



EXCELLENCE IN BUILDING SCIENCE EDUCATION
Transforming the Design/Construction Profession

Education Responsive To Design/Construction Industry Job Requirements

Samuel J. Taylor, Coordinator
Joint Committee on Building Science Education

<http://www.BuildingScienceEducation.net>

March 27, 2014

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

JOINT COMMITTEE ON BUILDING SCIENCE EDUCATION

- Established as a standing joint committee on building science education, by the NCHRC (University Consortium) and ASC to facilitate excellence in building science education.
- Hosted by the University Consortium, & our Program is guided by partnering university organizations, including
 - ASC, NCHRC
 - Architectural Engineering Institute,
 - BETEC Education Committee, and others.

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

JOINT COMMITTEE MISSION

The mission of the Joint Committee on Building Science Education is to support the transformation of the education and training of the design and construction industry profession, such that it's professionals, educated, trained and certified in building science and related advanced design and construction management practices, routinely design and build quality, high performance buildings that are safe, healthy, durable, comfortable and very energy efficient and always provide the highest value to their clients.

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

INITIAL FOCUS

- Identifying, Rating and Sharing Curricula, Key Course Modules, and Teaching Resources and Methodologies – for Colleges & Universities (4-Year & Graduate)

- Support University Partners, DOE, and Technical Societies
 - Multi-Discipline Student Competitions
 - Share Curricula, Teaching Resources
 - Recognize Excellence in Building Science Education
 - Credentialing/Certification

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

INITIAL PROJECTS/TASK GROUPS

- **TASK GROUP on “Criteria for Excellence in Building Science Curricula” – Co-Chaired by Pat Huelman, U MN and John Straube, U Waterloo**
 - **Identifying, Reviewing & Sharing Teaching Resources**
 - **Support of Multi-Discipline Student Competitions**
 - **Support of Industry Certification/ Credentialing**

- **ANNUAL AWARDS Committee for “Excellence in Building Science Education” – Co-Chaired by Joe Laquatra of Cornell, for NCHRC, & Matt Syal of MSU, for ASC –we are now seeking nominations for this year’s award -**

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

TASK GROUP ON EXCELLENCE IN BUILDING SCIENCE CURRICULA

- Website: www.BuildingScienceEducation.net
 - ➔ “Programs/Task Groups”
 - ➔ “Criteria for Excellence in B.S. Curricula”
 - ➔ “Working Files”
- Other information available
 - “Events” for upcoming meetings/announcements
 - “Resources” page

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

INTERPRETATION & RESPONSE TO CHANGING MARKET NEEDS/CODES

- With 40% of our Energy Used in Buildings, DOE has and continues to Invest in **New Technologies and Stricter Codes & Standards**
- The Market Demands **Better Performing, Comfortable, Healthy Buildings**
- **OUR RESPONSE** to Changing Market Needs & Stricter Codes: **Focus on Building Science Education Supporting Quality, High Performance Buildings**
 - **RESIDENTIAL (NEW):** DOE Challenge Home or Better
 - **COMMERCIAL (NEW):** Congressional Definition of High Performance
 - BETTER BUILDINGS CHALLENGE
 - NEW FEMP REQUIREMENTS
 - NEAR ZERO READY
 - **HIGH PERFORMANCE RETROFITS** – TRADE-OFFS in terms of
 - FUNCTIONAL & ECONOMIC CONSTRAINTS
 - HEALTH & SAFETY,
 - DURABILITY & SUSTAINABILITY (ENERGY EFFICIENT; GREEN)

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

ACADEMIC PROGRAMS RESPONSIVE TO INDUSTRY

Changing Market Needs/Opportunities, Codes & Standards



Industry Response → CHANGING JOB REQUIREMENTS



NEW CORE COMPETENCIES



CURRICULA/KEY COURSES

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

DEVELOPMENT OF CORE COMPETENCIES

- **Joint Committee’s “Criteria Task Group” (see Handout)**
- **ASTM E06-55 – Certification Program – Building Enclosure Professionals**
- **DOE/NIBS Credentialing Council**
- **DOE Task Force on Building Science Education**
- **INDUSTRY – for their Staffing Plans & Hiring**
- **OTHERS**

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

NEXT STEPS FOR FACULTY

- Recognize Impact of Changes in Market, Codes and Standards on Job Requirements, and in turn on Core Competencies

- Provide Curricula, Incorporating Building Science, with Learning Outcomes Responsive to Changing Core Competencies
 - Specialized Courses, e.g., Building Science Fundamentals
 - Updated Standard Courses – Incorporating Building Science & Advanced Design & Construction Management Practices, for example –
 - Integrated Design/Project Management Process – Establishing Multi-Disciplinary Project and Communication Skills
 - Advanced Design/Construction Documentation, integrating Building Science, Quality Management, etc. (see Working Files)

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

NEXT STEPS FOR FACULTY (CONTINUED)

➤ **University /Student Programs**

- **Facilitate Internships; Co-Ops – Involved with Quality, High Performance Buildings**
- **Participate Multi-Disciplinary Student Competitions Requiring Building Science**
- **Augment Classes with Guest Lectures/ Adjunct Positions with Industry Building Science Experts;**
- **Collaborate with Joint Committee in Identifying & Sharing of Excellent Curricula, Course Modules and other Teaching Resources**

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

CONSTRUCTION MANAGEMENT FACULTY

- Construction Managers Need to Manage the Risks of Technically Complex Projects
- Proficiency in Building Science is Required in Managing the Planning, Design, Analysis, Building, Commissioning, and Operation of Quality, High Performance Buildings
- Construction Managers:
 - Hire and Manage Professionals for Multi-Discipline Project Teams: Engineers, Building and Material Scientists, Architects,
 - Review, Evaluate & Act on Their Technical Reports
 - Understand Functional Requirements Associated with Various Envelope Subsystems & their Application Details as a Risk Management Strategy
 - Understand the System Implications & Interactions when making Design & Technology Choices
- Will Your Students be Ready?

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION
Transforming the Design/Construction Profession

THANK YOU

**Your Comments and Input on the Handouts would
be Appreciated**

Samuel J. Taylor, Coordinator

sam@BuildingScienceEducation.net

Joint Committee on Building Science Education

<http://www.BuildingScienceEducation.net>

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION
Transforming the Design/Construction Profession

COMMENTS ON HAND-OUTS

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

DRAFT MATRIX – PROFICIENCY LEVELS FOR SKILLS VS. KEY DISCIPLINES

Key “Building Science” Courses For Quality, High Performance Buildings	Engineering				Design		Construction Management	Other - Sustainability /Housing Studies/ etc.
	Civil	Mech.	Arch. Engr.	Other - Material Science	Architecture - Bldg. Perf., Other	Other -		
Accreditation	ABET				NAAB, other		ACCE	Other
Building Science Fundamentals (Building Science 101)								
Building Enclosure Characterization & Optimization (Hygrothermal Analysis; Structure & Control Layers)								
Material Science for Buildings								
HVAC (MEP/other Building Services) Design, Analysis & Installation								
Indoor Air Quality								
Building Performance Tools & Analysis								
Advanced Design/ Construction Documentation (detailing, scopes-of- work, specifications, etc.)								
Quality Management/ Commissioning								
Integrated Design Process/ Multi- Disciplinary Project Management								
Systems Engineering/Integration- (ability to assess system implications)								
Other, e.g., <ul style="list-style-type: none"> • Facility operations & management • Testing; forensics • BIM, Etc. 								



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

CRITERIA TASK GROUP FOCUS

[UNDERGRADUATE/GRADUATE/PROFESSIONAL DISCIPLINES]

- **Construction Management**
- **Engineering**
 - Civil
 - Mechanical
 - Architectural
 - Building Material Science
- **Architecture/Design**
- **Other**
 - Sustainability
 - Housing Studies/Technologies

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

KEY CONTENT & SKILL AREAS

Proficiency Levels Identified for Each Skill Area vs. Discipline

- **Building Science Fundamental (BS-101)**
- **Building Enclosure Characterization & Optimization**
- **Building Material Science**
- **HVAC (& MEP, etc.) Systems Design, Analysis & Installation**
- **Indoor Environmental Quality**
- **Building Performance Tools and Analysis**
- **Advanced Design/Construction Documentation**
- **Quality Management and Commissioning**
- **Integrated Design Process/ Multi-Disciplinary Project Management**
- **Systems (and subsystems) Engineering/Integration**
- **Facility Operations & Management**
- **Testing, Forensics; Other**

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION
Transforming the Design/Construction Profession

PROFICIENCY LEVELS
(BASED ON BLOOM'S TAXONOMY)

- 1 = Remember (knowledge)**
- 2 = Understand (comprehension)**
- 3 = Apply (application)**
- 4 = Analyze (analysis)**
- 5 = Evaluate (synthesis)**
- 6 = Create (design)**



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

DRAFT SAMPLE MATRIX – PROFICIENCY LEVELS FOR SKILLS VS. KEY DISCIPLINES

Key “Building Science” Courses For Quality, High Performance Buildings	Engineering				Design		Construction Management	Other - Sustainability /Housing Studies/ etc.
	Civil	Mech.	Arch. Engr.	Other - Material Science	Architecture - Bldg. Perf., Other	Other -		
Accreditation	ABET				NAAB, other		ACCE	Other
Building Science Fundamentals (Building Science 101)							6	
Building Enclosure Characterization & Optimization (Hygrothermal Analysis; Structure & Control Layers)							1+	
Material Science for Buildings							2	
HVAC (MEP/other Building Services) Design, Analysis & Installation							2	
Indoor Air Quality							2	
Building Performance Tools & Analysis							2	
Advanced Design/ Construction Documentation (detailing, scopes-of- work, specifications, etc.)							6	
Quality Management/ Commissioning							6	
Integrated Design Process/ Multi- Disciplinary Project Management							6	
Systems Engineering/Integration- (ability to assess system implications)							3	
Other, e.g., <ul style="list-style-type: none"> • Facility operations & management • Testing; forensics • BIM, Etc. 								



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

CORE COMPETENCIES/KSA'S

[EXAMPLE DEVELOPED BY A & E FIRM]

- An understanding and competency in building physics
- Understanding of psychrometrics
- Ability to use hygrothermal modeling tools
- Broad understanding of lighting, acoustics, fire/smoke, security
- Understanding of the four major building enclosure systems

Joint Committee on Building Science Education



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

EXAMPLE OF CORE COMPETENCIES

[CONTINUED]

- **Ability to draw design details**
- **Understanding of both commercial and residential construction**
- **Understanding of testing equipment**
- **Understanding of HVAC interaction with the building enclosure**
- **Ability to analyze building performance**



EXCELLENCE IN BUILDING SCIENCE EDUCATION

Transforming the Design/Construction Profession

CORE COMPETENCIES SHOULD SUPPORT MANY EDUCATION & TRAINING PROGRAMS

- Accreditation
- Curricula/Course Learning Outcomes (LO)
[Linked to CC by LO Assessment Process]
- Professional Licenses & Certification
 - Accredited degrees
 - Internships/Experience [demonstrate proficiency towards CC].
 - License Exams/Certification Requirements

Joint Committee on Building Science Education