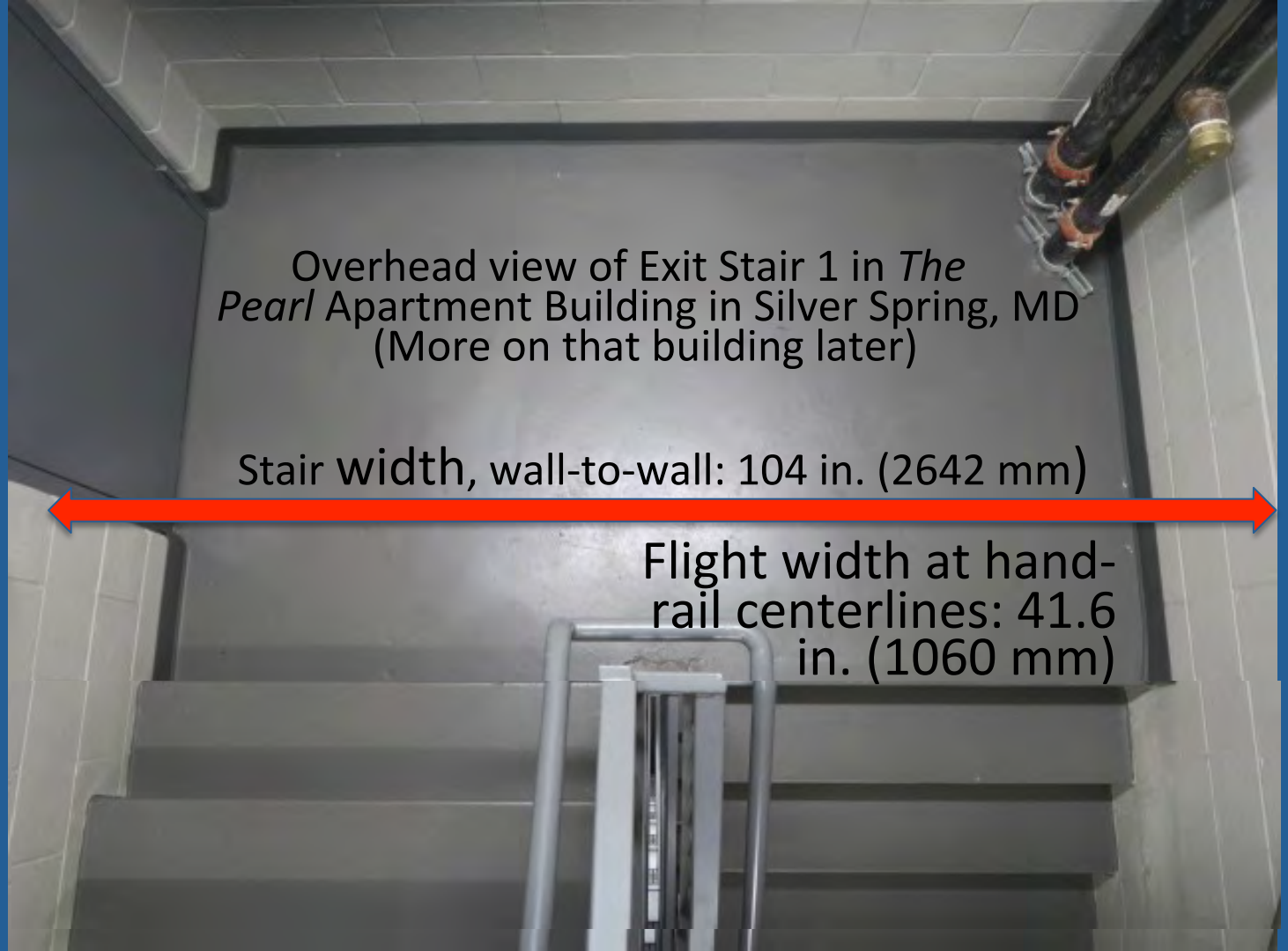
Was this option *even considered?*

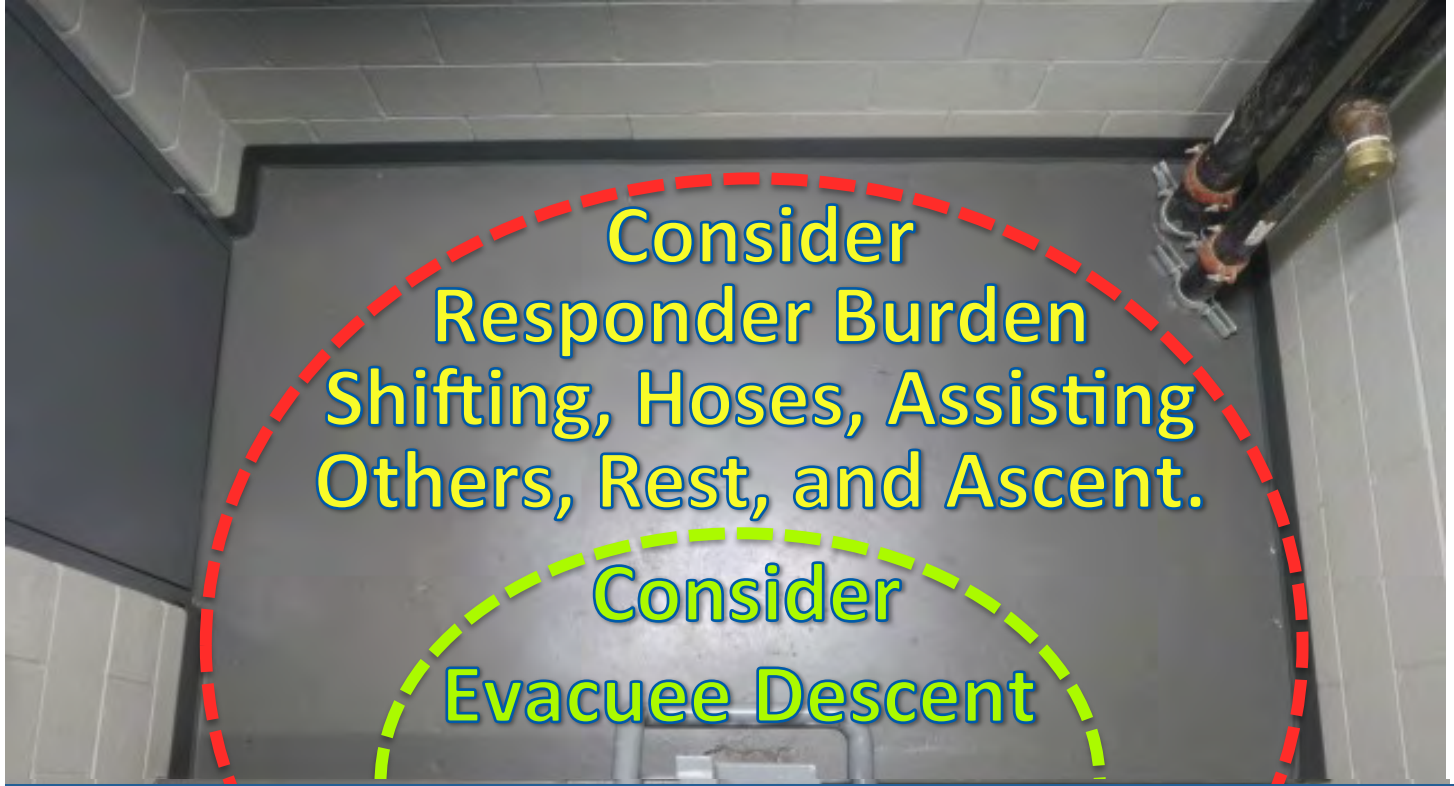
WTC Tower exit stairways



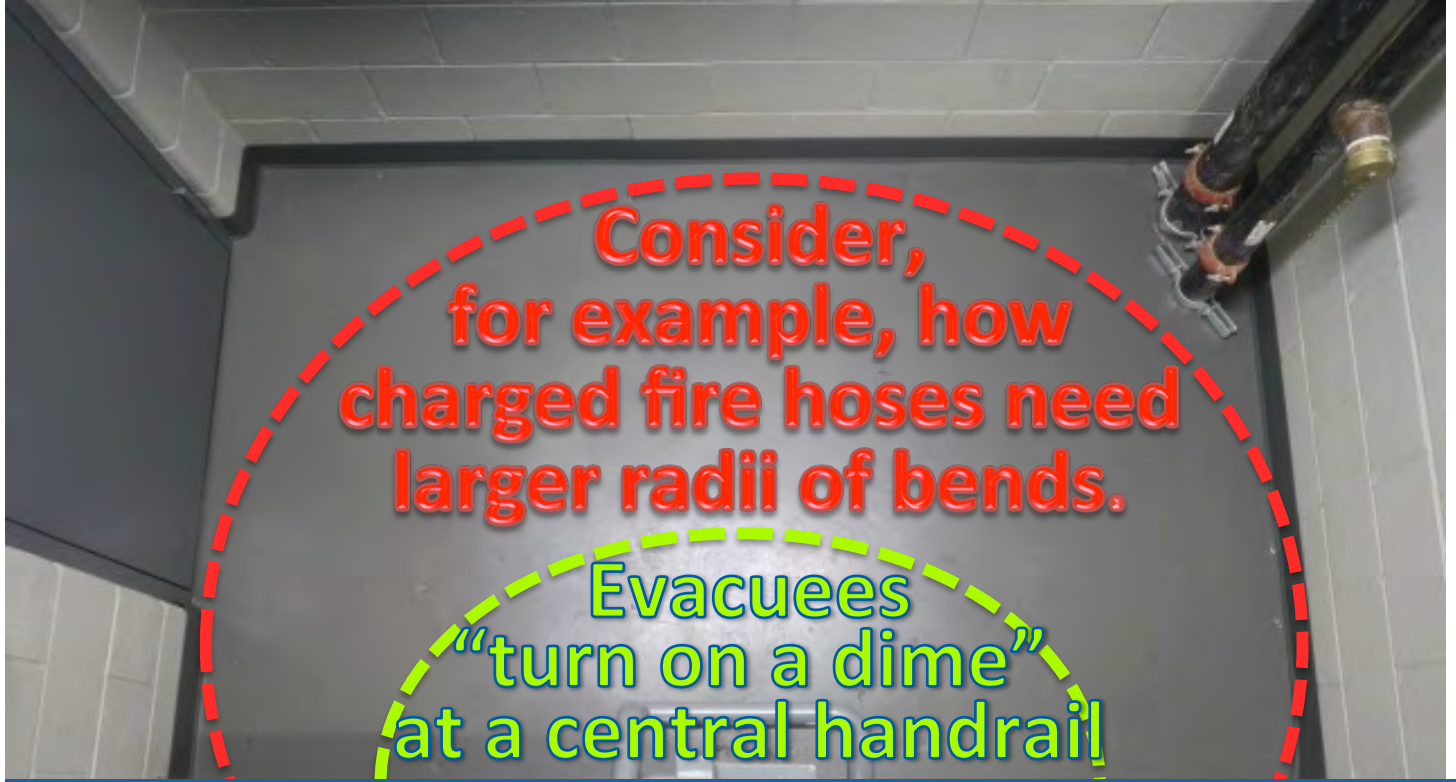
Evacuee's path of travel and exposure to defective handrails increased.

Study Team for 1993 Study of Evacuation of WTC Occupants with Disabilities.
From left to right, Bill Scott (wheelchair user); Edwina Juillet (Lead); Marianne Cashatt (wheelchair user); along with family and friends.


Overhead view of Exit Stair 1 in *The Pearl* Apartment Building in Silver Spring, MD
(More on that building later)
Stair width, wall-to-wall: 104 in. (2642 mm)
Flight width at hand-rail centerlines: 41.6 in. (1060 mm)



Updating Priority Assumptions for Fire Department Responder Operations whenever Evacuees are also using the EXIT stairway



Updating Priority Assumptions for Fire Department Responder Operations whenever Evacuees are also using the EXIT stairway

Building on six Decades of Professional Work:

- In Building Use Research and Consulting,
- To Facilitate Counterflow in Exit Stair Use, by Evacuees and Fire Service Responders,
- Focused on Ergonomics of Stairway Use in Emergency Situations including Fire.

Presented by Jake L. Pauls, BArch, CPE, HonDSc

Presentation is based partly on images from videos shot in ordinary and state-of-the-art exit stairways of high-rise apartment buildings occupied for years by Jake Pauls in Toronto, ON and Silver Spring, MD.

Here follow some ordinary and extraordinary examples.

Handrail Use on Dogleg (Switchback) Stairway

Demonstrated by Jake Pauls, BArch, CPE, HonDSc

Based on images from videos shot in Jake Pauls' apartment buildings, in 2024, in Toronto, ON and Silver Spring, MD, respectively at 22nd floor and 10th floor EXIT stairways.

Each sequence—*descent and ascent*—depicted lasted about 6 seconds.

Handrail Use on Dogleg (Switchback) Stairway

Demonstrated by Jake Pauls, BArch, CPE, HonDSc

Now, to be addressed with crowd-use studies, is to what extent such handrail usage patterns—*which are supported by handrail erosion patterns*—is, or is not, also found in crowd use of stairs.

For example, during an emergency evacuation, the use of handrails is both more extensive and critical to safety.

This would be even more critical if there was simultaneous use of the stair, in counterflow, by emergency responders.

The latter should be using the outer part of the stairway so they ascend with less interference to occupant descent flow.


37.0 inches
940 mm
43.5 inches
1105 mm
00:00:11
00:00:39

00:00:12
00:00:39

00:00:13
00:00:39


00:00:15
00:00:39

00:00:16
00:00:39

00:00:17
00:00:39

00:00:22
00:00:39

00:00:23
00:00:39

00:00:25
00:00:39

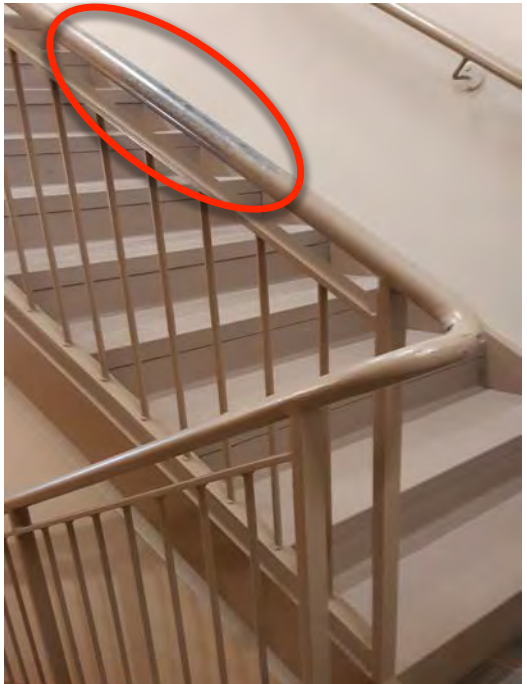
00:00:27
00:00:39

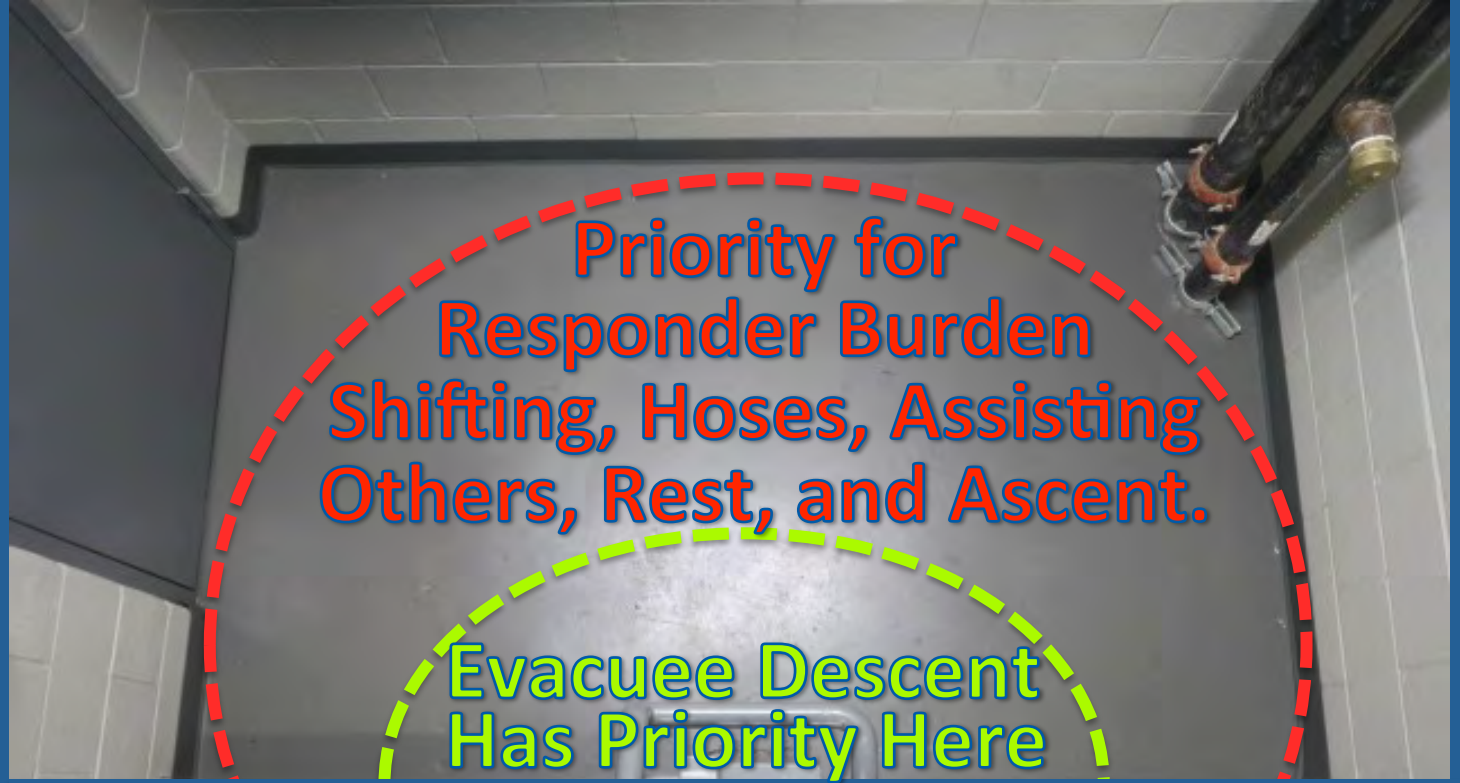

00:00:39
00:00:29

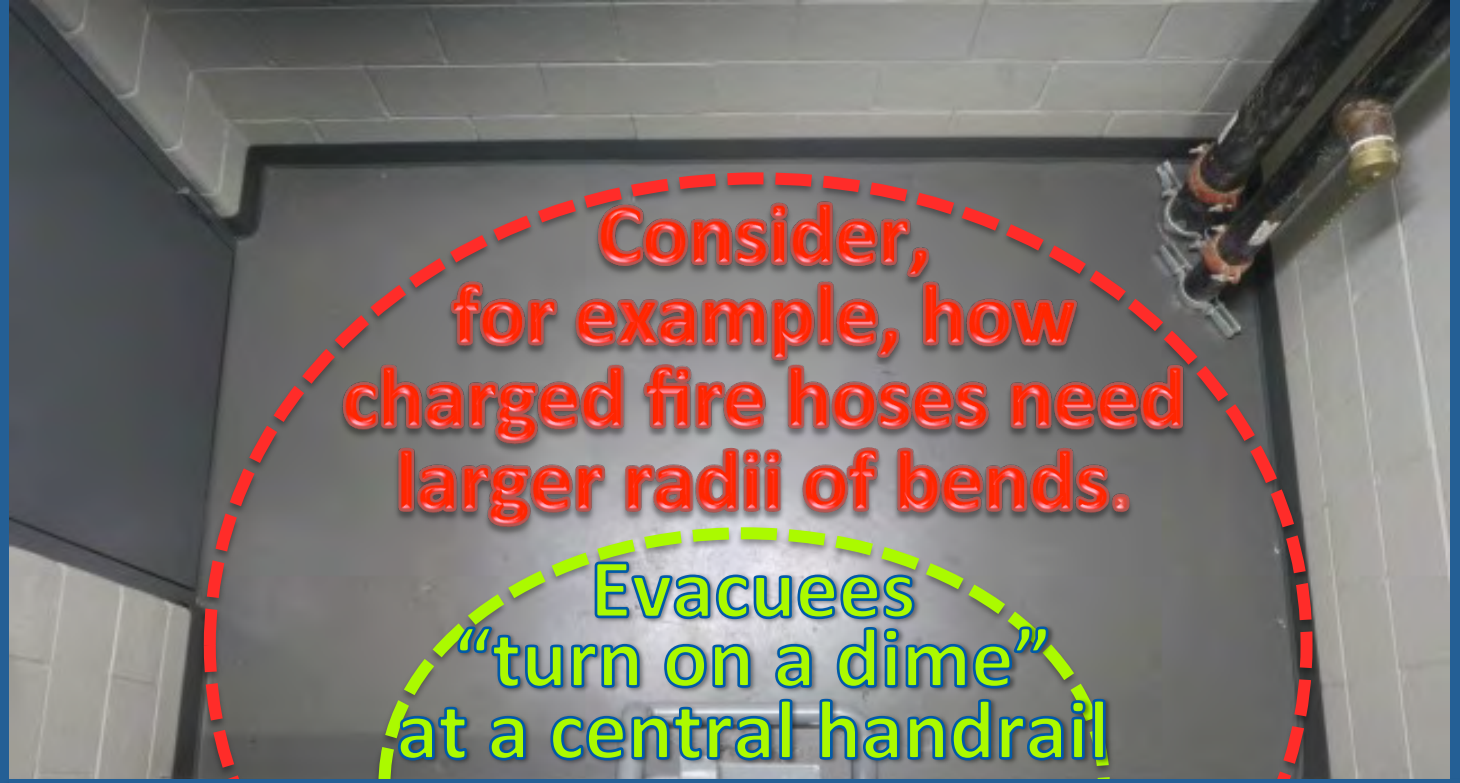
00:00:30
00:00:39

Handrail Use on Dogleg (Switchback) Stairways

Jake Pauls has collected handrail erosion records showing fairly consistent patterns of erosion from hands of stair users for a variety of public, dogleg stairs. Note that the hand grip rotates around the circular-section railing in this behavior, creating friction potent enough to erode and polish the railing coating.




Priority for
Responder Burden
Shifting, Hoses, Assisting
Others, Rest, and Ascent.
Evacuee Descent
Has Priority Here


Consider,
for example, how
charged fire hoses need
larger radii of bends.
Evacuees
“turn on a dime”
at a central handrail

Postscript: The foregoing slides are only a tiny fraction of Jake Pauls' photo library of prints, slides, and (most prolifically) digital images. There are also many videos, some edited and about 30 streaming www.bldguse.com including an 18-minute documentary film, *The Stair Event,* freely viewable at bldguse@aol.com along with 30 other videos. *Homes must be found for these as soon as possible. Contact Jake at bldguse@aol.com . Here follows a sampler of images, some of which might be referred to during open discussion.*

Postscript: Here follows sampler of images & video of world record-setting use of an exit stair, some of which might be referred to during our open discussion. *A selection will simply be quickly discussed—Time Permitting.*

Thank you for your interest in the topics.

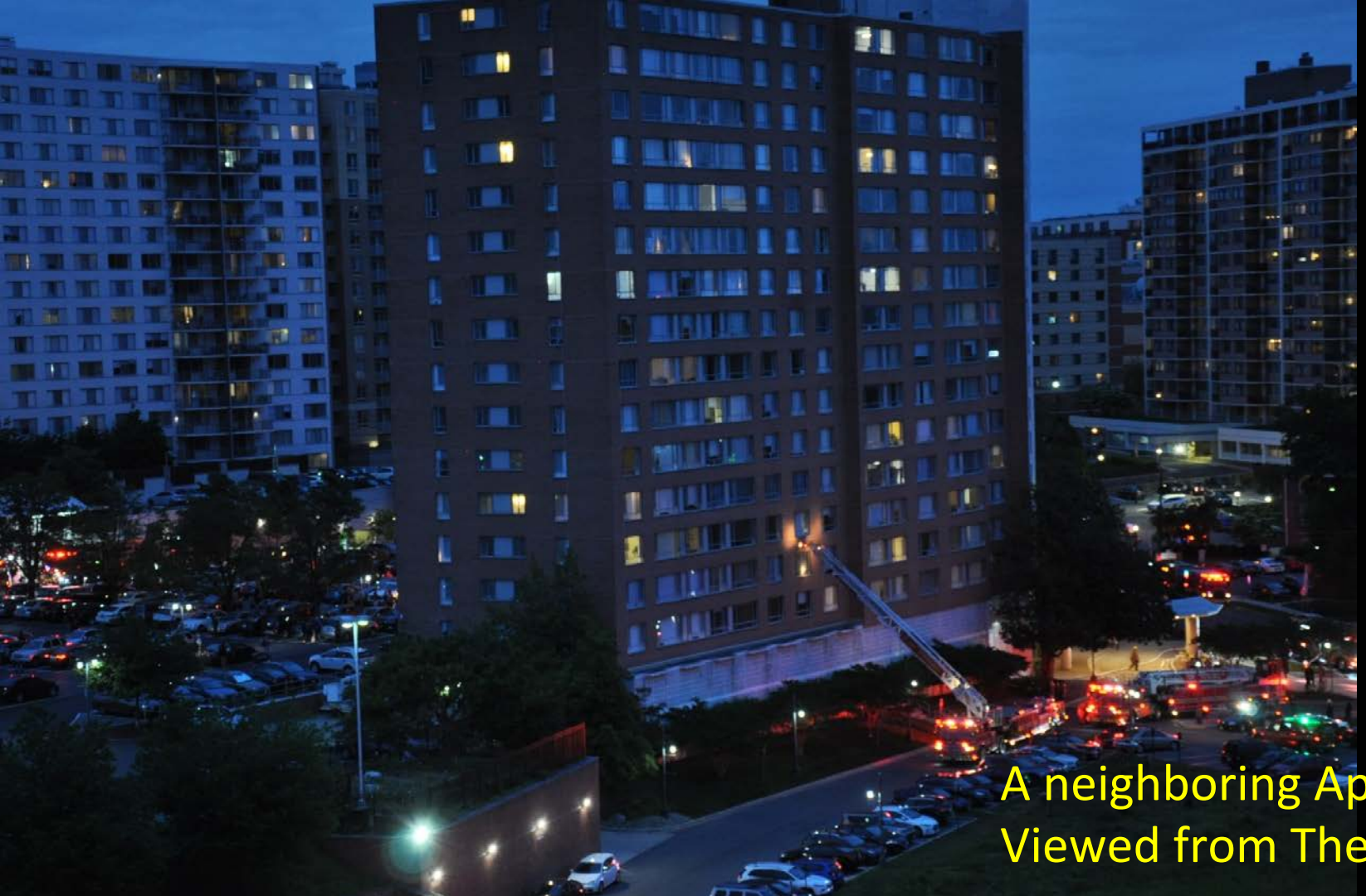
Jake Pauls, BArch, Certified Professional Ergonomist, HonDSc (U. Greenwich)


The Pearl Bldg., Apt.#1007
Silver Spring, Maryland, USA

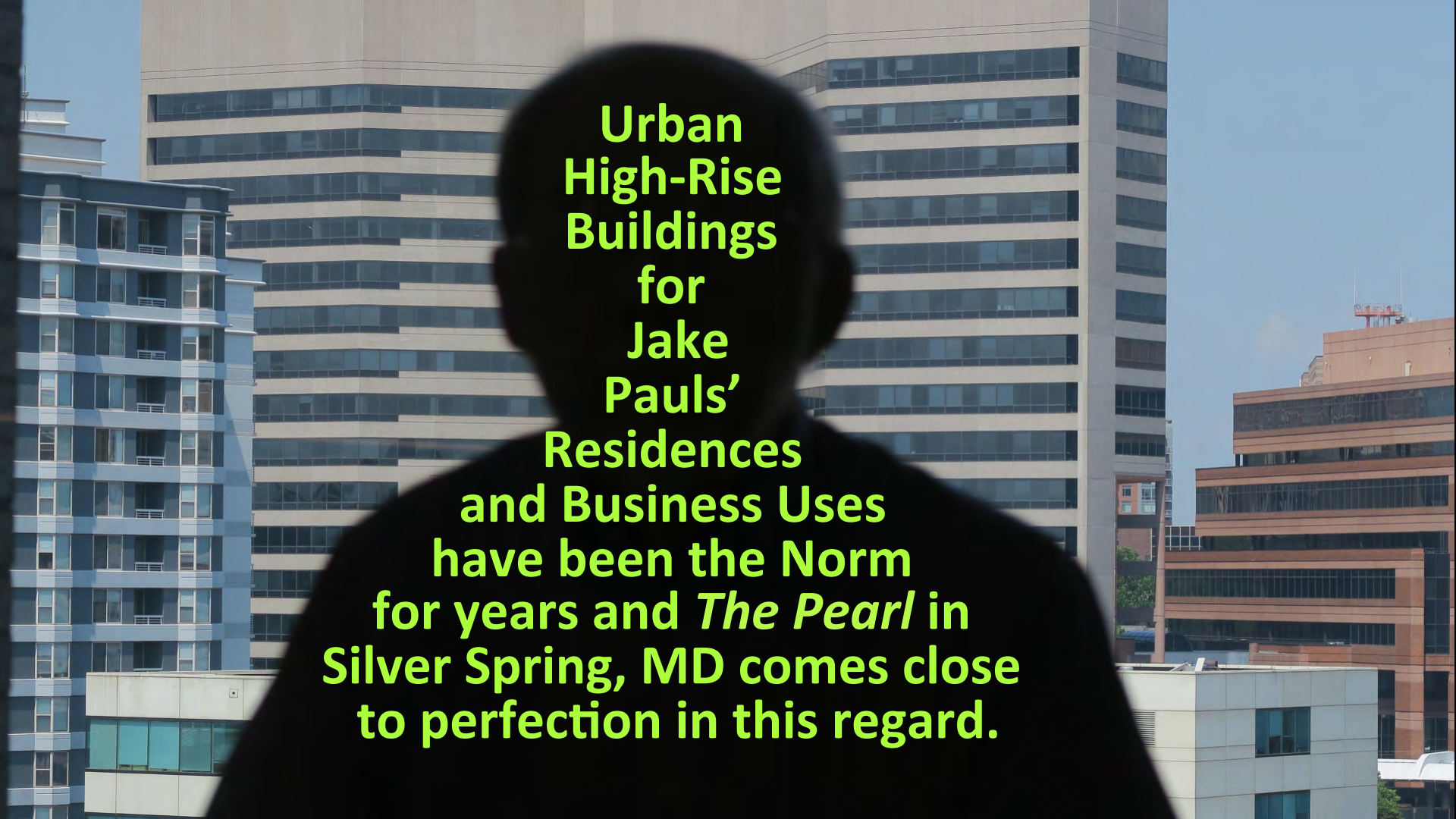

Apt.#1007

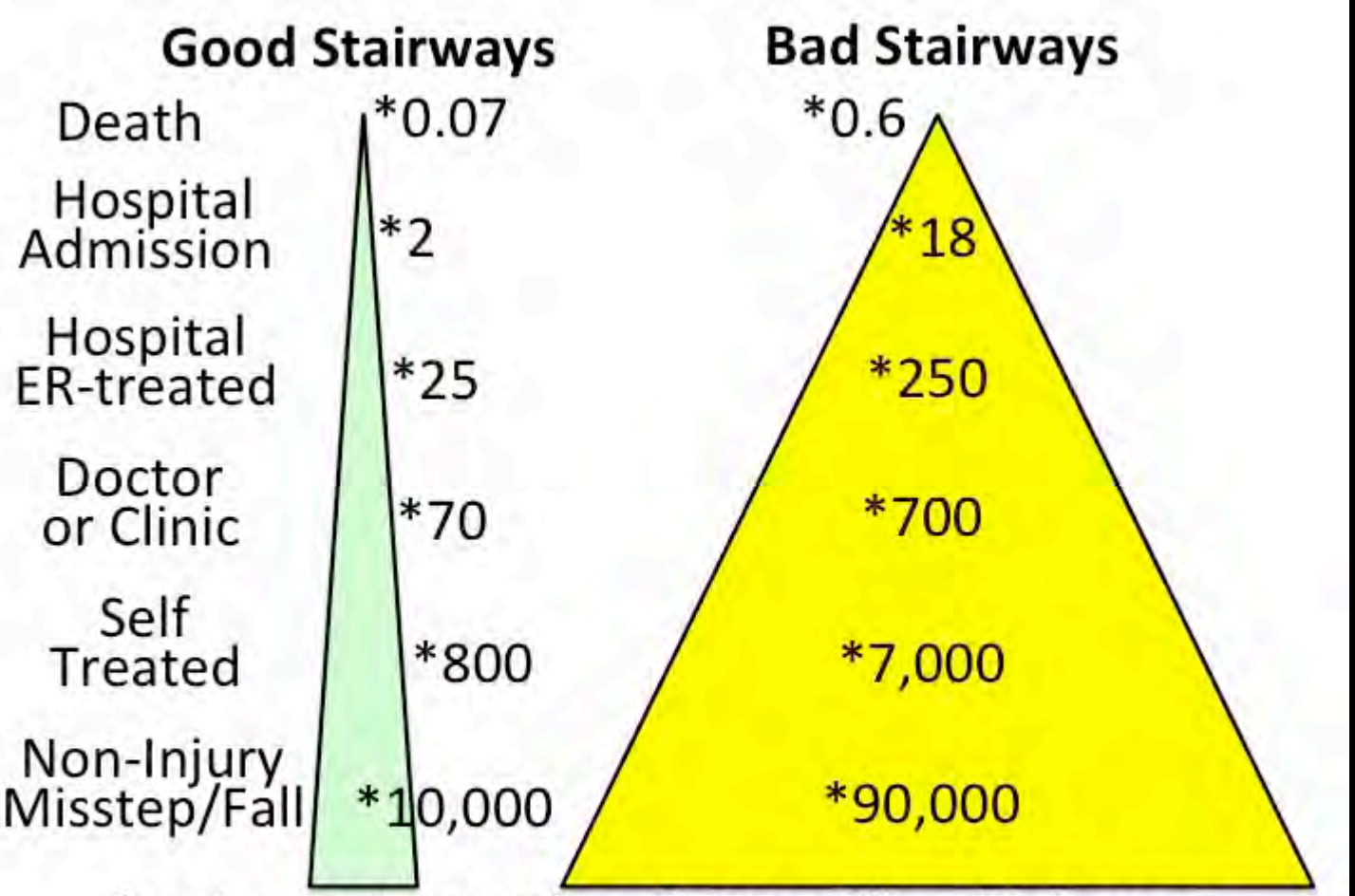

EXIT
EXIT
245 sq.ft.
Protected Elevator
Lobby


245 sq.ft.
Protected
Elevator
Lobby



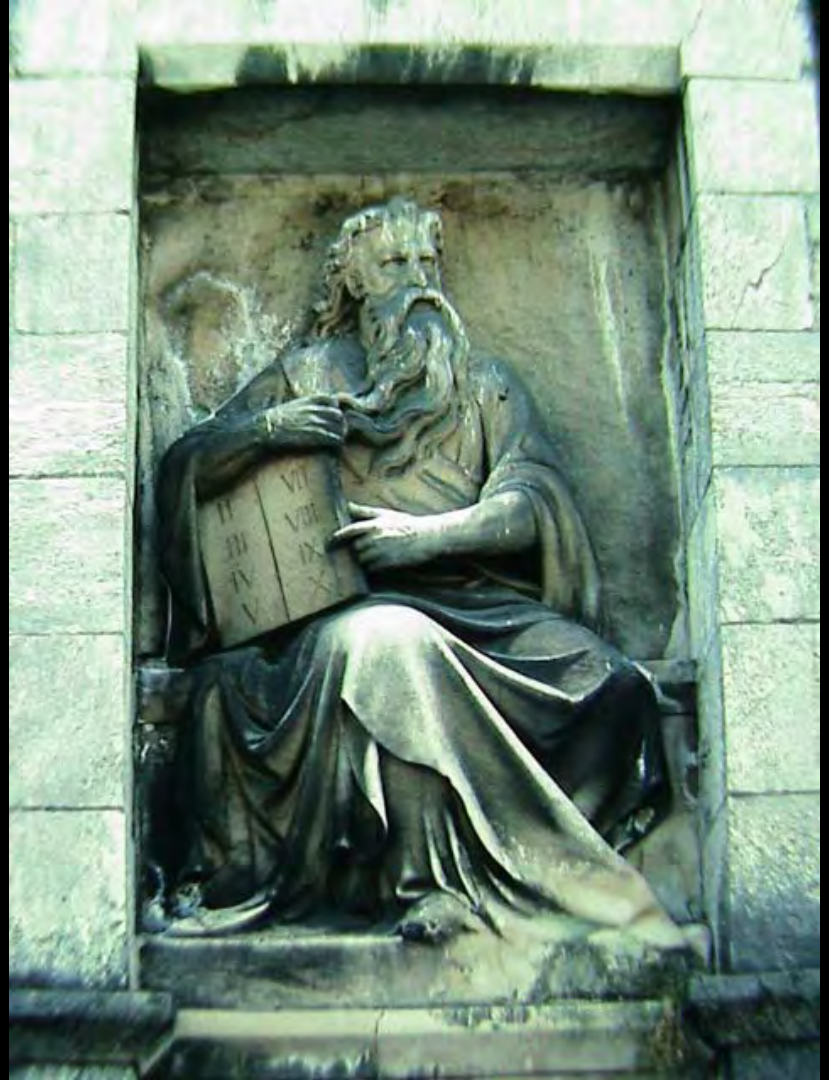
A neighboring Apt. Bldg.
Viewed from The Pearl

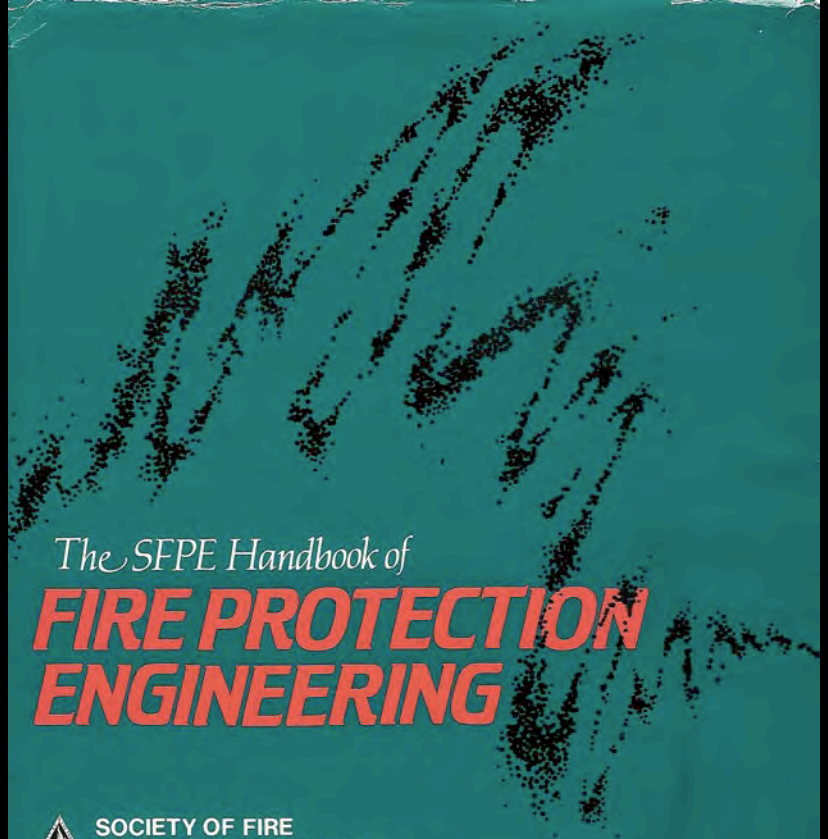

Urban
High-Rise
Buildings
for
Jake
Pauls'
Residences
and Business Uses
have been the Norm
for years and *The Pearl* in
Silver Spring, MD comes close
to perfection in this regard.



*Estimated on order of 700 million flight uses

***Incident Rate per 100,000 Population per Year**





The SFPE Handbook of FIRE PROTECTION ENGINEERING

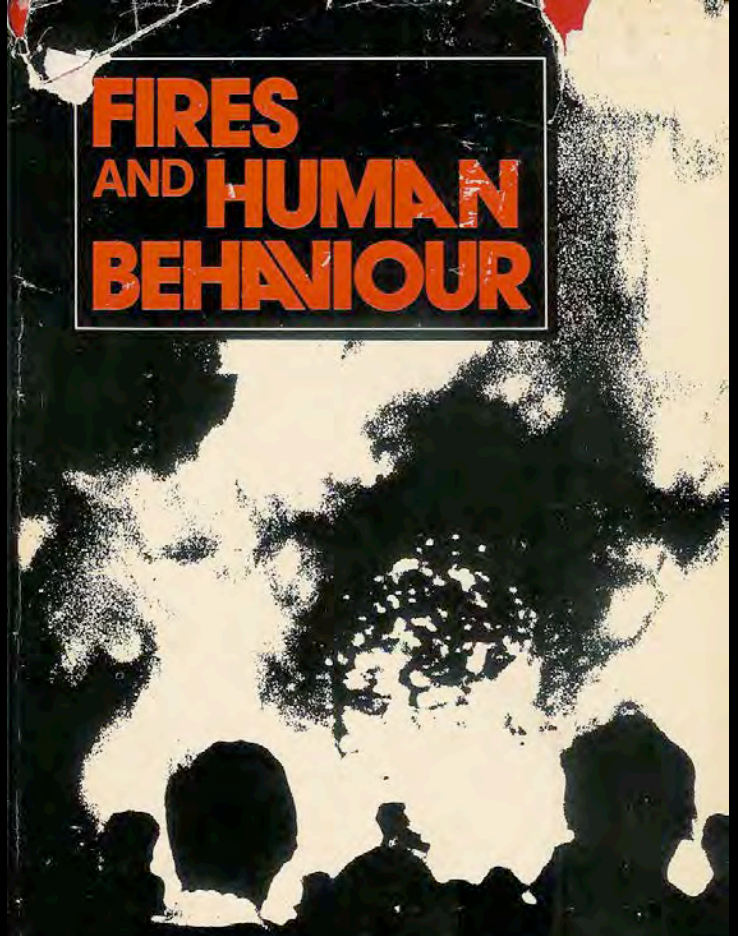
SOCIETY OF FIRE PROTECTION ENGINEERS

National Fire Protection Association

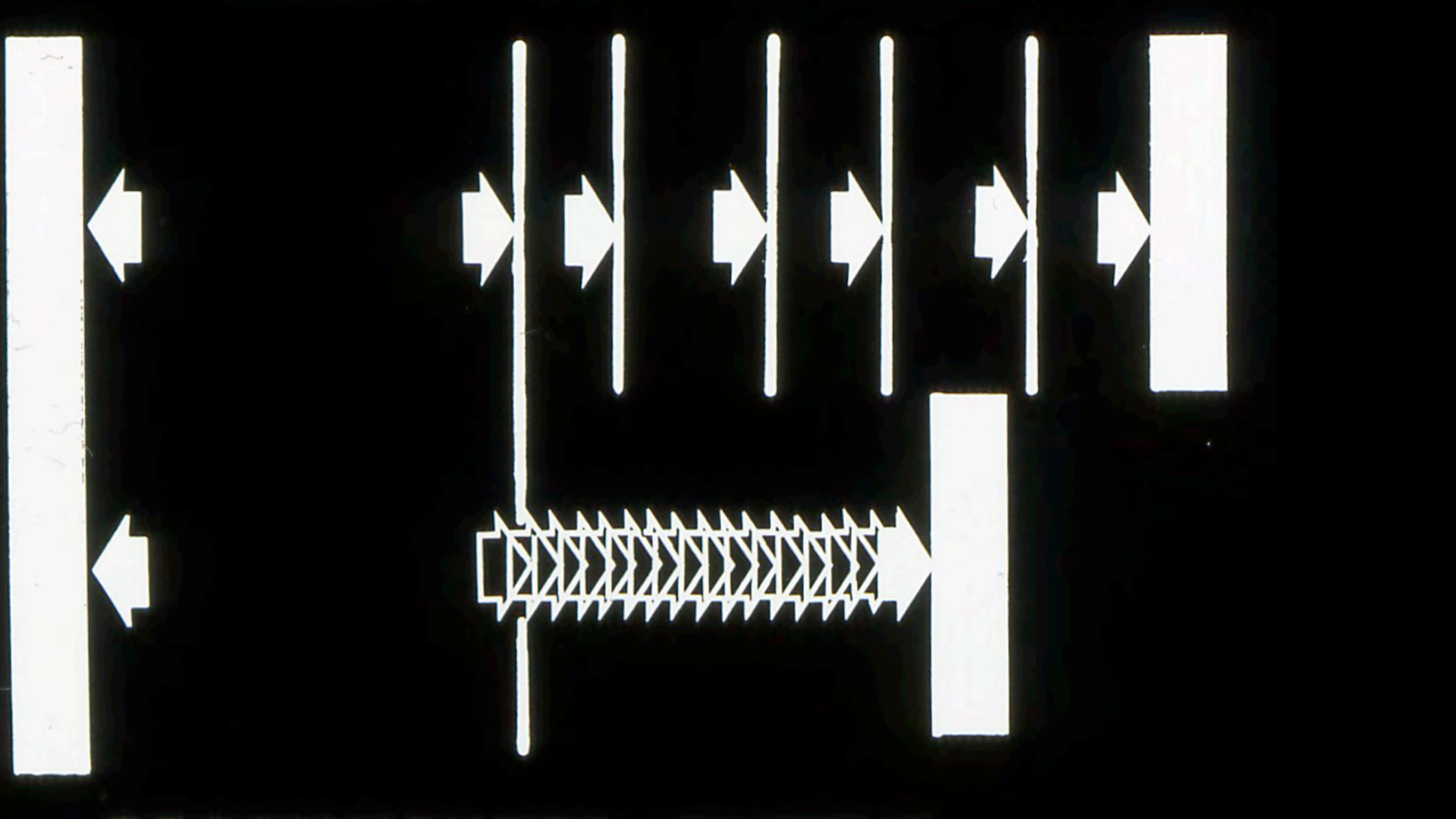
NFPA

Tower "A"
Evacuation Drill
General Purpose Bldg
Drill Results
Tower "C" Place de Ville
Drill Results
Transportation (NCC)
Drill Results
McDonald Bldg
Drill Results
Misc. Bldgs.
Drill Results
Gen. Purpose Bldg.
Evacuation Drill
Brooke Claxton
Evacuation Drill
(Questionnaire)
R.C. Hydro Bldg.
Evacuation Drill
Tabulation of Data (Stair)

FIRES AND HUMAN BEHAVIOUR



Edited by **DAVID CANTER**



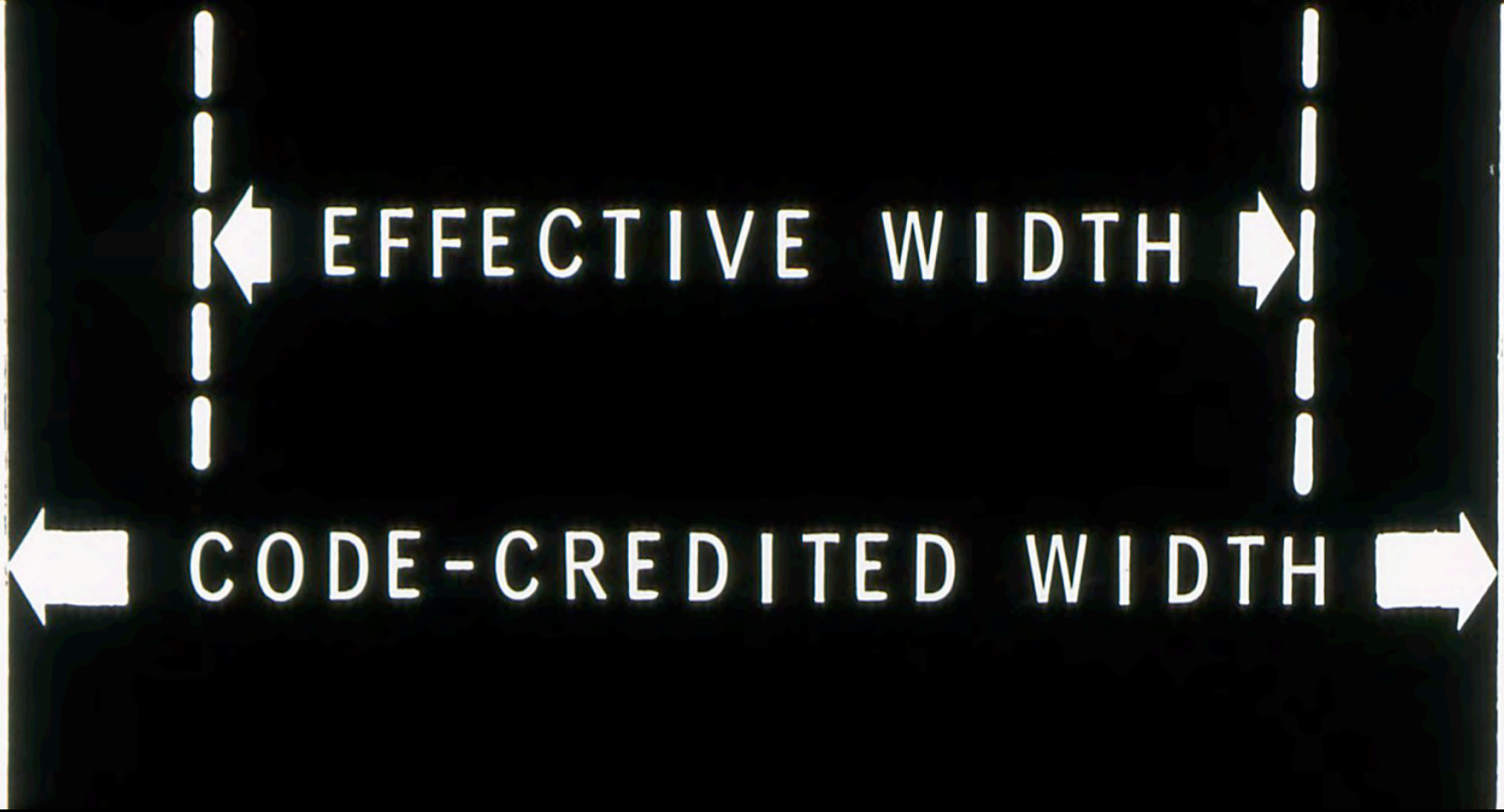
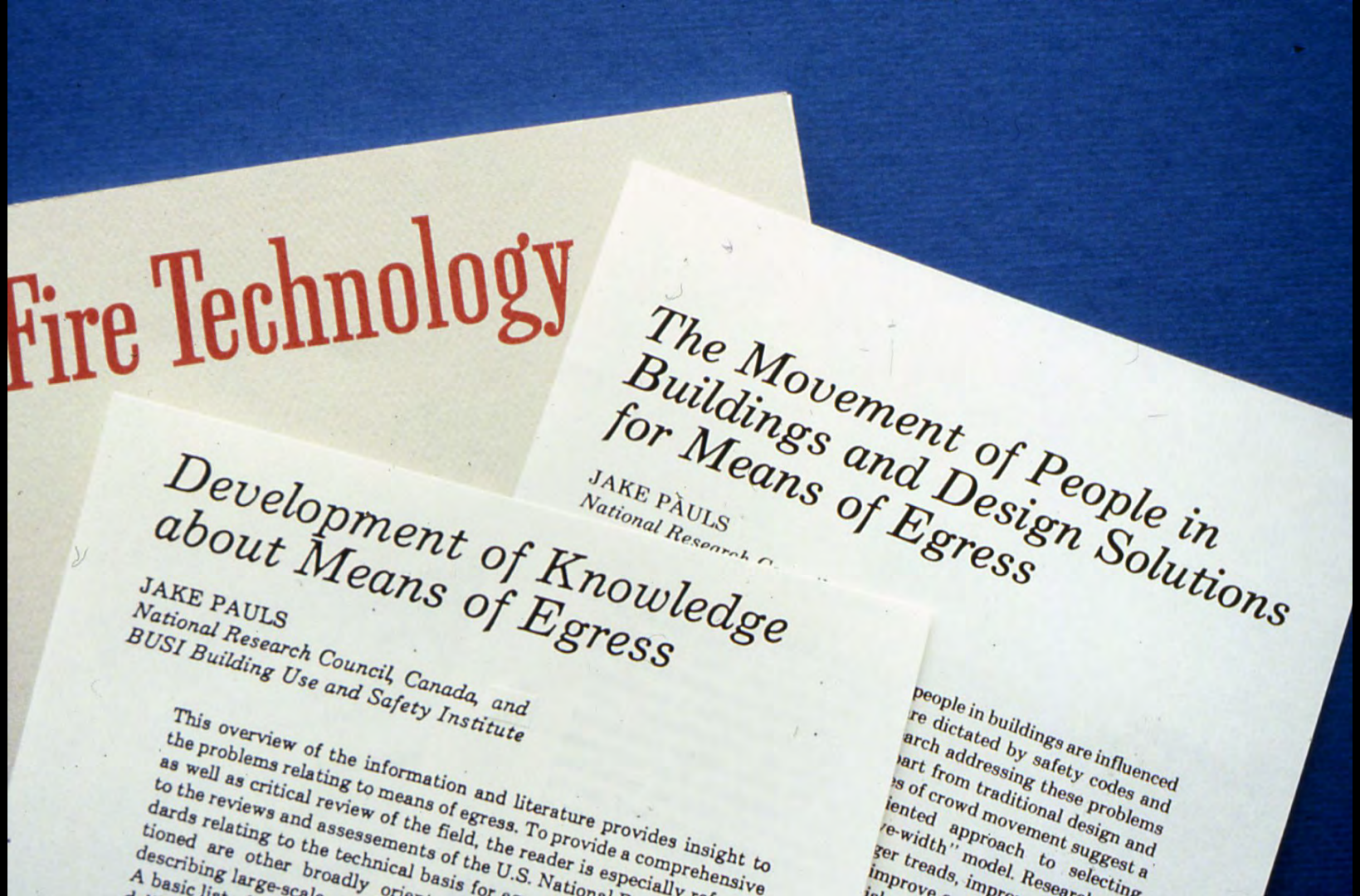

EFFECTIVE WIDTH
CODE-CREDITED WIDTH

Figure 2–10. 44 in. stairwell in WTC 1 taken on September 11, 2001.


Fire Technology
The Movement of People in Buildings and Design Solutions for Means of Egress
JAKE PAULS
National Research C
people in buildings are influenced
re dictated by safety codes and
arch addressing these problems
art from traditional design and
s of crowd movement suggest a
ented approach to selecting
e-width" model. Research
ger treads, impr
improve
Development of Knowledge about Means of Egress
JAKE PAULS
National Research Council, Canada, and
BUSI Building Use and Safety Institute
This overview of the information and literature provides insight to
the problems relating to means of egress. To provide a comprehensive
as well as critical review of the field, the reader is especially
to the reviews and assessements of the U.S. National
dards relating to the technical basis for
tioned are other broadly
describing large-scale
A basic list

The Washington Post

FINAL

SATURDAY, FEBRUARY 27, 1993

25¢

At Least 7 Die, 500 Hurt as Explosion Rips Garage Under World Trade Center

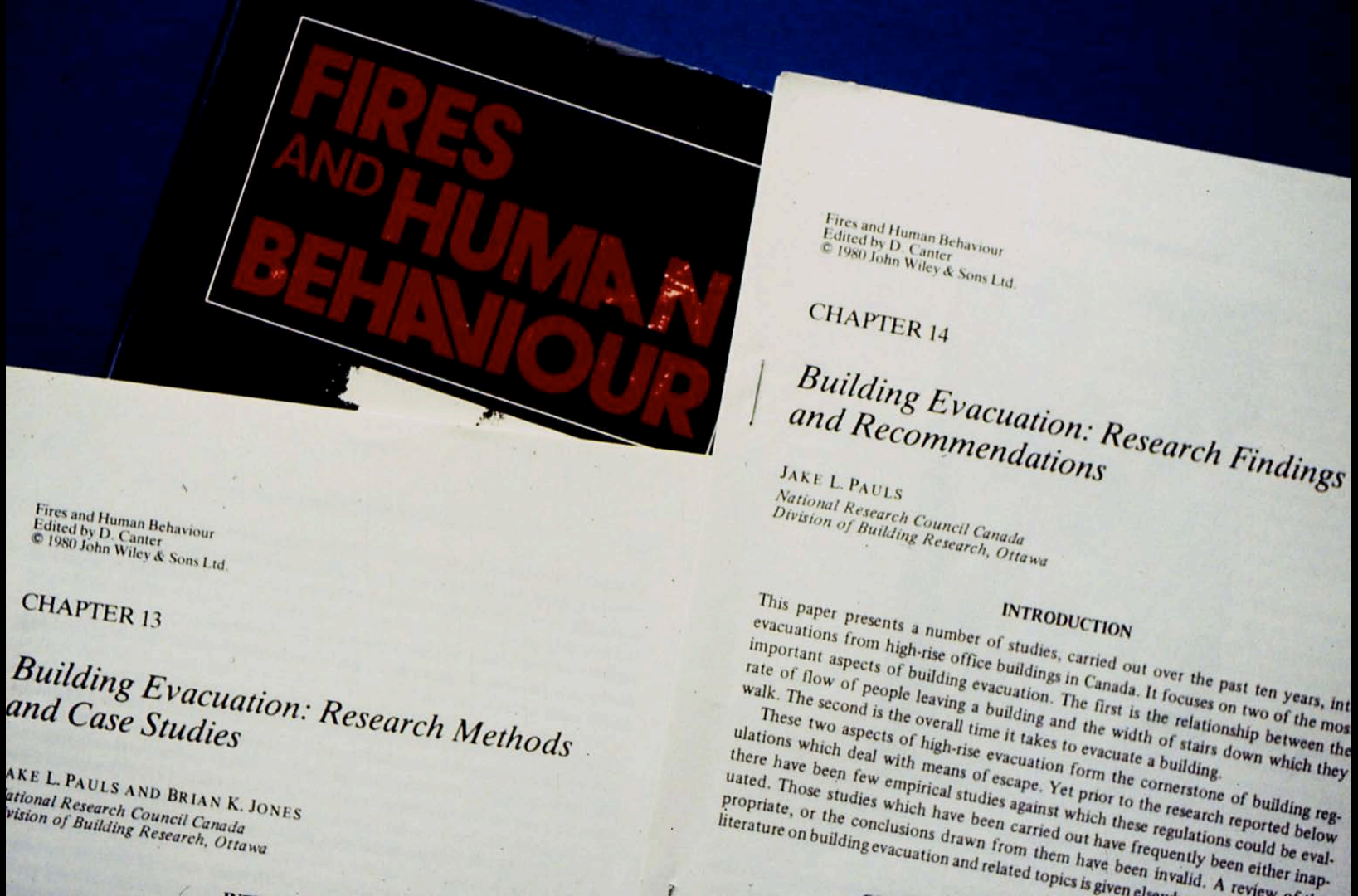
Bomb Suspected In Midday Blast; Thousands Flee

Rescue workers carry an injured man out of New York's World Trade Center after an explosion that officials suspect was caused by a bomb. More than 500 injuries were reported.

Descending the Stairwell Into a Smoky Hell

'People Were Screaming, Crying, Coughing. That Was the Worst,' Broker Recounts

Inside The World Trade Center



Fires and Human Behaviour
Edited by D. Canter

CHAPTER 13

Building Evacuation: Research Methods and Case Studies

AKE L. PAULS AND BRIAN K. JONES
ational Research Council Canada
ivision of Building Research, Ottawa

Fires and Human Behaviour
Edited by D. Canter

CHAPTER 14

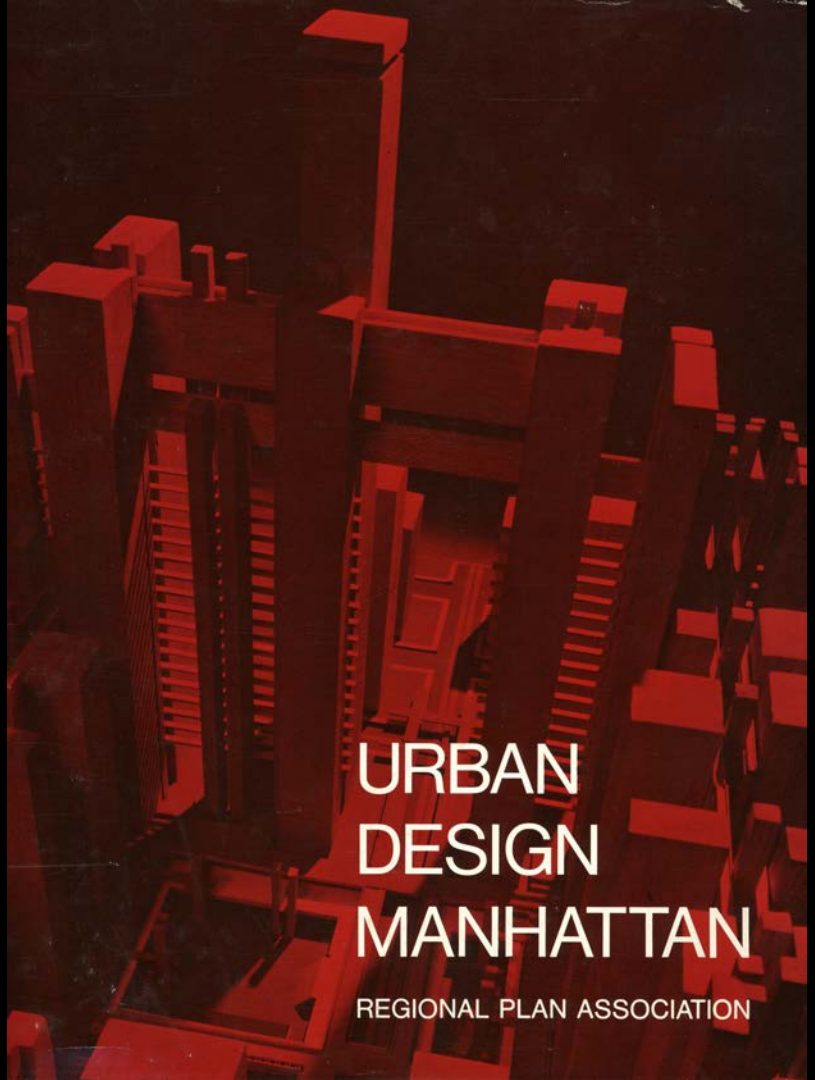
Building Evacuation: Research Findings and Recommendations

JAKE L. PAULS
National Research Council Canada
Division of Building Research, Ottawa

INTRODUCTION

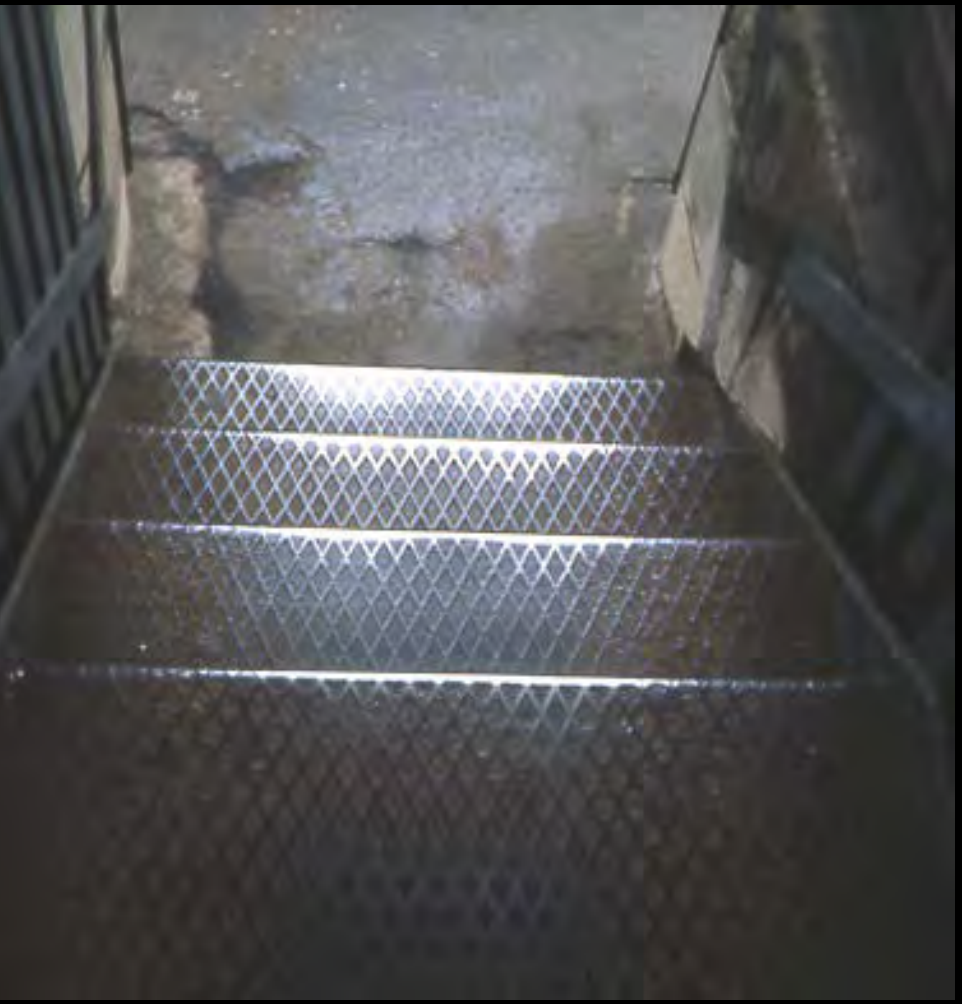
This paper presents a number of studies, carried out over the past ten years, int
evacuations from high-rise office buildings in Canada. It focuses on two of the mos
important aspects of building evacuation. The first is the relationship between the
rate of flow of people leaving a building and the width of stairs down which they
walk. The second is the overall time it takes to evacuate a building.

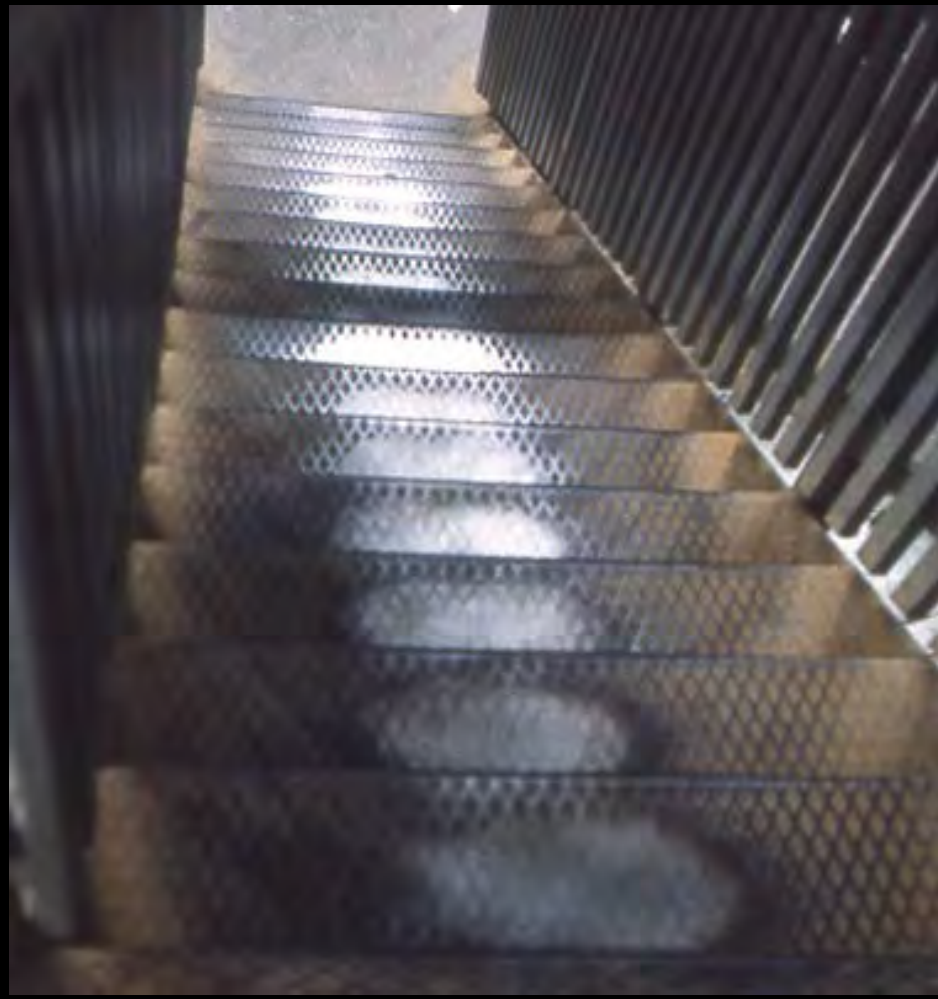
These two aspects of high-rise evacuation form the cornerstone of building reg-
ulations which deal with means of escape. Yet prior to the research reported below
there have been few empirical studies against which these regulations could be eval-
uated. Those studies which have been carried out have frequently been either inap-
propriate, or the conclusions drawn from them have been invalid. A review of
literature on building evacuation and related topics is given elsew

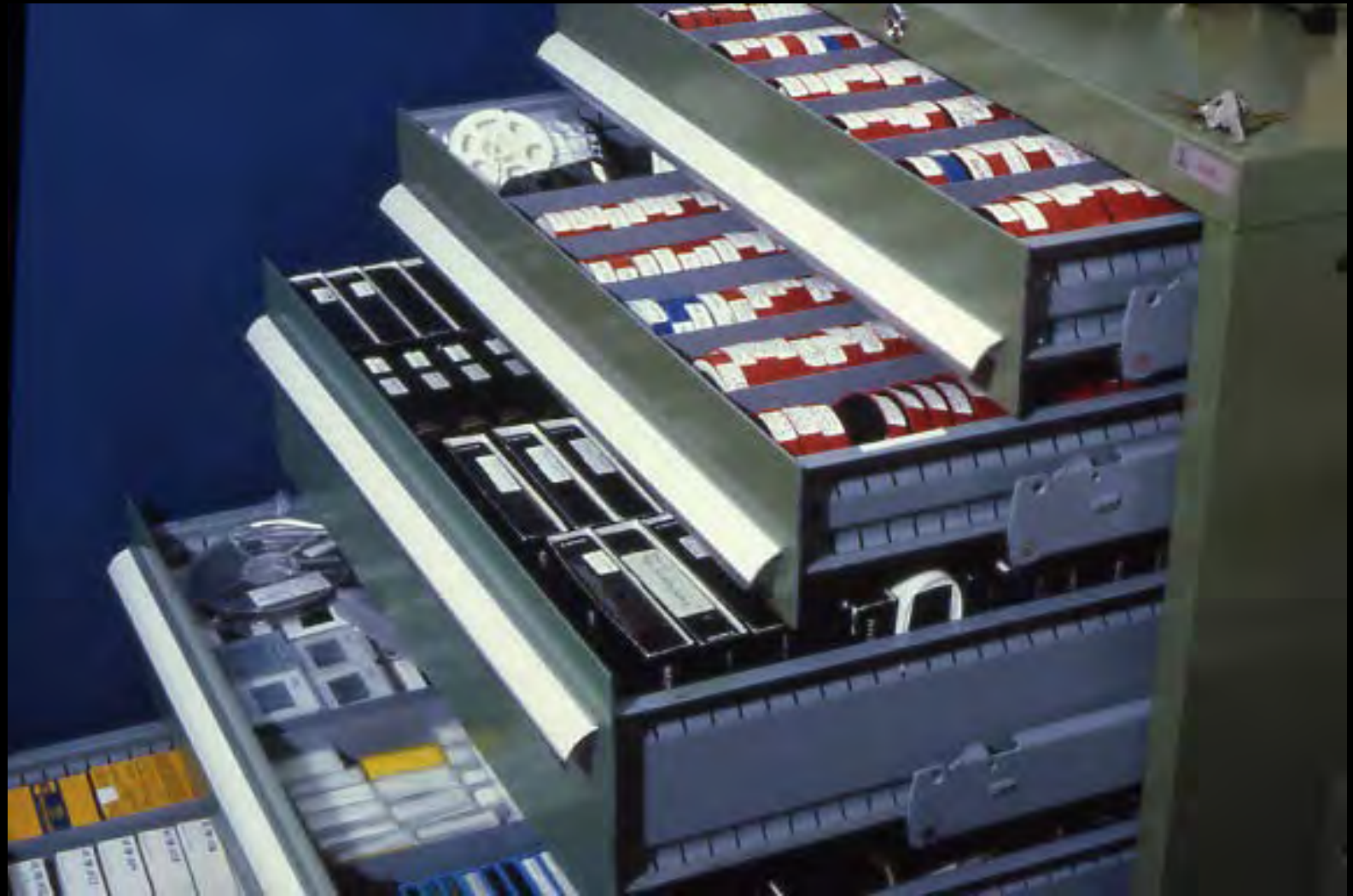


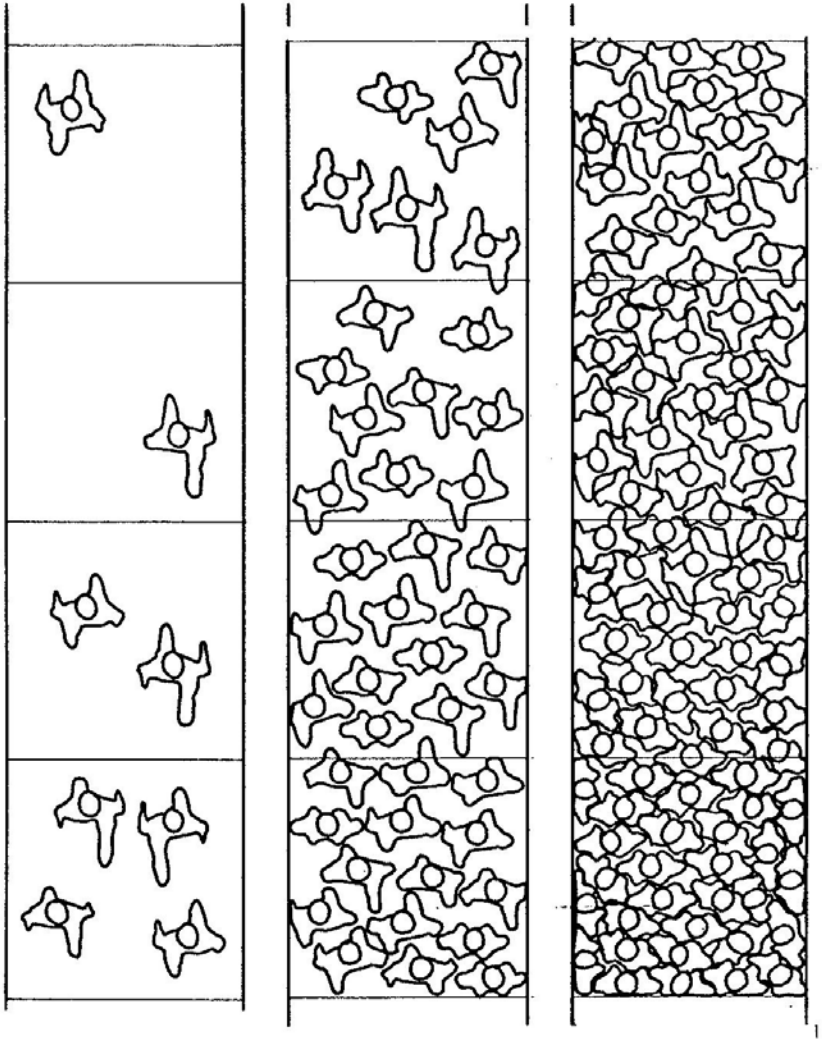
URBAN DESIGN MANHATTAN

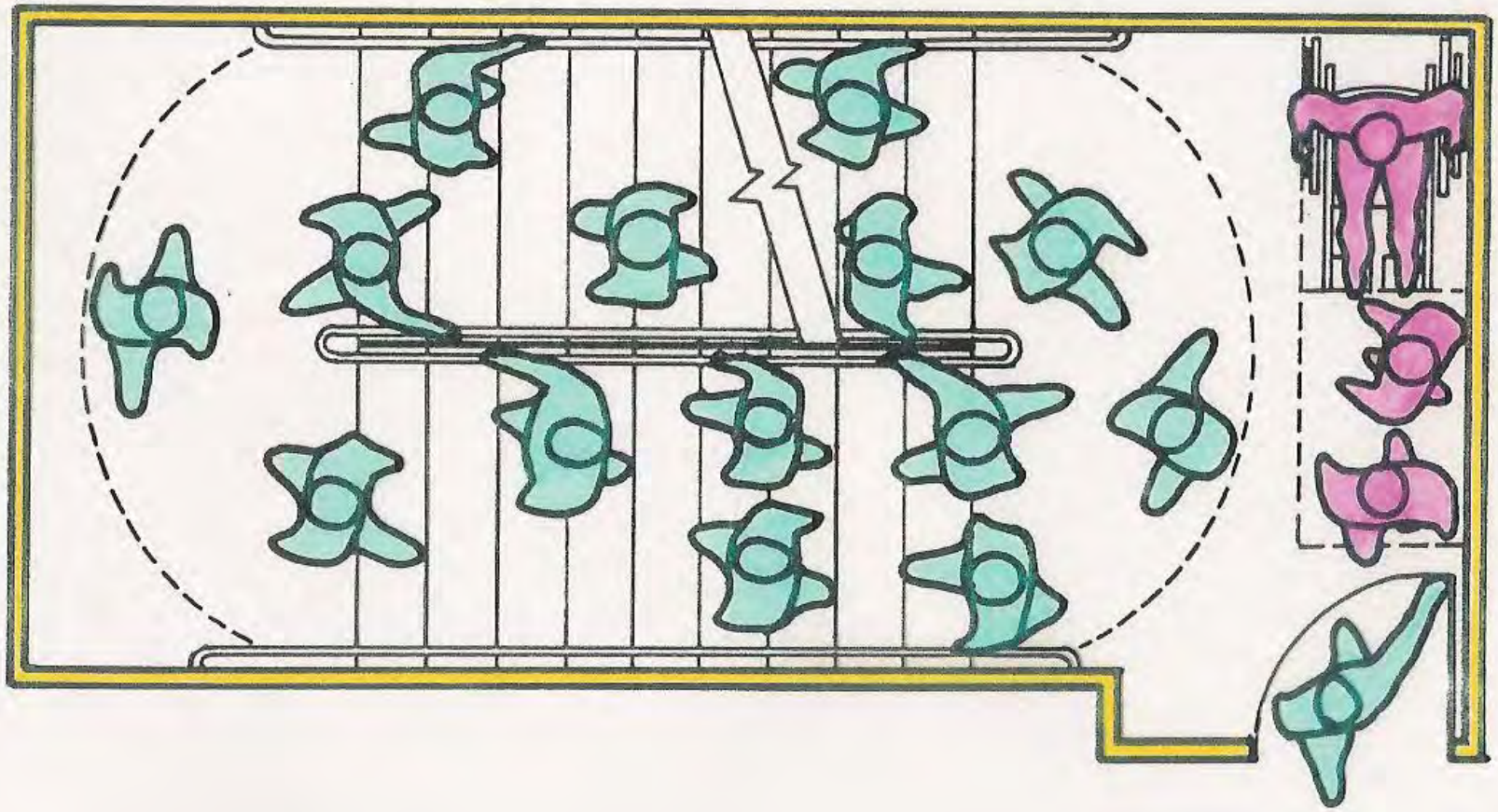
REGIONAL PLAN ASSOCIATION

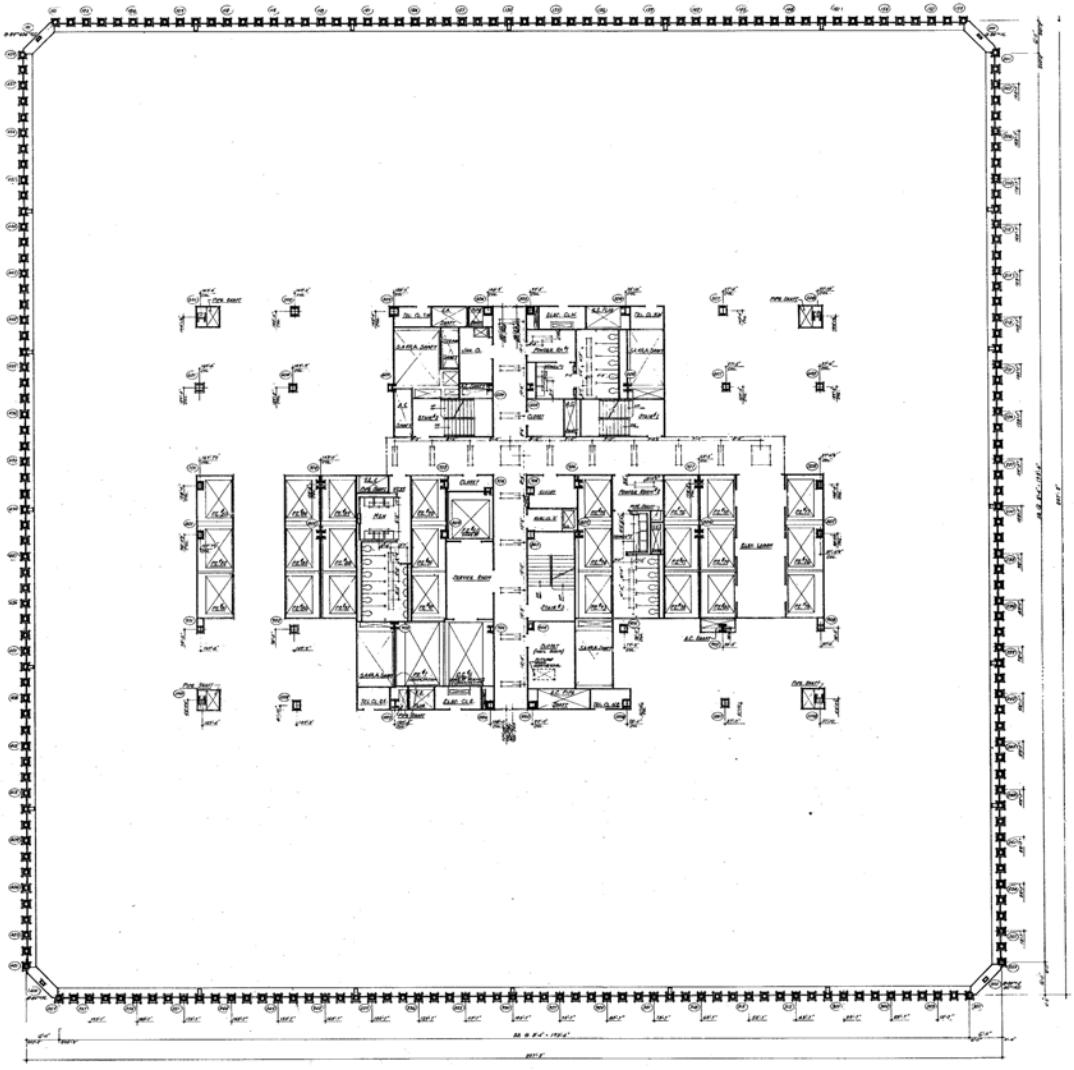










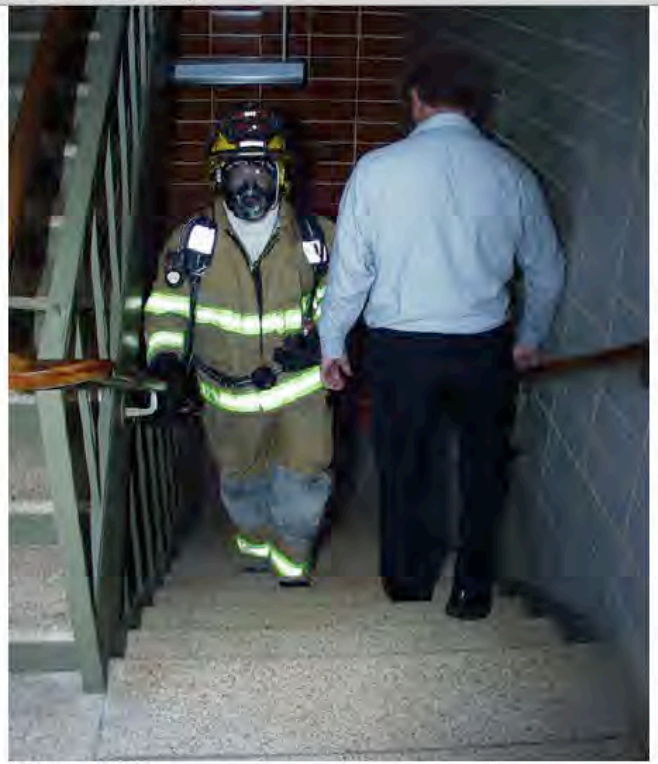


In some cases, occupants went so far as to show their appreciation. An occupant from WTC 1 Stairwell A recalled encountering firefighters near the 20th floor.

> "Firemen were going up and they were looking exhausted. People were cheering the firemen and some of the firemen said, 'Don't stop, you're almost there.' As we moved aside, we handed the firemen water." Interview 1000722 (NIST 2004)

Throughout the event, emergency responders supported the occupants by performing a variety of actions, including directing occupants to change stairs (especially in WTC 1 when exits were blocked by debris from the collapse of WTC 2), providing directions on how to exit through the Concourse, giving out snacks, water, and oxygen (from air bottles) to occupants in need.

Firefighters reportedly established a rest



Source: NIST.

Figure 10–8. Occupant and firefighter in bunker gear passing in a generic 44 in. stairwell.


SONY
Digital
Anti-Static Lid
Digital BETACAM


THE HUMAN FIGURE IN MOTION
A SOURCE BOOK OF SEQUENTIAL ACTION IMAGES BY A MASTER PHOTOGRAPHER
Eadweard Muybridge
PLATE 15
Anti-Static Lid
for Digital
SONY

"I was on the phone with Sean for the last half hour of his life, beginning at 9:30 a.m.

He described the situation, what escape routes he had tried and asked me for information based on what I was seeing on TV.

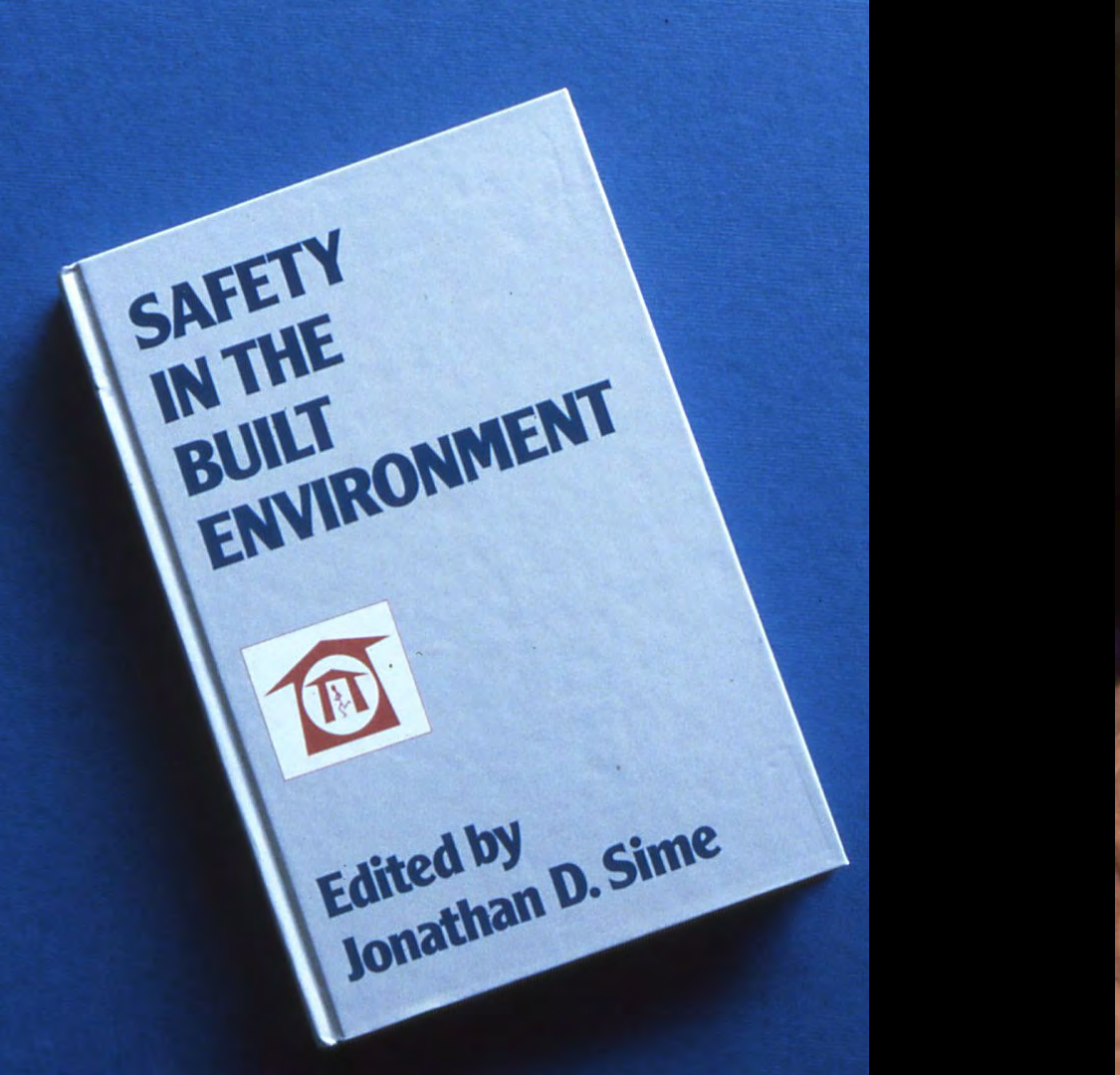
He was calmly and rationally trying to assess his options.

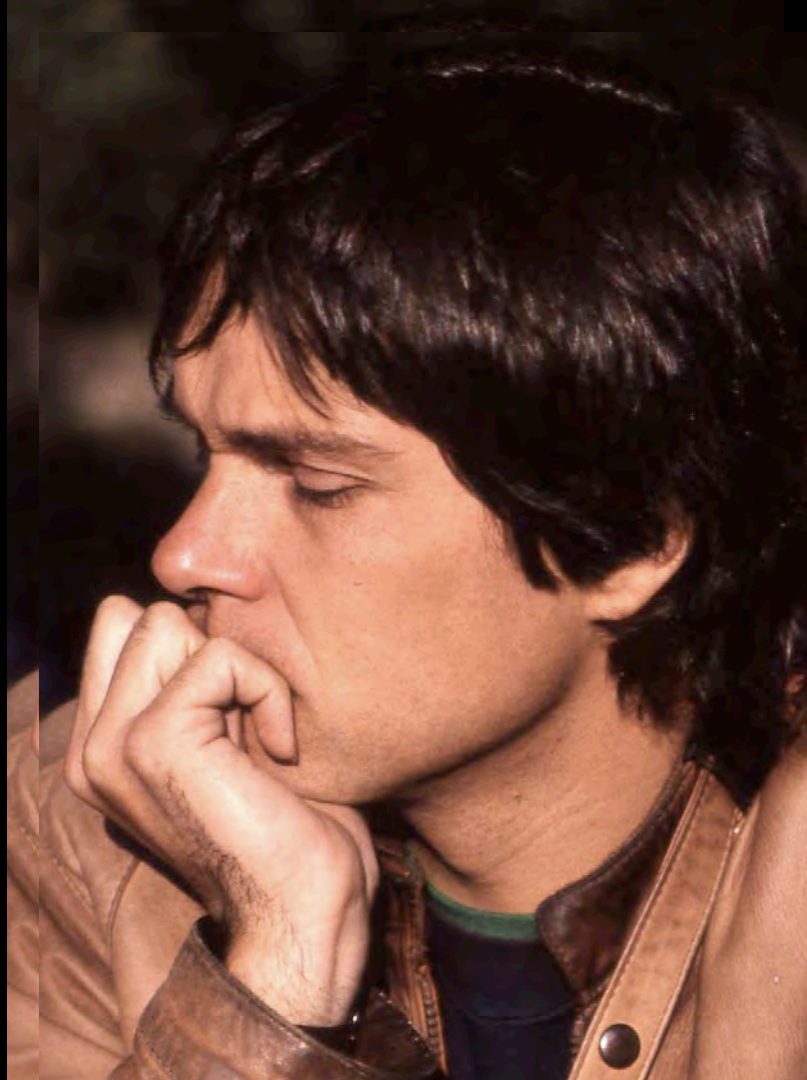
I reached 911 on another phone but a full half hour after the planes had struck they had no information to pass along. . . .

Sean died because of failures in communication. . . ."

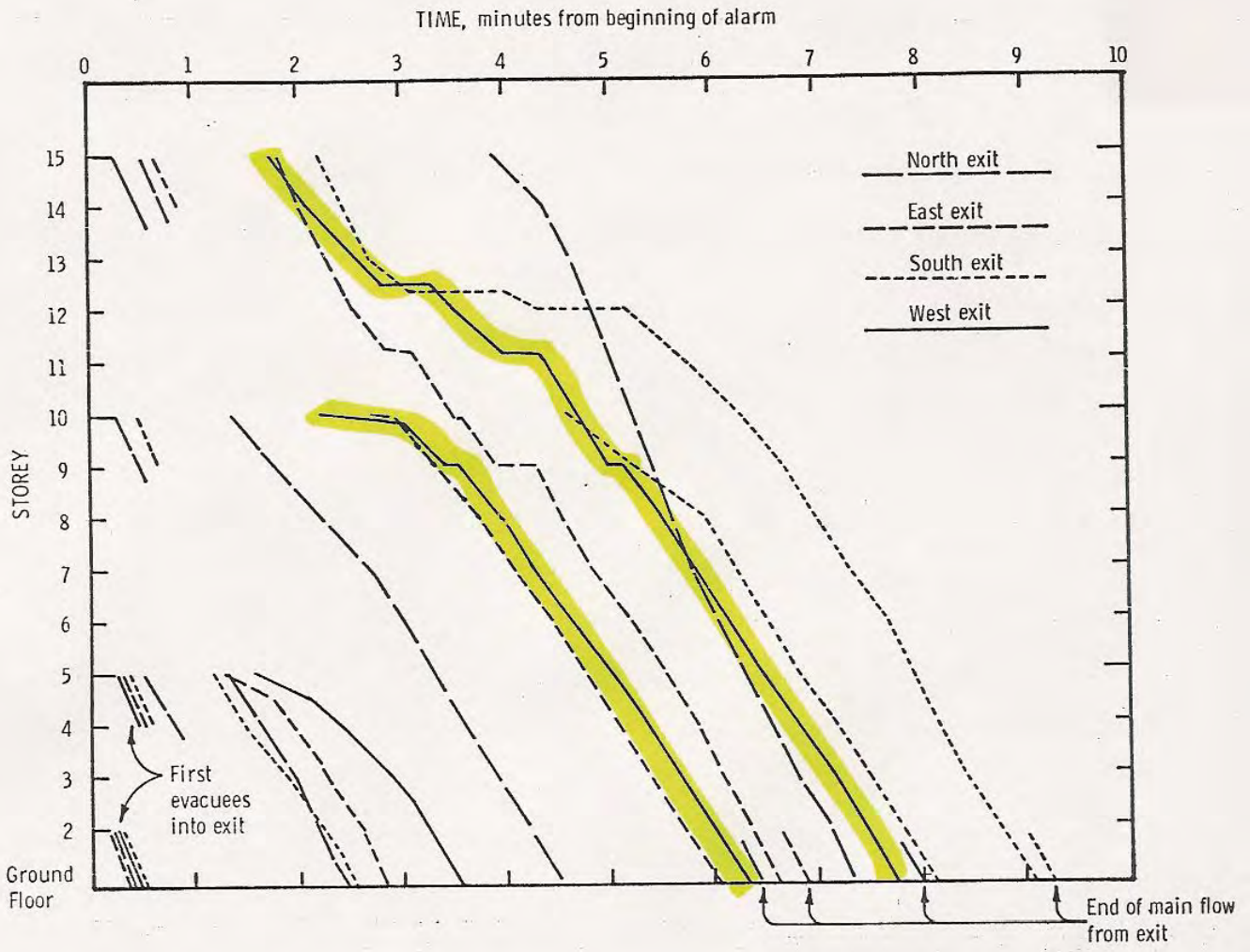
Beverly Eckert testifying at NIST Hearing, New York, June 24, 2002

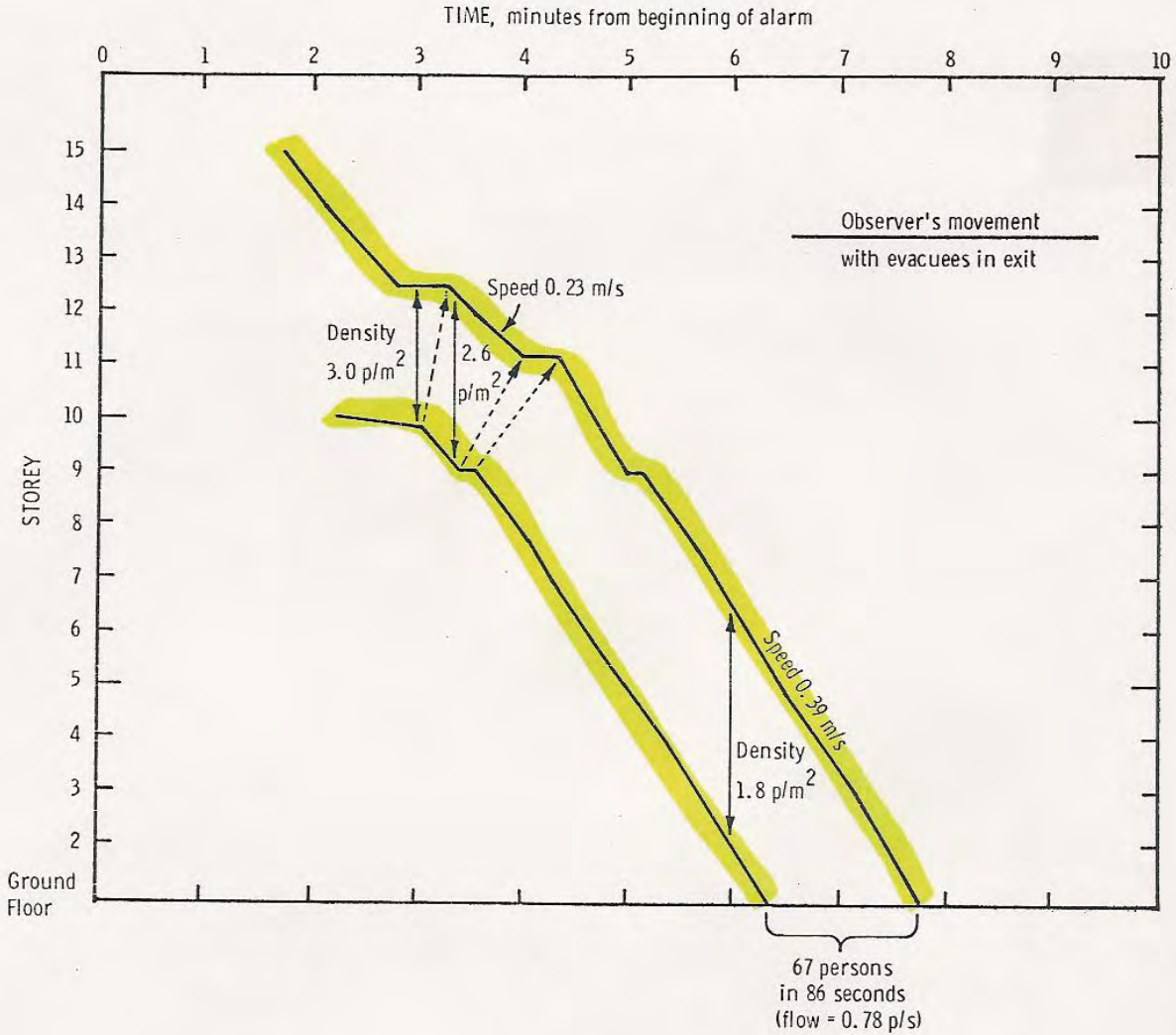

JALPAK


SAFETY
IN THE
BUILT
ENVIRONMENT
Edited by
Jonathan D. Sime




FIRE
PROTECTION
HANDBOOK
VOLUME I


TIME, minutes from beginning of alarm
0
1
2
3
4
5
6
7
8
9
10
STOREY
15
14
13
12
11
10
9
8
7
6
5
4
3
2
Ground Floor
North exit
East exit
South exit
West exit
First evacuees into exit
End of main flow from exit


TIME, minutes from beginning of alarm
0
1
2
3
4
5
6
7
8
9
10
STOREY
15
14
13
12
11
10
9
8
7
6
5
4
3
2
Ground Floor
Observer's movement
with evacuees in exit
Speed 0.23 m/s
Density
3.0 p/m2
2.6
p/m2
Speed 0.39 m/s
Density
1.8 p/m2
67 persons
in 86 seconds
(flow = 0.78 p/s)

The Stair Event

Movie Clip from "*The Stair Event*" (Click: 47 Subjects)
Correct Flow Duration: 25 sec: *Mean Flow: 110 p/min

- *Original filming done at 18 fps
- but film production was at 24 fps

Thanks to Ed Galea, Russ Timpson & Justin Francis
(not with us for this year's pre-FDIC meeting)

From the humble home where I was born in Hague, Sask., Canada, in March 1943:

Grades 7 & 8 teacher Phil Molberg at 90, on his favorite apartment stairway, was an early influence model to me - *and will be forever.*

to the modern, state of the art, apartment building, “The Pearl,” in Silver Spring, Maryland, USA. where my life might soon end well.