



# Resiliency – a Property Insurer's View

November 2011

Dan Howell, PE

## FM Global (Factory Mutual)

- Est. 1835
- Commercial Property Insurance
- Business Model:
  - Research
  - Loss prevention engineering
  - Risk improvement
- 220,000 insured locations
- 1200 field engineers
- 350 Loss Prevention Data Sheets

## Losses (\$)

Nat Haz / Fire / Other

## Risk Improvement

- Physical
- Human Element / Response

# FM Global Research Campus



# Building Hazards

- Natural Hazards
  - Flood
  - Wind
  - Earthquake
  - Snow
  - Ice
  - Rain
  - Hail
  - Bush/Wild Fire
- Fire (occupancy)
- Other (blast, impact, terrorism, etc.)

# Flood

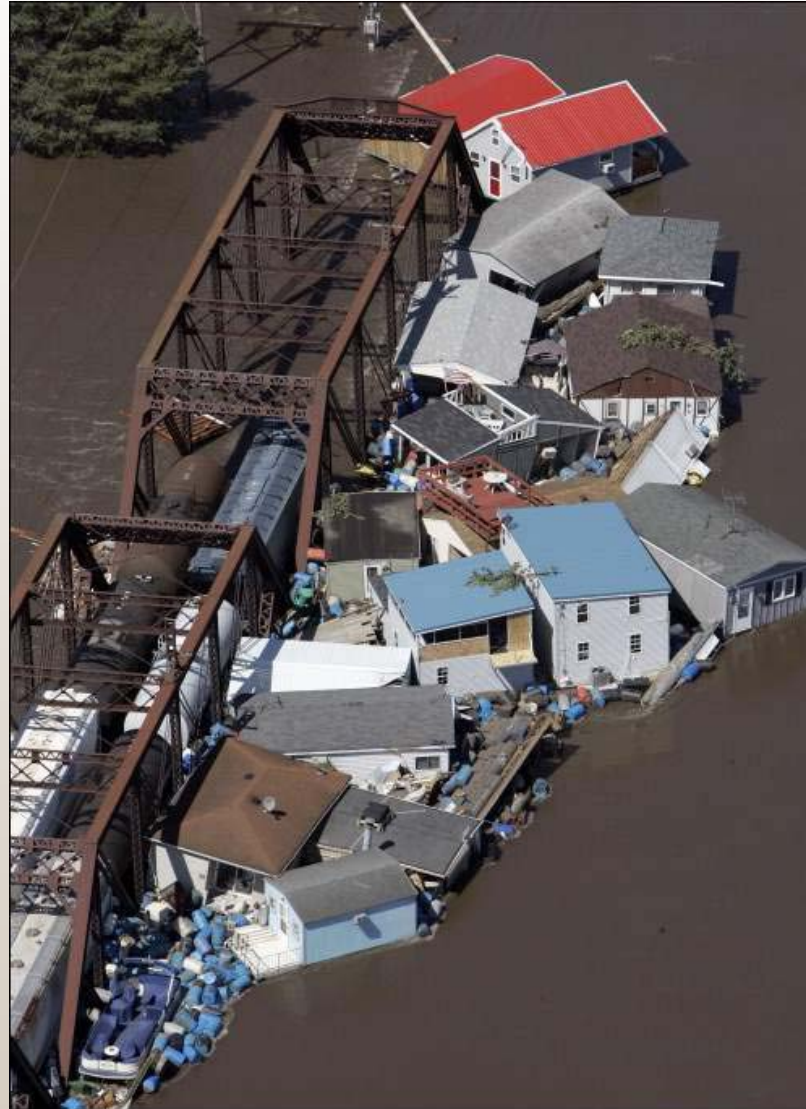


# Flood (2008 Midwest)





# Flood (2008 Midwest)



# Flood: Water Treatment Plant





# Flood



# Flood



# Reducing Flood Damage



# Wind: Roof Flashing





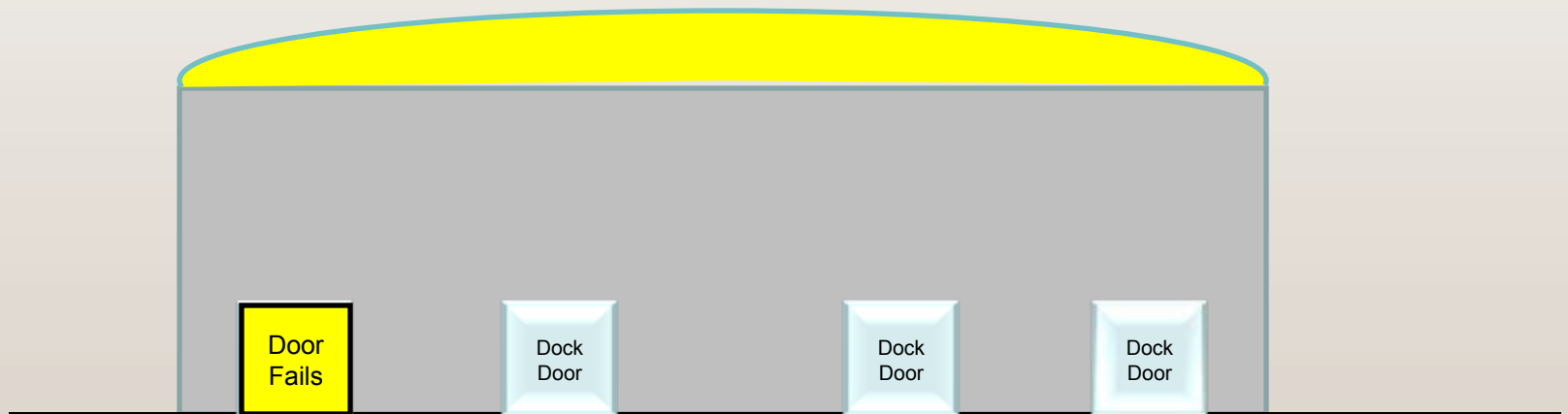
# Wind : RTU



Failure of Dock Door(s)



Roof Failure?



Wind: Building envelope is breached (dock door, windows, louvers, etc.)

- “Enclosed” → “Partially Enclosed”  
Internal pressure: 3x +/-  
External pressure: no change  
Net wind pressure increases (low rise, low slope) by:  
35% / 25% on walls (f/c) +/-  
30% / 20% / 15% on roof (f/p/c) +/-
- Could lose portion of roof → significant PD & BI



# Dock Door Bracing (int + ext)



# Miami-Dade NOA – Dock Door



**BUILDING CODE COMPLIANCE OFFICE (BCCO)  
PRODUCT CONTROL DIVISION**

**MIAMI-DADE COUNTY, FLORIDA  
METRO-DADE FLAGLER BUILDING  
140 WEST FLAGLER STREET, SUITE 1603  
MIAMI, FLORIDA 33130-1563  
(305) 375-2901 FAX (305) 375-2908**

## **NOTICE OF ACCEPTANCE (NOA)**

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**Cornell Iron Works, Inc.  
100 Elmwood Avenue  
Mountaintop, PA 18707**

**SCOPE:** This NOA is being issued under the applicable rules and regulations governing the use of construction materials. The documentation submitted has been reviewed by Miami-Dade County Product Control Division and accepted by the Board of Rules and Appeals (BORA) to be used in Miami Dade County and other areas where allowed by the Authority Having Jurisdiction (AHJ).

This NOA shall not be valid after the expiration date stated below. The Miami-Dade County Product Control Division (In Miami Dade County) and/or the AHJ (in areas other than Miami Dade County) reserve the right to have this product or material tested for quality assurance purposes. If this product or material fails to perform in the accepted manner, the manufacturer will incur the expense of such testing and the AHJ may immediately revoke, modify, or suspend the use of such product or material within their jurisdiction. BORA reserves the right to revoke this acceptance, if it is determined by Miami-Dade County Product Control Division that this product or material fails to meet the requirements of the applicable building code.

This product is approved as described herein, and has been designed to comply with the High Velocity Hurricane Zone of the Florida Building Code.

**DESCRIPTION: 25'- 4" Rolling Steel Door**

# Miami-Dade NOA – Dock Door Submittal Drawing (SF = 1.5)

		<p><b>GENERAL NOTES</b></p> <ol style="list-style-type: none"> <li>THIS DOOR WAS DESIGNED ACCORDING TO THE 1994 EDITION OF THE SOUTH FLORIDA BUILDING CODE, AND THE BROWARD COUNTY 1994 EDITION.</li> <li>CALCULATIONS ON POSITIVE AND NEGATIVE DESIGN PRESSURE ARE PERFORMED IN ACCORDANCE WITH ASCE 7-88 (MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES)</li> <li>THE DETAILS AND SPECIFICATIONS SHOWN WITHIN THESE SET OF DRAWINGS REPRESENT THE PRODUCTS TESTED FOR IMPACT, CYCLIC AND STATIC AIR PRESSURE ACCORDING TO DADE COUNTY PROTOCOLS PA 201, 202, AND 203 AT BASE DESIGN LOADS OF 60 PSF POSITIVE AND NEGATIVE.</li> <li>SLATS TO BE ASTM A-446 GRADE C WITH G-90 GALVANIZING OR STAINLESS STEEL WITH MINIMUM Fy = 40 KSI</li> <li>ALL STEEL ANGLES AND WINDBAR TO BE SHOP PRIMED.</li> <li>WINDBLOCKS TO BE DUCTILE IRON WITH MINIMUM Fy = 42 KSI</li> <li>ALL ASSEMBLY BOLTS TO BE ASTM - A 449 / SAE GRADE 5 OR STAINLESS STEEL-304</li> <li>ALL WELDING TO BE IN ACCORDANCE WITH AWS LATEST EDITION AND SOUTH FLORIDA BUILDING CODE. WELDING TO BE DONE BY CERTIFIED WELDERS USING 70XX ELECTRODES</li> <li>SPRING COUNTERBALANCE TO BE HOUSED IN A STEEL PIPE OF DIAMETER AND WALL THICKNESS TO RESTRICT MAXIMUM DEFLECTION OF 0.03" PER FOOT OF DOOR WIDTH.</li> <li>CHARGE WHEEL FOR APPLYING SPRING TORQUE FOR COUNTERBALANCE ASSEMBLY AND FUTURE ADJUSTMENTS</li> <li>RIVETS FOR WINDBLOCKS/ENDLOCKS ARE TO BE SEMI-TUBULAR 0.246/0.252 DIA. 0.437 MUSHROOM HEAD x 7/16", ASTM A-31.</li> <li>HOOD IS TO BE 24 GAUGE ASTM - 525 WITH G-90 GALVANIZING</li> <li>BRACKETS ARE STEEL PLATES NOT LESS THAN 1/4" THICK, BALL BEARING AT ROTATING SUPPORT POINTS, BOLTED TO MOUNTING ANGLE, SUPPORTS COUNTERBALANCE ASSEMBLY AND FORMS END ENCLOSURES. SIZED TO CONFORM SMOOTH OPERATION.</li> </ol>																									
	<p>22 GAUGE FLAT SLAT</p> <p>22 GAUGE INSULATED SLAT</p>	<div style="border: 1px solid black; border-radius: 15px; padding: 5px; text-align: center;"> <p>Design Pressure Rating +/- 60 PSF</p> </div>																									
<p>1/4" BOLTS 20" O/C</p> <p>2 x 2 x 1/8 ROLL-FORMED ANGLES ASTM A-525-93</p> <p>RUBBER ASTRAGAL DADE COUNTY APPROVED WEATHERSTRIPPING</p> <p>BOTTOM BAR</p>	<p>PRODUCT REVIEWED          F. P. DEGIOVANNI          6/20/03          02-0507.03          06/23/2007</p> <p>Special Dade Product Control          Division</p>																										
<p>COMPUTER GENERATED DRAWING</p>			<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">S.A.M.</td> <td style="width: 10%;">DRAWN</td> <td style="width: 10%;">S.A.M.</td> <td style="width: 10%;">CHECKED</td> </tr> <tr> <td style="width: 10%;">S.A.M.</td> <td style="width: 10%;">DRAWN</td> <td style="width: 10%;">S.A.M.</td> <td style="width: 10%;">CHECKED</td> </tr> <tr> <td colspan="2">ADDED CLARIFICATION NOTES</td> <td colspan="2">ADDED NOTES TO CLARIFY DETAIL</td> </tr> <tr> <td colspan="2">REVISED</td> <td colspan="2">REVISION RECORD</td> </tr> <tr> <td>DATE</td> <td>DATE</td> <td>DATE</td> <td>DATE</td> </tr> <tr> <td>7/18/98</td> <td>7/18/98</td> <td>7/18/98</td> <td>7/18/98</td> </tr> </table> <p style="text-align: center;"><b>Alpine</b></p> <p style="text-align: center;">         410 MASSA AVENUE, BROWARD COUNTY, FLORIDA 33412          TEL: (770) 884-6100 FAX: (770) 886-1534          © COPYRIGHT 1995     </p> <p>APPLICATION: 02-0507.03</p> <p>F.P. DEGIOVANNI          41 FLANDERS RD          MONTAUK, N.Y. 11954          PROFESSIONAL ENGINEER          FLORIDA LICENSE          NUMBER 55071</p> <p style="text-align: right;"> <i>F. P. DeGiovanni</i>          DATE: 6/20/03          DRAWN BY: S.A.M.          APPR BY: S.A.M.          DATE: 3-21-96          DRAWING: ALP2-01/3          REV: 2     </p> <p style="text-align: right;">© COPYRIGHT 1996</p>	S.A.M.	DRAWN	S.A.M.	CHECKED	S.A.M.	DRAWN	S.A.M.	CHECKED	ADDED CLARIFICATION NOTES		ADDED NOTES TO CLARIFY DETAIL		REVISED		REVISION RECORD		DATE	DATE	DATE	DATE	7/18/98	7/18/98	7/18/98	7/18/98
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# Wind damage to port cranes



# Broadcast tower: Ice + wind



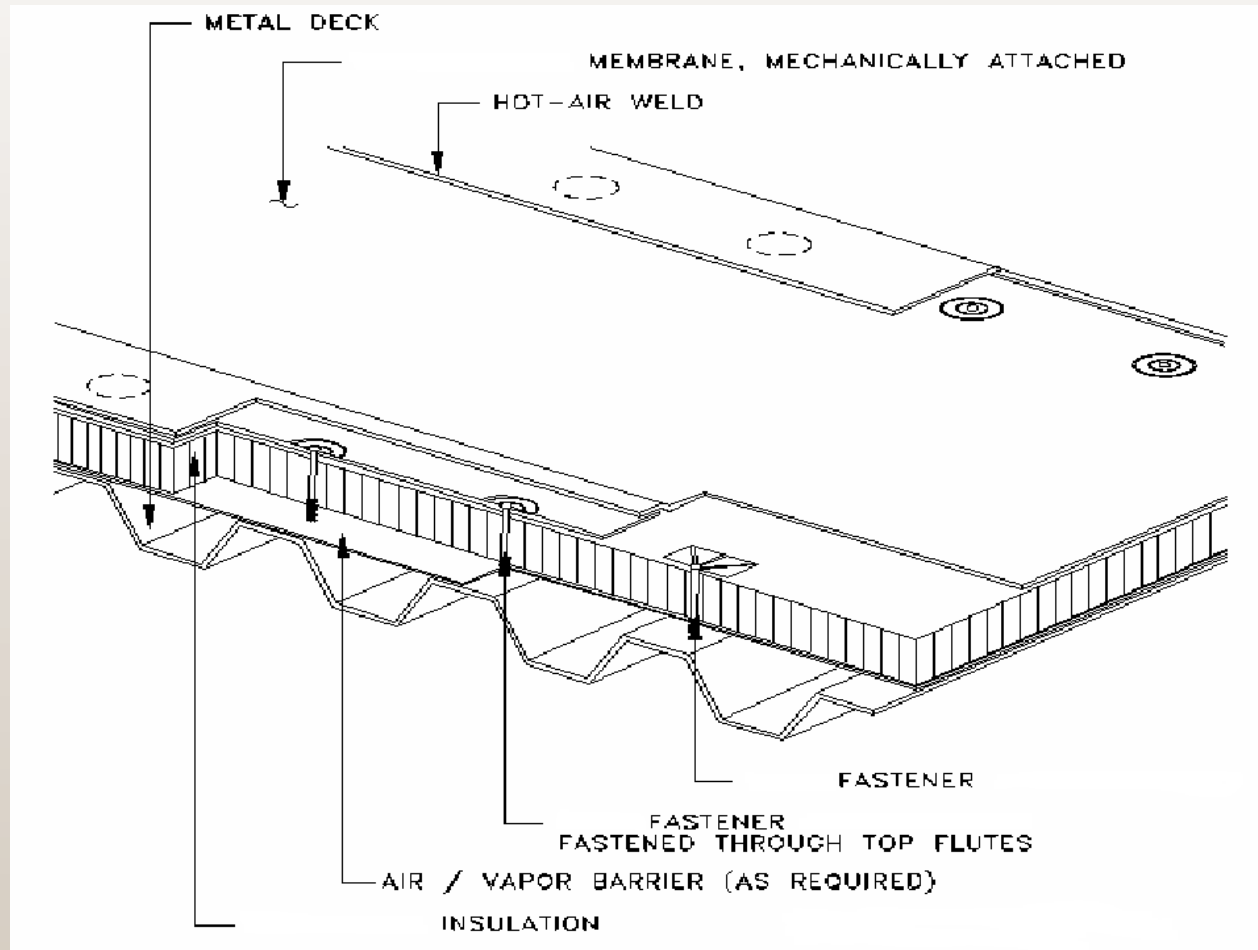


# Broadcast station roof: ice shedding and debris impact



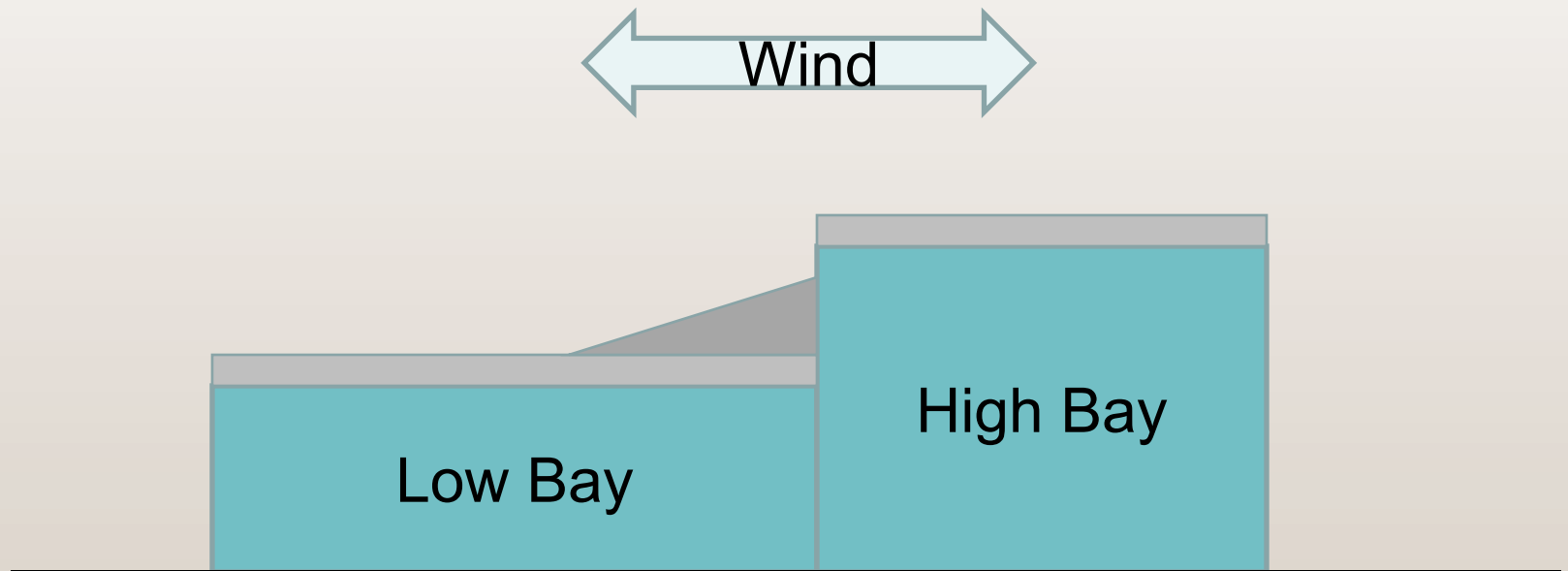
## Coordination of Design Disciplines (Arch & Struct)

Wind Uplift on deck w/MASP: line load  $\neq$  uniform load

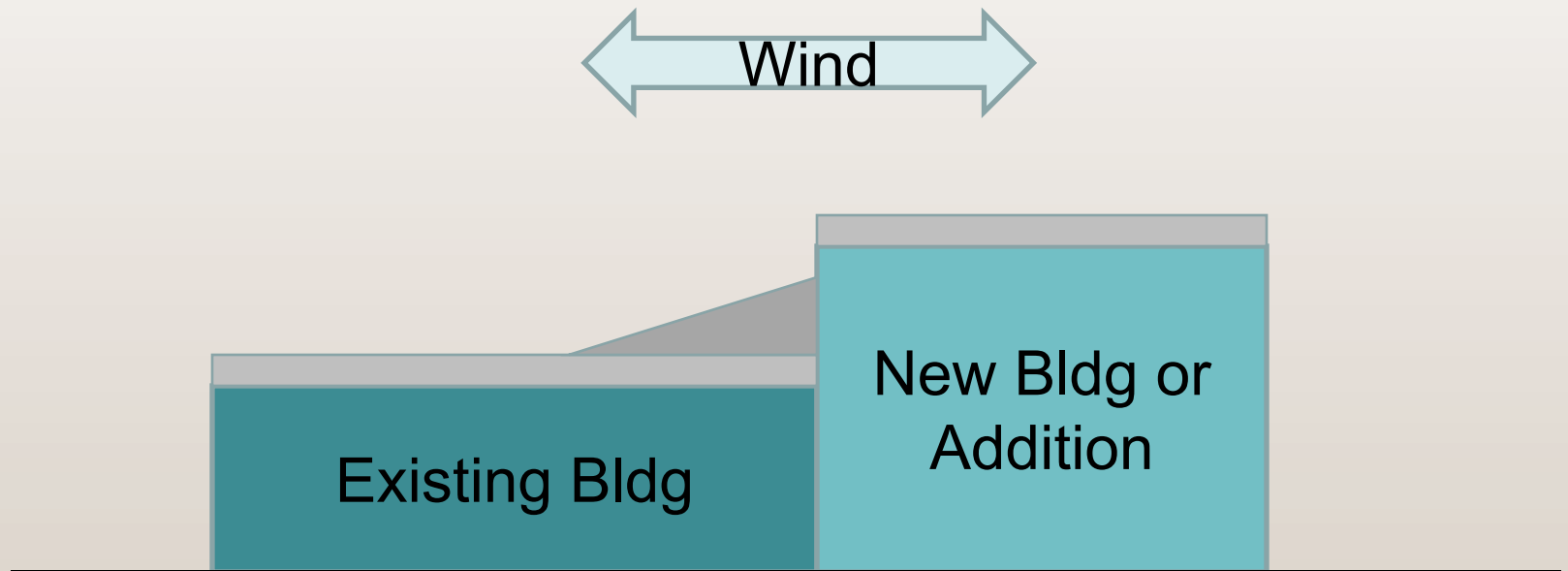




# Snow collapse at roof step (high/low bay)



# Snow collapse at roof step (new/exist.)



# Snow: purlin failure



# Snow: purlin failure (corrosion)



## Corrosion: Food processing plant (high int. humidity)





# Rain/Drainage: roof + wall



# Rain/drainage: soaked cover boards and ponding





# Rain/drainage: blocked scupper



# Partially blocked drains, slope



# Material deterioration





# Wave/surge damage to wharf utilities



# Wave/surge damage to wharf





## EQ damage: Storage rack (photo courtesy of ABS consulting)



## EQ damage: Electrical equipment (photo courtesy of ABS consulting)

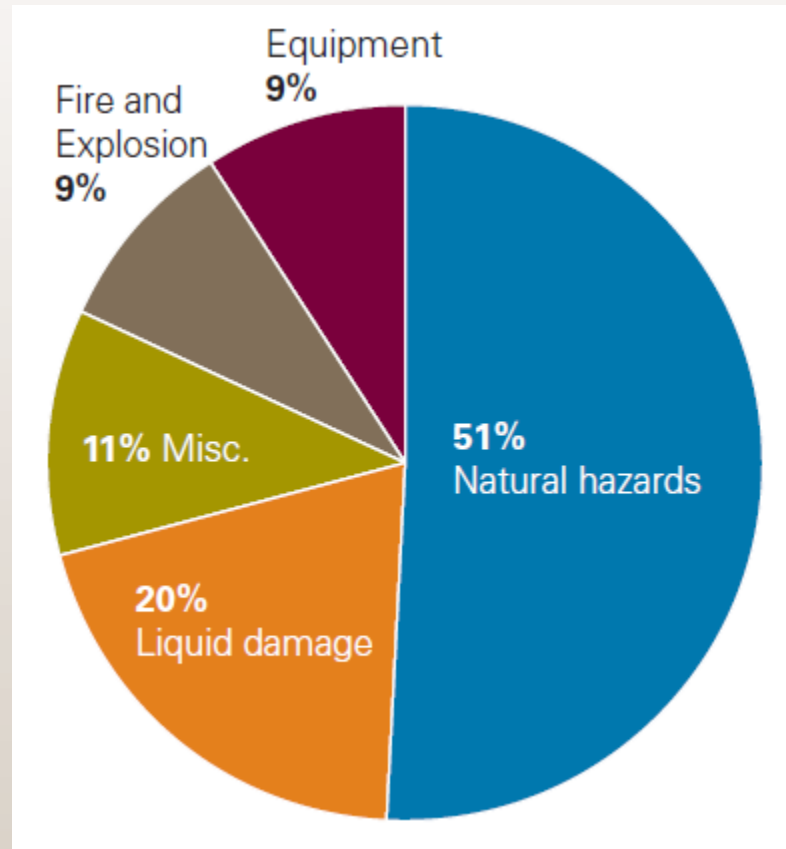




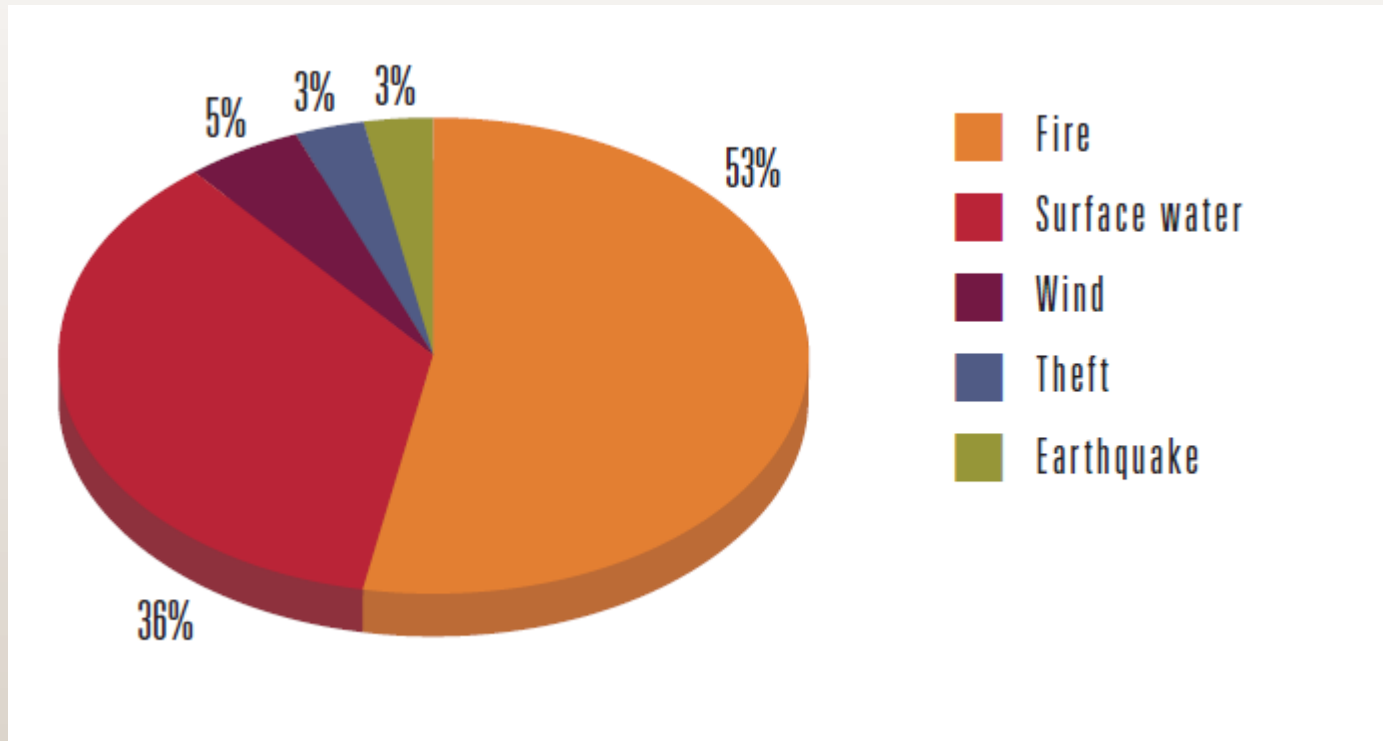
# EQ damage – Non Struct Comp (photo FEMA 74 1994 Northridge)



## Example: Hospital losses (2005-2009)



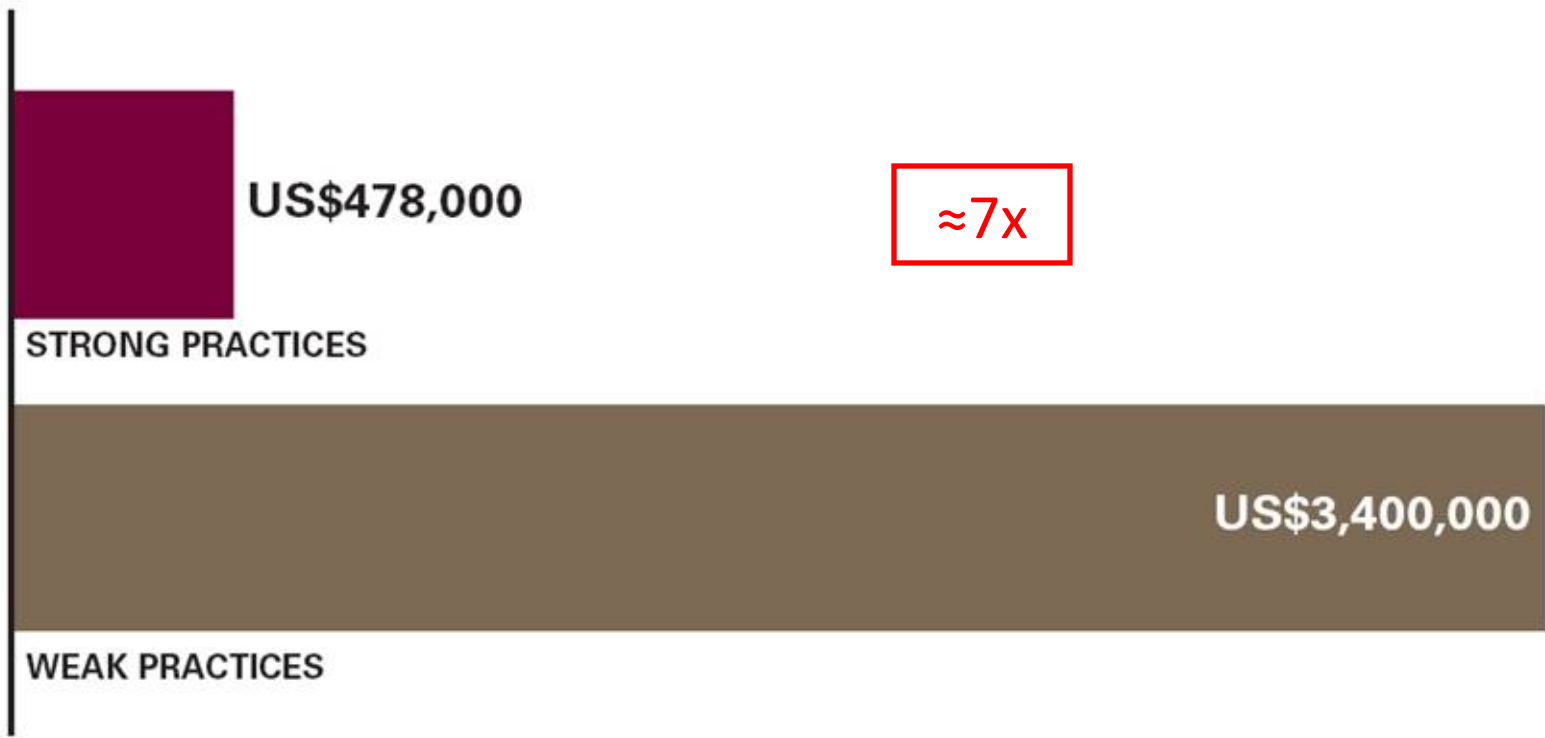
## Example: Telecom equipment bldg losses (1980-2000)



520 large multi-national companies (annual revenue >\$1 billion): Avg. Loss Severity (\$/loss)

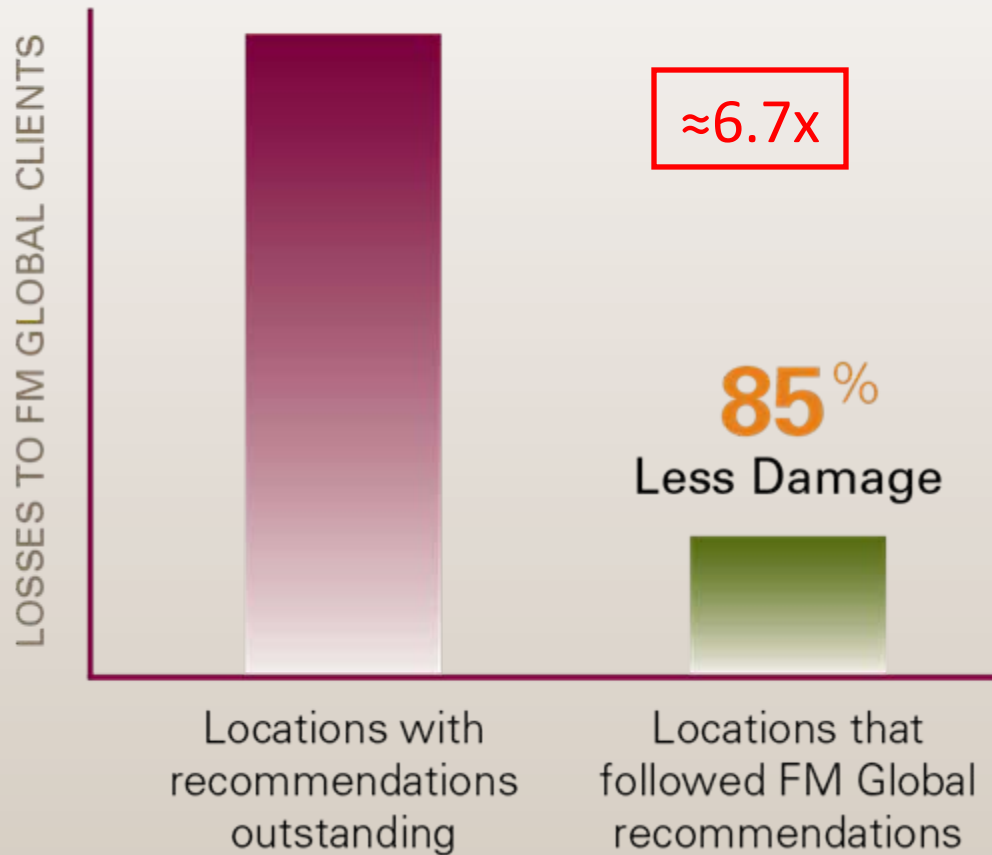
**Natural Catastrophes:**

Physical Risk Management Practices vs. Average Loss Severity (2005–08)



# Katrina Losses

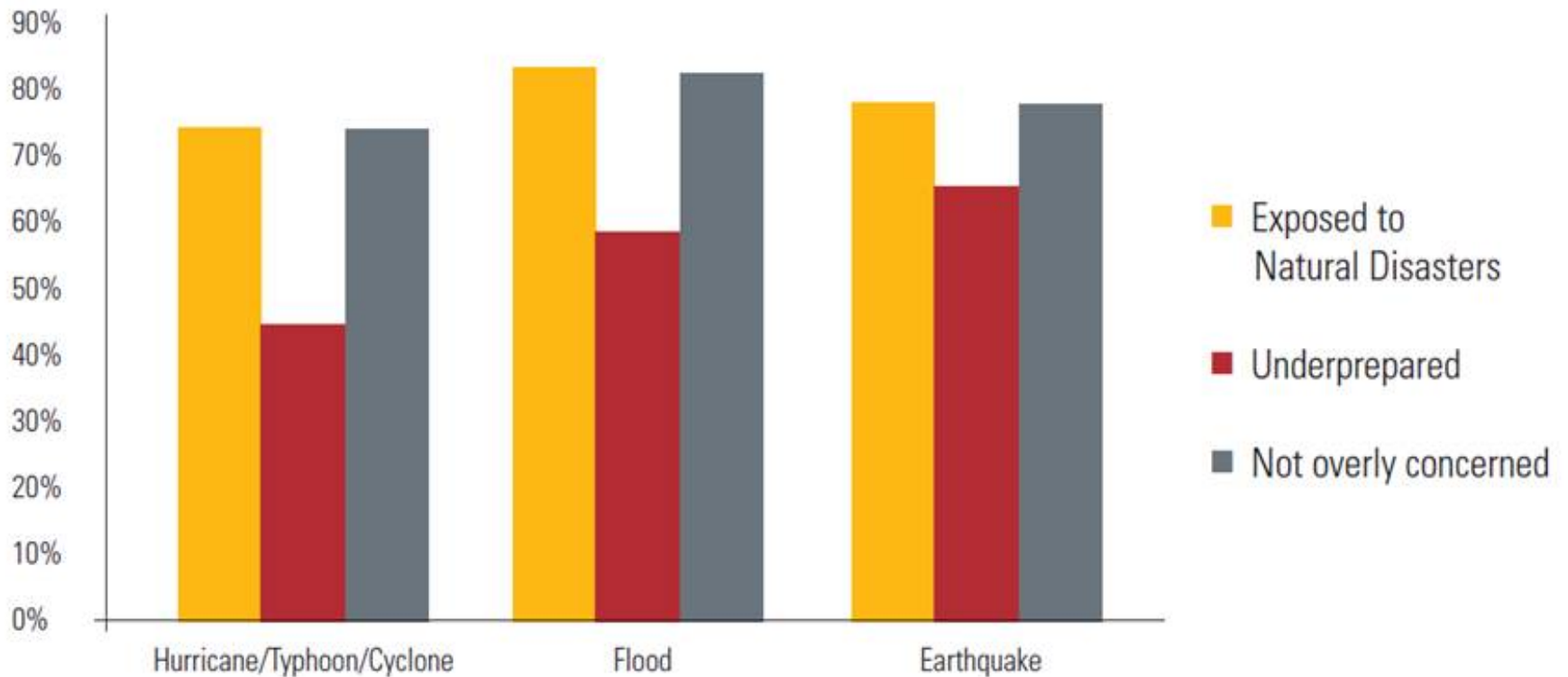
## Hurricane Katrina Loss Experience





# Perception of Risk: Exposure, Concern, and Preparation

## North America-based Companies



# Perception of Risk: Wind Speeds

“50-year” = 2% annual probability of exceedance (PoE)

“50-year” = 1 failure every 50 years?? No.

We just had a hurricane – I’m good for 50-years?? No.

- “50-year” (64% PoE over 50 years)
- “100-year” (39% PoE over 50 years)
- “500-year” (10% PoE over 50 years)

# Summary

- 1) FM supports evolution of code/std/guidelines for improving performance & resiliency of the built environment
- 2) Exposure-driven risk-based approach (beyond life safety)
- 3) Whole building approach – e.g., more attention to building envelope (wind) and non-struct comp (EQ)
- 4) Better assurance that: As-built = As-designed
  - Targeted (exposure) inspection/observation and enforcement
  - Periodic inspection (corrosion/alteration)

(Risk & resiliency improvement similar to risk improvement with 1200 FM field engineers inspecting insured locations)
- 5) Nat Haz Response Team (facilities) – feasible/enforceable?
- 6) Design: Better arch/struct coordination (how?)
- 7) Risk awareness: countering wishful thinking (e.g. likelihood, PoE)

# Questions/comments?

