ATC 71-2

Proceedings:
Workshop on a Rating System for the Earthquake Performance of Buildings

Applied Technology Council

Funded by
Federal Emergency Management Agency

Applied Technology Council

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ATC-71-2

Proceedings:
Workshop on a Rating System for the Earthquake Performance of Buildings

Prepared by

APPLIED TECHNOLOGY COUNCIL
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May, 2011

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Chapter 1
Introduction

The earthquake engineering community has made major progress in the development and implementation of standards and guidelines for the design of new buildings and the retrofit of existing buildings over the past three decades. However, one elusive goal has been the development of a broadly applicable system that communicates to the general public the expected earthquake performance of either new or existing buildings. The development of such a building seismic rating system was one of the major recommendations at the National Earthquake Hazards Reduction Program (NEHRP) *Workshop on Meeting the Challenges of Existing Buildings* (ATC, 2008), which was conducted by the Applied Technology Council (ATC) and the Earthquake Engineering Research Institute (EERI), with funding from all four NEHRP federal agencies, in September 2007 in San Francisco. The desire of participants in that workshop was to provide a building seismic rating system (for use anywhere in the United States) that communicates building seismic risk in consistent, reliable terms understandable to tenants, owners and other stakeholders. Such a rating system would inform the public about the condition of the buildings they live and work in and would place seismic risk on the front burner of elected officials to require seismic rehabilitation of hazardous buildings. As a consequence of that NEHRP Workshop recommendation FEMA funded the ATC-71-2 *Workshop on a Rating System for the Earthquake Performance of Buildings* (the subject of this document) on March 28-29, 2011 in Millbrae, California.

The purpose of the ATC-71-2 Workshop was to gather input on developing and successfully implementing a broadly applicable system for rating the earthquake performance of new and existing buildings. The workshop was designed to identify relevant issues, including the extent to which a rating system would encourage and promote building seismic evaluation and rehabilitation. It was also intended to identify technical difficulties and related consistency issues, potential socio-economic impediments, and stakeholder pros and cons. Workshop attendees included a broad range of stakeholders, including representatives from the insurance, financial, and real estate industries, social scientists, risk managers, building owners and regulators, earthquake engineering professionals, and key specialists involved in “Green” and “Sustainable” building and construction initiatives.

Prior to that Workshop ATC organized an internet-based Forum to enable Workshop participants and other interested stakeholders to openly discuss the relevance and usability of a system that rates earthquake performance of buildings and to express their views on the desirability of developing and implementing such a system. Forum input and deliberations served as background information for the Workshop discussions.

1.1 Report Organization and Content

This *Proceedings* describes the discussions and findings of the workshop participants, and provides a roadmap on the steps necessary to develop a rigorous, but practical broadly applicable building rating system for use anywhere in the United States. Chapter 2 describes the workshop planning efforts, background information, and the workshop program. A record of the plenary session presentations is provided in Chapter 3, and a summary of the balloted issues together with a summary of the key issues resulting from each of the discussion groups are provided in Chapter 4. Chapter 5 provides a summary of the pros and cons of developing a rating system, and Chapter 6 provides a road map on the steps necessary to develop a practical rating system. Several appendices are also included. Appendix A provides a list of persons involved in the organization and management of the workshop, Appendix B provides a list of workshop attendees, Appendix C summarizes the results of the web based discussions that occurred prior to the workshop. And Appendix D provides the breakout groups for Day 1 and 2.

Chapter 2
Workshop Preparations and Program

The need for a building seismic rating system has been discussed at several workshops focused on research needs over the past 20 years and most recently at the ATC (2008) Workshop on Meeting the Challenges of Existing Buildings. Preparation for this workshop commenced in September 2010. Planning was conducted by the ATC Project Management Committee listed in Appendix A. Planning activities included the development of the workshop agenda including the plenary speakers, the selection of a diversified group of workshop attendees and the writing of ballot questions for polling the attendees. In addition a unique method of engaging the workshop attendees ahead of the workshop was used and this is discussed in more detail in Section 2.2 and the feedback obtained is summarized in Appendix C.

2.1 Workshop Participants

The Project Management Committee (PMC) spent a considerable amount of time to get a complete cross section of the "owner community" including representatives of the mortgage, banking and insurance industries, private and public sector owners, real estate representatives, developers, social scientists, government and public policy advocates and building regulators. In addition to a diversity in disciplines we also sought a reasonable geographic distribution of the attendees. The following ballot questions demonstrate that both goals were achieved.

A list of the workshop attendees is provided in Appendix B.


1. My organization's role with respect to buildings (the hat I will wear for these two days)
1. Owner or developer, or owner's consultant
30%
2. Tenant (or tenant advocate)
7%
3. Financier at risk (lender, insurer, investor)
19%
4. Regulator, policy-maker
26%
5. Researcher
11%
6. Other
7%
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2. My role within my organization regarding business decisions about buildings
1. Decision-maker
25%
2. Upper management
14%
3. Leader or expert in one area or department
40%
4. Other, or NA
21%
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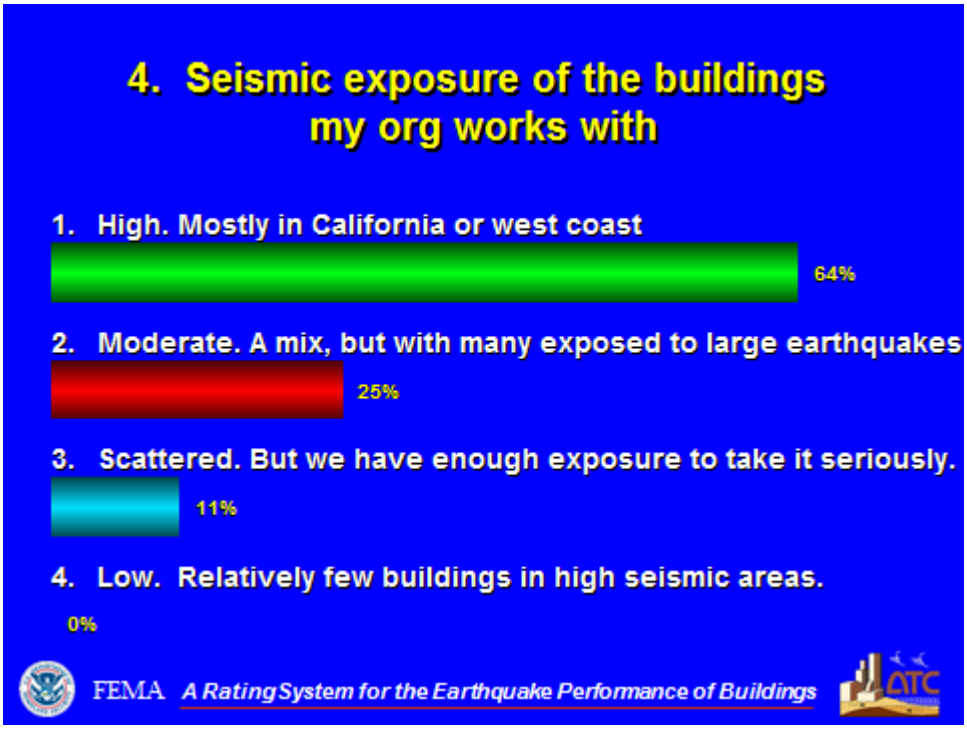


2.2 Pre-Workshop Issues

In January 2011, the ATC Project Team approached the World Bank, and inquired if they would be willing to allow us to create a web-based Discussion Group on their *Understanding Risk* website. They agreed, and with their technical guidance, we created an *Earthquake Rating System for*

Building Performance Discussion Group, with seven Discussion Group Moderators and seven Discussion Threads. We invited several hundred colleagues to join our Discussion Group, as well as the entire *Understanding Risk* community. The intent was to obtain "kernels" of information to help develop the agenda for the Workshop. The resulting discussions provided a lot of valuable input, and significantly affected our agenda. The feedback from the forum is summarized in Appendix C.

In addition to the forum feedback the PMC had the opportunity to review the work of the SEAONC Buildings Ratings Sub-Committee. This group has been active over the past three years developing a rating system and their work is summarized in SEAONC Existing Buildings Committee, Building Ratings Subcommittee (2008 and 2009). The PMC did not want to start with the current status of the SEAONC work and felt it was important to begin fresh and re-examine some of the basic assumptions inherent in the SEAONC approach.

2.3 Workshop Format and Agenda

The day and a half format was structured around plenary introductory presentations and group discussions as shown in the Agenda below. We organized two breakout sessions, one each day. The intent of the Day 1 breakout session was to obtain feedback on the current status of a number of issues from various disciplines of the "Owner Community." Thus the participants were divided into 5 groups roughly representing the banking industry, insurance industry, public sector owners, private sector owners and public policy/social scientists/building regulators. On Day 2 the groups were completely mixed so that there was a reasonable representation of each discipline in each breakout session. The introductory presentations are presented in Chapter 3.

ATC-71-2 PROJECT: *WORKSHOP ON A RATING SYSTEM FOR THE EARTHQUAKE PERFORMANCE OF BUILDINGS*

March 28-29, 2011

Westin SFO, Cypress Room
One Old Bayshore Highway
Millbrae, CA 94030

WORKSHOP PROGRAM

Monday, March 28 (Day 1)

12:00 pm ***Registration***

12:30 pm **Introductions**

1. Mike Mahoney – Federal Emergency Management Agency (FEMA) Project Officer
2. Ron Mayes – Chair, ATC-71-2 Project Management Committee
3. David Bonowitz – Benefits of Existing Ratings Systems (ERS),
   What attributes should an ERS consider

12:50 pm **Panel Discussion: Existing Ratings Systems – Ron Mayes, Moderator**

Four speakers will be asked to address the following rating system issues, which will form the basis of the panel discussion:

- What need did the rating system fill
- What are its limitations
- What works and what lessons can we learn
- Do you incorporate a review process – pros and cons
- Your thoughts on the desirability of an Earthquake Rating System

1. Dan Cronan – Building Owners and Managers Association (BOMA) Representative; Sr. Vice President, Tenant Representation Services, Kidder Mathews
2. Brendan Owens – Leadership in Energy and Environmental Design (LEED) Representative; Vice President, LEED Technical Development
3. Sharene Rekow – Green Globe Representative; Vice President of Marketing/Sales/Membership, Green Building Initiative

4. David McCormick – Probable Maximum Loss (PML) Specialist; Senior Principal, Simpson Gumpertz & Heger; Co-Chair of American Society for Testing and Materials (ASTM) Committee on PML's
5. Initial demographic electronic polling
6. Ron Mayes – discussion group members and assignments, issues to be addressed as part of first breakout session

2:45 pm ***Break***

3:00 pm **First Breakout Session**

1. Discussion Group Topics
   - Introductions
   - Needs/Uses/Decisions
     - What decisions do you make that currently/already factor in seismic risk, and by what means is it factored in?
     - What information would you need or are you missing for making decisions?
     - What is wrong with your status quo?
   - Dimensions
     - What dimensions/categories of information do you need information for your decisions? (safety, damage costs, downtime, etc.)
     - What is the relative importance of each category of information?
   - If a rating system were to be developed, the following issues related to dimensions may be addressed or held over to Day 2.
     - Single rating for buildings versus separate ratings for safety, capital loss and business down time
     - Hazard quantification
     - Rating Symbols
     - Qualifications and approval process
     - Cost of providing a rating
     - Absolute vs. relative measures
     - Mandatory vs. voluntary

4:45 pm ***Break***

5:00 pm **Plenary Session**

1. Chair of each discussion group briefly presents a summary of the prioritized pros and cons for a rating system
2. Electronic Polling
3. Facilitated discussion by David Bonowitz regarding the polling questions and the group feedback on the pros and cons

Tuesday, March 29 (Day 2)

8:00 am **Plenary Session**

1. Ron Mayes –summary of first day issues, questions to be asked following breakout session
2. Evan Reis – presentation of the issues to be discussed in Second Breakout Session

8:30 am **Second Breakout Session**

Discussion Group Topics

1. Items requiring further deliberations from Day 1 discussions
2. Pros and Cons of developing a rating system and reasons why

11:15 am ***Break***

11:30 am ***Working Lunch*/Plenary Session**

1. Chair of each discussion group briefly presents a summary of the group discussions
2. Facilitated discussion by Evan Reis among the large group, including the pros and cons of developing a rating system
3. Electronic Polling

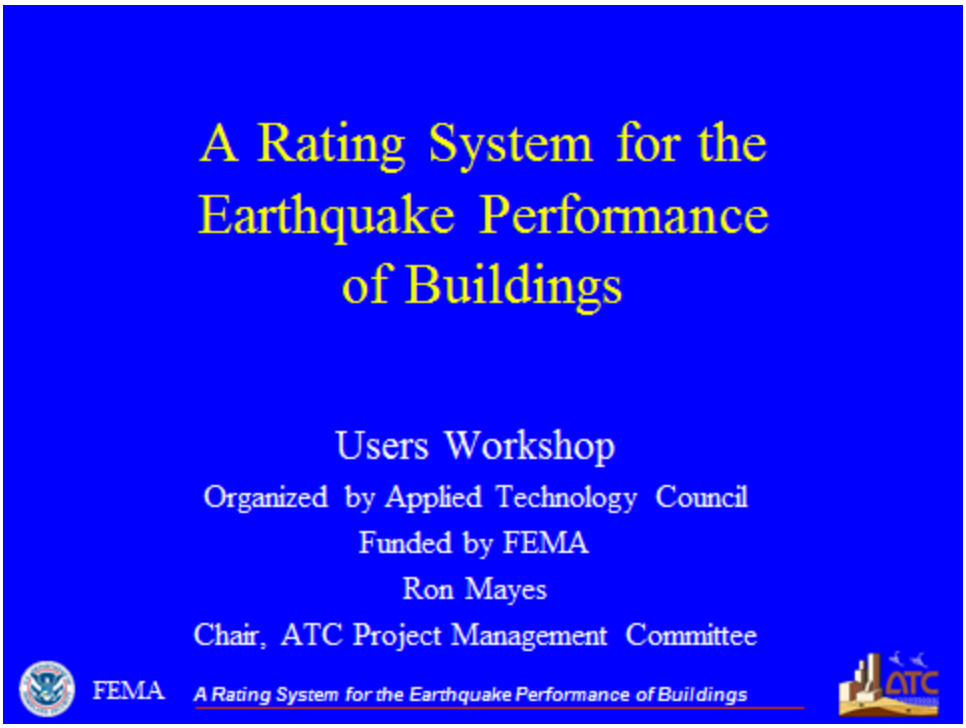
1.00 pm **Adjournment**

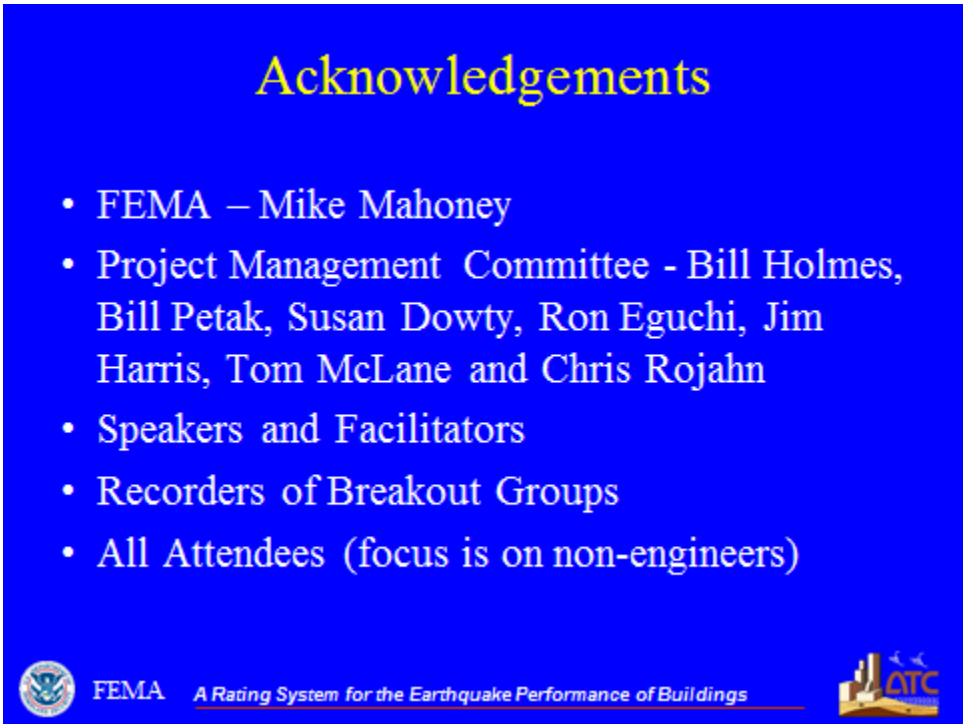
Chapter 3
Plenary Session

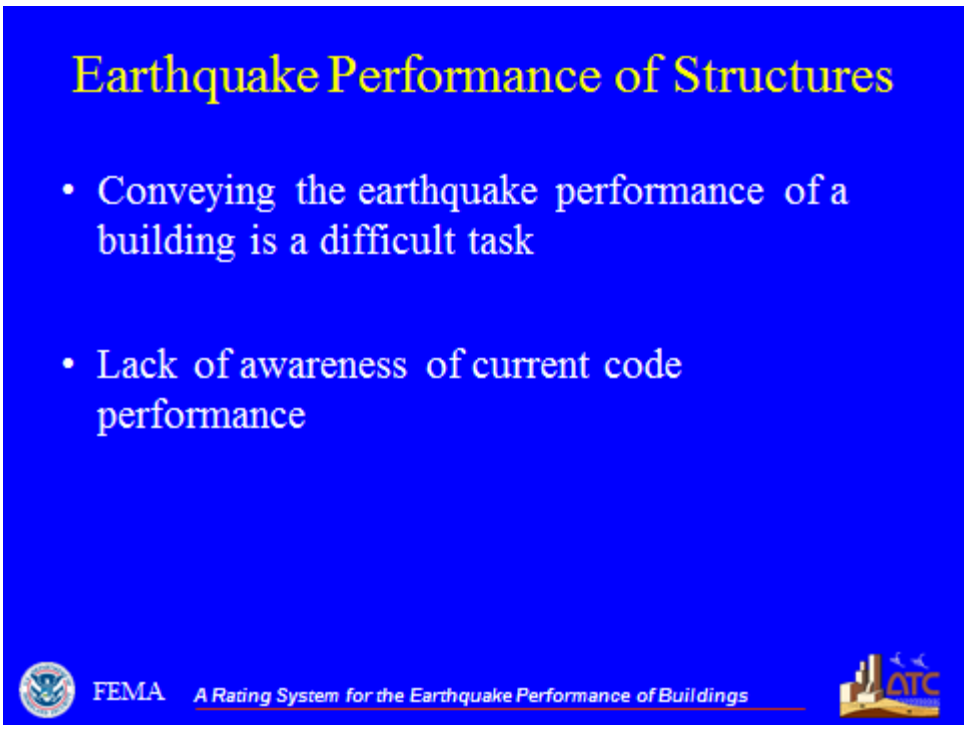
The opening session consisted of six presentations and the slides from each of these presentations are provided in each of the following subsections. The six presentations were as follows:

- Introductory comments on a rating system for the earthquake performance of buildings by Ron Mayes, Chair of ATC Project Management Committee.
- Communicating earthquake risk – SEAONC progress toward a rating system by David Bonowitz
- Buildings Owners and Managers Association (BOMA) system by Daniel Cronan, Sr. VP, Kidder Mathews
- LEED System by Brendan Owens, Vice President, LEED Technical Development
- Green Globe System by Sharene Rekow, VP Marketing and Sales, Green Building Initiative
- Probable Maximum Loss Methodology and ASTM E2026 by David McCormick, Senior Principal, SGH Inc.

3.1 Introductory Comments on a Rating System for the Earthquake Performance of Buildings by Ron Mayes, Chair of ATC Project Management Committee






Earthquake Performance of Structures
• Conveying the earthquake performance of a building is a difficult task
• Lack of awareness of current code performance
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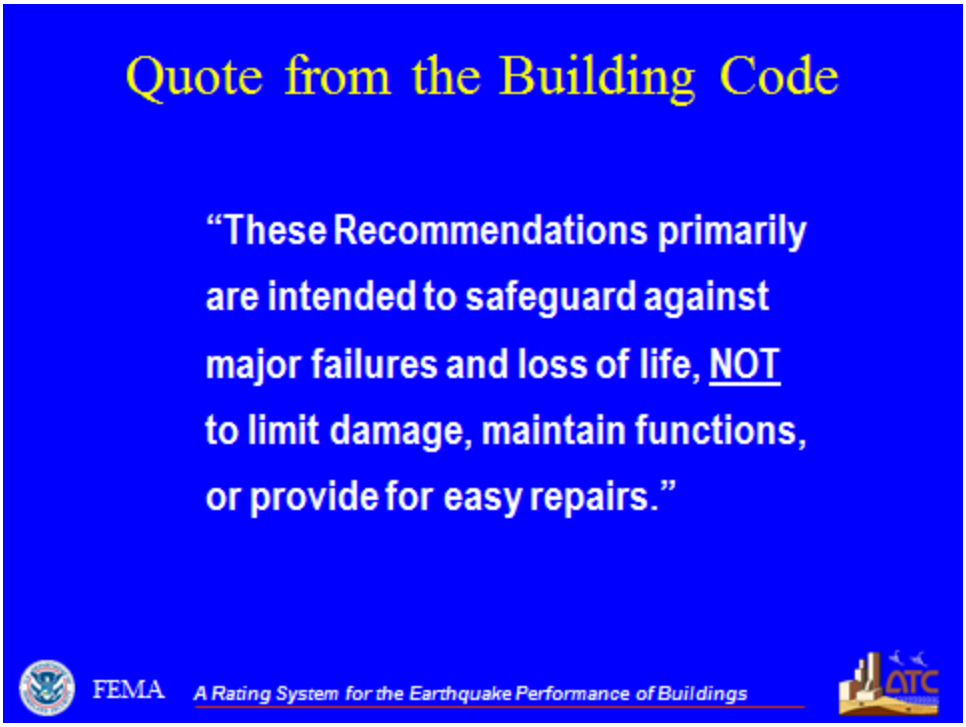
Quote from the Building Code
"These Recommendations primarily are intended to safeguard against major failures and loss of life, NOT to limit damage, maintain functions, or provide for easy repairs."
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Significant $$$ Damage in Recent Earthquakes

- Economic impact of the 1994 Northridge ($30B) and 1995 Kobe ($200B) earthquakes caused a rethinking of the code design philosophy by SE's.
- Much of the downtime and damage costs was a result of nonstructural damage
- Performance Based Design (Guidelines not yet code)
- Owner chooses desired performance rather than default to code performance

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The "Essence"

- A "Decision-maker" states a desire that a building be able to "perform"
  - Protect life safety
  - Minimize potential repair costs
  - Minimize disruption of use

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Some Typical User Expectations

"I want my existing building to be safe- "

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Some Typical User Expectations

"I want to be able to use my new building, right away - "

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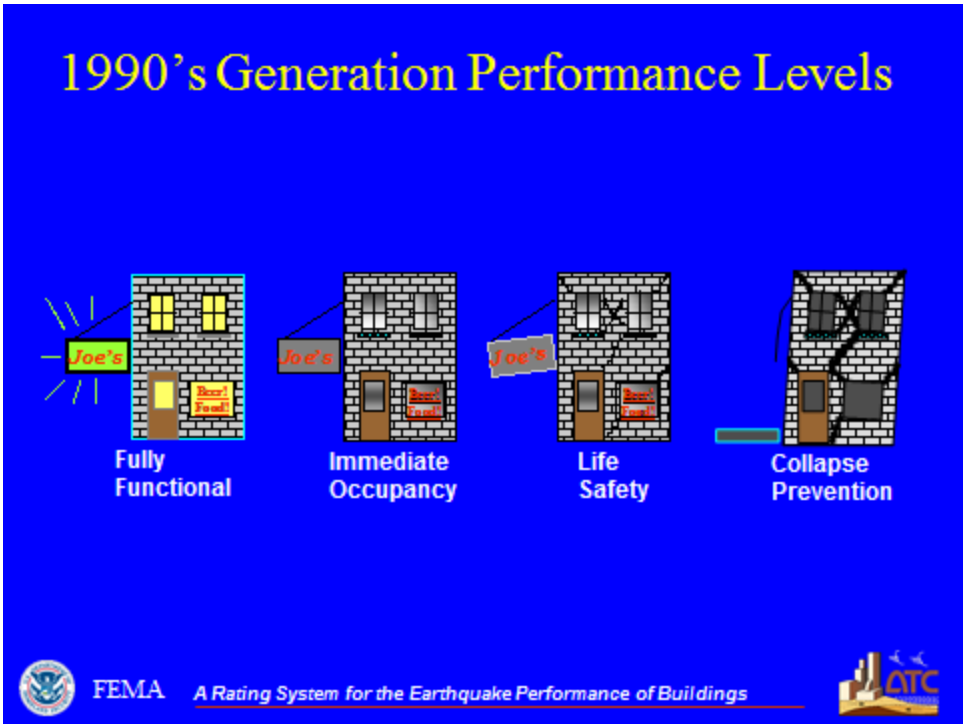
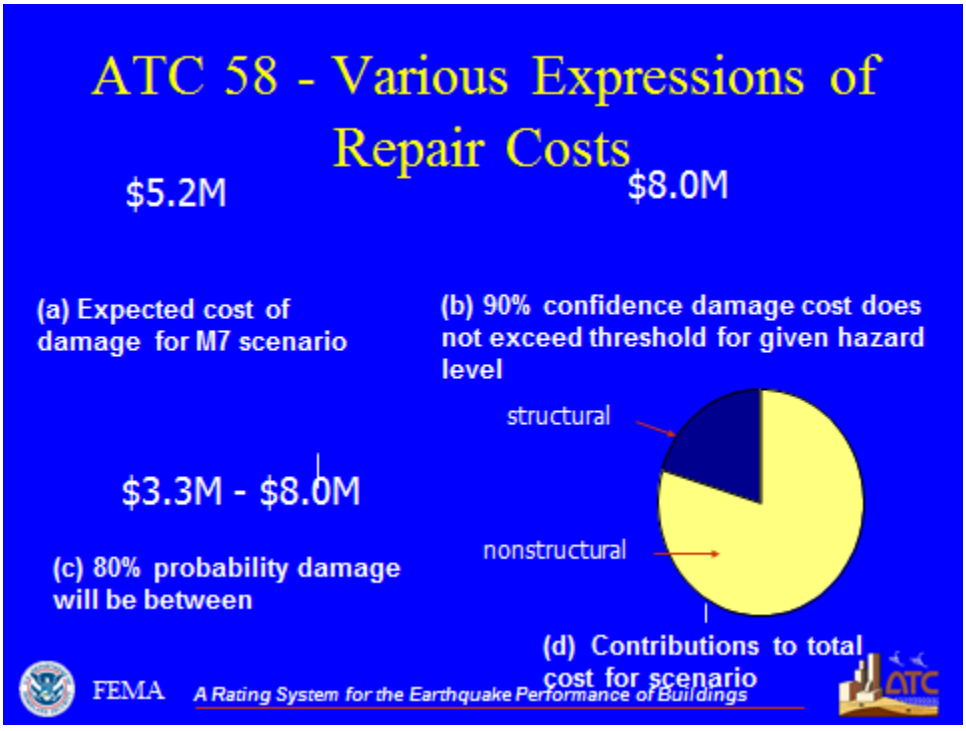

1990's Generation Performance Levels
Joe's
Fully Functional
Immediate Occupancy
Life Safety
Collapse Prevention
FEMA
A Rating System for the Earthquake Performance of Buildings


ATC 58 - Various Expressions of Repair Costs
$5.2M
$8.0M
(a) Expected cost of damage for M7 scenario
(b) 90% confidence damage cost does not exceed threshold for given hazard level
structural
nonstructural
$3.3M - $8.0M
(c) 80% probability damage will be between
(d) Contributions to total cost for scenario
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Objective of the Workshop

- Determine if there is any interest by potential users to develop a relatively simple system that rates the earthquake performance of buildings.

FEMA *A Rating System for the Earthquake Performance of Buildings*

Potential Users of the System

- The system should be usable by all occupants, buyers, sellers, and tenants/lesee's of a building.
- The users of the system therefore includes a broad cross section of the general population, many of whom know little about seismic risk.

FEMA *A Rating System for the Earthquake Performance of Buildings*

Historical Perspective

- The idea/concept of a rating system has been around for about 20 years but there has not been a consensus with SE's as to how to do it technically
- A SEAONC Committee has concluded that it is practical and feasible to develop a system using existing technical standards.

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Next Step

- FEMA decided the next step was to see if there was any interest from the user community
- Need feedback on a number of issues that will be part of breakout groups

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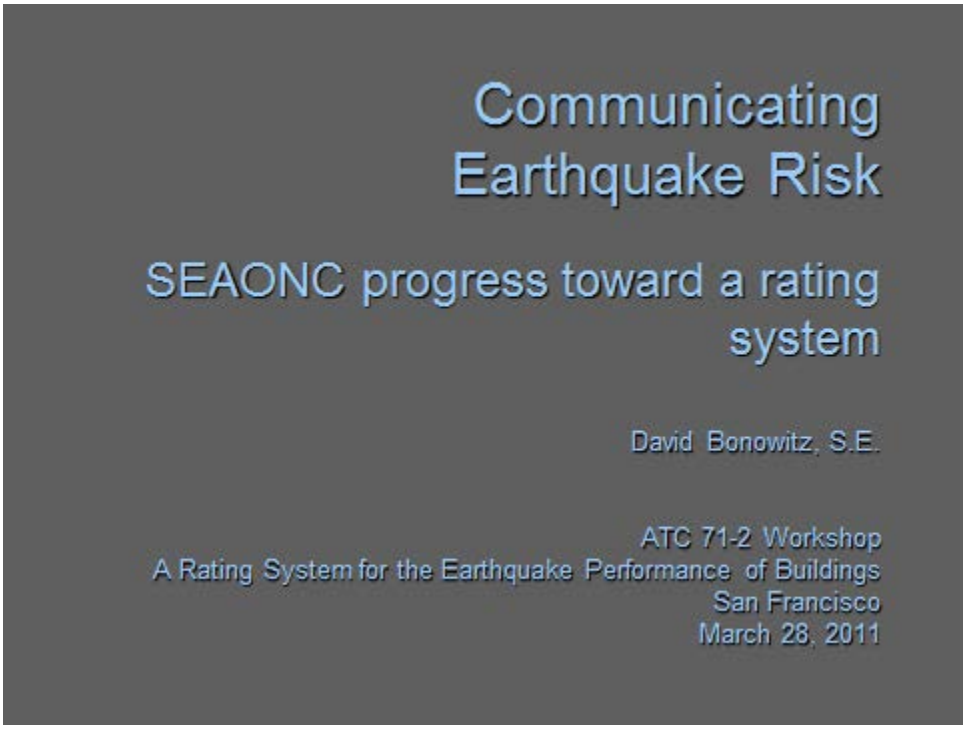
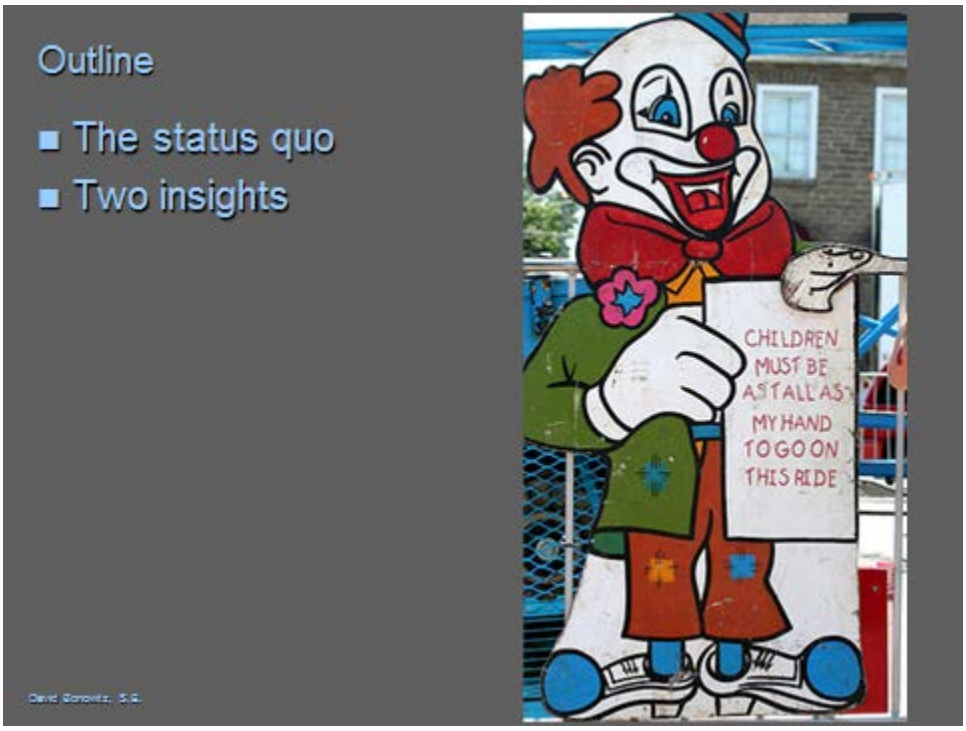
3.2 Communicating Earthquake Risk – SEAONC Progress Toward a Rating System by David Bonowitz, S.E.





A hypothetical

- 5 buildings, 5 reports
  - BOMA Class A
  - ASCE 31: Structural Life Safety
  - Permit record: Per 1991 UBC
  - PML: 19 or better
  - SSC Commercial Property Disclosure Checklist

David Bonowitz, S.E.

Do reports help you decide?

- Are people getting good information?

David Bonowitz, S.E.

Do reports help you decide?

- Are people getting good information?
- Do they understand it?

Drug Facts

Active ingredient (in each tablet) — **Purpose**
Chlorpheniramine maleate 4 mg — Antihistamine

Uses temporarily relieves these symptoms due to hay fever or other upper respiratory allergies: ■ sneezing ■ runny nose ■ itchy, watery eyes ■ itchy throat

Warnings
Ask a doctor before use if you have
■ glaucoma ■ a breathing problem such as emphysema or chronic bronchitis
■ trouble urinating due to an enlarged prostate gland
Ask a doctor or pharmacist before use if you are taking tranquilizers or sedatives
When using this product
■ you may get drowsy ■ avoid alcoholic drinks
■ alcohol, sedatives, and tranquilizers may increase drowsiness
■ be careful when driving a motor vehicle or operating machinery
■ excitability may occur, especially in children
If pregnant or breast-feeding, ask a health professional before use.
Keep out of reach of children. In case of overdose, get medical help or contact a Poison Control Center right away.

Directions

adults and children 12 years and over	take 1 tablet every 4 to 6 hours; not more than 6 tablets in 24 hours
children 6 years to under 12 years	take 1/2 tablet every 4 to 6 hours; not more than 3 tablets in 24 hours
children under 6 years	ask a doctor

Other information ■ store at 20-25°C (68-77°F) ■ protect from excessive moisture

Inactive ingredients D&C yellow no. 10, lactose, magnesium stearate, microcrystalline cellulose, pregelatinized starch

Nutrition Facts
Serving Size 1 large apple (242g / 8 oz.)

Amount Per Serving

Calories 130	Calories from Fat 0
	% Daily Value**
Total Fat 0g	**0%**
Saturated Fat 0g	**0%**
Trans Fat 0g	**0%**
Cholesterol 0mg	**0%**
Sodium 0mg	**0%**
Potassium 260mg	**7%**
Total Carbohydrate 34g	**11%**
Dietary Fiber 5g	**20%**
Sugars 25g	
Protein 1g	

Vitamin A 2% • Vitamin C 8%
Calcium 2% • Iron 2%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

David Banowitz, S.E.

Do reports help you decide?

- Are people getting good information?
- Do they understand it?
- What do they really need?

4.7 quake causes minor property damage in L.A. County

Employees of a Starbucks located at Hawthorne and Artesia Boulevards work to clean up broken glass that shattered on the floor and reportedly injured one person who was taken to a nearby hospital.

David Banowitz, S.E.

Insight #1

- We don't need a new technical standard

David Bonowitz, S.E.

Insight #2

- Ratings come through programs
- A given system might be great for one program and awful for another

David Bonowitz, S.E.

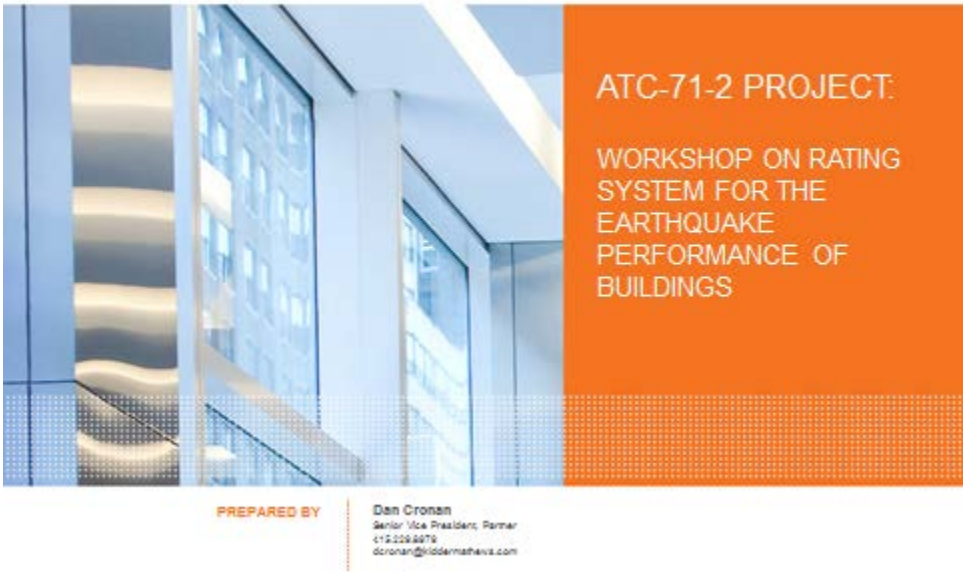
Rating programs

- Mandatory or voluntary?
- Rating produced by you or by others?
- Public or private?

- Then, design the system.

David Sarokin, S.E.

3.3 Building Owners and Managers Association (BOMA) System by Daniel Cronan, Senior Vice President, Kidder Mathews



What is BOMA?

BOMA (Building Owners and Managers Association)

It's an organization that, in part, has attempted to create a methodology/ standardization for measuring and ranking office buildings.

Does BOMA's Approach to Measuring Work?

- I believe that most Landlords would say that it's been very helpful in calculating the rentable square footage in their buildings, versus the actual usable square footage.
- Some tenants' perception of BOMA's approach to measuring is simply a way for landlord's to collectively increase their profitability, at the detriment of the tenant. Whether that is true or not, what they miss is that without a uniform approach, tenants would have to physically measure all of their alternatives in order to compare buildings.

Does BOMA's Approach to Ranking Buildings Work?

BOMA ranks buildings as either being an "A", "B", or "C". "A" buildings are the best, "C" buildings are the worst.

BOMA's definition of the three building categories:

Class A
Most prestigious buildings competing for premier office users with rents above average for the area. Buildings have high quality standard finishes, state of the art systems, exceptional accessibility and a definite market presence.

Class B
Buildings competing for a wide range of users with rents in the average range for the area. Building finishes are fair to good for the area. Building finishes are fair to good for the area and systems are adequate, but the building does not compete with Class A at the same price.

Class C
Buildings competing for tenants requiring functional space at rents below the average for the area.

.

Is BOMA's ranking scientific?

NO. It is, in fact, very subjective. To quote BOMA's website:

"These classes represent a subjective quality rating of buildings which indicates the competitive ability of each building to attract similar types of tenants. A combination of factors including rent, building finishes, system standards and efficiency, building amenities, location/accessibility and market perception are used as relative measures."

BOMA's definition of the three building categories:

Examples of "A" Buildings:

4 Embarcadero

101 California

One California

One Bush

BOMA's definition of the three building categories:

Examples of "B" Buildings:

351 California

116 New Montgomery

369 Pine

612 Howard

BOMA's definition of the three building categories:

Examples of "C" Buildings:

121 2nd Street

1136 Howard

111 New Montgomery

88 1st Street

Does BOMA's rating system incorporate a review process?

NO! If you own an older downtown highrise, in a good location, with a security guard, but no HVAC, you are probably going to market the building as a class-A highrise.

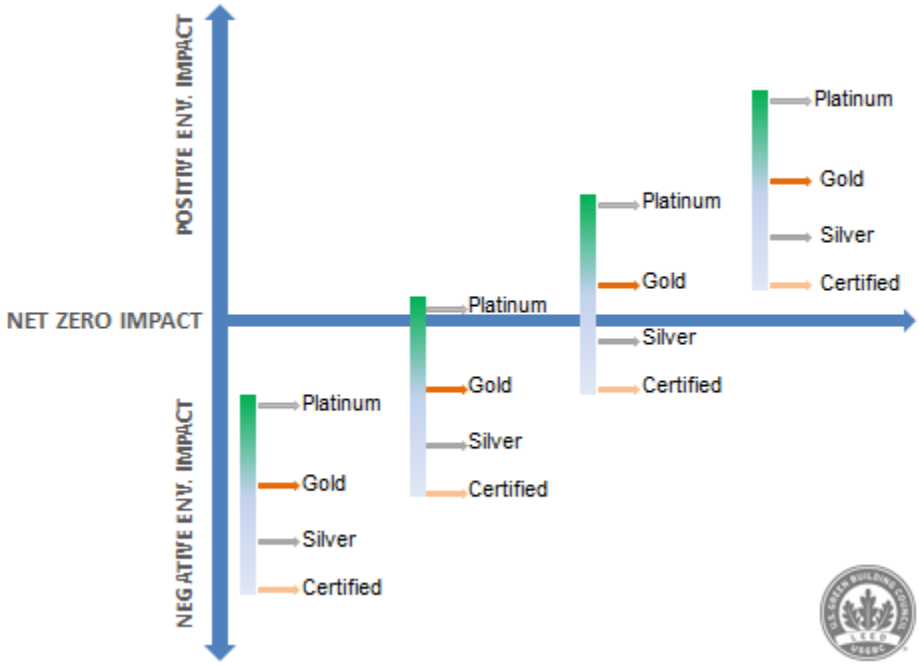
Would it be beneficial to have an earthquake rating system incorporated into BOMA's building rating system – something beyond the PML (Probable Maximum Loss) approach?

ABSOLUTELY! Will it happen? I suspect not; because, there are too many BOMA, dues paying landlords who own buildings with structural deficiencies.

Would an earthquake rating system be beneficial?

ABSOLUTELY! As a pure tenant office leasing broker, I would find such a matrix invaluable in formulating my recommendation to a client as to which buildings to pursue for negotiations. If my tenant is more risk tolerant, and willing to pursue a building, or buildings, that are not to the highest earthquake standards, I could use the rating system information to my client's advantage, by justifying to the landlord why he/she should provide more economic incentives in their proposed deal, to offset the risk that my client would be taking by occupying their building, compared to their safer alternatives.

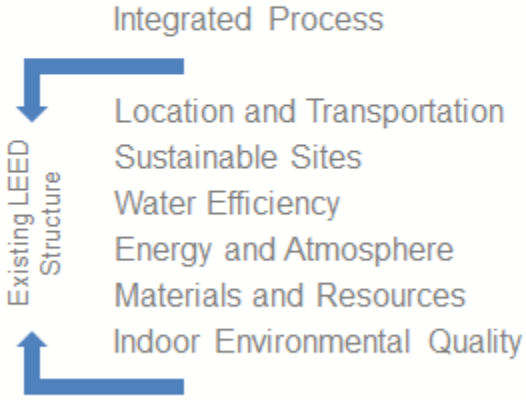
3.4 Leadership in Energy and Environmental Design (LEED) System by Brendan Owens, Vice President, LEED Technical Development



2012 Impact Categories

- **Reverse Contribution to Global Climate Change**
- **Enhance Individual Human Health, Wellbeing and Vitality**
- **Protect and Restore Water Resources**
- **Protect, Restore and Enhance Biodiversity and Ecosystem Services**
- **Conserve and Renew Natural Resources**
- **Promote Transformative Processes and Innovation/Green Economy**
- **Enhance Social Equity, Environmental Justice, Community Health and Quality of Life**

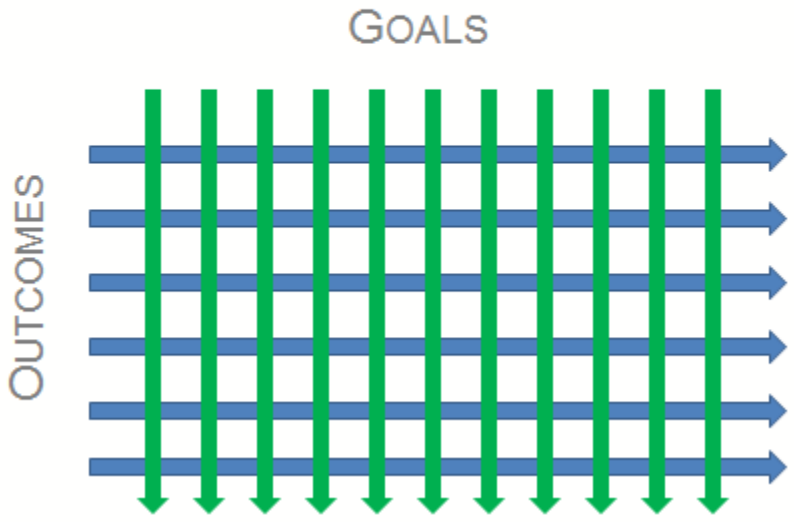
LEED Credit Categories



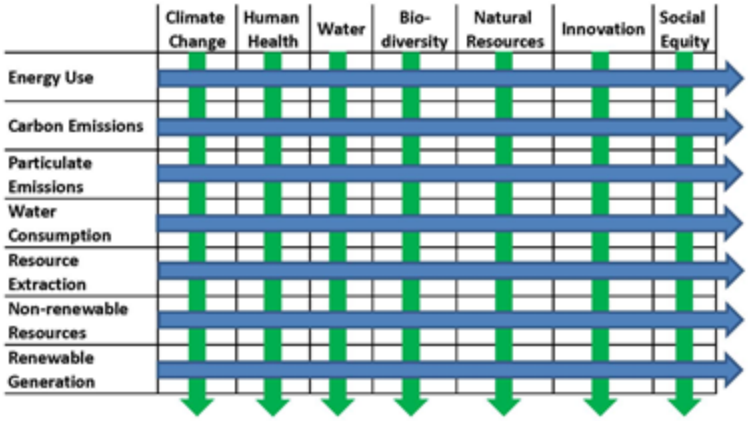
Energy and Atmosphere

- Optimize Energy Performance – EAc1
  - Reduce energy consumption
  - Reduce carbon emisisons
  - Reduce particulate emissions from power plants
  - Reduce water use in thermoelectric power plants
  - Decrease impacts from resource extraction
  - Reduce Consumption of non-renewable resources
  - Increase use of renewable generation technologies

Goals and Outcomes



Combining Goals and Outcomes



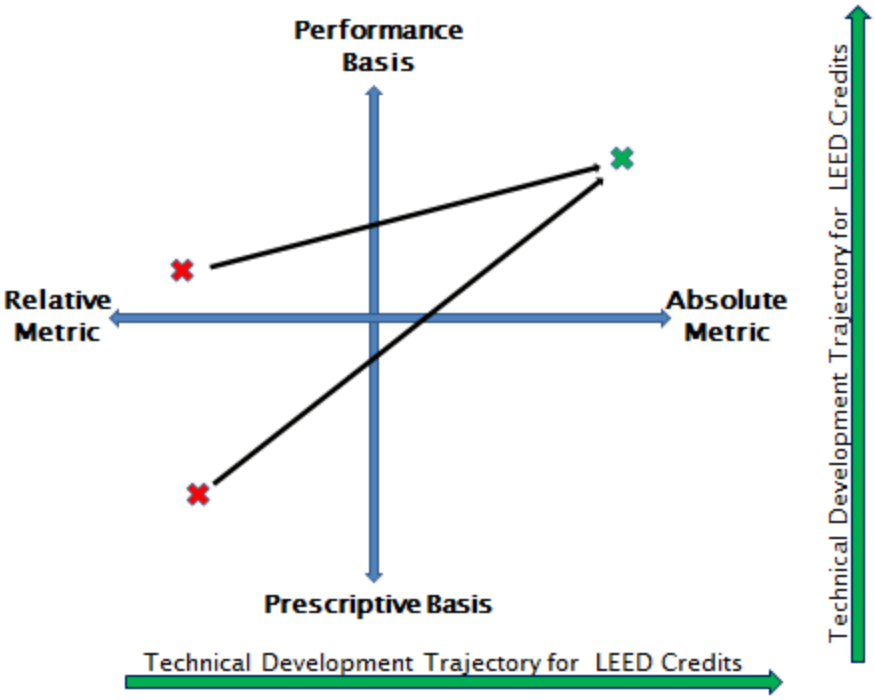
Combining Goals and Outcomes

Impact Weight	15%	25%	50%	10%	100%
	Impact 1	Impact 2	Impact 3	Impact 4	
Credit 1	65	0	0	0	
Credit 2	10	50	20	45	
Credit 3	10	15	75	35	
Credit 4	15	35	5	20	
	100	100	100	100	

Calculation of Credit Point Value

15%	25%	50%	10%	
9.75	0	0	0	9.75
1.5	12.5	10	4.5	28.5
1.5	3.75	37.5	3.5	46.25
2.25	8.75	2.5	2	15.5
				100

	Credit Point Value
Credit 1	10
Credit 2	29
Credit 3	46
Credit 5	16
Total Points	100



175,000 building professionals across all areas of practice have become LEED credentialed professionals.

GREEN BUILDING CERTIFICATION INSTITUTE

LEED GREEN ASSOCIATE

LEED AP ID+C

LEED AP HOMES

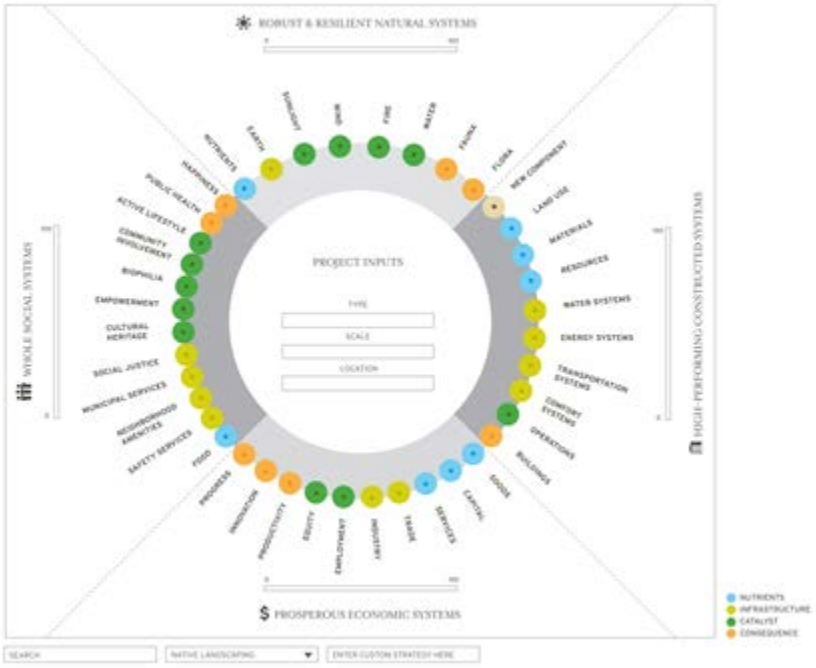
LEED AP O+M

LEED AP ND

LEED AP BD+C

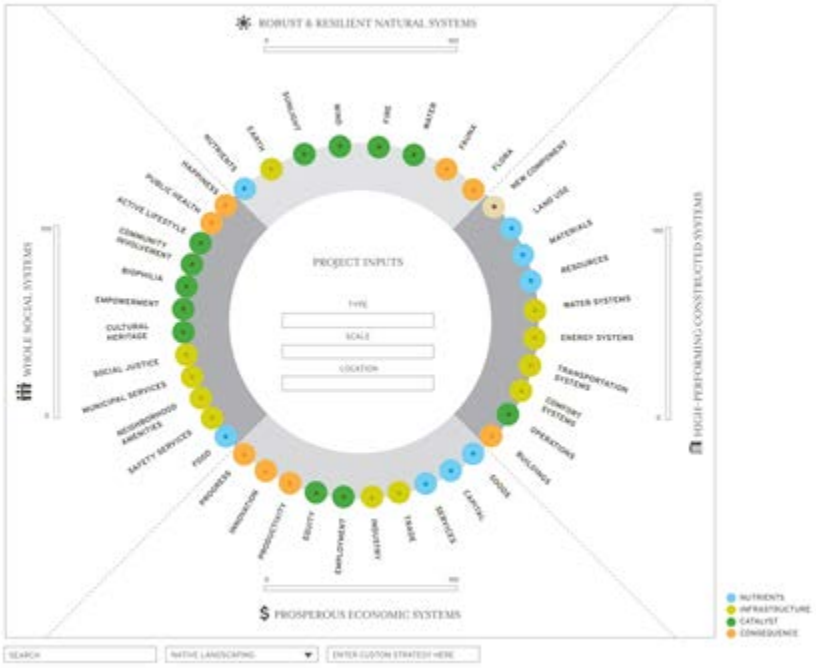
LEED Project Stats (February 2011)

Rating System	Registered	Certified
LEED Commercial	31,000	8,200
LEED Homes	15,000	7,500
Total (project count)	46,000	15,700
Total (project SF)	7 billion	1.5 billion




ROBUST & RESILIENT NATURAL SYSTEMS
PROJECT INPUTS
TYPE
SCALE
LOCATION
WHOLE SOCIAL SYSTEMS
HIGH-PERFORMING CONSTRUCTED SYSTEMS
PROSPEROUS ECONOMIC SYSTEMS
NUTRIENTS
INFRASTRUCTURE
CATALYST
CONSEQUENCE


USGBC


ROBUST & RESILIENT NATURAL SYSTEMS
SUNLIGHT
WIND
FIRE
WATER
FAUNA
FLORA
NEW COMPONENT
LAND USE
MATERIALS
RESOURCES
WATER SYSTEMS
ENERGY SYSTEMS
TRANSPORTATION SYSTEMS
COMFORT SYSTEMS
OPERATIONS
BUILDINGS
GOODS
CAPITAL
SERVICES
TRADE
INDUSTRY
EMPLOYMENT
EQUITY
PRODUCTIVITY
INNOVATION
PROGRESS
FOOD
SAFETY SERVICES
NEIGHBORHOOD AMENITIES
MUNICIPAL SERVICES
SOCIAL JUSTICE
CULTURAL HERITAGE
EMPOWERMENT
BIOPHILIA
COMMUNITY INVOLVEMENT
ACTIVE LIFESTYLE
PUBLIC HEALTH
HAPPINESS
NUTRIENTS
EARTH
PROJECT INPUTS
TYPE
SCALE
LOCATION
WHOLE SOCIAL SYSTEMS
HIGH-PERFORMING CONSTRUCTED SYSTEMS
PROSPEROUS ECONOMIC SYSTEMS
NUTRIENTS
INFRASTRUCTURE
CATALYST
CONSEQUENCE
SEARCH
NATIVE LANDSCAPING
ENTER CUSTOM STRATEGY HERE

3.5 Green Globe System by Sharene Rekow, Vice President of Marketing and Sales, Green Building Initiative

GREEN GLOBES
A better way to build.

Earthquake Rating System for Buildings

Sharene Rekow, GBI VP Marketing/Sales

March 28, 2011

The Green Building Initiative (GBI)

- A 501(c)(3) non-profit organization dedicated to advancing green design and operation by offering practical and affordable approaches to green building assessment and certification
- Exclusive provider of Green Globes in the US
- Seed-funded by green building stakeholders who believe in the benefits of competition among rating systems

GREEN BUILDING INITIATIVE

GBI's values

- Green certification itself is NOT the goal – it's not about the plaque
- Green building certification must be practical and affordable if we expect people to do it.

GREEN BUILDING INITIATIVE

Green Globes Strengths

- Online tool
- Uses LCA for material impacts
- Benchmarks against Energy Star
- Requires third party site visits for certification
- Cost effective and scalable
- First -American National Standards Institute (ANSI) – recognized green rating and assessment tool in the US

GREEN GLOBES™

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GREEN BUILDING INITIATIVE

Green Globes: Tools

Green Globes for New Construction

Guides the integrated design process at each stage of project through delivery.

Green Globes for Continual Improvement of Existing Buildings

Establishes the baseline, gives a current performance report, guides improvement.

GREEN BUILDING INITIATIVE

Green Globes Personnel Certification

GREEN GLOBES PROFESSIONAL

Green Globes Professional (GGP)

- Qualified to assist in filling out the GG questionnaire and getting the building ready for certification

GREEN GLOBES

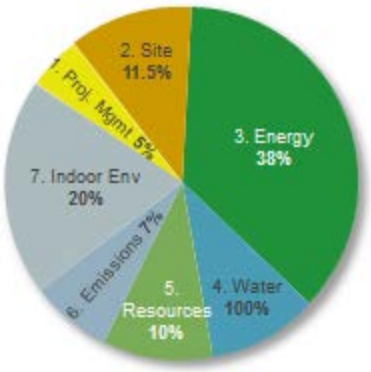
Green Globes Assessor (GGA)

- Qualified to act as an independent third part for the GBI and to audit registered projects and assign the appropriate number of GG

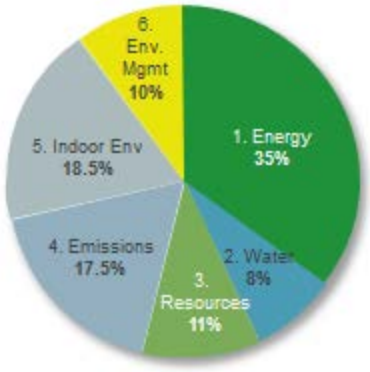
GREEN BUILDING INITIATIVE

Green Globes System: Points

New Construction
1000 points



CIEB
1000 points



GREEN BUILDING INITIATIVE

Green Globes® Environmental Assessment Areas

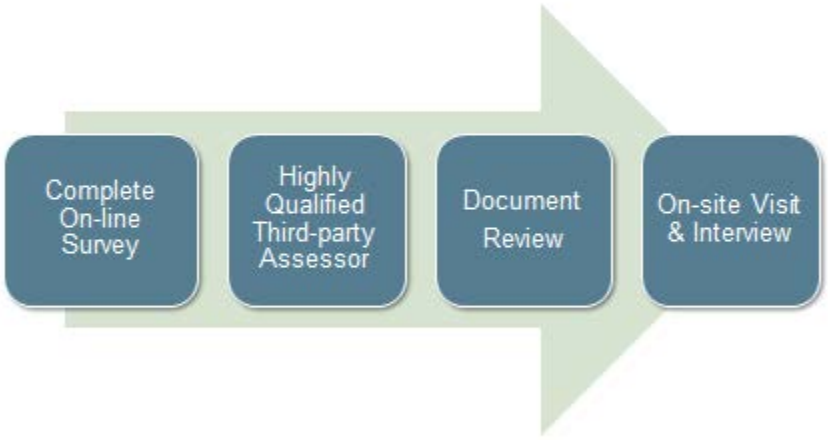
50	1	Management
11.5	2	Site
36	3	Energy
30	4	Water
10	5	Resources
17.5	6	Emissions
28.5	7	Indoor Environment

New Construction = 1000 points Existing Building = 1000 points

GREEN BUILDING INITIATIVE

Green Globes Report

Third-Party Assessment



Scoring

85-100%

70-84%

55-69%

35-54%

Green Globes Assessment and Rating System for New Construction Projects

GREEN BUILDING INITIATIVE

Why Certify?

- Assessors report
- Publicity
- Satisfying the political agenda

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GREEN BUILDING INITIATIVE

3.6 Probable Maximum Loss Methodology and ASTM E2026 by David McCormick, Senior Principal, SGH Inc.

History

- **1970s - Steinbrugge developed the concept of PML**
  - Used in insurance industry to set rates.
    - Function of seismic zone and building class.
  - *1982 - Earthquake Volcanoes and Tsunamis, An Anatomy of Hazards.*
    - Modify building type PMLs based on characteristics.
  - PML = Probable Maximum Loss – *loss that will not be exceeded by 9 out of 10 similar buildings in the event of a 475-year earthquake.*
    - Expressed as percent of replacement value.
    - Typical range 0 – 100%.

SIMPSON GUMPERTZ & HEGER

History

- **1985 - ATC-13, *Earthquake Damage Evaluation Data for California***
  - Loss data based on expert judgment plus limited experience data from past earthquakes.
  - Basis of portfolio and PML studies.
- **More push for due diligence by lenders.**
  - 1989 - Loma Prieta EQ.
  - 1994 - Northridge EQ.
- **20% evolved as the de facto threshold.**
  - PML > 20% requires either:
    - Seismic retrofit.
    - Earthquake insurance.

SIMPSON GUMPERTZ & HEGER

History

- **1990s - Slowly the PML definition blurred.**
- **Some new Providers (engineers) started providing mean loss (SEL) in 475-year earthquake in their reports.**
  - Lower values, began to capture the market.
- **Some Users found they could not compete for the purchase of higher risk properties if they stayed with traditional PML definition.**
  - Pushed for redefinition.
- **New Providers started performing lesser scope at lower fees.**
- **Today – mean loss in the 475-year is the standard, but….**

CONFUSION!

SIMPSON GUMPERTZ & HEGER

History

- **Late 1990s - Dissatisfaction by Users and Providers**
  - ASTM E2026-99 - Standard Guide for the Estimation of Building Damageability in Earthquakes.
  - Goal: Standardize seismic risk assessments.
- **Mid 2000s – Continued dissatisfaction**
  - Update ASTM E2026-07 Standard Guide for Seismic Risk Assessment of Buildings – toolbox.
  - ASTM E2557-07 - Standard Practice for Probable Maximum Loss (PML) Evaluations for Earthquake Due Diligence Assessments.

Types of Investigations
- Building Stability (Y/N)
- Site Stability (Y/N)
- Building Damageability (%)
- Contents Damageability (%)
- Business Interruption (duration)

Levels of Investigations
- Level 0 – table top
- Level 1 – typical* → Site visit, Drawing review, <Calculations>, Report
- Level 2
- Level 3 – very detailed, rarely done

SIMPSON GUMPERTZ & HEGER

1. What Need Does the PML Process Fill?

1. **Used by insurance industry to help calculate premiums and exposures (risk modelers).**
2. **One component of data in securitization process in real estate transactions.**
3. **Provides information to owners and occupants who really want to understand risk to organization, investment, portfolio, and personnel.**

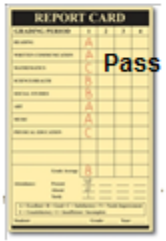
SIMPSON GUMPERTZ & HEGER
Engineering of Structures and Building Enclosures

2. What are the Limitations of the PML Process?

- **No standardized procedure.**
  - Black box – proprietary software.
  - No accessible data base of losses in past EQs to use for developing estimates.

Thiel-Zsutty
ST-Risk
ATC-13

- **There is no official qualification process for Providers.**
- **20% loss threshold is arbitrary – pass/fail.**
  - Encourages dishonest behavior.
  - Triggers insurance or retrofit.
  - Option: Variable insurance requirement?



2. What are the Limitations of the PML Process?

- **A large portion of the Users see it as a hurdle for which they are willing only to pay a minimum (commodity) price.**
  - Shop for cheapest engineer (e.g. $500).

- **No potential rewards for detailed study.**

- **Not used rationally for securitization.**
  - Return periods for earthquake are too long.
  - Individual building with high PML has little effect on portfolio PML for a geographically well-distributed portfolio.
  - Risk of default for other reasons more substantial.

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2. What are the Limitations of the PML Process?

- **Terminology is confusing.**
  - PML, SEL, SUL, PL, User-defined
  - Building codes : MCE, DBE (475-year), DE etc.
- **Many different Users.**
  - Want portability, 7 or 8 loss levels required.
- **ASTM process is not working well for PMLs.**
  - Self interests of Users and Providers.
  - PMLs - many Users don't specify ASTM.
  - ASTM process works for construction industry.
    - Building officials and testing agencies.

- **No enforcement of clear violations.**
  - ASTM or Boards of Registration.

SIMPSON GUMPERTZ & HEGER

3A. What Works in the PML Process?

- **An honest effort by User and a qualified Provider can produce useful information about expected losses and safety in a major earthquake.**
  - Although precise loss numbers are difficult to obtain, process is valuable in providing relative risks of different buildings.
- **Process provides incentive to retrofit the high risk buildings.**

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3B. What Lessons Can We Learn?

- **Need a consensus-based analytical methodology that yields consistent and reproducible results.**
- **Need quality assurance/control process.**
  - Enforcement agency or review board for Providers.
  - The current ASTM requirement for a qualifications statement is often ignored.
  - Require engineers to stamp reports.

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3B. What Lessons Can We Learn?

- **Documents detailing the process need to be concise and straightforward.**
  - A template for reports might be helpful.
    - MBA document.
- **Need a Practice, not a Guideline.**
  - Guide E2026 Guide not as effective as Practice E2557.

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4. Does it Include a Review Process?

- **There is no review process.**
- **Requires sufficient information so peer review is possible.**
  - Not followed by most Providers.
  - Proprietary software or databases.
- **Typically not practical for economic and schedule reasons.**
  - Exception is large buildings.

SIMPSON GUMPERTZ & HEGER

5. Desirability of an Earthquake Rating System

- **There are already many "earthquake rating systems".**
  - PML, ASCE-31, FEMA-154
- **Desirable features of a rating system:**
  - It communicates to Providers what they need to know in simple terminology.
  - It is tied to a standard methodology with enforcement that prevents gaming.
  - It is flexible enough to satisfy different User needs and recognize that they have different uncertainty tolerance levels.

Chapter 4
Characteristics of a Rating System

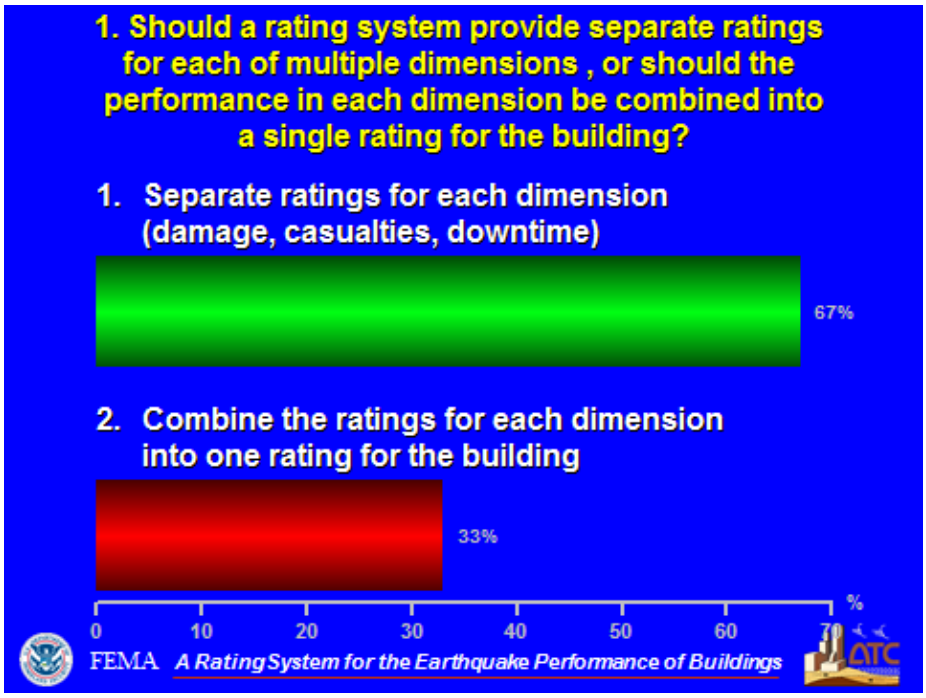
The breakout sessions were followed by balloting on a number of topics that would guide future development of a rating system. In addition, the recorders of each breakout group took notes in an attempt to capture key points that were made during the breakout sessions. The results of the ballot questions are presented and are followed by a bullet list of relevant comments from the discussion groups. Each of the key items that were balloted are summarized in the following sub-sections

4.1 Dimensions

One of the key issues for any earthquake rating system are the dimensions on which it is based. The dimensions may include items such as safety, damage costs and downtime to re-occupy and/or downtime to become operable. If multiple dimensions are included in the rating system then the issue of whether they should they be combined into one final rating needs to be addressed. The questions posed in the discussion groups were:

- Single rating for buildings versus separate ratings for safety, capital loss and business down time
- Will stakeholders find value in risks broken into multiple dimensions?
- How will one dimension be valued against another?
- Will stakeholders use multidimensional data to target remedial measures?

The ballot question and the summary from the breakout groups follow:



4.1.1 Key Issues from Group Discussion

- Rating system will need all three dimensions (life safety, repair cost, and downtime.
- Life Safety is most important because people's safety is more important than financial considerations -"Employees are our greatest asset."
- The rating system should have one up front dimension, but it would be useful to provide more details in the backup information showing how the single rating came about.

Besides life safety, downtime and repair cost the following dimensions should be considered:

- Damage to contents vs damage to structure
- Estimating downtime is problematic, but owners may depend on rated value.
- There should be separate ratings because people have different foci.
- There should be separate rating systems for single family residences and engineered buildings.
- The three dimensions are inherently related, e.g., if you increase safety, you also improve capital loss and business interruption.

- Knowledge of the 3 dimensions is not uniform so it should NOT be a single rating
- If downtime is rated, there may be a potential disconnect between expectation and reality.

4.1.2 PMC Summary

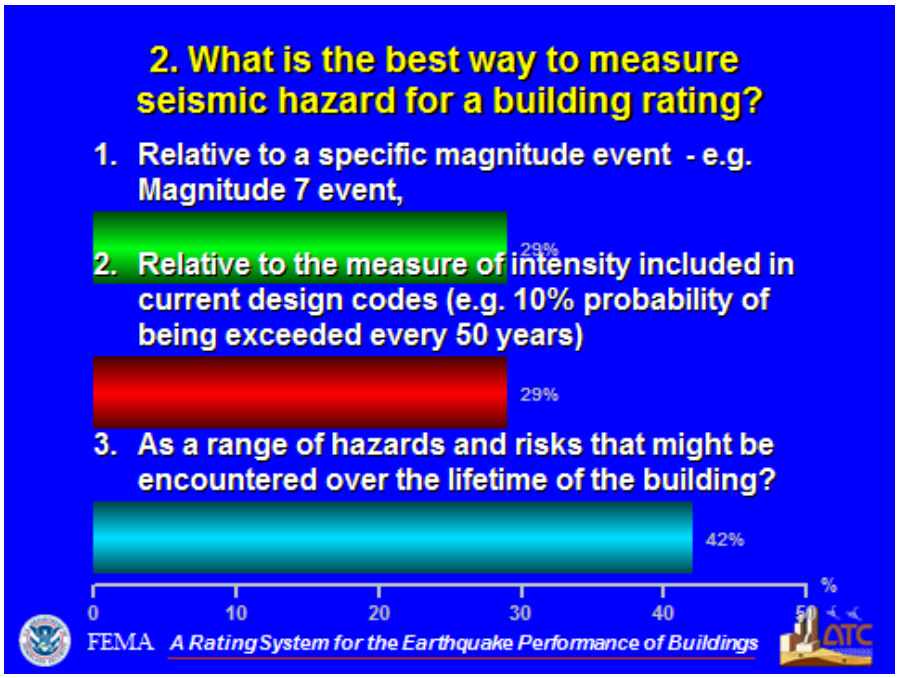
It appears that there is a consensus to incorporate safety, damage/repair costs and downtime (either or both time to re-occupy and time for operability) as key dimensions of a rating system. There was a discrepancy between the feedback from the discussion groups and the ballot item. The consensus of the discussion in the breakout groups was that the rating system should include multiple dimensions and that these should be combined into a final single rating for presentation to the community. The individual key dimensions used to generate the final single rating should be available to anyone requesting such information as it would be an integral part of the rating.

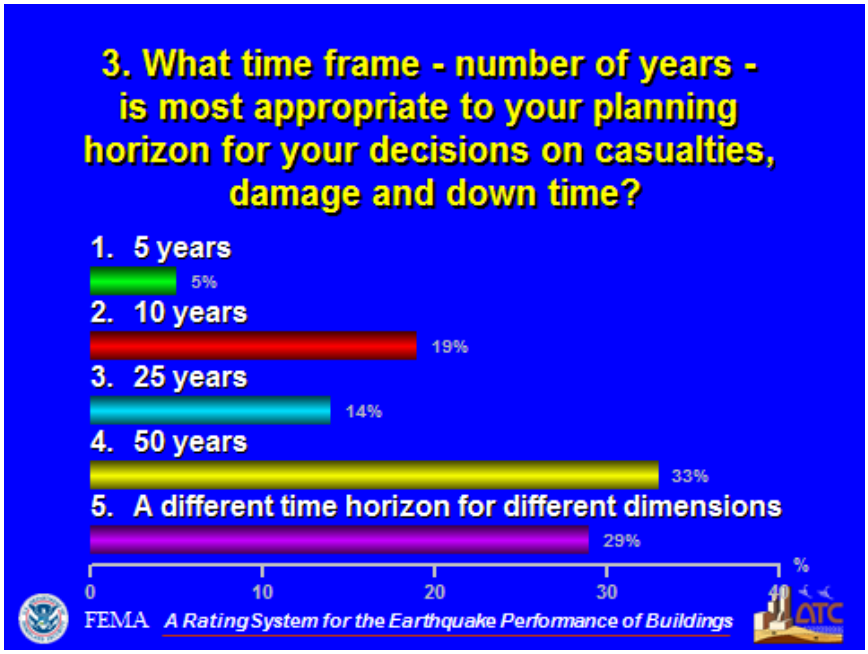
4.2 Hazard Level

The hazard level is another key component of a rating system, and probably needs to be different for the different dimensions of the rating system. Building codes have recently moved to a 1% risk of collapse in a 50 year period as their basis and the fundamental concern there is safety. Other standards make use of 10% and 50% chances of being exceeded in a 50 year period for various purposes. The expected life span of a commercial building maybe in the 50 to 100 year time frame whereas government owned buildings may have an expected life span considerably in excess of 100 years. The questions posed in the discussion groups were:

- Deterministic hazard: “What will happen to my building in a repeat of the 1906 San Francisco Earthquake?”
- Code based probabilistic hazard: “How will my building perform under ground shaking that has a recurrence interval of 475 years?”
- Financial based probabilistic hazard: “Over the next thirty years, what are the annualized and confidence bounded risks to my building?”

The ballot questions and the summary from the breakout groups follows:





4.2.1 Key Issues from Group Discussion

- A standard hazard level should be utilized. However, there could be room for different hazard levels for special situations.
- Most logical hazard level is the code mapped level of shaking.
- Need to describe the hazard in terms that a layperson can understand.

4.2.2 PMC Summary

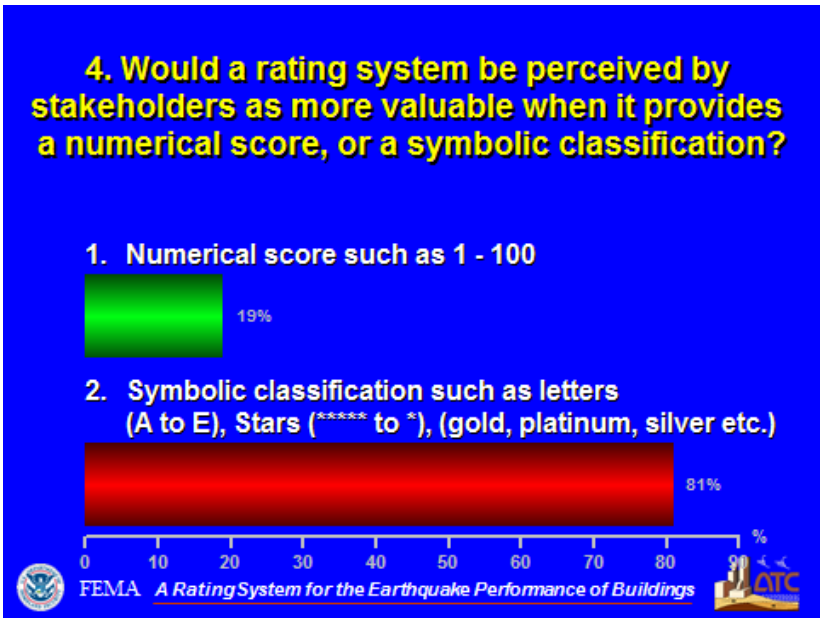
This was probably a difficult question for the attendees to comprehend as it involves a number of interrelated probabilistic issues. The balloting results reflect that difficulty with no clear winner. The consensus from the group discussions was that whatever hazard level the design codes use for new design then that level should probably be the basis for the rating system as a minimum for the safety dimension. Other return periods less than the code level maybe more appropriate for downtime and damage dimensions.

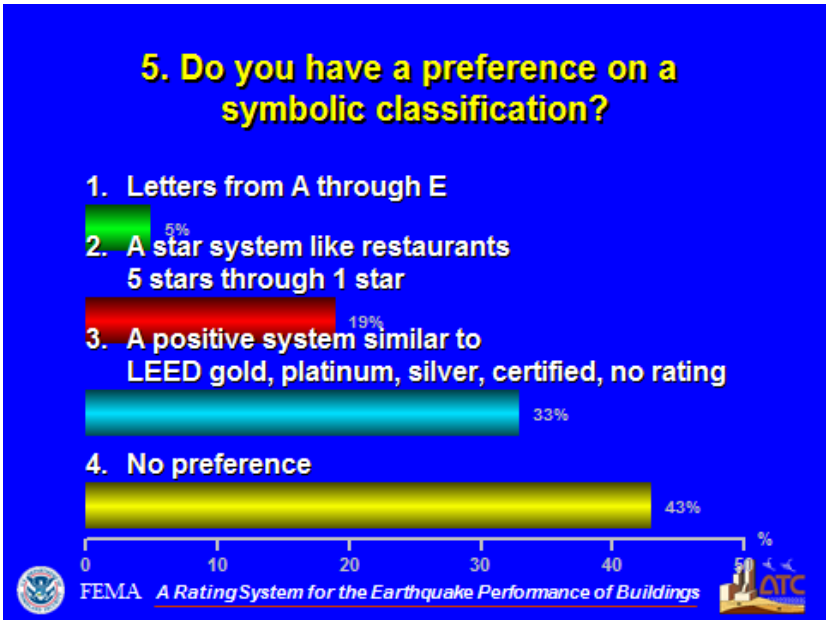
4.3 Rating Symbols

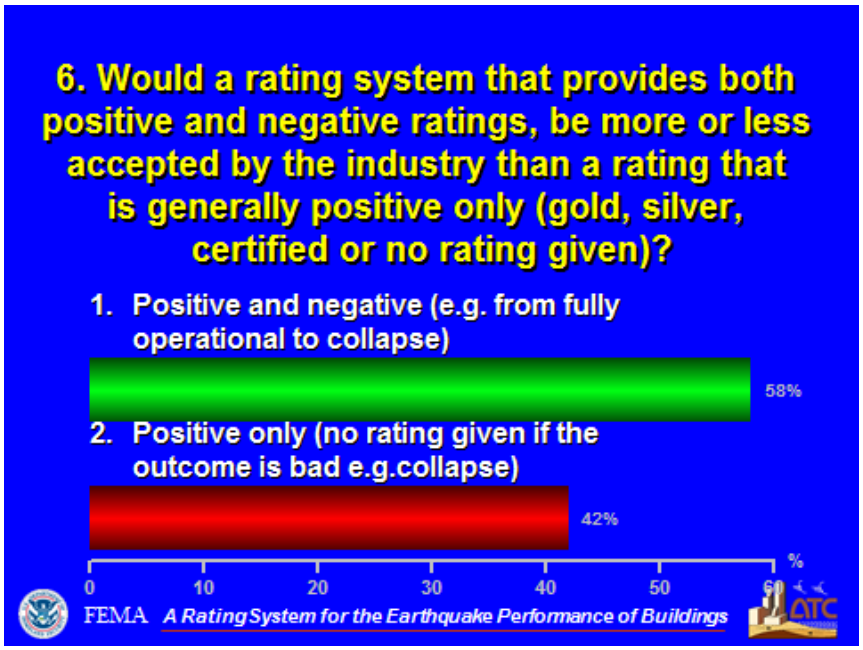
There are many different systems that have been utilized for existing rating systems such as movies, restaurants, hotels, hazardous chemicals, bonds, etc. The key is that they are simple and convey the basis of the more detailed dimensions on which they are based. The questions posed in the discussion groups were:

- Symbolic rating
  - Grade: A-F
  - Stars or other symbols
  - Terms: Platinum, Gold, Silver, Bronze, Lead
- Point scale rating: 1-10, 1-100. How refined a rating is realistic (i.e., 72 vs 78)
- Only positive ratings or positive and negative ratings

The ballot questions and the summary from the breakout groups follow:


4. Would a rating system be perceived by stakeholders as more valuable when it provides a numerical score, or a symbolic classification?
1. Numerical score such as 1 - 100
19%
2. Symbolic classification such as letters (A to E), Stars (***** to *), (gold, platinum, silver etc.)
81%
%
0 10 20 30 40 50 60 70 80 90
FEMA
A Rating System for the Earthquake Performance of Buildings
ATC


5. Do you have a preference on a symbolic classification?
1. Letters from A through E
5%
2. A star system like restaurants 5 stars through 1 star
19%
3. A positive system similar to LEED gold, platinum, silver, certified, no rating
33%
4. No preference
43%
%
0 10 20 30 40 50
FEMA
A Rating System for the Earthquake Performance of Buildings
ATC



4.3.1 Key Issues from Group Discussion

- Generally metallic or stars are preferable to A, B, C (unless system is mandatory)
- Point scale is too complicated.
- Keep it simple. If it's overly burdensome, it won't get buy-in.
- Too fine of a gradation may lead to a misperception of accuracy but if not finely gradated, the raters may be more conservative resulting in lower ratings.
- A more detailed rating (e.g., matrix combo of letters/numbers) can be the backup for the simple rating presented.
- Sociologists/marketing experts should develop the rating symbols, not engineers! There are ways to communicate using symbols (without words/numbers).

4.3.2 PMC Summary

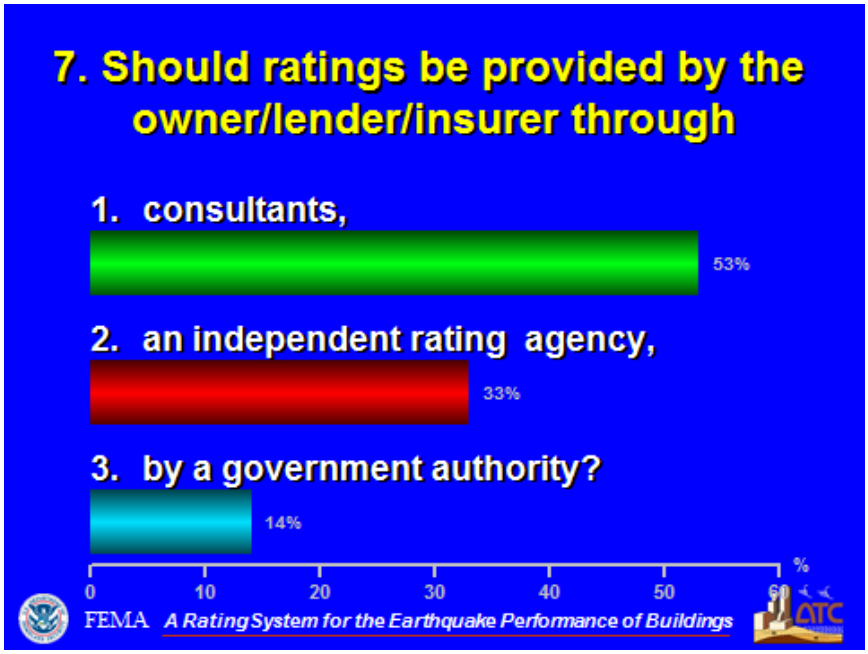
There appeared to be a preference toward either a star rating system as used in hotels and restaurants or a metallic-based system that is used by LEED system (platinum, gold, silver, etc.) as well as a majority ambivalent as to the specific rating terminology. As to whether the system should include negative ratings, the attendees were split assuming that a building without a rating is negative.

4.4 Qualifications and Quality Control

Another key item in the development and use of a rating system is the qualifications of the individual or firm that provides the ratings. This issue is coupled with the need to oversee and provide peer review of the implementation of the system. This situation is similar to what the Sarbanes–Oxley legislation has pushed the accounting industry to meet this credibility challenge by having "an audit of the audits process" where those CPA's that meet certain criteria and agree to be subject to this annual review of their audit reports are allowed to audit SEC reviewed companies. A similar peer-review process may be necessary for an earthquake rating system. The questions posed in the discussion groups were:

- Should those that develop building ratings be licensed engineers?
- Should peer review of ratings be required or only confirmation that rating developer is qualified and using an accepted standard of analysis?

The ballot question and the summary from the breakout groups follow:



4.4.1 Key Issues from Group Discussion

- Qualifications: Commercial – should be licensed, Residential – should be credentialed.
- Should be a licensed engineer, preferably a structural engineer.

- A rating system should be orchestrated by an organization otherwise it will be commoditized. It can be an organization that certifies the raters or that reviews the ratings.
- An engineer's stamp should be required but it should still be affordable.
- People who do the rating should be qualified to do the design of that building type.
- There should be a list (clearinghouse) of qualified firms/raters.
- If such a certification or rating program is funded, it could create a "feeding frenzy of firms who smell the money and would undercut everyone by doing mass evaluations."
- The system should allow a re-rating after improvements are made.
- The person rating the building should be certified. The certification requirements should be different if rating a residential building vs a commercial building. For a commercial building the "rater" should be a licensed engineer and also certified to know how to rate the building. For a residential building, the "rater" need not be a licensed engineer, but should be certified to know how to rate the building.
- Control of raters is required. From least effective to most:
    - License
    - Peer review, either project by project or annually (like accountants)
    - Certification Agency

4.4.2 PMC Summary

The consensus is for a certified licensed engineer to perform the ratings for commercial buildings and a certified credentialed individual to perform the ratings of a residential property. In addition it appears that an organization that oversees the process and provides a peer review process will be useful for the long term credibility of the system.

4.5 Absolute Versus Relative Rating

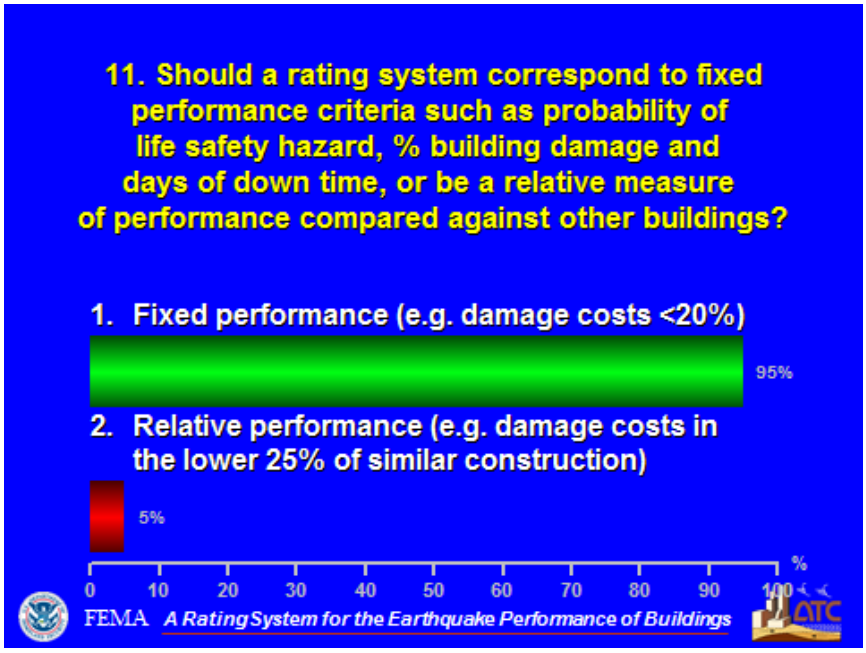
Another important issue is the decision to provide ratings that satisfy absolute ratings (i.e., damage costs less than 20%) or relative ratings such as the damage a building would sustain is similar to or less than a building designed to current code. The questions posed in the discussion groups were:

- Absolute rating would be compared to fixed performance criteria
    - Probability of life safety hazard

- Percentage damage to building as function of replacement cost
- Down time quantified (days, weeks, months)

- Relative rating would be based on comparison to typical buildings
  - Which quartile does my building fall into relative to other buildings: top quarter, top half, bottom half, bottom quarter?

The ballot question and the summary from the breakout groups follow:



4.5.1 PMC Summary

The response to this question was overwhelming support for an absolute rating of whatever dimensions are included.

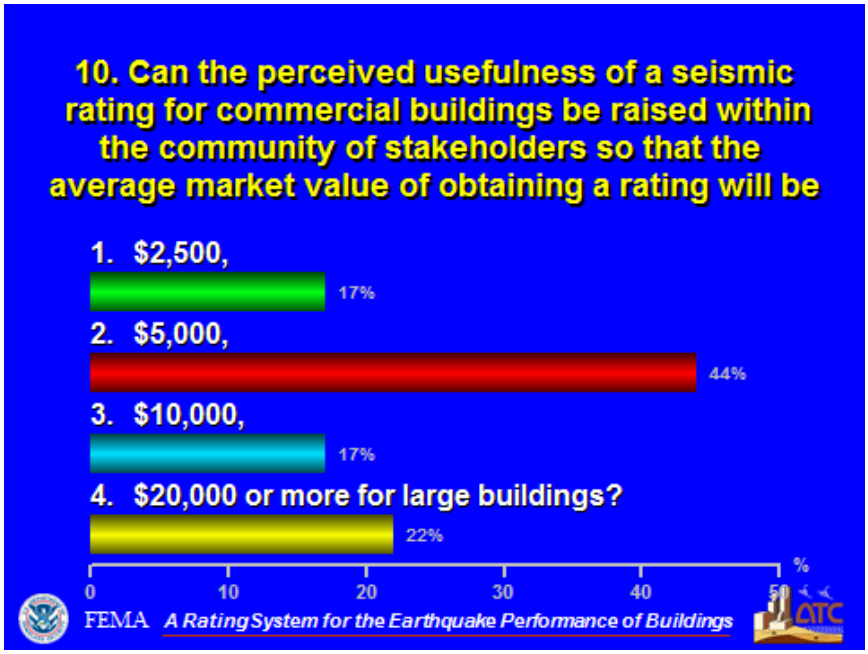
4.6 Cost

The cost of developing a rating will be key in its implementation phase. If it is very expensive it will not be widely used. If it is a voluntary program it would generate a lot of opposition due to its potential to become mandated by a jurisdiction. Until it is decided how a rating system will be developed the following questions were posed to get some idea on price points that maybe acceptable for a rating system.

- Ratings provided by licensed engineers, using thorough building analysis are likely to cost significantly more than the simple PML studies asked for today by the large majority of the market.

- Can the industry successfully promote the value of a rating beyond simply a way to fill in a checkbox on a lender's due diligence report?

The ballot question and the summary from the breakout groups follow:



4.6.1 Key Issues from Group Discussion

- Each building is different - Let the market define it
- Can't be too costly for single family residences or small/medium businesses or it won't move forward.
- We shouldn't be discussing cost/price because we don't know what's involved (details, who's doing the rating, etc.) yet.

4.6.2 PMC Summary

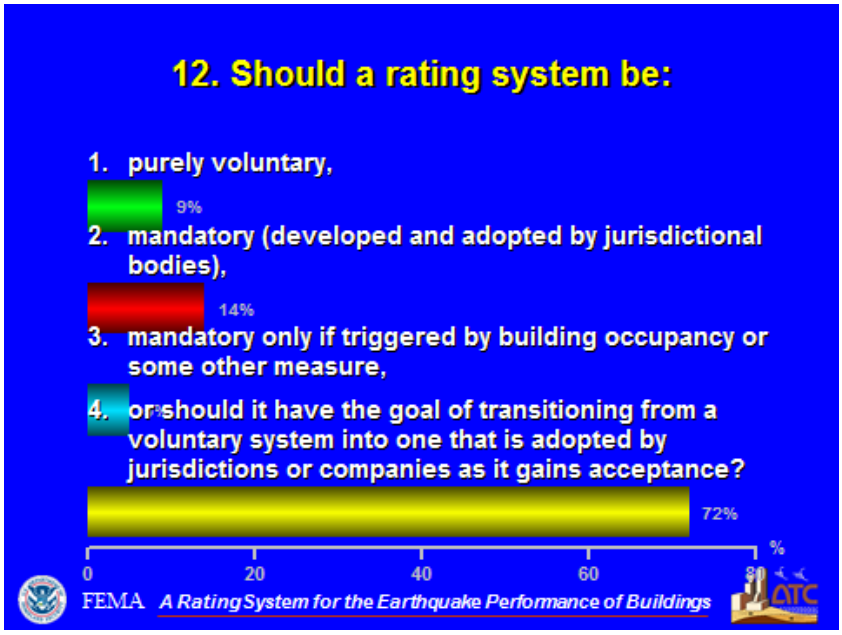
As the cost of developing a rating is not yet known, the above feedback will be helpful as a rating system is being developed. Clearly the more detail that is developed to obtain the rating the higher the cost but the better and more precise the rating will be. There will be a trade-off related to the level of effort and thus cost and some methods of developing a rating may have a cap because of their technical limitations. The balloting suggests that high costs should be avoided.

4.7 Mandatory Versus Voluntary

A key issue in the development of a system is whether it is envisioned to be a mandatory or a voluntary program. A mandatory program will need to be more detailed and precise regarding its applicability whereas a voluntary program can be more flexible in its early phases of application. This decision will have an impact on the level of development for the system. The questions posed in the discussion groups were:

- A mandatory rating system will more quickly "lift all boats" to improve seismic resilience, but is considerably harder to implement from scratch.
- A voluntary rating system is slow to gain widespread adoption if it is not perceived as valuable.
- Some voluntary systems, such as LEED, become popular quickly because of perceived value, and then are adopted as mandatory requirements by owners and jurisdictions. Could a seismic rating system achieve that catalytic state?

The ballot question and the summary from the breakout groups follow:



4.7.1 Key Issues from Group Discussion

- Voluntary, as this can move forward.
- The rating system should be a "package" that can then be considered at a jurisdictional (or agency) level for use in a manner appropriate for the

specific jurisdiction or agency. It is the jurisdiction or agency that should make the decision if the rating system is to be mandatory or voluntary. They may choose to make it mandatory for certain types of structures and voluntary for others, or they may choose another approach at their discretion.

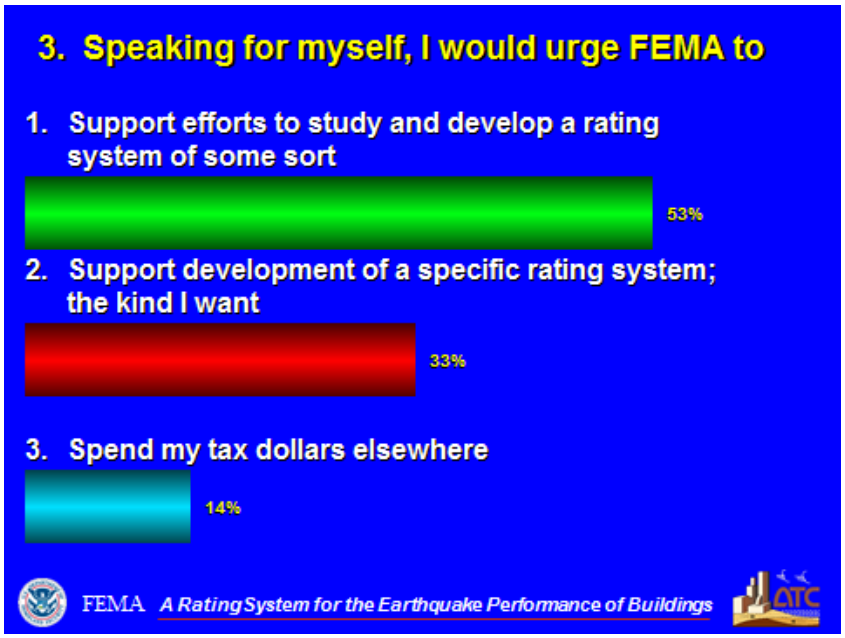
- Voluntary will eventually become mandated if it works (LEED cited as an example).
- Leave up to the local jurisdiction.
- Need to find its footage as valuable first.

4.7.2 PMC Summary

The consensus of the ballot voting and the group discussion was that the system should be developed as a voluntary system which could transition to a mandatory system over time.

Chapter 5
Pros and Cons of Developing a Rating System

One of the key questions for FEMA was feedback from the owner community on the pros and cons of developing a rating system. This question consumed a significant portion of time during the discussion groups and the recorders kept detailed notes and these are summarized below. There were two ballot questions related to this issue as follows:



5.1 Key Issues from Group Discussion on the Pros of a Rating System

Key Issues from Group Discussion on the Pros of a Rating System:

1. There is an obvious need because so many rating systems already exist and grew organically due to need (UC system, CSU system, San Francisco)
2. Use Existing Evaluation and Retrofit Standards
    a. Don't create anything new and different
    b. Coordinate with existing systems where possible
3. Should be user friendly
    a. Keep it simple
    b. Must be understood in layman's terms
4. Must be developed in collaboration with all stakeholders
5. Critical that the development of the rating system is funded by FEMA for general acceptance by all
6. Critical to create a market place for new rating system
    a. Education: The general public needs to know that building code is only for life-safety
    b. Create demand
    c. Tenants deserve to know seismic safety of building

7. Development will take a long time during which time public awareness can be improved
8. The rating system fills the need for a uniform system where common language is used by all and where gradations are identified. It can serve as an invaluable tool to communicate seismic risk to nontechnical people.
9. The technical horsepower needed to create the rating system already exists.
10. There are existing rating systems, such as LEED and Green Globe that can easily be morphed into an earthquake rating system and effect a change.
11. A rating system will help identify potentially deadly building inventory. This is when the following question came up: What is the purpose of a rating system? In addition to providing information, is its purpose to:
    a. save lives?
    b. make building purchasing decisions?
    c. spur owners into action?

    It is important that this question be answered.
12. Timing is right to move forward now because a system would be available to be embraced when timing is right after earthquake.
13. Knowledge arising from a system creates market efficiency, which will help people know what they are buying or lending on
14. It would encourage effective mitigation
15. It would standardize and improve qualification of evaluators (thinking of PMLs)
16. It would save more lives
17. It would generate meaningful, useful, and more accurate data which could be used to make community decisions (improve understanding of the code)
18. It would provide incentive for owners to do retrofit
19. Rating system for a residential and commercial building should be different
20. A favorable seismic rating could be used as a competitive advantage

5.2 Key Issues From Group Discussion on the Cons of a Rating System

Key Issues from Group Discussion on the Cons of a Rating System:

1. A rating system should only be developed after a market use study is performed…otherwise it will simply collect dust on a bookshelf. The rating system needs a market driver and more sex appeal…the kind of stuff LEED has. Right now there is no clear way to make money on this; if there was a way to make money, probability of success would be much higher. Marketers need to be involved rather than engineers because engineers are too linear in their thinking and broad thinkers are needed.
2. There are lots of opportunities for misinterpretation. People may think that it is required and fear that it will be used against them. However, it was noted that the perceived level of fear over the rating system is overstated.
3. There is limited ability to evaluate accuracy of rating system until event occurs.
4. It is expected that it will be difficult to obtain the same rating from different engineers, and owners will "shop around" for the rating they want as is similarly done for other evaluations such as real estate appraisals.
5. A rating cost versus the perceived benefits
6. Acceptance and approval would be a political can of worms as there is too much money in real estate
7. A system would be owner financially driven and an owner may have too much influence in the outcome of a rating.
8. It would be difficult to develop a system for all building types (including single family home.
9. How do you deal with constantly changing codes
10. In reality, results are ground motion and site dependent and these trump the type of seismic system used. A system may not make that above point transparent to its users.
11. Could lead to red lining of areas
12. The importance of having a correct system for a Green building versus a correct rating for a safe building is quite different

5.3 PMC Summary

A significant majority of the attendees were in favor of the development of a rating system and many believed it should be developed as soon as possible. Some of the cons of a rating system were that it would be susceptible to abuse much like the PML system and it will be a challenge to provide adequate quality control and peer review.

Chapter 6
Summary and a Road Map Forward

A significant majority of the attendees were in favor of the development of a rating system. Most were in favor of a separate system for residential and commercial buildings primarily because the cost of the two systems must be quite different. The consensus was for a licensed engineer certified by a third party organization to perform the ratings for commercial buildings and a certified credentialed individual to perform the ratings of a residential property. In addition an organization that oversees the process and provides a peer review process will be useful for the long term credibility of the system.

The rating system should use existing standards and therefore provide an overlay or a translation matrix on top of the results obtained from existing evaluation methodologies. One major challenge will be the development of an organization that is capable of both certifying raters and providing a mechanism to peer review the ratings that are being performed to ensure technical validity of the ratings. A new rating system needs to avoid the pitfalls of the commoditization that has occurred with PML's.

There was a consensus to incorporate safety, damage/repair costs and downtime (either or both time to re-occupy and time for operability) as key dimensions of a rating system. The consensus of the discussion in the breakout groups was that the rating system should include multiple dimensions and that these should be combined into a final single rating for presentation to the community. The individual key dimensions used to generate the final single rating should be available to anyone requesting such information as it would be an integral part of the rating. In addition there was overwhelming support for an absolute rating of whatever dimensions are included.

The rating system should begin as a voluntary system and may migrate to some mandatory applications over time. It should offer a common vocabulary for understanding post-earthquake performance of buildings. With data on safety, repair cost, and time to recover occupancy and operations, an earthquake rating will contain information for real estate

decisions that current seismic assessment reports either obscure or altogether lack.

It was the consensus of the attendees that a rating system when available will encourage effective earthquake mitigation and improve the earthquake resiliency of our cities.

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Appendix C
Pre-Workshop Discussions

C.1 Input to Earthquake Rating System for Building Performance Workshop Agenda from *Understanding Risk* Website

C.1.1 Background

In January 2011, the ATC Project Team approached the World Bank, and inquired if they would be willing to allow us to create a web-based Discussion Group on their *Understanding Risk* website. They agreed, and with their technical guidance, we created an *Earthquake Rating System for Building Performance Discussion Group*, with seven Discussion Group Moderators and seven Discussion Threads. We invited several hundred colleagues to join our Discussion Group, as well as the entire *Understanding Risk* community. The intent was to obtain, prior to holding the Earthquake Rating System Workshop, "kernels" of information to help develop our agenda for the Workshop. The resulting discussions provided a lot of valuable input, and significantly affected our agenda.

Summaries of the Discussion Threads are provided below. For additional information, go to:

http://community.understandrisk.org/group/earthquakeratingsystemforbuildinggperformance

C.1.2 Discussion Thread: Relevance and Need for an Earthquake Rating System for Building Performance

1. There may be a psychologically-driven and socially reinforced misperception, rooted in the collective behaviors of multiple real estate participants, that seismic performance is of little importance and value. Think about it, though: do tenants and buyers of property (and the banks and insurers who have large stakes in those transactions) truly NOT CARE about seismic performance? That hardly seems like a credible claim. Or rather: do tenants, buyers, builders, owners, and financial institutions alike tend to ignore, suppress, or deny the issue in their rental, purchase, construction, mitigation, and underwriting decisions because they lack a transparent, standardized, and validated way to

converse about, measure, and weight predicted seismic performance along with the other costs and benefits associated with in those decisions?

2. Our sources of debt capital are for the most part life companies and securitized lenders, and they have two objectives in addressing seismic risk: loss of value to their collateral, and to a lesser extent bad publicity associated with injury or death to occupants. With respect to the latter, I have not checked recently, but for some years MetLife and Prudential would refuse to finance buildings above a certain seismic risk level even when offered earthquake insurance to cover the risk of collateral loss because of the risk of bad PR. "MetLife Financed Building Collapses and Killed Dozens!" is not a headline they want to see. On the collateral risk, many companies are willing to accept earthquake insurance in lieu of meeting a PML test.

3. Capital sources whether debt or equity are more conservative by nature because they worry more about the downside. At the present, they can and do enforce actual construction changes in properties so they will meet their seismic risk thresholds. Most buyers address seismic issues because they want to comply with government standards, and because they don't want their property handicapped in the capital market with a substandard seismic risk profile. This is a real issue right now on a significant part of the market. Unfortunately, it's a pass/fail system with a 20% PML as the threshold. From my perspective, many of the parties involved don't really understand what that means but they've been told above that number is bad, and below that number is good.

4. I see our goal as a system that facilitates market participants such as tenants, owners, and banks in expressing, through dollar amounts, their innate (but *not* unlimited or even high priority) desires to live in, own, or underwrite more seismically-sound buildings. The more clearly buyers/renters/lenders can understand what they would be paying for, the more they can tell you how much it would be worth to them, which tells builders and owners how much to spend on providing it.

5. For a building owner, the financial implications of a rating might be translated into dollar value by getting an estimate from a contractor/engineer of the cost of improving the property so it would achieve the next highest rating. That works roughly the same on the buyer's end -- she would be willing to offer that much less for the property, assuming she desires to buy a property at the higher rating level. However, her desire to buy a building at a particular "rating" level

is also fed by some kind of understanding of the relative benefits of buying a property at one level versus another, namely, what she perceives as the change in the chances, types, or magnitude of loss and also the emotional discomfort & hassle avoided that moving from one level to another represents. Those are much more intangible and socially-driven perceptions than are the direct "costs" of upgrade work.

6. In earthquake country we will need building evaluations to identify the hazardous, vulnerable structures. But we need to keep a close eye on the two sides of evaluations: If a building scores poorly, it would definitely create a liability for the property owner. But, we also need to assure that there are offsetting benefits for those buildings which perform well. We would hope that those buildings would command higher rents and higher sales prices, but it would be great if insurance companies and lenders could offer lower rates, reflecting the buildings' lower risks. Unfortunately, there have not been many signs of interest from the lenders and insurers – although there should be.

7. The problem with the capital sources is the same as it is with the government - they like pass/fail systems because most of the users don't understand the nuances of seismic risk, and probably don't want to know. I deal primarily with CA real estate - ask me about hurricane risk to building structures and you'll get a blank stare - and you see that same thing in the national debt capital market with respect to seismic. Let me add that most of the debt capital is national and the decision makers from other parts of the country know seismic risk needs to be addressed, but then so do a host of other issues, so they don't want nuances, they want pass/fail criteria. Since they have a host of other requirements, seismic gets a pass/fail and they move on to what are other more significant property issues in their minds.

C.1.3 Discussion Thread: Information Contained in a Rating/Reported Categories

1. With respect to building performance, safety remains the most fundamental measure of performance.

2. The person rating the seismic safety of a building must be a Professional Engineer (Civil or Structural).

3. Rating scheme must be tied back to established standards in order to be credible.

4. Room for rating dimensions that might be useful for which standards don't yet exist (e.g., down time), should be considered.

5. One approach to bundling multiple dimensions of performance into a single metric is to give FEMA 356 performance levels that would reflect life safety and post-earthquake operability.

6. Possible dimensions: death, damage and downtime.

7. A key issue is to what hazard level would these criteria be developed be developed for?

8. A grading system for homeowners and small businesses that give "risk points" may be preferable over a letter grade to buildings.

9. One problem with PMLs is that the system can be "gamed." Is there a way to design a system that limits or inhibits gaming?

C.1.4 Discussion Thread: Existing Rating Systems

1. The Association of Bay Area Governments (ABAG) developed a grading system for homeowners and small businesses that gave "risk points" rather than a letter grade to buildings - more on the "heart-health risk model" and less on the "school grades model."

2. One attractive feature of "point" rating systems is that they allow for combination and weighting of multiple factors affecting risk. It makes sense to "reduce" all that information into a single number if there is a transparent formula for how that number is comprised of the other numbers. This is how LEED works.

3. In the case of the Heart Health risk model, a lower number is better. In LEED, a higher number is better. If you want to emphasize rewarding buildings that are expected to perform well in earthquakes, then points should be awarded for *positive* factors. If, in contrast, you want to scare people into taking preventative actions, then make a high number representative of higher risk. However, negative threat appeals have generally failed as a model for risk communication.

4. The literature on risk communication of probabilities is not encouraging (at least on the surface). People in general are not very comfortable incorporating probability information in their decision making. However, in the EQ case, the context could make probability information both useful and usable as long as the information is decision-relevant and linked to clear outcome benchmarks.

5. The LEED rating has very simple output: “Certified, Silver, Gold, Platinum.” One rating, not one for each component of sustainability.

6. The LEED rating system is POSITIVE. There is no rating that describes the building as not meeting conventional standards. All the ratings imply a better than expected or average performance. These last two statements, I think are worth considering relative to an earthquake rating. Anything not meeting the “Certified” standard would simply not get a rating. I have spoken with a couple of people informally and they can’t see a seller spending money to get a 2-star rating, which implies the building is not safe. If they got such a rating, they’d be apt just to throw it in the trash and do what they can to prevent a potential buyer from obtaining enough information on the building to calculate a similar rating. I really believe that the all positive rating system that USGBC developed was a brilliant stroke.

7. Also, the use of words rather than a number of stars is better from a marketing perspective – “5-star” is a widely accepted term for “the best” so everything less will subconsciously be identified with “substandard,” whereas the LEED rating words all have at least some positive connotation. I recall hearing that they threw out a “Bronze” rating – or at least made that “Certified,” probably because bronze just doesn’t sound valuable like the other metals.)

C.1.5 Discussion Thread: Regional and Political Issues

1. Voluntary vs. Mandatory: Mandatory rating will most likely result in many political issues making it less likely to happen. A voluntary program does not "need" political support to get started. But, it might benefit from it (both faster start up & spread) or never be able to reach beyond a certain level (e.g., sporadic use or adoption) without it.

2. Access to qualified, experienced engineers to perform rating evaluations will naturally vary by location. Evaluation of property in certain areas is bound to occur.

3. The average skills or experience level of local engineers with a rating system will vary until broad acceptance and experience is developed. The market will need to mature.

4. Typically policy considerations result from broadly accepted awareness that the current system is not reducing risk, putting many people at risk, leading to urgency to fix the problem.

5. Seismic Safety Commission has heard no complaints from those involved in real estate transactions about PML's, specifically how they may have been harmed by them. If the Dept. of Real Estate were getting a lot of seismic questions, they would likely contact the SSC.

6. Suggest that an alternative to a ranked rating would be to provide a permanent "placard" on buildings, similar to those currently required for un-retrofitted URMs.

7. How do we cause vulnerable buildings in San Francisco (65% of which is non-owner occupied) to undergo retrofit.

8. The main problem is with residential buildings, not the commercial stock.

9. Commercial buildings have been pretty effective in self-regulating, and self-correcting, since commercial players (owners, tenants, lenders, and so on) tend to be more sophisticated and better informed.

10. In order to cause "market based retrofits" to occur, the essential components would have to include evaluations, and public dissemination of those evaluations.

11. Residential landlords have a higher duty of care than commercial property landlords, yet they have been less proactive in addressing that obligation (and liability).

C.1.6 Discussion Thread: Third-Party Approvals, Verification, or Certification

1. Civil or Structural Engineer is qualified person to complete the rating.

2. The rating system should communicate a relative ranking for the following 3 "D's": death, damage and downtime.

3. If a rating system does not materialize, at a minimum, the following information should be posted outside buildings: Year Built, Design Code, Architect, Structural Engineer (firm name), Gravity load-carrying system, Lateral Force-resisting system.

4. Based on past experience with California laws, the problem with posting signs is individuals remove them and there is not adequate enforcement.

C.1.7 Discussion Thread: Process of Obtaining a Rating

1. Persons preparing ratings need to be competent and free from owner's influence. Competence was defined by others as being licensed.

2. The California disclosure law of near fault sites (Alquist-Priolo) was brought up and the disclosure was suggested to be ineffective because it is most often done at or near closing of a sale when the buyer is "sold." A suggestion was made that a rating must be much more obvious and up front (the Los Angeles restaurant sanitary rating in Los Angeles was used as an example where the rating is posted on the front window.)

C.1.8 Discussion Thread: PMLs – Usefulness and Standards

1. There is little argument that the PML report has been fully commoditized within the market place. For the mortgage industry, where these reports are most widely used, "studies" and reports are typically generated for a few hundred dollars, often by non engineering professionals, and often without a detailed evaluation of the subject building. It is rare for a PML study to "fail" – that is, come in above the mythical 20% threshold, so that the whole process seems little more than a formality.

2. One problem with PMLs is that the system can be "gamed." Is there a way to design a system that limits or inhibits gaming?

3. The first question of usefulness should examine the technical relevance of the PML study vis a vis other mortgage risks and their actual usefulness to the mortgage backed securities investor in estimating his or her risk.

Appendix D

Breakout Groups

D.1 Day 1 Breakout Groups

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- John Paxton
- Daniel P. Cronan
- David L. McCormick
- Sharyl Rabinovici
- Eric Von Berg
- W. Scott Tanner

FEMA *A Rating System for the Earthquake Performance of Buildings*

Breakout Group #3

- **Leader: Bill Holmes; Recorder: Stephen Bono**
- Steve Levy
- Silvio Ferrari
- Tim Carrico
- Skip Soskin
- Jeffrey R. Soulages
- William E. Moor
- Ken Paige

FEMA *A Rating System for the Earthquake Performance of Buildings*

Breakout Group #4

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- Michael J. Bocchicchio
- Amy L. Brown
- Steven R. Winkel
- Salinder Dutta
- Jeff Dragovich
- Brent Woodworth

FEMA *A Rating System for the Earthquake Performance of Buildings*

Breakout Group #5

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- Lucy Arendt
- Bill Bell
- Rick Renfro
- Sharene Rekow
- Brendan Owens

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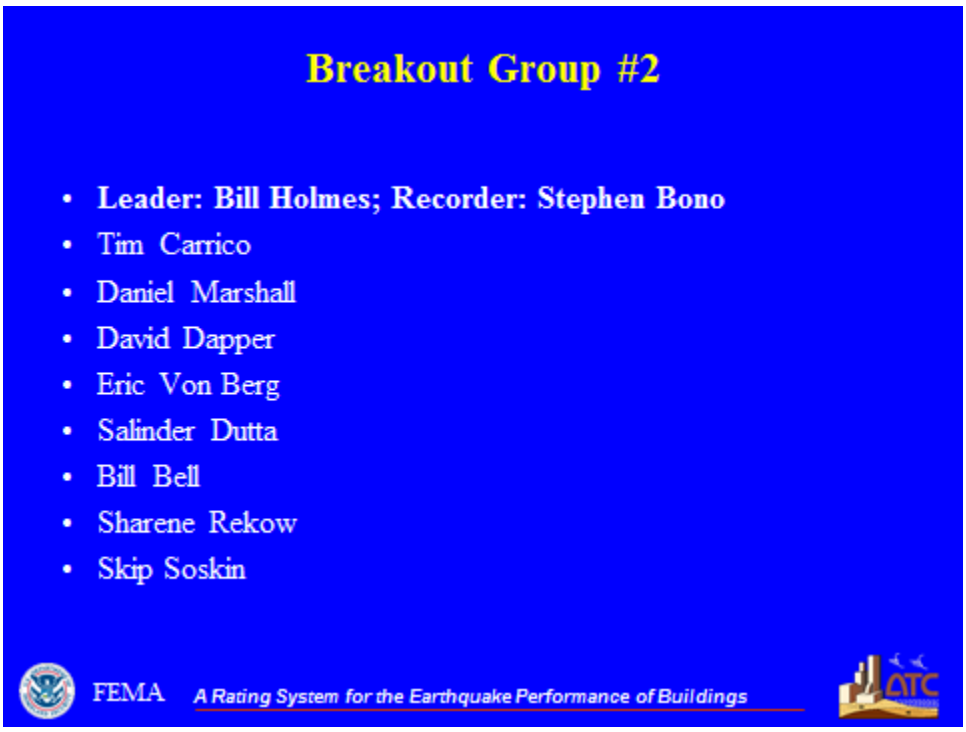
D.2 Day 2 Breakout Groups



Breakout Group #3

- **Leader: Susan Dowty; Recorder: Mathew Bittleston**
- James (Jed) Sampson
- Wanda Edwards
- Sharyl Rabinovici
- Jeff Soulage
- Jeff Dragovich
- Bob Hendrickson
- Brendan Owens
- Emily Cabal

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Breakout Group #4

- **Leader: Bill Petak; Recorder: Marguerite Bello**
- Lucy Arendt
- John Paxton
- Ken Cooley
- Steve Levy
- William Moor
- Mike Bocchicchio
- Brent Woodworth

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