

High Performance Based Design of the Building Envelope

Supported by:

Infrastructure Protection and Disaster Management Division
Science and Technology Directorate
Department of Homeland Security

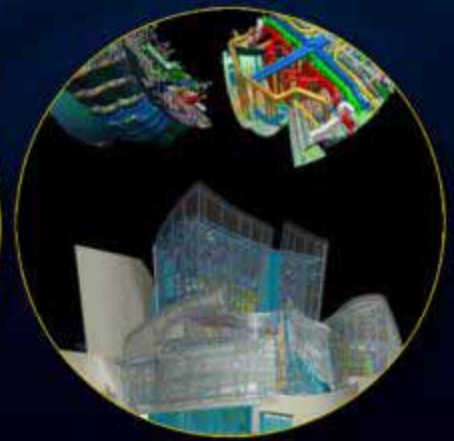
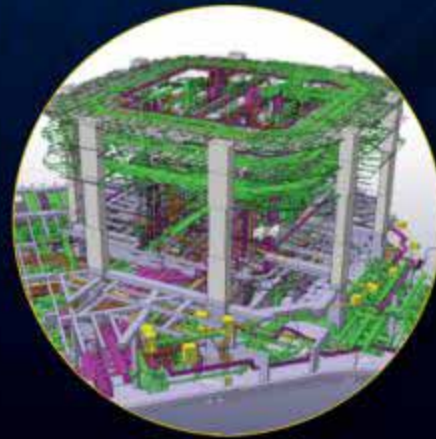


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Project Overall Goal

To promote protection of the built environment through the adoption of enhanced security measures (including blast resistance) optimized and integrated with other high performance attributes in the building envelope as envisioned in the Energy Independence and Security Act of 2007.



U.S. Energy Independence and Security Act (EISA) of 2007

- Title IV – Sec 401. Definitions.
- **High Performance Building** – The term “high-performance building” means a building that integrates and optimizes on a life cycle basis all major high performance attributes, including energy conservation, environment, safety, security, durability, cost-benefit, productivity, sustainability, functionality, and operational considerations.



Definitions

- **Performance Based Design** is the process used to achieve performance levels for specific attributes based on quantifiable benchmark metrics that can be verified.
- **Attributes** are specific performance characteristics.
- **Metrics** are the quantifiable measurements used to gauge a level of performance.
- **Baselines** are performance levels that are currently being achieved that can be used for comparison.
- **Benchmarks** are points of reference for evaluating specific levels of performance.
- **Verification** is the method by which a benchmark can be validated or ascertained.



Attribute Levels of Performance

- Many High Performance Attributes Interact at the Envelope
- Envelope systems are first line of defense from attack
- Owners need to balance competing requirements to achieve highest overall performance

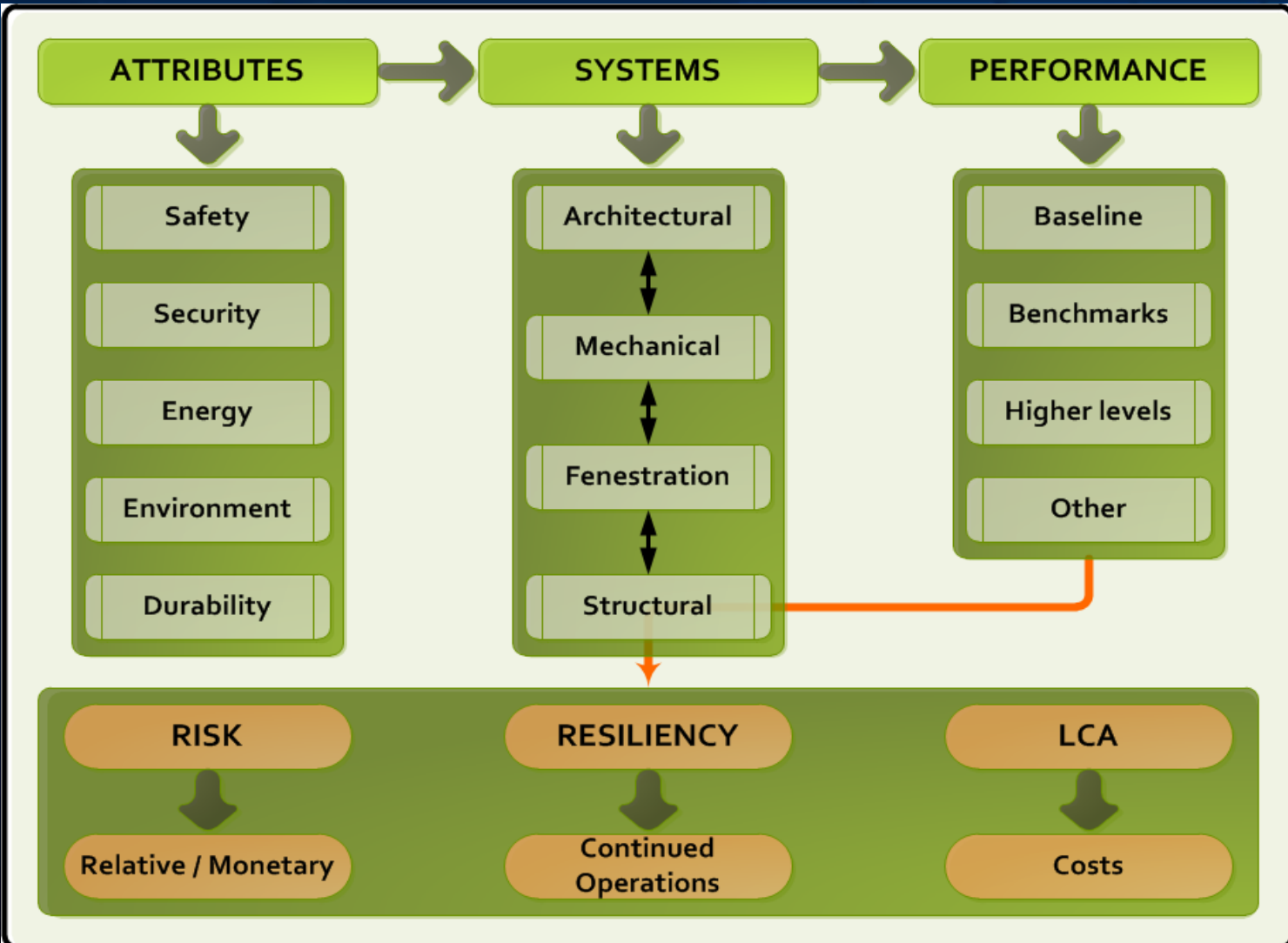


Attributes Relevant to the Building Envelope as Defined in EISA 2007

- **Energy Conservation**
 - Thermal Transfer
 - Air Leakage
- **Environment**
 - Environmental Footprint
 - Acoustic Transmission
- **Safety**
 - Seismic Resistance
 - Wind Resistance
 - Flood Resistance
 - Fire Resistance
- **Security**
 - Blast Protection
 - Chemical/Biological/Radiological Protection
 - Ballistic Protection
- **Durability**
 - Service Life
 - Water Vapor Migration
 - Water Penetration
- **Sustainability**
 - Renewable Energy
 - Day Lighting
- **Operational**
 - Interruption of Operations



Performance Based Design Model



Project Approach – Phase 1

1. Convene Expert Committees
 - Architectural
 - Structural
 - Mechanical
 - Fenestration
 - Owner Requirements
2. Identify metrics and benchmarks for EISA high performance attributes relevant to the building envelope
3. Develop a tool to help Owners establish high performance envelope requirements that address Security along with other goals
4. Reach out to Industry for review



Project Committees

- **Architectural** - Chair - Wagdy Anis, FAIA, LEED AP, Wiss, Janney, Elstner, Associates Inc.
- **Structural** - Chair – Robert Smilowitz, PhD, PE, Weidlinger Associates
- **Fenestration** - Chair – Joseph Derringer, AIA, LEED AP, Institute for Sustainable Performance of Buildings (SuPerBe)
- **Mechanical** - Chair – James Woods, PhD, PE
- **Owner** - Chair – Mohammed Ettouney, PhD, PE, MBA, F.AEI, Weidlinger Associates, Mark Sands, PE, Performance Building Institute



Committee Deliverables

- Expert identification of useful measurements for attributes' performance (Metrics)
- Expert consensus of attributes' existing and high performance levels (Baselines and Benchmarks)
- Expert selection of method for validating or verifying benchmarks (Standards)
- Industry review of high performance model (Metrics + Benchmarks + Validation)
- Development of Owner's decision making tool for high performance attribute selection based on the model (Software)



Project Approach – Phase 2

1. Convene Expert Committees
 - Structural
 - HVAC
 - Lighting
 - OPR Tool
 - Owners /Users
2. Identify metrics and benchmarks for EISA high performance attributes relevant to the structural, HVAC and lighting building systems
3. Complete the OPR Tool to establish high performance whole building requirements that address Security/Safety along with other goals
4. Reach out to Industry for review



Owner Project Requirements Tool

- Web-based planning tool
- Establish requirements and view results
- Change performance objectives and evaluate scenarios
- Develop a performance based plan for the design team
- Coordinated with ASTM Cx standard



The screenshot shows the homepage of the Owner Project Requirements (OPR) Tool. At the top left is the Homeland Security logo with the text "Science and Technology". To its right is the title "Owner Project Requirements (OPR) Tool for Performance Based Design" followed by "developed and managed by the National Institute of Building Sciences in partnership with Department of Homeland Security/Science and Technology Directorate". In the top right corner are links for "ABOUT" and "CONTACT". Below this is a navigation bar with "PROJECT", "RESOURCES", "SUPPORT", and "LOG OUT". The main content area is divided into three columns: "Welcome, Roger Grant!" with a "Click here" link and a description of the tool; "Organization Information" for NIBS, including address and email; and "Terms of Use Agreement/Disclaimer" with a detailed disclaimer text.



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Project Deliverables – Phase 1

- Identification of High Performance Metrics, Benchmark levels and Verification standards for the Design community and Building industry
- Owner Performance Requirements (OPR) Tool Version 1
- Documentation of OPR Tool assumptions and methodology for Research community
- Plans for Subsequent Phases - Structure, HVAC, Lighting, and others



Industry Review

- NIBS High Performance Building Council
Get Moy, PhD, PE, LEED AP, PMP
- NIBS Building Enclosure Technology and Environmental Council (BETEC)
Wagdy Anis, FAIA, Wiss, Janney, Elstner Associates Inc.
- Building Enclosure Councils (BECs)
Rob Kistler, AIA, The Facade Group
- ASTM Committee E06.55 Exterior Wall Systems
Daniel Lemieux, AIA, Wiss, Janney, Elstner Associates Inc.
- Retrofit of Buildings Industry Advisory Council (IAC)
Joseph Valancius, PE, Karagozian & Case





Thank You.



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