



L.E.E.D. *READY* COURSE

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN-NC 2.2

FALL 2007

LEED-NC

80 ques - 2 hr 1.5min/ques

170/200 = 85% 2.5pt/ques

Nov 2 LA / Nov 9 NYC / Nov 29 Houston

instructor: Umber Kazmi
umberk@gmail.com



GRADING CRITERIA

TECHNICAL KNOWLEDGE	Knowledge of LEED Rating System Implement LEED-NC Process
DESIGN PROCESS	Coordinate Project and Team Technical Analysis of Design

QUESTION TYPES

Credit based	Fees
Process	Project Scenarios
Terminology	Project Phases

EXAM BREAKDOWN

70%	LEED-NC Rating System
20%	Standards/Laws
10%	Certification Process

QUESTION FORMAT

Multiple Choice
select 1 / 2 / 3



A PPI Partner

LEED-NC

New Construction and Major Renovation
Version 2.2

LEED Links:

www.funkaarstudios.com/leedlinks.php

Sustainable Sites

SS Pre 1: Construction Activity Pollution Prevention

- Construction Activity Pollution Prevention
- Intent: sediment control during construction
- Requirements:
 - **Erosion Sediment Control Plan** to meet 2003 EPA General Construction Permit (CGP) or local codes whichever is more stringent.
- Strategies:
 - Best Management Practices (BMP)
Silt fences, mulching, seeding, basins, traps etc
- Usually met by Storm Water Pollution Prevention Plan (SWPPP) required by most jurisdictions



www.funkaarstudios.com

Fall 2007 27

SS 1: Site Selection

- Requirement: Do not develop on restricted sites:
 - Farmland as defined by USDA **7CFR** (currently used as farmland and able to support crop and animal farming)
 - Previously undeveloped 0-5ft above **FEMA** flood elevation
 - Threatened / Endangered species habitat per **50CFR**
 - Within 100ft of Wetlands as defined by EPA **40CFR** (permanently saturated ground that supports habitat)
 - Within 50ft of water body as defined by **CWA** (seas, lakes, rivers, streams, etc that support marine life)
 - Public parks unless replaced



www.funkaarstudios.com

Fall 2007 28

SS 2: Development Density & Community Connectivity

- Intent: reduce infrastructure extension /protect greenfields
- Requirements:
 - Option 1: Development Density
 - Minimum density=60,000sf/acre within Density Radius
 - Density Radius = $3\sqrt{\text{Site Area in sqft}}$
 - Option 2: Community Connectivity
 - Within 1/2 mile of Residential Zoned Area
 - OR within 1/2 mile, average density = 10units/acre
 - AND within 1/2 mile radius of (10) Basic Services (one of each: bank, laundry, grocery, library, post-office, police, etc) and (two max restaurants) Requirements:
- Submit MAP for either Option



www.funkaarstudios.com

Fall 2007 29

SS 3: Brownfield Redevelopment

- Requirements:
 - Option 1: Develop on contaminated site as found by ASTM E1903-97 and defined by EPA
 - Option 2: defined by local, federal, state
- Submittal:
 - Required Narrative detailing remediation action taken



www.funkaarstudios.com

Fall 2007 30

SS 4 Alternative Transportation

- Intent: Reduce Automobile use
- SS 4.1: Public Transportation
- SS 4.2: Bike Storage & Changing Rooms
- SS 4.3: Low-e & Fuel Efficient Vehicles
- SS 4.4: Parking Capacity



www.funkaarstudios.com

Fall 2007 31

SS 4.1 Public Transportation

- Requirements:
 - Option 1: Train station within 1/2 mile walk from site
 - Option 2: (2) busline stops within 1/4 mile walk from site
- Submittal:
 - Map showing linear path



www.funkaarstudios.com

Fall 2007 32

SS 4.2 Bike Storage & Changing Rooms

- Requirements:
 - Option 1 COMMERCIAL within 200yds of building entrance, provide bike storage for 5% occupants AND shower/changing rooms for 0.5% FTE
 - Full Time Equivalent (FTE) is based on 8hr work day occupants. (ie double shift employee=2FTE)
 - Option 2 RESIDENTIAL provide covered bike storage for 15% occupants
- Submittal
 - Site/Floor plan with calculations



www.funkaarstudios.com

Fall 2007 33

SS 4.3 Low-Emitting & Fuel Efficient Vehicles

- Requirements:
 - Option 1: provide LEV or FEV as classified as ZEV by California Air Resources Board OR 40min greenscore on ACEEE Greenbook for 3% of FTE AND preferred parking
 - Option 2: preferred parking for LEV or FEV for 5% of total parking
 - Option 3: fueling station for LEV or FEV for 3% of total parking



www.funkaarstudios.com

Fall 2007 34

SS 4.4 Parking Capacity

- Requirements
 - Option 1: NON-RESIDENTIAL Minimum parking by zoning AND van/carpool preferred parking for 5% of total parking
 - Option 2: NON-RESIDENTIAL where parking < 5% FTE, van/carpool preferred parking for 5% of total parking
 - Option 3: RESIDENTIAL minimum parking by zoning AND carpool Infrastructure: carpool service, vanpool parking, drop-off, ride boards
 - Option 4: No new parking



www.funkaarstudios.com

Fall 2007 35

SS 5 Site Development

- SS 5.1 Protect or Restore Habitat
- SS 5.2 Maximize Open Space



www.funkaarstudios.com

Fall 2007 36

SS 5.1 Protect or Restore Habitat

- Intent: protect/restore existing natural areas
 - Option 1 GREENFIELDS limited site disturbance
 - 40ft from building perimeter
 - 25ft from construction permeable areas (sports fields)
 - 15ft from curbs
 - 10ft from paving
 - 1ft diameter around utility posts
 - Option 2 PREVIOUSLY DEVELOPED
 - Protect/restore 50% of open site area with native/adaptive vegetation.
 - Protect/restore 20% of site area with Green Roof
 - Native/Adaptive plants are adjusted to local climate to use less water



www.funkaarstudios.com

Fall 2007 37

SS 5.2 Maximize Open Space

- Intent: limit development footprint (building and paving)
- Requirements:
 - Option 1: ZONED → Open space = 125% zoning
 - Option 2: UNZONED → Open space = Bldg footprint
 - Option 3: ZONED ZERO → Open space = 20% site area
 - Open space must be vegetated
 - Green Roofs and Wetlands allowed as open space
 - Submittal: Landscape Plan with calculations



www.funkaarstudios.com

Fall 2007 38

SS 6 Stormwater Design

- Intent: reduce run-off , increase natural absorption on site
- SS 6.1 Quality Control
- SS 6.2 Quality Control



www.funkaarstudios.com

Fall 2007 39

SS 6.1 Quality Control

- Requirements:
 - Option 1: If existing IMPERVIOUS ≥ 50% of site → new run-off = existing
 - Option 2: If existing IMPERVIOUS < 50% of site → new run-off ≤ 75% existing
 - Strategies: increase pervious surfaces, stormwater collection



www.funkaarstudios.com

Fall 2007 40

SS 6.2: Quality Control

- Requirements:
 - Catch and treat 90% run-off
 - Remove 80% of total suspended solids (TSS) before release off-site



www.funkaarstudios.com

Fall 2007 41

SS 7 Heat Island Affect

- Intent: reduce microclimate affect on habitat
- SS 7.1: Non-Roof
- SS 7.2: Roof



www.funkaarstudios.com

Fall 2007 42

SS7.1 Non-Roof

- Requirements
 - Option 1: 50% of hardscape is shaded/open-grid/min SRI 29
 - Solar Reflectance Index (SRI) is a measure of material heat reflectance + emittance
 - SRI zero = black surface (0.05 reflectance + 0.9 emittance)
 - SRI 100 = white surface (0.8 reflectance + 0.9 emittance)
 - Standard gray concrete = SRI 35 / White concrete = SRI 86
 - Asphalt = SRI Zero
 - Open Grid needs 50% permeable surface cells
 - Option 2: 50% covered total parking with shade cover min SRI 29



www.funkaarstudios.com

Fall 2007 43

SS 7.2 :Roof

- Requirements:
 - Option 1: min SRI for 75% of total roof area
 - slope ≤ 2:12 = SRI 78
 - Slope > 2:12 = SRI 29
 - Option 2: Green Roof for 50% of total roof area
 - Option 3: Combined = (SRI area/0.75) + (GR area/0.5) ≥ Total Roof



www.funkaarstudios.com

Fall 2007 44

SS 8: Light Pollution Reduction

- Intent: reduce light trespass or sky-glow to improve night sky for habitat
- Requirements:
 - Option 1 INTERIOR:
 - zero leakage through windows
 - OR auto-off sensors during non-use
 - Option 2 EXTERIOR
 - Design to max 80% light density + max 50% façade lighting density per IESNA 90.1
 - comply with IESNA RP-33 zones
 - LZ1: Parks = 0.01fc max beyond site
 - LZ2: Residential = 0.10fc at boundary + 0.01 max beyond site
 - LZ3: Commercial/Industrial = 0.2fc at boundary + 0.01 max beyond site



www.funkaarstudios.com

Fall 2007 45

Water Efficiency

WE 1: Water Efficient Landscaping

- Intent: reduce potable (drinkable/clean) water consumption
- WE 1.1 Reduce by 50%
- WE 1.2 No Potable Water Use or No Irrigation



www.funkaarstudios.com

Fall 2007 47

WE 1.1: Reduce by 50%

- Requirements:
 - Reduce irrigation water use by 50% from mid-summer Baseline Case
 - Total Water Applied (TWA)
 - Total Potable Water Applied (TPWA)
 - based on plant species factor, irrigation efficiency, rainwater use, recycled water use, city treated water use
 - Evapotranspiration rate measures total water needed average regional plants.



www.funkaarstudios.com

Fall 2007 48

WE 1.2: No Potable Water Use or No Irrigation

- Requirements:
 - Option 1: use only rainwater, recycled waste water, recycled gray water, or city treated water
 - Option 2: No permanent irrigation system



www.funkaarstudios.com

Fall 2007 49

WE 2: Innovative Wastewater Technologies

- Requirements:
 - Option 1: Reduce potable water use by 50% from Baseline Case for total annual volume in gallons
 - Based on code requirement for number of fixtures
 - Daily frequency of use
 - Fixture flow rates from EPA Energy Policy Act 1992
 - Water-conservation fixtures or non-water water use
 - Option 2: Treat and use 50% of wastewater on-site
 - Package systems, wetlands, other filtration systems



www.funkaarstudios.com

Fall 2007 50

WE 3.1: Water Use Reduction

- Requirements:
 - 20% potable water use reduction from baseline case
 - EPA Energy Policy Act 1992 Fixture performance
 - Strategies: waterless urinals, low flush toilets, automatic sensors,



www.funkaarstudios.com

Fall 2007 51

Energy & Atmosphere

EA Pre 1: Bldg Energy Systems Fundamental Commissioning

- Intent: verify optimal performance of systems
- Requirements:
 - Commissioning within 10 days of Substantial Completion for: HVAC + Lighting + Hot water + Renewable Energy
 - Commissioning process: startup, calibration, training of maintenance, balancing, etc
 - Commissioning Authority (CxA) to review, lead and oversee commissioning
 - Ideally a licensed engineer with (2) bldg commissioning experience
 - Can be employee but not team member for design team (exception: bldgs<50,000sf → CxA can be team member)
 - Reports directly to Owner (not design team)
- Submittal:
 - Owner Project Requirements (OPR) – produced by owner stating goals (future expansion, LEED, indoor air quality, system expectations, maintenance expectations)
 - Basis of Design (BOD) – produced by design team stating (assumptions based on OPE, standards used/cited, narratives of systems recommended)
 - CxA responsibilities: Commissioning Plan – outline of process, order, responsibilities, timeline for testing. + Summary of Commissioning Report



www.funkaarstudios.com

Fall 2007 53

EA Pre 2: Minimum Energy Performance

- Requirements:
 - ASHRAE 90.1 mandatory compliance
 - ASHRAE 90.1 prescriptive OR performance
 - Performance compliance is based on annual Energy Cost Budget that exceeds the standard in comparison to design Performance Rating



www.funkaarstudios.com

Fall 2007 54

EA Pre 3: Fundamental Refrigerant Management

- Requirements:
 - Option 1 NEW BUILDINGS
 - Zero use of Chlorofluorocarbons (CFC)
 - Select
 - Option 2 EXISTING BUILDINGS
 - Phase-out plan of CFC to HCFC or HFC or natural (CO₂, Propane)
 - Minimize CFC leakage during phase-out
 - Select refrigerant based on EPA CAA: Ozone Depletion + Global Warming



www.funkaarstudios.com

Fall 2007 55

EA 1: Optimize Energy Performance

- Requirements:
 - Option 1: Whole Building Energy Simulation
 - Establish annual baseline energy cost per ASHRAE 90.1
 - Energy cost reduction from baseline: starting 10.5% with 3.5% incremental increase with max 42%
 - 1-10 points
 - Default process energy is 25% of baseline (computers, appliances, kitchen equip, laundry, etc) + (bldgs with less must submit calculation)
 - Option 2: Prescriptive Compliance
 - Compliance with ASHRAE Advanced Energy Design Guide
 - Only for office + under 20,000sf bldg
 - 4 points
 - Option 3: Prescriptive Compliance
 - Compliance with Advanced Building Benchmark
 - Only for office + under 20,000sf bldg
 - 1 point



www.funkaarstudios.com

Fall 2007 56

EA 2: Onsite Renewable Energy

- Requirements:
 - Use BASELINE from EA 1
 - OR BASELINE per DOE Commercial Buildings Energy Consumption Survey (CBECS)
 - Provide % of BASELINE to come from Onsite Renewable Energy
 - 2.5% energy cost from Renewable = 1pt
 - 7.5% = 2pt
 - 12.5% = 3pt
- Strategies:
 - Solar panels, wind turbines, geothermal, hydro, etc



www.funkaarstudios.com

Fall 2007 57

EA 3: Enhanced Commissioning

- Requirements:
 - CxA is independent (not employee of design team)
 - 10 month post-occupancy review with maintenance staff and occupants
 - Produce training manual
 - Re-review of OPR and BOD and Summary



www.funkaarstudios.com

Fall 2007 58

EA 4: Enhanced Refrigerant Management

- Requirements:
 - Option 1: Zero Refrigerants
 - Option 2: Building HVAC&R
 - with max threshold = $LCGWP + LCODP \times 10^5 \leq 100$
 - Based on Refrigerant leakage rate + end of life loss + recharge + equipment life



www.funkaarstudios.com

Fall 2007 59

EA 5: Measurement & Verification

- Requirements:
 - One year post occupancy M & V plan based on IPMVP Vol III
 - Option B: ECM Isolation
 - Option D: Calibrated Simulation
 - Strategies: system monitors for collection of data



www.funkaarstudios.com

Fall 2007 60

EA 6: Green Power

- Requirements:
 - 35% of baseline energy cost from renewable Green-e certified provider
 - 2 year contract



www.funkaarstudios.com

Fall 2007 61

Materials & Resources

MR Pre 1: Storage & Collection of Recyclables

- Requirements:
 - Designate central area for collection of recyclables :
 - Paper
 - cardboard
 - Metals
 - Glass
 - Plastics
 - Submit plan with storage location
 - Storage room area based on building area (ie 5000sf = 82sf min area)



www.funkaarstudios.com

Fall 2007 63

MR 1.1: Building Reuse (structure and envelope)

- Requirements:
 - Maintain 75% of existing walls, floors and roof
 - Based on square footage take-offs



www.funkaarstudios.com

Fall 2007 64

MR 1.2: Building Reuse (structure and envelope)

- Requirements:
 - Maintain 95% of existing walls, floors and roof



www.funkaarstudios.com

Fall 2007 65

MR 1.3: Building Reuse (non-structural)

- Requirements:
 - Maintain 50% of interior non-structural



www.funkaarstudios.com

Fall 2007 66

MR 2.1: Construction Waste Management

- Intent: divert construction waste from landfills by sending to salvage, recycling, donation, reuse
- Requirements:
 - Divert 50% by weight/volume off-hauled
 - Excavated soil is excluded from total volumes
 - Hazardous waste excluded



www.funkaarstudios.com

Fall 2007 67

MR 2.2: Construction Waste Management

- Intent: divert construction waste from landfills by sending to salvage, recycling, donation, reuse
- Requirements:
 - Divert 75% by weight/volume off-hauled



www.funkaarstudios.com

Fall 2007 68

MR 3.1: Material Reuse

- Intent: use salvaged, refurbished material value
- Requirements:
 - 5% of total material cost
 - Total material cost = 45% of total construction cost
 - Mechanical Electrical Plumbing and conveying systems excluded
 - Furniture included



www.funkaarstudios.com

Fall 2007 69

MR 3.2: Material Reuse

- Intent: use salvaged, refurbished material
- Requirements:
 - 10% of total material cost
 - Mechanical Electrical Plumbing and conveying systems excluded
 - Furniture included



www.funkaarstudios.com

Fall 2007 70

MR 4.1: Recycled Content (post-consumer + 1/2 pre-consumer)

- Requirements:
 - 10% of total material cost is recycled
 - Recycled content per ISO14021
 - Post Consumer: after purchase/use
 - Pre-consumer: manufacturing waste is worth half the value (ie actual \$2000 = calculated \$1000)
 - Mechanical Electrical Plumbing and conveying systems excluded
 - Furniture included



www.funkaarstudios.com

Fall 2007 71

MR 4.2: Recycled Content (post-consumer + 1/2 pre-consumer)

- Requirements:
 - 20% of total material cost is recycled



www.funkaarstudios.com

Fall 2007 72

MR 5.1: Regional Materials

- Requirements:
 - 10% building material cost should be regional
 - Regional materials are harvested, extracted, processed and manufacture within 500 miles of project
 - Fraction of material part of total assembly is allowed
 - Mechanical Electrical Plumbing and conveying systems excluded
 - Furniture included



www.funkaarstudios.com

Fall 2007 73

MR 5.2: Regional Materials

- Requirements:
 - 20% building material cost should be regional
 - Regional materials are harvested, extracted, processed and manufacture within 500 miles of project site
 - Mechanical Electrical Plumbing and conveying systems excluded
 - Furniture included



www.funkaarstudios.com

Fall 2007 74

MR 6: Rapidly Renewable Materials

- Requirements:
 - 2.5% of total cost is rapidly renewable material
 - Rapidly renewable materials have a 10year or less harvest cycle



www.funkaarstudios.com

Fall 2007 75

MR 7: Certified Wood

- Requirements:
 - 50% of wood is FSC certified wood



www.funkaarstudios.com

Fall 2007 76

Environmental Quality

EQ Pre1: Minimum IAQ Performance

- Requirements:
 - ASHRAE 62.1 compliance
 - Mechanical: Ventilation Rate Procedure
 - Natural: operable window 4% of floor area and within 25ft of space



www.funkaarstudios.com

Fall 2007 78

EQ Pre2: Environmental Tobacco Smoke Control (ETS)

- Requirements:
 - Option 1: NON SMOKING
 - Designate exterior smoking areas 25ft+ from entries, operable windows and air intakes
 - Option 2: SMOKING
 - Designate interior smoking areas with deck-to-deck partitioning and exhaust
 - Designate exterior smoking areas 25ft+ from entries, operable windows and air intakes
 - Option 3: RESIDENTIAL
 - Residential Unit max leakage 1.25sqin/100sqft
 - Common areas nonsmoking
 - corridors with positive pressure
 - Designate exterior smoking areas 25ft+ from entries, operable windows and air intakes



www.funkaarstudios.com

Fall 2007 79

EQ 1: Outdoor Air Delivery Monitoring

- Requirements:
 - Option 1: MECHANICAL
 - Provide CO2 monitor (max 1000ppm)
 - Measure 15% outdoor air delivery variance from ASHRAE 62.1 design
 - Option 2: NATURAL
 - Provide CO2 monitor



www.funkaarstudios.com

Fall 2007 80

EQ 2: Increased Ventilation

- Requirements:



www.funkaarstudios.com

Fall 2007 81

EQ 3.1: Construction IAQ Management Plan (construction)

- Requirements:



www.funkaarstudios.com

Fall 2007 82

EQ 3.2: Construction IAQ Management Plan (pre-occupancy)

- Requirements:



www.funkaarstudios.com

Fall 2007 83

EQ 4.1: Low-Emitting Materials (adhesives & sealants)

- Requirements:



www.funkaarstudios.com

Fall 2007 84

EQ 4.2: Low-Emitting Materials (paints & coatings)

- Requirements:



www.funkaarstudios.com

Fall 2007 85

EQ 4.3: Low-Emitting Materials (carpet)

- Requirements:



www.funkaarstudios.com

Fall 2007 86

EQ 4.4: Low-Emitting Materials (composite wood & agrifiber)

- Requirements:



www.funkaarstudios.com

Fall 2007 87

EQ 5: Indoor Chemical Pollutant Source Control

- Requirements:



www.funkaarstudios.com

Fall 2007 88

EQ 6.1: Controllability of Systems (lighting)

- Requirements:



www.funkaarstudios.com

Fall 2007 89

EQ 6.2: Controllability of Systems (Thermal Comfort)

- Requirements:



www.funkaarstudios.com

Fall 2007 90

EQ 7.1: Thermal Comfort (design)

- Requirements:



www.funkaarstudios.com

Fall 2007 91

EQ 7.1: Thermal Comfort (verification)

- Requirements:



www.funkaarstudios.com

Fall 2007 92



STUDY METHODOLOGY

(1) WEEK

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN-NC v2.2

FALL 2007

TEXTBOOK: USGBC PPI **LEED-NC V2.2 REFERENCE GUIDE**
LEED-NC SAMPLE QUESTIONS

LEED-NC ACCREDITATION EXAM **MULTIPLE CHOICE**

Day 1	CLASS DAY		→	6 hrs	Study Time 30 hrs
Day 2	SS	→	15min/credit	→ 4	
Day 3	WE + EA	→	15min/credit	→ 4	
Day 4	EA	→	15min/credit	→ 4	
Day 5	MR	→	15min/credit	→ 4	
Day 6	EQ	→	15min/credit	→ 4	
Day 7	ID	→	5min/credit	→ 1	
	Standards / Laws	→	10min/website	→ 4	
	On-Line + Mock Exams			→ 2	
Day 8	EXAM DAY		morning 9 am	→ 2	

90% **STUDYING** (Information gathering / Reading / On-line Research)
10% **ACTIVE PRACTICE** (Mock Exams / Answering approaches)

4 - HR **BREAKDOWN** daily study routine = 1hr morning + 1hr lunch + 2hr plus evening

NOTE: This is a recommended approach to studying for each exam. Students can modify this for individual needs.