A Look at Your Campus with Resilience in Mind

Presented by:
Steve Raskin, AIA
Carol Stolt, WELL AP

October 2017
• **RDI** defines **Resilience** as “the capacity to adapt to changing conditions and to maintain or regain functionality and vitality in the face of stress or disturbance. It is the capacity to bounce back after a disturbance or interruption.”

• College campuses are community resources that are subjected to **Destructive Forces**.

• **Responsibility** to design facilities in response to these vulnerabilities. Essential mindsets and design strategies.
Educational Facilities

- Future of learning, communities
- Shelter from disasters
- Physical, mental health and well being

Resiliency

- The ability to prepare and plan for, absorb, recover from, and more successfully adapt to adverse events.
Essential Mindset
Building Resilience

**Shocks**
Threats & Hazards

- Riot/Civil Unrest
- Heat Wave
- Tornado
- Flooding

- Endemic Violence
- Educational Disparities
- Declining Populations
- Aging Infrastructure
- Health and Well Being
Shared Attributes

- Systems Thinking*
- Diversity and Shared Goals
- Integrative Design Approach
Systems Thinking

- Building
- Environment
- Occupant
- Community

Individual Parts

Interconnected
Environment

- Protect the Native Habitat
- Water Efficiency*
- Plan the Site
Water Efficiency

- Reduce potable water consumption
- No irrigation
- Reduce runoff
- Improve water quality
- On-site food production
- Rainwater Harvesting

Missouri Botanical Gardens
Community

- Community Engagement
- Community Connectivity*
- Local Investments
Connectivity

- Walkability
- Non-Motorized Transit
- Public Transit
- Crisis and Health Services
- Green Focused Services
- Social Equity
- Economic Vitality
Community Connectivity
Building

Performance and Productivity

Hazard Preparedness and Mitigation

Threats Assessment*
Threats/Security – Trends Impacting Design

Earthquake  Wind  Snow  Rain

Flood  Hurricane  Water  Tornado

Hazard  Assault  Arson  Crime

What is the leading cause of school-related fatalities?
Fatalities

- Transportation: 40%
- Homicides: 26%
- Suicide: 10%
- Severe Winds: 2%
- Active Shooter: 5%
- Robbery: 0%
- Interpersonal Disputes: 4%
- Accidents: 1%
- Gang-Related: 2%
- Bullying: 0%
- Hate Crime: 0%

FGM ARCHITECTS
Active Shooter Threats

194 School Shootings Since 2013
Discover the risks you face.
Click your state on the map or enter your Zip Code below.

62002 GO

Earthquake | Flood | Hail
Hurricane | Water | Storm
Tornado | Fire | Snow
Weather Safety:
TornadoHistoryProject.com

<table>
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<tr>
<th>Date(s) (yyyy-mm-dd)</th>
<th>Tornadoes</th>
<th>Fatalities</th>
<th>Highest Fatalities</th>
<th>Injuries</th>
<th>Highest Injuries</th>
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<td>27 people</td>
<td>21 people</td>
<td>468 people</td>
<td>345 people</td>
<td>156.7 miles</td>
<td>1000 yards</td>
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</table>
Emergency / Hazard Planning

**Emergency Generator**
- Lighting
- Exit signs
- Communications
- Command center
- Fire alarm
- Coolers and freezers

**Manual Transfer Switch**
- Portable generator
- Lights and heating at gyms, locker rooms, kitchen, cafeteria, maintenance
- Kitchen equipment

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*Image of a portable generator and a building layout with labeled areas.*
Reinforced Design for Hazards

- 38 individual rooms
- 8 locations
- 2,800 occupants

Educational Facility
Site Avoidance

- Site Access
- Safety during emergencies

Educational Facility
Site Avoidance

- December 30, 2015
- No Site Access
- No Building Access
- No Community Services

Eureka, MO
Occupant Health And Well Being

WELL IS FOR PEOPLE
Design Strategies

Occupant health outcomes:
The physical factors influence the health of occupiers which can be measured or evaluated.

Health:
- Headaches
- Eye strain/damage
- Skin irritation
- Infections
- Fatigue
- Season Affective Disorder
- Asthma & breathing disorders
- Stress & depression
- Other physical complaints, e.g. back ache
- Other serious disorders, including cardio vascular etc.

Occupant well-being and Perception outcomes:
Health is an important element of well-being, but an occupant’s sense of well-being is also comprised of their perception of numerous factors, including how productive they think they are:

- Perceived physical health
- Perceived psychological health
- Perceived productivity
- Perceived environment
- Perceived organizational culture

Organizational or financial Outcomes:
The environment can have a direct impact on occupant productivity, in which health and well-being is often a compounding factor. This outcome for the organization can be measured or evaluated in the following ways (not exhaustive), all of which have financial implications for the employer.

Productivity:
- Absenteeism
- Presenteeism
- Staff turnover/retention
- Revenue
- Medical Costs
- Medical Complaints
- Physical complaints
- Task efficiency & deadlines met
Design Strategies

Occupant Health and Well-Being

WELL Features evaluate ongoing aspects of building performance and occupant behavior to support the operations and maintenance of healthy buildings throughout the building lifecycle.
WELL Building Standard

Seven Concepts

air
water
nourishment
light
fitness
comfort
mind
Air Quality

SOURCES OF INDOOR AIR QUALITY CONCERN

- INADEQUATE VENTILATION: 52%
- CONTAMINATION FROM INSIDE BUILDING: 13%
- CONTAMINATION FROM OUTSIDE BUILDING: 4%
- MICROBIAL CONTAMINATION: 5%
- CONTAMINATION FROM BUILDING FABRIC: 10%
- UNKNOWN SOURCE: 16%

Promote safe and clean water through proper filtration and other methods, and require the appropriate quality of water for various uses.
Light

Circadian Lighting Emulates the Natural Environment

The eyes detect light and send this information to the brain, triggering the calibration of our 24-hour cycle. Light has impacts on human health and well-being outside of image formation and color perception – including:

*calibration of the body’s biological clock and circadian rhythms*
*direct effects on alertness, mood and cognition*
Comfort

Thermal Considerations

4% reduction in performance at warmer temperatures.¹

6% reduction in performance at cooler temperatures.¹

Acoustic Considerations

66% drop in performance when exposed to distracting noise.²

Fitness

What happens to your body when you sit for a prolonged period of time?

Calorie burning drops to less than 1 per minute.¹

Cardiovascular, endocrine, digestive, reproductive, respiratory, muscular, skeletal and nervous systems are negatively affected.²

Prolonged sitting disturbs mood, energy levels and productivity.³

² IWBI Fitness Welflory, Elements of Fitness: Physical Inactivity.
References

C3 Living Design Project - REli
U.S. Green Building Council (USGBC)
ASCE – PRISM Infrastructure Resilience
Envision - Institute for Sustainable
Infrastructure
Zofnass Program for Sustainable
Infrastructure (Harvard)
Financial System Resilience Index (NEF)
2030 Challenge / SB2030
International Living Future Institute
Living Future
Living Building Challenge
Autodesk
2030 Palette: Design and Planning
Strategies
Disaster Safety
TornadoHistoryProject
Illinois State Geological | ISGS
Red Cross

FEMA P-320, Taking Shelter from the
Storm: Building a Safe Room
FEMA P-361, Safe Rooms for Tornadoes
and Hurricanes
FEMA-428, Design Safe School Projects
in Case of Terrorist Attacks and School
Shootings
ICC 500-2014: ICC/NSSA Standard for
the Design and Construction of Storm
Shelters
NFPA 909: Code for the Protection of
Cultural Resource
NFPA 13: Standard for the Installation
of Sprinkler Systems
National Institute of Building Sciences
NIST Special Publication 1190
Community Resilience Planning Guide
Newsweek
Every Town

ASCE 7-10 American Society of Civil
Engineers (ASCE) 2010. Minimum
Design Loads For Buildings and Other
Structures.
ASCE 24-14. Flood Resistant Design
and Construction.
FEMA P-750 NEHRP Recommended
Seismic Provisions for New Buildings
and Other Structures
FEMA P-55. Coastal Construction
Manual.
FEMA P-908. Mitigation Assessment
Team Report
ICC 500 ICC/NSSA Standard for the
Design and Construction of Storm
Shelters.
IRC International Residential Code.
NOAA National Weather Service,
National Hurricane Center.
WELL Building Institute
Resilient Communities

- Resilient Design
  - Shocks and Stresses Assessment
  - Resilient Design Analysis

- Sustainable Design
  - Low or No Cost Design Strategies
  - Energy Efficiency
  - Systems, Materials and Finishes

- WELL Building
  - Students, teachers and administrators
  - Air, Water, Nourishment, Light, Fitness Comfort and Mind

- Safety and Security
  - Crime Prevention through Environmental Design, CPTED
  - Natural Surveillance, Territorial Reinforcement, Access Control and Maintenance
  - Vulnerability Assessment
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October 2017
# Shocks and Stresses

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<th>Description</th>
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Resilience from Shocks and Stresses

- UNINTENTIONAL ACT: 3 Shocks, 7 Stresses
- INTENTIONAL ACT: 5 Shocks, 5 Stresses
- SYSTEM FAILURE: 5 Shocks, 5 Stresses
- GEOLOGICAL: 3 Shocks, 6 Stresses
- BIOLOGICAL: 3 Shocks, 6 Stresses
- METEOROLOGICAL: 2 Shocks, 7 Stresses
- SOCIAL: 6 Shocks, 3 Stresses

Legend: Blue = Shocks, Orange = Stresses
# Resilient Design Action List

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<th>Credit</th>
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<th>Reference</th>
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<td>Required</td>
<td>Protection For Prime Habitat &amp; Floodplain Functions</td>
<td>LEED BD+C V4</td>
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<td>Preserve Prime Habitat (protect local biodiversity)</td>
<td>Envision NW1.1</td>
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<td>Action</td>
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<td>Preserve Species Biodiversity; Restore &amp; Create Habitat Site Development - Protect or Restore Habitat:</td>
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<td>Provide Buffer Zones protecting from development &amp; supporting bio-diversity and biophilia</td>
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<td><strong>Prevent</strong></td>
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<td>Action</td>
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<td>Indoor Water Use Reduction (20% &lt; LEED Baseline)</td>
<td>LEED BD+C V4</td>
<td>Design F6</td>
<td>3</td>
<td>$</td>
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<tr>
<td>Action</td>
<td>E3.2</td>
<td>Outdoor Water use Reduction (30% &lt; Calculated Baseline)</td>
<td>LEED BD+C V4</td>
<td>Design B9</td>
<td>3</td>
<td>$</td>
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<tr>
<td>Action</td>
<td>E3.3</td>
<td>Rainwater Management - Option 1, 95th Percentile of Rainfall Events</td>
<td>LEED BD+C V4</td>
<td>Design B9</td>
<td>2</td>
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<tr>
<td>Action</td>
<td>E3.4</td>
<td>Rainwater management - Water Recycling / Reuse: Space and Planning</td>
<td>LEED BD+C V4</td>
<td>Design B9</td>
<td>1</td>
<td>$$</td>
<td>2</td>
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<td>Action</td>
<td>E3.5</td>
<td>Rainwater Harvesting, Recycled Water, On-Site and/or Neighborhood Water Storage</td>
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<td>Design/Ops B9</td>
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<td>$$$</td>
<td>2</td>
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<td>Action</td>
<td>E3.6</td>
<td>Alternative Sewage Management</td>
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<td>Design F6, B9</td>
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<tr>
<td>Action</td>
<td>E3.7</td>
<td>Deep, Net Zero &amp; Net Positive Water</td>
<td>LBC</td>
<td>Design/Constr/Ops B9</td>
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<td>$$$</td>
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Action List Summary

- Community and Occupants: 38%
- Building: 32%
- Environment and Site: 30%