Conceptual Cost Estimating for Development Case Studies

By Steve Stouthamer

Skanska USA Building - NC

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Agenda

Review Cost Modeling vs Cost Estimating

Review Benchmarking

Discuss Market Conditions

Share Relative Cost Ranges

Offer a Shameless Plug

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Cost Modeling – Minimal Knowns

Considerations

- "The 5 Minute Model"
- Building Use (Hospital, Lab, Office, Classroom?)
- How Big (Physical Area)
- Where (Site Location)
- When (Timeline)
- Construction Costs + Indirect Costs
- Quick Modeling with the Above is feasible, but accuracy is a ?

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More Accuracy with More Direction

Considerations

- New Construction or Renovation
- Who are the likely design candidates and what are our experiences with them?
- Desired Architecture / Style (How Critical is the fit to adjacent architecture...How Grand is the vision?)
- Number of Floors
- Site Development – How Big, Parking Requirements, Site Standards, Hardscapes, etc?
- Geotechnical Considerations – Foundation Types
- Likely Structural System

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More Accuracy with More Direction

Considerations

- Most Likely Exterior Skin Systems
- Impacts of Required Construction Logistics – Parking, Hoisting, Work Hours, Phasing, etc)
- Direct Costs – CM Services, Design Services, Land Acquisition, FF&E, 3rd Party Consultants, IT, Legal Services, Infrastructure Upgrades!!
- Delivery Method – CMAR, Design-Build, Design-Bid-Build, Hybrid
- Local Market Conditions – Don't believe what you read

Knowing these items will make conceptual cost modeling more accurate without more time

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A Benchmarking Approach

Considerations

- Partition Density
- Office / Open Space Ratio
- Lab / Office Ratio
- Floor to Skin Area Ratios
- Unique Program Spaces (Food Service, Labs with Special Equipment Requirements, Medical Facilities with Special Equipment Requirements, etc)
- University / Owner Standards
- Durations for Design, Bidding, Construction
- Net to Gross Ratio
- Roof Systems

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A Benchmarking Approach

Considerations

- Attribute Relationships
- Systems Comparisons
- Regionalizing Costs
- Normalizing Costs over Time
- Core and Shell / Upfit
- Noise Mitigation
- LEED Requirements
- Commissioning Requirements

There's a lot to Consider!!!

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Benchmarking to Create the Cost Model

Develop Costs Based on Programmatic Data (Cost by Space Use)

- Develop Shell/Enclosure/Infrastructure Costs which are Required to Support Programmatic Data
- Develop/Analyze System Cost
- Compile/Compare Overall Building Cost Data

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Benchmark Database Overview

Net to Gross

Type	Discipline	GSF	Occupants	NSF	NSF:GSF
Research	Biomedical	328,496	1,600	212,264	65%
Research	Biomedical	69,523	618	58,315	84%
Research	Biology	150,193	350	100,648	67%
Research	Physics & Astronomy	82,323	175	49,819	61%
Teaching	Biology & Geology	110,266	530	60,176	55%
Research	Biomedical	47,285	170	23,210	49%
Research	Plant Science	143,998	200	62,548	43%
Teaching	Biomedical	118,979	891	70,001	59%
Teaching	Biology & Chemistry	168,000	400	105,840	63%
Teaching	Chemistry	78,600	332	47,160	60%
Teaching	Technology	143,998	833	92,479	64%
Research	Chemistry	158,068	340	82,602	52%
Research	Medicine	186,251	601	103,674	56%
Research	Plant Science	83,753	202	56,813	68%
Research	Plant Science	59,538	100	41,347	69%
Teaching	Biology & Chemistry	64,510	560	43,520	67%

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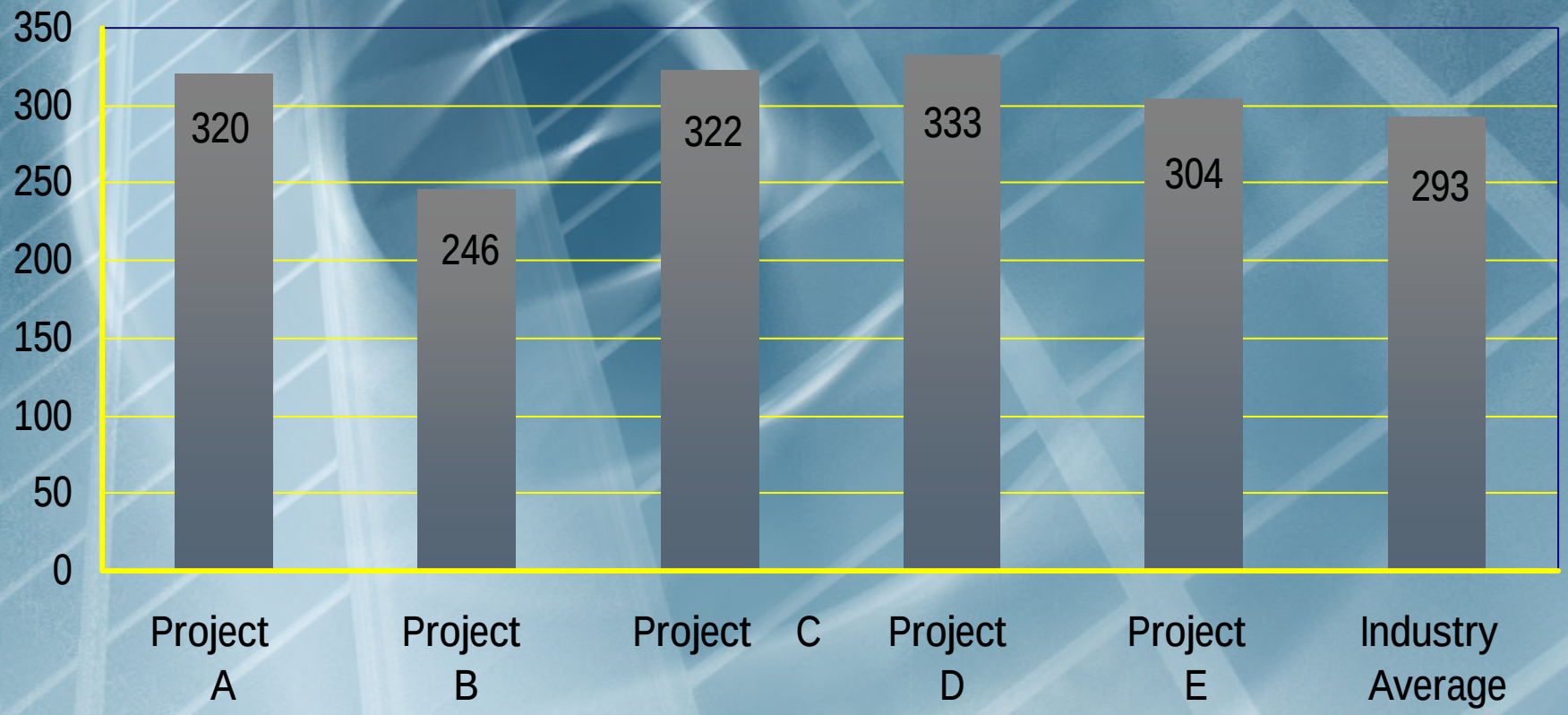
Multi-Function R & D Facility ($/GSF)

Project Level (in 2002 Dollars)
(Land and Scientific Equipment Costs Excluded)



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Building Efficiency Factors

- Variables w/High Impact on Net/Gross Ratio
  - Building Configuration
  - Mechanical Space
  - Atriums
  - Vertical Circulation
  - Wall Construction
  - Structural Systems
  - Service Spaces
  - Building Egress Issues
- Establish Benchmark Net/Gross
  - Low Efficiency: 56%
  - Average Efficiency: 61%
  - High Efficiency 67%

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Benchmarking

Pros

- Ensure Design Meets Funding
- Identify Areas of Cost Outside Metrics
- Focus Team on High Cost Areas

Pit Falls

- Reliance on Average Cost Data for Decision
- Failure to Differentiate between Project / Design Differences
- Lack of Comparable Facilities

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Our Approach

Benchmark Data

- National Estimating Director Resources
- Project Advisors Group
- Benchmark Studies Completed
  - Healthcare
  - Residence Halls
  - Research Laboratories
  - Dining Facilities
  - Parking Structures
  - Museums
  - Escalation Studies

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Examples

Review Some Sample Cost Information

Review Some Sample Benchmark Studies

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Tracking Construction Material Escalation

29-Aug-06

Product Type	2000 Pricing	Unit	2006 Pricing	Unit	$ Variance	% Increase
16’ - 3-5/8” Metal Stud	$ 0.100	lf	$ 0.440	lf	$ 0.340	340.0%
#10 Wire (Solid THHN)	$ 0.048	ft	$ 0.197	ft	$ 0.149	308.9%
500 MCM Cable	$ 2.239	ft	$ 9.013	ft	$ 6.774	302.5%
2" Copper tubing	$ 3.260	lf	$ 11.210	lf	$ 7.950	243.9%
1" Copper Tubing	$ 1.200	lf	$ 3.930	lf	$ 2.730	227.5%
Cat 6E Cable vs Cat 5 in 2000	$ 0.135	ft	$ 0.385	ft	$ 0.250	185.2%
4" Carbon Steel Pipe	$ 2.760	lf	$ 7.730	lf	$ 4.970	180.1%
4’ x 12’ sheet of 5/8” Gypsum Wallboard	$ 7.920	sheet	$ 19.200	sheet	$ 11.280	142.4%
Asphalt	$ 182.000	ton	$ 409.000	ton	$ 227.000	124.7%
3” Rigid Polyisocyanurate Insulation Board	$ 0.730	sf	$ 1.460	sf	$ 0.730	100.0%
350 KW Gen Set(100KW on GV2)	$ 188.330	KW	$ 375.000	KW	$ 186.670	99.1%
3/4" EMT Conduit	$ 0.215	ft	$ 0.426	ft	$ 0.211	98.0%
3" Composite Metal Floor Deck	$ 68.000	sq	$ 130.000	sq	$ 62.000	91.2%
Unfabricated Structural Steel Material (Grade 50)	$ 450.000	ton	$ 850.000	ton	$ 400.000	88.9%
4000# PSI Concrete - No Additives	$ 52.000	cy	$ 98.000	cy	$ 46.000	88.5%
Fuel Pricing	$ 1.600	gallon	$ 2.880	gallon	$ 1.280	80.0%
4” Rigid Steel Conduit	$ 6.100	ft	$ 10.180	ft	$ 4.080	66.9%
Concrete Reinforcing Steel	$ 480.000	ton	$ 780.000		$ 300.000	62.5%
Freight Costs (Steel Example)	$ 20.000	ton	$ 32.000	ton	$ 12.000	60.0%
8" Regular Weight CMU	$ 0.890	ea	$ 1.390	ea	$ 0.500	56.2%
2500 KVA Transformer (2000KVA on GV2)	$ 22.660	KVA	$ 35.000	KVA	$ 12.340	54.5%
60 mil TPO membrane (Pending vendor input)	$ 0.360	sf	$ 0.540	sf	$ 0.180	50.0%
Steel Erection (Representative Project)	$ 400.000	ton	$ 550.000	ton	$ 150.000	37.5%
4’ x 8’ sheet of ¾” Type AA Grade Plywood	$ 40.000	ea.	$ 52.000	ea.	$ 12.000	30.0%
Commercial Grade Latex Paint	$ 24.500	gallon	$ 31.500	gallon	$ 7.000	28.6%
3’ x 7’ Hollow Metal Door Door (No HW)	$ 200.000	ea.	$ 252.000	ea.	$ 52.000	26.0%
3’ x 7’ Solid Core Wood Door Door w/ Oak Veneer (No HW)	$ 280.000	ea.	$ 352.000	ea.	$ 72.000	25.7%
2 x 4 Parabolic Light Fixture	$ 58.000	ea	$ 72.700	ea	$ 14.700	25.3%
Raw Aluminum Material – Price / Lb	$ 1.740	lb	$ 2.130	lb.	$ 0.390	22.4%
Standard Face Brick	$ 328.000	thou	$ 375.000	thou	$ 47.000	14.3%

Competing Local Projects

Large Local Projects ($50M and Higher)	$(M)	Probability	Q2 '07	Q3 '07	Q4 '07	Q1 '08	Q2 '08	Q3 '08	Q4 '08	Q1 '09	Q2 '09	Q3 '09	Q4 '09
Wake County Schools - Plan 2004 Bond Program	$564	Underway											
RDU Airport Terminal "C" Reconstruction	$200	Underway											
New Hanover Hospital	$200	Underway											
The Raleigh Convention Center	$160	Underway											
North Carolina University Cancer Hospital	$130	Underway											
Eisai Parenteral Facility (RTP)	$125	Underway											
Cape Fear Valley Hospital - Tower Expansion	$106	Underway											
CCRC at Glenwood	$90	Underway											
RBC Headquaters Building	$80	Underway											
Raleigh Convention Center Hotel	$65	Underway											
Wyeth Admin Commons Bldg 116	$55	Underway											
Novont Healthcare Systems	$500	High											
Duke Central Campus	$500	High											
Duke Healthcare - New Patient / OR Hospital	$425	High											
Fidelity - New Corporate Campus	$500	High											
Wake County Justice Facility	$250	High											
Central Prison Medical Facility	$150	High											
Novartis Vaccines Facility (Holly Springs)	$150	High											
Duke University Hospital System - Cancer Center	$100	High											
UNC Science Complex Phase II	$80	High											
NCSU R. Terry Center Companion Animal Hospital	$80	High											
Duke Nicholas School for the Environment	$80	High											
Wake County Jail Facility	$75	High											
UNC - Oral Sciences	$65	High											
United Therapeutics - Research Lab	$60	High											
N.C. Museum of Art Expansion	$60	High											
UNC Bell Tower	$150	Moder											
North Hills Phase II	$150	Moder											
Soleil Tower	$80	Low											
Totals	**$5,230**												

Relative Values of Major Construction Elements
North Carolina Marketplace Basis
2nd Quarter 2007

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Ite	Description	Unit	Low	Mid	High	Contributing Factors (All affected by Market Cond)
	Basic Assumptions 100,000 sf Facility University Facility - Engineering / Science Use New Construction / Reasonable Schedule					
	Site Construction					
	Site Development	ACRE	$250,000	$500,000	$800,000	Grades, Rock, Hard/Land-Scapes, Parking, Lighting
	Elements of Site Construction					
	Clearing and Grubbing	ACRE	$6,500.00	$8,500.00	$15,000.00	Extent / Density of Vegetation
	Excavate / Haul	CY	$13.00	$18.00	$25.00	Haul Site, Material Composition
	Import / Place	CY	$15.00	$21.00	$32.00	Import Site, Material Reqt's, Compaction
	Cut to Fill	CY	$6.00	$8.00	$10.00	Equipment Types to be used
	Asphalt Paving	SY	$25.00	$28.00	$34.00	Thickness, Price of Fuel
	Curb & Gutter	LF	$12.00	$15.00	$18.00	Curb Section
	Sidewalks	SF	$4.00	$5.50	$10.00	Thickness, Reinforcing, Finish, Color
	Utilities - Too Many		Danger	Danger	Danger	
	Feature Elements		Danger	Danger	Danger	
	Landscape Plantings	ACRE	$20,000.00	$30,000.00	$50,000.00	Extent of Plantings, Species, Maintenance Reqts
	Lawns	ACRE	$5,000.00	$10,000.00	$12,000.00	Sod vs Seed? Type of Grass, Maintenance Reqts
	Foundations / Substructures					
	Foundation System Complete	SF	$7.00	$12.00	$18.00	Soil Bearing Capacity, Load of Structure
	Elements of Foundations					
	Caissons	CY	$475.00	$600.00	$850.00	Depth, Diameter, Rock Socketing
	Spread Footings	CY	$275.00	$350.00	$425.00	Formed, Reinforcing, Access
	Foundation Walls	CY	$475.00	$575.00	$850.00	Thickness, Reinforcing, Height, Turns, Shape, Access
	Retaining Walls	CY	$500.00	$600.00	$900.00	Thickness, Reinforcing, Height, Turns, Shape, Access
	Slabs (On-Grade)	SF	$6.50	$7.75	$10.00	Thickness, Reinforcing, Finish, Vapor Barrier, Stone

Relative Values of Major Construction Elements
North Carolina Marketplace Basis
2nd Quarter 2007

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Ite	Description	Unit	Low	Mid	High	Contributing Factors (All affected by Market Cond)
	Superstructures					
	Flat-Plate, Conventionally Reinforced Concrete F	SF	$28.00	$38.00	$50.00	Complexity of Shape, Bldg Use, Height
	Flat-Plate, PT Reinforced Concrete Frame	SF	$27.00	$37.00	$48.00	Complexity of Shape, Bldg Use, Height
	Structural Steel (Simple Braced Frame)	SF	$24.00	$32.00	$44.00	Complexity of Shape, Bldg Use, Height
	Structural Steel (Moment Frame)	SF	$27.00	$35.00	$47.00	Complexity of Shape, Bldg Use, Height
	Elements of Superstructures					
	Slabs (On-Metal Deck)	SF	$4.75	$5.75	$7.00	Thickness, Reinforcing, Finish, Method Placement
	Concrete Columns	CY	$650.00	$850.00	$1,100.00	Shape, Reinforcing, Height, Finish
	Concrete Shear Walls	CY	$525.00	$600.00	$850.00	Thickness, Reinforcing, Height, Finish
	Concrete Beams	CY	$650.00	$850.00	$1,100.00	Thickness, Reinforcing, Height, Finish
	Concrete Flat Plate Formed / Elevated Slabs	CY	$325.00	$450.00	$650.00	Thickness, Reinforcing, Finish
	Structural Steel (Simple Braced Frame)	TON	$2,300.00	$3,000.00	$3,500.00	Weight of Shapes, Bay Config, Pieces, Shop Treatm
	Structural Steel (Moment Frame)	TON	$2,600.00	$3,300.00	$3,800.00	Weight of Shapes, Bay Config, Pieces, Shop Treatm
	Metal Decking	SF	$1.50	$1.85	$2.50	Quantity of Studs
	Spray Applied Fireproofing	SF	$1.45	$1.85	$2.50	Thickness and Type
	Façade Support Steel	TON	$4,500.00	$5,500.00	$7,000.00	Type of Structure, Pieces, attachment, erection
	Metal Pan Stairs	FLT	$6,500.00	$9,000.00	$11,000.00	
	Skin Systems					
	Brick w/ 8" Block Backup	SF	$32.00	$39.00	$44.00	Includes Vapor Barrier and 2" Rigid Insulation
	Brick w/ Stud Backup	SF	$30.00	$37.00	$42.00	Includes Vapor Barrier and 2" Rigid Insulation
	Curtainwall System	SF	$60.00	$75.00	$110.00	Glass Reqt's, Depth & Quantity of Aluminum, Steel
	Metal Panel System w/Stud Backup	SF	$34.00	$39.00	$42.00	Fastening method, Insulation, Colors
	Precast Skin with Interior Furring	SF	$27.00	$32.00	$36.00	Finish, Thickness, Insulation
	Granite / Stone Panels w/block backup	SF	$58.00	$65.00	$75.00	Material Origination, Thickness, Placement, Support
	Skin Elements					
	Standard Size Face Brick	SF	$16.00	$20.00	$23.00	$/M for Material, Shapes, Complexity of Install
	8" CMU	SF	$10.00	$11.00	$12.00	Complexity of Install
	12" CMU	SF	$10.00	$11.00	$12.00	Complexity of Install
	Add to CMU for fully Grouted / Reinforced	SF	$2.00	$2.00	$2.00	
	Add for Cast Stone Trim Elements	SF	$55.00	$75.00	$95.00	Number of Different Shapes, Pieces, Erection
	Metal Panels	SF	$25.00	$30.00	$33.00	Fastening method, Insulation, Colors
	Precast Panels	SF	$18.00	$28.00	$35.00	Finish, Thickness, Insulation
	Granite Panels	SF	$25.00	$30.00	$33.00	Material Origination, Thickness, Placement, Support
	Punched Windows / Storefront	SF	$45.00	$55.00	$75.00	Glass Reqt's, Depth & Quantity of Aluminum, Steel
	Louvers	SF	$45.00	$55.00	$65.00	Finish, Size, Frame

Relative Values of Major Construction Elements
North Carolina Marketplace Basis
2nd Quarter 2007

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Ite	Description	Unit	Low	Mid	High	Contributing Factors (All affected by Market Cond)
	Interior Partitions / Doors / Finishes					
	Std Metal Stud Wall (5/8 " Gyp, 3-5/8" Stud, 5/8"	SF	$5.00	$5.50	$6.00	
	3070 HM Dr Frm / Solid Core Wd Door / Passage	EA	$1,000.00	$1,075.00	$1,200.00	Pre-Finished, Domestic Veneers
	Interior Glass Walls	SF	$40.00	$48.00	$60.00	Aluminum, Glass Finish
	Interior Rated Walls	SF	$6.50	$7.50	$8.50	Type of Board, Layers of Board
	Interior Shaft Walls	SF	$7.50	$9.00	$10.00	Type of Board, Layers of Board
	Base Cabinet / Counter	LF	$350.00	$500.00	$750.00	Species, Design
	Wood Paneling	SF	$28.00	$38.00	$55.00	Species, Design
	Interior Finish Elements					
	VCT Flooring	SF	$1.75	$2.25	$2.65	Product Line, Patterns, Surface Prep
	Carpeting	SY	$22.00	$35.00	$55.00	Product Line, Patterns
	Ceramic Tile Flooring	SF	$7.00	$8.00	$10.00	Product Line, Patterns
	Terrazzo Flooring	SF	$16.00	$22.00	$32.00	Thickness, Color Requirements, Staging, Surf Prep
	Epoxy Flooring	SF	$8.00	$10.00	$12.00	Thickness, Color Requirements, Staging, Surf Prep
	Seamless Sheet Vinyl Flooring	SF	$6.00	$8.00	$10.00	Product Line, Patterns, Surface Prep
	2' x 2' ACT Ceilings	SF	$2.50	$3.00	$4.50	Size of Space, Height, Product, Grid, Patterns
	Drywall Ceilings	SF	$5.00	$6.50	$8.00	Height, Reveals, Susp System, Shapes
	Metal Ceilings	SF	$12.00	$15.00	$25.00	Product Line, Height, Patterns
	Wood Ceilings	SF	$18.00	$22.00	$35.00	Product Line, Species, Shapes, Height
	Drywall Soffits	SF	$7.00	$9.00	$15.00	Height, Reveals, Susp System, Shapes
	Paint	SF	$0.40	$0.55	$1.10	Material (Latex, Epoxy), Production
	Vinyl Wallcovering	SF	$1.25	$2.00	$4.00	Product
	Fabric Wrapped Wall Panels	SF	$18.00	$25.00	$45.00	Fabric Type, Location of Install

Relative Values of Different Project Types
North Carolina Marketplace Basis
Construction Values Only

Item	Description	Unit	Low	Mid	High	Contributing Factors (All affected by Market Cond)
General Comments 1 Numbers below exclude site development 2 Numbers exclude Owner Indirects (Land Costs, Design Fees, FF&E, Owner Contingency, Moving Costs) 3 Numbers include Construction Indirects (GCs, Fees, Insurances, Contingency) 4 Scale assumed to be 100kgsf or larger 4 LEED Not Considered						
	Residence Hall	SF BED	$175 $45,000	$225 $80,000	$300 $150,000	Shower / Restroom Arrangements HVAC Systems Building Appearance Interior Layout (Bed to Fixture Densities) Other Amenities Central Plant Contributions
	Classroom Building	SF	$140	$175	$245	Tiered Seating Requirements AV Requirements / IT Requirements Interior Layout Building Appearance Central Plant Contributions
	Science Building	SF	$325	$390	$550	Fume Hood Density, Exhaust Management Central Plant Contributions, Energy Recovery Vivariums, Equipment Purchases Lab to Office Ratio
	Hospital	SF	$250	$350	$450	Patient Room / OR's Only Campus Setting Special Uses (Cancer Treatment, Heart) Logistical challenges
	Central Plant Building	EU SF	$2,500 $800	$3,000 $1,000	$4,000 $1,500	Energy Unit (Tons of Chiller Cap + Boiler HP) Type of Equipment Local Utility Company Contributions No Distribution to Bldgs
	Office Building - Core & Shell Only **Office Building - Tenant Fitout**	SF SF	$85 $35	$105 $60	$135 $100	Developer or End User Customer Skin Materials Lobby / Core Area Aesthetics / Upgrades Raised Flooring / LEED Requirements Partitioned Spaces vs Open Office HVAC System Selection