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Managing Metamorphosis, Building for Change

Session: 100215
Date: Thursday, October 2, 2014
Time: 3:15 pm – 4:15 pm

CONTINUING EDUCATION AIA

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Changing the Preconstruction Paradigm in Today's Volatile Market

Presented by:

- Butch Kuester, Executive Director - Facilities Planning, Design & Construction, UT MD Anderson Cancer Center
- Jon Crane FAIA, EDAC, LEED AP, Sr. Vice President & Global Director of Translational Health Sciences, HDR Architecture
- Danny Thompson, Construction Director, Vaughn Construction

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CONTINUING EDUCATION AIA

Today's Program

- Project Challenge Overview
- Three Point Solution
  1. Continuous Cost Modeling
  2. Design as Schedule Accelerator
  3. Streamlined Review Process
- Review Learning Outcomes

Participants Will Learn . . .

- Ideas for integrating design and construction process for more efficient project delivery
- Ways to utilize continuous cost modeling as a means to meet tight budgets and schedules on complex projects
- Ways to streamline design review processes for complex owners/user groups
- How design can be used as a schedule accelerator

About UT MD Anderson Cancer Center

- Integrated in Major Medical Center
- (Extremely Complex) Single Focus
- Significant Faculty Size (>1,500 faculty)
- Well-Funded Research Programs (> $600 M in 2012)
- Close Relationship Between Clinical Care and Science
- Research Capability of Basic, Discovery, Development, Scale-up, Preclinical and Clinical Trials
- > 15,000,000 SF of Facilities
- Large, Complex Facility Planning and Design Review Teams
- Well-established Design Review Process

Project Challenge Overview

Zayed Building for Personalized Cancer Care

Project Background

- How Zayed Came to Be
- Challenges from MDACC's Perspective
  - Foundation
  - Cornerstone of MDACC campus
  - Researcher recruiting tool

Failure is Not an Option

- Donor Dollars Contingent on Meeting Deadline
- “Typical” Design Schedule Accelerated by > 6 Months

Design Intentions

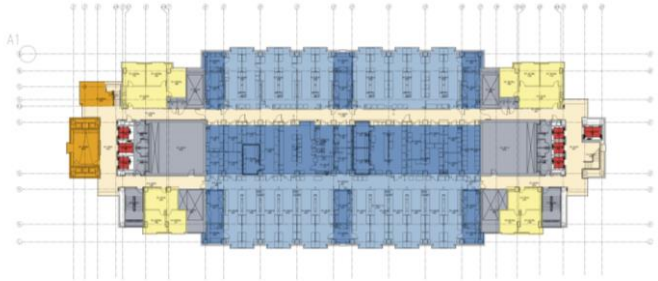
- Attract World-Class Researchers (Moon Shots)
- Encourage Interaction Within and Between Teams
- Support Shift from Departments to Programs, Centers and Institutes

next generation

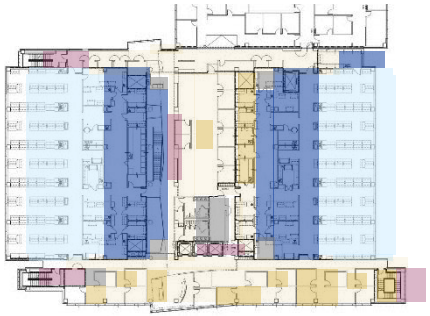
social interaction

warehouse laboratory

Design Intentions



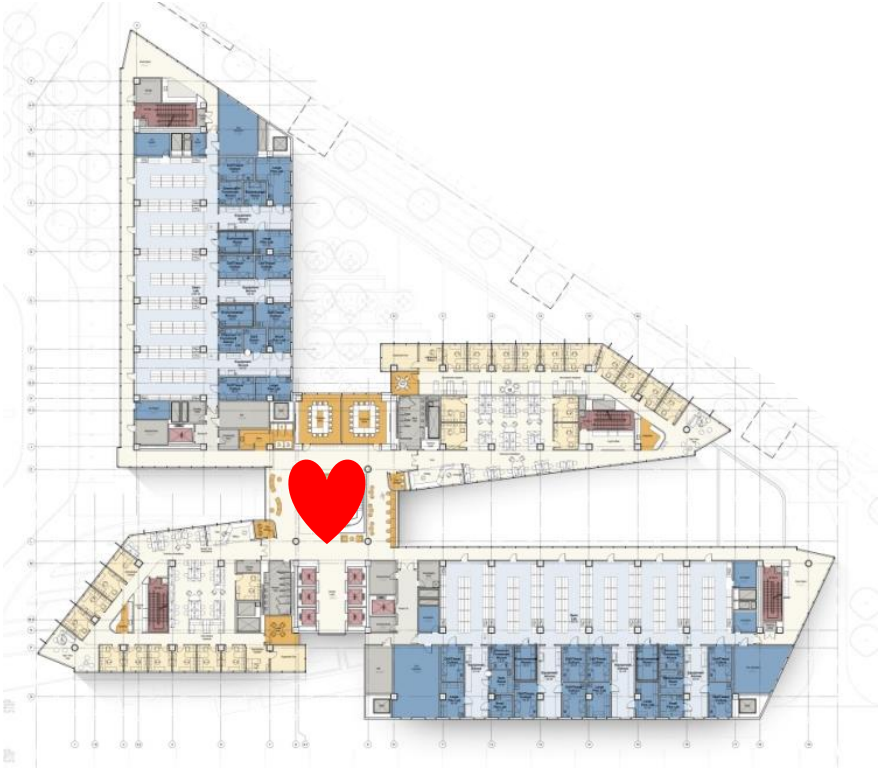
BSRB1 – 2002

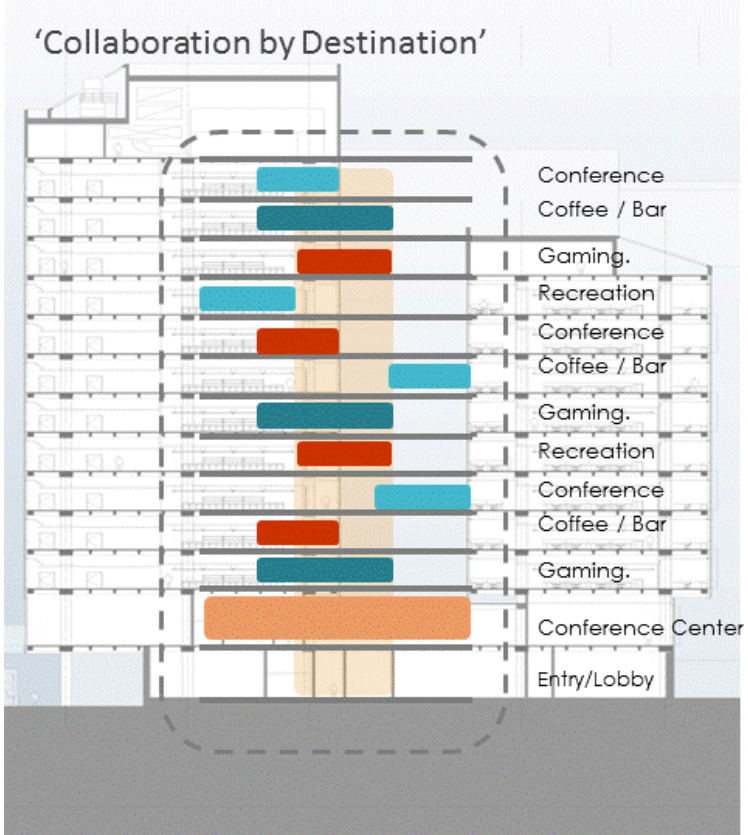


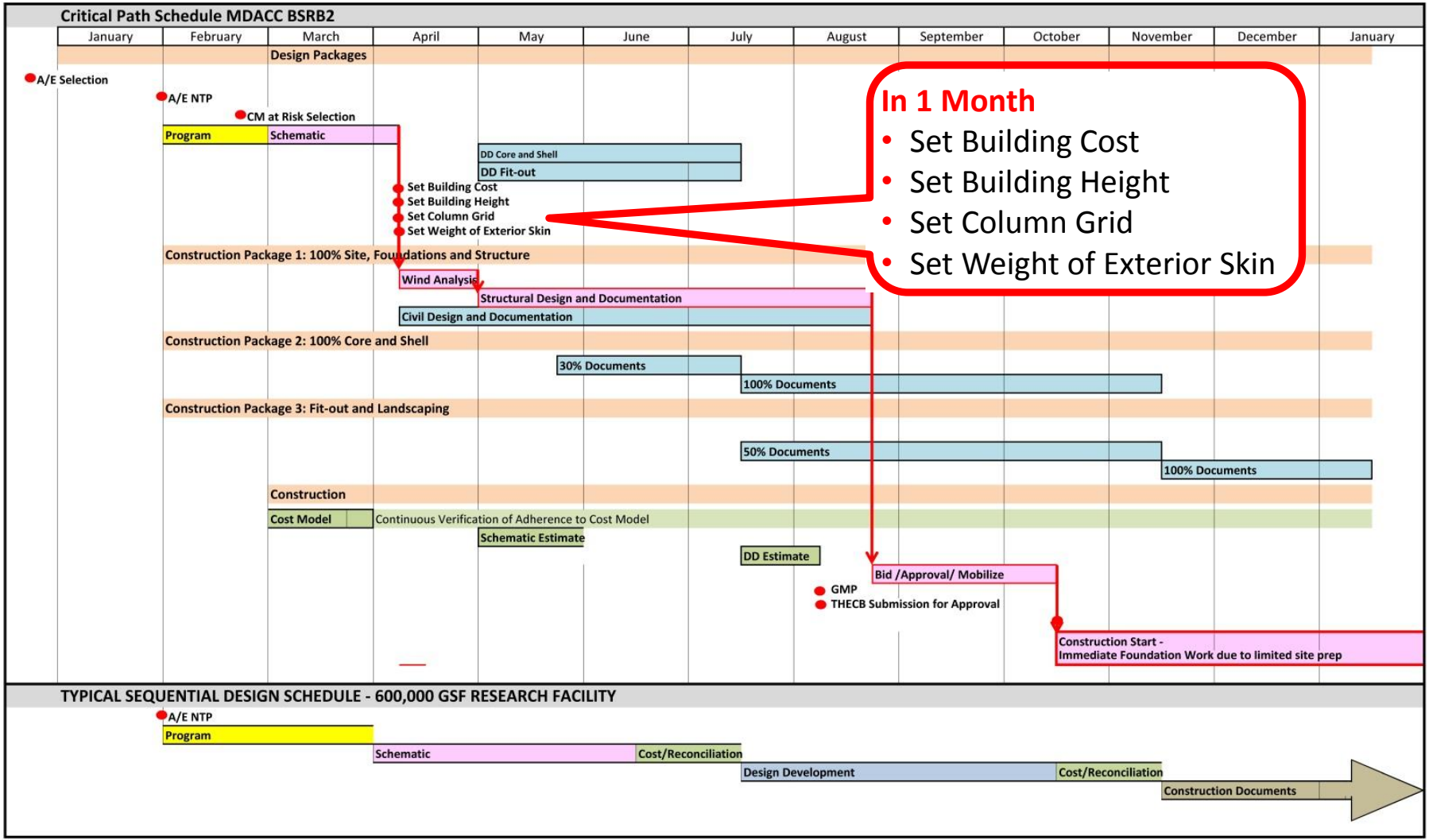
SCRB4 – 2006

ZAYED – 2011

Design Intentions






Critical Path Schedule MDACC BSRB2
January
February
March
April
May
June
July
August
September
October
November
December
January
Design Packages
A/E Selection
A/E NTP
CM at Risk Selection
Program
Schematic
DD Core and Shell
DD Fit-out
Set Building Cost
Set Building Height
Set Column Grid
Set Weight of Exterior Skin
Construction Package 1: 100% Site, Foundations and Structure
Wind Analysis
Structural Design and Documentation
Civil Design and Documentation
Construction Package 2: 100% Core and Shell
30% Documents
100% Documents
Construction Package 3: Fit-out and Landscaping
50% Documents
100% Documents
Construction
Cost Model
Continuous Verification of Adherence to Cost Model
Schematic Estimate
DD Estimate
Bid /Approval/ Mobilize
GMP
THECB Submission for Approval
Construction Start -
Immediate Foundation Work due to limited site prep
In 1 Month
• Set Building Cost
• Set Building Height
• Set Column Grid
• Set Weight of Exterior Skin
TYPICAL SEQUENTIAL DESIGN SCHEDULE - 600,000 GSF RESEARCH FACILITY
A/E NTP
Program
Schematic
Cost/Reconciliation
Design Development
Cost/Reconciliation
Construction Documents

3-Point Solution

1. Continuous Cost Modeling
2. Design as Schedule Accelerator
3. Streamlined Design Review Process

1. Continuous Cost Modeling

Aggressive Cost Modeling

Challenge

- Cost review at design milestones would not work
- Schedule too aggressive
- “Over budget” was not an option – no time to back up

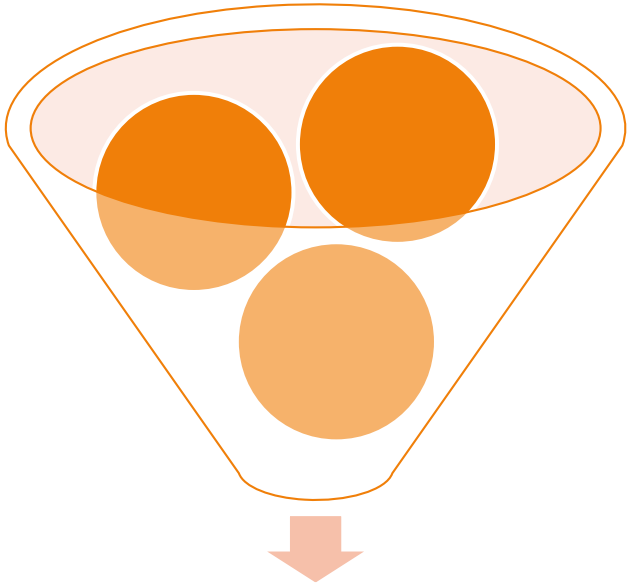
Solution

- HDR/Vaughn agreed on cost bucketing by division
- Had to meet MD Anderson guidelines

Design to Buckets of Money

Big Decisions Early On

- Column Grid Layout
- Basement vs Crawl Space
- Horizontal vs Vertical Build-out Scheme
- Structural vs. Non-Structural Glazing
- Architectural Glazing



Cost Model Factors

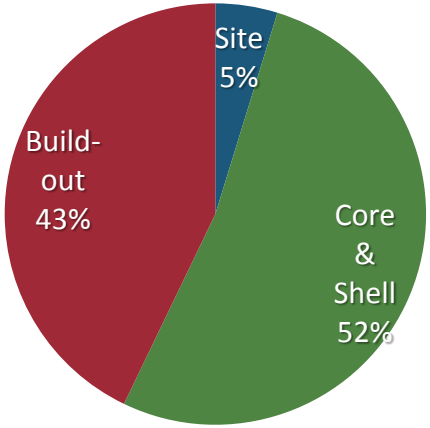
- Historical Data for Building Type
- Owner Standards for Equipment & Systems
- Discussions between AE and CM
- Meeting of the Minds regarding Process
  - Allow flexible design w/real time cost feedback

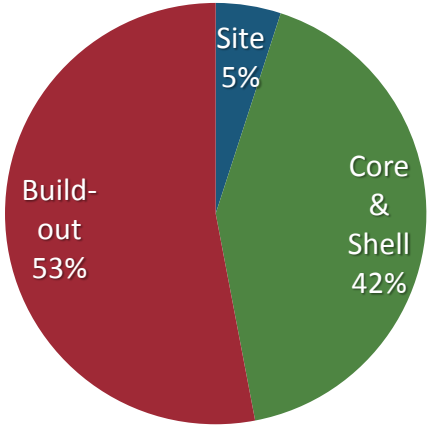
Cost Model Comparisons

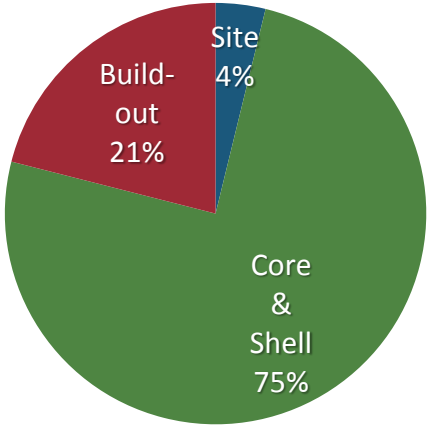
So. Campus Research Bldg. 3

So. Campus Research Bldg. 4

Zayed Bldg. for Personalized Cancer Care







Structural Skin Comparisons

So. Campus Research Bldg. 3

Glass/Floorplate: 22%

So. Campus Research Bldg. 4

Glass/Floorplate: 19%

Zayed Building for Personalized Cancer Care

Glass/Floorplate: 60%

Fixed vs Variable Cost Components

Fixed Costs

- Structure
- Vertical Transportation
- Core Spaces

Variable Costs

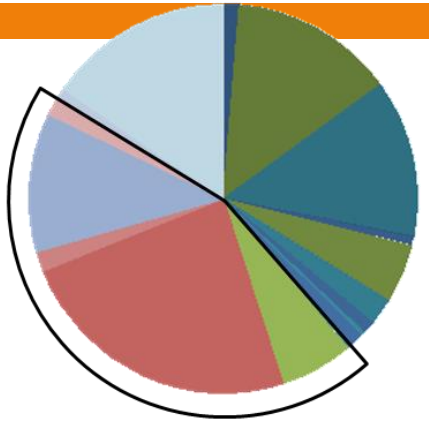
- Skin
- Crawl Space
- MEP
- Build-out Schemes

MDACC BSRB 2: PARAMETRIC COST AND SF MODEL					HDR
Location: Houston					Draft 12/12/2010
Construction Start November 2011					
Space Category	Space Type				
Space Type	Shell	Clinical Space	Laboratory Space	Shell Space	
Net Assignable Space	312,000	15,000	50,000	247,000	
Departmental Gross Factor	1.50	1.40	1.50	1.50	
Departmental Gross SF	466,500	21,000	75,000	370,500	
Building Gross Factor	1.27	1.27	1.27	1.27	
Building Gross SF	592,455	26,670	95,250	470,535	
Net to Gross	0.53	0.56	0.52	0.52	
System					
Substructure					
Base Cost	$3.0				Assume Typical High-Rise
Superstructure					
Base Cost	$31.0				Assume Concrete Frame
Exterior Construction					
Base Cost	$30.0				Assume 230K exterior skin
Roofing					
Base Cost	$1.6				Assume Similar to CTT
Interior Construction					
Base Cost	$7.0	$18.0	$15.0	$1.0	Assume Similar to CTT
Interior Finishes					
Base Cost	$3.0	$10.0	$10.0		Assume Similar to CTT
Conveying Systems					
Passenger Elevators	$2.0				Assume eight at $150K
Freight Elevators	$0.7				Assume two at $200K
Vivarium Elevators	$0.0				None Required
Furnishings					
Blinds / Shades	$0.5				Assume Sun Control
Equipment					
Casework and Fume Hoods		$4.0	$14.0		Assume Similar to CTT
Glassware		$0.0	$0.8		Assume 3 sets in lab fit-out
Biosafety Cabinets		$0.2	$1.5		Allowance in fit-out
Autoclaves - Decon		$0.2	$1.0		Allowance in fit-out
Autoclaves - Pass through		$0.0	$0.0		None Required
Autoclaves - Roll Through		$0.0	$0.0		None Required
Cage Wash		$0.0	$0.0		None Required
Misc.		$0.0	$0.0		TBD
Wall Guard		$2.0	$2.0		Assume Typical Clinical/Lab
Environmental Rooms					
Cold Rooms		$0.0	$0.2		Assume 4 in lab fit-out
Freezers		$0.0	$0.3		Assume 4 in lab fit-out
Warm Rooms		$0.0	$0.0		None Required
Plumbing					
Base Plumbing Systems	$11.5				Assume Similar to CTT
Clinical Systems		$8.0			Assume Typical Clinical
Lab Systems			$12.0		Assume Similar to CTT
Biowaste System					None Required
HVAC					
Base Cost	$44.0				Assume Similar to CTT
Clinical Systems		$18.0			Assume Typical Clinical
Lab Systems			$39.0		Assume Similar to CTT
Temporary Heating and Cooling				$4.0	Assume Minimal
Hepa Filter Systems					None Required
Fire Protection					
Base Cost	$2.7				Assume Similar to CTT
Clinical Systems		$2.0			Assume Typical Clinical
Lab Systems			$1.5		Assume Similar to CTT
Temporary Heads and Distribution				$1.0	Assume Minimal
Electrical Power					
Base Costs	$14.0				Assume Similar to CTT
Clinical Systems		$22.0			Assume Typical Clinical
Lab Systems			$35.0		Assume Similar to CTT
Temporary Lighting				$2.0	Assume Minimal
UPS					TBD
Emergency Generator	$4.0				Assume Similar to CTT
Electrical Systems					
Fire Alarm	$0.5				Assume Similar to CTT
AV Systems			$1.0		Assume Similar to CTT
IT Wiring	$0.5	$5.0	$4.0		Assume Similar to CTT
Security	$0.4	$0.5	$1.0		Assume Similar to CTT
Subtotal Building Costs	$156.4	$89.9	$138.3	$8.0	
Sitework	$2.0				Assume Moderate
Subtotal Cost of Work	$158.4	$89.9	$138.3	$8.0	
CM Fee, Bonds, CM Contingency and General Conditions	18%	20%	20%	20%	Assume Similar to CTT
CM Fee, Bonds, CM Contingency and GCs	$28.5	$18.0	$27.7	$1.6	Assume Similar to CTT
Current Cost of Construction	$186.9	$107.9	$165.9	$9.6	
Escalation to Midpoint 0%	$0	$0	$0	$0	Assume Flat
Total Cost per Gross Square Foot	$187	$108	$166	$10	
Scenario 1 - 15 Stories					
Building size: GSF	592,455	26,670	95,250	470,535	
Percent Space Type	100%	5%	16%	79%	
Cost	$110,702,432	$2,877,160	$15,801,975	$4,517,136	
Total Cost	$133,898,703				

Zayed Cost Model

MEP

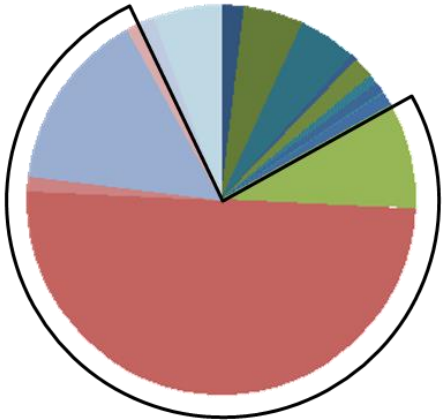
46%



Zayed Cost **Risk** Model

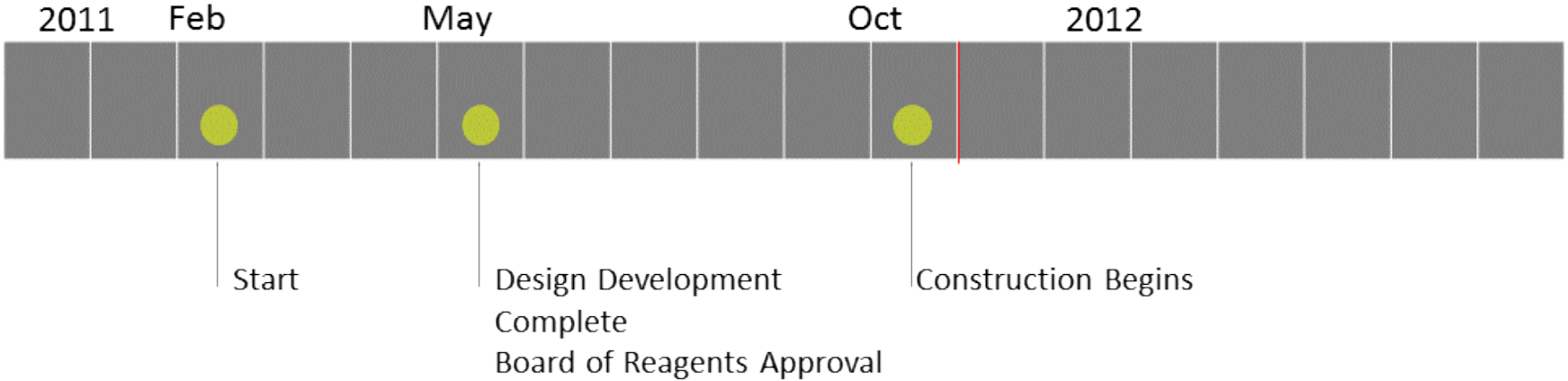
MEP

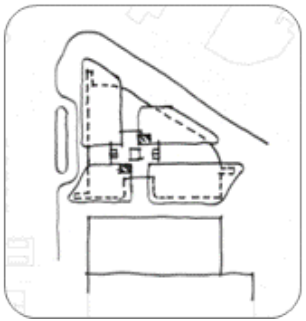
76%

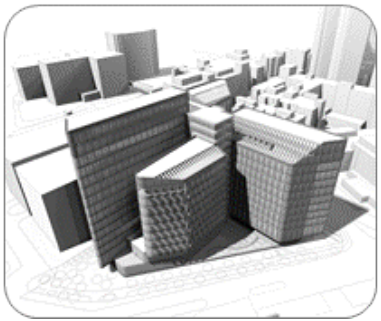


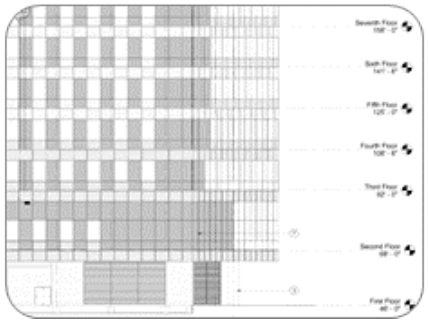
2. Design as Schedule Accelerator

Accelerated Schedule









Preview, Review, Endorse

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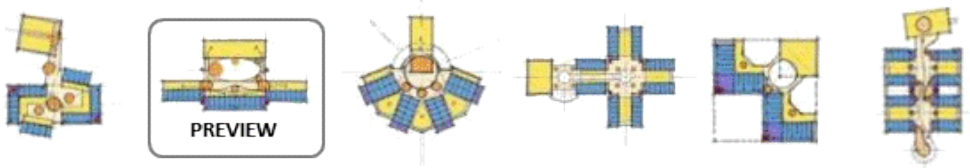

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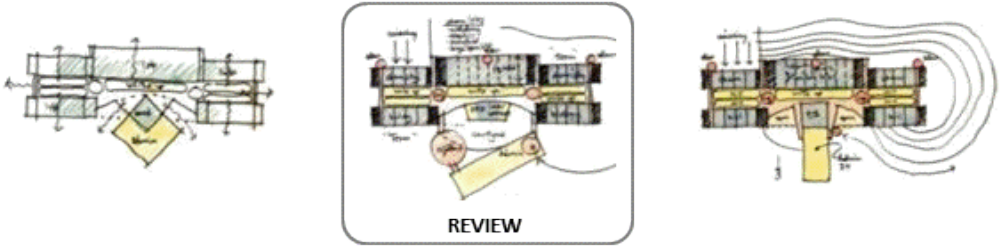

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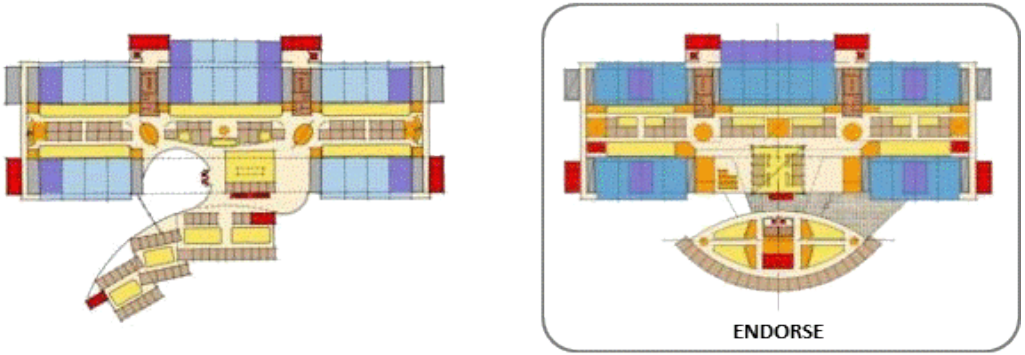

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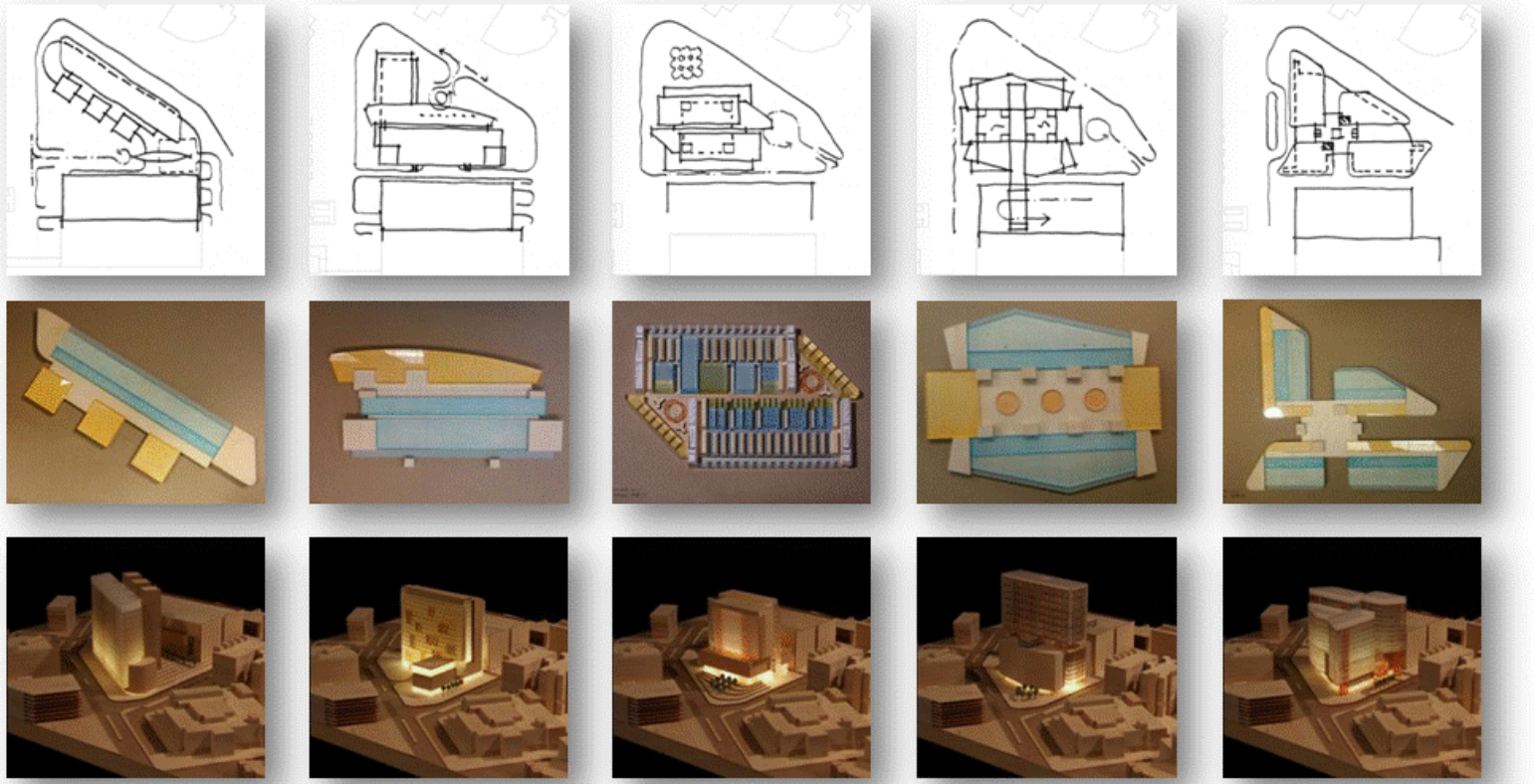

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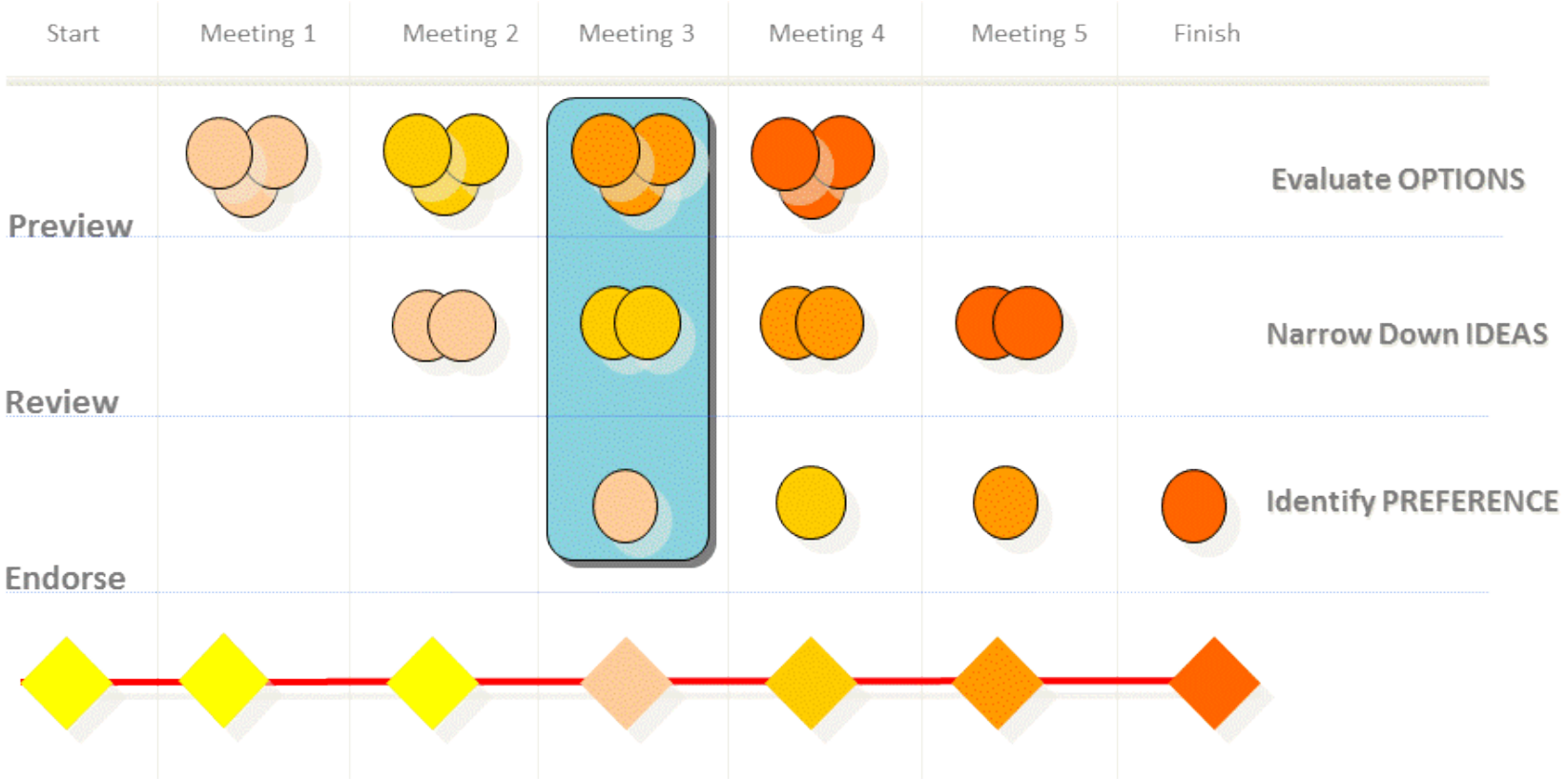

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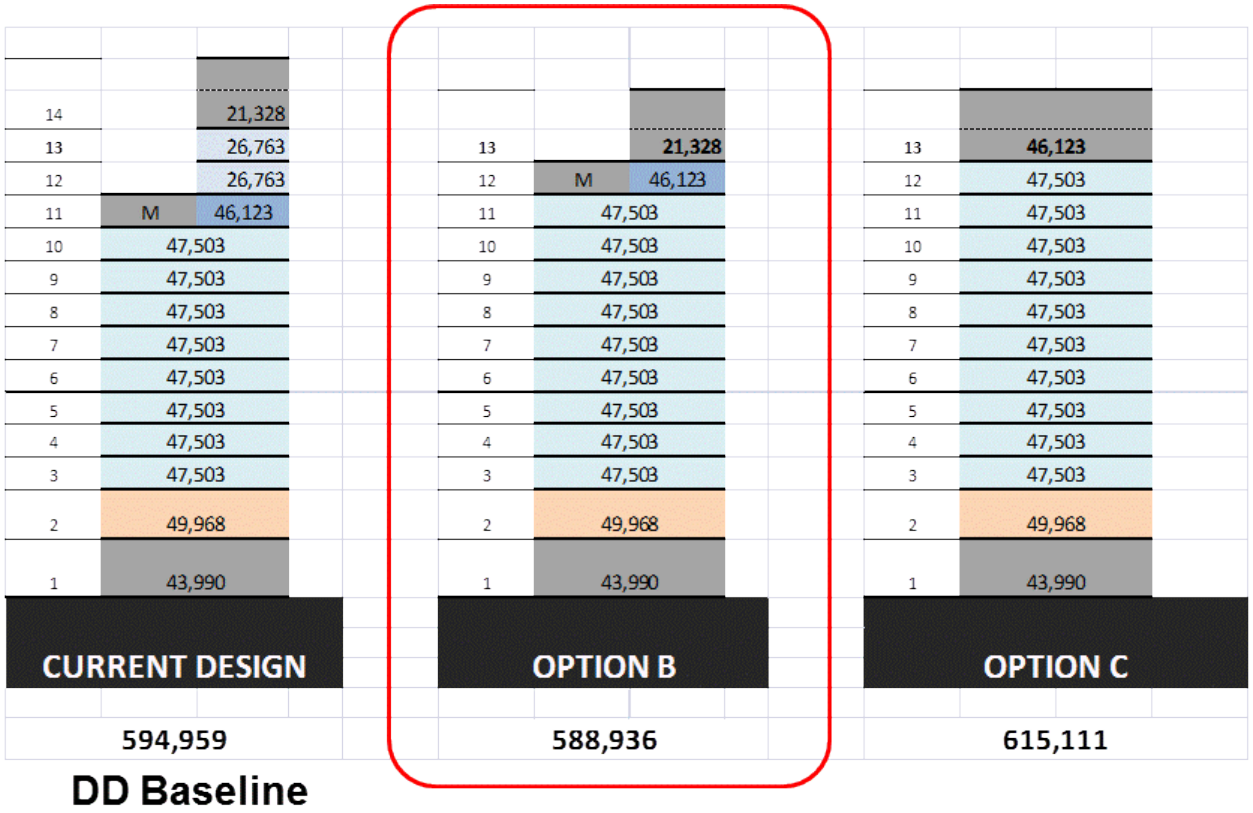


Preview, Review, Endorse

3. Streamlined Design Review Process

Design-Assist as Schedule Accelerator

1. HDR develops rough elevations & profiles
2. Vaughn procures glass & glazing sub to design, manufacture & install under a GMP agreement
3. Glass & glazing sub completes design (6’ vs. 12’ modules)
4. Glass & glazing sub starts manufacturing before construction commences
5. Glass panel manufacturing completed half way through structure
6. Achieved budget certainty for glass prior to Vaughn GMP Allowed savings to be reallocated

What Is a “Ben Franklin?”

- Rely on Owner/Design/CM Team as Virtual IPD
- Bring Options and Pros/Cons
- MD Anderson Core Team Makes Quick, Well-informed Decisions, w/Finality

Ben Franklin Process

Zayed Institute for Personalized Cancer Therapy - Site Scenarios

Scenario #1 Holcombe/Braeswood Site

Summary: Relocate the existing ROC facility and construct a new building at the corner of Holcombe and Braeswood. Relocate the majority of Pathology & Lab Medicine clinical labs, offices and translational research labs from the Main Campus, Naomi, and South Campus to the new building.

Cost Impact: Cost of new building (proposed at $225,000,000) and backfill of existing spaces. A bridge connection and pneumatic tube system will need to be included. Note that if a different pneumatic tube system is required, additional impacts to existing main campus facilities/infrastructure could result in major additional work and costs. This site currently lacks infrastructure to support a large building, and complexities in bringing the infrastructure to the site will increase costs. The currently unfunded Rotary House project was originally planned to help provide some of this support pathway. The ROC will also need to be relocated. Additional parking required (approx. 1,000 spaces).

Schedule Impact: A new location and operational plan for the ROC facility must be fnialized and implemented before the site becomes availbale for new construction. The Rotary House Phase 3 with bridge connection project with bridge connection is required in order to support the needed site utilities and connectivity to the Main Campus.

Reason "For"	Reason "Against"
Can be connected to the Main Campus.	Difficulty and cost of providing infrastructure/utilities, inlcuding chilled water, telecom, pneumatic tube, and connectivity to the Main Campus.
Site has high public/patient visibility because of its location.	Three other projects must be completed to make the site available and/or to support the site development (ROC relocation, Rotary House Phase III with associated bridge connection, and new parking).
	Awkward site - building footprint is limited and undesribale for some possible programs.
	Due to footprint limitations, building must be constructed higher to obtain the needed square footage, increasing costs and reducing building efficiency (core/circulation to usable SF ratios per floor are higher).
	If the building contains research labs, the high rise nature of building/site may be subject to pending code restrictions that limit height.
	Of the three sites, this site is the most vulnerable to flooding, likley requiring additional constrcution costs to provide flood protection.
	No lay-down area - difficult site for access and constructability, which typically influences cost and schedule..
	Parking will likely have to shift from the adjacent parking garage to a new location to be determined.

Scenario #2 MSI Site

Summary: Demolish the existing MSI building and construct a new building. Relocate the majority of Pathology & Lab Medicine clinical labs, offices and translational research labs from the Main Campus, Naomi, and South Campus sites to the new building.

Cost Impact: Cost of new building (proposed at $225,000,000) and backfill of existing spaces. A bridge connection is desirable but not mandatory to support the building. Needed infrastructure is either already available or in close proximity. May want to consider building the structure to support a larger building in the future (site is capable of accommodating a much larger building). Additional parking required (approx. 1,000 spaces).

Schedule Impact: The MSI site must be vacated by UTHSC before the site becomes available for demolition and new construction. UTHSC currently plans to vacate in late 2010. Would probably need to negotiate a bridge connection to the existing Garage 10 bridge.

Reason "For"	Reason "Against"
Ease of access to Main Campus and utilities/infrastructure, many of which are already in place (chilled water, IT/Telecommunications, etc.).	MSI must be abated and demolished before the site is available for new construction.
Less limited footprint - can support a lerger building with more contiguous space per floor.	Will require more coordination with TMC to develop site than other scenarios.
Site offers the most flexibility and value to the Main Campus, where space is most needed, including facilitating the Main Campus Master Plan and tear down of BRB and Bates Freeman for future site development.	
Pnuematic tube and bridge connection not mandatory to operation and utilities support ot the building.	
Still has public/patient visibility, but not as high as scenario #1.	
Site is scheduled to become available in to MDACC in 2010.	
Less flood potential than scenario #1.	
New parking can be accommdated next to new building, with addition to Garage 10.	

Scenario #3 South Campus

Summary: Construct new building on the South Campus and relocate the majority of Pathology & Lab Medicine clinical labs, offices and translational research labs from the Main Campus, Naomi, and South Campus.

Cost Impact: Cost of new building (proposed at $225,000,000) and backfill of existing spaces. Additional parking required (approx. 1,000 spaces). TECO and IT/Telecom loops will need to be completed - currently proposed but unfunded.

Schedule Impact: Sites are currently available.

Reason "For"	Reason "Against"
Several locations of varying size within the overall site are readily available.	Not a practical site for functions other than research.
High visibility to public and visitors, though more remote to the patient population.	Power has been unreliable on the South Campus.
Of three sites, South Campus is least vulnerable to flood and/or in need of flood protection.	Utilities/infrastructure loops in place at the site, but offsite pathway/connections must be funded and completed to support site development (TECO and IT/Telecom).
Parking can be accommodated in site vicinity via surface parking or new garage..	
No coordination with TMC required.	
Site is least traffic flow constrained.	

Ben Franklin Process

1. Evaluate Reasons "For" vs. "Against"

Ben Franklin #3 – Vertical vs. Horizontal Fit-out

Option A – Vertical Strategy

Reasons "For": Factors/Weights		Reasons "Against": Factors/Weights	
1. Elimination of Penthouse airside equipment in East towers reduces Phase 1 Core/Shell cost by $8.2MM to more closely align with CCL budget	5	1. Incremental cost burden to the first future build-out project for penthouse equipment in East towers of $700,000	3
2. Not building out the SE Tower provides segregation for building occupants during construction of adjacent parking garage	1	2. Future build-out of East towers requires separation of collaboration core for access to East service elevator	3
3. Annual maintenance savings of $50,000 through elimination of one Physical Plant FTE	1	3. Potential for different vendors to be installed for lab air handling equipment unless provisions are made during Core/Shell procurement for pricing	1
4. Separates future build-out construction from building occupants by segregating the West and East building towers; easier materials delivery, security, and construction logistics	5	4. Incremental annual energy expense of $30,000 due to increased fan energy	1
5. Enables installation of a more complete system for easier commissioning and system balancing	1		
Total "For"	+13	Total "Against"	-8
		Total Option A – Vertical Fit-out Score:	**+5**

Option B – Horizontal Strategy

Reasons "For": Factors/Weights		Reasons "Against": Factors/Weights	
1. Incremental cost burden savings to the first future build-out project for penthouse equipment in East towers of $700,000	3	1. To serve East lab and office towers, Penthouse airside equipment in East towers must be purchased at an additional cost of $8.2MM	5
2. Build-out of an entire floor affords increased program flexibility	3	2. Greater disruption to current occupants when Phase 3 programs are built-out	3
3. Lab air handling equipment will be purchased during Phase 1 for consistency in vendors	1	3. More equipment requires an additional Physical Plant Tech FTE at $50,000 incremental increase in annual maintenance expense	1
4. Incremental annual energy cost savings of $30,000	1		
5. Easier to a expand lab program on the same floor	3		
Total "For"	+11	Total "Against"	-9
		Total Option B – Horizontal Fit-out Score:	**+2**

Ben Franklin Process

2. Evaluate Schedule/Budget Impact

Ben Franklin #3 – Vertical vs. Horizontal Fit-out

Schedule Impact: None

Budget Impact:

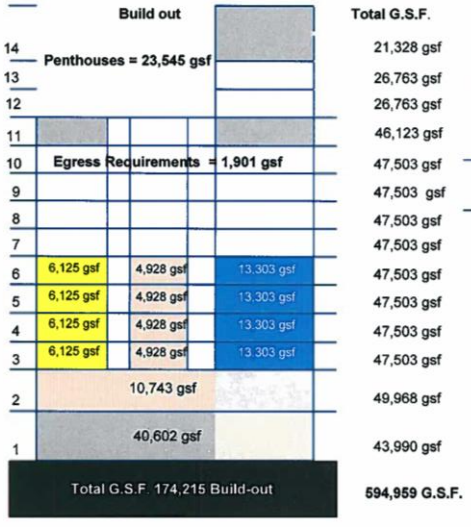
Option	Phase 1 & 2 CCL ($)	Scope
A – Vertical Strategy	137,800,000	Level 1 Building Support, NW Lab Tower Mechanical/Penthouse, SW Office Tower Mechanical/Penthouse, boilers and hot water pumps in SE Mechanical/Penthouse
B – Horizontal Strategy	146,800,000	Level 1 Building Support, Penthouse equipment including air handlers, exhaust fans, boilers, hot water pumps
Cost of NE and SE Penthouse Equipment	8,200,000	Lab and office air handling equipment associated with Option B
NE and SE Tower Deferred Cost	700,000	Deferred cost burden to initial lab program occupant for NE and SE penthouse equipment including escalation, rigging, mobilization

Ben Franklin Process

Ben Franklin #3 – Vertical vs. Horizontal Fit-out

Attachment A

Blocking and Stacking – Vertical Build-out Scenario

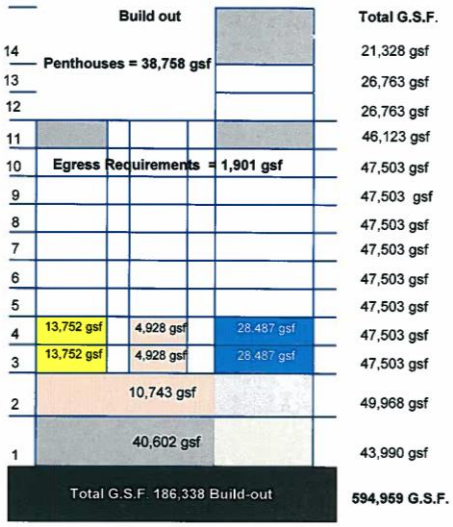


Summary

Total Program Space Build-out	148,769 gsf
Total Penthouse/Egress Build-out	25,446 gsf
Total Project Build-out	**174,215 gsf**
N.A.S.F.	**78,990**

Attachment A

Blocking and Stacking – Horizontal Build-out Scenario



Summary

Total Program Space Build-out	145,679 gsf
Total Penthouse/Egress Build-out	40,659 gsf
Total Project Build-out	**186,338 gsf**
N.A.S.F.	**80,700**

Ben Franklin Process

Ben Franklin #3 – Vertical vs. Horizontal Fit-out

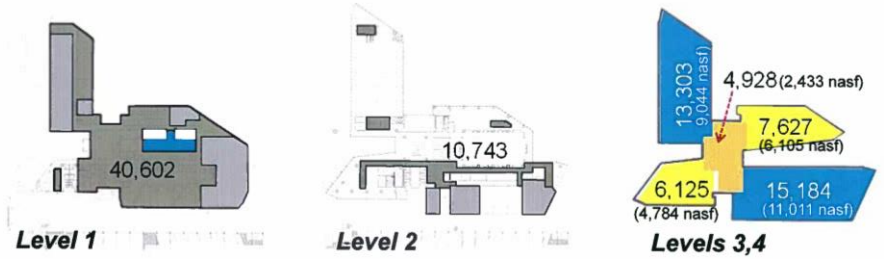
Blocking and Stacking – Vertical Build-out Scenario

Attachment A

Level	Description	Space GSF Included	Total GSF
1	All – some support space shell for future	40,602	40,602
2	Equipment rooms only	10,743	10,743
3	NW, SW, Collaboration Core	13,303 + 6,125 + 4,928	24,356
4	NW, SW, Collaboration Core	13,303 + 6,125 + 4,928	24,356
5	NW, SW, Collaboration Core	13,303 + 6,125 + 4,928	24,356
6	NW, SW, Collaboration Core	13,303 + 6,125 + 4,928	24,356
		Total Program Space GSF	**148,769**
	Total NASF – 78,990	**Penthouse Build-out**	**25,446**
		Total Build-out GSF	**174,215**

Blocking and Stacking – Horizontal Build-out Scenario

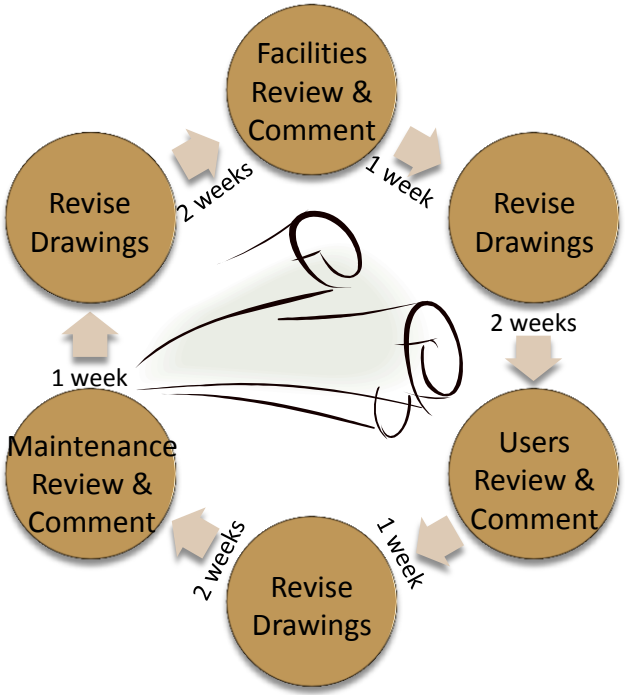
Attachment A



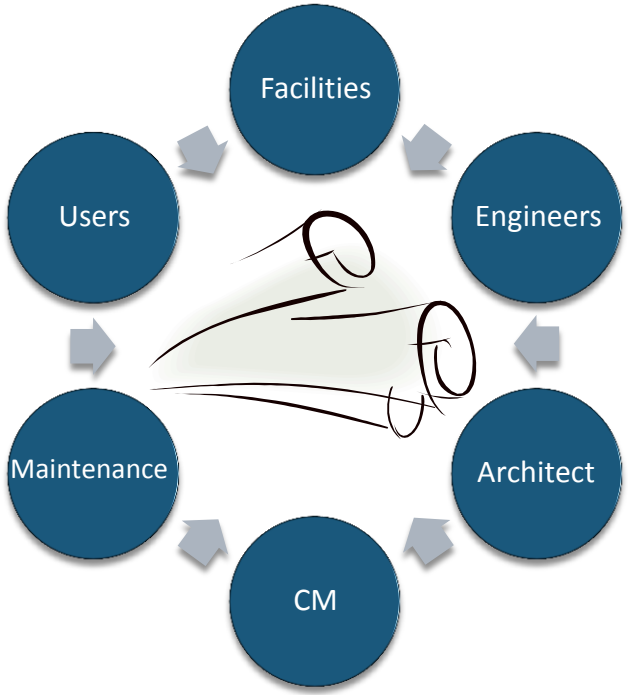
Level	Description	Space GSF Included	Total GSF
1	All – some support space shell for future	40,602	40,602
2	Equipment rooms only	10,743	10,743
3	Entire floor	13,303 + 6,125 + 4,928 + 7,627 + 15,184	47,167
4	Entire floor	13,303 + 6,125 + 4,928 + 7,627 + 15,184	47,167
		Total Program Space GSF	**145,679**
		Penthouse Build-out	**40,659**
	Total NASF – 80,700	**Total Build-out GSF**	**186,338**

Design Review “Jam Sessions”

Typical: 4-6 Weeks of Back/Forth



Streamlined: 2 Day Jam Sessions



Design Review “Jam Sessions”

Typical: 4-6 Weeks of Back/Forth

Pros

- Longer review period for users/reviewers

Cons

- Slower to next phase of design
- No conversations on reviewer comments

Streamlined: 2 Day Jam Sessions

Pros

- Consensus on review comments
- Group review provokes thought
- Collaborative approach

Cons

- Condensed review time

Conclusion

- Started Construction in 8 Months
- Added Scope (Phase 2)
- Added Benefit to MD Anderson

Review Learning Outcomes

- ☑ Ideas for integrating design and construction process for more efficient project delivery
- ☑ Ways to utilize continuous cost modeling as a means to meet tight budgets and schedules on complex projects
- ☑ Ways to streamline design review processes for complex owners/user groups
- ☑ How design can be used as a schedule accelerator

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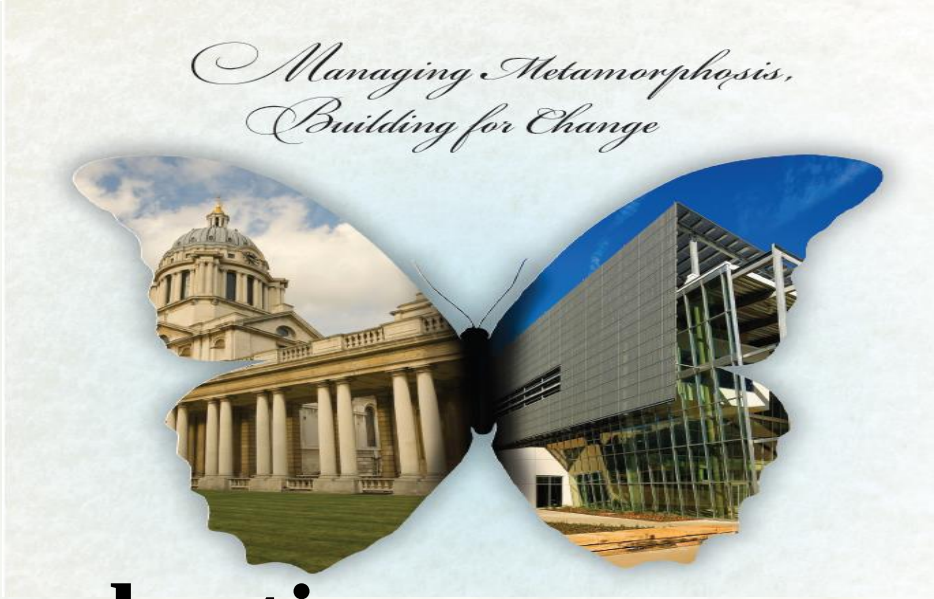

Seminar Evaluation

We hope you enjoyed this session…

Please take a moment to complete the evaluation form.

Thank you!

CONTINUING EDUCATION
AIA