LOOKING BACK / LOOKING FORWARD:

Catholic intellectual culture, sustainability and the necessity of traditional building and campus design









Truth revealed by God

Truth discovered through reason

RENEWING THE CAMPUS: SUSTAINABILITY AND THE CATHOLIC UNIVERSITY

PROF. SAMANTHA SALDEN • UNIVERSITY OF NOTRE DAME • OCTOBER 2009 • PROF. PHILIP BESS









Bruges, Belgium / chartered 1128

RENEWING THE CAMPUS: SUSTAINABILITY AND THE CATHOLIC UNIVERSITY

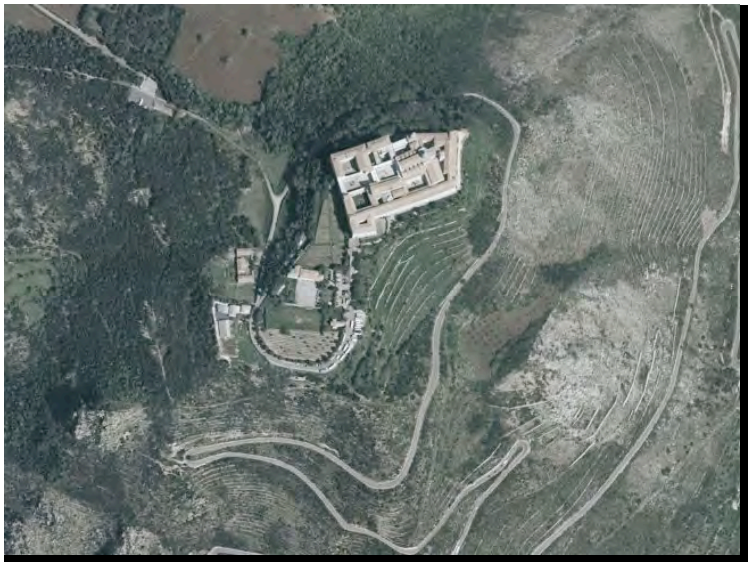
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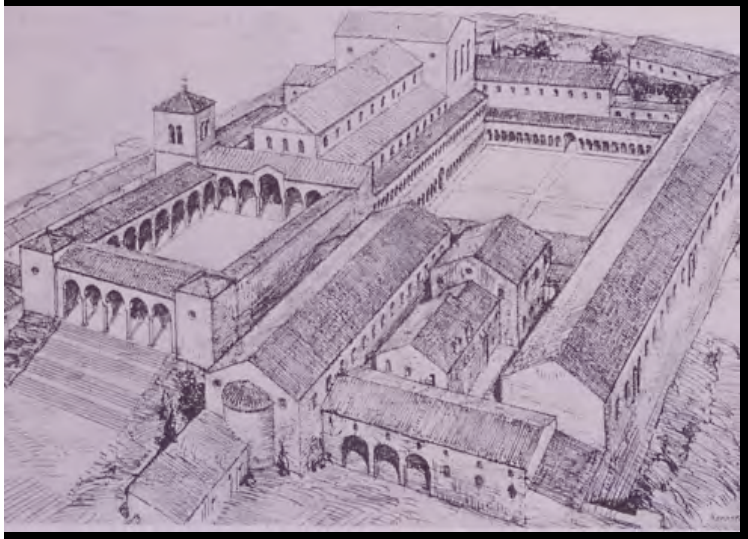
The Catholic Worldview / Catholic Metaphysics

- The World / Creation is real
- The World / Creation is good (albeit fallen and in need of redemption)
- The World / Creation is intelligible, and can be known truly
- The World / Creation is teleological, moving toward its end, who is God
- The World / Creation is "sacramentally charged," providing arenas, occasions and means for God's presence therein

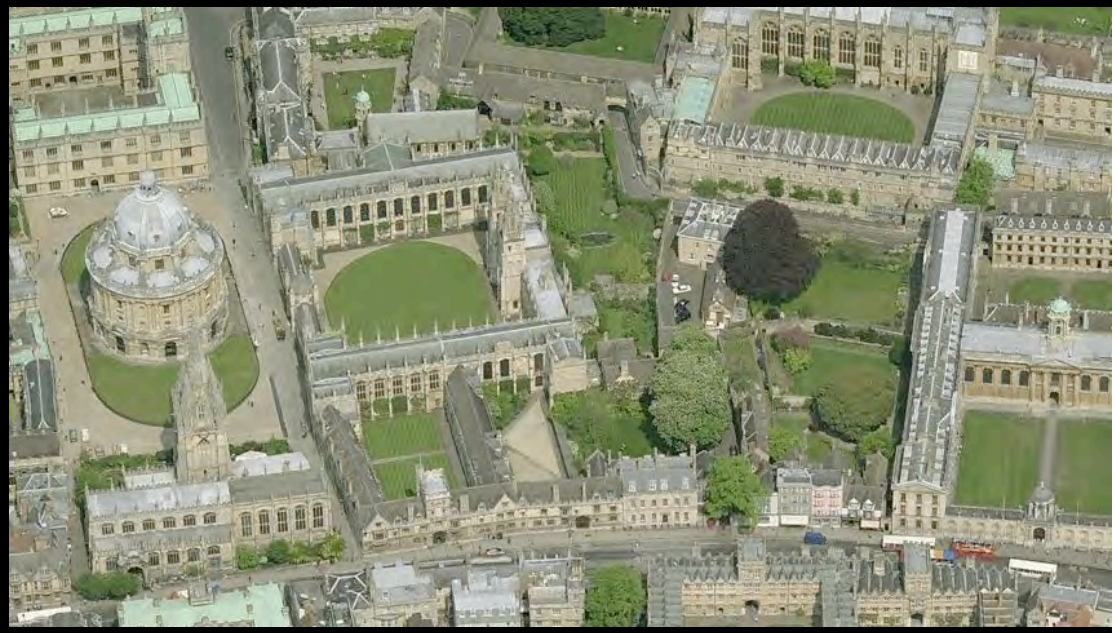
Themes of Catholic Social Teaching

- The dignity of the human person
- Concern for the common good
- The human being as social animal and moral agent
- Communal solidarity
- Subsidiarity in political authority
- Environmental stewardship
- Attention to the effect of policies upon the poor





Benedictine abbey, Montecassino, Italy (monastic)



Oxford University, Oxford, England (urban)







Thomas Aquinas College, Santa Paula, California – (quasi) monastic

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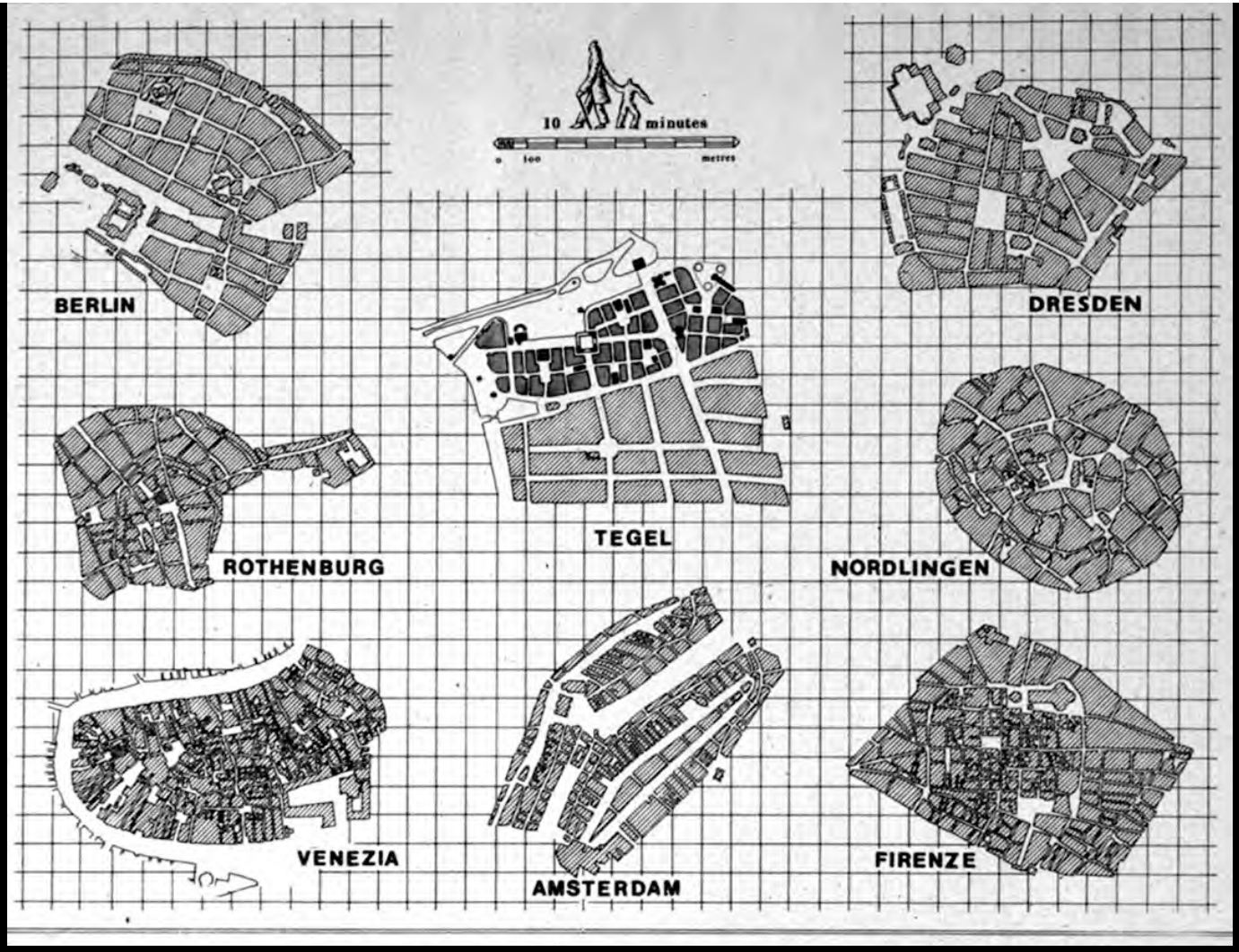
Georgetown University, Washington DC (urban)

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University of Notre Dame (monastic-to-urban?)



The MEASURE of good urbanism: the 1/2 mile (10-minute) walk

Historic Centers of pre-modern European cities at same scale (circles represent ½ mile diameter)

Grape Road, Mishawaka, IN

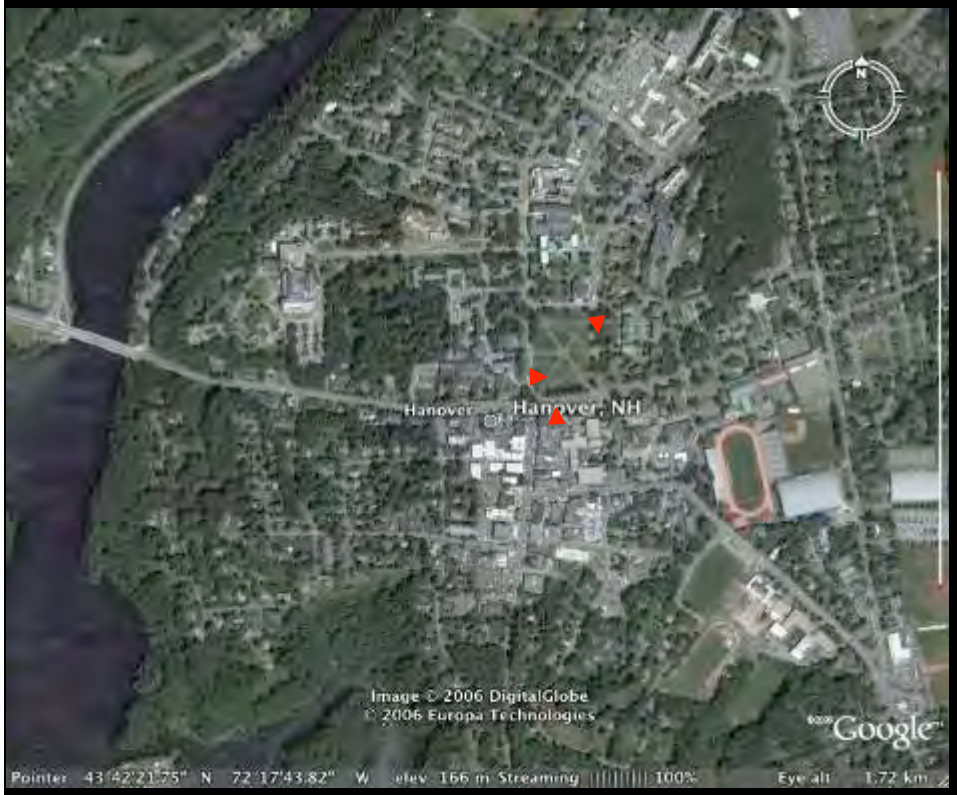


Woodfield Mall, Schaumberg, IL



Post-1945 sprawl: scale of typical shopping zone development (circles represent ½ mile diameter)









Dartmouth College / Hanover, NH: "Vox clamantis in deserto…."





Harvard University - Harvard Square / Cambridge, MA



Traditional-construction bearing-wall / pitched roof buildings:
left to themselves (but don't), Notre Dame's "God Quad" (and oldest) buildings will last the longest



Modern-construction curtain-wall / flat-roof buildings:
maintained, Notre Dame's "Mod Quad" buildings will require more frequent renovation and repair





Brownson Hall (left) and Main Building (right) – two traditional bearing wall Notre Dame buildings



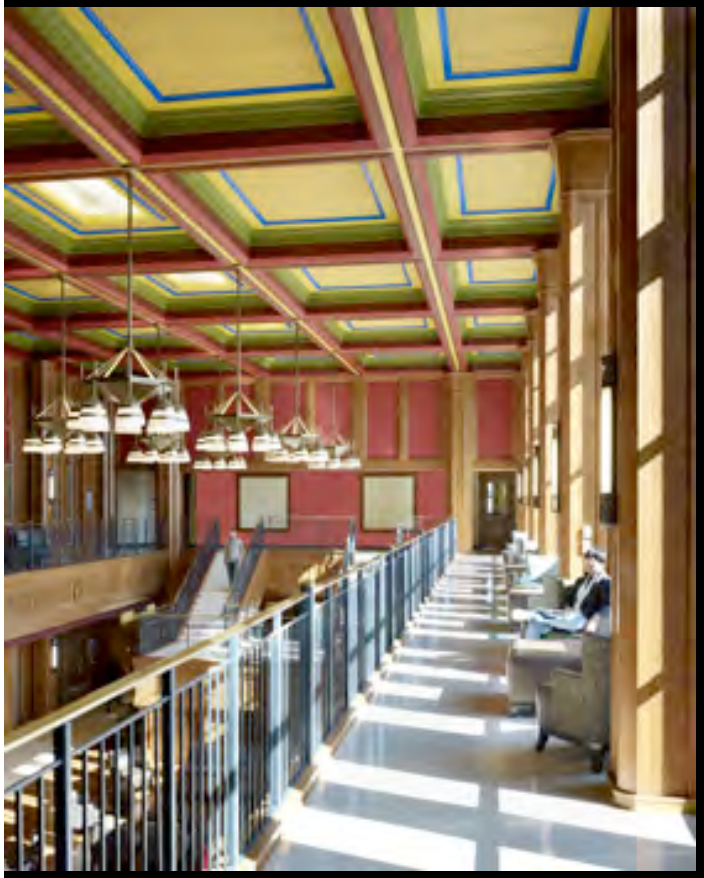
1800-year-old stair covered by 1800-year old brick vault at Hadrian’s Villa at Tivoli (near Rome)







New modern construction at Notre Dame (perhaps LEED certifiable)





New traditional bearing wall construction:
The Danforth University Center, Washington University, St. Louis -- a building “to last for 200 years”

GOING GREEN







Green products are available for every aspect of life—even from Saks Fifth Avenue.



GOING TO A GREEN COLLEGE



	Year	Overall Grade	Administration	Climate Change and Energy	Food and Recycling	Green Building	Student Involvement	Transportation	Endowment Transparency	Investment Priorities	Shareholder Engagement
Harvard University	2010	A-	A	A	A	B	B	A	C	A	A
University of Michigan–Ann Arbor	2010	B+	B	B	A	B	B	A	A	A	D
University of Notre Dame	2010	B	A	B	B	B	A	B	D	A	C
Boston College	2010	B	B	B	A	C	A	A	F	A	C
University of St. Thomas	2010	C+	A	C	B	D	C	C	D	A	D
DePaul University	2010	D+	D	D	B	C	D	D	F	C	F

68% of students say they would value having information about a college's commitment to the environment.

26% of students said such information would "very much" impact their decision to apply to or attend the school.

www.princetonreview.com www.greenreportcard.org

SOME CONTEXT

In the United States alone, buildings account for:

- 72% of electricity consumption,
- 39% of energy use,
- 38% of all carbon dioxide (CO2) emissions,
  Environmental Information Administration (2008). EIA Annual Energy Outlook
- 40% of raw materials use,
  Worldwatch Institute
- 30% of waste output (136 million tons annually)
  U.S. EPA (1997).
- 14% of potable water consumption.
  U.S. Geological Survey (2000). 2000 data.



Image courtesy of the
National Trust for Historic Preservation

What is “embodied energy” in buildings?

1. initial embodied energy, and
2. recurring embodied energy

Initial embodied energy refers to the non-renewable energy consumed in

- acquiring raw materials
- their processing, manufacture, and transportation to the site
- the construction of the building

Embodied Energy

Embodied energy in building materials has been studied for the past several decades by researchers interested in the relationship between building materials, construction processes, and their environmental impacts.

What is embodied energy?

There are two forms of embodied energy in buildings:

· ***Initial embodied energy;*** and
· ***Recurring embodied energy***

The ***Initial embodied energy*** in buildings represents the non-renewable energy consumed in the acquisition of raw materials, their processing, manufacturing, transportation to site, and construction. This initial embodied energy has two components:

Direct energy the energy used to transport building products to the site, and then to construct the building; and

Indirect energy the energy used to acquire, process, and manufacture the building materials, including any transportation related to these activities.

The ***recurring embodied energy*** in buildings represents the non-renewable energy consumed to maintain, repair, restore, refurbish or replace materials, components or systems during the life of the building.

As buildings become more energy-efficient, the ratio of embodied energy to lifetime consumption increases. Clearly, for buildings claiming to be "zero-energy" or "autonomous", the energy used in construction and final disposal takes on a new significance.

	EMBODIED ENERGY	
MATERIAL	MJ/kg	MJ/m3
Aggregate	0.10	150
Straw bale	0.24	31
Soil-cement	0.42	819
Stone (local)	0.79	2030
Concrete block	0.94	2350
Concrete (30 Mpa)	1.3	3180
Concrete precast	2.0	2780
Lumber	2.5	1380
Brick	2.5	5170
Cellulose insulation	3.3	112
Gypsum wallboard	6.1	5890
Particle board	8.0	4400
Aluminum (recycled)	8.1	21870
Steel (recycled)	8.9	37210
Shingles (asphalt)	9.0	4930
Plywood	10.4	5720
Mineral wool insulation	14.6	139
Glass	15.9	37550
Fiberglass insulation	30.3	970
Steel	32.0	251200
Zinc	51.0	371280
Brass	62.0	519560
PVC	70.0	93620
Copper	70.6	631164
Paint	93.3	117500
Linoleum	116	150930
Polystyrene Insulation	117	3770
Carpet (synthetic)	148	84900
Aluminum	227	515700

Direct Energy refers to the energy expended to bring building materials to a site and to construct the building itself; i.e., it concerns the proximate source of the building materials and the methods used for assembling them on site. For example: in South Bend, Italian marble requires more direct energy than Indiana limestone; and assembling a steel frame building with a crane requires more direct energy than laying up a solid masonry wall by hand.

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Indirect Energy is the energy used in the processing and manufacture of the materials themselves, including the cost of transporting their components from their point of origin in their raw state to their place of manufacture

The closer the finished material is to its natural state as taken from the earth---aggregate, straw bale, stone, lumber, brick---the lower its indirect embodied energy; and

The more complicated a material's manufacturing process---e.g. for plywood, fiberglass insulation, steel, linoleum, aluminum---the higher its indirect embodied energy

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Related to indirect energy, *recurring embodied energy* represents the non-renewable energy consumed to maintain, repair, restore or replace materials, components or systems over the life of the building; i.e., it is directly related to the durability of a building's materials and how frequently a building requires renovation. In other words: the use of non-durable building materials requires later expenditures of embodied energy

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REALITY OF WASTE



If we tear down one typical building in a North American downtown – 25 ft. wide and 100 or 120 or 140 ft. deep – we have wiped out the entire environmental benefit from the last 2.688,000 aluminum cans that were recycled.

Donovan Rypkema, National Trust for Historic Preservation



REALITY OF WASTE

Demolishing a 50,000 sq. ft. commercial building produces on average 40 tons of debris…the equivalent of 250 box cars--a train 2 miles long—headed for the landfill.





Replacing it is equivalent to the carbon release of driving 2.8 million miles.

LEED: THE INTENT



The Fitzpatrick Center at Duke University

- To create a national standard for green buildings
- To meet pent-up demand for reliable information with a rigorous rating system and a checklist

LEED: CRITICISMS OF THE SYSTEM

- Simply a marketing tool
- Misleading
- Clumsy
- Bureaucratic Red Tape
- Expensive
- Equivalency of Credits
- No Proof--Based only on paperwork
- LEED-Washing
  1) Not Following Through
  2) Valuing Gizmos Over Appropriate Design
  3) Laughably Inappropriate Use
  4) Wretched Excess.

	Credit Information		Phase	Involv	Pts	Key Requirement	Exemplary Performance	Reference
SS	PR 1	Const. Activity Pollution Prevention	Const.	DT/C		Prevent loss of soil/sedimentation/air pollution; Create ESC Plan		EPA 832R92005, Chapter 3 (NPDES)
	1	Site Selection	Design	O	1	No Dev.: Farmland, undev. land, endang. species, <100' of wetlands, <50' water body, public park		USDA, FEMA, Endangered species lists; 40CFR Parts 22, 230-33 'Wetlands' def.
	2	Dev. Density/Comm. Connectivity	Design	O/DT	1	Opt1: 60k sf/ac & prev. dev. Site; Opt2: prev. dev. site & ½ mi (reside+10units/ac, basic serv.) & pede	2x density or area	None
	3	Brownfield Redevelopment	Design	O	1	Develop on Phase I--documented contaminated site OR as defined by local, state, or federal agency		ASTM E1903-97 Phase II Environmental Site Assessment; EPA 'Brownfield' def.
	4.1	AT - Public Transportation Access	Design	O	1	½ mile of existing/planned/funded rail/subway OR ¼ mile 1+ slope of 2+ public/campus bus lines	2 rails or 4 bus &200 rides	None
	4.2	AT - Bike Storage/Changing Rooms	Design	DT/C	1	Comm. storage (5% peak) AND showers/changing (0.5% FTE); Resi: storage (15%+ occupants)	Comprehensive transportation management plan that quantifies/	None
	4.3	AT - L.E. & P.E. Vehicles	Design	O/DT	1	#1: LE/PE vehicles (3% FTE); #2: Pref. prkg. (5% capacity); #3: Refueling stations (3% capacity)		None
	4.4	AT - Parking Capacity	Design	O/DT	1	#1-C: =Zoning(5% carpool; #2-C: <5%-5% carpool; #3-R: =Zoning+carpool; #4-All: No new prkg	reduces automobile use	Portland Zoning (33.266); inst. of Trans. Eng. Parking Gen. (3rd Ed.)
	5.1	Site Dev. - Protect/Restore Habitat	Const.	O/DT/C	1	#1-Greenfield: 40(bldg), 10 (walkways),15(curbs),25 (basin); #2-Pre/Dev/Site: 50% site (excl. bldg.)	75% of site (excluding bldg)	None
	5.2	Site Dev. - Maximize Open Space	Design	O/DT	1	#1: >25% Zoning; #2: No zoning-Equal bldg footprint; #3: Zoning (no requirement)+20% of site area	Double amt of open space	None
	6.1	Stormwater Design - Quantity Ctrl	Design	DT	1	#1=Imperv ≤50%: Not exceed peak discharge; #2=Imperv >50%: Provide 25% volume decrease		None
	6.2	Stormwater Design - Quality Ctrl	Design	DT	1	BMP: Capture/treat 90% of rainfall AND remove 80% of post-development total suspended solids		EPA 840B92002 (Guidance Specifying Mgmt Measures …)
	7.1	Heat Island Effect - Non-Roof	Const.	DT/C	1	#1: 50% hardscape (3yr shade, SRI 29 paving, open-grid paving); #2: 50% covered parking w/SRI 29	100%: hi-alb/pav/3yr shad OR prkg	None
	7.2	Heat Island Effect - Roof	Design	DT/C	1	#1: 75% (SRI 29 or 78); #2: 50% vegetated roof; #3: SRI roof + ½(veg)roof + ½ = roof area	100% (excl. mech) green roof sys.	ASTM E1980-01, E408-71(1996)e1, E903-96, E1918-97, C137-1-04, C1549-04
	8	Light Pollution Reduction	Design	DT	1	INT: Not exit thru wdw OR auto-off; EXT: Power density (<40% areas & <70% façade/landscape)		ASHRAE/IESNA 90.1-2004, Section 9 (w/o amendments)
WE	1.1	WE Landscaping: Reduce by 50%	Design	DT	1	Measure from mid-summer baseline (species, efficiency, rainwater, recycled ww, treated by munic.)		None
	1.2	WE Landscaping: No Potable/Irrig.	Design	O/DT	1	Only rain, recycled ww/graywater, or treated by munic. OR no permanent irrigation (1-year temp. OK)		None
	2	Innovative Wastewater Tech.	Design	DT	1	#1: Water-conserving fixt or non-potable water; #2: 50% treatment on-site to tertiary standards	100% less potable OR 100% re-use	None
	3.1	Water Use Reduction - 20%	Design	DT	1	Est. occupant usage & include: water closets, urinals, lavatory faucets, showers & kitchen sinks	40% or greater water use reduction	EPAct of 1992 (water usage requirements)
	3.2	Water Use Reduction - 30%	Design	DT	1	Est. occupant usage & include: water closets, urinals, lavatory faucets, showers & kitchen sinks		
EA	PR 1	Fundamental Commissioning	Const.	O/DT/C		CxA (CCH, part, verify Install, summary), HVAC&R, Lighting/daylighting, hot water, renewable energy		None
	PR 2	Minimum Energy Performance	Design	DT		Mandatory provisions AND prescriptive or performance requirements		ASHRAE/IESNA 90.1-2004
	PR 3	Fundamental Refrigerant Mgmt	Design	O		Zero use of CFC-based ref. in new bldg; Comprehensive phase-out plan for existing bldg		None
	1	Optimize Energy Performance	Design	DT	10	#1: Calc energy costs; #2: Office <20k sf; #3: NOT health/warehouse/lab & <100k sf; #4: Vold	New: 45.5%; Existing: 38.5%	ASHRAE/IESNA 90.1-2004 / ASHRAE Adv Energy (2004) / Adv Bldg Core Perf.
	2	On-Site Renewable Energy	Design	DT	3	On-site, use energy cost from EA1 or DOE CBECS; 2.5% or 7.5% or 12.5%	Renewable energy ≥ 17.5%	ASHRAE/IESNA 90.1-2004
	3	Enhanced Commissioning	Const.	O/DT/C	1	Same as EA P/1 PLUS systems manual, training personnel, review operation within 10 months		None
	4	Enhanced Refrigerant Mgmt	Design	DT	1	#1: No ref*; #2: Sealed ref*; that minimize ODP & GWP compound emission (LCGWP+LCODP*105 ≤ 100)		None
	5	Measurement & Verification	Const.	DT	1	Develop & implement M&V plan (use Opt D or Opt B of IPMVP); M&V period no less than 1 year of occ.		Int'l Perf. M&V Protocol, Vol. 3 (Concepts & Options for Energ Svgs, 4/2003)
	6	Green Power	Const.	O	1	Use energy cost from EA1 or DOE CBECS; 35% from renewable sources (2-yr contract)	2x electricity OR 2x contract length	Center for Resource Solutions 'Green-e Product Certification Requirements
MR	Pr 1	Storage & Collection of Recyclables	Design	O/DT		Easily accessible area; includes mtrl :: paper, corrugated cardboard, glass, plastics, metals		None
	1.1	Bldg Reuse: 75% of Walls/Floor/Roof	Const.	O/DT	1	N/A for additions >2x orig. bldg.; includes structure & envelope, excludes windows & non-structural		None
	1.2	Bldg Reuse: 95% of Walls/Floor/Roof	Const.	O/DT	1	N/A for additions >2x orig. bldg.; includes structure & envelope, excludes windows & non-structural		None
	1.3	Bldg Reuse: 50% of Interior Non-stru.	Const.	O/DT	1	N/A for additions >2x orig. bldg.; includes interior non-structural (doors, ceiling, walls, floor coverings)		None
	2.1	Construction Waste Mgmt: 50%	Const.	C	1	Identify material and whether sorted on-site or co-mingled, calculations by weight OR volume, excludes	Total waste diverted ≥ 95%	None
	2.2	Construction Waste Mgmt: 75%	Const.	C	1	excavated soil and land-clearing debris		None
	3.1	Materials Reuse: 5%	Const.	DT/C	1	Use salvaged/refurbished/reused materials. Mechanical, electrical, plumbing components or specialty items	Salvaged/Reused materials ≥ 15% of total materials cost	None
	3.2	Materials Reuse: 10%	Const.	DT/C	1	(elevators, equipment, etc.) are excluded.		None
	4.1	Recycled Content: 10%	Const.	DT/C	1	Based on cost of materials OR weight of material assembly. Mechanical, electrical, plumbing components or	Total recycled value ≥ 30%	Int'l Standard ISO 14021-1999 (Environmental Labels & Declarations - Self-Declared
	4.2	Recycled Content: 20%	Const.	DT/C	1	specialty items (elevators, equipment, etc.) are excluded.		Environmental Claims (Type II Environmental Labeling)
	5.1	Regional Materials: 10%	Const.	DT/C	1	Use materials/products extracted/harvested/recovered and manufactured within 500 miles. Based on total	Harvested/extracted/manufactured ≥	None
	5.2	Regional Materials: 20%	Const.	DT/C	1	materials value. Mechanical, electrical, plumbing components or specialty items are excluded.	40%	None
	6	Rapidly Renewable Materials	Const.	DT/C	1	Materials/products made from plants that are harvested ≤10-year cycle.	Rapidly renewable mat'l = 5%	None
	7	Certified Wood	Const.	DT/C	1	Incl. struct./dimensional framing, flooring, sub-flooring, wood doors & finishes. Furn if used in MR3-7	≥ 95% FSC-certified wood	Forest Stewardship Council's Principles and Criteria
EQ	Pr 1	Minimum IAQ Performance	Design	DT		Meet minimum requirements of Section 4-7 of ASHRAE 62.1-2004		ASHRAE Standard 62.1-2004: Ventilation for Acceptable Indoor Air Quality
	Pr 2	Environmental Tobacco Smoke Ctrl	Design	O/DT		#1: No smkg, 25' dist., #2: #1+neg. press (5Pa); #3-R: No smkg, 25' dist., w/mstrip, seal penetrations		ANSI/ASTM-E779-03; Res. Min for Compliance w/CA's 2001 Energy Stds, Ch. 4
	1	Outdoor Air Delivery Monitoring	Design	DT	1	Mech Vent: CO2 monitor (3'-6' AFF) & outdoor airflow meas. device. Nat'l Vent: CO2 mon. (3'-6' AFF)		None
	2	Increased Ventilation	Design	DT	1	Mech Vent: ≥30% outdoor air abv min.. Nat Vent: 90% of occupied space, use macroscopic model		ASHRAE 62.1-2004; Carbon Trust Guide 237; CIBSE App. Manual 10; 2005
	3.1	Const. IAQ Mgmt: During Const.	Const.	C	1	IAQ Management plan, protect absorptive matl from moisture, MERV 8 for permanently installed air equip.		SMACNA IAQ Guidelines for Bldgs Under Const.; ANSI/ASHRAE 52.2-1999
	3.2	Const. IAQ Mgmt: Before Occupancy	Const.	C	1	#1: Flush-out (14K cfs/f & 60° & 60% humidity); #2: Air testing		EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air
	4.1	LE Matl: Adhesives & Sealants	Const.	DT/C	1	Adhesives, sealants, and sealant primers comply w/SCAQMD Rule #1168		South Coast (SCAQMD) Rule #1168 (10/3/03); Green Seal SE 36 (GS-36)
	4.2	LE Matl: Paints & Coatings	Const.	DT/C	1	VOC: 50 flat, 150 non-flat, 250 rust/stain/wirproof, 350 varn, 550 lacq, 100 fir, 200 sealer; 550 shellac		Green Seal Standard GS-11; Green Seal Standard GC-03
	4.3	LE Matl: Carpet Systems	Const.	DT	1	Carpet & cushion to meet Green Label Plus program, adhesive to meet EQ4.1 (VOC limit of 50g/L)		Carpet and Rug Institute Green Label Plus Testing Program
	4.4	LE Matl: Composite Wd & Agrifiber	Const.	DT/C	1	No added urea-formalde/phyde resins, include: particleboard, MDF, plywood, wheatlstrwboard, door cores		None
	5	Indoor Chem. & Pollutant Source Ctrl	Design	DT	1	6' entryway (maintain weekly), haz-gas (laundry/garage/copying) exhaust for neg. pressure, MERV 13		ANSI/ASHRAE 52.2-1999: Method of Testing Ventilation Air-Cleaning Devices
	6.1	Controllability of Systems: Lighting	Design	DT	1	Lighting controls for 90% of occupants AND controllability for all shared multi-occupant spaces		None
	6.2	Controllability of Systems: Thermal	Design	DT	1	50% indiv ctrls and/or operable wdws AND comfort systems for all shared multi-occupant spaces		ANSI/ASHRAE Standard 62.1-2004; ANSI/ASHRAE Standard 55-2004
	7.1	Thermal Comfort: Design	Design	DT	1	Design HVAC & building envelope to meet ASHRAE 55-2004		ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy
	7.2	Thermal Comfort: Verification	Design	O/DT	1	Survey of building occupants with 6-18 months. Develop corrective action if >20% dissatisfied		ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy
	8.1	Daylight & Views: 75% of Spaces	Design	DT	1	Affect 75%: #1: Calc (2% in 75%); #2: Computer simulation; #3: Measurement	95% daylighting	None
	8.2	Daylight & Views: 90% of Views	Design	DT	1	Line of sight to outdoors (30"-90" AFF) for bldg occupants in 90% of occupied areas	Decided on "case-by-case" basis	None
ID	1.1	Innovation in Design	Both	O/DT/C	1	In writing, identify the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the design approach (strategies) that might be used to meet the requirements.		None
	1.2	Innovation in Design	Both	O/DT/C	1			None
	1.3	Innovation in Design	Both	O/DT/C	1			None
	1.4	Innovation in Design	Both	O/DT/C	1			None
	2	LEED Accredited Professional	Const.	O/DT/C	1	At least one principal participant of the project team shall be a LEED AP		None



THE WIDE RANGE OF LEED CERTIFICATION



First LEED certified parking garage--Santa Monica, 2008



Right: A LEED certified 15,000 square foot home in Manalapan Beach, Florida

LEED: CRITICISMS OF THE SYSTEM





Adding a bike rack can earn as much credit as reusing an existing building according to the LEED rating system.

LEED BUILDINGS



LEED gold certified Lory Student Center, Colorado State University (Photo: Michael Kinsley)

LEED BUILDINGS





Washington University, St. Louis: The Danforth University Center
LEED Gold & Winner of the 2009 Palladio Award from Traditional Building Magazine

LEED BUILDINGS

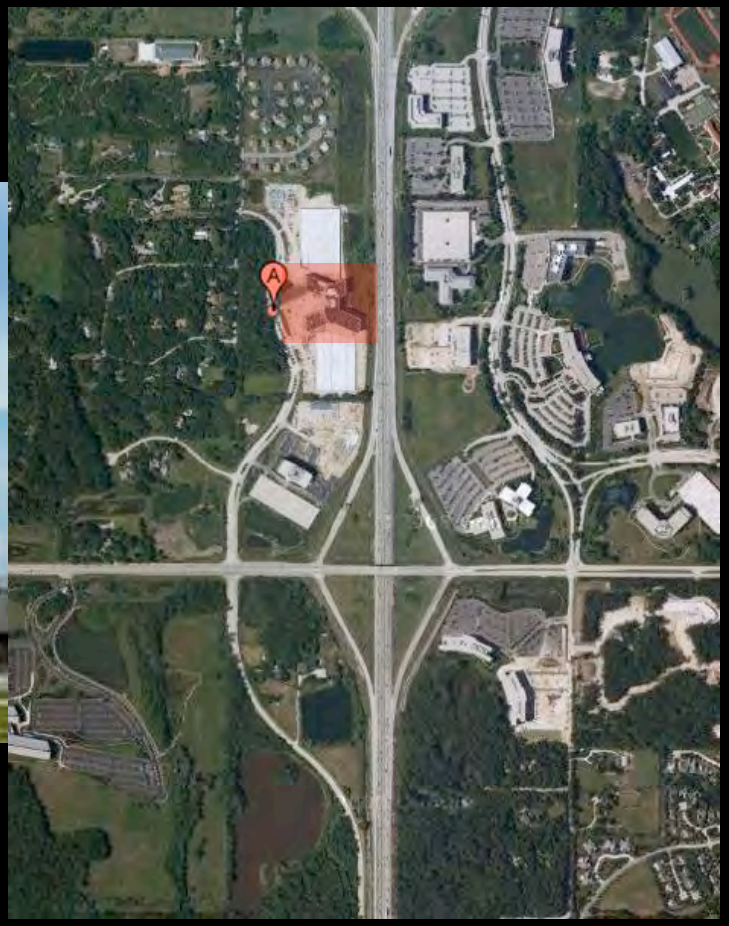




Both are considered “Green”, but will they both last?
What is the lifespan of each building?
40 years? 200 years?

GREEN BUILDING IS NOT SUSTAINABLE DEVELOPMENT





The HSBC Headquarters, newly LEED Gold Certified,
and an aerial view of its site.

GREEN BUILDING IS NOT SUSTAINABLE DEVELOPMENT



GREEN ACCESSORIES









Green accessories might include solar panels, green roofs, bike racks or wind turbines.

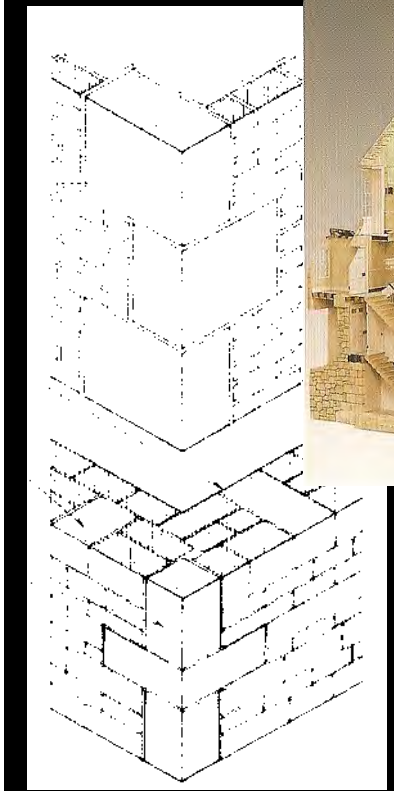
GREEN BUILDING

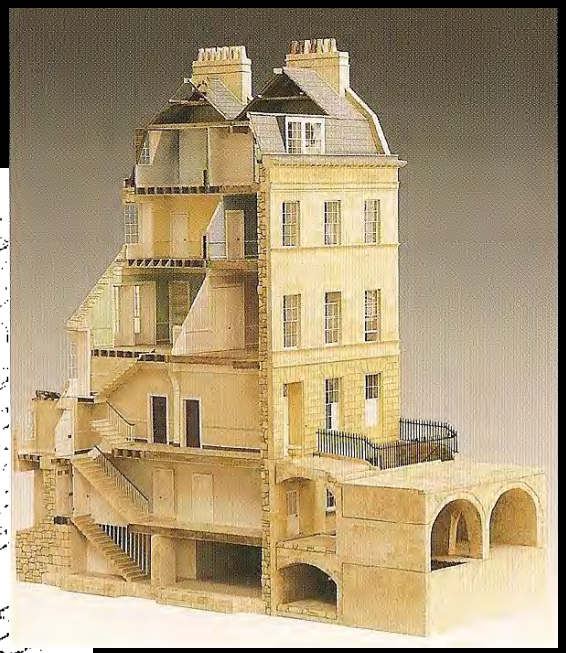




Left: Sustainability through traditional forms and materials.

GREEN BUILDING: WALLS





Load-bearing construction
~ gravitational forms of
nature vs. structural sealants.

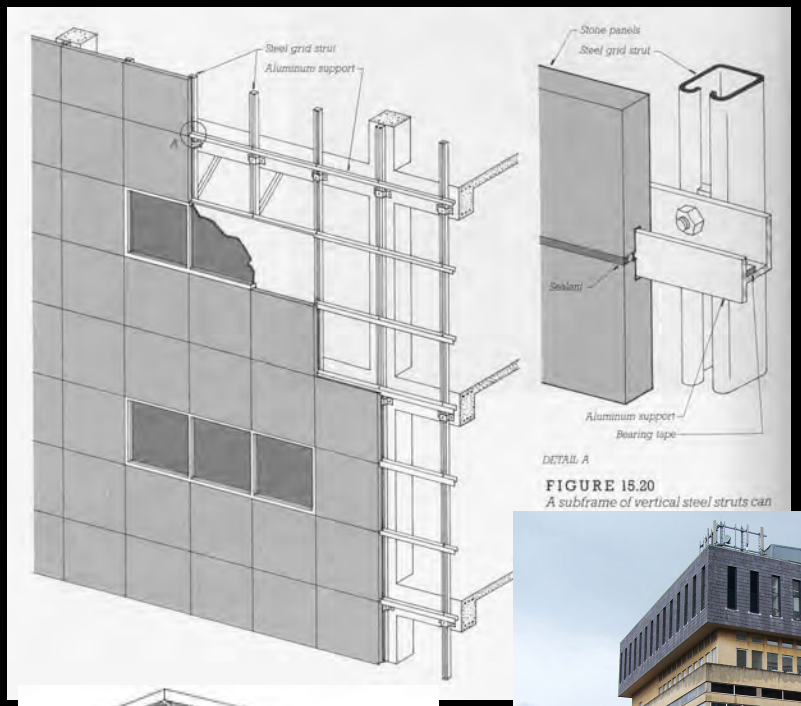
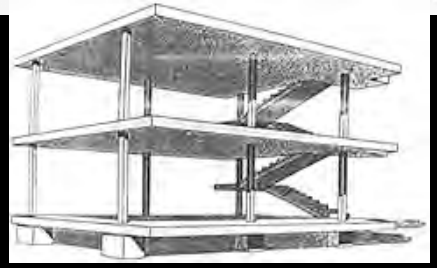
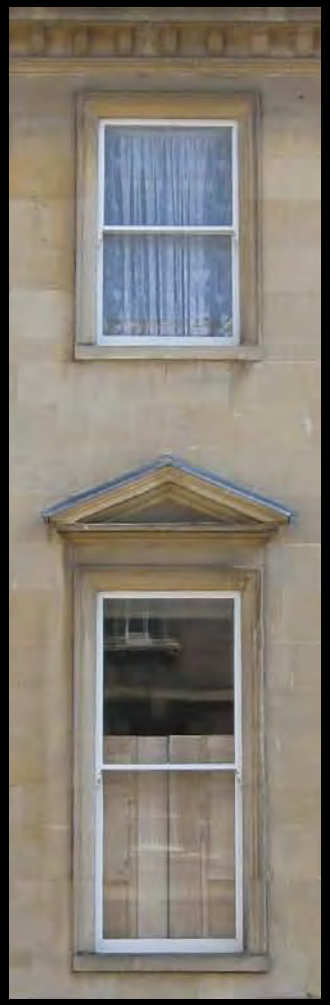


FIGURE 15.20
A subframe of vertical steel struts can





GREEN BUILDING: OPENINGS

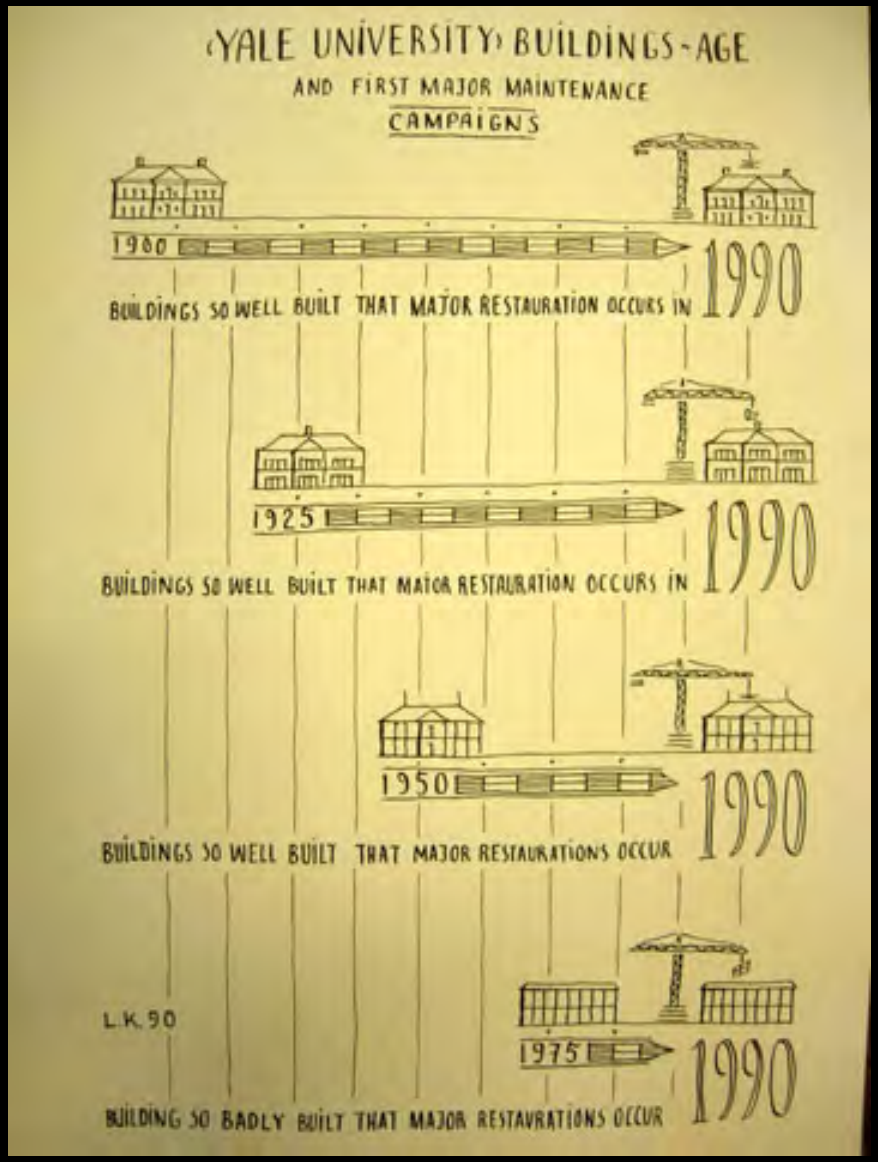




GREEN BUILDING: ROOFS

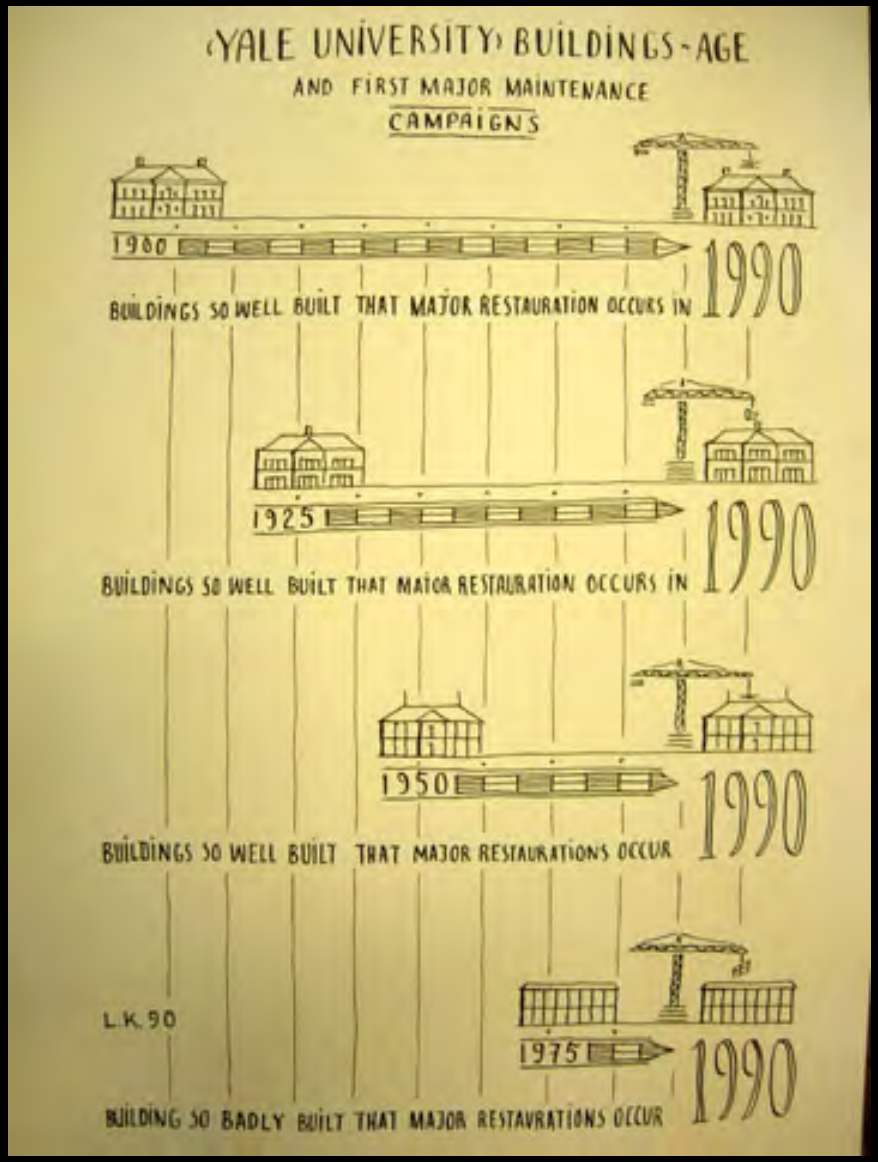


Shedding water vs. collecting water



Drawing courtesy of Leon Krier



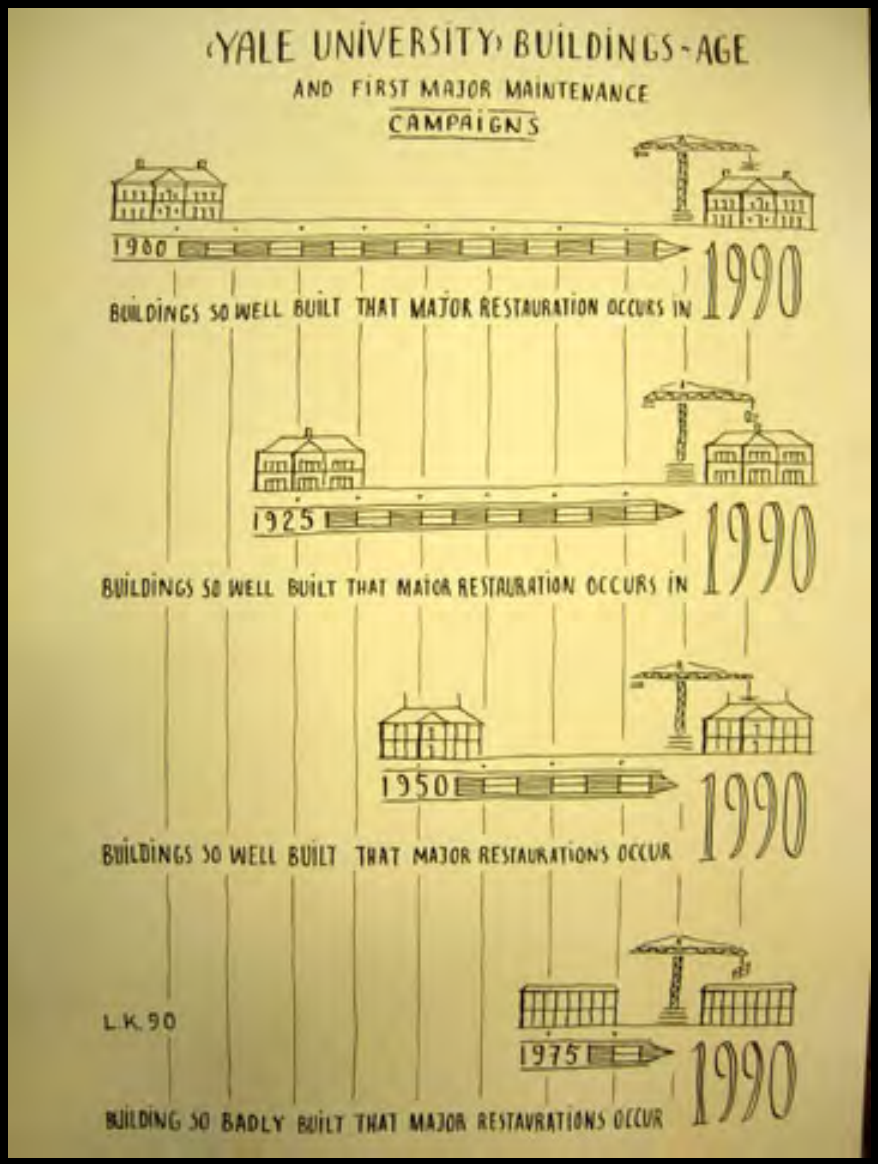


RENEWING THE CAMPUS: SUSTAINABILITY AND THE CATHOLIC UNIVERSITY

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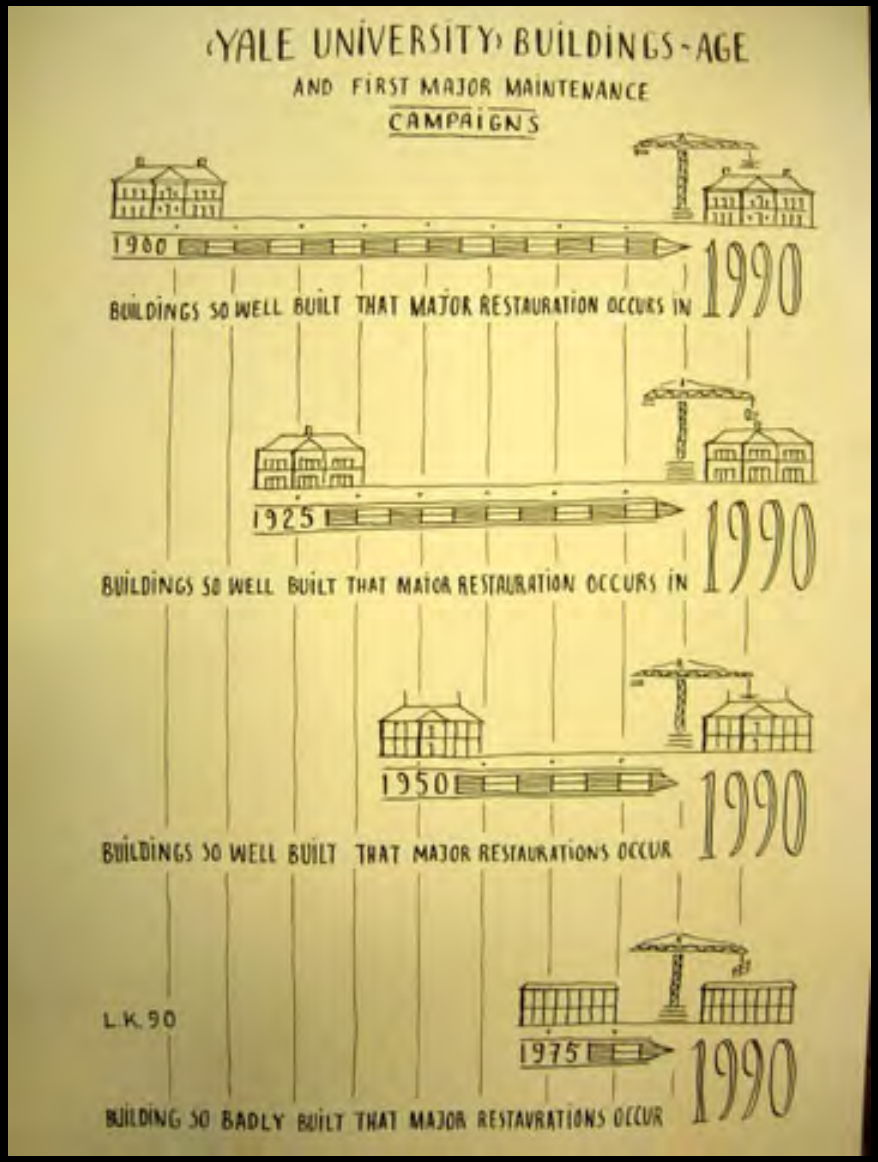
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MIT Sues Famed Architect Frank Gehry

Posted: 2007-11-06 20:16:00
Filed Under: Nation News

BOSTON (Nov. 6) - The Massachusetts Institute of Technology is suing renowned architect Frank Gehry, alleging there are serious design flaws in the Stata Center, a building celebrated for its unconventional walls and radical angles.

The school alleges the center, completed in spring 2004, has persistent leaks, drainage problems and mold growing on its brick exterior. It says accumulations of snow and ice have fallen dangerously from window boxes and other areas of its roofs, blocking emergency exits and causing damage.

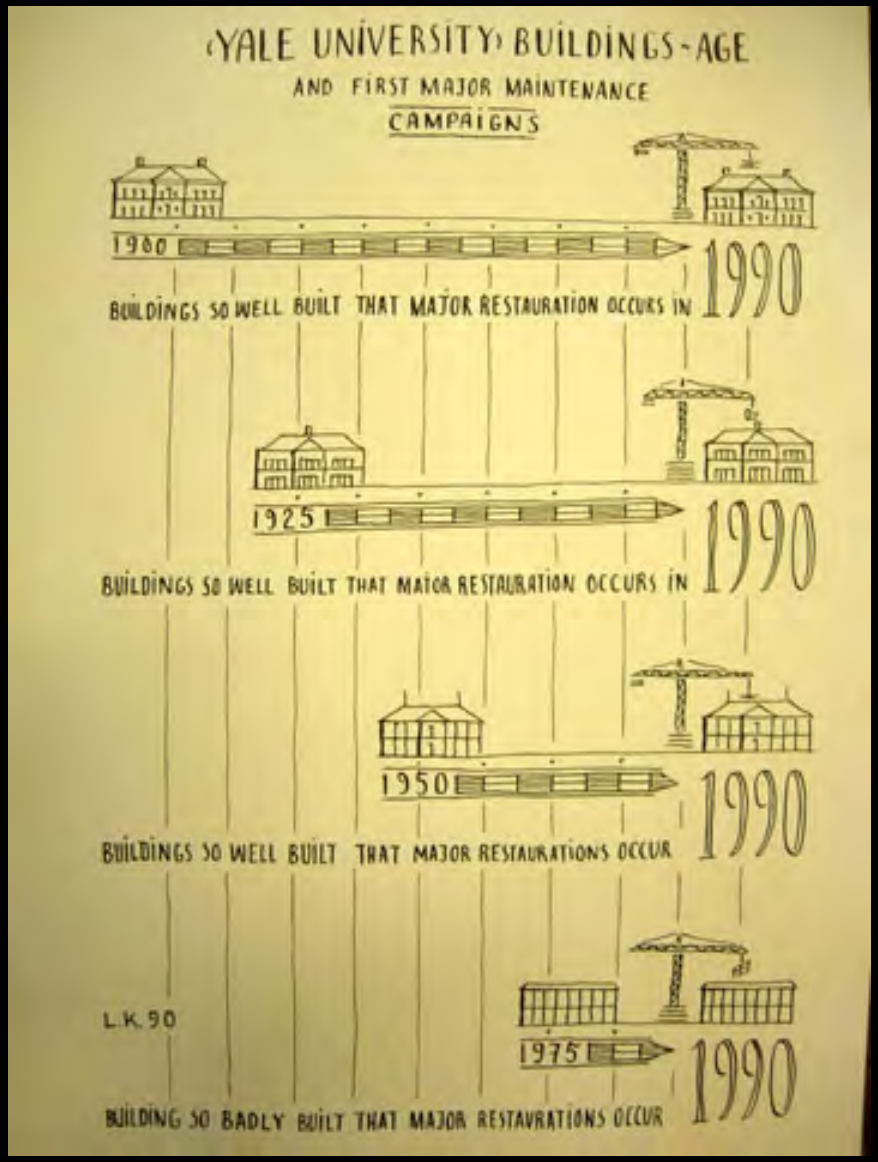
Photo Gallery: Frank Gehry Buildings



Joe Raedle, Getty Images

The Ray and Maria Stata Center on the campus of the Massachusetts Institute of Technology in Cambridge, Mass.

1 of 6



RESTORATION—AFTER 5 YEARS…





The Denver Art Museum by “STARchitect” Daniel Liebeskind opened in 2003. After only 5 years, a complete roof replacement was required. A cost of $60 million.

What do you know? It snows in Denver…

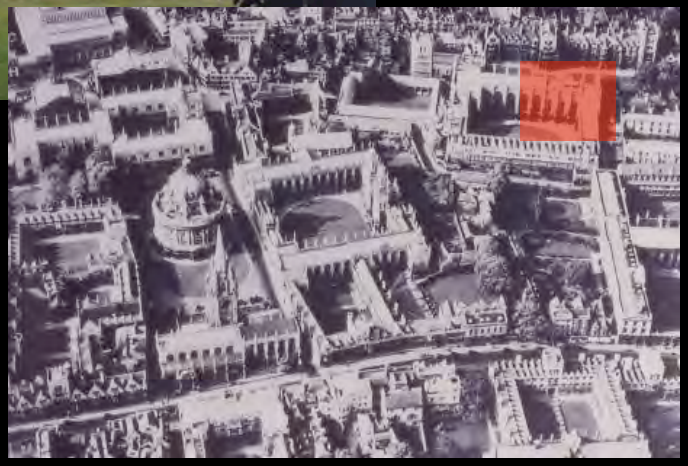
FLEXIBILITY & ADAPTABILITY FOR ENDURABILITY



Originally the University Library, now Bond Hall, Notre Dame's School of Architecture (photo courtesy of Sandy Sorlien)

HOPE FOR THE FUTURE







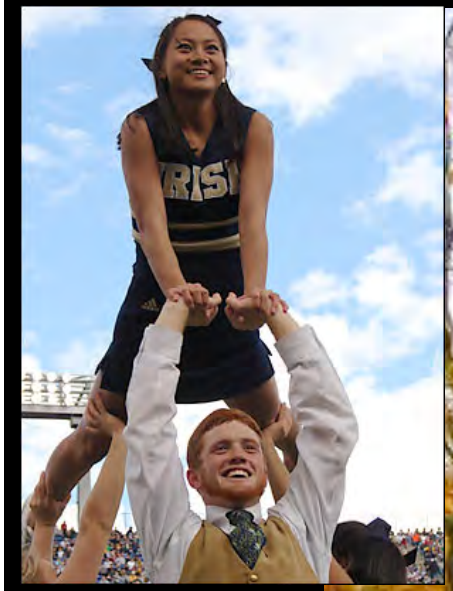
New College, Oxford
At right: The dining hall, originally completed in 1386 by Bishop William of Wykeham, is the oldest surviving college hall at Oxford.

COMMUNITY: IDENTITY, PRIDE AND HOPE



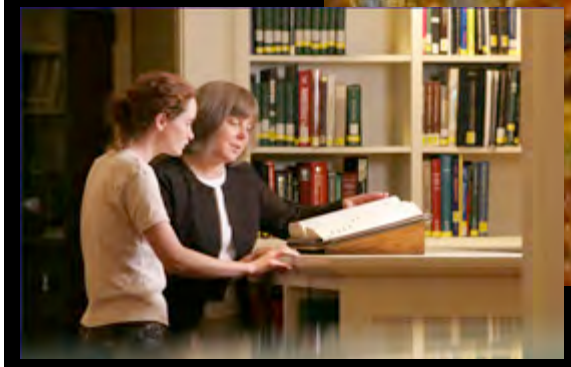
Notre Dame's Main Building (photo courtesy of Sandy Sorlien)

COMMUNITY: IDENTITY, PRIDE AND HOPE







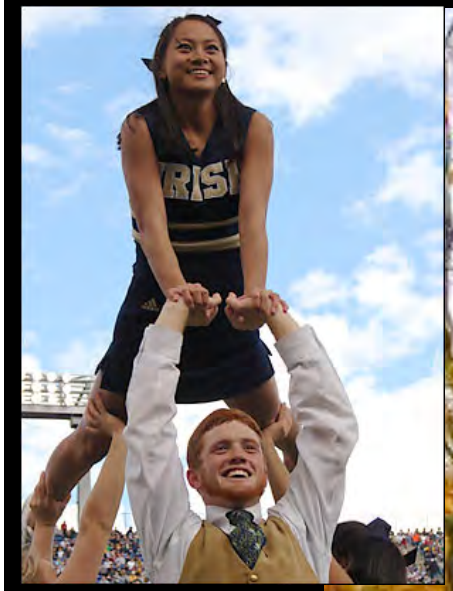




RENEWING THE CAMPUS: SUSTAINABILITY AND THE CATHOLIC UNIVERSITY

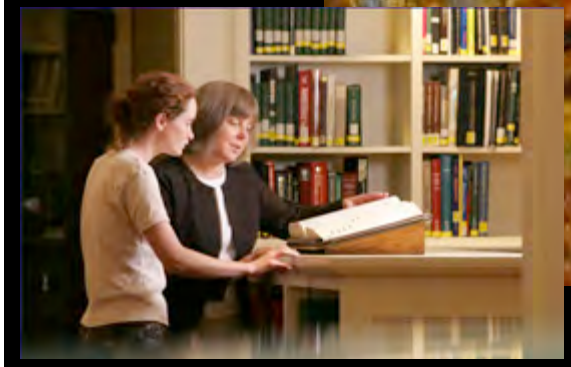
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COMMUNITY: IDENTITY, PRIDE AND HOPE















EDUCATION

Sustainable public realm building

Why We Teach Classical and Traditional Architecture and Urbanism

By Michael Lykoudis

With today's headlines and news stories focused on issues of global warming and peak oil production, how architects and urbanists will respond to the challenge might make all the difference in civilization's outlook. The classical curriculum at Notre Dame is based on the idea that traditional architecture and urbanism have been, and still are, innately and inherently environmentally friendly compared to more recent practices that feature sprawl and shoddy buildings with short life spans. Traditional urbanism relies on polycentric cities and towns with pedestrian accessibility, mixed-use neighborhoods and mass transit. Traditional architecture ensures the longevity of the built environment necessary for perpetuating a community's aspirations into the future. Classical and traditional architecture and urbanism have a significantly smaller carbon footprint than the current models of land use and construction which are based on maximizing high levels of fossil fuel consumption.

On a cultural level, we could think of classicism as the projection of society's highest aspirations into the future, thus ensuring the continuation of the best and perhaps the most sustainable aspects of a culture. Tradition is not duplication but rather a process that is always innovating upon itself. It is the inventive quality of tradition that allows each generation and region to shape the future in its own manner, and it is tradition's projection of the past forward that provides the sense of responsibility that is required for sustainability.

The Congress for New Urbanism (CNU) has been highly effective in bringing traditional urbanism into the mainstream because it made the case for the principles of the traditional city as real and pragmatic solutions to environmental and socio-economic problems. At Notre Dame, architecture and construction are subjected to the same scrutiny. The curriculum is structured to examine the built and natural environments as an interrelated, interconnected and inseparable spectrum of principles. This spectrum, which consists of urbanism, architecture and construction, provides a clear outline for establishing environmentally sustainable criteria at each level.

Urbanism is about how we live together with a shared purpose. In traditional urbanism streets, squares and blocks make up the infrastructure of the city that makes possible our lives in the public realm. It is at the urban scale that much of the conservation or waste of society's resources is made.

Architecture provides shelter and mediates between our private and public natures and between how we live together and how we build. Traditional building typologies also resolve technical problems that arise at the architectonic scale. Traditional buildings are designed for a purpose that often outlives the specific function a building was originally built to serve. This attribute of traditional building facilitates their longevity.

Construction is about how we build. Traditional construction materials can reduce waste and embodied energy with methods of construction that reflect local availability of materials and craft. Walls, openings and roofs make up the focus of this part of the spectrum, and classicism is the idealization and representation of these elements elevating the craft of building into a codified artistic form.

Without attention to these three scales we will not be able to optimize our efforts towards sustainability. Combined, the building industry and the built environment make up dependence on mechanical transportation, consume about 70 percent of our energy resources. By changing how we live together and how we build, we could make a radical difference in the accumulation of the crisis that is shared. While we recognize that other aspects of green and modern architecture are a necessary part of the solution to these problems, we also emphasize to our students that they could think of traditional architecture and urbanism as the foundation of sustainability. The principles guiding the culture of our studios and classes are designed to reflect this spectrum of sustainability as follows.

URBANISM

Traditional urbanism is the foundation to being "green." Traditional towns and cities emit a fraction of the greenhouse gases and consume a small part of the energy that those of modern sprawling suburbs. Traditional urbanism is based on a pedestrian scale. It is organized in such a manner so that within a 10-minute walk one can find all of life's necessities. It lives in a mixed-use neighborhoods. In traditional towns and cities, all citizens, including the young and old, do not rely on automobiles but can walk from their homes to commercial and civic centers, thus assuring that all are included in the life of the city. These neighborhoods reinforce the relationship between public and private life. The interconnected networks of streets allow access to all the parts of the city without labyrinthine or physical barriers common to suburban sprawl that require automobiles and other transportation using large amounts of fossil fuels.

The densities of traditional communities allow commerce and public life to thrive on neighborhood street corners and squares with economies of scale and without reliance on energy-driven transit. The density necessary for a traditional city requires the positioning of buildings to be aligned along streets and squares such that they define the public corridors and spaces of the public and private realms. The resulting urbanism enables people to watch over their children and their neighbors as well as to participate as the citizen of the community. The most sustainable communities are those we care about. We care about those communities where we become, and are a part of, the daily life.

The traditional city grows by multiplicity. New neighborhoods grow adjacent to older ones with their residential areas around commercial and civic centers. Through time these neighborhoods are integrated into larger villages, which become towns and cities, which are transformed into major metropolitan areas based on sustainable urban principles having smaller carbon footprints than today's megacities. This growth model provides for more compact, denser cities and encourages the preservation of farmlands, forests and the countryside.

Because of its dependence on large amounts of energy to support its structure, suburban sprawl wastes energy and contributes significantly to global warming as consumers drive their fossil-fueled cars for miles to buy the smallest item. By contrast, the traditional city with its dependence on pedestrian proximities and emphasis on mixed-use neighborhoods, conserves energy and emits only a small percentage of the greenhouse gases of the modern suburb. In an age where climate change is an accepted fact and the passing of peak oil production has risen concerns about the future, traditional urbanism is a basic common-sense strategy that, overall, costs less to build than its suburban counterparts and requires not much more than good planning.

ARCHITECTURE

Principles of traditional architecture are inherently green and complement traditional urbanism's ability to be sustainable. Traditional buildings are built with durable materials and materials that do not rely on petroleum and other high embodied-energy related material products. Traditional buildings typically rely less on mechanical means of air-conditioning and heating than their modernist counterparts.

The massing and organization of traditional buildings is a prerequisite for a durable building. Roofs protect a building from its primary enemies, water and sun. Traditional roof systems require floor plans that have widths with simple geometries and clear hierarchies such that the slopes of the roofs can be controlled to allow water to drain off effectively. The use of interior courtyards can reduce the effective width of a building so that the floor plans and roof spans are accessible and the water can drain outside rather than through interior drains. This approach to working not only disciplines the floor plans and massing of buildings, but adds significantly to their life spans.

In contrast to the amorphous ground-scrapers of suburbia, the narrower floor plates and interior courtyards of traditional buildings facilitate effective and design that allow light to penetrate the earthy mass of the building as less electricity needs to be used for lighting. The use of operable exterior windows and transoms over interior doors permits the natural flow-through ventilation to the building that requires less reliance on mechanical heating and air-conditioning systems, which owns energy. Traditional buildings, with party walls that abut one another, save energy used for heating and cooling as they limit their outside wall perimeter.

The massing and organization of a building determines much of its ability to be adapted to new uses long after its original functions have become obsolete. Designing for the long-range purpose of a building rather than its specific function allows for future recycling of that building through renovation. Embodied and life-cycle energy are conserved as fewer resources are used to rehabilitate a building as opposed to demolition and replacement construction.

CONSTRUCTION

Construction flourish when there is optimism for a bright future. The durability of a city or a neighborhood's buildings make that promise to its citizens. It is one generation's gift to the next. Traditional buildings do not have to be replaced often, and they conserve embodied energy and resources necessary in a sustainable world.

Traditional architecture uses the most resilient materials and methods in the most vulnerable places of a building such as the exterior walls, openings, and roofs, and the weakest materials in areas where they are protected from the elements, i.e. wet climates pitched roofs keep water and snow off. Tabernacled and arcuated construction has proven to withstand the test of time far much more than the 30-to-40-year life span of most contemporary buildings.

Masonry construction is the most enduring method of building we know. Potentially it can have the lowest level of embodied energy when its use is extended over long periods of time. Locally available stone or locally made bricks have low embodied energy with respect to being transported, and in the case of bricks that used to be fired, the embodied energy in the brick can last for long periods of time. When joined properly with lime-based mortars, masonry can be separated and be re-used again and again.

Masonry walls have other environmentally friendly properties. They absorb heat in the summer days and radiate it back out at night. The deep-set cornices, windows and doors provide shade and minimizes the heat gain in the summer when the sun is at its highest, and allow the sun in the winter to heat the interior of the buildings.

Wood may be a less permanent material for construction, but we know that wood-built have lasted in place for hundreds of years. Today we avoid first-growth timber, but if we develop and use sustainable harvested, properly mixed wood, we also contribute to the absorption of the world's carbon footprint caused elsewhere during the lifetime of these trees. Wood's inherent environmental and economic potential and natural insulative properties make it a viable building material in a sustainable built environment. Some of the same elements of classicism that are found in masonry such as cornices also work in wood construction.



Sustainable conservation (rehab and material)

SUSTAINABILITY IN THE NOTRE DAME CURRICULUM

The principles outlined in this spectrum are explicit in the school's studios and lecture courses and seminars. Each year stresses a specific theme. In the first year of study, the liberal arts program common to all Notre Dame students examines the continuities found in knowledge and between disciplines. This emphasis on the unity of knowledge becomes the basis on which principles of construction are related to architectural form in the second year, which is focused on how we build. The third year, which the students spend entirely in Rome, explores traditional urbanism and how traditional architecture facilitates an environmentally sustainable and civil way of life. By the fourth year, sustainability is tied to issues of regionalism and cross-cultural values that are contained through the typological understanding of the city and its architecture developed during the previous three years. By the fifth year, the students have forged individual viewpoints about architecture and engage a diversity of issues that culminates in their synthesis multi. Invariably sustainability and the good city become synonymous in their minds.

The final fuel era has brought about the most egregious misallocation of resources in human history. Through suburban sprawl and consumption we have squandered so much, and so little time remains to correct what we have done. The models of architecture and land development taught in architecture and planning schools for the last half-century have been based on the premise of unlimited energy sources and infinite possibilities. As we are now faced with limited options and difficult choices, the cities and buildings of yesterday that found similar constraints have something to teach us today.

The knowledge of the traditional city and its architecture applied to modern times can facilitate significant conservation of energy and emit into the air a fraction of the greenhouse gases of our modern sprawling suburbs. Traditional urbanism and architecture an and will continue to be the basis for the most effective circulation and transit systems, passive solar heating/cooling and energy-saving practices that we have. By studying the lessons they offer and incorporating them into our culture along with all that we have learned about sustainability and green building in modern times we could have the best of both worlds.

As teachers in this architectural academy it is our role to prepare our students for the challenges and opportunities they will face in their lives. We are not only preparing future architects to enter the profession, but empowering citizens of the world to value their opportunities to contribute to the public realm and give back more than they have received. Our society is better today than those of generations past. The way we build and live together should be a reflection of that. Our cities should be reflections of our highest hopes and aspirations and a gift to the generations that follow us. It is this sense of stewardship we hope we impart to our students.

Congress for New Urbanism "Green Council Report" - http://www.tndtownpaper.com/

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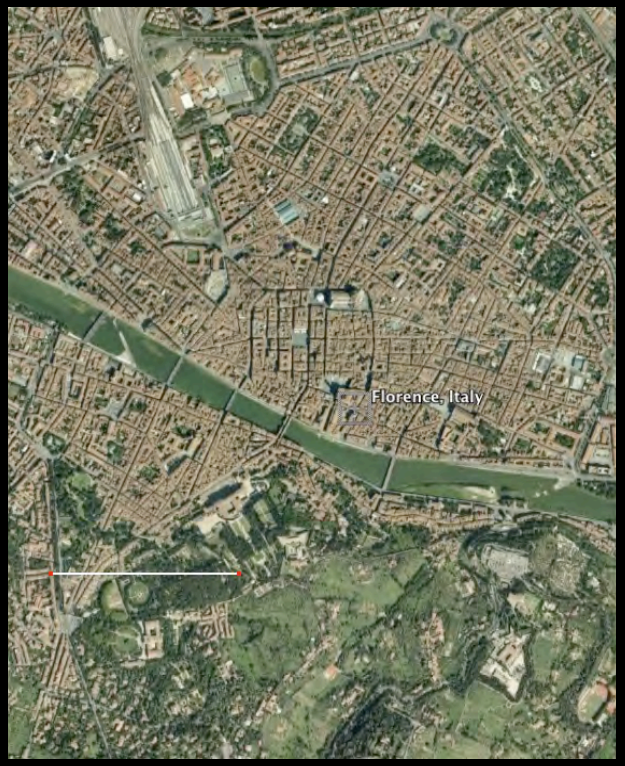
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Notre Dame campus (left) / historic center of Florence (center) / historic center of Bruges (right) - all at same scale

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Learning Traditional Construction / American College of the Building Arts – masonry & timber framing

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Learning Traditional Construction / American College of the Building Arts – plastering & finish carpentry

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