American Society of Heating, Refrigeration, and Air-Conditioning
ASHRAE Johnstown Chapter

Design Build for Green Buildings
Integrated Delivery of an Integrated Idea

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ASHRAE
Engineering for Sustainability

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Program Overview

- Overview of Design-Build
  - Putting the project together
    - Key Issues
    - Concerns
- Sustainable Design
- LEED Ratings & Certifications
- Impacts on the 'Practice'
- The Art of the Deal
- Execution
- A Test
- Risk and Design-Build
- Summary

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What is Design-Build?

- The Design-Build entity...
  - …holds all the contracts.
  - ...bears performance risk.
    - for both design & workmanship
  - ...bears cost risk.
  - ...a single point of responsibility
- The Owner gets..
- ..and expects to..
  - ...save time and money.

Sounds Good !

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But remember…
Ibi est nullus talis res pro libero prandium*
*'There is no such thing as a 'free lunch'
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Why do it?
Good Points
• Better & earlier cost estimates
• More cost effective design
– Coordination
– Constructability
• Eliminates change orders!
Bad points
• Insurance & bonding issues
• 'checks and balances' ?
– Who represents the Owner?
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Ingredients for Effective Design/Build

- Good Team Alignment
- Good Scope Definition
- Clear Acceptance Criteria*

*measurable and do-able!

Other good stuff…

- Appropriate Design
- Front end Planning Focus
- Financial Stability
- Fair Contracts
- Fair Dispute Resolution Process

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In traditional arrangements…

The Owner…

- …defines scope via the bid documents;
- …warrants "Adequacy Of Design" (Spearin Doctrine)

therefore…

  - …if the result is not what the owner 'wanted'…
  - …if the design is flawed or impossible
- …the Contractor still gets paid!

Contractor is eligible for…

  - Delay and disruption damages

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Key Issues

- Project Program
  - Budget & schedule
- Owner changes
- Owner-supplied equipment, utilities, systems, etc.
- Close-out & Acceptance
- 'expectations' ≠ marketplace 'realities'
- Scope creep
- Owner identifies scope boundaries
  - "by others"
- D|B entity identifies limits of work.
  - Define 'completion' at the start.

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Concerns
"Expectations" vs. "Intent"
• Integrity of "design intent"
• Cost
– Product substitutions
• Schedule
– Delivery & Lead time
– Product sourcing
Owner vs. Design-Build
• RFP vs. Proposal
– Products & Materials
– Techniques
– Certifications
• Who 'approves'?
• The battle over the 'float'
• Balancing Cost, Schedule and Certification


How are they similar?
Where do they differ?
Design-Build
• Integrated construction and design
• Real world "cost of design" feedback
• Performance contract environment
Green Buildings
?
We'll get there.

Sustainable Design

- a team oriented approach;
- a common goal;
- a life cycle cost-based methodology;
- results in high(er) performance ('better') buildings;
- is considered a 'value-added' approach;
- is a result of responsible design, responsible construction and responsible ownership.

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Summary

- Green design emphasizes better or 'high performance' buildings as an outcome.
- The process requires greater team contribution and coordination.
- Success is measured over time.

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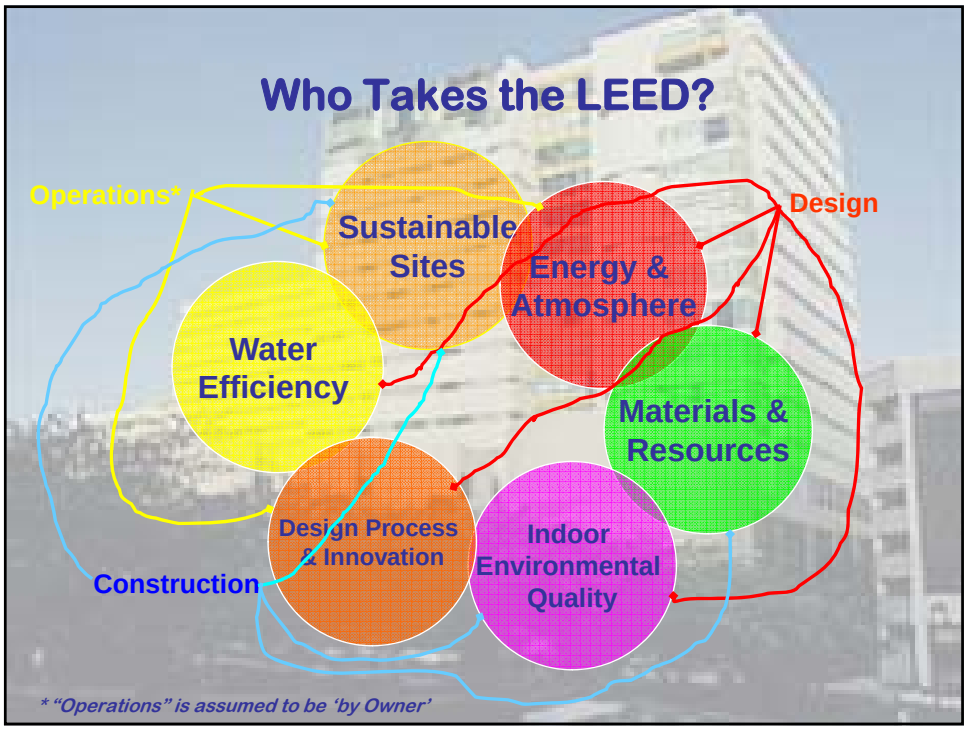
LEED Rating System
Certified
Silver
Gold
Platinum
Sustainable Sites 14 pts.
Energy & Atmosphere 17 pts
Water Efficiency
LEED Accredited Professional
Resources 13 pts
Design Process & Innovation 4pts
Indoor Environmental Quality 15 pts
Think about personnel management, shop drawings, CA.


Who Takes the LEED?
Operations*
Sustainable Sites
Energy & Atmosphere
Design
Water Efficiency
Materials & Resources
Design Process & Innovation
Indoor Environmental Quality
Construction
* "Operations" is assumed to be 'by Owner'


LEED Fundamentals
Prerequisites
• Fundamental Building Commissioning
• Energy Performance
• Meet ASHRAE 90.1 plus*
• Predictive
• CFC Use in HVAC & R Equipment
• Indoor Environmental Quality
• Meet Applicable Ventilation Standards
• ASHRAE Standard 62
* latest LEED NC requires 'better than' 90.1 performance


Energy & Atmosphere
Category Credits
Indoor Environmental Quality
• Ventilation Control
• Carbon Dioxide Monitoring
• Increase Ventilation Effectiveness
• Construction Management
• Can impact 'means & methods'
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Impact on 'built' Value

Energy Utilization

- **Cost of Operation**

Commissioning

- **Energy, Maintenance and Life Cycle Costs**

IEQ/IAQ

- **Occupant Satisfaction**
  - ***Often 'productivity improvements' are attributed to IEQ/IAQ!***
- ***Rating\Certification level may also impact on (potential) market value AND possible tax breaks or subsidies.***

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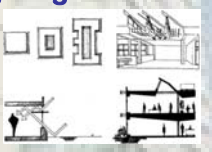
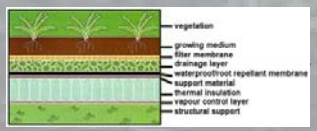
- **Lighting**
  - **Light Pollution**
  - **Daylighting**
  - **Lighting Controls**



- **Water Management**
  - **Stormwater Management**
  - **Rainwater Harvesting**
  - **Landscaping**
- **Waste Management**
  - **Construction Waste**
  - **Minimization (reuse)**
  - **Recycling**

Other Areas



- **Roofing**
  - **Heat Islands**
  - **Reflective Roofing**
  - **Green Roofs**

IEQ/IAQ

Low VOC Emitting Materials

- ***Request detailed information***
  - ***beyond MSDS***
- ***Develop a VOC Budget***
  - ***includes both 'specified' and 'incidental' materials***
  - ***Track materials used by total weight and unit volume***
  - ***Shop 'wisely' to eliminate sources***

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Impacts on the Practice

- **LEED 2.2 - Post Occupancy Evaluations**
  - **to secure thermal comfort credits.**
  - **Should evaluation include operations review too?**
- **"Carbon 2030 Challenge"**
  60% reduction in carbon footprint by 2010.
- **BIM requirements**
  - **Integrated documentation and integrated delivery**

Construction IAQ Plan

Should address:

- *Storage of materials on site*
  - *Consider moisture content testing*
- *Protection of 'open ends' during construction;*
  - *Daily walk thru and report?*
- *"Housekeeping" during construction*
  - *Food, smoking, trash, WATER!!!*
- *Sequencing & scheduling of the work*

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Materials Management Plan

Specifications control but program includes

- Recycled Content
  - Certification form (per shipment or total)
    - Signed by vendor & subcontractor
    - Traceable to manufacturer
- Rapidly Renewable Materials
    - Independent, verifiable certificate signed by manufacturer
    - Third Party Certification of content
      - *Certified Wood*
  - Regional Materials (distribution sensitive)
    - *Remember schedule!!*

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Materials & Resources
Construction Waste Management Plan
Prerequisites
• Storage & Collection of Recyclables
Category Points
• Building Reuse – site selection controls
• Materials Reuse – specifications dictate
• What is the 'value' of materials 'damaged' that could have been reused???
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Materials & Resources
Construction Waste Management
• Recycling Process Mangement
– Tracking
– Quantifying
– Separation, Segregation and Storage
– Site laydown space for containers
– Documentation
• Compliance across all subcontractors!
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Waste Management Plan
Write a detailed waste management plan
• Outline intent & set goals;
• Outline requirements of all Subcontractors
• Suggest methodologies
• Describe "specifics" or 'terms of art'
• Incorporate plan into subcontract agreement
• Outline special materials as necessary
• i.e. concrete, masonry, steel, interiors
• Track monthly as a part of project report
• Identify and allocate time in schedule for 'salvage' operations
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The Art of 'the Deal'
Contracts
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'The Deal' - Contracts

Give Each Party A Stake In Achieving Project Goals

POSITIVE REINFORCEMENT (Carrots..)

- **Quality:**
  - **Consider Extended Warranty periods or O & M contracts to discourage "cheapening".**
- **Costs: Shared Savings plans.**
- **Performance Goals:**
  - **Bonuses for exceeding business performance requirements**
- **Discourage 'save now – pay later' approach.**

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'The Deal' - Contracts

Give Each Party A Stake In Achieving Project Goals

NEGATIVE REINFORCEMENT (...and Sticks)

- **Liquidated damages:**
  - **If using penalties for late delivery; consider bonuses for early completion**
- **Adjustment required for the owner's role in project execution.**
- **Condition acceptance and final payment on passing clearly defined performance tests.**
  - **Pay for Performance and 'profit-at-risk'**

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"Superman" Language

"…we will provide world class…"

"…our superior expertise…"

"…the best design and construction personnel…"

When in Doubt – Avoid using it.

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Effective Design-Build Execution
Start with the End in Mind

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Planning Considerations

Including, but not limited to…

- Administrative
- Execution Logistics
- Start-up/ Testing
- Acceptance Criteria
- Operational

Frequently Overlooked items

- Resource Constraints
- Supply Constraints
- Acceptance Criteria
  - (when are you done?)
- Transfer\Transition

The Unexpected

(Expect It!)

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Critical Issue
"Performance" versus "Prescription"

Project Critical Point - Scope Definition:

- Owner's RFP provides adequate definition of…
  - capacity,
  - quality level,
  - performance requirements,
  - 'Post-construction' support and
  - final deliverables (record drawings, O&M manuals, etc.).
- Operational Goals, Testing & Acceptance Criteria are specified in writing.

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Critical Issue
"Performance" versus "Prescription"

Project Critical Point - Scope Definition:

- **D|B Proposal defines**
  - **work/project boundaries**
  - **services provided.**
- **define what is *not* being provided as well as what is!**
- **Pre-determined design specifications and Lump Sum bids:**
  - **For D|B firm - can be seen as implied or expressed warranty**
  - **For Owner – can be seen as 'direction' or 'interference'**

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Identify Project Assumptions

- **Rules of Engagement**
- **Resources**
- **Project Conditions**
- **Other…**
- **Codes, Regulations, Standards and Permit requirements**
- **Labor**
- **Materials/Equipment**
- **Procurement Schedules**
- **Existing Infrastructure**
- **Transportation & Communications**
- **Technology Platforms**
- **'the neighbors'**
- **Testing and Operation**
- **Economic Drivers (Exchange Rates)**

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Vehicle Bid Sheet

• Item	• Requirement
• Year 'in service'	• 2005 – 2007
• Body Type	• Sedan
• Seating Capacity	• 4 adults
• Features	• Leather, sunroof, CD player
• Transmission	• Auto or Manual
• Fuel Economy	• 24 highway/18 city
• Performance	• 0 – 60 under 7.5s
• Drive Arrg't	• Rear wheel

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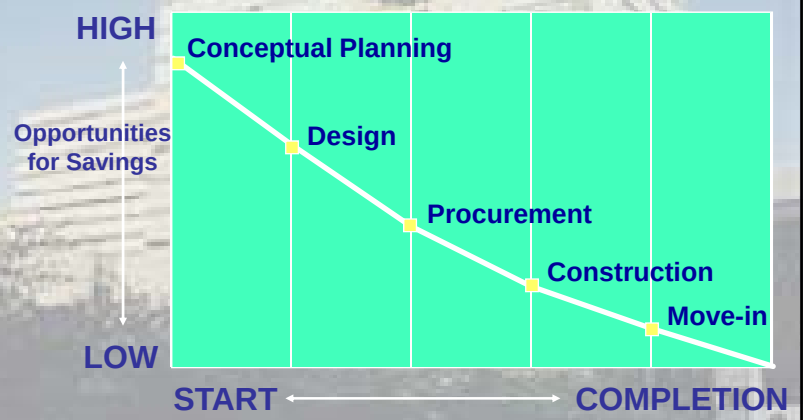
Value of Early Involvement



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Risk and Design Build

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Risk and Design Build

Typical Design|Build:

- **Design-Build firm bears total responsibility for cost and schedule**

With Green Buildings…

- **Additional risk of certification (or failure to achieve)**

Which can create "downstream" damages like…

- **loss in value;**
- **increased operations cost.**

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Additional Risks for D|B Entity

- **Price Risks**
  - **fluctuation of commodity prices**
- **Schedule guarantees**
  - **(contract fulfillment)**
- **Plant performance guarantees**
- **Site-specific risks**
- **Logistical risks**
- **Safety risks**

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Risk Management – Risk Allocation

- **Be Realistic:**
  - Do not expect to shift risk without paying for that shift.
- **Traditional Execution**
  - Design Risk - Owner (and Design Professional as 'agent')
  - Construction Risk - the Contractor
- **Design-Build Execution**
  - Adequacy of design – the D|B entity.
  - Quality of construction – D|B entity.
  - Cost Control – the D|B entity
  - Schedule Compliance – the D|B entity.

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Just in case you were wondering…

Comparison of risks in traditional project delivery vs. design/build delivery.

TRADITIONAL	DESIGN-BUILD
✓ Late Design	✓ No
✓ Incomplete Design	✓ No
✓ Unclear Design	✓ No
✓ Incorrect Design	✓ No
✓ RFIs	✓ They're in there!

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Green Design/Build Summary

Green Building projects:

- requires close cooperation between all project parties incl. (the owner).
- certification requires specific building features.
- have many 'jointly controlled' certification categories

Design|Build execution:

- integrated design\construction team.
- creates positive arrangement for green projects
- is not well 'structured' for 'joint' control.
  - Owner is 'silent' partner

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Green Design/Build Summary

- inherent design/construct integration
- 'incentives' must be aligned
  - (long term vs. short term thinking)
- Clear Scope of Work\Scope of 'Supply'
  - completion date; budget; certification level, etc.
  - in both RFP and Proposal
  - Consider 2 step process
- Contract must have provisions to 'choose' governing factors if problems arise.

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Thank You!!
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That 'black box' feeling...
• How does the Owner 'monitor' the project during 'development' and before completion to 'insure' the outcome?
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Approval of Approach & Execution

Project Critical Point – Client Design Approval & Review:

- **Hands-on approach during design…**
  - **'prescriptive' design direction**
  - **Scope creep and change orders**
- **Hands on approach during construction…**
  - **'Means and methods', scope creep and change orders**
- ***Inappropriate client participation can affect the cost and quality of work as well as the project schedule.***

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Getting what you paid for…

- **How to 'define' or measure quality and how to distinguish design quality from construction quality.**

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Quality - definition, control & assurance

Project Critical Point – Quality Definition, Control & Assurance:

- **…defines the expected level of performance;**
- **…'means & methods' are dictated by industry 'custom & practice' and specific requirements of manufacture**
- **Quality control and quality assurance:**
  - **Process, procedures and workmanship (construction).**
- **D|B entity must 'self-referee' performance.**
- **'Performance' of this type is covered under the typical 'warranty' expectations of quality of work.**

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Professional Bio

- Drexel University, Bachelor of Science, Mechanical Engineering, 1981
- Professional Engineer: Pennsylvania, New Jersey, New York, Connecticut, California, Michigan, Illinois, Georgia, Kentucky, Texas; US Green Building Council LEED Accredited Professional
- Professional Affiliations: American Bar Association, American Society of Heating, Refrigeration, and Air Conditioning Engineers, International Society of Pharmaceutical Engineering, US Green Building Council, Defense Research Institute
- Over 25 years of extensive experience with both domestic and international projects including management consulting and problem solving, engineering design, project and construction management forensic engineering and construction claims analysis. Mr. Swann's career includes the analysis, evaluation and design of complex systems across a wide range of industries and buildings types including commercial, institutional and industrial facilities, hospitals laboratories, pharmaceutical manufacturing, microelectronic operations and data centers. Mr. Swann has chaired technical committee within national and international organizations and been a contributing author and editor for a number of technical publications and journals. He is a frequent speaker both nationally and internationally and is a listed member of the speakers' bureau in the Distinguished Lecturer program of ASHRAE. He has recently presented on Green Building issues in Indiana, Chicago, Kansas City, Virginia, New York and Delaware. He is a contributing author to the ASHRAE "Green Guide – The Design, Construction and Operation of Sustainable Buildings" and co-author of the ASHRAE Survival Guide to Design|Build Project Execution.
- Other Activities: The Engineer's Club of Philadelphia – Board of Directors; Drexel University - Alumni Board of Governors

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